

Hanoi Medical University, Vietnam
Research for International Tobacco Control (RITC)

*"Research to support and inform the development, implemen
evaluation of tobacco control policies in relation to the framework convention
on tobacco control in low and middle-income countries"*

HEALTH PROBLEMS, HEALTH COSTS AND HEALTH BELIEFS RELATED TO TOBACCO CULTIVATION AND PROCESSING AMONG TOBACCO FARMERS IN RURAL VIETNAM



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EXECUTIVE SUMMARY

Rationale

While the industry could not approve that tobacco farming is a mainstay of many country's economy, the seriously damaging health and environmental impacts caused by tobacco farming have been evident by many publications worldwide. The hazards posed by tobacco cultivation place tobacco workers at increased risk of injury and illness. Children and adults, who are mainly women working with tobacco frequently suffer from green tobacco sickness (GTS), which is caused by dermal absorption of nicotine from contact with wet tobacco leaves. Green tobacco sickness is normally a self limiting condition from which workers recover in two or three days. However, symptoms are often severe enough to result in dehydration and the need for emergency medical care. Large and frequent applications of pesticides to protect the plant from insects and diseases can cause a lot of damages to human such as poisonings, skin and eye irritation and other disorder of the nervous, respiratory systems as well as kidney damage.

Viet Nam, a developing country with a tropical climate and hard-working labourers has been a target of cigarette companies. The total area devoted to tobacco cultivation in Vietnam in 2002 was about 18 000 hectares, account for 0.28% of total agricultural land in 2002, which gave an output of about 27 400 tones of tobacco per year. The tobacco industry has established a plan to gradually increase domestic tobacco leaf production toward the year 2010 through increased production area and improved yields.

In Vietnam, tobacco control has received recent attention. The Vietnamese Government's readiness to curb tobacco epidemic was well reflected in the Prime Minister's Decision No 77/2002/QĐ-TTg on Ratification of Programme of Prevention and Control of Certain Non-communicable Diseases for the Period 2002–2010 and the Government Resolution No 12/2000/NQ-CP on National Tobacco Control Policy 2000 – 2010. Vietnam signed the Framework Convention on Tobacco Control on August 8, 2003 and ratified it on 17 December 2004. Recently, on 21 August 2009, the Prime Minister issued the decision No. 1315/QĐ-TTg on Ratification of the Action plan for the Implementation of the WHO Framework Convention on Tobacco Control. The Action Plan provides contents, time frame and delegation of responsibility to related agencies in the development and promulgations of domestic legislations to meet the requirements of the Framework Convention.

In order to enforce the policies on tobacco control in Vietnam, reliable information on health and socio-economic hazards associated with tobacco farming are urgently needed by those with advocacy's responsibility as well as for society in general. However, even though

the number of research on tobacco in Vietnam has recently increased, there remains too little information on this area.

Objectives

The general objective of this study is to investigate the harmful impact of tobacco cultivation and processing on health of tobacco farmer in a rural community in northern Vietnam. The findings of this study may be of use for evidence-based policy making against tobacco in Vietnam and elsewhere.

The specific objectives of this study are to:

1. Examine the relationship between tobacco cultivation and processing and the occurrence of health problems among farmers in a rural community in the North of Vietnam
2. Estimate health care **costs (from the farmer's perspective) to tobacco cultivation and processing** in the study setting
3. Explore health beliefs related to tobacco cultivation and processing in tobacco farmers in the study setting

Methods

This study was conducted in Vo Nhai district, Thai Nguyen province, located 90 km North from Hanoi capital. In Vo Nhai district, two communes, one is tobacco farming and one is non-tobacco farming which has similar geographical and socio-economical characteristics were chosen for this study.

In this study, both quantitative and qualitative approaches were applied.

- Prospective cohort design was used in the quantitative method: In each selected commune, 200 households were randomly selected from each list of all households in that commune. In the non-tobacco farming commune, only households with the members who had not grown tobacco during the last 5 years and had no intention to grow tobacco in the coming time were included. Farmers and their family members from a representative sample of households in the 2 select communes were the study participants.
- In-depth interview and focus group discussion techniques were used in the qualitative approach. The chairman of the 2 communes and the heads of commune health centres in the 2 selected communes were interviewed about health beliefs related to tobacco farming. In each commune, two FGDs were conducted with 8-10 farmers (1 FGD with men and 1 FGD with women). Purposive sampling approach was used to selected the participants to the in-depth interviews and the FGDs (both poor and non-poor were included)

The trained surveyors (10 people) were responsible for conducting interview at selected households. Each of them was responsible for 40 households. They conducted interviews with the head of households to obtain information on household characteristics and with all household members to collection information on individual information. There were one baseline survey (conducted in August 2009) and 10 monthly follow-up surveys (conducted during September 2009 to June 2010). Qualitative data were collected by research team based on developed guidelines.

Quantitative data were entered into computer using Epi-data software by experienced research assistants. Both descriptive and analytical statistics were carried out using Stata 10 software (Stata Corporation). Wilcoxon rank-sum (Mann-Whitney) test was used to explore the difference in total illness episodes of tobacco growers and of other farmers. Poisson regression modelling was performed to examine the association between tobacco cultivation and the occurrence of health problem in the study populations while controlling for confounding factors. All in-depth interviews (4 interviews) and focus group discussions (4 FGDs) were transcribed for analysis. Analysis of qualitative data was done using content analysis approach. Data were synthesized and coded according to key themes.

Results

*** *Demographic characteristics***

A total of 400 households were selected from the 2 communes in Vo Nhai district. On average, each household in Lau Thuong commune (the tobacco-farming commune) had about 4.4 people and Phu Thuong district (the non tobacco-farming commune) had 4 members. The number of study participants in Lau Thuong and Phu Thuong was 820 and 705, respectively. The distributions of the study participants in both communes were similar in terms of gender (a bit more females than males), age (a large proportion aged 15-64 years), ethnicity (Nung people accounted for a large share) and working status (about 3/4 of them were currently working). However, the percentage of the study participants with high school and higher education was higher in Phu Thuong compared to that in Lau Thuong (28.1% vs. 14.9%, respectively).

*** *The livelihood***

Household in the tobacco-farming commune had a bit more land for farming than those in the non tobacco-farming commune (3984.1 m²/ household and 3495.4 m²/household, respectively). The proportions of household who had different household assets in the 2 study communes were quite similar. Annual household income in the tobacco-farming commune was higher than that in the non tobacco-farming commune (40.4

million vs. 33.4 million). Similarly, annual per capita income was higher in the tobacco-farming commune was higher than that in the non tobacco-farming commune (9.7 million vs. 8.7 million). The differences were statistically significant. The proportion of poor household, as classified by local Authorities (based on per capita income and area of land household possessed), was not so different between the 2 communes (9.9% in the tobacco-farming commune vs. 11.6% non tobacco-farming commune)

*** *Self-reported chronic illness and behavioural risk factors***

The proportion of the study participants who reported having at least on chronic problem (including high blood pressure, other hear diseases, chronic respiratory diseases, digestive tract diseases, diabetes, cancer, chronic join/back problems, mental distress, etc) was higher in Lau Thuong commune compared to that in Phu Thuong commune (Male: 43.4% vs. 35.1%, respectively; Female: 47.6% vs. 41.1%, respectively; Overall: 45.5% vs. 38.3%, respectively).

The prevalence of both smoking and alcohol use were slightly higher in Lau Thuong commune compared to those in Phu Thuong commune (Overall prevalence of smoking: 24.2% vs. 22.7%, respectively; Overall prevalence of alcohol use: 44.1% vs. 36.6%, respectively)

*** *Tobacco cultivation and processing and health problems***

In Phu Thuong commune, people used their lands for planting rice and/or maize only but in Lau Thuong commune, the farmers used their land for growing tobacco and rice and/or maize. In Lau Thuong commune, there were 2 tobacco farming seasons: winter season (October, 2009-January, 2010) and spring season (February-May, 2010) and the land used for tobacco farming decreased during the study period (3329.8 squared meters in the winter season and 1997.3 squared meters in the spring season).

The average number of days that a person in Lau Thuong commune spent in a month in tobacco farming activities was highest in December 2009 (harvesting and processing tobacco leaves of the winter season) and was lowest in March 2010 (caring tobacco plants and leaves of the spring season) (20.3 days vs. 8.4 days, respectively).

During the 2 tobacco farming seasons (8 months), the average number of days spent by a person in Lau Thuong commune on tobacco faming related activities was 109.7 days. Females spent significantly more time on tobacco faming related activities than males (120.1 days vs. 99.2 days). People aged 15-64 spent more time on tobacco faming related activities than the children (less than 15 years) and the elderly (aged 64 years and over). However, the times spent on tobacco faming related activities by both the children and the elderly were not minimal (about 39 days). The poor spent significantly more time on

tobacco farming related activities than the non-poor (165.8 days vs. 103.4 days, respectively).

People in Lau Thuong commune generally had more illness episodes than those in Phu Thuong commune¹. During September 2009 – June 2010, the total number of illness episodes experienced by a person in Lau Thuong commune and in Phu Thuong commune were 5.8 and 3.9, respectively. The difference was statistically significant. Females had significantly higher illness episodes than males (6.5 vs. 5.1). People aged 45 years and over had significantly more illness episodes than the younger people. The poor had more illness episodes than the non-poor (6.6 vs. 5.8) but the difference was not statistically significant.

People in Lau Thuong commune were also asked about green tobacco sickness (GTS)– a form of nicotine poisoning that affects workers who have direct contact with tobacco plants during cultivation and harvesting. Green tobacco sickness was most prevalent in December 2009 (13.6%, 0.3 episodes/person). During the whole study period, 319 people in Lau Thuong commune (39%) experienced at least one green tobacco sickness episode. The average number of episodes of green tobacco sickness experienced by a person in Lau Thuong during the 2 tobacco farming seasons was 0.8. Females had significantly higher episodes of green tobacco sickness than males (1.0 vs. 0.5). People aged 45 years and over had significantly more episodes of green tobacco sickness than the younger people. The poor had more episodes of green tobacco sickness than the non-poor (0.8 vs. 0.6) but the difference was not statistically significant.

Logistic regression models showed that after controlling for other factors, female gender, older age, doing tobacco farming activities for more than 60 days, being poor, using alcohol and having chronic disease were significantly associated with higher probability of getting illness (Table 9). Most notably, females who spent more than 60 days on tobacco farming activities had 3.6 times higher risk of getting GTS as compared with males who spent less than 60 days on tobacco farming activities.

*** Health care costs attributable to tobacco cultivation and processing**

During the study period, 319 people in Lau Thuong commune (39%) experienced at least one green tobacco sickness episode. The average annual per capita out-of-pocket payment for treatment of GTS was VND 54,600. As a result, the total health care expenditure for all the GTS episodes during the year was VND 17,417,000. Total health care cost due to green tobacco sickness in Lau Thuong commune (all 7000 people) was VND 530,267,000 (about US\$ 28,000²).

¹ *GTS among tobacco farmers in Lau Thuong, confirmed by doctors from commune health center are reported separately*

² *1 US\$ = VND 19,000*

Household out-of-pocket payment for health was also higher in Lau Thuong commune than that in Phu Thuong commune (VND 354.700 per person per year vs. VND 330,000 per person per year, respectively³). The excess in total household out-of-pocket payment for health in Lau Thuong commune (7000 people⁴) was VND 173,040,000 (US\$ 9,107.37)⁵. As a result, the tobacco cultivation and processing related actives cost to Lau Thuong commune VND 703,307, 000 a year (about US\$ 37,000).

*** Health beliefs**

The focus group discussions with the farmers revealed that both tobacco farmers and non-tobacco farmers could name 2 main problems associated with tobacco cultivation, including 1) Tobacco plants requites more fertilizers and pesticides; 2) Tobacco farming activities are more labor intensive. Some tobacco farmers mentioned that exposure to smokes while curing tobacco leaves could also lead to health problems. Some farmers noticed that they had more illness while disbudding of auxiliary buds and harvesting tobacco leaves and they though exposure to pesticides was the cause of the problems. However, none of the study participants can correlate their illness with nicotine from tobacco leaves. They had never heard about Green Tobacco Sickness. Local authorities were also not much aware of the harmful effects of nicotine poisoning among tobacco farmers.

The tobacco farmers were not concerned about severity of health problems they got while growing tobacco. Similarly, the community leader in Lau Thuong commune did not show his worries about health consequences of tobacco farming in his community. Some farmers had stopped or decreased growing tobacco because they did not get much economic benefits. None of the study participants reported that they had stooped tobacco farming because of health problems.

Tobacco farmers did not know about any other economically beneficial crops that can replace tobacco. Tobacco farmers and the community leaders, tobacco industry has been playing a very important role in tobacco farming activities in Lau Thuong commune. Tobacco industry provided trainings on tobacco cultivation techniques. They sold or provided fertilizers/pesticides to the farmers and purchased tobacco products. However, the tobacco industry did not ensure stable prices for tobacco products.

Both the farmers and local authorities did not have any clear strategies for promoting the livelihoods of the population while protecting them from possible occupational hazards. The local health staffs in Lau Thuong reported that had had no opportunity to do

³ *Expenditure for treatments of green tobacco sickness were excluded*

⁴ *All of them were part-time tobacco farmers*

⁵ *There was no difference between the 2 communes in the number of days the farmers can not work because of illness as well as in the number of days the care givers spent on taking care of the ill people*

any formal health education about harmful social, environmental and health effect of tobacco farming. They also showed their willingness to take part in future health education **programs on promotion of people' knowledge and perception of harmful effects of tobacco farming.**

Conclusion and policy implications

Our study provides the first prospective data on socio-economic and health effects of tobacco growing in the Vietnamese context. It confirms the facts that tobacco farming does not bring prosperity to the farmers while causing a lot of health problems to them, especially among the women. The health care cost attributable to tobacco cultivation and processing is considerable. Unfortunately, most farmers cannot correlate their health problems with tobacco farming works. There was still no intervention to improve people's awareness and perception of harmful effects of tobacco farming. Tobacco farmers knew that tobacco farming brought very little economic benefits to them but they did not know about other alternative crops to replace tobacco.

Article 17 of the WHO Framework Convention on Tobacco Control (FCTC) calls upon **Parties to "promote, as appropriate, economically viable alternatives for tobacco workers, growers and, as the case may be, individual sellers" which should be done "in cooperation with each other and with competent international and regional intergovernmental organizations".**

Given the findings from this study, several public health implications could be considered:

- Promoting communications about harmful social, environmental and health effect of tobacco farming to raise awareness aiming at policy and behaviour change in both local governments and communities.
- Providing information on other crop options for farmers and on employment outside tobacco growing for them (especially the women and the children)
- To strengthen the evidence on harmful effects of tobacco farming on socio-economic and health of tobacco farmers, it is also important to replicate this research in a larger scale. An intervention study (health education program and introduction of alternative crops) would be a research priority in the coming time.

Key words:

Tobacco farming, processing, livelihood, health problems, health expenditure, Vietnam

I. RATIONALE/PROBLEM JUSTIFICATION

Tobacco industry has been promoting tobacco growing as a panacea, claiming that it will bring unparalleled prosperity to farmers, their communities, and their countries [1]. However, in reality, while the industry could not approve that tobacco farming is a mainstay **of many country's economy, the seriously damaging health and environmental impacts** caused by tobacco farming have been evident by many publications worldwide. From the moment the tobacco seed is planted to the time the tobacco plant is harvested and cured, the health of those who cultivate the crop is constantly put in peril [1, 2].

The hazards posed by tobacco cultivation place tobacco workers at increased risk of injury and illness. Children and adults, who are mainly women working with tobacco frequently suffer from green tobacco sickness (GTS), which is caused by dermal absorption of nicotine from contact with wet tobacco leaves. GTS is acute nicotine poisoning caused by the dermal absorption of nicotine from mature tobacco plants, *nicotiana tabacum*. Symptoms include dizziness or headache and nausea or vomiting, but may also include abdominal cramps, headache, prostration, difficulty breathing, abdominal pain, diarrhea, and occasionally fluctuations in blood pressure or heart rate. Green tobacco sickness is normally a self limiting condition from which workers recover in two or three days. However, symptoms are often severe enough to result in dehydration and the need for emergency medical care. [3-5]. Large and frequent applications of pesticides to protect the plant from insects and diseases can cause a lot of damages to human such as poisonings, skin and eye irritation and other disorder of the nervous, respiratory systems as well as kidney damage [6, 7].

A recent qualitative systematic review using a standardized electronic literature search strategy show that GTS constitutes a significant public health problem. An incidence of 2 cases in 100 person days exposed and an OR of 17 for non-smokers compared to smokers leads to the conclusion that particularly non-smoking tobacco harvesters face a daily health risk of intoxication due to transdermal absorption of nicotine [8]. Another study suggested that tobacco farm workers seem to be at increased risk of suffering from disorders of the upper airways (e.g. nasal dysfunction) [9]. Several factors have been proven to be related with health problems among tobacco farmers such as dermal exposure to nicotine, wearing protective clothing, working environment (temperature, humidity, wet weather, etc) [8]. However, the majority of studies on health problems associated with tobacco farming were conducted in the USA whereas most, and the percentage is increasing, tobacco harvesters work in developing countries. As a result, data on health problems related to tobacco cultivation and processing in developing countries are still limited [8].

Viet Nam, a developing country with a tropical climate and hard-working labourers has been a target of cigarette companies. The total area devoted to tobacco cultivation in Vietnam in 2002 was about 18 000 hectares, account for 0.28% of total agricultural land in 2002, which gave an output of about 27 400 tones of tobacco per year [2]. The tobacco industry has established a plan to gradually increase domestic tobacco leaf production toward the year 2010 through increased production area and improved yields [10].

In Vietnam, tobacco control has received recent attention. The Vietnamese Government's **readiness to curb tobacco epidemic was well reflected in the Prime Minister's Decision No 77/2002/QĐ-TTg** on Ratification of Programme of Prevention and Control of Certain Non-communicable Diseases for the Period 2002–2010 [11] and the Government Resolution No 12/2000/NQ-CP on National Tobacco Control Policy 2000 – 2010 [12]. Vietnam signed the Framework Convention on Tobacco Control on August 8, 2003 and ratified it on 17 December 2004. Recently, on 21 August 2009, the Prime Minister issued the decision No. **1315/QĐ-TTg** on Ratification of the Action plan for the Implementation of the WHO Framework Convention on Tobacco Control. The Action Plan provides contents, time frame and delegation of responsibility to related agencies in the development and promulgations of domestic legislations to meet the requirements of the Framework Convention [18].

In order to enforce the policies on tobacco control in Vietnam, reliable information on health and socio-economic hazards associated with tobacco farming are urgently needed by those **with advocacy's responsibility as well as for society in general. However, even though the** number of research on tobacco in Vietnam has recently increased, there remains too little information on this area.

Recently in 2007, under the support of Southeast Asia Control Alliance (SEATCA), we have conducted a preliminary cross-sectional study comparing tobacco cultivation related revenue and expenditure in selected areas in rural Vietnam and examining the relationship between tobacco cultivation and self-reported illness in the study population. The study showed that the benefit the farmers got from tobacco cultivation was seen to be minimal. It also suggested that people who grew tobacco were more likely to report more health problems they had during the last 6 months before interview. Prospective study design and qualitative approach were recommended to be applied in the next step to provide high quality evidence on health problems, health costs and health beliefs related to tobacco farming among farmers in rural Vietnam.

II. RESEARCH OBJECTIVES

The general objective of this study is to investigate the harmful impact of tobacco cultivation and processing on health of tobacco farmer in a rural community in northern Vietnam. The findings of this study may be of use for evidence-based policy making against tobacco in Vietnam and elsewhere.

The specific objectives of this study are to:

1. Examine the relationship between tobacco cultivation and processing and the occurrence of health problems among farmers in a rural community in the North of Vietnam
2. Estimate health care costs **(from the farmer's perspective)** to tobacco cultivation and processing in the study setting
3. Explore health beliefs related to tobacco cultivation and processing in tobacco farmers in the study setting

The research questions of this study include:

1. To what extent does tobacco cultivation and processing increase the risk of getting health problems among farmers?
2. How much tobacco cultivation and processing cost to tobacco farmers?
3. To what extent do tobacco farmers understand the harmful effects of tobacco cultivation and processing on their health and household economy?

III. METHODS

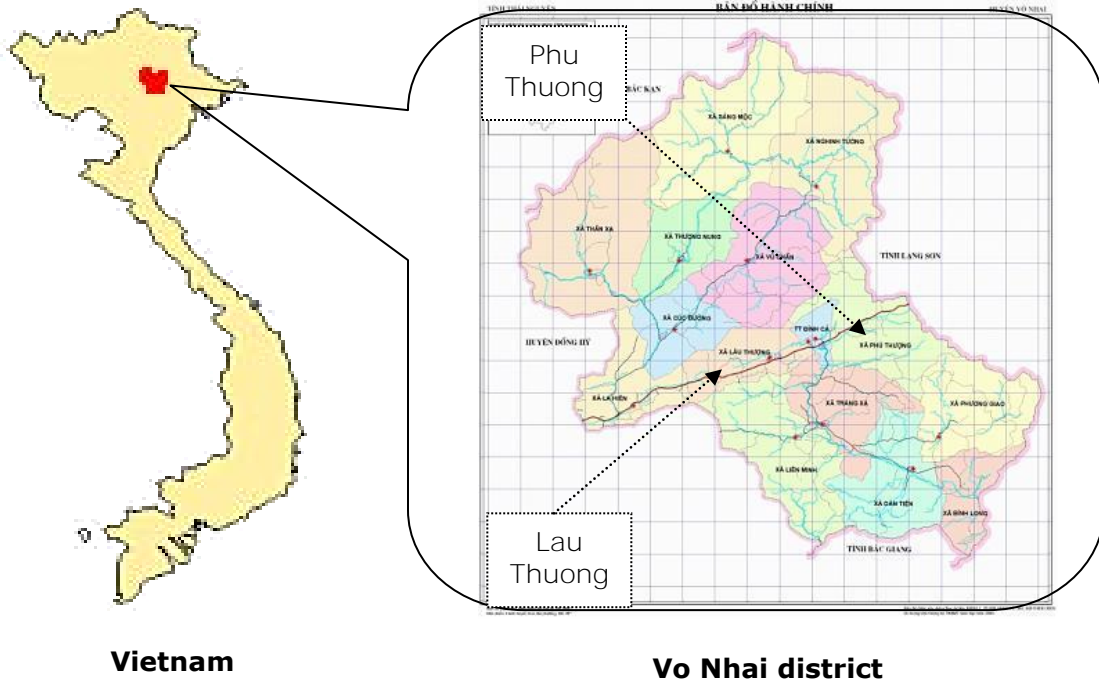
3.1. Study design

In this study, both quantitative and qualitative approaches were applied. Prospective cohort design was used in the quantitative method. In-depth interview and focus group discussion techniques were used in the qualitative approach.

3.2. Study site

Vo Nhai district, Thai Nguyen province was selected for this study. Vo Nhai district is a rural area located in the North of Vietnam, 90 km North from Hanoi capital. The district has 14 communes and 1 town. The total population of Vo Nhai is about 63,000 people. Vo Nhai covers an area of 84,510.4 hectares, mainly highland and mountainous areas.

Vo Nhai has about 29,703 agricultural labours, accounting for 47.4% of its population. 6/16 communes (38%) in Vo Nhai have been involved in growing tobacco. In the tobacco farming communes, tobacco has not been cultivated in the whole year. Other crops such as maize, rice, cassava, etc have been alternately planted.



Vietnam

Vo Nhai district

The study site: Lau Thuong district

In Vo Nhai district, two communes, one is tobacco farming and one is non-tobacco farming which has similar geographical and socio-economical characteristics were chosen for this study (These 2 commune were also selected for our previous survey):

- o Lau Thuong commune (tobacco growing commune): is located along side the national road 1B. The commune covers an area of 400 hectares. It has 11 villages where live 7000 people. In 2006, crude birth rate was 14.9‰, crude mortality rate was 5.18‰ and infant mortality rate was 10.9‰. Number of poor household in year 2000 in the commune was 36 %.
- o Phu Thuong commune: share its southern border with Lau Thuong commune. The commune covers an area of 544 hectares. It has 11 villages where live 4,655 people. In 2006, crude birth rate was 16.2‰, crude mortality rate was 5.6‰

and infant mortality rate was 15.7‰. Number of poor household in year 2000 in the commune was 37.7 %.

3.3. Study participants/sample size and sampling

* **Quantitative approach**

- Study participants: Farmers and their family members from a representative sample of households in the 2 select communes (1 tobacco farming and 1 non-tobacco farming commune) were the study participants.
- Sample size: The sample size was calculated for estimating a relative risk with specified relative precision using the below formula

$$n = \frac{Z_{1-\alpha/2}^2}{[\log_e(1-\varepsilon)]^2} \left[\frac{1-P_1}{P_1} + \frac{1-P_2}{P_2} \right]$$

Where:

Confidence level= 95% ($\alpha = 5\%$)

Relative precision $\varepsilon = 20\%$

Anticipated probability of getting any health problem among exposed

$P_1 = 45\%$ (according to our previous study)

Anticipated probability of getting any health problem among

unexposed $P_2 = 30\%$ (according to our previous study)

Minimum sample size needed in each commune would be 275 individuals. To control for design effect (survey all the member in a household), we need to survey on 550 individuals.

To allow for non-response rate (expected to be 10%); a sample of 600 individuals is required. This sample size would be achieved by selecting 200 households in each commune.

- Sampling: The lists of households in each selected commune were obtained from local authority. 200 households were randomly selected from each list. In the non-tobacco farming commune, only households with the members who had not

grown tobacco during the last 5 years and had no intention to grow tobacco in the coming time were included.

****Qualitative approach***

- In-depth interview: The chairman of the 2 communes and the heads of commune health centres in the 2 selected communes were interviewed about health beliefs related to tobacco farming.
- Focus group discussion (FGD): In each commune, two FGDs were conducted with 8-10 farmers (1 FGD with men and 1 FGD with women).
- Purposive sampling approach was used to selected the participants to the in-depth interviews and the FGDs (both poor and non-poor were included)

3.4. Data collection

****Quantitative approach***

Quantitative approach was done through different household interviews

- Field staffs: Staffs from commune health centers and commune population unit (with medical background) were selected to form 2 data collection teams. Each team (consisting of 1 team leader and 5 members) was responsible for collecting data in one commune.
- Training: All the field staffs took part in a 2-days training given by the research team at the beginning of the survey. During the training, every question was studied and discussed. Field like condition was simulated in the classroom and mock interviews were done to make questionnaire clear to the surveyors. After every mock interview, problems were raised and clarified by the trainers.
- Data collection tools: Data collection tools were developed by research team with reference to previous studies, internationally and nationally. The tools include household and individual questionnaires.
 - **The household questionnaire:** 2 questionnaires were used
 - **Q1 (Baseline household questionnaire):** for collecting information on household characteristics at the beginning of the study period. The household information includes household size, assets, type of house, water source, latrine, land owned, areas used for planting tobacco and other crops, economic situation, etc.

- **Q3 (Follow-up household questionnaire):** for collecting information on household during each follow-up round (monthly): farming activities, expenditures, etc.
- **The individual questionnaire:** 2 questionnaires were used :
 - **Q2 (Baseline individual questionnaire):** for collecting information on individual characteristics at the beginning of the study period: age, sex, ethnicity, education, working status, chronic disease, health behaviours, etc.
 - **Q4 (Follow-up individual questionnaire):** for collecting information on each individual during each follow-up round (monthly): farming activities (intensity), morbidity, health care utilization and expenditure, etc
- In order to get accurate information on morbidity, health utilization and costs, heads of household (or other family members) were also asked to report all morbidity events, health care utilization and costs in a health diary. The information on morbidity, health care utilization and costs was also cross-checked with information from health facilities every month. In Lau Thuong commune, people who got sick while doing tobacco farming were entitled to call for helps from doctors from commune health center. The doctors should come to check weather or not it was a Green Tobacco Sickness.
- Data collection procedures: The trained surveyors (10 people) were responsible for conducting interview at selected households. Each of them was responsible for 40 households. They conducted interviews with the head of households to obtain information on household characteristics (using Q1, Q3) and with all household members to collection information on individual information (using Q2, Q4).

There were one baseline survey (conducted in August 2009) and 10 monthly follow-up surveys (conducted during September 2009 to June 2010).

The table below describes the study process and corresponding faming activities in the 2 study sites.

The study process and farming activities in the 2 study sites⁶

Time	Study process	Farming activities	
		Lau Thuong (The tobacco-farming commune)	Phu Thuong (The non tobacco-farming commune)
Aug-09	Baseline survey	Growing rice or/and maize	Growing rice or/and maize
Sep-09	Follow-up 1		
Oct-09	Follow-up 2	Growing tobacco 1 Growing rice or/and maize	
Nov-09	Follow-up 3		
Dec-09	Follow-up 4		
Jan-10	Follow-up 5	Growing tobacco 2 Growing rice or/and maize	
Feb-10	Follow-up 6		
Mar-10	Follow-up 7		
Apr-10	Follow-up 8		
May-10	Follow-up 9	Growing rice or/and maize	
Jun-10	Follow-up 10		
Jul-10	Qualitative study		

- Quality control: Filled questionnaires were submitted by the surveyors to the team leaders on daily basis and feedbacks on the data collected from the team leaders to the surveyors were given during the next day. Two staffs from district health centers were involved as field supervisor. They reviewed all the filled questionnaire submitted by the team leaders and did re-interview of 10% of the sample. Investigators of this study frequently visited field site to ensure the quality of data collected. Monthly review meetings with the participations of the research team, district supervisor, data collection team were conducted every month to discuss and solve problems arisen during the field work.

⁶ *Annually, in Vo Nhai district, tobacco cultivation and processing activities have been done in 2 seasons: winter season (October-January) and spring season (February-May). In this study, the 10 follow-up surveys were done from September, 2009 to June 2010 in order to capture data on tobacco farming activities and related issues happening in the 2 tobacco farming seasons as well as in one month before and in one month after the seasons.*

*** Qualitative approach**

- Qualitative data were collected by research team based on developed guidelines.
- In-depth interviews were mainly **conducted at interviewees' office**. Two researchers (one facilitator and one note taker) were responsible for conducting each FGDs. FGDs were mainly conducted at community hall
- Health beliefs of tobacco farmers were explored using Health Belief Model (HBM). Health Belief Model (HBM) is a psychological model that attempts to explain and predict health behaviors. This is done by focusing on the attitudes and beliefs of individuals. The HBM was first developed in the 1950s by social psychologists Hochbaum, Rosenstock and Kegels working in the U.S. Public Health Services. HBM involves five aspects that orient people behavior (1) Perception of susceptibility to the risk; (2) Perception of severity of diseases/health problems cause by health behavior; (3) Perception of benefits of good health behavior; (4) Perception of barriers to conduct good health behaviors; (5) Cues to action – strategies to activate readiness; (6) Self efficacy – confidence in ones ability to take action [13].
- The main topics of the in-depth interview and FGDs were:
 - Perception of harmful effects associated with tobacco cultivation and processing
 - Perception of severity of health problems associated with tobacco cultivation and processing
 - Perception of benefits of stopping tobacco cultivation
 - Perception of barriers for stopping tobacco farming
 - Possible solutions for improving the situation
- Qualitative data were collected in July, 2010.

3.5. Data analysis

*** Quantitative data**

- Quantitative data were entered into computer using Epi-data software by experienced research assistants. Logical checks were done while dates are entered. Double entry verification was used on a random sample of 10% of the completed questionnaires.

- Both descriptive and analytical statistics were carried out using Stata 10 software (Stata Corporation). Wilcoxon rank-sum (Mann-Whitney) test was used to explore the difference in total illness episodes of tobacco growers and of other farmers. Poisson regression modelling was performed to examine the association between tobacco cultivation and the occurrence of health problem in the study populations while controlling for confounding factors.

*** Qualitative data**

- All in-depth interviews (4 interviews) and focus group discussions (4 FGDs) were transcribed for analysis. Analysis of qualitative data was done using content analysis approach. Data were synthesized and coded according to key themes.

3.6. Gender considerations

Gender issues were considered in all the research process:

- Both men and women were encouraged to be involved in implementing the research
- Attention was given to explore opinion of women regarding health issues and health beliefs related tobacco
- In analysis step, comparisons of outcome variables between men and women were done

3.7. Ethical considerations

- This research was approved by Scientific and Ethics Committee of Hanoi Medical University
- Before conducting data collection at 2 communes, approval from District Health Center and **People's Commune** Committees was achieved.
- Before participating into this study, all invited respondents were provided with clear information regarding this research. They were informed that participation would be voluntary following informed consent. Their responses would be confidential, there would be no right or wrong answers, and they could stop or withdraw from participation at any time and refusal or withdrawal would not have an effect on them in any way.

IV. RESULTS

4.1. Baseline characteristics of the study population

4.1.1. Demographic characteristics

At the beginning of the study, a total of 400 households were selected from the 2 communes in Vo Nhai district. On average, each household in Lau Thuong commune (the tobacco-farming commune) had about 4.4 people and Phu Thuong district (the non tobacco-farming commune) had 4 members. The number of study participants in Lau Thuong and Phu Thuong was 820 and 705, respectively.

As shown in Table 1, the distributions of the study participants in both communes were similar in terms of gender (a bit more females than males), age (a large proportion aged 15-64 years), ethnicity (Nung people accounted for a large share) and working status (about 3/4 of them were currently working). However, the percentage of the study participants with high school and higher education was higher in Phu Thuong compared to that in Lau Thuong (28.1% vs. 14.9%, respectively).

Table 1: Demographic characteristics of the study populations

	Lau Thuong (The tobacco-farming commune) n(%)	Phu Thuong (The non tobacco-farming commune) n(%)
Gender		
○ Male	408 (49.8)	325 (46.1)
○ Female	412 (50.2)	380 (53.9)
Age		
○ <15	180 (22.0)	159 (22.6)
○ 15-24	138 (16.8)	103 (14.6)
○ 25-34	150 (18.3)	105 (14.9)
○ 35-44	133 (16.2)	130 (18.4)
○ 45-54	134 (16.3)	122 (17.3)
○ 55-64	39 (4.8)	40 (5.7)
○ >64	46 (5.6)	46 (6.5)
Ethnicity		
○ Kinh	232 (28.3)	157 (22.3)
○ Nung	545 (66.5)	454 (64.4)
○ Other	43 (5.2)	94 (13.3)
Education		
○ Less than primary	180 (22)	178 (25.3)
○ Graduated primary	206 (25.1)	126 (17.9)
○ Graduated secondary	312 (38.1)	203 (28.8)
○ Graduated high school and higher	122 (14.9)	198 (28.1)

	Lau Thuong (The tobacco-farming commune) n(%)	Phu Thuong (The non tobacco-farming commune) n(%)
Working status		
○ Currently working	631 (77.0)	529 (75.0)
○ Not working (student and old age)	189 (23.1)	176 (25.0)
Total	820 (100)	705 (100)

4.1.2. The livelihood

As shown in Figure 1, household in the tobacco-farming commune had a bit more land for farming than those in the non tobacco-farming commune (3984.1 m²/ household and 3495.4 m²/household, respectively) (Figure 1). The proportions of household who had different household assets in the 2 study communes were quite similar (Table 2).

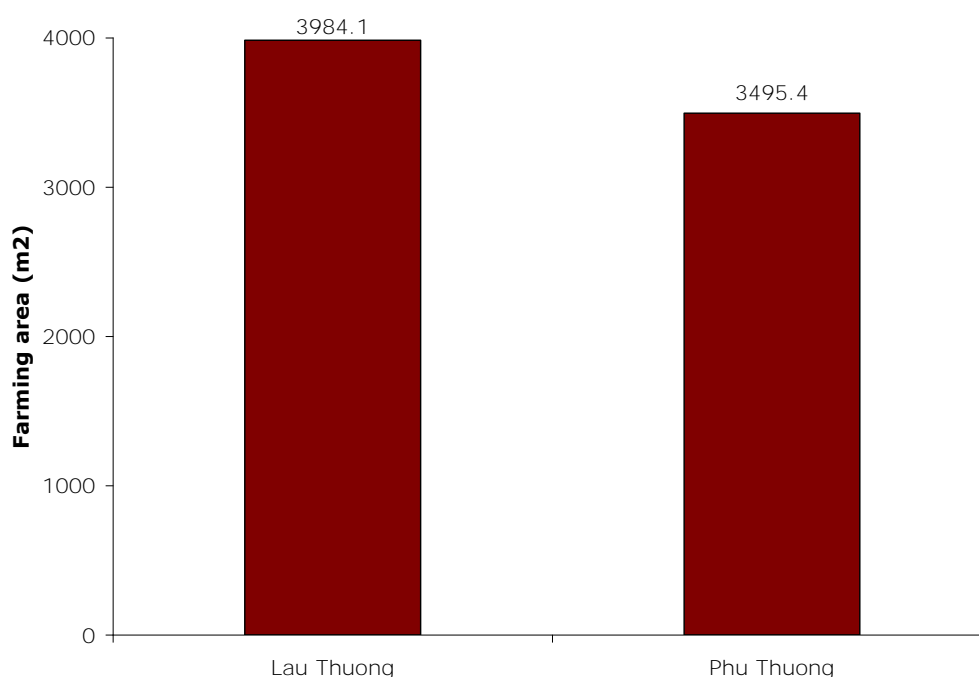


Figure 1: Farming area owned by each household (m²)

Table 2: Assets owned by the studied households

	Lau Thuong (The tobacco-farming commune) (%)	Phu Thuong (The non tobacco-farming commune) (%)
Motorbike	89.0	82.8

	Lau Thuong (The tobacco-farming commune) (%)	Phu Thuong (The non tobacco-farming commune) (%)
Television	99.0	97.7
Video	72.4	64.0
Radio	13.2	10.4
Fridge	28.4	39.3
Air conditioner	0.0	1.1
Heater	0.0	0.7
Washing machine	0.0	2.6
Truck	0.0	0.7
Electricity generator	0.0	0.6
Buffalo/cow	4.1	4.8

Annual household income in the tobacco-farming commune was higher than that in the non tobacco-farming commune (40.4 million vs. 33.4 million). Similarly, annual per capita income was higher in the tobacco-farming commune was higher than that in the non tobacco-farming commune (9.7 million vs. 8.7 million). The differences were statistically significant (Table 3). The proportion of poor household, as classified by local Authorities (based on per capita income and area of land household possessed), was not so different between the 2 communes (9.9% in the tobacco-farming commune vs. 11.6% non tobacco-farming commune)(

Table 4).

Table 3: Household and personal income

	Lau Thuong mean (sd)	Phu Thuong mean (sd)
Annual household income (VND million)	40.4 (18.3)	33.4 (5.2)
Annual per capita income (VND million)	9.7 (4.8)	8.7 (1.0)

Table 4: Economic situation of the surveyed households

	Lau Thuong (The tobacco-farming commune) n(%)	Phu Thuong (The non tobacco-farming commune) n(%)
Poor	81 (9.9)	82 (11.6)
Non-poor	739 (90.1)	623 (88.4)

	Lau Thuong (The tobacco-farming commune) n(%)	Phu Thuong (The non tobacco-farming commune) n(%)
Total	820 (100)	705 (100)

4.1.3. Self-reported chronic illness and behavioural risk factors

Figure 2 shows the prevalence of self reported chronic diseases among the study populations at the beginning of the study period. The proportion of the study participants who reported having at least on chronic problem (including high blood pressure, other hear diseases, chronic respiratory diseases, digestive tract diseases, diabetes, cancer, chronic join/back problems, mental distress, etc) was higher in Lau Thuong commune compared to that in Phu Thuong commune (Male: 43.4% vs. 35.1%, respectively; Female: 47.6% vs. 41.1%, respectively; Overall: 45.5% vs. 38.3%, respectively).

In terms of behavioural risk factors, as shown in Figure 3 and Figure 4, the prevalence of both smoking and alcohol use were slightly higher in Lau Thuong commune compared to those in Phu Thuong commune (Overall prevalence of smoking: 24.2% vs. 22.7%, respectively; Overall prevalence of alcohol use: 44.1% vs. 36.6%, respectively).

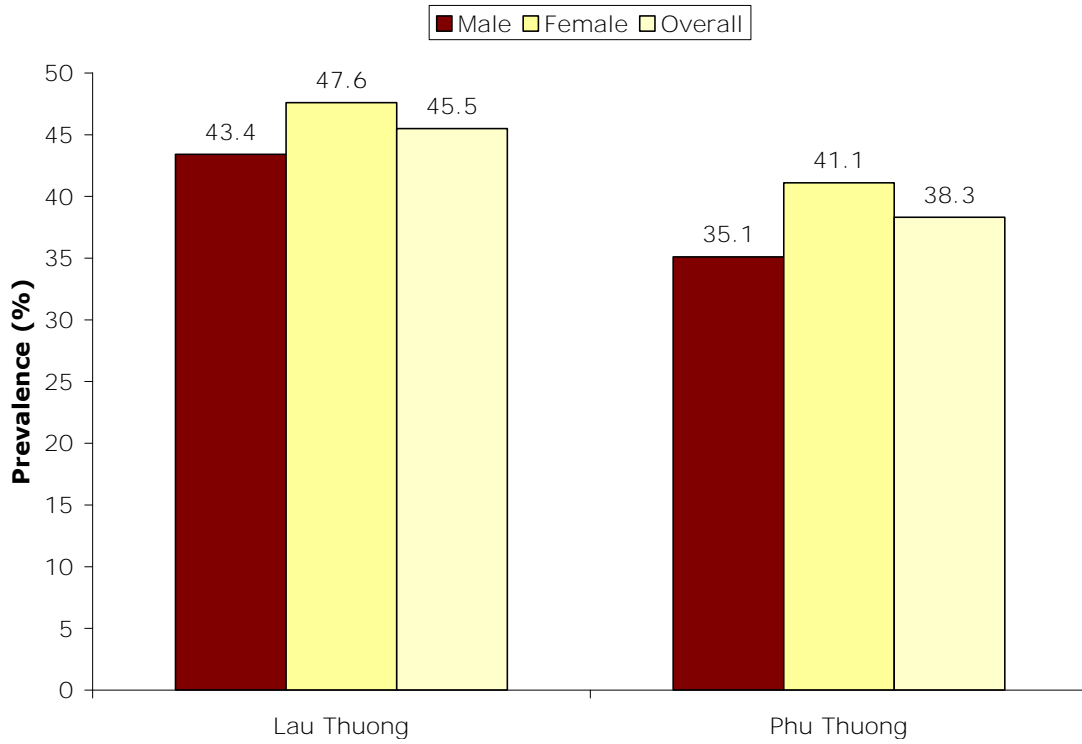


Figure 2: Prevalence of self-reported chronic illness among the study populations

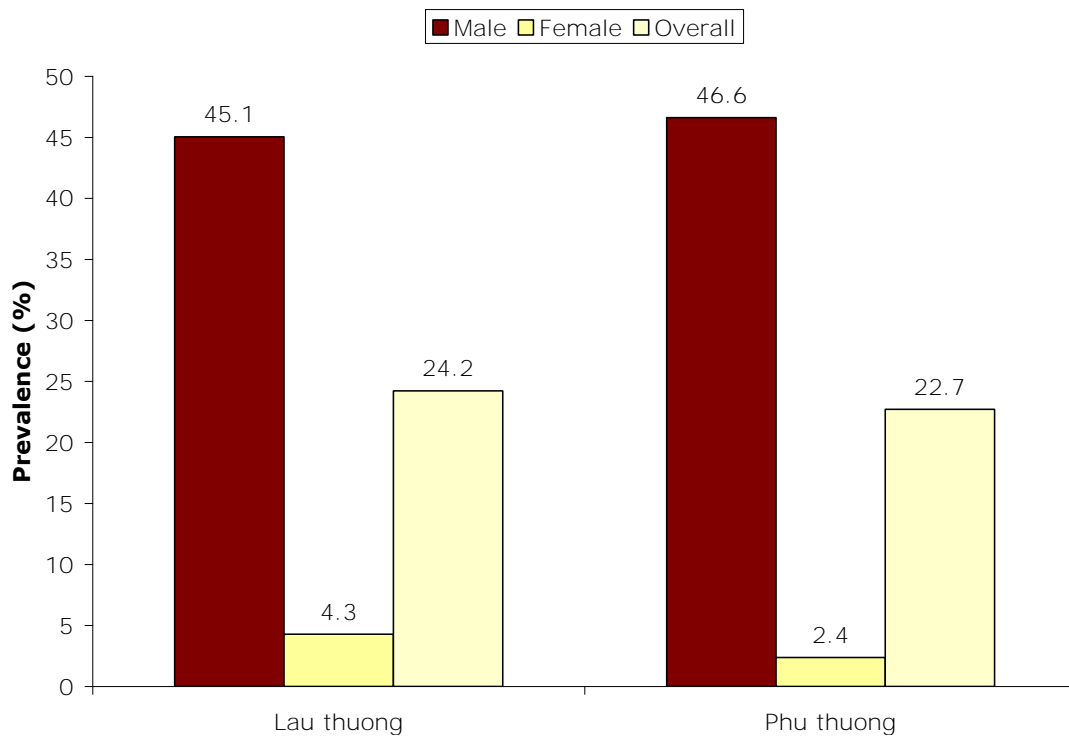


Figure 3: Prevalence of smoking among the study populations

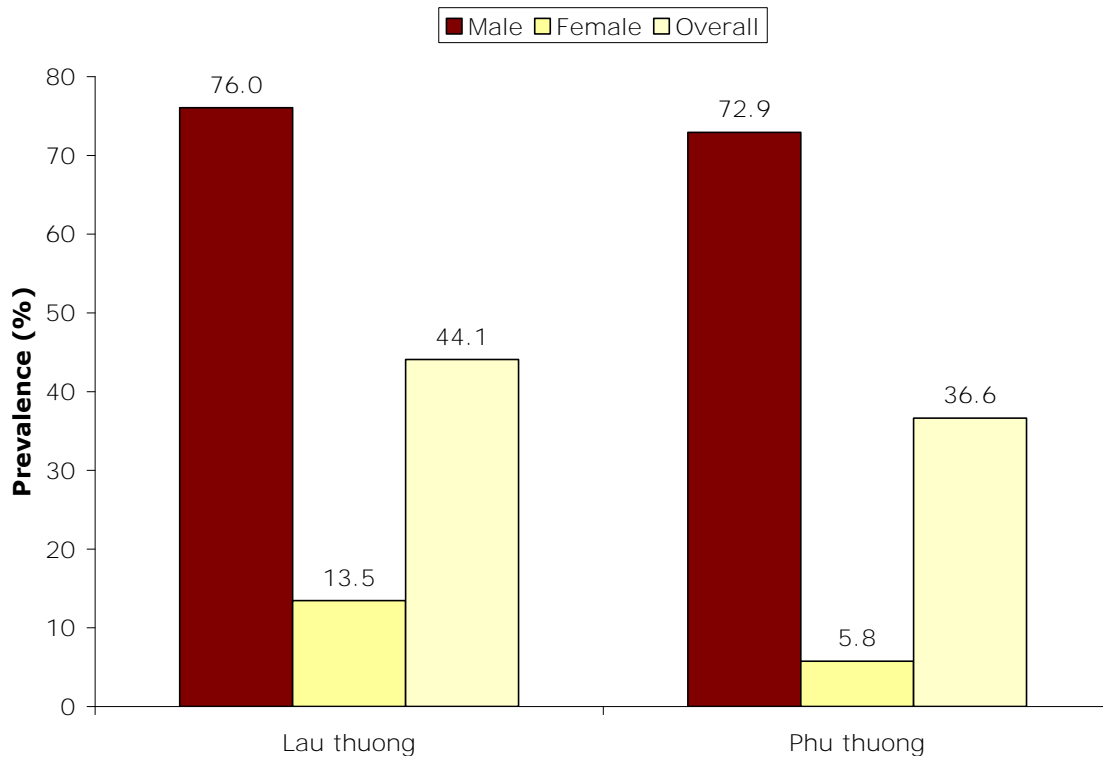


Figure 4: Prevalence of alcohol use among the study populations

4.2. Tobacco cultivation and processing and health problems

Figure 5 presents the average area of land (in squared meters) of a household in the 2 study communes used for cultivation during the study period. In Phu Thuong commune, people used their lands for planting rice and/or maize only but in Lau Thuong commune, the farmers used their land for growing tobacco and rice and/or maize. In Lau Thuong commune, there were 2 tobacco farming seasons: winter season (October, 2009-January, 2010) and spring season (February-May, 2010) and the land used for tobacco farming decreased during the study period (3329.8 squared meters in the winter season and 1997.3 squared meters in the spring season).

Figure 7 reports the average number of days that a person in Lau Thuong commune spent in a month in tobacco farming activities⁷. The figure was highest in December 2009 (harvesting and processing tobacco leaves of the winter season) and was lowest in March 2010 (caring tobacco plants and leaves of the spring season) (20.3 days vs. 8.4 days, respectively).

⁷ See annex for tobacco farming activities

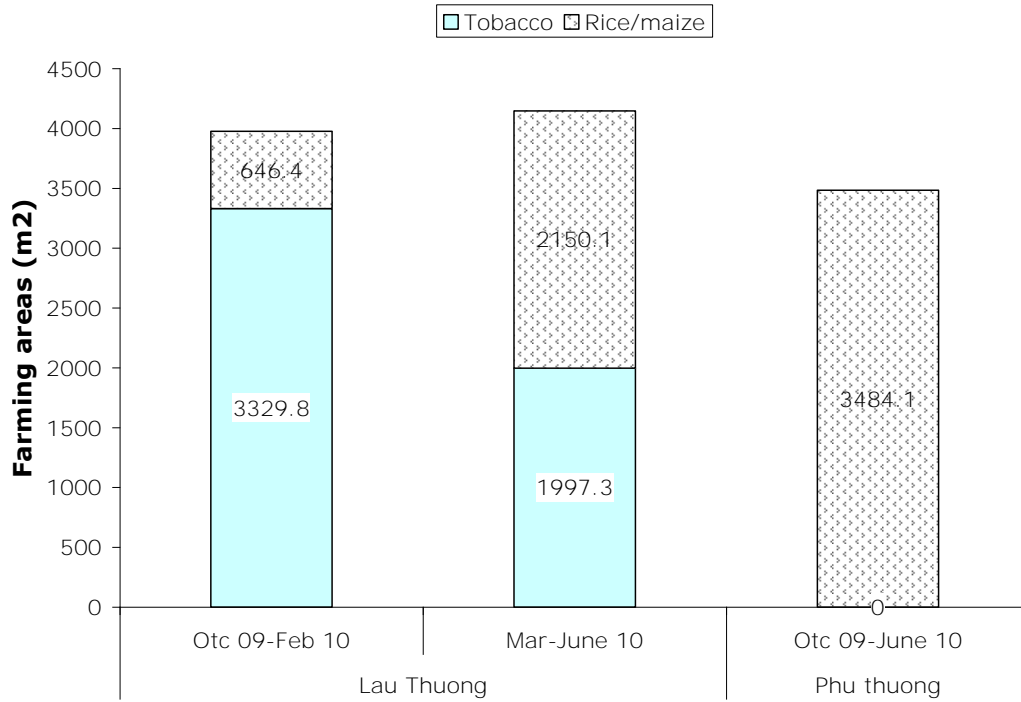


Figure 5: Average area of land used for cultivation in the 2 study commune (squared meters/household)

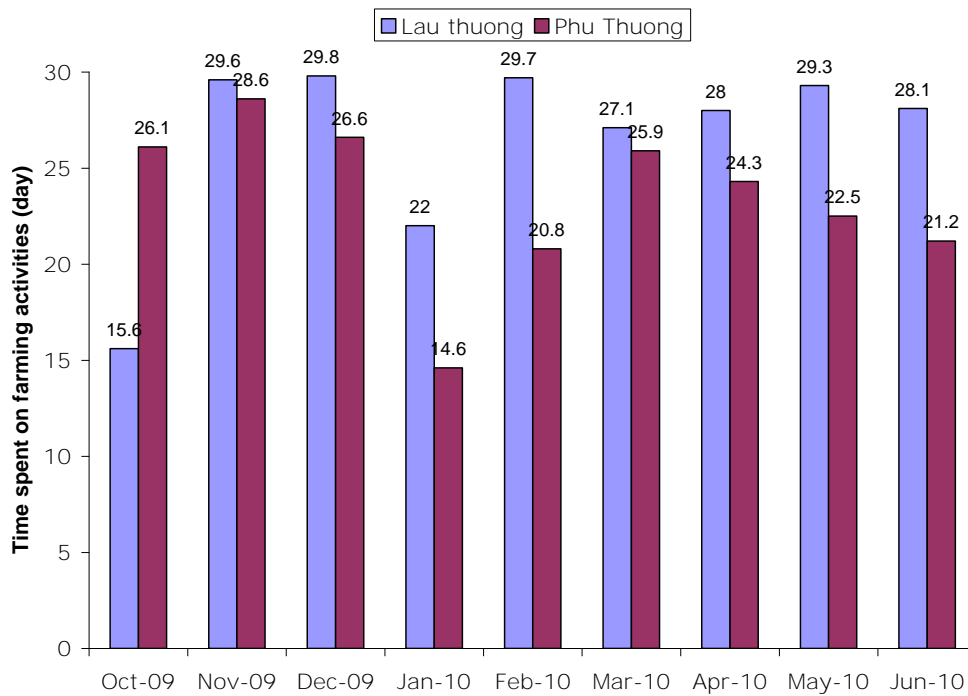


Figure 6: Time spent on farming activities in 2 study communes (days/person)

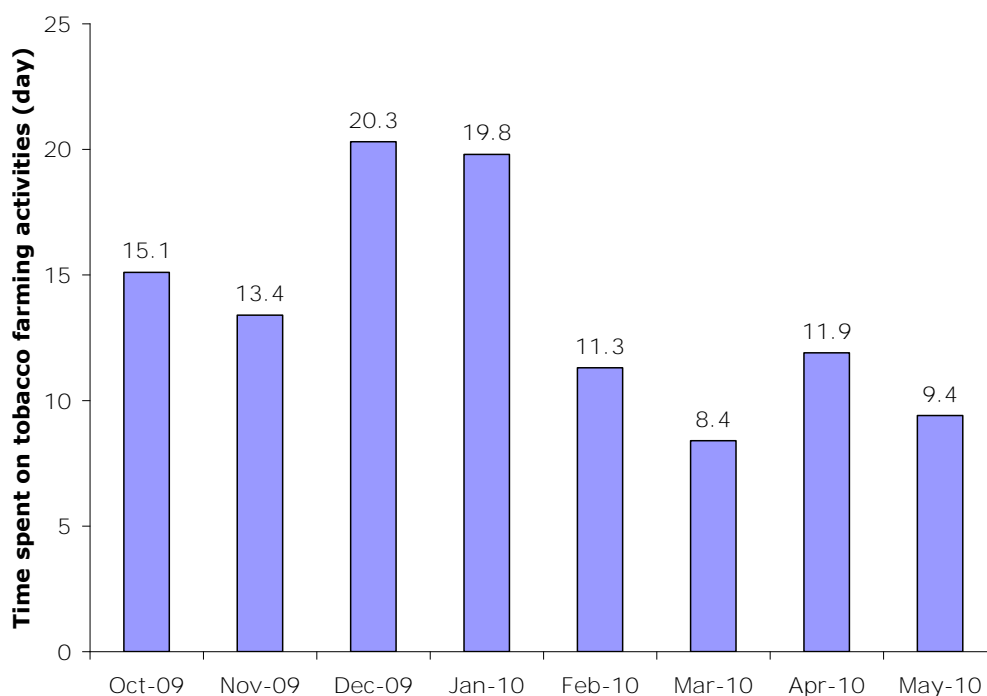


Figure 7: Time spent on tobacco farming activities in Lau Thuong commune (days/person)

Table 5 shows the total number of days a person in Lau Thuong commune spent on tobacco farming activities (overall and by gender, age and economic status). During the 2 tobacco farming seasons (8 months), the average number of days spent by a person in Lau Thuong commune on tobacco farming related activities was 109.7 days. Females spent significantly more time on tobacco farming related activities than males (120.1 days vs. 99.2 days). People aged 15-64 spent more time on tobacco farming related activities than the children (less than 15 years) and the elderly (aged 64 years and over). However, the times spent on tobacco farming related activities by both the children and the elderly were not minimal (about 39 days). The poor spent significantly more time on tobacco farming related activities than the non-poor (165.8 days vs. 103.4 days, respectively).

Table 5: Total number of days spent on tobacco farming activities in Lau Thuong commune by gender, age and economic status (days/person)

Characteristics	mean	sd	P value (Man-Whitney test)
Gender			
Males	99.2	67	<0.05
Females	120.1	70.7	
Age			
<15	39.3	30.7	<0.05

15-24	93.6	56.3	
25-34	152.4	54.9	
35-44	163.8	43.9	
45-54	149.3	55.3	
55-64	86.2	65.2	
>64	39.9	29.8	
Economic status			
Poor	165.8	90.8	<0.05
Non-poor	103.4	63.9	
Overall	109.7	69.6	

During the monthly follow-up surveys, the study subjects were asked about the number of illness episodes they experienced during the last month and the results are presented in Table 6 . People in Lau Thuong commune generally had more illness episodes than those in Phu Thuong commune⁸. During September 2009 – June 2010, the total number of illness episodes experienced by a person in Lau Thuong commune and in Phu Thuong commune were 5.8 and 3.9, respectively. The difference was statistically significant.

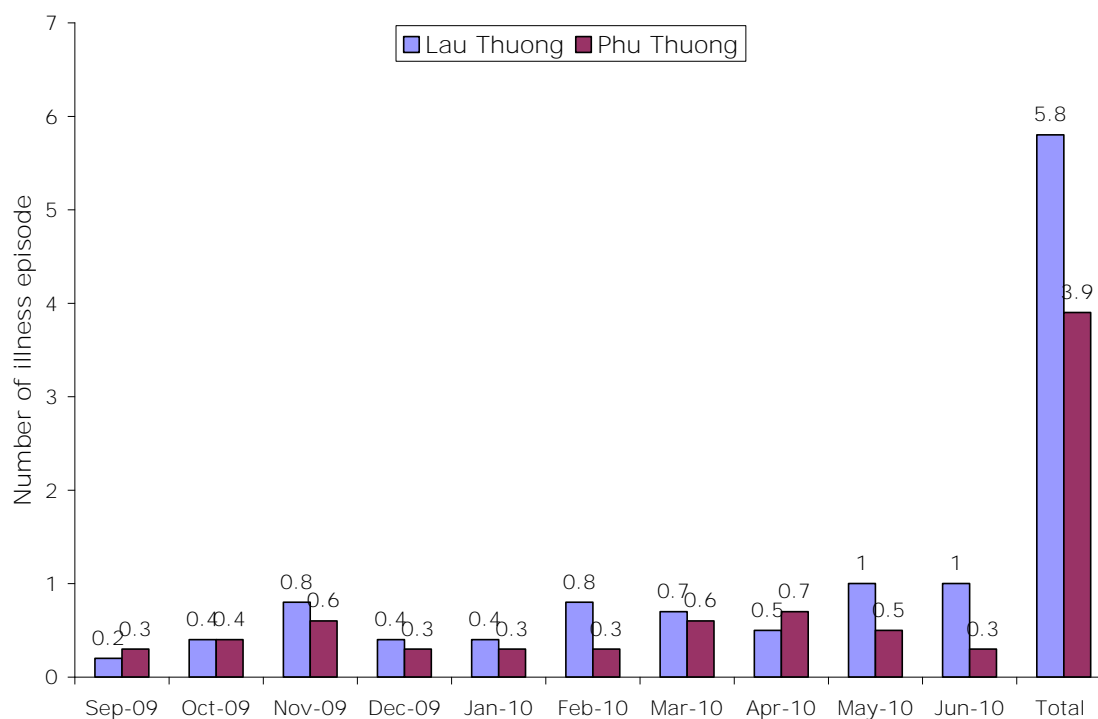


Figure 8: Number of illness episodes experienced by the study population

⁸ GTS among tobacco farmers in Lau Thuong, confirmed by doctors from commune health center are reported separately

Table 6: Distribution of illness episodes by gender, age and economic status (episodes per person)

Characteristics	Number of illness episodes mean(sd)
Gender*	
Males	5.1 (8.2)
Females	6.5 (8.0)
Age*	
<15	2.5 (3.1)
15-24	1.8 (2.4)
25-34	5.3 (6.7)
35-44	7.1 (6.5)
45-54	10.7 (12.3)
55-64	10.4 (9.9)
>64	10.4 (11.3)
Economic status*	
Poor	6.6 (9.5)
Non-poor	5.8 (8.0)
Overall	5.8 (8.1)

* *Significant difference ((Man-Whitney test)*

Table 7 report the distribution of illness episodes experienced by study population by gender, age and economic status. Females had significantly higher illness episodes than males (6.5 vs. 5.1). People aged 45 years and over had significantly more illness episodes than the younger people. The poor had more illness episodes that the non-poor (6.6 vs. 5.8) but the difference was not statistically significant.

People in Lau Thuong commune were also asked about green tobacco sickness (GTS)– a form of nicotine poisoning that affects workers who have direct contact with tobacco plants during cultivation and harvesting. Symptoms of GTS include weakness, headache, nausea, vomiting, dizziness, abdominal cramps, breathing difficulty, abnormal temperature, pallor, diarrhoea, chills, fluctuations in blood pressure or heart rate, and increased perspiration and salivation⁹. As shown in Figure 9 and Figure 10, green tobacco sickness was most prevalent in December 2009 (13.6%, 0.3 episodes/person). During the whole study period, 319 people in Lau Thuong commune (39%) experienced at least one green tobacco sickness

⁹ *People who got sick while doing tobacco farming were entitled to call for helps from doctors from coomune health center. The doctors should come right away to check weather or not it was a Green Tobacco Sickness.*

episode. The average number of episodes of green tobacco sickness experienced by a person in Lau Thuong during the 2 tobacco farming seasons was 0.8.

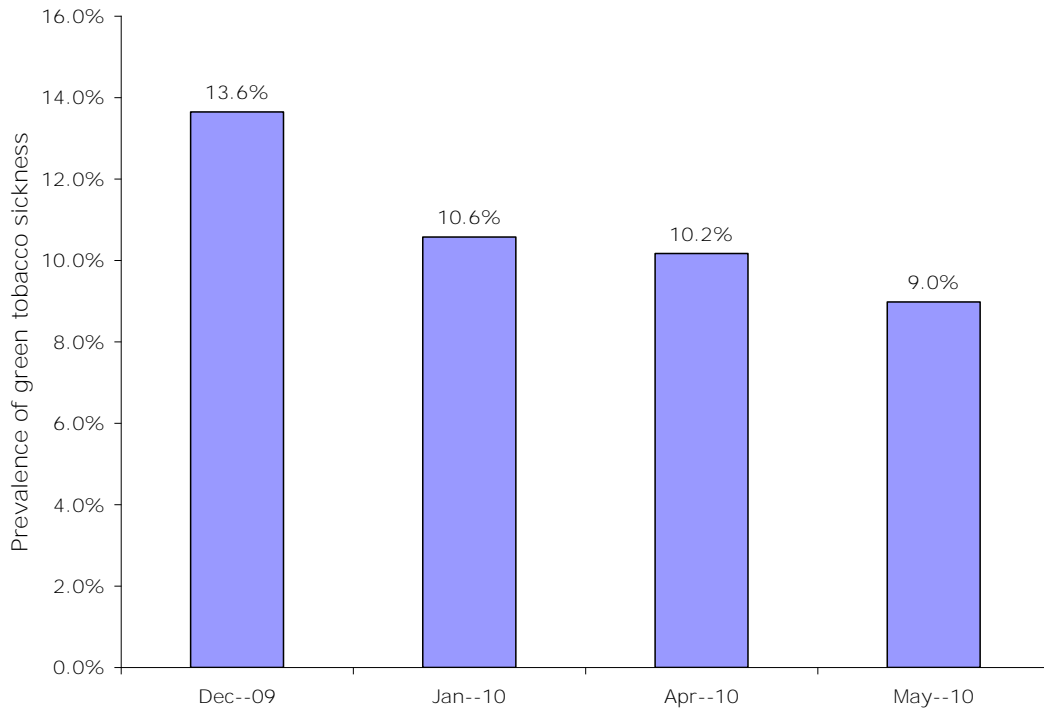


Figure 9: Prevalence of green tobacco sickness in Lau Thuong commune

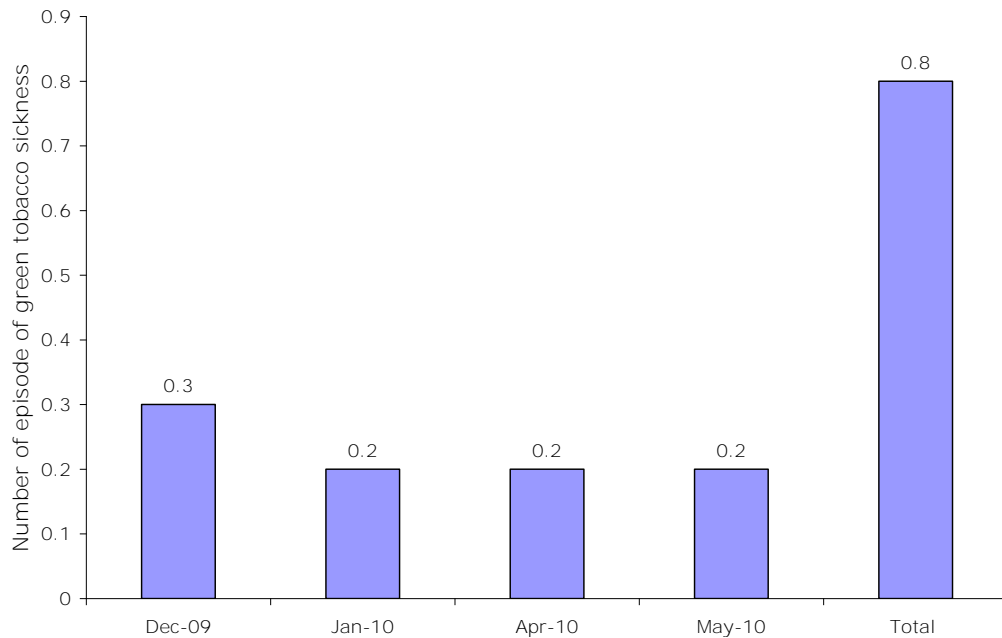


Figure 10: Number of episodes of green tobacco sickness experienced by study population in Lau Thuong commune

Table 7 report the distribution of episodes of green tobacco sickness experienced by study population in Lau Thuong commune by gender, age and economic status. Females had significantly higher episodes of green tobacco sickness than males (1.0 vs. 0.5). People aged 45 years and over had significantly more episodes of green tobacco sickness than the younger people. The poor had more episodes of green tobacco sickness that the non-poor (0.8 vs. 0.6) but the difference was not statistically significant.

Table 7: Number of number of episodes of green tobacco sickness experienced by study population in Lau Thuong commune by gender, age and economic status

Characteristics	Number of episode of green tobacco sickness mean(sd)
Gender	
Males	0.5 (0.9)
Females	1.0 (1.3)
Age	
<15	0.2 (0.4)
15-24	0.3 (0.7)
25-34	0.9 (1.2)
35-44	1.1 (1.3)
45-54	1.3 (1.4)
55-64	1.2 (1.4)
>64	1.2 (1.4)
Economic status	
Poor	0.6 (1.0)
Non-poor	0.8 (1.2)
Overall	0.8 (1.2)

* *Significant different ((Man-Whitney test)*

Different poisson regression models were performed (presented as Incidence Rate Ratio IRR and corresponding 95%CI) to examine the association between tobacco cultivation and the occurrence of health problem in the study populations. The dependent variables were the number of illness episodes and episodes of green tobacco sickness experienced by the study population. The independent variables were socio-demographic factors (gender, age, and economic situation), time spent on tobacco farming activities, having behavioural risk factors (smoking and alcohol use) and chronic disease at the beginning of the study period.

Model 1, with the number of illness episodes as dependent variable and included the all the study population from the 2 communes, shows that, after controlling for other factors, female gender, older age, living in Lau Thuong commune, doing tobacco farming activities for more than 60 days, being poor, smoking, using alcohol and having chronic disease were significantly associated with higher probability of contracting illness (Table 8). Most notably, females had 1.5 times higher risk of getting illness as compared with males. People aged 15-64 years had 2.0 times higher risk, and those aged more than 64 years had 3.9 times higher risk of getting illness as compared with the children aged less than 15 years. Farmers spent more than 60 days on tobacco farming activities had 1.4 times higher risk of getting illness as compared with those spent less than 60 days on tobacco farming activities.

Table 8: Model 1- Poisson regression analysis of the relationship between numbers of illness episode and selected factors (both communes)

Characteristics	IRR	95%CI
Gender		
Male	1	
Female	1.4*	1.4 -1.5
Age		
<15	1	
15-64	2.0*	1.8 -2.2
>64	3.9*	3.5 -4.3
Commune		
Lau Thuong	1	
Phu Thuong	0.9*	0.8 -0.9
Tobacco farming		
<60 days	1	
>= 60 days	1.4*	1.3 -1.5
Economic		
Poor	1	
Non-poor	0.9*	0.8 -0.9
Smoking		
Yes	1.2*	1.1 -1.3
No	1	
Alcohol use		
Yes	1.1*	1.1 -1.2
No	1	
Chronic disease		
Yes	1.4*	1.3 -1.5
No	1	

* Significant results

Model 2, with the number of illness episodes as dependent variable and included only population from Lau Thuong commune and interaction term between gender and number of day spent on tobacco farming activities, shows that, after controlling for other factors, female gender, older age, doing tobacco farming activities for more than 60 days, being poor, using alcohol and having chronic disease were significantly associated with higher probability of getting illness (Table 9). Most notably, females who spent more than 60 days on tobacco farming activities had 1.9 times higher risk of getting illness as compared with males who spent less than 60 days on tobacco farming activities.

Table 9: Model 2- Poisson regression analysis of the relationship between numbers of illness episode and selected factors (Only Lau Thuong, interaction between gender and tobacco farming day)

Characteristics	IRR	95%CI
Gender_tobacco farming day		
Male_ less than 60 days of tobacco farming	1	
Male_ more than 60 days of tobacco farming	1.2*	1.1 -1.2
Female_ less than 60 days of tobacco farming	1.1	0.9 -1.3
Female_ more than 60 days of tobacco farming	1.9*	1.7 -2.2*
Age		
<15	1	
15-64	1.6*	1.5 -1.8
>64	3.1*	2.7 -3.6
Economic		
Poor	1	
Non-poor	0.9*	0.8 -0.9
Smoking		
Yes	1.2*	1.1 -1.3
No	1	
Alcohol use		
Yes	1.5*	1.4 -1.6
No	1	
Chronic disease		
Yes	1.4*	1.3 -1.5
No	1	

* *Significant results*

Model 3, with numbers of episode of green tobacco sickness (GTS) as dependent variable and included only population from Lau Thuong commune, shows that, after controlling for

other factors, female gender, older age and using alcohol were significantly associated with higher probability of getting GTS (Table 10). Most notably, females had 2.9 times higher risk of getting GTS as compared with males. People aged 15-64 years had 2.6 times higher risk, and those aged more than 64 years had 4.2 times higher risk of getting GTS as compared with the children aged less than 15 years. Farmers spent more than 60 days on tobacco farming activities had 1.7 times higher risk of getting GTS as compared with those spent less than 60 days on tobacco farming activities.

Table 10: Model 3- Poisson regression analysis of the relationship between numbers of episode of green tobacco sickness and selected factors

Characteristics	IRR	95%CI
Gender		
Male	1	
Female	2.9*	2.3 -3.7
Age		
<15	1	
15-64	2.6*	1.7 -3.9
>64	4.2*	2.7 -6.7
Tobacco farming		
<60 days	1	
>=60 days	1.7*	1.3 -2.3
Economic		
Poor	1	
Non-poor	1.2	0.9 -1.6
Smoking		
Yes	0.9	0.7 -1.1
No	1	
Alcohol use		
Yes	2.3*	1.9 -2.8
No	1	
Chronic disease		
Yes	1	0.9 -1.2
No	1	

* *Significant results*

Model 4, with numbers of episode of green tobacco sickness as dependent variable and included only population from Lau Thuong commune and interaction term between gender and number of day spent on tobacco farming activities, shows that, after controlling for other factors, female gender, older age and using alcohol were significantly associated with higher probability of getting GTS (Table 11). Most notably, females who spent more than 60 days on tobacco farming activities had 3.6 times higher risk of getting GTS as compared with males who spent less than 60 days on tobacco farming activities.

Table 11: Model 4-Poisson regression analysis of the relationship between numbers of episode of green tobacco sickness and selected factors (interaction between gender and tobacco farming day)

Characteristics	IRR	95%CI
Gender_tobacco farming day		
Male_ less than 60 days of tobacco farming	1	
Male_ more than 60 days of tobacco farming	0.9	0.7 -1.3
Female_ less than 60 days of tobacco farming	1.3	0.9 -2.0
Female_ more than 60 days of tobacco farming	3.6*	2.6 -5.0
Age		
<15	1	
15-64	2.5*	1.6 -3.7
>64	4.4*	2.8 -6.9
Economic		
Poor	1	
Non-poor	1.3	0.9 -1.8
Smoking		
Yes	0.9	0.7 -1.2
No	1	
Alcohol use		
Yes	2.5*	2.0 -3.0
No	1	
Chronic disease		
Yes	1.0	0.9 -1.2
No	1	

* *Significant results*

4.3. Health care costs attributable to tobacco cultivation and processing

During the study period, 319 people in Lau Thuong commune (39%) experienced at least one green tobacco sickness episode. The average annual per capita out-of-pocket payment for treatment of GTS was VND 54,600 (Figure 11). As a result, the total health care expenditure for all the GTS episodes during the year was VND 17,417,000 (Table 12).

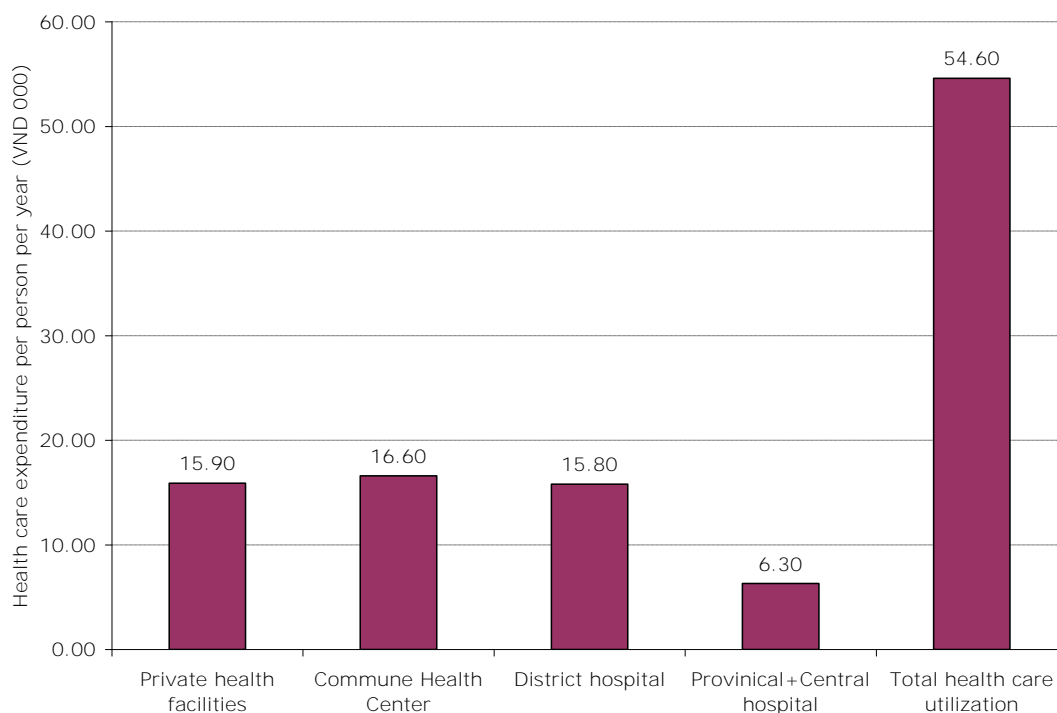


Figure 11: Out-of-pocket health care expenditure for treatment of GTS (000 VND per person per year)

Table 12 also shows that the productivity loss by the people with GTS (number of day the farmers can not work because of the GTS multiply by average daily earning¹⁰) was VND 34,400, 000 and the productivity loses by caregivers of the people who had GTS was VND 10, 300,000. The total health care costs attributable to green tobacco sickness among the study participants in Lau Thuong commune (820 people) was VND 62,117,000. Total health care cost due to green tobacco sickness in Lau Thuong commune (all 7000 people) was VND 530,267,000 (about US\$ 28,000¹¹).

Table 12: Health care costs attributable to green tobacco sickness

Type of expenditure	Expenditure (VND)
Total health care expenditure for all the GTS episodes during the year (VND 54.600 * 319 GTS episodes)	17,417,000
Productivity loses by the people who had GTS due to GTS (number of day the farmers can not work because of the GTS=	34,400,000

¹⁰ Average daily earning was about VND 100,000

¹¹ 1 US\$= VND 19,000

VND 100.000* 344 days)	
Productivity loses by caregivers of the people who had GTS (number of day the care givers spent on taking care of the people with GTS = VND 100.000* 103 days))	10,300,000
Total health care costs attributable to green tobacco sickness among the study participants in Lau Thuong commune (820 people)	62,117,000
Total health care costs attributable to green tobacco sickness in Lau Thuong commune (all 7000 people)	530,267,000

Figure 12 shows that household out-of-pocket payment for health was also higher in Lau Thuong commune than that in Phu Thuong commune (VND 354.700 per person per year vs. VND 330,000 per person per year, respectively¹²). The excess in total household out-of-pocket payment for health in Lau Thuong commune (7000 people¹³) was VND 173,040,000 (US\$ 9,107.37)¹⁴. As a result, the tobacco cultivation and processing related actives cost to Lau Thuong commune VND 703,307, 000 a year (about US\$ 37,000).

¹² Expenditure for treatments of green tobacco sickness were excluded

¹³ All of them were part-time tobacco farmers

¹⁴ There was no difference between the 2 communes in the number of days the farmers can not work because of illness as well as in the number of days the care givers spent on taking care of the ill people

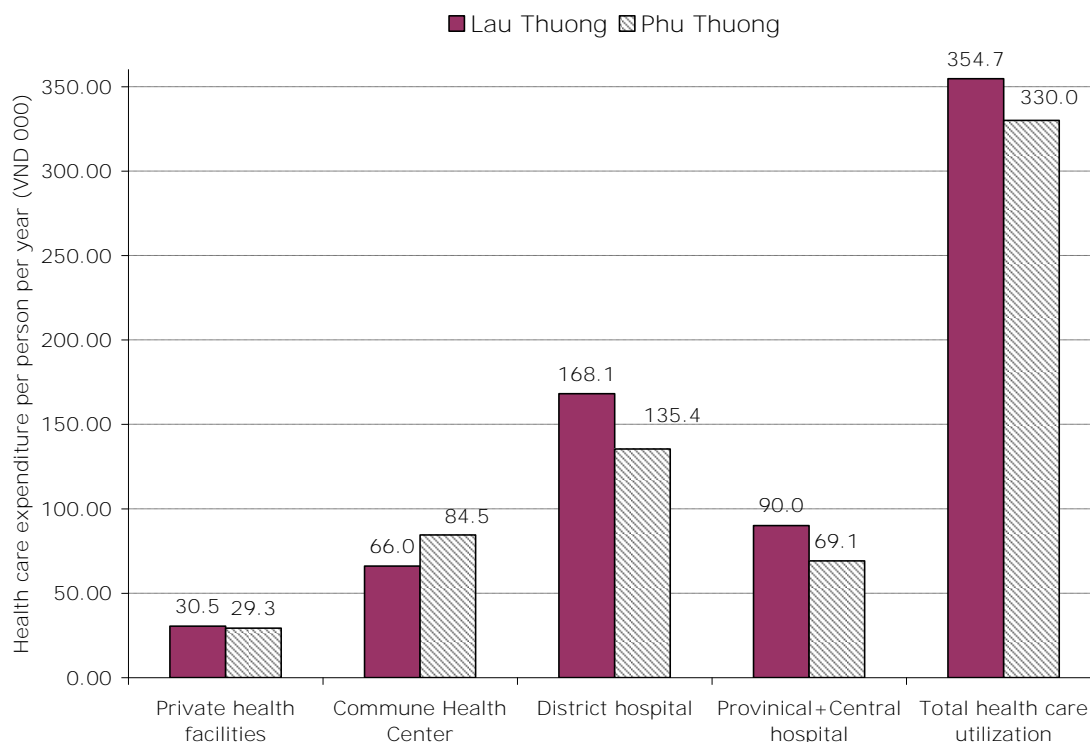


Figure 12: Out-of-pocket health care expenditure by the study population (000 VND per person per year)

4.4. Health beliefs

*** Perception of harmful effects associated with tobacco cultivation and processing**

The focus group discussions with the farmers revealed that both tobacco farmers and non-tobacco farmers could name 2 main problems associated with tobacco cultivation, including 1) Tobacco plants requires more fertilizers and pesticides; 2) Tobacco farming activities are more labor intensive. Some tobacco farmers mentioned that exposure to smokes while curing tobacco leaves could also lead to health problems.

Tobacco farmers also reported that they seemed to have more health problems while growing tobacco than during the time they planted other crops. Female tobacco farmers complained more about getting health problems during tobacco farming seasons than male tobacco farmers. Some farmers noticed that they had more illness while disbudding of auxiliary buds and harvesting tobacco leaves and they thought exposure to pesticides was the cause of the problems. However, none of the study participants can correlate their

illness with nicotine from tobacco leaves. They had never heard about Green Tobacco Sickness.

In-depth interviews with community leaders also indicated that the local authorities were not much aware of the harmful effects of nicotine poisoning among tobacco farmers.

The heads of Commune Health Center reported that local health staffs were aware of harmful effects of tobacco farming as they had to provide more health care services to the farmers during tobacco harvest than during other periods of time. The local health staffs in Lau Thuong (tobacco-farming commune) did know about Green Tobacco Sickness while taking part in our pilot study in 2007 [14].

*** Perception of severity of health problems associated with tobacco cultivation and processing**

Our study shows that the tobacco farmers were not concerned about severity of health problems they got while growing tobacco. None of the participants to the FGD said that they had ever worry about health problems they had during tobacco cultivation and processing times. They perceived *"the health problems were not very serious, just headache and dizziness"*.

Similarly, the community leader in Lau Thuong commune did not show his worries about health consequences of tobacco farming in his community: *"The tobacco farmers had to work had to get more revenues so that they might have more illness"*.

In-depth interviews with the heads of Commune Health Center showed that the health staffs had knowledge of possible serious consequences caused by Green Tobacco Sickness *"Green Tobacco Sickness is normally mild and can resolve on its own within one to two days, but symptoms may be so severe as to require emergency medical treatment"*.

*** Perception of benefits of stopping tobacco cultivation**

The focus group discussions revealed that some farmers had stopped or decreased growing tobacco because they did not get much economic benefits *"tobacco farming areas had been decreased because of tobacco price had declined during the last two years"*. None of the study participants reported that they had stooped tobacco farming because of health problems.

The community leaders and the heads of Commune Health Center had the same opinion *"if farmers find that tobacco farming brings them better revenues, they will continue plant tobacco"*.

*** Perception of barriers for stopping tobacco farming**

The focus group discussions showed that tobacco farmers did not know about any other economically beneficial crops that can replace tobacco: *"We don't know what to do, what to plant, we don't have any other stable works except some months where we can we plant rice and maize"*.

According to the community leader, in the past, the farmer were not successful with some other crops such as sunflower, colza and potato due to problems with either the planting soil or selling products *"The farmers here did try planting sunflower and colza but the soil is not appropriate. They switched to growing potato but the product could not be sold"*.

According to tobacco farmers and the community leaders, tobacco industry has been playing a very important role in tobacco farming activities in Lau Thuong commune. Tobacco industry provided trainings on tobacco cultivation techniques. They sold or provided fertilizers/pesticides to the farmers and purchased tobacco products. However, the tobacco industry did not ensure stable prices for tobacco products. *"The tobacco price has been seriously decreased during the past years, the price used to be VND 35,000-40,000/kilogram but now only VND 4,000-5,000/kilogram"*.

*** Cues to action**

Our study showed that both the farmers and local authorities did not have any clear strategies for promoting the livelihoods of the population while protecting them from possible occupational hazards. They simply stated that *"If price of tobacco goes up we will expand the tobacco farming areas because we don't know what to do. Health condition is important but we have no other choice"*

The local health staffs in Lau Thuong reported that had had no opportunity to do any formal health education about harmful social, environmental and health effect of tobacco farming *"in some community meetings, we have just been able to warn tobacco farmers that they should protect them self from illness while working in the field by wearing appropriate clothes"*. The local health staffs showed their willingness to take part in future health

education programs on promotion of people' knowledge and perception of harmful effects of tobacco farming.

V. DISSCUSSION

The demographic characteristics of the study populations are typical for mountainous communities in Vietnam. A majority of the study populations are Nung (an ethnic minority) and they had low educational level. The distributions of age and sex in the population correspond well to the usual pattern of population pyramid in Vietnam, which has more females and males and consists of a small proportion of elderly people.

Even though per capita income was a bit higher in the tobacco-farming commune compared to that in the non tobacco-farming commune (9.7 million/year vs. 8.7 million/year, respectively), the proportion of poor household, as classified by local Authorities, was not much different between the 2 communes (9.9% in the tobacco-farming commune vs. 11.6% non tobacco-farming commune). The per capita income in both commune was lower than average income level of Thai Nguyen province in 2008 (10.2 million/year)[15]. This proves the fact that the tobacco growers are not wealthier than other farmers. This is **contrary to the tobacco companies' claim that "tobacco brings prosperity to its planters"** [16] **and "tobacco is an important solution for hunger elimination and poverty reduction"** [17]. A study from Kenya also concluded that earnings from tobacco are not commensurate with the input by the farmers. Tobacco farmers are not in positions to feed, educate or clothe their children adequately [18] and an annual net income of a non-tobacco farmer is higher than that of a tobacco farmer[19].

In contrast, tobacco growers had more chronic diseases as well as behavioural risk factors. The prevalence of chronic disease among people in Lau Thuong was also higher than that among people in other rural setting in Vietnam (39%) [20].

This study revealed that females spent significantly more time on tobacco farming related activities than males (120.1 days vs. 99.2 days). It was also estimated from you qualitative survey that woman workload accounted for approximately from 60 to 70 percent of the total amount of tobacco production activities. This is in line with what reported worldwide, woman labour was widespread and essential at almost all stages of tobacco farming in this study [1, 21].

Consistent with previous reports elsewhere this study also found that the utilization of the labour of young children below the age of 15 was a common experience in the tobacco

farms (a children spent about 39 days on tobacco farming activities). This intensive involvement in tobacco farming activities would place these children at particular hazards to health and physical development [22, 23]. The poor were shown to be involved more in tobacco farming activities than the non-poor. These findings raise an important issue related to gender equality, social and health impact of tobacco growing on these vulnerable groups.

Our data clearly show that tobacco cultivation and processing was strongly associated with the occurrence of health problems. People in Lau Thuong commune had more illness episodes than those in Phu Thuong commune (total number of illness episodes experienced by a person in Lau Thuong commune and in Phu Thuong commune over 10 months were 5.8 and 3.9, respectively). This is consistent with the finding from our pilot study in the same setting [14] as well as reports of previous international researches [1, 8, 24, 25].

We also found that, during the whole study period, 319 people in Lau Thuong commune (39%) experienced at least one green tobacco sickness episode. The prevalence of green tobacco sickness lies in between the figures reported by studies from USA (from 24.2% [26] to 47% [24]). The average number of episodes of green tobacco sickness experienced by a person in Lau Thuong during the 2 tobacco farming seasons was 0.8.

Both general health problems and green tobacco sickness were more commonly reported among females than males (females had 1.5 times higher risk of getting general illness as compared with males and females had 2.9 times higher risk of getting GTS as compared with males). In this study, the joint effects of gender and the time spent on tobacco farming activities were also confirmed (females who spent more than 60 days on tobacco farming activities had 1.9 times higher risk of getting illness as compared with males who spent less than 60 days on tobacco farming activities and females who spent more than 60 days on tobacco farming activities had 3.6 times higher risk of getting GTS as compared with males who spent less than 60 days on tobacco farming activities).

The finding on green tobacco sickness is different from the pattern found in other international investigations which showed that nearly all of those affected by GTS are male [3, 27]. One common element of the explanation for women's higher rates of morbidity is that there are gender differences in the way that symptoms are perceived, evaluated and acted upon. However, a study in rural Vietnam has shown no gender differences in the reporting of health problems [28]. This suggests that there may be gender inequality in the health effects of tobacco growing in Vietnam. In fact, it is important to note that the roles women are vital at almost all stages of tobacco farming in the study settings. Women not only share with men the role of economic producers through their labour, but do so under

the added weight of their roles as biological producers of children and social reproducers through child-rearing and household management. Given the findings, actions toward **women's livelihoods and health** in the study settings are urgently needed.

This study shows that household out-of-pocket payment for health was higher in Lau Thuong commune than that in Phu Thuong commune (VND 354,700 per person per year vs. VND 330,000 per person per year, respectively). (The household out-of-pocket payments for health in both study communes were, however, lower than the average annual healthcare expenditure per capita in rural areas in Vietnam (VND 456,000) [15] but this was due to the fact that people, belonging to communes in disadvantaged mountainous areas, receive free health insurance as part of a national program on hunger eradication and poverty reduction. As a result, their health care costs at health facilities were mainly covered by the insurance scheme.)

Our study revealed that the tobacco cultivation and processing related activities caused Lau Thuong commune (with 7000 part-time tobacco farmers) an economic loss of VND 703,307,000 a year (about US\$ 37,000) . This amount of money was not small, accounting for about 1% total income of the commune. In Vietnam, the number of full-time equivalent tobacco cultivators was about 136,000 [10] and the out-of-pocket health spending attributable to tobacco cultivation and processing would be VND 27.3 billion (about US\$ 1.4 million). The figure on health cost attributable to tobacco cultivation and processing would be much higher the costs of health care incurred by health care providers and health insurance sector were included.

Our study found that tobacco farmers did notice some health problems during the times they grew tobacco or processed tobacco products. This is similar with the findings from the study by Quandt et al. , 2001 [29]. However, most farmers cannot well correlate their health problems with tobacco farming works. None of the study participants did know about green tobacco sickness. Study elsewhere also reported similarity that tobacco farmers often mis-identified their occupational illness causes and minimized its seriousness [30]. One of the reasons to explain this fact was that in this area, there was still absence of intervention to improve people awareness and perception of harmful effects of tobacco farming. The main barrier for stopping tobacco farming was that the farmers did not find other suitable crops to replace tobacco.

Limitations

This study is not without limitations. We could not assess the effects of pesticide on health of the study population because many farmers did use smuggled pesticide which has no any information on either brands as well as active substance. The farmers could not remember and quantify the amount of pesticides used for tobacco farming because the pesticides were usually shared for different crops. We did not include the costs of health care incurred by health care providers and health insurance sector. Characteristics of respondents such as their educational level, their ability to recall and their willingness to report information on different quintiles (e.g. days spent on tobacco farming activities, health care payments, etc) might also have influenced the accuracy of the study findings.

VII. CONCLUSION AND POLICY IMPLICATIONS

Our study provides the first prospective data on socio-economic and health effects of tobacco growing in the Vietnamese context. It confirms the facts that tobacco farming does not bring prosperity to the farmers while causing a lot of health problems to them, especially among the women. The health care cost attributable to tobacco cultivation and processing is considerable. Unfortunately, most farmers cannot correlate their health problems with tobacco farming works. There was still no intervention to improve people's awareness and perception of harmful effects of tobacco farming. Tobacco farmers knew that tobacco farming brought very little economic benefits to them but they did not know about other alternative crops to replace tobacco.

Article 17 of the WHO Framework Convention on Tobacco Control (FCTC) calls upon Parties to **"promote, as appropriate, economically viable alternatives for tobacco workers, growers and, as the case may be, individual sellers" which should be done "in cooperation with each other and with competent international and regional intergovernmental organizations"**.

Given the findings from this study, several public health implications could be considered:

- Promoting communications about harmful social, environmental and health effect of tobacco farming to raise awareness aiming at policy and behaviour change in both local governments and communities.
- Providing information on other crop options for farmers and on employment outside tobacco growing for them (especially the women and the children)

To strengthen the evidence on harmful effects of tobacco farming on socio-economic and health of tobacco farmers, it is also important to replicate this research in a larger scale. An intervention study (health education program and introduction of alternative crops) would be a research priority in the coming time.

VIII. REFERENCES

1. Campaign for Tobacco Free Kids: **Golden leaf barren harvest, the costs of tobacco farming**. 2001.
2. Mackay J, Eriksen M: *The Tobacco Atlas*. Geneva: World Health Organization; 2005.
3. Ballard T et al.: **Green tobacco sickness: occupational nicotine poisoning in tobacco workers**. *Archives of Environmental Health*. 1995, **50**:384-389.
4. Southeast Center Studies Ways To Prevent Green Tobacco Sickness: **NIOSH Agricultural Health & Safety Center News**. 1996.
5. Arcury TA et al.: **High levels of transdermal nicotine exposure produce green tobacco sickness in Latino farm workers**. *Nicotine & Tobacco Research* 2003, **5**:315-321.
6. Cox C. : **1,3-Dichloropropene**. *Journal of Pesticide Reform* 1992.
7. Cox C: **Chlorpyrifos Factsheet, Part 2**. *Journal of Pesticide Reform* 1995.
8. Schmitt NL, Schmitt J, Kouimintzis DJ, Kirch W: **Health risks in tobacco farm workers—a review of the literature**. *J Public Health* 2007, **15**:255-264.
9. Chloros D, Sichletidis L, Kyriazis G, Vlachogianni E, Kottakis I, M K: **Respiratory effects in workers processing dried tobacco leaves**. *Allergol Immunopathol* 2004, **32**(6):344-351.
10. Kinh HV, Bales S: **Tobacco in Viet Nam:the industry, demand, control policies and employment**. 2002.
11. Viet Nam Prime Minister’s Office: **Decision 77/2002/QD-TTg: Ratification of Programme of Prevention and Control of Certain Noncommunicable Diseases for the Period 2002–2010.**; 2002.
12. Viet Nam Prime Minister’s Office: **Government Resolution No.12/2000/NQ-CP on National Tobacco Control Policy 2000 - 2010**. 2000.
13. Glanz K, Marcus Lewis F, Rimer BK: *Theory at a Glance: A Guide for Health Promotion Practice*. *National Institute of Health.*; 1997.
14. Van Minh H, Giang KB, Bich NN, Huong NT: **Tobacco farming in rural Vietnam: questionable economic gain but evident health risks**. *BMC Public Health* 2009, **9**:24.
15. General Statistics Office: **Vietnam Living Standards Survey 2008** 2009.
16. Thang HD: **Investment in planting tobacco in Vietnam**. 2003.
17. Ministry of Planning and Investemnt: **Situation of cigarrete trading in Vietnam 1999-2000**. 2000.
18. Oongo E. O: **Tobacco growing in Kenya: viable alternative income generating activities for the farmers**. 2006.
19. Kibwage J K, Odondo A J, Momanyi GM: **Assessment of livelihood assets and strategies among tobacco and non tobacco growing households in south Nyanza region, Kenya**. *African Journal of Agricultural Research* 2009, **4**(4):294-304.

20. Hoang Van M, Dao Lan H, Kim Bao G: **Self-reported chronic diseases and associated sociodemographic status and lifestyle risk factors among rural Vietnamese adults**. *Scand J Public Health* 2008, **36**(6):629-634.
21. Muwanga-Bayego H: **Tobacco growing in Uganda: the environment and women pay the price**. *Tobacco Control* 1994, **3**:255-256.
22. WHO: **Tobacco & Health in the Developing World**. 2003.
23. Line Eldring, Sabata Nakanyane, Malehoko Tshoaedi: **Child Labour in the Tobacco Growing Sector in Africa**. 2000.
24. J.R. Parikh VNGPBDPKKARSHNS: **Acute and chronic health effects due to green tobacco exposure in agricultural workers**. 2005, **47**(6):494-499.
25. Nordin RB, et al: **Effects of Safety Behaviours with Pesticide Use on Occurrence of Acute Symptoms in Male and Female Tobacco-growing Malaysian Farmers**. *Industrial Health* 2002, **40**:182-190.
26. Arcury TA, Quandt SA, Preisser JS, Norton D: **The incidence of green tobacco sickness among Latino farmworkers**. *J Occup Environ Med* 2001, **43**(7):601-609.
27. McBride JS, Altman DG, Klein M, White W: **Green tobacco sickness**. *Volume 7*. 1998:294-298.
28. Giang KB, Allebeck P: **Self-reported illness and use of health services in a rural district of Vietnam: findings from an epidemiological field laboratory**. *Scand J Public Health Suppl* 2003 2003, **62**:52-58.
29. Sara Quandt, Thomas Arcury A, Bernert JT, John S Preisser, Deborah Norton: **Environmental and Behavioral Predictors of Salivary Cotinine in Latino Tobacco Workers**. *Journal of Occupational and Environmental Medicine*, 2001, **43** (10):844-852. .
30. Arcury TA, Quandt SA, Simmons S: **Farmer health beliefs about an occupational illness that affects farmworkers: The case of green tobacco sickness**. *Journal of Agricultural Safety and Health* 2003, **9**(1):33-45.