

## Review Article

# Non-communicable diseases, food and nutrition in Vietnam from 1975 to 2015: the burden and national response

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**Background and Objectives:** This review manuscript examines the burden and national response to non-communicable diseases (NCDs), food and nutrition security in Vietnam from 1975 to 2015. **Methods and Study Design:** We extracted data from peer-reviewed manuscripts and reports of nationally representative surveys and related policies in Vietnam. **Results:** In 2010, NCDs accounted for 318,000 deaths (72% of total deaths), 6.7 million years of life lost, and 14 million disability-adjusted life years in Vietnam. Cardiovascular diseases, cancers, chronic obstructive pulmonary disease, and diabetes mellitus were major contributors to the NCD burden. Adults had an increased prevalence of overweight and obesity (2.3% in 1993 to 15% in 2015) and hypertension (15% in 2002 to 20% in 2015). Among 25-64 years old in 2015, the prevalence of diabetes mellitus was 4.1% and the elevated blood cholesterol was 32%. Vietnamese had a low physical activity level, a high consumption of salt, instant noodles and sweetened non-alcoholic beverages as well as low consumption of fruit and vegetables and seafood. The alcohol consumption and smoking prevalence were high in men. Exposure to second-hand tobacco smoke was high in men, women and youths at home, work, and public places. In Vietnam, policies for NCD prevention and control need to be combined with strengthened law enforcement and increased program coverage. There were increased food production and improved dietary intake (e.g., energy intake and protein-rich foods) thanks to appropriate economic, agriculture, and nutrition strategies. **Conclusions:** NCDs and their risk factors are emerging problems in Vietnam, which need both disease-specific and sensitive strategies in health and related sectors.

**Key Words:** food, noncommunicable diseases (NCDs), nutrition, policies, Vietnam

## INTRODUCTION

More and more people worldwide are dying from non-communicable diseases (NCDs).<sup>1,2</sup> Among the world's 56 million deaths in 2012, NCDs were responsible for 38 million deaths (68%), of which 28 million occurred in low- and middle-income countries (LMICs).<sup>2</sup> In LMICs, the increased burden of NCDs resulted from a higher life expectancy at birth, a less healthy diet (e.g., high in fat, LDL cholesterol, sugar, salt; low in fiber and polyunsaturated fatty acids), sedentary lifestyles, and increased overweight and obesity.<sup>1,2</sup> In addition to NCDs, LMICs still have to deal with malnutrition and infectious diseases, suboptimal breastfeeding and complementary feeding practice for children, food insecurity, and disasters.<sup>1,3,4</sup>

Within several years after 1975, Vietnam was in an economic crisis. The existing centralized economic policies that remained after the war into the postwar period were not appropriate, especially in the south of Vietnam with a market-oriented economy.<sup>5,6</sup> Economic reforms (termed Doi Moi) which began in the 1980s transformed Vietnam from one of the poorest countries to a lower middle-income country by 2011.<sup>7</sup>

The annual gross domestic product (GDP) increased

from 4% in the late 1980s to 7-11% from 1991 to 2011, and about 5% from 2012 to date, with a minimal fluctuation after regional financial crises in the late 1990s and late 2000s.<sup>7</sup> Per capita GDP (in Purchasing Power Parity terms) increased from less than \$1000 in 1980s to \$2650 in 2000, and about \$5500 in 2014.<sup>7</sup> From 1990 to 2015, the trend of lower death rate and birth rates was associated with an increased total population from 66 to 93 million; life expectancy at birth rose from 71 to 76 years; the elderly population increased from 8% to 10%; and urban population rose from 20% to 34%.<sup>7-10</sup>

Similar to other LMICs,<sup>1</sup> the rapid economic growth, urbanization and aging population in Vietnam have led to presented findings about nutrition status from 1992 to

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2005,<sup>6,14-17</sup> dietary intake in 2000,<sup>17-19</sup> hypertension an increased burden of NCDs.<sup>11-13</sup> Previous peer-reviewed papers using nationally representative data in Vietnam from 2002-2008,<sup>11,16,20</sup> smoking from 1992 to 2010,<sup>21</sup> and cancer mortality in 2005.<sup>22</sup> However, most of the data were more than 10 years old, and few data focused on other NCDs (e.g., chronic obstructive pulmonary disease (COPD) and mental disorders) or their risk factors (e.g., hyperglycemia, elevated blood cholesterol, physical activity, and alcohol consumption). Findings from Vietnam were typically published in project reports, presentations, factsheets, or websites, which make it difficult to have a quick overview about NCDs, food, and nutrition in Vietnam. The first aim of this review manuscript is to examine secular trends in food production, consumption, nutritional and health status with focus on NCDs and their risk factors from 1975 to 2015.

In addition, Vietnam has tailored policies for each developmental period to address the demographic, epidemiological, and nutrition transition.<sup>23</sup> The second aim of this study is to determine key policies that related to agriculture, food, nutrition, and health in Vietnam between 1975 and 2015.

## METHODS

### *Search strategy*

We extracted data from peer-reviewed manuscripts and reports of national representative surveys in Vietnam during 1990-2015. To identify peer-reviewed publications, we used PubMed search through September 10, 2016: 1) location in the title and abstract (Vietnam or Viet Nam), and in any fields for 2) human subject (man, woman, men, women, male, female, children, infant, boy, or girl), 3) the size of surveys (representative, national, or nationwide), and 4) NCDs terms (overweight, hypertension, hyperglycemia, elevated blood cholesterol, cardiovascular diseases (CVD), NCD, metabolic syndrome, physical activity, dietary intake, alcohol consumption, tobacco, smoking, cancer, chronic obstructive pulmonary disease, COPD, or mental). Based on screening titles of 312 articles, we narrowed to 27 relevant publications (excluded mostly those with a non-representative sample, or about overseas Vietnamese populations). Additional screening of abstract and full text found 13 relevant papers. We did not find additional articles from the references in relevant articles. We also searched for related reports in libraries of different institutions, including the World Health Organization, World Bank, Vietnam Ministry of Health, research institutes, universities, and non-governmental organizations. We also discussed with experts in the field to explore unpublished data from working reports. In total, we identified additional 8 published and two working reports.

The 13 papers and 10 reports included in this study were based on 10 multi-stage, nationally-representative surveys related to NCDs and/or their risk factors in Vietnam from 1990 to 2015 (Table 1). They are: the Vietnam Living Standard Survey 1992-93,<sup>6,14,24</sup> the Vietnam National Health Survey 2001-2002,<sup>6,14,25</sup> the National Nutrition Survey 2000<sup>15,26</sup> and 2010,<sup>27</sup> National Adult Obesity Survey 2005,<sup>15,16,28</sup> the WHO STEPwise approach to Surveillance (STEPS) in 2009-2010 and in

2015,<sup>21,29,30</sup> the Vietnam Global Adult Tobacco Survey in 2010 and in 2015,<sup>31-33</sup> and the Vietnam Global Youth Tobacco Survey 2014.<sup>34,35</sup>

### *Data extraction*

In this report, we describe the status and/or trend of four NCDs (cancers, cardiovascular diseases, diabetes mellitus, COPD and asthma), four physiological and metabolic risk factors (overweight/obesity, hypertension, hyperglycemia, and elevated blood cholesterol), and four behavioral risk factors (tobacco smoking, sedentary, unhealthy diet, and harmful use of alcohol). Whenever possible, we stratified the data by sex, age, and place of residence. In cases of multiple data sources for a given NCD or risk factor, we gave priority to peer-reviewed publications and published reports; data were measured consistently and stratified by age, gender and location. The Annual Health Review focusing on NCDs<sup>12</sup> was our reference for cancers and mental diseases.

### *Identification of policies*

The list of policies was identified based on previous publications as related to policies for economic and agricultural policies,<sup>36-38</sup> foods and nutrition,<sup>39,40</sup> and NCDs in Vietnam.<sup>12,40</sup> in Vietnam. We collected information about the name, year of issue, and select comments from published reports about these policies.

### *Ethical consideration*

This review was exempted from Institutional Review Board review because the authors worked with published or under preparation reports and published papers in peer-reviewed journals, in which participant information was de-identified.

## RESULTS

### *Burden of noncommunicable diseases*

In 2010, NCDs accounted for 318,000 deaths (72% of total deaths), 6.7 million years of life lost (56% of total YLLs), and 14 million disability adjusted life years lost (66% of DALYs lost) in Vietnam (Table 2).<sup>12,41</sup> Cardiovascular diseases, cancers, chronic obstructive pulmonary disease, and diabetes mellitus were major contributors to the NCD burden.<sup>12,41</sup>

### **Cardiovascular disease**

Table 2 shows that relative to the contribution of NCDs, cardiovascular disease accounted for 38% of total deaths (or 122,000), 28% of YLLs (or 1,920,000), and 14% of DALYs lost (or 2,030,000).<sup>12,41</sup> Common cardiovascular diseases were hemorrhagic stroke, ischemic heart disease, hypertensive heart disease, and ischemic stroke.<sup>12,41</sup>

### **Cancers**

Relative to other NCDs, cancers accounted for 29% of total deaths (or 91,500), 34% of YLLs (or 2,320,000), and 17% of DALYs lost (or 2,360,000) (Table 2).<sup>12,41</sup> The number of new cancer cases within a year in Vietnam was estimated at 125,000.<sup>12,42</sup> Cancers were more prevalent in males than females (57 vs 43%). Liver, lung, stomach and colon cancers were the most common types of cancers in males, which accounted for about 66% of all new cases.

**Table 1.** Nationally representative surveys with measured noncommunicable disease components from 1990 to 2015 in Vietnam.<sup>6,12,14-16,21,24-29,31,32,35</sup>

Survey description	Participants and sample size	NCD related variables											
		Weight	Height	Blood pressure	Fasting glucose	Total cholesterol	F&V consumption	Tobacco usage	Alcohol consumption	Physical activities	Cancers	COPD	Mental health
1 Vietnam Living Standard Survey (1992–1993): <sup>6,14,24</sup> aimed at measuring the living standard of Vietnamese using two-stage-cluster, self-weighted, nationally representative, household survey that was implemented by GSO.	4,800 hhs; n=24,100; age ≥0 y	✓	✓						✓				
2 Vietnam National Health Survey (2001-2002): <sup>6,14,25</sup> aimed at measuring different aspect of health and access to healthcare services using three-stage-cluster sampling, nationally representative, household survey that was managed by MOH and implemented by GSO.	36,000 hhs; n=158,000; age ≥0 y	✓	✓	✓					✓	✓			
3 National Nutrition Survey (2000): <sup>15,26</sup> aimed at measuring nutrition status and dietary intake of Vietnamese children and adults using two-stage-cluster sampling, nationally representative, household survey that was managed and implemented by NIN	7,686 hhs; n=150,000; age ≥0 y; 9.9% aged 25-64 y	✓	✓				✓						
4 National Adult Obesity Survey (2005): <sup>15,16,28</sup> aimed at measuring nutrition status, dietary intake, obesity, and NCDs risk factors of Vietnamese adults aged 25-64 y using two-stage-cluster sampling, nationally representative survey of adults aged 25-64 y, which was managed by MOH, implemented by GSO.	N=17,200; age 25-64 y	✓	✓	✓	✓	✓	✓	✓	✓	✓			
5 National Nutrition Survey (2009-2010): <sup>27</sup> aimed at measuring nutrition status and dietary intake of Vietnamese children and adults using two-stage-cluster sampling, nationally representative, household survey that was managed and implemented by NIN	7,680hhs; n=118,000; 83% participants <5 y	✓	✓				✓		✓				
6 Vietnam STEPS Survey (2009-2010): <sup>21,29</sup> aimed at measuring chronic disease risk factors in Vietnamese adults using two-stage-cluster sampling, nationally representative survey of adults aged 25-64 y, which was managed by MOH and implemented by GSO.	N=14,700; age 25-64 y	✓	✓	✓	✓	✓	✓	✓	✓	✓			
7 Vietnam STEPS Survey (2015): <sup>30</sup> aimed at measuring chronic disease risk factors in Vietnamese adults using two-stage-cluster sampling, nationally representative survey of adults aged 18-69 y, which was managed by MOH and implemented by GSO. †	N=3,760; age 18-69 y. Findings were also reported for 25-65 y old	✓	✓	✓	✓	✓	✓	✓	✓	✓			
8 Global Adult Tobacco Survey (GATS; 2010): <sup>31,32</sup> aimed at establishing a baseline for indicators of tobacco use and tobacco control measures in adults, using two-stage-cluster sampling, nationally representative survey of adults aged ≥15 y, which was conducted by Vietnam MOH, Hanoi Medical University, and GSO	N=9,930; age ≥15 y								✓				

COPD: chronic obstructive pulmonary disease; F&V: fruit and vegetables; GSO: General Statistic Office; hhs: households; MOH: Ministry of Health; NCDs: noncommunicable diseases; NIN: National Institute of Nutrition.

†The GATS and STEPS in 2015 were nested within one another (i.e., shared data collectors and some participants).

**Table 1.** Nationally representative surveys with measured noncommunicable disease components from 1990 to 2015 in Vietnam.<sup>6,12,14-16,21,24-29,31,32,35</sup> (cont.)

Survey description	Participants and sample size	NCD related variables											
		Weight	Height	Blood pressure	Fasting glucose	Total cholesterol	F&V consumption	Tobacco usage	Alcohol consumption	Physical activities	Cancers	COPD	Mental health
9 Global Adult Tobacco Survey (GATS; 2015): <sup>31-33</sup> aimed at monitoring the trend of tobacco usage and related factors in Vietnamese adults, using two-stage-cluster sampling, nationally representative survey of adults aged ≥15 y, which was conducted by Vietnam MOH, Hanoi Medical University, and GSO. <sup>†</sup>	N=9,210; age ≥15 y							✓					
10 Global youth tobacco use survey (GYTS; 2014): <sup>34,35</sup> aimed at establishing a baseline for indicators of tobacco use and tobacco control measures in youth, using two-stage-cluster sampling, nationally representative, school-based survey of students aged 13-15 y, which was conducted by Vietnam MOH, Hanoi Medical University, and GSO	N=3,430; age 13-15 y							✓					
11 Others, including disease registry, smaller scale surveys <sup>12</sup>										✓	✓	✓	

COPD: chronic obstructive pulmonary disease; F&V: fruit and vegetables; GSO: General Statistic Office; hhs: households; MOH: Ministry of Health; NCDs: noncommunicable diseases; NIN: National Institute of Nutrition.

<sup>†</sup>The GATS and STEPS in 2015 were nested within one another (i.e., shared data collectors and some participants).

**Table 2.** The burden of non-communicable diseases in Vietnam.<sup>12,41</sup>

	No. of deaths	Years of life lost (YLL)				Disability adjusted life years (DALY)			
		Total	Percentage of total			Total	Percentage of total		
			Overall	Males	Females		Overall	Males	Females
<b>Absolute contribution</b>									
Total	318,000	6,760,000	56.1	35.1	20.9	14,200,000	66.3	36.2	30.1
Hypertensive heart disease	6,820	105,000	0.9	0.3	0.5	109,000	0.5	0.2	0.3
Hemorrhagic stroke	80,800	1,240,000	10.3	6.5	3.8	1,250,000	5.8	3.7	2.2
Ischemic heart disease	27,100	469,000	3.9	2.6	1.3	533,000	2.5	1.6	0.9
Ischemic stroke	6,830	105,000	0.9	0.5	0.3	136,000	0.6	0.4	0.3
Diabetes	11,300	214,000	1.8	0.8	0.9	367,000	1.7	0.8	0.9
COPD	18,600	241,000	2.0	1.3	0.7	702,000	3.3	1.8	1.5
Asthma	5,460	101,000	0.8	0.5	0.3	301,000	1.4	0.7	0.7
Cancers	91,500	2,320,000	19.2	12.0	7.2	2,360,000	11.0	6.8	4.2
Alcohol-related mental disorder:	1,130	42,000	0.3	0.3	0.0	275,000	1.3	1.1	0.1
Other NCDs	68,900	1,920,000				8,190,000			
<b>Relative to all NCDs (%)</b>									
Cardiovascular diseases	38.2	28.4				14.3			
Cancers	28.7	34.3				16.6			
COPD/Asthma	7.6	5.1				7.1			
Diabetes mellitus	3.5	3.2				2.6			
Other NCDs	22.0	29.1				59.5			

COPD: chronic obstructive pulmonary disease; NCDs: noncommunicable diseases.

Breast, lung, liver and cervix cancers were the most common types of cancer in women, which accounted for about 50% of all new cases.<sup>12,42</sup>

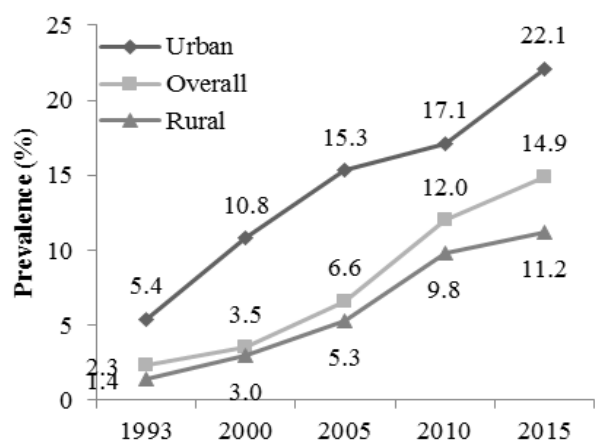
### Chronic lung disease

The prevalence of COPD was 4.2% (overall), 7.1% in men and 1.9% in women.<sup>12</sup> Asthma prevalence was 3.9% (overall), 3.3% in children and 4.4% in adults.<sup>12</sup> Relative

to other NCDs, COPD and asthma accounted for 8% of total deaths (or 24,100), 5% of YLLs (or 342,002), and 17% of DALYs lost (or 1,000,000) (Table 2).<sup>12,41</sup>

### Mental and neurological disorders

A survey on mental health in 2000 indicated that 14.9% of the population was affected by a type of mental disorders and conditions, namely alcohol abuse (5.5%), de-



**Figure 1.** The trend of overweight and obesity in adults from 1993 to 2015.<sup>6,14,15,29,30</sup>

pression (2.8%) and anxiety (2.6%).<sup>12,38</sup> Also, nearly three million Vietnamese had a severe mental disorder such as schizophrenia, depression, bipolar disorder and other severe signs of anxiety and depression.<sup>12</sup> Alcohol-related mental disorders itself accounted for 1,130 deaths, 42,000 YLLs, and 275,000 DALYs lost (Table 2).<sup>12,41</sup>

#### Physiological and metabolic risk factors

Overweight and obesity. Among Vietnamese 18-65 years old, the prevalence of overweight and obesity increased from 2.3% in 1993 to 15% in 2015 (Figure 1).<sup>6,14,15,27,29,30</sup> Rural residents had a lower prevalence of overweight and obesity than urban residents. However, the increment rate became higher in rural population in the 2005-2010 period. In children under five in the 2000-2010 period, the prevalence of overweight and obesity increased from 0.6% to 5.6% (overall), 0.9% to 6.5% in urban, and 0.5 to 4.2% in rural areas (Data not shown).<sup>6,14,15,27,29</sup>

#### Hypertension

The prevalence of hypertension in adults aged 25-64 increased from 15% in early 2002 to about 20% in surveys between 2005 and 2015 (Table 3).<sup>16,20,25,28-30</sup> The prevalence of hypertension was higher in men than women in

all surveys, especially in surveys between 2005 and 2015 (Table 2).<sup>16,20,25,28-30</sup>

The prevalence of hypertension was 25% in adults aged 25 or older reported by another study in eight Vietnam provinces from 2002 to 2008.<sup>11,43</sup> Among the detected hypertensive individuals, only 48% had known their status, 30% were treated, and 11% controlled their blood pressure (i.e. blood pressure <149/90 mmHg).<sup>11,43</sup> The prevalence of hypertension increased with age in both men and women, and was higher in urban than rural residences (33% vs 17%).<sup>11,43</sup> Annually, hypertension accounted for 91,600 deaths (20.8% of total deaths) and 7.2% of DALYs lost, mainly through increased stroke and cardiovascular diseases.<sup>12,41</sup>

#### Impaired fasting glucose

The prevalence of elevated fasting glucose in 25-64 years old was 1.6% in 2009-2010 and 3.6% in 2015 (Table 3).<sup>29,30</sup> The prevalence of diabetes mellitus increased from ~1.5% in 1990s, to ~3% in 2010, ~4% in 2015, and projected to be ~4.5% in 2030.<sup>29,30,44,45</sup> Elevated fasting blood glucose caused 6.3% of total deaths and 3% of total DALYs lost in 2010.<sup>12,41</sup>

#### Elevated blood cholesterol

In 2010 and 2015, almost one-third of adults aged 25-64 had an elevated cholesterol (Table 3).<sup>29,30</sup> Elevated blood cholesterol accounted for 1.4% of total deaths and 0.7% of DALYs lost.<sup>12,41</sup>

#### Behavioral risk factors

##### Unhealthy diet

Vietnam experienced changes in dietary pattern, namely increased consumption of meat, fish, eggs, milk and dairy products, fruits and vegetable, and thus increased consumption of protein and fat between 1981 and 2010, especially between 2000 and 2010 (Figure 2).<sup>25,26</sup> Vietnamese had a high consumption of salt (18-22 g/person/day), instant noodles (5.1 billion packs/year) and sweetened beverages (925 million L/year), and low consumption of fruit and vegetables (e.g., 80% adults with less than 5

**Table 3.** The prevalence of select NCD risk factors in adults aged 25-64 years.<sup>29,30</sup>

	2010			2015		
	Both sexes	Males	Females	Both sexes	Males	Females
<b>Physiological and metabolic risk factors</b>						
Overweight (body mass index $\geq 25$ kg/m <sup>2</sup> )	12.0	12.5	11.4	17.5	16.9	18.1
High blood pressure <sup>†</sup>	19.2	23.1	15.5	20.3	24.7	16.1
Impaired fasting blood glucose <sup>‡</sup>	3.6	3.9	3.1	1.6	2.0	1.2
Diabetes mellitus <sup>§</sup>	2.7	2.8	2.6	4.1	4.6	3.6
Elevated blood cholesterol <sup>¶</sup>	30.1	27.8	32.3	32.4	27.9	36.7
<b>Behavioral factors</b>						
Low level of physical activity <sup>††</sup>	28.7	26.4	30.8	26.1	19.0	32.6
Drank alcohol in the past 30 days	37.0	69.6	5.6	44.8	80.3	11.2
Consumed <5 servings of fruit and/or vegetables per day	80.4	80.2	80.6	57.2	63.2	51.5
Ever smokers	29.6	59.4	1.7	.	.	.
Smoke tobacco daily	28.2	56.5	1.7	.	.	.

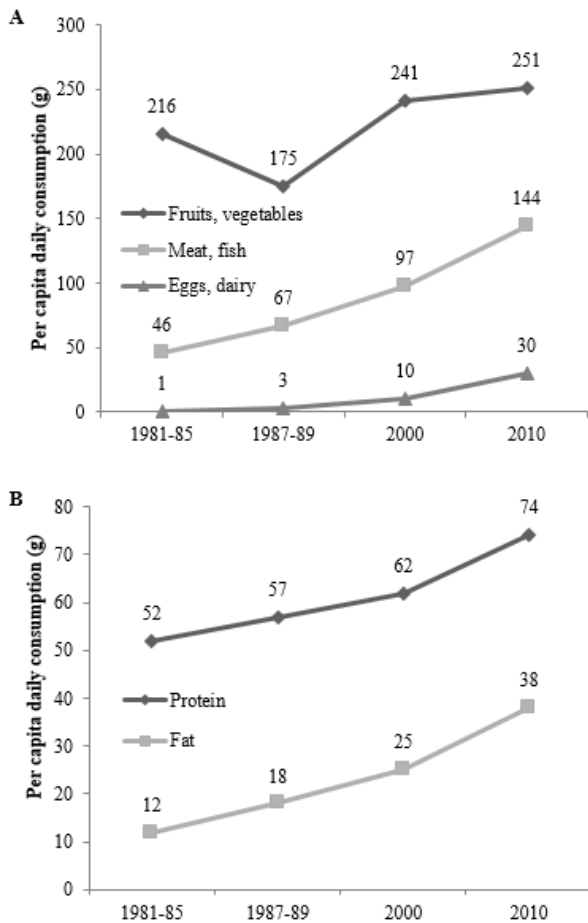
<sup>†</sup>Systolic blood pressure  $\geq 140$  and/or diastolic blood pressure  $\geq 90$  mmHg, or currently on medication.

<sup>‡</sup>Whole blood value  $\geq 6.1$  mmol/L (or 110 mg/dL) but <7.2 mmol/L (or 126 mg/dL).

<sup>§</sup>Whole blood value  $\geq 7.2$  mmol/L or currently on medication.

<sup>¶</sup>Total cholesterol  $\geq 5.0$  mmol/L (or 190 mg/dL) or currently on medication.

<sup>††</sup>Level of physical activity <600 MET-min per week.



**Figure 2.** The trend of per capita, daily consumption of foods (A) and macronutrients (B).<sup>26,27</sup>

portions /day) and seafood (2.5 kg/ person/month).<sup>12,28</sup>

### Physical inactivity

The prevalence of adults aged 25-64 with a low level of physical activity was 26% in men and 31% in women in 2010, and 19% in men and 32% in women in 2015 (Table 3).<sup>29,30</sup> Physical inactivity accounted for about 2.8% of total deaths and 1.5% of DALYs lost annually, mainly through cardiovascular diseases, colon cancer and diabetes mellitus.<sup>12,41</sup>

### Alcohol usage

As of 2010, the proportion of men who used alcohol in the previous 30 days was 70%, about 11 times higher than that of women (Table 3).<sup>29</sup> For unknown reasons, the prevalence of alcohol consumption was higher in 2015

than in 2010 (10 percentage points in men and 6 percentage points in women).<sup>30</sup> The annual consumption of pure alcohol in men was 12.1 L (overall) and 27.4 L (in alcohol drinkers) and in women was 0.2 L (overall) and 0.9 L (in alcohol drinkers).<sup>12</sup> Annually, alcohol use accounted for 5.7% of total deaths and 4.7% of DALYs lost.<sup>12,41</sup>

### Tobacco usage

In 2010, almost 60% of people 25-64 years old (Table 3) and 48% of those  $\geq 15$  years old were current smokers (Table 4).<sup>30,31</sup> Minimal reduction (15 percentage points in the last 25 years or an 0.6 percentage point annually) in the prevalence of smoking in men aged  $\geq 16$ : from 60.5% in 1992-1993, 56.1% in 2001-2002, 47.4% in 2010, and 45% in 2015.<sup>12,30</sup> Exposure to secondhand tobacco smoke at home, at work, and public places was high in both men and women (Table 4).<sup>29,30</sup> A survey in children aged 13-15 showed a prevalence of current tobacco usage of 6% in boys and 1% in girls; and the prevalence of exposure to secondhand tobacco smoke was 48% at home and 70% outdoor and public places.<sup>35</sup> In 2010, tobacco smoking was associated with 16.9% of total deaths (about 74,700 people) and 8.8% of DALYs lost, mainly through impact on NCDs.<sup>12,41</sup>

### Food production

Vietnam had a sharp increase in cereal production after appropriate economic policies from less than seven million tons in 1975 to almost 35 million tons in 2013 (Figure 3).<sup>46</sup> The achievements resulted from economic policies starting from 1980s,<sup>46</sup> which help to translate Vietnam from a poor country, highly dependent on food aid, to the second-largest rice exporter in the world (more than seven million tons in 2013) (Figure 3).<sup>46</sup> The production of meat, fish, seafood, milk, eggs, fruits and vegetables has also increased in the last 40 years (Figure 3).<sup>46</sup> Starting from 2000, fish, seafood, fruits and vegetables became increasing important in export agricultural products of Vietnam (Figure 3).<sup>46</sup>

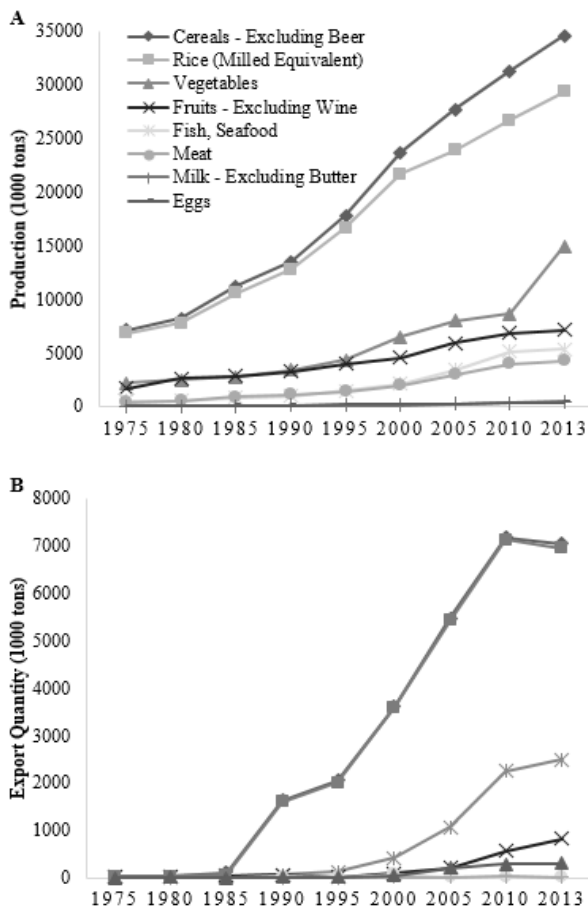
### National policies relating to agriculture, food, nutrition and NCDs

#### Economic and agricultural policies

There are four stages of agricultural policies. During 1976-86, agriculture was a part of the centrally-planned system, in which agricultural production was organized around co-operatives and state farms, with state-owned enterprises providing inputs and controlling output markets. In 1981, the "100" contracting (product contracting)

**Table 4.** Tobacco use and exposure to secondhand smoke in Vietnamese adults aged  $\geq 15$  years old.<sup>31,33</sup>

	2010			2015		
	Overall	Males	Females	Overall	Males	Females
Tobacco smokers						
Current tobacco smokers	23.8	47.4	1.4	22.5	45.3	1.1
Daily tobacco smokers	19.5	38.7	1.2	19.2	38.7	0.9
Current cigarette smokers	19.9	39.7	1.2	18.2	36.7	0.8
Daily cigarette smokers	15.6	31.0	1.0	15.2	30.7	0.6
Secondhand smokers						
At home	73.1	77.2	69.2	59.9	65.2	55.0
At workplaces	55.9	68.7	41.4	42.6	54.4	29.9



**Figure 3.** Food production (A) and export (B) in Vietnam between 1975 and 2013.<sup>46</sup>

gave farmers more autonomy in producing and selling their products.<sup>36</sup> However, the insufficient agricultural output, hyperinflation after failure of the “price, wages, and money” reform, and Sino-Vietnamese war contributed to a major economic crisis.<sup>37</sup> During 1986-93, economic reform (Doi Moi) promoted a multi-sector economy with state management. Farmers have primary role in farmland management, production, and food distribution. Broader policies such as Foreign Investment Law, Open-door policies, Land Law, and Corporate Law helped to increase agricultural production sharply.<sup>36,37</sup>

During 1993-2000, expanding agricultural production was the focus. A large number of bilateral and regional trade agreements and partnerships were entered into to expand market opportunities. A Price Stabilization Fund was created to stabilize the prices of essential commodities including urea, paddy and rice, coffee and sugarcane.<sup>36,37</sup> From 2000-present, agriculture sector emphasizes on a modern and industrialized agricultural sector and on improving yields, quality and value based.<sup>37</sup> International integration at the bilateral, regional and multilateral level signed. Two major resolutions are currently guiding agricultural policy development in Vietnam: No. 26/2008/NQ-TD on development based on the market economy with socialist orientation and Resolution No. 63/2009/NQ-CP on ensure national food security by guaranteeing adequate food supplies, particularly rice.<sup>37</sup>

### Food and nutrition policies

Economic growth does not necessary lead to optimal nu-

trition and health; it requires appropriate nutrition specific and sensitive policies. Professor Tu Giay – the pioneer of modern nutrition in Vietnam and in the world – played a critical role in improving nutrition and health status of Vietnamese from 1945 through governance, mutual social responsibility, infrastructure development, ecological sensitivity, agricultural diversification and emphasis on family needs and traditional food patterns.<sup>47,48</sup> He was the founder of leading research and teaching institutions for nutrition and food safety, such as the Vietnam National Institute of Nutrition (in 1980) and the first Department of Nutrition and Food safety (in 1990).<sup>48</sup> He led the development of nutritional strategies and mentored generations of leaders in medicine, food and nutrition.<sup>48</sup>

Key food and nutrition strategies were the National Nutrition Strategy for 1996-2000, 2001-2010 and 2011-2020, Dietary Recommended Intake, and Plan of Action for Infant and Young Child Feeding.<sup>39,40</sup> The National Nutrition Strategy for 1996-2000 focused on interdisciplinary approaches with collaboration for reduction of malnutrition, micronutrient deficiency, poverty, and hunger.<sup>39,40</sup> For the following strategies, components relating to food safety, prevention of NCDs, integration of nutrition interventions to primary health care, integrating nutrition indicators into socio-economic development, and strategic use of data from monitoring, evaluation, and surveillance of Nutrition.<sup>39,40</sup>

### Policies relating to NCDs

For a few decades after 1954, most of the NCDs were handled within internal medicines, led by Professor Dang Van Chung.<sup>49</sup> Then additional branches were established in the form of Departments and Faculties.<sup>49</sup> Then to provide leadership to the field of NCDs, several institutions and hospitals were established, such as the National Psychiatric Hospital (in 1963), National Hospital of Lung Diseases (in 1965), National Hospital of Endocrinology (in 1969), and Vietnam National Heart Institute (in 1989).<sup>49</sup>

Vietnam has a number of policies relating to the prevention and control of NCDs, including policies on healthy diet (in 2001) and physical activity (various guidelines and regulations issued from 1989 to 2013), law on Tobacco Control (issued in 2012), policies on control and minimization of the harmful use of alcohol (in 2014), and Environment Law (in 2014).<sup>12</sup> Vietnam has National Target Programs for the prevention and control of NCDs, which have integrated community mental health since 1998, hypertension, cancers, diabetes mellitus since 2006, and COPD/asthma since 2011. Based on the Vietnam Annual Health Review 2014, these NCD programs have achieved some results such as successful establishing network from central to commune levels, training for health staff, development and strengthening for screening, diagnosis and management of treatment of diseases at different levels, and widespread implementation of health information, education and communication activities.<sup>12</sup>

However, this report also revealed a number of difficulties and shortcomings relating to the implementation of NCD programs in Vietnam. First, five programs for the prevention and control of NCDs have been separately designed, managed and implemented by different organi-

zations, which makes it difficult to coordinate, integrate, and implement activities. Because there are no national guidelines on screening for early detection of NCDs and a population-based monitoring data (e.g., cases, treatment, cause of death) on NCDs, it is not easy to monitor NCD status and progress of programs to combat NCDs.<sup>12,50</sup> Second, NCD control programs have relatively low coverage of areas and population, and the rate of scaling up remaining low. Funding for NCD programs is mainly from the state budget and is low (e.g., 2.5% of total budget for health in 2009) and being cut further. Health insurance (covering 70% Vietnam population) does not cover most NCD preventive services, such as tobacco cessation counseling, nutrition examinations and counselling, and screening for early cancer detection. Those with health insurance, however, still have to pay a large portion of the costs from their own pockets for NCD prevention, diagnosis and treatment.<sup>12</sup> Third, Vietnam lacks of essential drugs for treatment of NCDs (e.g., compared to the WHO Package of Essential NCD Interventions for Primary Health Care) in public health facilities, especially at sub-district health centers.<sup>12,50,51</sup> Fourth, Vietnam does not have adequate health staff with sufficient knowledge and skills to work in the NCD field.<sup>12</sup>

## DISCUSSION

Increased burden of NCDs and their risk factors is difficult to avoid in a country such as Vietnam, which is undergoing socioeconomic growth, urbanization, aging population, changing in lifestyles. The Global Status Report of the WHO indicates that 1) NCDs currently cause more deaths than all other causes combined, and NCD deaths were projected to increase from 38 million in 2012 to 52 million by 2030, 2) four major NCDs (cardiovascular diseases, cancer, chronic respiratory diseases and diabetes) were responsible for 82% of all NCDs deaths worldwide, and 3) almost 75% of NCD deaths occurred in LMICs. In Vietnam, the probability of dying from the four main NCDs between the ages of 30 and 70 years was 17.4%.<sup>13</sup> One of the issues related to the high burden of NCDs in Vietnam is that most NCD patients do not receive preventive services and diagnoses in time to receive proper treatment.<sup>11,16,43,52</sup> Vietnam needs to scale up its NCD intervention programs so that the majority of people in need can receive the appropriate interventions.<sup>12,52</sup> Lessons from other countries suggest the need of prioritizing on NCD prevention, such as tobacco and alcohol control, healthy diets, and physically-active lifestyles.<sup>13</sup>

Our study shows that there is much room for improvement in Vietnam. First, we found that tobacco consumption in men was very high, in fact, higher than most other countries and regions around the world.<sup>13,53</sup> Exposure to secondhand tobacco smoke was high among men, women and youth at home, work, and public places.<sup>13,54</sup> It is well-known that exposure to tobacco is associated with many different NCDs, including cardiovascular diseases, cancers, COPD, and diabetes mellitus.<sup>13</sup> Although Vietnam passed laws and regulations relating to tobacco smoking (e.g., increased tobacco taxes, smoke-free environments in all indoor workplaces, public places, and ban all forms of tobacco advertising, promotion and sponsorship) and warned people of the dangers of tobacco through interpersonal counseling and mass media campaign, the enforcement of these regulations may not be strong enough.<sup>12,31,35</sup>

Second, the prevention of harmful use of alcohol needs further attention, demonstrated by high level of alcohol consumption among Vietnamese. It is well-known that excessive consumption of alcohol is associated with accidents and various NCDs, including cardiovascular diseases, cancers, liver failure, mental disorders, and diabetes mellitus.<sup>13,55</sup> Data from 68 countries in 2003 showed a strong correlation between per capita consumption of alcohol in adults and alcohol consumption in adolescents.<sup>56</sup> Pricing policies such as tax increases on alcoholic beverages might not be effective in Vietnam due to the illegal import of alcohol and uncontrollable small-scale production.<sup>12</sup>

Third, families in Vietnam need to improve their diets. For example, they should minimize the consumption of salt, foods with trans fats, and sweetened beverages, and maximize the consumption of seafood, fruits, and vegetables. A healthier diet helps to reduce a number of NCDs, such as cardiovascular diseases, cancers, and diabetes mellitus.<sup>13</sup> Furthermore, our study found that almost one-third of Vietnamese adults had a low physical activity level, which is much higher than the global prevalence of about 20%.<sup>13</sup> Low physical activity is associated obesity, cardiovascular diseases, diabetes mellitus, and breast and colon cancer.<sup>13</sup>

At the macro level, although in the last 20 years, Vietnam has implemented NCD policies that are in line with those recommended by the World Health Assembly, law enforcement and increased program coverage are needed to maximize the impact of these NCD programs.<sup>12</sup> For example, although policies to minimize alcohol and tobacco consumption have been implemented for years, problems relating to tobacco smoking and excessive use of alcohol remain. Because Vietnam national health target programs are managed by different organizations, a common management and coordinating mechanism is needed to have a more effective and efficient response to NCDs. In addition, this change is needed because for the 2016-2020 period, Vietnam will have only two national target programs: New Rural Development and Sustainable Poverty Alleviation;<sup>57</sup> and all health programs will be a part of the two national target programs. Vietnam should develop national guidelines on screening for the early detection of NCDs and include screening cost into health insurance packages or subsidize the fees for those without the insurance to ensure detection of NCDs at earlier stages.<sup>12</sup> Vietnam should make medical products and technology related to NCDs available and accessible to patients to prevent the progress and complications of NCDs.<sup>12</sup>

In conclusion, NCDs and their risk factors are persistent and emerging problems in Vietnam, which suggests the need for increasing coverage of effective and sustainable interventions for the prevention, screening, treatment, and management of NCDs. These interventions should include disease-specific strategies in a strengthened health system and related sectors with financial affordability. This study might be a good reference for policy makers in Vietnam and in other countries undergoing similar health and nutritional transitions. Information about NCDs and lifestyles from this study can also be used to evaluate NCD risk factors of Vietnamese in other countries.

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#### AUTHOR DISCLOSURES

None.

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