

# Patterns of behavioral risk factors for non-communicable diseases in Vietnam: A narrative scoping review

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## Abstract

This review describes both magnitude and patterns of major behavioral risk factors for NCDs. Positive changes in tobacco use were identified, though this is far to meet the established expectation. Harmful alcohol consumption was reported, especially for males. Only small proportion of the population consumed an adequate amount of fruits and vegetables daily. Average salt intake was approximately doubled, in comparison to WHO's recommendations. Physical activity has shifted gradually negatively, but future trends are unpredictable. An organized surveillance system should be developed initially with adequate tools and public resources to maintain and ensure sustainability over time.

## Keywords

lifestyle, non-communicable diseases, risk factor, Vietnam

## Introduction

Non-communicable diseases (NCDs) have been identified as a major health issue in the 21st century and cause an estimated 71% of all global deaths in 2016 (World Health Organization, 2018c). The rising burden of NCDs has been referred to as the accumulation of behavioral risk factors which negatively impact an individuals' life span (World Health Organization, 2005). The combination of four major NCD behavioral risk factors: tobacco use, harmful consumption of alcoholic beverages, insufficient physical activity, and unhealthy diet were found to contribute to over 40% of all cancers and 80% of cardiovascular diseases (World Health Organization, 2005). Approximately 78% of global NCDs-caused deaths were found to be associated with low and middle income countries (LMICs) (World Health Organization, 2018c). LMICs are burdened with 85% of the global premature adult deaths worldwide, in which adults from these countries are at a double risk of death from NCDs as compared to adults in high-income countries (World Health Organization, 2018c).

Like other LMICs, Vietnam has suffered from the rising burden of NCDs in the last 20 years. Specifically, during the period of 1986–2015, hospital admissions of patients with NCDs and their mortality rate have risen from 39% to 65.6%, and 41.8% to 73.4%, respectively (Vietnam Ministry of Health, 2017). It was estimated in 2016 that nearly one—in—five (17.4%) Vietnamese aged from 30 to 70 years of age, will suffer a premature death due to one of four common NCDs (cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes) (World Health Organization, 2018c). However, most NCD patients are unable to receive treatment at an early stage of illness due

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to a lack of health awareness, in addition to inadequate coverage of preventive services (Nguyen et al., 2012b; Son et al., 2012).

In the early 2000s, the Vietnamese government recognized the widespread impact of NCDs and its profound influence on human health and economic development. Therefore, two phases of the National Program on NCDs Prevention & Control were implemented in 2002–2010 and 2010–2015, yet this program the program achieved minuscule success. This was due to the fragmented implementation of the program, in addition to the lack of both inter-sectoral coordination and direction for NCD prevention in Vietnam (Vietnam Ministry of Health, 2015). Hence, an updated National Strategy on Prevention and Control of NCDs for the period of 2015–2025 was developed in 2014. This focused primarily on communication activities, screening, early detection, treatment management, network development, and capacity enhancement (Vietnam Ministry of Health, 2015; Vietnam Ministry of Health and Health Partnership Group, 2015). Vietnamese Ministry of Health has conducted large household surveys in Vietnam, such as Vietnam Living Standard Surveys (VLSS), Multiple Indicator Cluster Surveys (MICS), Demographic and Health Surveys (DHS) on a regular basis since the early 1990s, but these surveys provide limited data on NCDs burden and risk factors. In the last 20 years, several studies which assess NCDs and associated risk factors have been carried out in response to the rising burden of NCDs. These include the STEPwise Survey on NCD Risk factors (STEPS), Global Adult Tobacco Use Surveys (GATS), and Global Youth Tobacco Use Surveys (GYTS) in addition to other national studies on hypertension, diabetes, obesity, and cancer (Nguyen and Hoang, 2018; Vietnam Ministry of Health, 2015). However, these surveys were carried out separately from one another and employed inconsistent methodology for data collection and analysis. This in turn has led to difficulties in the validation and comparison of findings across a variety of surveys.

Presently, we identified a number of literature reviews describing NCDs risk factors in Vietnam until the early 2010s. However, with regard to the rapid change in NCDs burden and the political and social context, there is a need for an updated comprehensive review. This is necessary to frame the overall landscape of NCDs and related behavioral risk factors in Vietnam to further inform the design of future research agenda. In this paper, we describe the magnitude and trends in major behavioral risk factors for NCDs which include smoking, alcohol use, physical inactivity, and unhealthy diet over the past decades in Vietnam.

## Methods

### Design

This is a narrative scoping literature review.

### Review approach

This scoping review was adopted in alignment with a narrative synthesis approach. The scoping review follows the proposed methodology based on the JBI Framework of Evidence Synthesis (Khalil et al., 2016) which seeks to identify all relevant documents within a studied topic. Based on the main purpose of this narrative synthesis to describe patterns of most common behavioral risk factors, we specified relevant inclusion and exclusion criteria as well as specific information to be extracted from the identified materials. As there are no guidelines for designing a narrative scoping review, the process of reviewing and reporting was done in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Tricco et al., 2018) and suggested guidelines on systematic scoping reviews by Peters and colleagues (Peters et al., 2015).

### Data source and search strategies

Given that the overall goal of this scoping review is to describe and analyze the most common behaviors attributed to the NCD burden in Vietnam, four common risk factors were included in this study: tobacco use, harmful use of alcoholic beverages, physical inactivity, and unhealthy diet. All population-based studies which provide data on at least one of the four main NCD-related behavioral risk factors were gathered and reviewed for information extraction. The search was performed from December 2019 to February 2020. Peer-reviewed articles published in English language were searched through online databases including PubMed, EMBASE, and the Cochrane Database of Systematic Reviews. Peer-reviewed articles in Vietnamese language were retrieved from Hanoi Medical Library, Hanoi University of Public Health Library, and other Vietnamese online journals. A variety of grey literature sources were gathered from the online portals of Vietnamese governmental agencies, WHO, international organizations, and non-governmental organizations working in the field of NCDs. The reference lists of the included studies were also screened and reviewed for additional eligible studies. The search strategy was developed by using keywords with the following combinations: “*Vietnam*” OR “*Viet Nam*” AND “*non communicable diseases*” OR “*chronic diseases*” OR “*cancer*” OR “*cardiovascular diseases*” OR “*hypertension*” OR “*diabetes*” OR “*overweight*” OR “*COPD*” AND “*risk factors*” OR “*tobacco*” OR “*alcohol*” OR “*physical activity*” OR “*physical inactivity*” OR “*diet*” OR “*salt intake*” OR “*fruit intake*” OR “*vegetable intake*” in the title/ abstract/ keywords. There was no set limit or range in chronological time to search for published documents, this was necessary to accurately capture patterns of health behaviors over time.

### *Inclusion and exclusion criteria*

Eligible publications for the inclusion of this scoping review are studies or reports which were conducted on the Vietnamese population without pre-existing health conditions (pregnant, hypertension, overweight, etc.). Surveys conducted specifically on minority populations or conducted outside of Vietnam were excluded. The included materials must report statistics on at least one of major behavioral risk factors that is relevant to this study (smoking, alcohol use, physical activity, diet-related risk factors) as original research or literature reviews. Studies that were included must also report data from a national or subnational representative sample of the entire Vietnamese population or its findings are representative for the specific demographic settings (rural/urban). Studies with a small sample size (preferably to be at least 1000) or study findings which could not be generalized to a larger scale of population, were excluded following the recommendation of Hoy et al. (2013) and Nethan et al (2017). Since there is a lack of population-based research on dietary behaviors among the Vietnamese population, this study focuses on salt intake and the consumption of fruits and vegetables. Excess intake of salt and low consumption of fruits and vegetables represents dietary related risk factors which follow the NCD Global Monitoring Framework adopted by the UN General Assembly in 2012 (UN General Assembly, 2012).

### *Data processing, extraction, and synthesis*

All articles/reports that were identified with the previously mentioned search terms were initially screened by title and abstract. Relevant literature was then assessed by thoroughly reading the full text. All data which was extracted from eligible literature and when possible, was stratified by age, sex, and geographical setting. The extracted information includes the article title, author list, year of publication, year of data collection, study design, sampling method, sample size, definitions of measured risk factors, main findings, and so forth. Further analysis and data validation of the extracted data was done with the application of a data extraction spreadsheet. Relevant findings were presented and interpreted for the modeling of a general framework to describe behavioral risk factors which could influence NCD burden and prevention strategies in Vietnam for the forthcoming future.

## **Results**

### *Search results*

From the previously described search methodology, a total of 243 articles were procured from peer reviewed online databases (PubMed = 116; EMBASE = 118; Cochrane = 9). Additionally, we also identified 12 documents from the

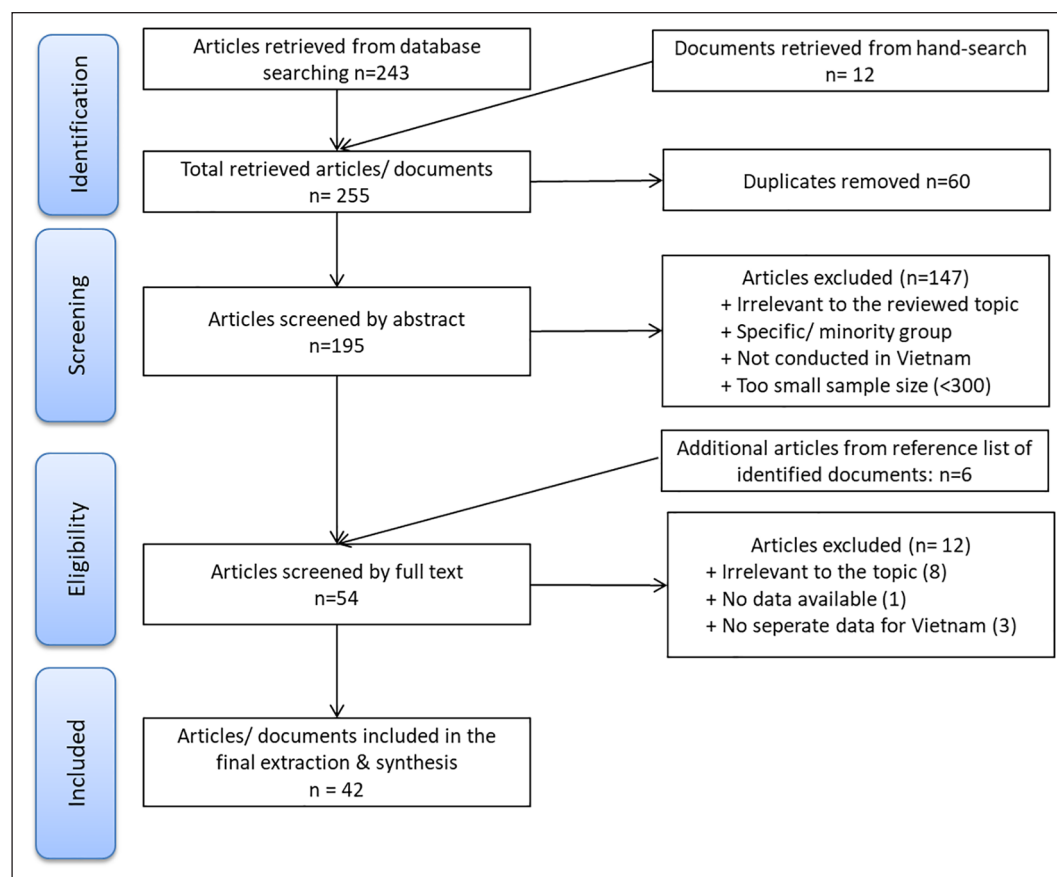
databases of World Health Organization (WHO), Vietnam Ministry of Health (MOH), National Institute of Nutrition (NIN) and General Statistics Office of Vietnam (GSO). Among the total retrieved articles of 255, 60 duplicate materials were identified and removed. After screening the abstracts of the identified literature, 48 articles or documents were found to have met the inclusion criteria; six additional articles were identified by reviewing the reference list of included documents. The full texts of 54 articles and documents were gathered and reviewed. In this final review, 12 articles were excluded for reasons such as: not providing data that was exclusive for Vietnam (three articles), irrelevant data sources for the reviewed topic (eight articles), and no data available (one article). A total of 42 articles and documents were included in the final synthesis and reported in this paper (See Figure 1).

The majority of included studies reported data between the years 2001 to 2015. Four literature reviews were included, given their inclusion of explicit data prior to 2000 while the original reports or articles could not be acquired. Among the 42 included studies, 24 studies employed a national representative sampling frame and five used datasets from the Vietnam Health and Demographic Surveillance System (subnational sampling). Among the remaining studies, one article provided data with the community-based observational sample in Da Nang (sample size 1621), one article provided data from an urban setting in Ho Chi Minh City (HCM) (sample size 1488), and seven articles focused on lifestyle risk factors in adolescent populations.

The theme which emerged from the systematic review of research includes the major behavioral risk factors which contribute to NCDs, primarily these include tobacco use, alcohol-use, physical activity, fruit and vegetable consumption, and salt intake. Tobacco usage was the most common risk factor reported, with results being reported in 22 studies, followed by physical activity (19 studies), alcohol use (17 studies), fruit and vegetable consumption (14 studies), and salt consumption (eight studies). In the presented review, substantive findings in each of these areas are summarized to characterize the patterns of these behavioral risk factors over time in Vietnam.

### *Tobacco use*

As the leading cause of premature deaths in Vietnam, smoking behaviors have been studied in Vietnam since the early 1990s and is reported in 22 major studies. Among these, 11 studies have reported national representative results and four national surveys which include Vietnam Living Standards Survey (VLSS) 1992–93, 1997–98, Vietnam National Health Survey (VNHS) 2001–02, Vietnam National Surveys on NCD Risk Factors (STEPS) 2005, and Global Adults Tobacco Use (GATS) in both 2010 and 2015. The definition of smoking behavior was observed to be consistent across studies since 2005 with WHO's



**Figure 1.** PRISMA flow chart of screening and reviewing process.

definition in STEPS survey protocols (in which a current smoker is defined as individuals who used any type of tobacco products in the last 30 days). For data collected prior to 2005, the question “*Do you currently smoke any tobacco products, such as cigarettes, cigars or pipes?*” was mostly used to classify current smokers, former smokers, and those who never smoked.

In Vietnam, it has been observed that tobacco usage is the most common among men and tends to increase with age, especially from 25 years old and above (Hoy et al., 2013; Nguyen and Hoang, 2018; Nguyen et al., 2012b; Vietnam Ministry of Health, 2012; Vietnam Ministry of Health and Health Partnership Group, 2015; Vietnam Ministry of Health et al., 2010; Vietnam Ministry of Health et al., 2016). In 2015, it was estimated that the number of current smokers in Vietnam was 15.6 million or equal to 22.5% of the total population in that year (45.3% in men and 1.1% among women) (Vietnam Ministry of Health et al., 2016). Among current smokers, cigarettes were identified to be the most popular product for tobacco consumption and is used by approximately 80.6% of current smokers, though the use of electronic cigarettes has been observed to increase in recent years (Vietnam Ministry of Health et al., 2016). Noticeably, current smokers were found to additionally use traditional water pipes which accounted for approximately one third (29.3%)

of the smoking population (Vietnam Ministry of Health et al., 2016) and ranks first among Asian countries (Jawad et al., 2018). It has been reported that a high proportion of both men and women report secondhand exposure to tobacco smoke at home and at work or public places (Minh An et al., 2013; Nguyen et al., 2013; Vietnam Ministry of Health and Health Partnership Group, 2015; Vietnam Ministry of Health et al., 2010; Vietnam Ministry of Health et al., 2016).

Tobacco use was extensively reported in men, conversely in women, and reflects a consistent pattern across both national and local surveys which use large sample cohorts (Cuong et al., 2007; Ly et al., 2013). The smoking prevalence in males has been shown to be in a downward trend for the last 40 years starting from 60.5% in 1992–1993 (General Statistics Office of Vietnam, 1998; Morrow and Barraclough, 2003), to 56.1% in 2001–2002 (Son et al., 2012; Vietnam Ministry of Health and Health Partnership Group, 2015), then 47.4% in 2010 (Vietnam Ministry of Health et al., 2010), and finally to 45.3% in 2015 (Vietnam Ministry of Health et al., 2016). Similarly, the smoking prevalence among women decreased throughout the years from 1.8% in 2001 (General Statistics Office of Vietnam, 2003; Morrow and Barraclough, 2003), to 1.4% in 2010 (Vietnam Ministry of Health et al., 2010), and finally to 1.1% in 2015 (Vietnam Ministry of Health et al., 2016).

**Table 1.** Tobacco consumption among adults in Vietnam from 1992 to 2015.

	1992–1993 <sup>a</sup>	1997–1998 <sup>a</sup>	2001 <sup>b</sup>	2005 <sup>c,d</sup>	2006 <sup>a</sup>	2010 <sup>e</sup>	2015 <sup>e</sup>
Smoking prevalence by sex							
Male	63.1%	50.7%	56.1%	66.1% <sup>c</sup> 58.8% (North) 57.7% (HCM) 67.8% (Mekong Delta)	49.2%	47.4%	45.3%
Female	4.7%	3.5%	1.8%	1.7% <sup>c</sup> 1.6% (North) 1.6% (HCM) 1.1% (Mekong Delta)	1.5%	1.4%	1.1%
Smoking prevalence in urban areas							
Male	56.6	47.4	55.1	N/A	46.9	47.7	42.7
Female	2.7	1.9	1.4	N/A	1.2	1.0	0.7
Smoking prevalence in rural areas							
Male	62.6	51.7	56.4	N/A	50.0	47.3	46.7
Female	4.6	3.6	2.0	N/A	1.6	1.7	1.3
Daily consumption (number of cigarettes, among current smokers)							
Male	11.4	11.1	N/A	N/A	N/A	13.6	13.8
Female	9.9	9.5	N/A	N/A	N/A	10.9	10.5

<sup>a</sup>Vietnam Living Standard Survey 1992/93; 1997/98; 2006: national household survey, 3-stage random stratified cluster sampling; aged 6 years and over. (General Statistics Office of Vietnam, 1993, 1998; Morrow and Barraclough, 2003).

<sup>b</sup>Vietnam National Health Survey 2001: 3-stage cluster sampling; national household survey (General Statistics Office of Vietnam, 2003; Morrow and Barraclough, 2003; Nguyen et al., 2012b).

<sup>c</sup>National Adult Overweight Survey 2005: 2-stage cluster sampling of adults aged 25–64 (Do et al., 2015; Hoang et al., 2007; Pham et al., 2009; Trinh et al., 2008, 2010; Van Minh et al., 2008).

<sup>d</sup>Vietnam STEPS 2005 in 3 representative regions (North, South, Mekong Delta): multi-stage sampling with national representative sample of adults aged 25–64 (General Statistics Office of Vietnam, 2007).

<sup>e</sup>Vietnam GATS 2010, 2015: national representative sampling aged 15+ (Vietnam Ministry of Health et al., 2010, 2016).

Throughout the time frame from 1992 to 2015, smoking prevalence for both sexes residing in rural areas was slightly higher than urban areas (Van Minh et al., 2017). Data on tobacco usage among adults in Vietnam from 1992 to 2015 is gathered in Table 1 using data from national surveys. It should be specifically noted that the sampling method employed in these surveys differs from the GATS protocol, in respect to the use of similar classifications and definitions.

A result that should be highlighted is that tobacco use among adolescents was less likely to be reported, in comparison to adults in most studies during the early 2000s. Vietnam had first surveyed smoking behaviors among individuals aged 15–24 through National Survey Assessment of Vietnamese Youth (SAVY) in both 2003 and 2006 (Nguyen Thanh Liem et al., 2010). Additionally, there were three rounds of Global Youth Tobacco Use Surveys (GYTS) conducted in 2003, 2007, and 2014 which provided information on the overall pattern of smoking among youth under 15 years of age. In general, boys showed a higher smoking prevalence as compared to girls (Hanoi Medical University, 2013; Vietnam Ministry of Health, 2003, 2007; Vietnam Ministry of Health et al., 2014). The recent results from Vietnam Global School-based Student Health Survey 2013 found that 4.1% of students aged 13–17 smoked in the past 30 days (7.5% among boys and 1.2% among girls)

(Hanoi Medical University, 2013). The number of adolescent smoking increased slightly from 3.7% (in 2003) (Vietnam Ministry of Health, 2003), to 3.8% (in 2007) (Vietnam Ministry of Health, 2007), and 4.0% (in 2014) (Vietnam Ministry of Health et al., 2014) throughout the three rounds of the Global Youth Tobacco Survey. Tobacco use among male adolescents was relatively low, this is in comparison to the next age group bracket, 15–24; these observations illustrate a significant transition in smoking behaviors, as individuals move from adolescence into young adulthood (Sirichotiratana et al., 2008; Vietnam Ministry of Health, 2003, 2007; Vietnam Ministry of Health et al., 2014, 2016). In 2003, the first round of SAVY (Nguyen Thanh Liem et al., 2010) provided illuminating evidence on the remarkable increase of smoking prevalence from 10% (ages 14–17) to 41% (ages 18–21) and up to 59% (ages 22–25). Similarly, the smoking prevalence of the youth population aged from 14–17, 18–21, 22–25 years old was 11%, 41%, and 47% respectively, in 2008 as observed in SAVY II (Nguyen Thanh Liem et al., 2010).

### Alcohol consumption

The results from this review identified 17 materials which report on alcohol consumption in the Vietnamese population. Among identified documents, the results from four

national surveys were reported within 10 different articles (Do et al., 2015; Hoy et al., 2013; Nguyen and Hoang, 2018; Trinh et al., 2008; Van Bui et al., 2016; Vietnam Ministry of Health, 2012, 2016; Vietnam Ministry of Health and Health Partnership Group, 2015; World Health Organization, 2014, 2018b) and four studies used regional sampling methods (Huu Bich et al., 2009; Ly et al., 2013; Pham et al., 2009; Trinh et al., 2010; Van Minh et al., 2008). Also, we found two studies with data describing youth alcohol use (aged 10–19, sample size = 1408) (Hanoi Medical University, 2013; Thoa et al., 2013). The analyzed documents have provided descriptive statistics on the percentage of current drinkers within the population, average amount of alcohol consumption, and a percentage which described the number of current drinkers engaged with hazardous or harmful binge drinking behaviors.

The average amount of alcohol consumption per capita demonstrates an increasing trend over time. The WHO's 2014 Global Status Report on Alcohol has reported that the annual alcohol consumption in 2008–2010 (6.6 L per capita) was almost doubled, in comparison to the 2003–2005 figure (3.8 L per capita) (World Health Organization, 2014). Similarly, the 2018 Global Status Report on Alcohol estimated that the amount of pure alcohol consumption annually rose from 4.7 L in 2009–2011 to 8.3 L in 2015–2017, per capita (World Health Organization, 2018b). Generally, alcoholic beverages were more likely to be consumed by men than women through all surveyed periods (2009–2011: 8.2 L vs 1.3 L, respectively; 2015–2017: 14.5 L vs 2.5 L, respectively) (Vietnam Ministry of Health and Health Partnership Group, 2015; World Health Organization, 2018b). The percentage of current drinkers was found to be extraordinarily high among males (about 70%–80% from 2005–2015), in regard to the limited time period of the definition (“*Did you drink at least once in the last 30 days/ 6 months/ 12 months?*”) (Do et al., 2015; Pham et al., 2009; Van Bui et al., 2016; Vietnam Ministry of Health, 2012, 2016). Thoa et al. (2013) also found that the rate of adolescents who consumed alcohol among the ages 10–19 was approximately 16.5% (32.0% among boys and 10.6% among girls).

For current drinkers, the typical indicator for assessing the risk of alcohol use can be determined from the number of standard drinks consumed in any drinking occasion. In many countries, including Vietnam, one standard drink was defined as equivalent to 10 g of pure alcohol as followed by the WHO's recommendation, but a wide variation of this definition was reported from eight grams (UK) to 20 g (Japan, Austria) (Kalinowski and Humphreys, 2016). The WHO has recommended that the hazardous level of drinking alcohol is if the average consumption reaches 4.0–5.9 standard drinks per occasion for males (2.0–3.9 drinks for women); the harmful level for the average consumption of alcoholic beverages is  $\geq 6$  standard drinks per occasion ( $\geq 4$  drinks for women) (Vietnam Ministry of Health, 2012,

2016). Overall in Vietnam, the mean number of standard drinks consumed in any occasion was found to be 5.2 drinks (5.5 drinks among men and 2.7 drinks among women) (Vietnam Ministry of Health, 2016) following the most recent survey from 2015. From 2010 to 2015, the percentage of current drinkers who drank at hazardous or harmful levels was observed to have declined among men. There were about 16.2% of the male population drinks alcohol at hazardous levels in 2010, this proportion decreased to 5.9% in 2015 (Vietnam Ministry of Health, 2012, 2016). Likewise, the proportion of harmful use of alcohol (heavy episodic drinkers) among men reduced from 11% in 2010 to 5.9% in 2015 (Vietnam Ministry of Health, 2012, 2016). While the percentage of male drinkers who consume alcohol at both hazardous and harmful levels decreased over time, the proportion of heavy episodic drinkers among females was shown to have doubled from 2010 (0.9%) (Vietnam Ministry of Health, 2012) to 2015 (2.1%) (Vietnam Ministry of Health, 2012).

Excessive alcohol consumption is noted to be one of the most common and deadly patterns of alcohol consumption (Esser et al., 2014; Sacks et al., 2015; Stahre et al., 2014). This was reported in seven studies which were included in this scoping review as binge drinking or at-risk drinking reported among current drinkers. However, the definition of excessive drinking varies largely between studies (See Table 2 for detailed information). Findings from STEPS 2010 uses the cut-off point at  $\geq 5$  drinks per drinking occasion ( $\geq 4$  for women); additionally, this study shows that one fourth of current male drinkers have reported binge drinking, while binge drinking only occurs in less than 1% of female drinkers (Vietnam Ministry of Health, 2012). A survey on diabetes and its risk factors from 2008 to 2009 in two Northern provinces of Vietnam uses the cut-off point of  $\geq 3$  drinks per occasion (2 for women) and reports 24.1% men and 1.1% women have at-risk drinking behaviors (Nguyen et al., 2012a).

### Physical Inactivity

Since 2005, physical activity was included in most national surveys of NCDs and its associated risk factors, such as the National Adult Overweight Survey 2005, National survey on Diabetes and its risk factors 2008–2009, and Vietnam STEPS 2005, 2010, and 2015. The Global Physical Activity Questionnaire (GPAQ) developed by WHO is the most common tool for physical activity surveillance. The total time spent and the intensity of physical activity during a typical week were used as metrics to calculate the total number of MET-minutes per week, in which one MET is defined as 1 kcal/kg/hour and equivalent to the level of energy spent during sitting quietly (Vietnam Ministry of Health, 2016). The cut-off points for the determination of physical activity have been established at  $< 600$  MET-min/week (low), 600–2999 MET-min/week (moderate), and  $\geq$

**Table 2.** Alcohol consumption among adults in Vietnam.

Indicator	Time	Both sexes	Male	Female	Definition	Sources
% of Current drinkers	2005	N/A	40.2%	3.5%	In last 6 months	National Adult Overweight Survey 2005 (Do et al., 2015)
	2010	37.0%	69.6%	5.6%	In last 30 days	STEPS 2010 (Vietnam Ministry of Health, 2012)
	2015	43.8%	77.3%	11.1%	In last 30 days	STEP 2015 (Vietnam Ministry of Health, 2012)
	2005	N/A	80.9%	9.3%	In last 12 months	STEPS 2005 (Mekong Delta) (Pham et al., 2009)
	2010	47.4%	84.3%	11.8%	In last 12 months	STEPS 2010 (Vietnam Ministry of Health, 2012)
	2015	42.6%	79.2%	11.1%	In last 12 months	STEPS 2015 (Van Bui et al., 2016; Vietnam Ministry of Health, 2016)
Amount of alcohol consumed (liters)	2002	6.8	N/A	N/A	Amount of pure alcohol consumed per month (liter) *12 months	VLSS 2001/02 (General Statistics Office of Vietnam, 2003)
	2003–2005	3.8	N/A	N/A	Amount of pure alcohol consumed in 1 year (liter) (adjusted for tourist consumption)	Global report on alcohol and health 2014 (Vietnam Ministry of Health and Health Partnership Group, 2015; World Health Organization, 2014)
	2009–2011	4.7	8.2	1.3	Amount of pure alcohol consumed in 1 year (liter) (adjusted for tourist consumption)	Global report on alcohol and health 2018 (World Health Organization, 2018b)
	2015–2017	8.3	14.5	2.5	Amount of pure alcohol consumed in 1 year (liter) (adjusted for tourist consumption)	Global report on alcohol and health 2018 (World Health Organization, 2018b)
% Drinkers with intermediate (hazardous) level of drink	2010	8.8%	16.2%	2.4%	4–5.9 drinks/ occasion (2–3.9 for women)	STEPS 2010 (Van Bui et al., 2016; Vietnam Ministry of Health, 2012)
	2015	5.3%	5.9%	1.3%	4–5.9 drinks/ occasion (2–3.9 for women)	STEPS 2015 (Vietnam Ministry of Health, 2016)
% Drinkers with high-end/ Harmful level of drink	2010	11.0%	22.8%	0.9%	≥6 drinks/ occasion (≥4 for women)	STEPS 2010 (Van Bui et al., 2016; Vietnam Ministry of Health, 2016)
	2015	5.5%	5.9%	2.1%	≥6 drinks/ (≥4 for women)	STEPS 2015 (Vietnam Ministry of Health, 2016)
Excessive drink (binge drink/ at-risk drink)	2005	N/A	38.6%	0.4%	≥5 drinks in any drinking day, both sexes	STEPS 2005 (Mekong Delta) (Pham et al., 2009)
	2005	N/A	31.0%	0.4%	≥5 drinks in any drinking day; (≥4 for women) - Filabavi, rural	STEPS 2005 (North Vietnam) (Hoy et al., 2013; Huu Bich et al., 2009)
	2005	N/A	17.0%	0.3%	>5 drinks in any drinking day; (≥4 for women) - Chililab, rural	STEPS 2005 (North Vietnam) (Hoy et al., 2013; Huu Bich et al., 2009)
	2005	32.1%	60.9%	5.0%	≥3 drinks/ occasion (≥2 for women)	STEPS 2005 (North Vietnam) (Van Minh et al., 2008)
	2009	N/A	24.1%	1.1%	≥3 drinks/ occasion (≥2 for women)	National survey on diabetes & risk factors 2008–09 (Nguyen et al., 2012a)
	2010	12.7%	25.1%	0.6%	≥5 drinks/ occasion (≥4 for women)	STEPS 2010 (Van Bui et al., 2016; Vietnam Ministry of Health, 2012)

\*One standard drink defined as one unit of alcoholic beverage equivalent to 10g of pure alcohol.

**Table 3.** Level of physical activity by sex in Vietnam from 2005 to 2015.

Year	Age range	Men			Women			Sources
		Low	Moderate	High	Low	Moderate	High	
2005	25–64	10.9%	9.5%	79.6%	7.9%	8.8%	83.3%	National Adult Overweight Survey 2005 (Do et al., 2015)
2005	25–64	32.7%	16.7%	50.6%	40.4%	24.2%	35.4%	STEPS2005 – Mekong Delta region* (Pham et al., 2009)
2005	25–64	46.5%	17.9%	35.6%	41.2%	28.5%	30.3%	STEPS2005 - Ho Chi Minh City (Trinh et al., 2008)
2005	25–64	10.9%	9.5%	79.6%	7.9%	8.8%	83.3%	STEPS2005 – North Vietnam (Filabavi & Chililab) (Ahmed et al., 2009; Ng et al., 2009)
2009	≥25	N/A	N/A	13.7%	N/A	N/A	11.5%	Survey on diabetes and its risk factors from 2008 to 2009* (Nguyen et al., 2012a)
2010	25–64	26.4%	20.8%	52.0%	31.1%	27.8%	41.1%	Vietnam STEPS 2010 (Nguyen and Hoang, 2018; Van Bui et al., 2016; Vietnam Ministry of Health, 2012; Vietnam Ministry of Health and Health Partnership Group, 2015)
2015	18–69	25.6%	15.8%	58.6%	38.6%	23.6%	37.9%	Vietnam STEPS 2015 (Nguyen and Hoang, 2018; Vietnam Ministry of Health, 2016)

\*All results were calculated by using Global Physical Activity Questionnaire, except for the STEPS survey 2005 in Mekong Delta region and the National Survey on Diabetes and its risk factors 2008–2009 using self-reported data.

3000 MET-min/week (high); this can then be applied to classify the percent of a population that does not meet the WHO recommendations for physical activity (Vietnam Ministry of Health, 2012, 2016).

About one third of the Vietnamese population is physically inactive. The total time that one spent for physical activities was found to be higher in rural areas (Bui et al., 2015; Thu Hien et al., 2013; Vietnam Ministry of Health, 2012, 2016) and largely came from work-related activities (Bui et al., 2015; Vietnam Ministry of Health, 2012, 2016). Hien and colleagues reported that approximately 31.5% of the urban population has a high level of physical activity in comparison to 40.8% of population in rural areas (Thu Hien et al., 2013). Table 3 illustrates the level of physical activity among the adult population by sex. The most recent data from 2015 shows that about 30.4% of Vietnamese population does not meet the WHO recommendations (defined as less than 150 minutes of moderate to intense physical activity per week or equivalent <600 MET-min/week) (25.6% among men; 38.6% among women) (Vietnam Ministry of Health, 2016). The results were consistent with previous national studies (Ahmed et al., 2009; Do et al., 2015; Hoy et al., 2013; Ng et al., 2009; Nguyen et al., 2012a; Pham et al., 2009; Van Bui et al., 2016; Vietnam Ministry of Health, 2012) as well as other local studies (Hoy et al., 2013; Nguyen et al., 2012a; Thu Hien et al., 2013). The average time spent on physical activity per day tends to be higher among men (221.0 MET-min/day), in comparison to women (162.9 MET-min/day) in 2015 (Vietnam Ministry of Health, 2016). The unweighted data from STEPS 2010 showed a similar pattern of physical activity by sex with the median time of physical activity among men at 171.4 MET-min/day, in comparison to 115.7 MET-min/day among women (Vietnam Ministry of Health, 2012).

Among the population under 18 years old, physical activity was found to have a similar pattern by sex and tends to decrease with adolescence (Trang et al., 2009, 2012a, 2012b). A 5-year longitudinal cohort in Ho Chi Minh City (Trang et al., 2009, 2012a, 2012b), which employed both an accelerometer and the Adolescent Physical Activity Recall Questionnaire, found that that total time spent on physical activity decreased significantly in a 5-year period from 87 to 50 minutes per day (Trang et al., 2012a). In general, it was observed that boys tend to be more physically active than girls, in which approximately 16.7% of boys were shown to be physically inactive in comparison to 31.8% of girls (Trang et al., 2012b).

### Unhealthy diet

In Vietnam, nutritional status and national strategy programs in 1996–2000 focused on the mitigation of malnutrition, micronutrient deficiency, poverty, and hunger. Hence, assessing healthy dietary behaviors in relation to NCDs was not discussed by Vietnamese regulatory bodies until 2002, with the development of the first National Strategy on NCD Prevention and Control. According to the NCD Global Monitoring Framework, there are at least three dietary risk behaviors which should be evaluated and managed at a population level for WHO Member States including: (1) fruit and vegetable consumption, (2) salt or sodium consumption, and (3) fat intake (especially saturated fat) (UN General Assembly, 2012). In regards to the lack of documented information on fat intake (only one available study (National Institute of Nutrition, 2012), our review summarizes findings on both fruit and vegetable consumption, and



**Table 4.** Fruit and vegetable consumption in Vietnam from 2005 to 2010.

Time	Low consumption of fruit/vegetables (<5 servings/day)		Number of fruit/vegetables servings/day		Sources
	Men	Women	Men	Women	
2005	87.0%	87.5%	2.6	2.7	STEPS2005 (Filabavi) (Ahmed et al., 2009; Hoy et al., 2013; Kanungsukkasem et al., 2009)
2005	63.5%	57.5%	2.3	2.4	STEPS2005 (Chililab) (Ahmed et al., 2009; Hoy et al., 2013; Kanungsukkasem et al., 2009)
2005	30.2%	26.5%	N/A	N/A	STEPS2005 (Mekong Delta region) (Hoy et al., 2013; Pham et al., 2009)
2009	44.3%	38.1%	N/A	N/A	National survey on diabetes and its risk factors 2008–09 (Hoy et al., 2013; Nguyen et al., 2012a)
2010	80.2%	80.6%	3.2	3.2	STEPS 2010 (Bui et al., 2016; Hoy et al., 2013; Van Bui et al., 2016)
2015	63.1%	51.4%	4.7	5.5	STEPS 2015 (Nguyen et al., 2020; Vietnam Ministry of Health, 2016)

salt intake, while other dietary risk factors can be found in the discussion section below.

**Low fruit and vegetable consumption.** Data on fruit and vegetable consumption was first reported in the National Nutrition Survey in 1985 and later in the National Survey for NCDs, such as cardiovascular diseases or diabetes. In the National Nutrition Surveys, the consumption of fruit and vegetables was previously reported as the daily amount of fruit and vegetables consumed in kilogram or in percentage of total daily calories (Khue, 2015; National Institute of Nutrition, 2010; Vietnam Ministry of Health and Health Partnership Group, 2015). From 1985 to 2000, the consumption of fruits and vegetables did not change much in terms of proportion (fluctuating at about 5% of total daily energy intake) (Khue, 2015; Vietnam Ministry of Health and Health Partnership Group, 2015). From 2005, with the promotion of NCD burden and the variety of dietary risk factors associated with it, a significant shift in dietary habits have been recorded (Khue, 2015; Nguyen and Hoang, 2018). The percentage of the population reporting a low daily consumption of fruits and vegetables (less than 5 servings of fruits and vegetables per day), decreased in both males and females over time (See detailed information in Table 4). Low consumption of both fruits and vegetables was reported in approximately 87.0% of the male population in 2005 (Ahmed et al., 2009; Hoy et al., 2013; Kanungsukkasem et al., 2009), dropped to 80.2% in 2010 (Bui et al., 2016; Van Bui et al., 2016; Vietnam Ministry of Health, 2012), and was observed to be 63.1% in 2015 (Nguyen et al., 2020; Vietnam Ministry of Health, 2016). Otherwise, among women, the low consumption of fruit and vegetables was found to be 87.5%, 80.6% and 51.4% in 2005, 2010, and 2015, respectively (Bui et al., 2016; Hoy et al., 2013; Kanungsukkasem et al., 2009; Nguyen et al., 2020; Van Bui et al., 2016; Vietnam Ministry of Health, 2012, 2016). Overall, there is a rising trend in average

quantity of fruits and vegetables consumed daily overtime in both sexes. In 2005, the Health and Demographic Surveillance System (HDSS) in Vietnam estimated that the number of fruits and vegetable servings per day ranged from 2.3 to 2.7 servings per day in the suburban areas of North Vietnam (Ahmed et al., 2009; Hoy et al., 2013; Kanungsukkasem et al., 2009). These figures rose to 3.2 servings per day for both sexes in 2010 (Vietnam Ministry of Health, 2012) and reached 5.1 servings per day in 2015 (4.7 in men and 5.5 in women) (Vietnam Ministry of Health, 2012).

**Salt consumption.** Only eight studies included in this scoping review mentioned salt intake for the Vietnamese population among the 42 identified documents. Since the measurement of salt intake requires urine samples, only two studies had empirical data enabling the calculation of salt consumption from a 24-hour urinary sodium excretion (Jensen et al., 2018; Vietnam Ministry of Health, 2016). The method for this technique is described elsewhere (Jensen et al., 2018). Findings from a dataset acquired from STEPS 2010 exhibited that the average consumption of salt within the Vietnamese population was approximately 9.9 g of salt per person per day (10.2 g in men and 9.5 g in women) (Jensen et al., 2018). In 2015, the average salt consumption was 9.4g per person per day (10.5 g in men and 8.3 g in women) which was not significantly different than the 2010 figure (Vietnam Ministry of Health, 2016; World Health Organization, 2018c). Prior to 2010, the amount of salt intake was much higher and found to be approximately 18–22 g per person per day as reported by National Institute of Nutrition in 2007 (Nguyen and Hoang, 2018; Vietnam Ministry of Health and Health Partnership Group, 2015; Vietnam National Institute of Nutrition, 2007). Other studies reported the at-risk salt consumption by asking the question: “*always/ often/ preferred daily food containing more salts*” (Nguyen and Hoang, 2018;

Nguyen et al., 2012a, 2020; Vietnam Ministry of Health, 2012, 2016). About one-third of the population reported to have included salt additives as part of their dietary habits in 2009 (men 32.2%, 27.1% women) (Nguyen et al., 2012a), while the figure in 2015 was about 22.2% overall (men 22.3%, women 22.2%) (Nguyen et al., 2020; Vietnam Ministry of Health, 2016).

## Discussion

### *Tobacco use*

Our scoping review identified that the pattern of tobacco usage in Vietnam has been well documented by numerous studies throughout the last few decades. In 2015, Vietnam was noted to be one of the top 25 countries in the world with highest smoking prevalence worldwide with a disproportionate pattern of tobacco consumption by sex, skewed on males (World Health Organization, 2015). The high-profile of smoking in the Vietnamese male population (nearly 50%) is understandable, given that smoking remains socially acceptable for men in Vietnamese culture. In contrast, tobacco usage among women is approximately 2% over the reviewed time frame and is expected to remain stable at this level in the future. This pattern was similar to other neighboring countries such as Thailand (Ministry of Health of Thailand, 2012) or Malaysia (Ministry of Health of Malaysia, 2012), but the smoking prevalence remains lower than the reported data from both China (Ministry of Health of China, 2011) and Indonesia (Ministry of Health of Indonesia, 2012). On the other hand, there has been an observed significant increase in tobacco use from adolescents under 15 years of age into young adulthood aged 15–24 years old (12.6% overall, 24.3% in boys); generally the smoking initiation age of Vietnamese begins at around 18–19 years of age (Vietnam Ministry of Health et al., 2016). Hence, this fact implies a priority toward young populations on the national tobacco control plan in Vietnam.

Several studies have also suggested that special attention should be paid to higher figures of tobacco use which is reported among disadvantaged Vietnamese groups, such as individuals living in a rural area, having a low level of education, or having lower quantile of income (Morrow and Barraclough, 2003; Nguyen et al., 2012b; Van Minh et al., 2017). Data reflect two crucial pieces of information: the first being that social and demographic factors play key roles in smoking prevalence and the second, that the lack of interventions which target these groups or prior interventions may need to be tailor-made to fit such groups. Another worthy point in the pattern of tobacco use, is the common use of traditional water-pipes for smoking tobacco (“thuốc lả”) in rural areas and the rising number of smokers who use electronic cigarettes, especially among younger individuals. A common usage of such traditional water-pipes in

rural Vietnam is likely due to misperception of low risks of health problems. Therefore, this ought to be one area for designing prevention plans for people in a rural setting. Unfortunately, such patterns are not frequently mentioned or detailed among reviewed materials, but previous studies have noted that there is a necessity to appropriately monitor and evaluate the harmful effects of thuốc lả on smoking populations (Korfei, 2018; Saleheen et al.).

Observations in several studies have noted that the pattern of tobacco use in Vietnam and its transition, this has been greatly modified by social norms and the changing awareness of Vietnamese people (Jawad et al., 2018; Minh An et al., 2013; Morrow and Barraclough, 2003). Undoubtedly, tobacco control in Vietnam has made certain achievements which are highly recognized by international agencies. Synchronous efforts of putting tobacco use into the national policy agenda for over 20 years and the implementation of MPOWER package could have explained this change. Over the last 20 years, the consumption of tobacco has shown a downward trend, but the reduction of its use has not yet been met as expected, especially in rural areas. This fact should be important information to decision-makers with consideration to the nature of tobacco use in many countries (Giovino, 2002; Institute of Medicine, 2007). An analysis of smoking indicators from the WHO Comprehensive Information Systems for Tobacco Control estimated that the age-standardized prevalence of current smoking among males in the Western Pacific region would decrease by merely 1% by 2025 (Bilano et al., 2015). As a result, more adequate action plans on tobacco control should be developed and implemented to increase compliance of the MPOWER package to maintain both the current achievement on changing awareness and behavior of community toward tobacco use.

### *Alcohol consumption*

Vietnam was not identified as one of the world’s top countries with a high consumption of alcohol; however, the increasing tendency presented in Table 2 has illustrated the opposite tendency in comparison with the situation of alcohol consumption in European countries. The rising tendency of alcohol consumption in Vietnam is in line with the increase of per capita alcohol consumption by 34% in Southeast Asian region between 2010 and 2017 (Manthey et al., 2019). In contrast, European countries which once had the world’s heaviest alcohol consumption has shown a significant decrease in harmful alcohol use due to the effective implementation of long-period alcohol policies (Manthey et al., 2019). The most recent data on alcohol consumption in Vietnam was reported to be 8.3L per person per year (World Health Organization, 2018b), is higher than the figure in the Western Pacific region at 7.3L, and the global

average consumption at 6.4 L per person per year (World Health Organization, 2018b). This figure was higher for the actual consumption of current drinkers in Vietnam (22.8 L overall; 29.1 L in males and 10.4 L in females) (World Health Organization, 2018b). These findings are equivalent to the daily consumption of 63.8 g of pure alcohol among male drinkers and 22.8 g of pure alcohol in female drinkers. Another issue of alcohol consumption in Vietnam's context is the use of unrecorded or home-made alcoholic beverages, which seemed to be increasing in quantity and difficult to measure (Lachenmeier et al., 2009).

The most dominant risk behavior of alcohol consumption was reported to be binge drinking, especially among young people (Archie et al.; Hermens et al.; US Department of Health and Human Services, 2009). In Vietnam, from 2005 to 2015, the prevalence of binge drinking was reported to be approximately one-fourth of the male population and less than 1% among females. Though the National Institute on Alcohol Abuse and Alcoholism recommended measuring alcohol consumption from 2004 (National Institute of Alcohol Abuse and Alcoholism, 2004), binge drinking was not reported in many studies. The exception is the STEPS surveys which suggested the inclusion of this indicator for future research in regards to NCDs. Prior to 2020, Vietnam had already imposed a number of policies for controlling the harmful use of alcohol (excise tax, drinking, and driving enforcement, mandatory business license to sell alcohol, and regulations on both advertising and sales in specific locations) but the implementation and the compliance to such regulations were determined to be poor (Giang et al., 2013). This may reflect not only a lack of stronger and strictly imposed control policies, but also that the monitoring of these policies is not well implemented. The enactment of Law on Prevention and Control of Harmful effects of Alcoholic beverages in 2020 is therefore expected to bring substantial changes in the drinking behavior of the entire Vietnamese population.

### *Physical activity*

The Vietnamese adult population is slightly more physically active than the world population for both sexes. The percent of insufficient physical activities for the national population is at 19.9% among males and 30.6% among females; in comparison with worldwide statistics physical activity is approximately 23.4% in males and 31.7% in females (World Health Organization, 2018a). However, the physical activity in Vietnam's population is low as compared to the average level of the Western Pacific region in which 18.8% males and 18.5% females were reported to have a low level of physical activity (World Health Organization, 2018a), but reported to be similar with other developing countries in Asia and Africa (Bui et al., 2015). This difference was assumed to be caused by the diversity of cultures, religions, and patterns of agricultural activities between countries (Bui

et al., 2015). We identified a pattern of physical activity among adolescents in which Vietnamese youth between 11 and 17 years of age had a low level of physical activity (86.4%), which was higher than both the global prevalence (81.1%) and Western Pacific Region's figure (85.8%). It was highlighted that the prevalence of insufficient physical activity was approximately three to four times higher among adolescents than in the adult population. Previous studies have explained that this pattern may be due to the change of adolescent social roles (moving out of family, school/work environment, etc.) and the establishment of good lifestyle behaviors in adolescence and youth adulthood (Bell and Lee, 2005; Corder et al., 2019; Nelson et al., 2008). Given the overall understanding of physical activity in community, more considerations should be taken into account for adolescent groups when developing a control policy for the mitigation of NCDs. Currently, questionnaires are the most widely used tool to monitor physical activity levels in community-based studies. However, given the numerous approaches in physical activity measurement, a better understanding of the existing standardized measurements is necessary. This is needed to ensure not only the validity of a survey, but also to both discuss and share results with involved researchers and decision makers to apply novel approaches to future research.

### *Unhealthy diets*

Although the traditional diet in Vietnam and other Western countries has been known for a high proportion of plant-based foods, the average consumption of fruits and vegetables during 1987 until 2010 in Vietnam (175–251 g) was lower than the recorded consumption of half of European countries (Nguyen and Hoang, 2018; Nguyen et al., 2020; Vietnam Ministry of Health, 2012). Yet, the findings from STEP 2015 illustrated that Vietnam's figure had increased to become higher than most of European countries; this was done in pace with the rising awareness of eating more fruits and vegetables for a healthy lifestyle (Nguyen et al., 2020; Vietnam Ministry of Health, 2016). Salt consumption among Vietnamese population was assessed to be at 9.9 g/day (2010) and 9.4 gram/day (2015) respectively, almost double of the WHO recommendations, but similar to other countries around the world (Vietnam Ministry of Health, 2016; World Health Organization, 2012). These figures reflect the concerted efforts of WHO on salt intake reduction. Therefore, there is a need for coordinated actions by regional agencies to provide recommendations to boost Vietnam's national salt reduction strategies.

Additionally, this review has identified data on dietary indicators which likely affect the burden of developing a NCD over time. The National Nutrition Survey in 1985, 2000, and 2010 demonstrated that there is no virtual change in total energy intake in the Vietnamese adult population since 1985 (1925 kcal in 1985 and 1925.4 kcal

in 2010). However, consumption of lipids in proportion to total energy intake increased remarkably from only 6.2% in 1985 to 17.6% ( $\pm 8.7\%$ ) in 2010 (National Institute of Nutrition, 2012). The pattern of fat intake among Vietnamese population was assessed to be lower than the WHO recommendation of less than 30% of total energy intake (World Health Organization, 2003), appropriate monitoring and surveillance of this factor should be taken into account for future studies.

From our review, we identified that dietary evidence in Vietnam can be considered as poor-quality in relation to other NCD risk factors which have led to the lack of representative data for decision making. Given its critical role in the manifestation of NCDs, the measurement of dietary risk factors should be included in future studies to enrich the evidence pool for a Vietnamese specific diet. Furthermore, government actions are needed to promote a healthier lifestyle that is accustomed to Vietnamese culture, with the application of both worldwide recommendations and lessons.

### **Broad context and further steps**

From a scattered picture with limited data which was available from 2000 up to 15 years later, the mapping of major behavior risk factors at the national level has been created leading to the increased use of empirical data for addressing the burden of NCDs in Vietnam. Lessons learned from other developed countries in the world illustrate that when a population begins to age, NCD burden surges rapidly and severely with the accumulation of lifestyle risk factors. Similar issues that are presented by NCDs would challenge Vietnam due to the unavoidable aging population trend and the rapid economic growth. However, there is a possibility that Vietnam could keep pace with the growing burden of NCDs by controlling and directing change by modifying NCD risk factors.

To redirect limited resources for health policies and programs in NCDs, monitoring and surveillance of NCDs in a timely fashion is a necessary step to approach this problem. However, with exception of the STEPS surveys which were conducted every 5 years since 2005 (smoking behavior has been separated into the GATS survey since 2010), there is a lack of an established and organized surveillance system in Vietnam to monitor and evaluate NCDs risk factors regularly. At present, monitoring and evaluating NCD modifiable risk factors is still not a major priority in Vietnamese policymaking. This has made the integration of NCD risk-factor surveillance into national health information systems fall short when attempting to translate the disease patterns in real-time and for future applications. On the other hand, our review has identified multiple surveys that have been conducted at the subnational or regional scale which overlap with the content of STEPS surveys, thereby wasting resources.

Therefore, in a low-resource setting, a possible approach is to encourage the collection of NCD-related information on a regular basis, even at a small-scale. Through this, information about the patterns of NCDs and NCDs-related health behaviors would be surveyed and later incorporate into large datasets. Most importantly, the use of nine voluntary targets for NCDs and the Global Monitoring Framework for NCDs indicators should be better informed in NCD-related research to ensure the consistency of data quality for decision making. Additionally, the consistency in health behaviors surveillance which use a set of nine voluntary targets for NCDs and the Global Monitoring Framework for NCDs indicators, would be better informed in using this service to strengthen the database for decision-making. This way not only saves resources and time, but enables Vietnam to monitor progress across the entire country and allow comparison with neighboring countries. In the long run, the establishment and maintenance of such program would require both adequate tools and public resources to ensure sustainability over time. Given its fundamental role and the long-term utilization of health data for policy evaluation, the development of such database is highly recommended.

### **Limitations**

A few limitations should be noted in this review. First, numerous documents published in the Vietnamese language before 2000 were not available as an electronic version at the time of review, resulting in the limited access and assessment of their validity. Secondly the definitions and the methods for calculation were not fully described in some retrieved published articles. This may hinder or mislead the explanation and comparison of findings across all included materials. As a result, the findings of this review could be limited to generalizations both actual and local studies, rather than in a wider context.

### **Conclusion**

Our review illustrates current patterns of behavioral risk factors for non-communicable diseases in Vietnam. First, tobacco use across a vast number of long-term daily smokers still remains a significant challenge that requires novel initiatives to expand the current impact to a higher degree. Second, as the use of alcoholic beverages is a long-standing cultural tradition, Vietnam has just been confronted with the enactment of Law on Prevention and Control of Alcohol-related harms in 2020 as the first country-level action. Third, diet and physical activity have shifted gradually but are unpredictable under the influence of rapid economic growth. The lack of information and supporting environment for the regular practices surrounding a healthy lifestyle have been recognized as the front-line barrier in Vietnam and many other developing countries (Bui et al., 2015; Heath et al.,

2012). It should be noted that the application of current data is not fully met, based on the demand of program and policy planning. This is due to the fact that findings tend to be fragmented and are not regularly updated, in addition to the lack of a total representation for all disadvantaged groups. Thus, the major issues in present are both the lack of an organized surveillance system and the heavy reliance on international funds, which have hindered the implementation of effectively tailored interventions at the national level.

As a result, surveillance and monitoring of behavioral risk factors should be at the forefront and primary step at present to control NCDs. A standardized surveillance framework system should first be initially developed, allocated with adequate public budget and tools for the regular monitoring of the current situation and to assess upcoming trends. Depending on the priority, the surveillance system should target diverse socioeconomic groups and evaluate both the policy implementation and impact. Following the population-based data, a major benefit can be received not only in terms of NCD prevention and control, but also the health sector and other central agencies who can make use of the detailed and up-to-date analytics provided by selecting health priorities through the allocation of available resources. This manuscript will hopefully serve as a reference for health authorities, health activists, and researchers in Vietnam in developing long term initiatives for NCD prevention and control.

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