

SHORT THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (PHD)

**Health Awareness and Epidemiology of  
Cardiometabolic Diseases and Influenza Vaccine**

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University of Debrecen  
Kálmán Laki Doctoral School  
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## **Introduction**

### **Background and rationale**

#### *The increasing prevalence of cardiometabolic diseases*

Cardiometabolic diseases (CMDs), encompassing conditions such as type 2 diabetes mellitus (T2DM) and hypertension, are rapidly becoming a major health concern in developing countries. The rising prevalence of these diseases is primarily attributed to changes in lifestyle and diet that accompany economic development and urbanization. In developing countries, urbanization leads to a sedentary lifestyle, increased consumption of processed foods, and higher rates of obesity, all of which are risk factors for CMDs. According to the World Health Organization (WHO), non-communicable diseases (NCDs), which include CMDs, are responsible for 41 million deaths each year, accounting for 74% of all deaths globally. Of these, 77% occur in low- and middle-income countries (LMICs). In Southeast Asia, the prevalence of T2DM and hypertension is increasing at an alarming rate, leading to a significant public health burden. Vietnam, a rapidly developing country in this region, mirrors these global trends. In Vietnam, the incidence of CMDs has risen sharply over the past few decades. This increase is partly due to the country's economic growth, which has led to significant changes in lifestyle and dietary patterns. The traditional Vietnamese diet, which was once rich in vegetables and low in fats, is increasingly being replaced by a diet high in processed foods, sugars, and fats, together with decreased physical activity, these dietary changes have contributed to higher rates of obesity, T2DM, and hypertension. The growing burden of CMDs in Vietnam presents a significant challenge for the healthcare system, which is already grappling with the dual burden of infectious diseases and NCDs. Despite advancements in medical care and infrastructure, the healthcare system in Vietnam still struggles with limited resources and accessibility issues, particularly in rural areas. Public awareness and preventive behaviors play a crucial role in managing CMDs, yet studies indicate that awareness levels are generally low.

#### *Importance of influenza vaccination and its low uptake*

Seasonal influenza remains a persistent threat to global health, causing significant morbidity and mortality each year. The burden of influenza extends beyond the direct morbidity and mortality associated with the infection itself; the virus often triggers exacerbation of existing health conditions, particularly in vulnerable populations. These include the elderly, young children, pregnant women, and individuals with chronic health conditions, such as CMDs, which encompass hypertension, diabetes, and cardiovascular disease (CVD). The influenza

virus is highly contagious, transmitted via droplets when an infected person coughs or sneezes, and its ability to spread rapidly contributes to annual epidemics. This poses significant challenges in preventing widespread transmission. The severity of influenza infection varies, but it can lead to severe respiratory illnesses such as pneumonia, bronchitis, and acute respiratory distress syndrome, particularly in at-risk groups. Individuals with chronic health conditions, especially those with CMDs, are particularly vulnerable during influenza seasons. Research indicates that the risk of complications, including hospitalization and death, is significantly higher in patients with underlying cardiometabolic conditions. For example, influenza infection can exacerbate cardiovascular problems, leading to events such as heart attacks and strokes. Studies have found that individuals with heart disease are up to six times more likely to suffer a heart attack during the week following an influenza infection. Similarly, patients with diabetes are more prone to experiencing severe complications from influenza due to their compromised immune systems and increased susceptibility to infections. During influenza epidemics, there is often a marked increase in excess mortality, particularly among those with CMDs. These patients are more likely to experience severe outcomes due to both the direct impact of the virus and the exacerbation of their pre-existing conditions. The interaction between CMDs and influenza underscores the importance of preventive measures, such as vaccination, which has been shown to reduce the severity of illness and prevent many of the life-threatening complications associated with influenza infection. Moreover, the COVID-19 pandemic further highlighted the risks that infectious diseases pose to individuals with CMDs. Fatality rates were particularly high among cardiometabolic patients during the pandemic, as they were more likely to experience severe illness, hospitalization, and death due to the virus. This experience has highlighted the importance of preventive health measures such as vaccination, not just against COVID-19 but also against other respiratory infections like influenza. The high mortality rates observed among CMD patients during the COVID-19 pandemic make it imperative to promote health education and vaccination campaigns targeting these vulnerable groups. Given the shared risk factors and the vulnerability of CMD patients, influenza vaccination is crucial. Vaccination not only helps prevent the onset of influenza but also reduces the risk of triggering severe cardiometabolic events. However, despite the clear benefits, influenza vaccine uptake remains low in many regions, including Vietnam. In Vietnam, the overall vaccination coverage is low, even among healthcare worker (HCW) and medical students who are at higher risk of exposure. Several factors contribute to this low uptake, including lack of awareness about the vaccine's benefits, misconceptions about the vaccine's efficacy and safety, cultural beliefs, and logistical challenges such as vaccine

availability and access. HCW and medical students play a pivotal role in influenza prevention and control. As frontline health professionals, they are not only at increased risk of contracting and transmitting the virus, but also serve as key influencers of public health behaviors. Their attitudes and practices regarding influenza vaccination can significantly impact the broader population's acceptance and uptake of the vaccine. Therefore, understanding their knowledge, attitudes, and practices (KAP) towards influenza vaccination is critical for designing effective public health interventions.

### **Research objectives**

This research aims to bridge the gap in understanding the awareness and preventive behaviors regarding CMDs and influenza vaccination in Vietnam by pursuing the following objectives:

1. To assess the level of awareness, knowledge, attitudes, and preventive behaviors concerning CMDs among a selected population in Ho Chi Minh City.
2. To evaluate the knowledge, attitudes, and practices regarding influenza vaccine uptake among medical students and HCW in northern Vietnam.
3. To identify sociodemographic factors that influence awareness and preventive behaviors in both health contexts.
4. To provide evidence-based recommendations for improving health education and intervention programs targeting CMDs and influenza vaccination.

## **Methodology**

### **Study design**

Cross-sectional study design was applied to both studies. In-person interview-based questionnaire was used for CMD study in southern Vietnam. Anonymous online survey was used for influenza vaccine study in northern Vietnam.

### **Sampling and sample size**

#### *Sample size calculation for CMD study in southern Vietnam*

The sample size was determined using the “sampsiz” command in STATA, based on systolic blood pressure data from a previous study, which reported mean ( $\pm$  SD) values of 126.0 ( $\pm$  18.3) for males and 120.4 ( $\pm$  18.5) for females. The calculation indicated a need for 227 participants per district, totaling 454 participants. To account for potential rejection, incorrect responses, and ineligible households, an additional 10% of participants were added, bringing the required number to 500.

#### *Sampling method for CMD study in southern Vietnam*

To ensure accurate information, trained interviewers were utilized, and participants were given a small reimbursement for their time in completing the long and time-consuming questionnaire. Anonymity and confidentiality were maintained by assigning code numbers to participants, with all data securely stored in locked files accessible only to the researchers.

Data collection took place from June to August 2019. Participants were randomly selected from households within the designated areas using a two-stages sampling method. In the first stage, streets were conveniently selected in the two districts. In the second stage, households were chosen through systematic random sampling, starting with the first house on the right side of the street and then selecting every second household on the right thereafter. Selected households needed to have at least one eligible member aged 18 or older.

Participants were informed about the study’s purpose and procedures before signing an informed consent form. By signing, participants agreed to share their personal medical records and accurately respond to the interviewer's questions. Participation was voluntary, with no identifying information collected.

Ultimately, 402 participants completed the study, resulting in a response rate of 80.4%.

### *Sample size calculation for influenza vaccine study in northern Vietnam*

The sample size was calculated according to the formula of Pourhoseingholi MA et al. “Sample size calculation in medical studies.”:

$$n = \frac{Z^2 P(1 - P)}{d^2}$$

In which:

- Prevalence (p) = 53% (average prevalence of influenza vaccine uptake from two studies in Vietnam).
- Level of confidence (Z) = 95%,
- Precision (d) = 5%.

### *Sampling method for influenza vaccine study in northern Vietnam*

Medical students and HCW were invited to take part in this survey. This included postgraduate and residency students who were on 72-hour duty shifts and had regular office hours, treating them as regular hospital staff.

The survey was anonymous and conducted between June and August 2022 using Google Forms in both Vietnamese and English. Each participant could only respond once and had to give consent before starting the survey. We excluded incomplete responses and people without medical background, based on their universities or workplaces. For confidential reason, each participant got a code number, and all data were securely stored in locked digital files that only researchers could access. Participants were told about the study’s purpose and procedures and had to sign a consent form before taking part. Participation was voluntary, and no identifying information was collected.

Initially, as the result of the sample size calculation, 90 participants were required for the study population. Since the study covered five provinces in northern Vietnam, we multiplied this by five, making the target 450. To account for possible dropouts or exclusions, we added 20%, bringing the final target to 540 participants.

In the end, a total of 585 medical students and HCW were included in the study.

## **Questionnaire**

### *Interview-based questionnaire for CMD study*

The questionnaire was based on a survey created by the Vietnamese Ministry of Health. It was designed to take about 30-40 minutes to complete. The first part of the questionnaire had eight questions to gather basic information about the participants, including sociodemographic

characteristics and medical history. To avoid bias, we asked the 22 behavior questions at the beginning of the interview. The next 42 questions aimed at assessing their knowledge of CMD, followed by 12 questions evaluating participants' attitudes toward their conditions. Blood pressure and blood glucose levels were tested by hospital nurses early in the morning, between 5:00 and 7:00 am, before they had breakfast.

#### *Anonymous online survey for influenza vaccine study*

The study used a questionnaire originally from a 2014 study by Walker et al. The first part of the questionnaire, consisting of 28 questions regarding socioeconomic background and vaccination status. The next 10 questions focused on the participants' vaccination history and their current vaccination status within the past year, and their willingness of vaccination. Following this, there were 30 questions aimed at assessing the participants' knowledge and attitudes towards the influenza vaccine. Every answer was pre-coded to make the data easier to analyze. Some multiple-choice questions included open-ended options to capture any unexpected responses. The entire questionnaire took about ten minutes to complete.

### **Data and data analysis**

#### *CMD study*

Blood pressure, blood glucose levels, and body mass index (BMI) were assessed following the guidelines provided by the IDF to evaluate participants' risk for CMDs. To ensure accuracy, participants' disease statuses were confirmed using their medical records. The selected districts were involved in the government health promotion programs on hypertension, CVD, and other related diseases; hence, the KAP of the participants would be interpreted rigorously. Therefore, the participant received one point for each category if the score was >70%, which was in accordance with previous studies. The participant was categorized as having good general knowledge on T2DM and hypertension if he/she received good knowledge for both parts of the knowledge section. The general awareness of CMD was evaluated on the combination of three factors: general knowledge of the diseases and their prevention, the attitude of the participants, and their preventive behaviors. Scoring in at least two out of three categories was considered as having a good degree of awareness concerning CMDs.

#### *Influenza vaccine study*

The knowledge section included 14 questions that referred to the understanding that participants possessed regarding the public health importance of influenza and influenza

vaccination. On the other hand, the 16 questions in the attitude section captured the psychological dispositions of individuals toward receiving the vaccine. This included not only willingness or hesitancy but also the underlying reasons. The participants received 1 point for each positive answer. With the medical background, the participants were rated as having “good knowledge” and a “good attitude” if their overall score in each category was 70% or higher, which was based on a study on previous KAP on health problems. There were 3 categories regarding the practice of the participants: their vaccination status, their willingness of getting vaccinated this year, and their willingness to advise others to get vaccinated. At the end of the survey, there was 1 question regarding whether influenza vaccine uptake should be compulsory among medical/health sciences students and healthcare workforce or not.

### **Statistical methods used for analysis**

Continuous variables were described by mean ( $\pm$  standard deviation), and categorical variables were described with percentages. In both studies, bivariate analyses were performed using Pearson’s chi-squared test and Fisher’s exact test. Variables achieving a significance level of  $p < 0.05$  in bivariate analysis were subsequently incorporated into a regression model. Multiple binary logistic regression models were performed to identify the association between independent predictors (sociodemographic characteristics) and the key outcome variables. Association between KAP was measured using similar regression models, adjusted for possible confounders such as age, gender, education, employment, BMI, and CMD status. Odds ratios and the corresponding 95% confidence intervals were reported. Intercooled Stata v17 and Microsoft Excel 2018 were used for data analysis. The significance threshold was set at  $< 0.05$ .

### **Ethical considerations**

The implementation of the data collection for the study “Awareness Related to Cardiometabolic Diseases: A Cross-Sectional Study in Southern Vietnam” was approved by the University of Public health, Vietnam (444/DHYTCC).

Ethical approval was obtained from the Scientific and Research Ethics Committee of the University of Debrecen (6462-2023) for the study “Association Between Influenza Vaccine Uptake and Health Awareness: A Cross-Sectional Questionnaire-Based Study Among Medical Students and Healthcare Workers in Northern Vietnam”.

## **Results**

### **CMD awareness and preventive behaviors**

A significant majority of participants, 88.06% (354), had poor knowledge about T2DM. Knowledge about hypertension was better compared to T2DM, with 35.07% (141) of participants having good knowledge. Overall knowledge about CMDs remains low, with 89.05% (358) of participants had poor knowledge. Regarding attitude, 73.88% (297) of the participants have a negative attitude towards managing or understanding CMDs. When examining behavior related to CMDs, 95.02% (382), exhibited poor behavior. Awareness about CMDs was also low, with only 7.96% (32) of participants being aware.

Age showed a significant positive effect on attitude (OR = 1.04, 95% CI: 1.02 - 1.06), behavior (OR = 1.07, 95% CI: 1.02 - 1.12), and a borderline significant positive effect on overall awareness (OR = 1.04, 95% CI: 1.00 - 1.08). Gender significantly influenced knowledge, with females having a much higher odds ratio (OR = 2.80, 95% CI: 1.23 - 6.39) and overall awareness (OR = 3.89, 95% CI: 1.28 - 11.80) compared to males. Higher education level (tertiary or higher) was associated with significantly better knowledge (OR = 3.29, 95% CI: 1.24 - 8.72) compared to primary education or below. However, it had a negative association with attitude (OR = 0.43, 95% CI: 0.21 - 0.90). Secondary education also negatively impacted attitude (OR = 0.49, 95% CI: 0.28 - 0.86). Participants who were overweight or obese had a significantly positive attitude (OR = 2.05, 95% CI: 1.14 - 3.69). Participants with T2DM had substantially higher knowledge (OR = 10.61, 95% CI: 2.48 - 45.41) compared to those without CMD. Individuals with both T2DM and HTN showed significantly higher knowledge (OR = 7.16, 95% CI: 2.28 - 22.41) and awareness (OR = 6.97, 95% CI: 1.96 - 24.80). Having good knowledge of T2DM, HTN, and general knowledge were found significantly associated with better attitude regarding CMD (OR = 4.89, 95% CI: 2.27 - 10.55, OR = 4.74, 95% CI: 2.71 - 8.30, OR = 4.57, 95% CI: 2.06 - 10.16, respectively). Knowledge and attitude were not associated with the preventive behavior of the participants.

### **Influenza vaccine uptake**

Among the 585 participants, only 40.51% of the participants were vaccinated. In terms of vaccination knowledge, 36.58% of participants possessed good knowledge. Regarding attitudes, 42.39% of the participants had a positive attitude towards vaccination. Only 18.97% of the participants were willing to vaccinate or revaccinate. However, a high percentage (89.91%) were willing to advise others about vaccination. A little over half of the participants

(54.36%) believed in mandatory vaccination. In terms of awareness, 19.83% of participants had good awareness regarding vaccination. Females were twice as likely as males to have a positive attitude towards the influenza vaccine (OR = 2.00, 95% CI: 1.29–3.10). The Kinh ethnic group had significantly higher odds of having knowledge, attitude, and awareness regarding the influenza vaccine compared to other ethnic groups [(OR = 1.67, 95% CI: 1.12–2.49), (OR = 2.10, 95% CI: 1.41–3.11), (OR = 2.14, 95% CI: 1.26–3.64), respectively]. Medical doctors had significantly higher odds of having knowledge about the influenza vaccine compared to other occupations (OR = 2.45, 95% CI: 1.13–5.33). Pharmacists also showed significantly higher odds (OR = 2.11, 95% CI: 1.03–4.32). Females were significantly more willing to advise others on vaccination compared to males (OR = 2.66, 95% CI: 1.47 - 4.82). Individuals from the Kinh ethnic group were significantly more willing to advise others on vaccination (OR = 1.83, 95% CI: 1.02 - 3.28). Those who were not single were significantly more likely to be vaccinated compared to single individuals (OR = 2.09, 95% CI: 1.20 - 3.64), more willing to vaccinate/revaccinate (OR = 2.49, 95% CI: 1.33 - 4.65), and more likely to believe in mandatory vaccination for medical-related students and HCW (OR = 1.80, 95% CI: 1.04 - 3.12). Medical doctors were significantly more likely to be vaccinated compared to others (OR = 2.25, 95% CI: 1.04 - 4.87). Seeking healthcare at least once per year significantly increased willingness to vaccinate/revaccinate (OR = 1.68, 95% CI: 1.04 - 2.70). Being advised by a healthcare professional significantly increased the likelihood of being vaccinated (OR = 2.92, 95% CI: 1.98 - 4.32), the willingness to vaccinate/revaccinate (OR = 3.11, 95% CI: 1.96 - 4.94), and the willingness to advise others (OR = 2.25, 95% CI: 1.04 - 4.87). Good awareness significantly increased willingness to vaccinate/revaccinate (OR = 2.26, 95% CI: 1.36 - 3.76), the willingness to advise others (OR = 4.32, 95% CI: 1.31 - 14.26), and the belief in mandatory vaccination for medical-related students and HCW (OR = 3.19, 95% CI: 1.19 - 5.13).

## **Discussion**

### **Interpretation of findings**

#### *Low awareness and preventive behaviors for CMD*

The study provided critical insights into the current state of awareness and preventive behaviors regarding CMD among the participants.

The data indicated a substantial gap in knowledge about CMDs, which included T2DM and hypertension. Specifically, the findings showed that a significant majority of the participants had poor knowledge about T2DM, CMD, and hypertension. The analysis highlighted that gender, education, and CMD status significantly influenced various aspects of awareness towards CMDs. Older age, female gender, higher education, being overweight or obese, and having T2DM or both T2DM and HTN were associated with better knowledge. This lack of knowledge was a significant barrier to effective prevention and management of these diseases. The negative attitudes towards CMDs observed in the study were also a significant barrier to effective prevention and management. As the results of Pearson's chi square tests, older age, lower education levels, being female, unemployed, having higher BMI, and having good knowledge were associated with higher rate of positive attitudes. As the results of multiple binary logistic regression, higher educational level was found to be associated with worse attitude. As higher educational level was defined as an indicator for higher socioeconomic status (SES), people with better SES in Vietnam were more likely to be exposed to a western lifestyle, such as fast-food or sugar-rich diets, as they were more able to afford them, leading to unfavorable attitude. Also, having good knowledge of CMD was found significantly associated with more positive attitude regarding the conditions in the regression model.

Negative attitudes stemmed from various sources, including cultural beliefs, past experiences, and misinformation. For instance, some participants might have believed that CMDs were inevitable and could not be prevented, leading to a fatalistic attitude towards prevention and management. The data indicated that preventive behaviors towards CMDs were largely negative among the participants, with 95.02% exhibiting poor preventive behaviors. Younger age, being male, employment, not having CMDs, having bad knowledge and negative attitude were associated with higher proportions of bad preventive behaviors, according to the results of Pearson's chi-square tests. However, only age was found significant in the regression model. This included lack of physical activity, unhealthy dietary habits, and non-adherence to medical advice. These behaviors were major risk factors for the development and progression of CMDs.

The data indicated that the study population was extremely lacking in awareness regarding CMDs, with 92.04% exhibiting poor awareness. The univariate analysis highlighted that age, gender, education, BMI, and CMD status significantly influenced various aspects of awareness towards CMDs. Older age, female gender, higher education, being overweight or obese, and having T2DM or both T2DM and HTN were associated with better knowledge and awareness. Multiple logistic regression models indicated that older age was borderline significant with better awareness; female gender and having both T2DM and HTN were strongly associated with better awareness.

#### *Low awareness on influenza vaccine leads to low vaccination rate*

The study also highlighted the low awareness and low uptake of the influenza vaccine among participants. While many participants believed in mandatory influenza vaccination for medical students and HCW, there is significant reluctance to vaccinate or revaccinate. Interestingly, a large proportion of participants were willing to advise others about vaccination, indicating a discrepancy between personal health actions and public health advocacy.

Understanding the barriers to vaccination was crucial in addressing this issue. Common barriers included fear of side effects, misconceptions about vaccine efficacy, and perceived lack of necessity. For example, some individuals might believe that they do not need the vaccine because they are healthy or because they have never had the flu before.

Ethnicity, belief in mandatory vaccination, and willingness to vaccinate or advise others were particularly influential. Gender and marital status also played significant roles in shaping attitudes and practices towards vaccination. Additionally, the presence of CMDs, advice from healthcare professionals, and healthcare-seeking behavior significantly impacted vaccination willingness and practices.

### **Comparison with existing literature**

#### *CMD awareness and preventive behaviors*

The findings from this study are consistent with numerous studies documenting low awareness and suboptimal preventive behaviors regarding CMDs across different populations. For instance, a study by Sallis et al. (2016) reported that a significant portion of the population lacked adequate knowledge and engaged in unhealthy behaviors, similar to the findings of this study. The association between demographic factors such as age, gender, and education with CMD awareness and behaviors is also consistent with previous research. Studies have often

found that older adults and those with higher education levels tend to have better knowledge and more positive health behaviors.

The results align with studies showing widespread knowledge gaps about CMDs. For example, in a study by Rahman et al. (2018), a large proportion of participants were unaware of the symptoms and risk factors associated with T2DM and hypertension, similar to the knowledge deficits found in this study. The study by Hocking et al. (2013) also highlighted that a significant number of individuals with chronic disease lacked sufficient knowledge about their conditions, which adversely affected their disease management and outcomes.

Despite many health campaigns in Vietnam trying to increase public understanding and awareness of CMDs, many individuals do not fully understand the implications of CMDs, leading to inadequate preventive measures. This reflects the findings of this study, where most of the participants exhibited poor knowledge about CMDs and engaged in unhealthy behaviors. The negative attitudes towards CMDs observed in this study are consistent with findings from other research. For example, a study by Yusuf Mohamud et al. (2022) found that negative attitudes towards lifestyle modifications were prevalent among individuals at risk for CMDs. These attitudes were often rooted in cultural beliefs and misinformation, making it challenging to adopt healthy behaviors.

Similarly, two studies by Kalantzi et al. (2023) and Walker et al. (2012) highlighted that negative attitudes and fatalistic beliefs about CMDs were significant barriers to effective prevention and management. These attitudes can lead to a lack of motivation to engage in healthy behaviors, as observed in this study.

The poor preventive behaviors observed in this study are in line with findings from other research. A study by Robinson et al. (2023) found that many individuals at increased risk for CMDs did not engage in regular physical activity or adhere to dietary recommendations. This lack of adherence was often due to a combination of factors, including time constraints, lack of access to resources, and low motivation.

In another study by Ganiyu et al. (2013), participants reported difficulty in maintaining healthy behaviors due to competing priorities and lack of support. This is consistent with the findings of this study, where a significant majority of participants exhibited poor preventive behaviors. The influence of demographic factors such as age, gender, and education on CMD awareness and behaviors were indicated in many literatures. For example, a study by Ibarra-Sanchez et al. (2023) found that older adults and those with higher education levels were more likely to have better knowledge and engage in positive health behaviors. This aligns with the findings

of this study, where older participants and those with tertiary education showed relatively better knowledge about CMDs.

Similarly, a study by Stefan Ek (2015) reported that women were more likely to have better knowledge and engage in healthier behaviors compared to men. This is consistent with the findings of this study, where females exhibited better knowledge and more positive attitudes towards CMDs.

The finding that employed individuals displayed more negative attitudes and behaviors towards CMDs contrasts with some literature suggesting that employment is associated with better health outcomes. For instance, a study by Hoven et al. (2023) reported that employed individuals often have better access to healthcare resources and are more likely to engage in preventive behaviors.

However, other studies have shown that employment can also be associated with stress and time constraints, which can negatively impact health behaviors. Such as, a study by Huang et al. (2022) found that job stress and long working hours were associated with poor health behaviors, such as lack of physical activity and unhealthy eating. This is consistent with the findings of this study, where employed individuals exhibited more negative attitudes and behaviors towards CMDs.

### *Influenza vaccination*

The low awareness and low uptake of influenza vaccination observed in this study mirrors findings from other research. Studies have shown that despite substantial awareness campaigns, actual vaccination rates remain suboptimal due to factors such as vaccine hesitancy, misconceptions about vaccine efficacy, and fear of side effects.

Low vaccination rate of the influenza vaccine due to low awareness is a well-documented issue in public health. For example, a study by Sun et al. (2024) found that although a significant portion of the population was aware of the importance of the influenza vaccine, vaccination rates remained low due to various barriers.

In contrast, a study by Jiang et al. (2022) highlighted that high awareness of influenza vaccination did not necessarily translate into higher vaccination rates. This gap between knowledge and practice was attributed to factors such as fear of side effects, skepticism about vaccine efficacy, and logistical challenges.

The issue of vaccine hesitancy observed in this study is consistent with findings from other research. A study by Nuwarda et al. (2022) identified vaccine hesitancy as a major barrier to

achieving high vaccination rates. Factors contributing to vaccine hesitancy included concerns about vaccine safety, misinformation, and distrust of healthcare systems.

A study by Kumar et al. (2022) also found that vaccine hesitancy was influenced by psychological factors, such as risk perception and trust in health authorities. This reflects the findings of this study, where many participants were reluctant to vaccinate or revaccinate.

The significant influence of healthcare professionals on vaccination decisions observed in this study is supported by existing literature. For example, a study by Aguolu et al. (2022) found that recommendations from healthcare professionals were one of the most important factors influencing vaccination decisions.

Similarly, a study by Guillari et al. (2021) reported that advice from healthcare providers significantly increased the likelihood of individuals getting vaccinated. This aligns with the findings of this study, where advice from healthcare professionals was a key determinant of vaccination practices.

The impact of policy measures on vaccination rates observed in this study is consistent with findings from other research. For example, a study by Maltezou et al. (2022) found that mandatory vaccination policies for HCW significantly increased vaccination rates.

Similarly, a study by Singh et al. (2020) reported that providing free or subsidized vaccines reduced financial barriers and increased vaccination rates. This is consistent with the findings of this study, where policy measures such as mandatory vaccination and subsidized vaccines were suggested to improve vaccination rates.

The importance of community engagement in promoting vaccination observed in this study is supported by existing literature. For example, a study by Kan and Zhang (2018) found that social support and peer influence were critical determinants of vaccination behaviors.

Similarly, a study by Xie et al. (2024) reported that community engagement and involvement of trusted community leaders significantly increased vaccination acceptance. This aligns with the findings of this study, where fostering social support networks and engaging community leaders were recommended to promote vaccination.

## **Public health implications**

### *CMD awareness and preventive behaviors*

The significant gaps in knowledge and preventive behaviors regarding CMDs among the study population suggest a potential increase in the burden on healthcare systems. Individuals with poor knowledge and negative attitudes towards CMDs are less likely to engage in preventive behaviors, leading to higher rates of disease incidence and progression. This can result in

increased healthcare costs due to the need for more intensive treatments and management of complications associated with CMDs. The strain on healthcare resources could be substantial, particularly in regions with already limited healthcare infrastructure, especially in Vietnam. The disparities in CMD awareness and behaviors among different demographic groups highlight existing health inequities. For instance, younger individuals, males, and those with lower education levels exhibited poorer knowledge and behaviors related to CMDs. These inequities can lead to differential health outcomes, where certain groups are disproportionately affected by CMDs. Addressing these disparities is crucial for achieving health equity and ensuring that all population segments have access to the knowledge and resources needed to prevent and manage CMDs effectively. The poor preventive behaviors and low awareness of CMDs among employed individuals have significant implications for workforce productivity. CMDs can lead to increased absenteeism and presenteeism (working while sick), reducing overall productivity. Employees suffering from CMDs may require more frequent medical leave and may not perform at their optimal level when at work. This can have broader economic implications, affecting businesses and the economy as a whole. Promoting CMD awareness and preventive behaviors in the workplace is essential for maintaining a healthy and productive workforce. The study's findings indicate that the awareness of CMDs, preventive behaviors remain suboptimal. This suggests that current public health messaging strategies may not be effectively translating awareness into action. Public health campaigns need to be re-evaluated to ensure they are not only informative but also motivational and capable of overcoming behavioral barriers. Understanding the underlying reasons for the disconnect between awareness and behavior is essential for developing more effective health communication strategies.

### *Influenza vaccination*

The low awareness and low uptake of the influenza vaccine poses a significant risk for influenza transmission. High vaccination coverage is critical for achieving herd immunity and preventing the spread of influenza. The reluctance to vaccinate, as observed in the study, can lead to higher susceptibility to influenza in the population, increasing the likelihood of outbreaks. This can have severe public health consequences, particularly for vulnerable populations such as the elderly, young children, and individuals with underlying health conditions. The consistency between low awareness and low uptake of the influenza vaccine highlights challenges in maintaining public confidence in vaccination programs. Vaccine hesitancy, driven by factors such as fear of side effects and misconceptions about vaccine

efficacy, can undermine vaccination efforts. This issue is not limited to influenza but can also affect other vaccination programs, potentially leading to lower overall immunization rates and increased vulnerability to vaccine-preventable diseases. The low vaccination rates can have broader socioeconomic impacts. Influenza can lead to significant morbidity and mortality, particularly among high-risk groups. This can result in increased healthcare costs and loss of productivity due to illness and absenteeism. Addressing the barriers to influenza vaccination uptake is crucial for minimizing the socioeconomic impact of influenza and ensuring the well-being of the population. The significant influence of healthcare providers on vaccination decisions underscores the critical role they play in public health interventions. Healthcare providers are often the most trusted source of health information for patients. Their recommendations can significantly impact vaccination behaviors. Strengthening the role of healthcare providers in vaccination advocacy and ensuring they have the necessary training and resources to address patient concerns effectively can enhance vaccination uptake and overall public health outcomes. The study highlights the importance of addressing policy and structural barriers to improve vaccination rates. Factors such as financial constraints, lack of access to healthcare services, and logistical challenges can hinder vaccination uptake. Implementing policies that provide free or subsidized vaccines, improving access to vaccination services, and reducing logistical barriers can significantly enhance vaccination coverage. Policymakers need to consider these factors when designing and implementing vaccination programs to ensure they are accessible and equitable.

#### **4.4 Strengths, limitations and recommendations for future research**

The study provides a thorough examination of awareness, attitudes, and behaviors related to CMDs and influenza vaccination, offering a holistic view of the public's knowledge and practices. By analyzing data across various demographic groups, the study identifies specific populations with the most significant knowledge gaps and behavioral issues, enabling targeted interventions. The inclusion of a diverse participant group ensures that the findings are more generalizable and reflective of the broader population. The study highlights the crucial role of healthcare providers in influencing vaccination decisions underscores the importance of provider-patient communication in public health strategies. By emphasizing preventive behaviors, the study aligns with public health goals aimed at reducing the incidence and severity of CMDs through early intervention and lifestyle changes. The study sheds light on significant health disparities, providing a basis for developing equity-focused health policies and programs. The findings offer concrete insights that can inform the design of more effective

health promotion campaigns, community interventions, and policy measures to improve CMD management and vaccination rates. The study's insights into factors affecting health behaviors and vaccination uptake can guide policymakers in creating supportive environments and removing barriers to healthcare access. The identification of knowledge gaps and behavioral patterns lays the groundwork for further research to develop and test targeted interventions, ensuring ongoing improvements in public health.

While this study provides valuable insights into CMD awareness, preventive behaviors, and influenza vaccination uptake, several limitations should be acknowledged:

The study relied on self-reported data, which is subject to recall bias and social desirability bias. Participants may have provided responses they perceived as socially acceptable or may have inaccurately recalled their behaviors or attitudes towards CMDs and influenza vaccination. The cross-sectional design of the study limits the ability to establish causal relationships between variables. Longitudinal studies would provide more robust evidence of the temporal relationships between CMD awareness, preventive behaviors, and vaccination uptake over time. The study may not have accounted for all potential confounding variables that could influence CMD awareness, attitudes, and behaviors, such as access to healthcare services, socioeconomic status, or cultural factors. Failure to control these variables may have biased the study results. Participants may have provided responses they believed were socially desirable, leading to an overestimation of positive health behaviors or an underreporting of negative behaviors. This bias may have influenced the accuracy of self-reported data on CMD awareness, attitudes, and behaviors.

The findings from this study highlight several critical areas that warrant further investigation to enhance our understanding and address the issues related to CMD awareness, preventive behaviors, and influenza vaccination uptake. Future research should focus on the following areas to develop more effective interventions and public health strategies.

Further research should aim to explore the specific knowledge gaps related to CMDs in more detail. Understanding the particular aspects of CMDs that individuals are least informed about (e.g., risk factors, symptoms, management strategies) can help tailor educational programs more effectively. Studies should investigate how different demographic factors (e.g., age, gender, socioeconomic status) influence these knowledge gaps to create more targeted and impactful educational interventions.

Understanding the psychological and social determinants of health behaviors related to CMDs and influenza vaccination is crucial. Future research should employ qualitative methods, such as focus groups and in-depth interviews, to gain insights into the attitudes, beliefs, and

perceptions that drive health behaviors. These studies can uncover the underlying reasons for negative attitudes and poor preventive behaviors, helping to develop more nuanced and effective behavior change interventions.

Longitudinal research is needed to understand the long-term effects of interventions aimed at improving CMD awareness and preventive behaviors. Such studies can provide valuable information on the sustainability of behavior changes and the long-term impact on health outcomes. Tracking individuals over time can also help identify the factors that contribute to the maintenance or relapse of healthy behaviors.

Further research should focus on understanding and addressing health disparities related to CMDs and influenza vaccination. Investigating the social determinants of health that contribute to inequities in CMD prevalence, knowledge, and behaviors can inform the development of equity-focused interventions. Studies should also explore how different cultural contexts and social environments influence health behaviors and outcomes, ensuring that interventions are culturally sensitive and inclusive.

Investigating the impact of policy changes on CMD awareness, preventive behaviors, and vaccination rates is essential. Future research should evaluate the effectiveness of policies such as mandatory vaccination for HCW, financial incentives for vaccination, and public health campaigns. These studies can provide evidence for policymakers to design and implement effective health policies.

## **Practical recommendations**

### *CMD awareness and preventive behaviors*

Develop comprehensive educational programs that specifically target younger individuals, males, and employed populations. These campaigns should focus on the importance of CMD prevention and management, emphasizing practical steps individuals can take to improve their health. Educational content should cover the basics of CMDs, risk factors, symptoms, and the importance of early detection and management. It should also provide practical advice on healthy lifestyle choices, including diet, exercise, and smoking cessation. Utilize various delivery methods, including traditional media (TV, radio), social media, community events, and healthcare settings, to reach a broad audience. Interactive tools, such as mobile apps and online platforms, can also engage younger populations more effectively.

Health workers should be trained to deliver educational sessions, conduct health screenings, and provide one-on-one counseling. These workers can also serve as a bridge between the community and healthcare services. Introduce workplace health promotion programs that offer

regular health screenings, educational workshops, and incentives for engaging in healthy behaviors. Employers could play a pivotal role in creating a supportive environment that encourages healthy lifestyle choices. Organize regular health screenings and educational workshops on CMD prevention and management. Topics can include stress management, healthy eating, and physical activity.

### *Influenza vaccination*

Develop targeted communication strategies to address vaccine hesitancy. This could include providing clear, evidence-based information about vaccine safety and efficacy, and addressing common misconceptions and fears. Launch campaigns that address common myths and misconceptions about vaccines. Use testimonials from trusted figures, such as healthcare professionals and community leaders, to build trust. Distribute educational materials in various formats, including brochures, videos, and social media posts, to explain the benefits and safety of vaccines. Increase the involvement of healthcare professionals in advocating for influenza vaccination. Training healthcare providers to communicate effectively about the benefits of vaccination and addressing patient concerns can enhance vaccination rates. Develop training programs for healthcare providers to improve their communication skills and knowledge about vaccines. This can help them address patient concerns more effectively. Implement policy measures such as mandatory vaccination for HCW and providing free or subsidized vaccines to reduce financial barriers.

## **Conclusion**

The key findings reveal that a large majority of participants possess poor knowledge and negative attitudes toward CMDs, resulting in suboptimal preventive behaviors. Notably, younger individuals, males, and those with lower education levels are particularly affected. Similarly, the awareness of the influenza vaccine is low, leading to low vaccination rate. Interestingly, many participants unwilling to vaccinate despite that they are willing to advise the others to get vaccinated. These findings highlight several critical public health implications, including an increased burden on healthcare systems, existing health inequities, and the potential for influenza outbreaks due to low vaccination rates. The significant role of healthcare providers in influencing health behaviors is also emphasized, indicating a need for better support and training for these professionals. Addressing these issues requires multifaceted public health strategies that include targeted education programs, community-based interventions, workplace health programs, and the utilization of technology. Policy measures to reduce barriers to vaccination and enhance healthcare provider training are also crucial. Further research is essential to explore specific knowledge gaps, behavioral determinants, and the long-term effects of interventions. By addressing these areas, it is possible to improve CMD awareness, preventive behaviors, and influenza vaccination rates, ultimately leading to better health outcomes and reduced healthcare burdens in Vietnam.

## Chapter 6: New findings

### Study 1: Awareness regarding cardiometabolic diseases

- **General knowledge regarding CMDs among Vietnamese population was low.**  
Only 10.95% of the population had good knowledge regarding CMDs. Female gender, having tertiary education or higher, having T2DM, and having both T2DM and HTN were found significantly associated with better knowledge regarding CMDs (OR [95%CI] = 2.80 [1.23 - 6.39], 3.29 [1.24 - 8.72], 10.61 [2.48 - 45.41], and 7.16 [2.28 - 22.41], respectively).
- **A significant proportion (73.88%) of the population had negative attitude toward CMDs' treatment and prevention.**  
Increasing age, being overweight or obese, and having HTN were found associated with better attitude toward CMDs (OR [95%CI] = 1.04 [1.02 - 1.06], 2.05 [1.14 - 3.69], 1.92 [1.02 - 3.61]). In opposite, higher educational attainment, such as having secondary education and having tertiary education or higher were found associated with more negative attitude toward CMDs (OR [95%CI] = 0.49 [0.28 - 0.86], 0.43 [0.21 - 0.90]).
- **Preventive behavior was notably poor.**  
Less than 5% (4.98%) of adults living in HCMC engaged in good preventive practice. Increasing age was the only factor associated with better preventive behavior (OR [95%CI] = 1.07 [1.02 - 1.12]).
- **General awareness regarding CMDs among Vietnamese population was poor.**  
Only 7.95% of the population showed good awareness. Female gender and having both T2DM and HTN were significantly associated with better awareness regarding CMDs (OR [95%CI] = 3.89 [1.28 - 11.80], 6.97 [1.96 - 24.80]).

### Study 2: Knowledge, attitude and awareness regarding influenza vaccination

- **Knowledge regarding influenza vaccination should be improved among medical students and healthcare workers in Vietnam.**  
Only 36.58% of the population had appropriate knowledge. “Kinh” ethnicity, medical doctor and pharmacist were found associated with better knowledge regarding

influenza vaccination (OR [95%CI] = 1.67 [1.12–2.49], 2.45 [1.13–5.33], 2.11 [1.03–4.32], respectively).

- **Less than half of the population (42.39%) held positive attitude toward influenza vaccination.**

Female gender and “Kinh” ethnicity expressed better attitude toward influenza vaccination (OR [95%CI] = 2.00 [1.29–3.10], 2.10 [1.41–3.11]).

- **Influenza vaccination rate among medical students and healthcare workers in Vietnam was found below WHO recommendation, with 40.51% were vaccinated.**

Marital status (of not single), and medical worker had significantly higher vaccination rate (OR [95%CI] = 2.09 [1.20 - 3.64], 2.25 [1.04 - 4.87])

- **Healthcare providers were found to play a key role in influencing vaccination decisions.**

Being advised by healthcare provider regarding influenza vaccine uptake were significantly associated with higher vaccination rate, willingness of getting vaccinated/revaccinated, and willingness to advice others to be vaccinated (OR [95%CI] = 2.92 [1.98 - 4.32], 3.11 [1.96 - 4.94], 2.25 [1.04 - 4.87], respectively).

- **Awareness regarding influenza vaccination was found poor among the healthcare personnels in Vietnam, with only 19.83% had good awareness.**

“Kinh” ethnicity had significantly better awareness regarding influenza vaccination (OR [95%CI] = 2.14 [1.26 - 3.64]). However, having better awareness was found significantly associated with higher willingness of getting vaccinated/revaccinated, willingness to advice others to be vaccinated, and more believe in the mandatory influenza vaccination for medical students and healthcare workers (OR [95%CI] = 2.26 [1.36 - 3.76], 4.32 [1.31 - 14.26], 3.19 [1.99 - 5.13], respectively).

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## Publication list



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Subject: PhD Publication List

Candidate: Minh Chau Nguyen  
Doctoral School: Kálmán Laki Doctoral School

### List of publications related to the dissertation

1. **Nguyen, M. C.**, Nguyen, A. T. V., Nguyet To, M., Ghanem, A. S., Szöllősi, G. J., Móré, M., Nagy, A. C.: Association Between Influenza Vaccine Uptake and Health Awareness: A Cross-Sectional Questionnaire-Based Study Among Medical students and Healthcare Workers in Northern Vietnam.  
*Med. Sci. Monitor.* 30 (30), 1-9, 2023.  
DOI: <https://doi.org/10.12659/MSM.941406>  
IF: 2.2
2. **Nguyen, M. C.**, Santoso, C. M. A., Vu, D. T. H., Szöllősi, G. J., Bata, R., Zsuga, J., Nagy, A. C.: Awareness Related to Cardiometabolic Diseases: a Cross-Sectional Study in Southern Vietnam.  
*Int. J. Environ. Res. Public Health.* 18 (19), 1-8, 2021.  
DOI: <http://dx.doi.org/10.3390/ijerph181910209>  
IF: 4.614

### List of other publications

3. Ulambayar, B., Ghanem, A. S., **Nguyen, M. C.**, Vargáné Faludi, E., Móré, M., Nagy, A. C.: Evaluation of cardiovascular disease risk in patients with type 2 Diabetes Mellitus using clinical laboratory markers.  
*J Clin Med.* 13, 1-14, 2024.  
DOI: <http://dx.doi.org/10.3390/jcm13123561>  
IF: 3 (2023)
4. Varga, E., Ghanem, A. S., Faludi, E., **Nguyen, M. C.**, Kovács, N., Nagy, A. C.: Medical comorbidities and other factors associated with migraine among individuals with diabetes mellitus in Hungary: a cross-sectional study using European Health Interview Surveys 2009-2019.  
*Front Endocrinol (Lausanne).* 15, 2024.  
DOI: <http://dx.doi.org/10.3389/fendo.2024.1379127>  
IF: 3.9 (2023)





5. Ghanem, A. S., **Nguyen, M. C.**, Mansour, Y., Fábíán, G., Rusinné Fedor, A., Nagy, A. C., Móri, M.: Investigating the Association between Sociodemographic Factors and Chronic Disease Risk in Adults Aged 50 and above in the Hungarian Population. *Healthcare*. 11, 1-24, 2023.  
DOI: <http://dx.doi.org/10.3390/healthcare11131940>  
IF: 2.4
6. Szöllősi, G. J., **Nguyen, M. C.**, Santoso, C. M. A., Zsuga, J., Nagy, A. C., Kardos, L.: An Exploratory Assessment of Factors with Which Influenza Vaccine Uptake Is Associated in Hungarian Adults 65 Years Old and Older: findings from European Health Interview Surveys. *Int. J. Environ. Res. Public Health*. 19 (12), 1-12, 2022.  
DOI: <http://dx.doi.org/10.3390/ijerph19127545>
7. Szöllősi, G. J., **Nguyen, M. C.**, Pataki, J., Santoso, C. M. A., Nagy, A. C., Kardos, L.: Influenza Vaccination Coverage and Its Predictors among Self-Reported Diabetic Patients - Findings from the Hungarian Implementation of the European Health Interview Survey. *Int. J. Environ. Res. Public Health*. 19 (23), 1-11, 2022.  
DOI: <http://dx.doi.org/10.3390/ijerph192316289>
8. Santoso, C. M. A., Bramantoro, T., **Nguyen, M. C.**, Nagy, A. C.: Lifestyle and psychosocial correlates of oral hygiene practice among Indonesian adolescents. *Eur. J. Oral. Sci.* 129 (1), 1-10, 2021.  
DOI: <http://dx.doi.org/10.1111/eos.12755>  
IF: 2.16
9. Santoso, C. M. A., Bramantoro, T., **Nguyen, M. C.**, Bagoly, Z., Nagy, A. C.: Factors Affecting Dental Service Utilisation in Indonesia: a Population-Based Multilevel Analysis. *Int. J. Environ. Res. Public Health*. 17 (15), 1-11, 2020.  
DOI: <http://dx.doi.org/10.3390/ijerph17155282>  
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**Total IF of journals (all publications): 21,664**

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