Gender differences in prevalence and associated factors of multi-morbidity among older persons in Vietnam

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Abstract. The aim of this study was to examine the prevalence and the determining factors of multi-morbidity among older men and women in Vietnam. Data for this study was utilized from a nationally representative survey - that is, Vietnam Ageing Survey (VNAS) in 2011. The study sample was restricted to older people (those aged 60 and over). Multi-morbidity was defined as having at least two presences of chronic diseases. Bivariate, t-test, and multivariable logistic regression analyses were applied to identify potential factors correlated with multi-morbidity among older men and women. The results showed that around 44 per cent of older persons reported having multi-morbidity, in which a higher prevalence was found in women (49.4 per cent than men (36.7 per cent). The results of multivariate analysis indicated that factors associated with multi-morbidity were found to vary by gender, in which advanced age and living alone were the strongest predictive variables in both genders. Therefore, health interventions with regards to gender are increasingly essential to reduce burdens of chronic diseases.

Keywords: Ageing, chronic disease, gender, inequality in health, multi-morbidity, older persons.

Background

Vietnam has witnessed significant improvements in healthcare achievements, resulting in both declining in fertility and mortality as well as increasing life expectancy of people during the past three decades (United Nations Population Fund, 2011). The country now is at the end of demographic transition, shifting in age structure has produced a huge young population in working age and a growing number in older persons (United Nations, 2006).

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The process of individual ageing has been proved to be significantly associated with deterioration of health status and higher rates of morbidity (Haseen, Adhikari, & Soonthorndhada, 2010; Hoang, Dao, & Kim, 2008). In particular, a previous study on ageing in Vietnam found that the more advanced age, the higher proportion of older persons with illness (Evan et al., 2007). As one of the fastest ageing societies in the Association of South East Asian Nations (ASEAN), Vietnam is facing the challenges of epidemiological transition in term of shifting in disease patterns and it poses greater demands and higher expenditures on healthcare (Dam et al., 2010; Evans et al., 2007; Nguyen, 2010). Moreover, older persons in Vietnam are now facing with 'double disease burden' (United Nations Population Fund, 2011), and most of older persons in Vietnam are suffering at least one disease and have to deal with chronic diseases (Dam et al., 2010).

According to the World Health Organization (2011), non-communicable diseases are the main burdens for older persons, and older persons of middle-income nations are suffering more from the burden of non-communicable diseases as compared to wealthier nations. Recent evidence also shows that around 80 per cent of death caused by non-communicable diseases happens in low-and middle-income countries and most deaths occur after the age of 60 in the world (ibid., 2011). In addition, it has been implied that non-communicable diseases have become primary causes of illness for older persons in developing countries (Yach, Kellogg, & Voute, 2005). Indeed, non-communicable diseases are the main diseases of Vietnamese older persons in recent years, in which cancer and cardiovascular diseases are the main causes of years of life loss while lung and liver cancers are the major cause of deadly burden in both men and women (Nguyen et al., 2011). Therefore, understanding the association between health status and non-communicable diseases at a later age is crucial to build appropriate healthcare strategies in the future.

In terms of health, gender discrimination appears when people are aged (Moller, Fincher, & Thornhill, 2009). Vulnerability of older women has raised critical issues for government's social programmes to improve their living standards (United Nations, 2007). Furthermore, the World Health Organization (2008) reported that solving gender inequity is an only possible way to narrow the health gaps between countries and within countries, and this implies that empowerment of women is considered a key to achieve health equality. In addition, there has been growing concerns on the association between gender and ageing issues among policy makers in Vietnam. There are concerns that older women might suffer more than their male counterparts, since older women might be more vulnerable to health problems than male peers due to unfavorable socio-economic status when they were young and in addition, they also tend to be widowed when they are aged (Giang & Pfau, 2007). Studies on chronic diseases have been of longstanding interests to researchers in Vietnam, but these studies mostly focus in place of residence inequity (i.e., rural versus urban area) in terms of daily care and quality of life views. In addition, their sample settings are limited as their data are collected in a rural district in Vietnam, namely FilaBavi (Hoang et al., 2008; Le, Nguyen, & Lindholm, 2010; Le, Pham, & Lindholm, 2011).

At the best of our knowledge, there has been only one study examining the association between multi-morbidity and its social determinants among older persons (Ninh, Ninh,

Khanal, & Moorin, 2015). However, this study provided only a general picture about the prevalence and the association between multi-morbidity and selected factors rather than focusing on gender issues. Its sample, similar to previous studies, was derived from only two provinces in southern Vietnam, and thus it might not reflect the real situations of the older population as a whole. Our study, taking advantage of the first-ever nationally representative survey on older persons in Vietnam, namely the Vietnam Ageing Survey (VNAS) in 2011 (Vietnam Women Union [VWU], 2012), aims to provide information on the prevalence of multi-morbidity and potential factors associated with multi-morbidity among older persons in terms of gender.

Data and Methodology

Data

Data of this paper was utilized from the VNAS (Vietnam Women Union, 2012), a nationally representative survey on persons aged 50 and over in Vietnam, which was conducted in late 2011. This survey was designed and sampled by using the results from the Population and Housing Census in 2009 (General Statistics Office, 2010). Eligible interviewees were chosen by multi-stage sampling method. In the first stage, samples were drawn from 12 provinces of six ecological zones in Vietnam. In the second stage, 200 communes were chosen using the probability proportional to size method from the 12 selected provinces. In the third stage, within each selected commune, two villages were randomly selected. In the final stage, a list of all households with people aged 50 and over was collected from each selected village, and a sample of 15 people aged 50 and over was selected systematically using a random start. Out of 15 selected people, 10 people were officially interviewed and five people were reserved as alternatives. Data collection was conducted by face-to-face interview using a structured questionnaire. Once completed, all questionnaires were double-checked on-site by interviewers and then by supervisors to ensure that all questions in the questionnaire were filled out completely. All valid questionnaires were gathered for further review and data entry. The total survey sample consisted of 4,000 people aged 50 and over. However, this study was confined to those aged 60 and over. Thus, the sample size of this study comprised 2,789 people aged 60 and over (or older persons as defined in this paper). Among older persons, 1,683 were females and 1,106 were males; and 2,050 were living in rural areas, while 739 were living in urban areas. The response rate was about 93 per cent. All the information, such as those about individual and household socio-demographic characteristics, living conditions, health conditions, and roles and contributions of older persons to their families, is provided in VNAS (VWU, 2012).

Variables and measurements

Dependent variable

Questions related to health conditions of older persons in the questionnaire were based on references to a number of questionnaires used in aging surveys by the World Health Organization's *Study on Global Aging and Adult Health* (SAGE) (World Health Organization,

2016). Chronic diseases were constructed in such a way that they would represent major public health problems and cover a wide range of conditions among older persons. Particularly, in order to examine the presence of chronic diseases, participants were asked the question 'Have you ever been diagnosed with/told you have any chronic diseases as follow?' and there were 12 response options for them, namely: arthritis, angina, diabetes, chronic lung diseases, depression, blood pressure problem, cancer, cataract, heart diseases, and liver diseases. A person is defined as having multi-morbidity if he/she has at least two presences of diagnosed disease (Jerliu, Toci, Burazeri, Ramadani, & Brand, 2013).

Independent variables

A wide range of independent variables were included in this study – namely, demographic characteristics, socio-economic factors and lifestyle risk behaviors. These included (all variables are summarized in Table 1)

- Age was categorized into three sub-groups: 60-69 years, 70-79 years, and 80 and over.
- Gender was divided into two categories: male and female
- Marital status was grouped into two groups: married and others (single/divorced/ separated/widowed).
- Living arrangements were categorized into four sub-groups: living with at least one child, living alone, living with a spouse only and living with others without children.
- Place of residence was coded as rural and urban areas.
- Educational levels were transformed into four sub-groups: no schooling/did not complete primary school, primary school, secondary, high school and over.
- Household wealth was constructed by using principle component analysis techniques (Vyas & Kumaranayake, 2006). Five wealth quintiles were constructed by documenting a number of variables including: household income, lands' possession, type of house, materials of roof and floor, toilet facilities, electricity, water supplies, and household assets. These five quintiles then were continued to be grouped into three sub-categories as poor, average, and rich.
- Perceived sufficiency of income, respondents were asked about their self-perceived income to meet their daily needs, then this variable was coded as: no (rarely or never enough/sometimes not enough) and yes (enough/more than enough).
- Employment status was categorized as: still working and not working.
- Alcohol consumption measurement was based on frequent consumption of alcohol and this variable was collapsed into four categories: one or less than once a month, 2-3 times a month, several times a week, and one or more than twice a day.
- Smoking status was defined by individuals' confirmation of being a current smoker at the time of the interview and then was coded as yes and no.

Table 1: Variable measurements

Variable	Classification and measurement of variables
Dependent variable	
Multi-morbidity	No disease/having one chronic disease = 0; have multi-morbidity = 1.
Independent variables	
Age groups	Aged 60-69 = 0; 70-79 = 1; 80+ = 2.
Gender	Female = 0; male = 1.
Marital status	Others (single/divorced/separated/widowed = 0); married = 1.
Living arrangements	Living with at least one child = 0; living alone = 1; living with a spouse only = 2; living with others without children = 3.
Place of residence	Rural = 0; urban = 1
Educational levels	No schooling/did not complete primary school = 0; primary school = 1; secondary = 2; high school and over = 3.
Household wealth	Poor = 0; average = 1; rich = 2
Perceived sufficiency of income	No (rarely or never enough/sometimes not enough) = 0; yes (enough/more than enough) = 1.
Employment status	Not working = 0; working = 1
Alcohol consumption	One or less than once a month = 0; 2-3 times a month = 1; several times a week = 2; one or more than twice a day = 3.
Smoking	No = 0; yes = 1

Note: variables with a value of zero were treated as reference groups.

Methodology

Several analytical methods were applied in this study. Firstly, descriptive analyses were used to provide background information about socio-demographic characteristics and prevalence of having multi-morbidity among respondents by gender. Secondly, bivariate analyses were applied to differentiate the probability of having multi-morbidity among older males and females by socio-demographic and lifestyle risk factors, then t-test analyses were performed to examine whether the differences in reporting multi-morbidity were significant or not. Thirdly, a Chow test was conducted to examine whether parameters (slopes and intercept) have an equal effect on multi-morbidity between older men and women (Chow, 1960).. Finally, separate multivariable logistic regression models were performed to examine the association between potential factors and the presence of having multi-morbidity among older males and females. The odds ratios were used to measure the

significant effect of the independent variables on the dependent one. A p-value of <0.05 was regarded as statistically significant. Before performing the multivariable logistic regression models, multi-collinearity analysis was applied to make sure the independent association among the selected variables.

Results and discussion

Distribution of chronic disease in the older population

Distribution of chronic disease in the older population was presented in Table 2. Nearly two-third of the total population reported having chronic diseases, accounted for 72.12 per cent. Among them, more than half of disease-reported respondents had multi-morbidity with 43.91 per cent. Table 2 shows the distribution of chronic disease of the older population.

Table 2: Simple distribution of dependent variable

Variable	Weighted percent
% Chronic disease	
Having no disease	27.88
Having one chronic disease	28.21
Having multi-morbidities	43.91

Source: Authors' calculations, using VNAS 2011 (VWU, 2012)

Socio-demographic characteristics of respondents by gender

Table 3 presented the distribution of selected characteristics of sampled respondents by gender. The mean age for men was 71.5 years old, while corresponding figure for women was slightly higher, 72.2 years. Those aged 60-69 took the largest share of the selected sample (45.6 per cent), followed by those aged 70-79 (31.3 per cent) and 80 and older (23.1 per cent), respectively. Of those, the proportion of women was higher across age groups, except the youngest age group. A significantly higher prevalence of having morbidity was found in women than men (49.4 per cent versus 36.7 per cent), while having no or one chronic disease was seen significantly higher in men as compared to women (63.3 per cent versus 50.6 per cent). Our study added to the existing knowledge that a higher prevalence of multi-morbidity was found in women than men (Khanam et al., 2011; Marengoni, Winblad, Karp, & Fratiglioni, 2008; Ninh et al., 2015; Phaswana-Mafuya et al., 2013). The estimated association between men and multi-morbidity could have lacked of accuracy as the sampled women outnumbered their men counterparts in this study. However, it could reflect that the deficit number of men in a later age was because of a selected group of healthier individuals. In addition to that view, the notion that older women tended to perceive poorer health status than men but have better longevity has been well-established in the literature (Molarius et al., 2007; Singh, Arokiasamy, Singh, & Rai, 2013).

Table 3: Background information of socio-demographic characteristics and lifestyle risk behaviours of respondents by gender

Variables	Total	Female	Male	Female-Male Difference
% Chronic disease				
Having no or one chronic disease	56.1	50.6	63.3	***
Having multi-morbidity	43.9	49.4	36.7	***
% Age groups				
60-69	45.6	41.6	50.8	***
70-79	31.3	32.2	30.1	ns
80+	23.1	26.2	19.1	*
Mean age (±SD)		72.2 (±9.1)	71.5 (±8.6)	
% Marital status				
Married	68.5	52.7	89.4	***
Others (single/ separated/ divorced/ widowed)	31.5	47.3	10.6	***
% Living arrangements				
Living with at least one child	67.2	67.4	66.8	ns
Living alone	5.3	8.0	1.6	***
Living with a spouse only	17.1	12.6	23.1	***
Living with others without children	10.4	12.0	8.5	ns
% Place of residence				
Rural	67.1	67.0	67.3	ns
Urban	32.9	33.0	32.7	ns
% Educational levels				
No schooling/ did not complete primary school	50.1	64.7	30.2	***
Primary school	17.9	16.1	19.9	ns
Secondary school	16.3	10.9	23.0	***
High school and over	15.7	7.8	26.0	***
%Household wealth				
Poor	40.9	40.2	41.9	ns
Average	33.0	30.8	36.0	ns
Rich	26.1	29.1	22.1	**
% Perceived sufficiency of income				

Variables	Total	Female	Male	Female-Male Difference
Not enough (rarely or never enough/sometimes not enough)	61.1	60.6	61.9	ns
Enough (enough/ more than enough)	38.9	39.4	38.1	ns
% Working status in the past 12 months				
Not working	61.2	66.8	53.8	***
Still working	38.8	33.2	46.2	***
% Alcohol consumption				
One or less than once a month	35.2	57.7	30.4	***
2-3 times a month	19.5	13.0	21.0	***
Several times a week	13.1	11.9	13.4	***
One or more than twice a day	32.2	17.4	35.2	***
% Smoking				
Yes	21.0	5.9	40.9	***
No	79.0	94.1	59.1	***

*Note: *, **, *** denote P<0.05, P<0.01, and P<0.001, respectively. (ns) indicates insignificant.*
Source: Authors' calculations, using VNAS 2011 (VWU, 2012)

A majority of the sampled respondents were married (68.5 per cent), in which the proportion of married men (89.4 per cent) was significantly predominant that of women (52.7 per cent). Living with at least a child was the most common living arrangements of the sample (67.2 per cent) and the pattern was similar for both men (66.8 per cent) and women (67.4 per cent). A higher proportion of older men (23.1 per cent) than older women (12.6 per cent) resided with a spouse only, while the proportion of living alone was higher among older women (8.0 per cent) than older men (1.6 per cent). Those living in rural areas (67.1 per cent) outnumbered those from urban areas (32.9 per cent) in both genders, in which the proportion of both men and women was similar.

Regarding socio-economic circumstances, although half of the sample of older persons was uneducated, there were more educated men than women among those who did complete education. A majority of older persons were not working (61.2 per cent). Among those who still participated in the workforce, a significantly higher proportion of working men (46.2 per cent) than women (33.2 per cent) was found in this study. In terms of household wealth, more than one-third of the selected sample reported living within a poor household (40.9 per cent), and there were near equal proportions of men (41.9 per cent) and women (40.2 per cent) within this category. In contrast, a higher proportion of women indicated living in rich households as compared to their male counterparts (29.1 per cent versus 22.1 per cent). A

majority of older persons perceived their income as insufficient to meet their means (61.1 per cent), and women were more likely than men to indicate such economic insecurity.

With regards to lifestyle risk behaviors, drinking alcohol one or less than once a month was the most common drinking behaviors among men and women, in which, the proportion of women (57.7 per cent) was significantly higher than men (30.4 per cent). However, daily drinking alcohol was found to be higher in men (35.2 per cent) than women (17.4 per cent). Most respondents did not smoke, only 21 per cent of respondents reported smoking and smoking was seen significantly more prevalent in men than women.

Differences in reporting multi-morbidity by selected variables and gender

The results of bivariate and t-test analyses in Table 4 showed that most of the selected variables were found to be statistically significant difference in reporting multi-morbidity among older men and women, except age groups, perceived sufficiency of income, and place of residence.

Table 4: Differences in reporting multi-morbidity by selected variables and gender

Variables	Female	Male	Female-Male Difference
% Age groups			
60-69	46.08	27.55	18.53
70-79	55.71	46.31	9.4
80+	46.8	45.74	1.06
% Marital status			
Married	53.08	37.64	15.44***
Others (single/ separated/ divorced/ widowed)	45.23	28.42	16.81***
% Living arrangements			
Living with at least one child	50.45	35.01	15.44
Living alone	51.62	54.56	2.94***
Living with a spouse only	43.83	45.41	1.58***
Living with others without children	47.6	22.39	25.21*
% Place of residence			
Rural	49.89	37.99	11.9
Urban	48.31	33.95	14.36
% Educational levels			
No schooling/ did not complete primary school	48.53	28.54	19.99***

Variables	Female	Male	Female-Male Difference
Primary school	52.43	39.68	12.75***
Secondary school	49.64	37.12	12.52***
High school and over	49.14	41.05	8.09***
%Household wealth			
Poor	58.72	38.2	20.52
Average	40.42	40.13	0.29
Rich	44.93	28.74	16.19**
% Perceived sufficiency of income			
Not enough (rarely or never enough/sometimes not enough)	51.56	36.28	15.28
Enough (enough/ more than enough)	46.01	37.1	8.91
% Working status in the past 12 months			
Not working	54.52	43.64	10.88***
Still working	40.05	28.54	11.51***
% Alcohol consumption			
One or less than once a month	41.21	35.8	5.41***
2-3 times a month	39.52	24.71	14.81***
Several times a week	31.29	43.87	12.58***
One or more than twice a day	25.8	31.44	5.64***
% Smoking			
Yes	50.01	43.87	6.14***
No	39.19	26.25	12.94***

*Note: *, **, *** denote P<0.05, P<0.01, and P<0.001, respectively.*
Source: Authors' calculations, using VNAS 2011 (VWU, 2012)

Of those significances, marital status, educational levels, employment status, smoking, and alcohol consumption were found to be statistically significant differences in reporting multi-morbidity in all categories by gender. In which, no schooling/did not complete primary school category was shown as the highest difference between men and women, accounted for around 20 per cent, followed by those who were single/separated/divorced/widowed with 16.81 per cent of the difference. On the other hand, those who drank alcohol one or less than once a month ranked the smallest difference with only 5.53 per cent.

Overall, the proportion of having multi-morbidity was higher among women than men in most categories of the selected variables, including variables that were not shown their significances. The proportion of having multi-morbidity consistently increased with age and was shown clearest in the age of 70-79 for both genders (55.71 per cent for women and 46.31 per cent for men). Married group was seen to have a negative association with multi-morbidity in both sexes as compared to other group, and a significantly higher proportion of having multi-morbidity was found in women (53.08 per cent) than men (37.64 per cent). Living alone was the highest proportion of having multi-morbidity in both genders and the figures were higher in men (54.56 per cent) than women (51.62 per cent). Living with spouse only and living with others without children were the smallest proportion of having multi-morbidity in women (43.83 per cent) and men (22.39 per cent), respectively.

Educational levels showed a negative relationship with having multi-morbidity among both men and women, such as the proportion of having multi-morbidity was found to be higher in those with higher educational levels than those with lower education. However, the proportion of having multi-morbidity was shown significantly and consistently higher in women than their male counterparts. Women with poor household wealth (58.72 per cent) and men with average household wealth (40.13 per cent) were found to be the highest proportion of having multi-morbidity. However, statistical significance between men and women was found in rich group only, and in general, the proportion of multi-morbidity was consistently higher in women than men. The highest proportion of having multi-morbidity was found in those who were not working in both sexes and the figures were seen to be higher in women as compared to men (54.52 per cent versus 43.64 per cent).

Those who drank alcohol one or less than once a month in women and several times a week in men were the highest proportion of having multi-morbidity. It was interesting to see that those who drank alcohol daily were less likely to have multi-morbidity in women. Those who smoked had a higher prevalence of multi-morbidity than those who did not smoke in both genders and the pattern was higher in women than men.

Determining factors associated with multi-morbidity among older men and women

Results of Chow test showed that effect of variables of interest on multi-morbidity among older men and women was significantly different, thus logistic regression models were executed for men and women separately. Table 5 presents results of multivariate logistic regression analysis estimated to determine the association between the selected factors and probability of having multi-morbidity among older men and women in Vietnam. The results reiterated that age was strongly correlated with multi-morbidity, however, statistical significance was found only in men, but not in women.

Table 5: Multivariate logistic regression results: likelihood estimated of having multi-morbidity among older men and women

| | Having multi-morbidity | | | |
| | Female | | Male | |
Variables	**O.R (s.e)**	**p-value**	**O.R (s.e)**	**p-value**
Age groups				
60-69 (ref)	-	-	-	-
70-79	1.5 (0.3)	ns	2.3 (0.6)	<.01
80+	1.0 (0.2)	ns	2.6 (0.8)	<.01
Marital status				
Married (ref)	-	-	-	-
Others (single/separated/divorced/widowed)	0.5 (0.1)	<.05	0.4 (0.2)	<.05

Living arrangements				
Living with at least one child (ref)	-	-	-	-
Living alone	1.9 (0.6)	<.05	4.9 (2.6)	<.01
Living with a spouse only	0.8 (0.2)	ns	1.4 (0.3)	ns
Living with others without children	1.2 (0.3)	ns	0.5 (0.2)	ns
Place of residence				
Rural (ref)	-	-	-	-
Urban	0.6 (0.1)	<.05	0.6 (0.1)	<.05
Educational levels				
No schooling/did not complete primary school (ref)	-	-	-	-
Primary school	1.1 (0.3)	ns	1.5 (0.4)	ns
Secondary school	1.0 (0.3)	ns	1.5 (0.5)	ns
High school and over	0.8 (0.3)	ns	1.9 (0.5)	ns
Household wealth				
Poor (ref)	-	-	-	-
Average	0.3 (0.8)	<.001	1.1 (0.3)	ns
Rich	0.3 (0.9)	<.001	0.5 (0.1)	<.01
Perceived sufficiency of income				
Not enough (rarely or never enough/sometimes not enough) (ref)	-	-	-	-
Enough (enough/more than enough)	0.6 (0.1)	<.01	0.9 (0.2)	ns
Working status in the past 12 months				

Not working (ref)	-	-	-	-
Still working	0.6 (0.1)	<.05	0.7 (0.2)	ns
Alcohol consumption				
One or less than once a month (ref)	-	-	-	-
2-3 times a month	0.6 (0.3)	ns	0.5 (0.2)	<.05
Several times a week	0.4 (0.3)	ns	1.4 (0.5)	ns
One or more than twice a day	0.4 (0.2)	ns	0.8 (0.2)	ns
Smoking				
Yes (ref)	-	-	-	-
No	0.7 (0.3)	ns	0.5 (0.1)	<.05

*Note: *, **, *** denote P<0.05, P<0.01, and P<0.001, respectively. (ns) indicates insignificant. OR means odds ratio. (s.e.) denotes standard error. "Ref" means reference group.*
Source: Authors' calculations, using VNAS 2011 (VWU, 2012)

For men, older groups (i.e., aged 70-79 and aged 80 and over) were more likely to report multi-morbidity than those who are younger (i.e., aged 60-69). In detail, the likelihood of reporting multi-morbidity among those aged 70-79 and 80 and over was 2.3 and 2.6 times higher than that of those aged 60-69, respectively. Our study's findings remain consistent with previous studies (Hoang et al., 2008; Jerliu, Toci, Burazeri, Ramadani, & Brand, 2012; Phaswana-Mafuya et al., 2013) that more advanced age was strongly associated with multi-morbidity, but in this study, statistical significance was seen in men only. The reason why older age groups suffer more from multi-morbidity than those who are younger is possibly because as described by World Health Organization (2005), chronic diseases are diseases of long duration and slow progress. Moreover, in Vietnam, healthcare system for older persons is not well-established, community-based care is underdeveloped and regular health examination is not a traditional custom among individuals. Thus, chronic diseases normally are detected at an older age and a late stage of progression.

Regarding marital status, those who were in other group (that was, single/separated/ divorced/widowed) had a lower probability of having multi-morbidity than those who were married in both genders. The odds ratios of other group were 0.5 and 0.4 for women and men, respectively. This implied that those who were in other group were 0.5 and 0.6 times less likely to have multi-morbidity than those in reference category in men and women, respectively. The association between marital status and multi-morbidity is not clearly understood and this needs a further investigation. However, this finding is in line with previous studies (Khanam et al., 2011; Phaswana-Mafuya et al., 2013).

Living alone was found to be positively and significantly associated with having multi-morbidity in both genders. Those living alone were 1.9 and 4.9 times more likely to have multi-morbidity than those living with at least one child. Impacts of other categories (i.e., living with a spouse only and living with others without children) on having multi-morbidity were found to vary by gender, however, none of them showed statistical

significance. This could be explained by the fact that living alone in developing countries may reflect an individual's vulnerable status in terms of financial insecurity, which in turn may influence the health conditions of older persons (United Nations Population Fund & HelpAge International, 2012). As traditional, extended family structure is still prevalent and most important healthcare for older persons in Vietnam (Le et al., 2011). Thus, lack of such support may increase the risk of having chronic diseases among those living alone. Possible explanation for a much higher probability of having multi-morbidity among men living lone than women in the same category is that, although women are seen to have disadvantages in economic activities, they tend to have stronger social networks than men at an old age. In particular, older women are more likely to receive material and spiritual support from their adult children than older men and that may result in better health conditions and disease managements among women when they co-reside with adult children.

The odds ratios of those living in urban areas were 0.6 for both women and men. This implied that those living in urban areas were 0.4 times less likely to have multi-morbidity than those living in rural areas in both genders. This finding could be explained by healthcare accessibility and healthcare development system between rural and urban areas in Vietnam. Indeed, previous studies in Vietnam showed that those living in rural areas had struggles to access healthcare services (Nguyen, Nguyen, & Phan, 2007), or older persons in urban areas were seen to access healthcare service more often than those living in rural areas (Ministry of Health, 2003; Giang and Bui, 2013). In terms of the quality of healthcare, a higher prevalence of using low-quality services was found in older persons living in rural areas than those living in rural areas (Giang, 2008). Another possible explanation is that rural-to-urban migration among younger generations is significantly associated with health conditions of older persons in both spiritual and material senses as such phenomenon may cause social isolation and lack of social network between older persons and their younger family members in urban areas (Agewell Foundation, 2010). This finding is consistent with the existing knowledge of the association between place of residence and multi-morbidity (Hoang et al., 2008; Ninh et al., 2015).

Educational levels were shown statistically insignificant in both genders. However, the results revealed that the higher the education, the higher the probability of having multi-morbidity in men. Possible explanation is that individuals with higher levels of education are more aware of their health conditions and they are more likely to see doctor, resulting in having chronic diseases diagnosed. Another explanation is that those with low education levels just die and are not in the sample of this study. Household wealth was significantly associated with having multi-morbidity in both sexes, except average category in men. For women, those who were in average or rich category were 0.7 times less likely to have multi-morbidity than those with poor household wealth. For men, those who were rich were 0.5 times less likely to have multi-morbidity than those who were in reference category. These findings were in line with other studies on ageing (Hoang et al., 2008; Jerliu et al., 2012; Khanam et al., 2011). This could be reflected by the fact that wealthier individuals can spend their financial resources to afford healthcare services and a better and healthier diet, resulting in reduction in sickness and poor and unhealthy nutrition that lead to be less associated with multi-morbidity.

Perceived sufficiency of income was seen positively and significantly correlated with multi-morbidity in both genders, but statistical significance was shown in women only, not in men. Those who perceived sufficiency of income were 0.4 and 0.1 times less likely to have multi-morbidity than those who perceived insufficiency of income for women and men, respectively. Possible explanations could be lying in the fact that financial resources such as income may play a more important role for women as compared to men in terms of health conditions. For example, a previous study indicated that inequality in health between men and women would have disappeared if women had financial security (Molarius et al., 2012). In fact, women are seen to have poorer finance as compared to men as they tend to be less active in economic activities (World Health Organization, 2008). In addition to that view, simultaneous with the feminization phenomenon of old age, there have been growing concerns about the consequences of gender imbalance among older persons in Vietnam that older women are more susceptible to health problems than men. This may be owing to the fact that women are more likely to have unfavorable socioeconomic status when they are young and tend to be widowed when they are aged (Giang & Pfau, 2007). It has been argued that self-perceived income is a more applicable assessment than the amounts of money. A person really has in reporting health problems since it reflects the perception of individuals as to whether they have sufficient resources to afford daily living expenditures or medical care or to maintain their health (Andrade, Lebrão, Santos, Teixeira, & Duarte, 2012; Beverly, Pozehl, Hertzog, Zimmerman, & Riegel, 2013).

The likelihood of reporting multi-morbidity was lower among those who were working than those who were not working in the past year in both sexes. However, the results did not find statistical significance in men. Working women in the past year were 0.4 times less likely to have multi-morbidity than non-working women. Non-working may reflect sedentary status of an individual and a systematic review on the association between sedentary behavior and health outcomes indicated that sedentary was associated with risk factors for health, such as increasing the probability of having metabolic syndrome, or reducing in HDL cholesterol (a good cholesterol for health), or increasing blood pressure, or having obesity, and increasing mortality (Rezende, Rey-López, Matsudo, & Luiz, 2014). Another possible explanation is that healthier individuals are more likely to continue working, while those in poorer health or in illness are more likely to withdraw from the workforce.

In contrast to previous studies that found alcohol consumption a risk factor of chronic diseases (Hoang et al., 2008; Islam et al., 2014). This study found that drinking alcohol seemed positively associated with not having multi-morbidity in women. However, it was not statistically significant. Among men, consumed alcohol 2-3 times a month or one or more than twice a day was negatively associated with having multi-morbidity, while consumed alcohol several times a week was found to increase probability of having multi-morbidity. However, the results found statistically significant in those who consumed alcohol 2-3 times a month only. Previous studies revealed a positive effect of drinking alcohol on health status, such as those who consumed small to moderate amounts of alcohol were found to report their health status as being better as compared to heavy drinkers (Demirchyan, Petrosyan, & Thompson, 2012), or regular alcohol consumption was seen to

contribute to better health status (Perlman & Bobak, 2008). In this study, those who consumed alcohol regularly (that was, more than one or less than once a month) in both genders, except those who consumed several times a week in men, may consume adequate amounts of alcohol each time, which in turn result in good health conditions. However, this hypothesis needs a further investigation.

As expected, smoking was shown to be positively associated with having multi-morbidity in both genders, but statistical significance was found in men only, not in women. For men, those who did not smoke were 0.5 times less likely to have multi-morbidity than smokers. Smoking is well-known to be a risk factor of chronic diseases and a main cause of a wide range of fatal diseases, such as lung diseases and various types of diseases. Tobacco use has a substantial negative effect on health conditions and is responsible for millions of deaths each year in the world. It has been estimated that tobacco use is responsible for around 5 million deaths annually and is projected to kill 8 million deaths by 2030. Tobacco use ranks as a leading cause of death in Vietnam as it was estimated that smoking caused approximately 40,000 deaths in 2008 and is expected to cause 50,000 deaths by 2023 (Ministry of Health., 2010). As one of the leading causes of chronic diseases, tobacco use poses a great burden on society and the healthcare system due to the cost of treatment. Previous studies indicated that smoking was seen to have a strong association with chronic diseases (Hoang et al., 2008; Islam et al., 2014). Future studies may benefit from the findings of this study and further research should focus on the healthcare needs and healthcare expenditures of the older population. Several limitations in this study should be taken into account. Firstly, since this study was a cross-sectional study, thus it could not tell the cause-effect relationships between multi-morbidity and the selected factors. Secondly, because the data for this study came from community-dwelling participants, individuals with severe disease status, e.g. hospitalised patients, may not have been included in this survey dataset.

Policy recommendations and conclusion

Population ageing in developing countries poses a huge impact on many public services, especially for health care. Healthcare systems in many developing countries are still focusing on infectious diseases and reproductive health. However, healthcare for older persons is increasingly needed to meet the high prevalence of chronic diseases and rapid ageing process in these setting contexts. By identifying the determinant factors of multi-morbidity among older men and women, some policy recommendations are being proposed. Firstly, the results showed that having multi-morbidity was prevalent in the older population. In order to achieve healthy and active ageing, more efforts from policy makers and government should be given to:

− Focusing and investing more on chronic disease management and treatment as well as health conditions of older persons by improving healthcare facilities and the quality of healthcare services. Courses on geriatric issues, especially chronic diseases, should be provided for healthcare providers.
− For long term care, community-based care is increasingly essential to cope with a high healthcare demand and lack of geriatric care centers among older population in Vietnam.

Secondly, in order to decelerate the process of chronic diseases and promote the health conditions of older persons, health promotion should be encouraged as follows:

− Providing appropriate nutrition programmes for older persons by promoting well-balanced and healthy diets, such as encourage older persons to have sufficient fruit and vegetable, low-fat, low-cholesterol foods in their daily meals and to try and avoid food substances that may be associated with chronic diseases, such as fatty, salty and sugary foods.
− Encouraging older persons to do physical exercise at least 30 minutes per day by walking or riding a bicycle to stay physically active.
− Encouraging older persons to have health examination regularly and, by doing so, latent health problems like chronic diseases can be detected in early stages.

Thirdly, living alone was shown to be the most vulnerable group to multi-morbidity in this study. There should be:

− Establishing and expanding elderly clubs so that older persons can communicate, share information, open their social network, and help each other.
− Encouraging older persons to participate in cultural and social activities that are appropriate for both genders.

Finally, smoking is one of the main factors associated with multi-morbidity in this study and Vietnam is seen to have a high prevalence of tobacco use, especially in rural areas. Therefore, governments should:

− Provide and enhance healthcare information, healthcare education and damages of smoking to older persons through mass media, local loudspeakers.
− Develop and replicate tobacco-abstained models based on community. By doing so, smokers can be encouraged and referred to such models to quit smoking.

Advanced age is associated with health deterioration. Health status of older persons in Vietnam is relative poor as reports of VNAS in 2011 (VWU, 2012) showed that 65.4 per cent of older persons reported poor or very poor health status, while nearly 5 per cent of older persons perceived their health status as being good or very good. Older persons in Vietnam are susceptible to chronic diseases due to rapid demographic transition and social changes. This study found that factors associated with multi-morbidity varied by gender, in which increasing age and living alone were the strongest determinants of having multi-morbidity in both genders.

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