

## Short Communication

# Prevalence of underweight, overweight and obesity in urban Hanoi, Vietnam

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This study aims to assess the prevalence of underweight, overweight and obesity among adults in urban Hanoi, Vietnam; and compare these results to previous estimates among adults in urban Ho Chi Minh City. Survey participants were residents in urban Hanoi, Vietnam and aged between 25-74 years. Data from a cross-sectional biomedical survey conducted in 2004 were collected; which included a questionnaire, physical examination and blood tests. The age-standardised prevalence of overweight and obesity in 2004, using Asian-specific body mass index cut-offs, were 28.6% and 2.1%, respectively. The prevalence of overweight/obesity (combined) was similar in males (29.7%) and females (31.5%), and generally increased with age. The prevalence of overweight/obesity was considerably lower if the standard cut-off values of the World Health Organization were used. The age-standardised prevalence of underweight was 13.3%; and that of 'increased risk'/substantially increased risk' waist circumference (combined) was 27.9% in males and 25.7% in females, respectively. Almost one in three adults in urban Hanoi were overweight or obese in 2004 and more than one in ten were underweight (based on Asian-specific cut-off values). This prevalence of overweight/obesity is similar to that for adults in urban Ho Chi Minh City, but the prevalence of underweight is lower. While low body weight remains a concern, overweight and obesity are an increasing problem for urban Vietnamese adults.

**Key Words:** underweight, overweight, obesity, BMI, Vietnam

## INTRODUCTION

Overweight and obesity are increasing in countries worldwide, developing and developed alike.<sup>1</sup> Analysis of body weight trends in Vietnam, a populous country with a historically low overweight/obesity prevalence, found that the prevalence of overweight and obesity in adults has more than doubled between 1992 and 2002 and the prevalence of underweight declined significantly.<sup>2</sup> The prevalences of overweight/obesity in this study were arguably low as they were based on body mass index (BMI) cut-off values recommended by the World Health Organization (WHO) for Western populations rather than values appropriate for Asian populations. However a cross-sectional survey conducted in 2004 of urban adults in Ho Chi Minh City (HCMC), Vietnam's largest city with a population of approximately seven million, found that almost a third of adults were overweight or obese when using Asian-specific cut-off values.<sup>3</sup> Analysis of such prevalences in Hanoi, Vietnam's capital with a population of approximately three million, has not yet been undertaken. But such an analysis is of interest as Hanoi, like HCMC, is a large and dynamic city in a country that has undergone rapid economic and social change over the past fifteen years. The introduction of social and economic policy reforms and the lifting of the embargo placed on Vietnam by the US government catalysed these changes; changes that are likely to have contributed to a decrease in infec-

tious diseases and malnutrition and an increase in risk factors for chronic disease, such as obesity.<sup>3</sup>

Determining the prevalence of underweight, overweight and obesity in urban Hanoi and comparing these prevalences to those for HCMC will contribute to the evidence regarding body weight in Vietnam. Here, we determine the prevalence of BMI and waist circumference (WC) categories in adults of urban Hanoi in 2004, using Asian and Vietnamese-specific cut-offs, as well as commonly-used cut-off values arguably more appropriate for Caucasians.

## MATERIALS AND METHODS

This study analyses data from a population-based survey, the *2004 Epidemiological survey on heart failure, its main causes and some of its risk factors in northern Vietnam*.<sup>4</sup> The aim of this study was to describe the prevalence of heart failure and its risk factors in the northern provinces of Vietnam. The target population was persons

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aged 25 and older living in northern Vietnam, from which the target sample was selected using a randomised cluster sampling method, at the individual level. Vietnam is divided into 58 provinces and five centrally-controlled municipalities; each province is further divided into districts. Sampling in this study included three randomly-selected districts in each of the four provinces of northern Vietnam: Hanoi (urban), Thai Binh (lowlands), Nghe An (coastal) and Thai Nguyen (midlands). The response rate in Hanoi was 73.9%, 1066 Hanoi residents and 3780 outside of Hanoi (the overall response rate for all regions combined was 84.1%). Participants were administered a questionnaire, physical examination and blood tests. Weight, height and WC were measured by trained personnel and measured in accordance to WHO guidelines, such that height was measured without shoes, weight with only light clothes, and waist circumference was measured at the part of the trunk midway between the lower costal margin (bottom of lower rib) and the iliac crest (top of the pelvic bone) with the person standing. The measurement was taken at the end of a normal expiration.<sup>5</sup>

#### Definitions of underweight, overweight and obesity

Two sets of BMI and WC cut-off values were used in this analysis, values proposed to be appropriate for Vietnamese and Asian populations, as well as widely-used values which are often considered more appropriate for Caucasians. This second set of values will be referred to as the "comparator" cut-off values.

The "comparator" BMI cut-off values used in this analysis to classify people into underweight, normal weight, overweight and obesity are WHO standard cut-offs, as follows: underweight ( $<18.5 \text{ kg/m}^2$ ), normal weight ( $18.5\text{--}24.99 \text{ kg/m}^2$ ), overweight ( $25\text{--}29.99 \text{ kg/m}^2$ ) and obese ( $\geq 30 \text{ kg/m}^2$ ).<sup>6</sup> The Asian-specific cut-offs are as follows: underweight ( $<18.5 \text{ kg/m}^2$ ), normal weight ( $18.5\text{--}22.99 \text{ kg/m}^2$ ), overweight ( $23\text{--}27.49 \text{ kg/m}^2$ ) and obese ( $\geq 27.5 \text{ kg/m}^2$ ).<sup>6</sup> These Asian-specific cut-off values are consistent with what the WHO has suggested as overweight and obesity 'action trigger points for public health action' for Asian populations.<sup>7</sup> The cut-off values for underweight and normal weight are the same as in the "comparator" definition but the cut-off values for determining overweight and obesity are lower.

Cut-off values for the categorisation of WC are less defined than those for BMI. We have chosen common-used "comparator" values described by Lean et al. (1995), which classify people into 'low risk' ( $<94 \text{ cm}$  for men;  $<80 \text{ cm}$  for women), 'increased risk' ( $\geq 94\text{--}102 \text{ cm}$  for men;  $\geq 80\text{--}88 \text{ cm}$  for women), and 'substantially increased risk' ( $\geq 102 \text{ cm}$  for men,  $\geq 88 \text{ cm}$  for women).<sup>8</sup> As for Asian-specific WC cut-offs, we have chosen to use those proposed by Cuong et al. (2007) as optimal for people of Vietnamese ethnicity.<sup>3</sup> This definition also allows easy comparison with prevalence estimates from HCMC. The Vietnamese-specific WC cut-offs classify people into 'low risk' ( $<79 \text{ cm}$  for males;  $<77 \text{ cm}$  for females), 'increased risk' ( $79\text{--}86 \text{ cm}$  for males,  $77\text{--}86 \text{ cm}$  for females), and 'substantially increased risk' ( $\geq 86 \text{ cm}$  for males and females).<sup>3</sup>

#### Analysis

Analysis of BMI and WC were stratified by sex and age groups (age categorised in 10-year groups between ages 25 and 74 years). The statistical software, Stata (Inter-cooled Stata, Version 9.0, StataCorp) was used for the analysis. To account for different age structures in the comparison population from HCMC, total-population prevalence estimates were age-standardised based on data from the 1999 census (*Population & Housing Census 1999*), using the direct standardisation method. Cuong et al. (2007) used the same standard population in their HCMC study of body weight.<sup>3</sup> The prevalence of the BMI and WC categories were calculated for each survey, using both Asian and Vietnamese-specific BMI and WC cut-off values as well as higher "comparator" values, as previously described.

#### RESULTS

The number of participants in each sex and age group ranged from 52 to 168. The mean BMI was  $22.0 \text{ kg/m}^2$  and the mean WC was  $73.8 \text{ cm}$ . Males accounted for a smaller proportion (37.0%) than females (Table 1).

Tables 2 and 3 illustrate the prevalence of the BMI and WC categories in 2004. Overall the age-standardised prevalence of underweight, overweight and obesity using Asian-specific BMI cut-off values were: for males 14.5%, 27.5% and 2.2%; and for females 12.6%, 29.4% and 2.1%. However the prevalence of overweight and obesity using "comparator" cut-off values were: for males 13.7% and 0.3%, and for females 12.2% and 0.5% (the prevalence of underweight was the same). The prevalence of underweight ranged from 2.0% for females aged 55-64 to 23.1% in males aged 65-74, and the prevalence of overweight/obesity (combined) using Asian-specific cut-off

**Table 1.** Demographic information from the 2004 survey population.

Characteristics of the 2004 survey population	
Number (n)	978
Response rate	73.9%
Mean age (years), (SD)	
25-34	29.8 (2.9)
35-44	40.2 (2.9)
45-54	48.9 (2.9)
55-64	59.6 (2.9)
65-74	69.8 (2.9)
Percentage of sample represented by age group (%) (% in 1999 Census data)	
Males	
25-34	15.7 (38.3)
35-44	21.8 (30.0)
45-54	31.3 (14.8)
55-64	17.1 (9.4)
65-74	14.3 (7.5)
Females	
25-34	18.9 (35.1)
35-44	25.0 (29.1)
45-54	27.3 (15.6)
55-64	16.3 (11.1)
65-74	12.5 (9.1)
Mean BMI (SD)	22.0 (2.9)
Range of BMI (lowest, highest)	14.1, 32.9
Mean WC (SD)	73.8 (8.0)
Range of WC (lowest, highest)	52.0, 102.5
% male	37.0%

**Table 2.** Age-specific prevalence (%) of BMI categories in 2004 (with 95% confidence intervals) for males and females

	Age (years)	Asian-specific BMI cut-offs		'Comparator' BMI cut-offs	
		Males	Females	Males	Females
Underweight	25-34	21.1 (12.3 – 33.6)	22.4 (15.7 – 30.9)	21.1 (12.3 – 33.6)	22.4 (15.7 – 30.9)
	35-44	8.9 (4.3 – 17.5)	5.8 (3.1 – 10.9)	8.9 (4.3 – 17.5)	5.8 (3.6 – 10.9)
	45-54	10.6 (6.1 – 17.8)	4.8 (2.4 – 9.3)	10.6 (6.1 – 17.8)	4.7 (2.4 – 9.3)
	55-64	6.5 (2.4 – 16.0)	2.0 (0.5 – 7.8)	6.5 (2.4 – 16.0)	2.0 (0.5 – 7.7)
	65-74	23.1 (13.6 – 36.5)	20.9 (13.1 – 31.3)	23.1 (13.6 – 36.5)	20.8 (13.1 – 31.3)
	Total†	14.5 (10.0 – 19.1)	12.6 (9.5 – 15.7)	14.5 (10.0 – 19.1)	12.6 (9.5 – 15.7)
Normal weight	25-34	54.4 (41.4 – 66.8)	59.5 (50.3 – 68.0)	64.9 (51.7 – 76.2)	73.3 (64.5 – 80.6)
	35-44	64.6 (53.4 – 74.3)	62.3 (54.4 – 69.7)	79.8 (69.4 – 87.2)	81.8 (74.9 – 87.2)
	45-54	49.6 (40.4 – 58.7)	45.2 (37.9 – 52.8)	72.3 (63.6 – 80.0)	69.6 (62.3 – 76.1)
	55-64	50.0 (37.8 – 62.3)	49.0 (39.3 – 58.7)	77.4 (65.3 – 86.2)	75.0 (65.6 – 82.5)
	65-74	50.0 (36.7 – 63.3)	45.5 (34.7 – 56.7)	61.5 (47.7 – 73.7)	64.9 (53.7 – 74.8)
	Total†	55.8 (49.7 – 61.9)	55.9 (51.5 – 60.3)	71.5 (65.9 – 77.1)	74.7 (71.0 – 78.6)
Overweight	25-34	22.8 (13.7 – 35.5)	18.1 (12.1 – 26.2)	14.0 (7.2 – 25.7)	4.3 (1.8 – 10.0)
	35-44	24.1 (15.9 – 34.7)	31.2 (24.3 – 38.9)	11.4 (6.0 – 20.5)	12.3 (8.0 – 18.6)
	45-54	38.1 (29.6 – 47.4)	43.5 (36.1 – 51.1)	15.0 (9.5 – 22.9)	25.0 (19.0 – 32.1)
	55-64	38.7 (27.4 – 51.4)	42.0 (32.7 – 51.9)	16.1 (8.9 – 27.5)	20.0 (13.3 – 29.0)
	65-74	26.9 (16.6 – 40.5)	31.2 (32.7 – 51.9)	15.4 (7.9 – 27.9)	13.0 (7.1 – 22.5)
	Total†	27.5 (22.2 – 32.8)	29.4 (25.6 – 33.1)	13.7 (9.5 – 18.0)	12.2 (9.7 – 14.7)
Obese	25-34	1.8 (0.2 – 11.5)	0.0	0.0	0.0
	35-44	2.5 (0.6 – 9.6)	0.7 (0.1, 4.5)	0.0	0.0
	45-54	1.8 (0.4 – 6.8)	6.6 (3.7 – 11.5)	1.8 (0.4 – 6.8)	0.6 (0.1 – 4.1)
	55-64	4.8 (1.6 – 14.0)	7.0 (3.4 – 14.0)	0.0	3.0 (1.0 – 8.9)
	65-74	0.0	2.6 (0.7 – 9.8)	0.0	1.3 (0.2 – 8.7)
	Total†	2.2 (0.4 – 3.9)	2.1 (1.2 – 3.0)	0.3 (-0.1 – 0.6)	0.5 (0.1 – 0.9)

Abbreviations: BMI, body mass index; WHO, World Health Organization

† Age-standardisation (direct method) based on Vietnamese National Census April 1999

**Table 3.** Age-specific prevalence (%) of WC categories in 2004 (with 95% confidence intervals) for males and females

	Age (years)	Vietnamese-specific WC cut-offs		'Comparator' WC cut-offs	
		Males	Females	Males	Females
Low risk	25-34	82.5 (70.3 – 90.3)	88.8 (81.6 – 93.4)	100.0	97.4 (92.3 – 99.2)
	35-44	73.4 (62.6 – 82.0)	79.2 (72.1 – 84.9)	98.7 (91.5 – 99.8)	94.2 (89.1 – 96.9)
	45-54	61.1 (51.8 – 69.6)	55.4 (47.8 – 62.7)	98.2 (93.2 – 99.6)	73.8 (66.6 – 79.9)
	55-64	53.2 (40.8 – 65.3)	53.0 (43.2 – 62.6)	100.0	70.0 (60.3 – 78.2)
	65-74	65.4 (51.6 – 77.0)	54.6 (43.4 – 65.3)	100.0	66.2 (55.0 – 75.9)
	Total†	72.1 (67.0 – 77.2)	74.3 (71.0 – 77.7)	99.4 (98.5 – 100.0)	87.4 (85.2 – 89.7)
Increased risk	25-34	8.8 (3.7 – 19.5)	11.2 (6.6 – 18.4)	0.0	2.6 (0.8 – 7.7)
	35-44	22.8 (14.8 – 33.4)	20.8 (15.1 – 27.9)	1.3 (0.2 – 8.5)	5.8 (3.1 – 10.9)
	45-54	28.3 (20.8 – 37.3)	36.9 (29.9 – 44.5)	0.9 (0.1 – 6.1)	20.2 (14.8 – 27.0)
	55-64	32.4 (21.8 – 44.9)	35.0 (26.3 – 44.8)	0.0	24.0 (16.6 – 33.4)
	65-74	17.3 (9.2 – 30.1)	35.1 (25.3 – 46.3)	0.0	31.2 (21.8 – 42.3)
	Total†	19.0 (14.7 – 23.3)	22.4 (19.1 – 25.7)	0.5 (-0.3 – 1.3)	10.8 (8.7 – 13.0)
Substantially increased risk	25-34	8.8 (3.7 – 19.5)	0.0	0.0	0.0
	35-44	3.8 (1.2 – 11.2)	0.0	0.0	0.0
	45-54	10.6 (6.1 – 17.8)	7.7 (4.5 – 12.9)	0.9 (0.1 – 6.1)	6.0 (3.2 – 10.7)
	55-64	14.5 (7.7 – 25.7)	12.0 (6.9 – 20.0)	0.0	6.0 (2.7 – 12.7)
	65-74	17.3 (9.2 – 30.1)	10.4 (5.3 – 19.5)	0.0	2.6 (0.7 – 9.8)
	Total†	8.9 (5.5 – 12.2)	3.3 (2.2 – 4.3)	0.1 (-0.1 – 0.4)	1.7 (1.0 – 2.5)

Abbreviations: WC, waist circumference; WHO, World Health Organization

† Age-standardisation (direct method) based on Vietnamese National Census April 1999

values ranged from 18.1% for females aged 25-34 to 50.1% in females aged 45-54.

Overall the age-standardised prevalence of low-risk, increased-risk and substantially-increased risk WC using

Vietnamese-specific WC cut-off values were for males 72.1%, 19.0% and 8.9%; and for females 74.3%, 22.4% and 3.3%. However the prevalence of these categories using 'comparator' cut-off values were for males 99.4%,

0.5% and 0.1%; and for females 87.4%, 10.8% and 1.7%. Using Vietnamese-specific cut-off values, the prevalence of increased-risk WC ranged from 8.8% in males aged 25-34 to 36.9% in females aged 45-54, and substantially-increased-risk WC from 0.0% in females aged 25-34 and 35-44 to 17.3% in males aged 65-74.

Generally, the prevalences of overweight and obesity increased with age (decreasing after age 55-64) and were slightly higher in females than males. The prevalence of underweight was highest in the oldest and youngest age groups (age 25-24 and 65-74), and was slightly higher in males than females.

## DISCUSSION

These results show that both underweight and overweight are prevalent in urban Hanoi adults. Overweight (including obesity) was found in 29.7% of males and 31.5% of females; and increased-risk or substantially-increased-risk WC in 27.9% of males and 25.7% of females respectively. Underweight was found in 13.3% of the population. However the use of Asian and Vietnamese-specific cut-offs describes a much greater prevalence of excess body weight than the "comparator" or commonly-used cut-off values that has been considered to be more appropriate for Western populations. Using these higher cut-off values, the prevalence of underweight remains the same, but the prevalence of overweight/obesity and increased-risk or substantially-increased-risk WC were considerably lower (for overweight/obesity, 14.0% of males and 12.7% of females; for increased-risk or substantially-increased-risk WC, 0.6% of males and 12.5% of females).

The prevalences, based on Asian and Vietnamese-specific cut-off values, are not dissimilar to those found in HCMC and are substantially higher than those reported by Tuan et al. (2008) based on a national (rural and urban) population and not using Asian or Vietnamese-specific ethnicity cut-off values.<sup>2</sup> However in HCMC adults the prevalence of underweight was substantially higher (20.4%), the prevalence of overweight slightly lower (26.2%) and the prevalence of obesity higher (6.4%). The prevalence of 'increased risk' WC was slightly lower (18.7%) and the prevalence of 'substantially increased risk' WC similar (10.0%).

These Hanoi findings are further support the notion of a 'nutrition transition' occurring in Vietnam. Cuong et al. (2007) have suggested that Vietnam is at an early stage in the nutrition transition compared with that of many other Asian countries, as the problem of overweight in Vietnam is currently less severe.<sup>3</sup> However the finding of a doubling in the prevalence of overweight and obesity in Vietnam between 1992 and 2002 by Tuan et al. (2008) suggests a fairly rapid transition.<sup>2</sup> A cross-country study of the nutrition transition has found that changes are occurring rapidly, and at increasingly early stages of a countries' economic and social development.<sup>9</sup> Moreover, Popkin (2002) suggested that the rate of change with regard to obesity in low- and middle-income countries is much greater than that observed in high-income countries.<sup>10</sup> Hop et al. (1997) also found a positive secular trend in the height and weight of Vietnamese children.<sup>11</sup>

We found that the age-standardised prevalence of overweight/obesity (combined) was similar in men and

women. This supports the HCMC findings and those discussed by Cuong et al. (2007), and is consistent with the results of the majority of studies worldwide.<sup>3</sup> However this was not the case when we applied the traditional BMI cut-offs, emphasising the influence of the chosen cut-off values on results.

Cuong et al (2007) found that the prevalence of overweight and obesity (based on BMI) more than doubled between the youngest and oldest age groups in the study (ages 20-29 and 50-60),<sup>3</sup> which is similar to our finding of a doubling between age groups 25-34 and 55-64. However we found that the prevalence was lower in the older age group (65-74). We also found that the prevalence of underweight was, for both men and women, substantially higher in those aged 25-34 and 65-74 than those of other age groups (those aged 35-44, 45-54 and 55-64); a pattern much weaker in the HCMC findings. The explanation for these differences is unclear, but may be explained by cultural and environmental differences between the two cities.

This study is based on a population health survey with a reasonably high response rate (73.9%) and measured height, weight and waist circumference. The findings are similar to those for adults in urban areas of HCMC. However, these overweight/obesity estimates are likely to be larger, and the underweight estimates lower, than those occurring in rural Vietnam, a pattern shown by Tuan et al. (2008) and observed in a number of low-income countries.<sup>2,12</sup> Due to a relatively small sample size and wide confidence intervals, the patterns by age and sex are generally not statistically significant. The Vietnamese-specific WC cut-offs used are those proposed by a single study.<sup>3</sup> Further research into body weight in rural areas is needed, as is research into the most appropriate BMI and WC cut-off values for people of Asian ethnicity. Analysis of social variations in body weight, such as by smoking status and socio-economic status is also recommended. Our findings suggest that the opportunity currently exists to intervene at what appears to be an early stage of the nutrition transition, and thus understanding the context of these changes and why different age and sex groups may be affected differently is important.

In conclusion, while low body weight remains a concern, overweight/obesity is an increasing problem in urban Vietnamese adults. The speed of such changes may be quite different from, and studies suggest more rapid than, those observed in high-income countries. As the nutrition transition unfolds in Vietnam, regular and comprehensive monitoring of trends with regard to body weight in the population is essential, as is the development of appropriate programmes and policy responses.

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## AUTHOR DISCLOSURES

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### 越南河內市的成人體重過輕、體重過重及肥胖的盛行率

此研究目的為評估在越南河內市區的成人體重過輕、體重過重及肥胖的盛行率，並將這個結果與之前在胡志明市針對成人所做的評估作比較。調查對象為居住在越南河內市區，且年齡在 25-74 歲之間的成人。資料是來自於 2004 年收集的一個橫斷性生物醫學調查，其包含一份問卷、身體檢查及血液檢驗。使用亞洲身體質量指數的切點，2004 年年齡標準化體重過重及肥胖盛行率分別是 28.6% 及 2.1%。體重過重/肥胖(合併)的盛行率男性(29.7%)與女性(31.5%)相似，且普遍隨著年齡增加。假如採用世界衛生組織的標準切點，則體重過重/肥胖的盛行率則大幅降低。年齡標準化的體重過輕盛行率為 13.3%。腰圍在‘危險性增加’/‘大大增加危險性’(合併)的男性及女性分別為 27.9% 及 25.7%。2004 年在河內市 3 位成年人中將近有 1 位是體重過重或肥胖，並且 10 位中超過 1 位是體重過輕(依據亞洲的切點)。這個體重過重/肥胖的盛行率與胡志明市的成年人相似，但體重過輕的盛行率則較低。當體重過低仍然是被關注的議題時，越南城市的成人體重過重與肥胖是一個逐漸增加的問題。

**關鍵字：**體重過輕、體重過重、肥胖、身體質量指數、越南