AN INCREASE IN RISK FACTORS FOR CARDIOVASCULAR DISEASE IN YOGYAKARTA, INDONESIA: A COMPARISON OF TWO CROSS-SECTIONAL SURVEYS

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Abstract. This paper aims to describe changes in risk factors for cardiovascular disease (CVD) over a five year period in urban Indonesia. In 2004 (*n*=3,205) and 2009 (*n*=2,467) we conducted cross-sectional surveys of residents in Yogjakarta City, Indonesia evaluating risk factors for CVD. Smoking habits, fruit and vegetable intake, physical activity, blood pressure, weight, and height were recorded. The results of these 2 surveys conducted 5 years apart were then compared. The risk for having a CVD event was also calculated. Behavioral CVD risk factors were more common among men. The predicted risk of having a CVD event increased from 8.4% to 11.3% among men between 2004 and 2009. Effective measures need to be taken to change these behaviors among men in Yogyakarta, Indonesia.

Keywords: non-communicable diseases, chronic diseases, smoking, risk factor, Indonesia

INTRODUCTION

Cardiovascular disease (CVD) is a major cause of morbidity and mortality worldwide. The burden of CVD has especially increased among low and middle income countries (Dhillon *et al*, 2012; Demaio *et al*, 2014). Southeast Asia has a higher non-communicable disease (NCD) age-standardized mortality rate, a mortality rate adjusted to the age composition of the population, than the worldwide average (Dhillon *et al*, 2012; Demaio *et al*, 2014). Indonesia has also had an increase in CVD morbidity and mortality, especially on urban Java Island (Ala *et al*, 2010).

The causes of CVD have been studied extensively and so have behavior modification interventions (WHO and WEF, 2011). Prevention and control of CVD is rarely accomplished in Indonesia, where infectious and NCD both cause a public health burden for the country. Health care systems in low and middle income countries are not prepared to manage CVD (Beaglehole and Yach, 2003; Ala *et al*, 2010) due to a lack of resources and inte-

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grated surveillance systems (Daar *et al*, 2007) capable of monitoring changes in the prevalence of CVD.

One problem in controlling CVD is neglect of CVD by the political agenda (Alleyne *et al*, 2010). Poor tobacco control in Indonesia is as example of how smoking has been neglected (Thabrany, 2012). To bring CVD to the political agenda, it is necessary to convince decision makers at national and regional levels of its importance, but the number of CVD events in the Indonesian population is unknown. Changes in CVD risk factors over time can provide predictions for future risk of CVD in the population (Bonita *et al*, 2001).

We studied change in CVD risk factors by comparing two cross-sectional surveys of CVD risk factors (2004 and 2009) conducted in Yogyakarta, Indonesia. Since Yogyakarta has the highest life expectancy in Indonesia (Central Board of Statistics, 2010), it may also see the greatest risk for chronic diseases, such as CVD.

MATERIALS AND METHODS

Study population

This study was conducted in Yogyakarta City, Java, Indonesia. In 2009, the city had 462,752 inhabitants living in 32.5 km^2 (population density > 14,000 individuals/km^2) (Central Board of Statistics, 2010).

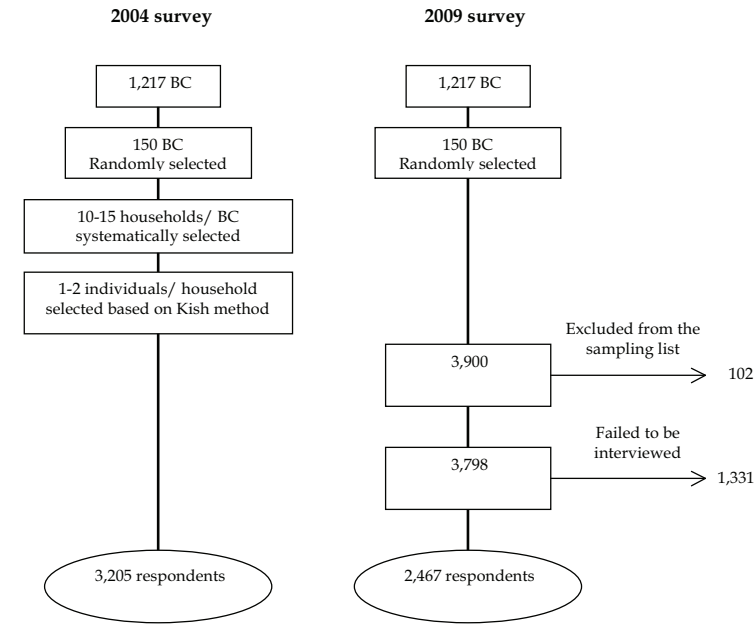
To evaluate changes in CVD risk factors we conducted two cross sectional studies: in 2004 and 2009. The sampling procedure has been described previously (Dewi *et al*, 2010). Yogyakarta is divided into 1,217 block censuses (BC) by the Central Board of Statistics. Each BC consisted of 80-120 households (Central Board of Statistics, 2010). One hundred fifty BCs were randomly selected and 3,000 subjects aged 15-75 years were asked to participate. The minimum sample size is specified by the WHO STEPs design; we added 30% more subjects to compensate for an estimated non-response rate (WHO, 2005a). A total of 2,467 respondents participated; 1,331 were not interviewed: 138 were unwilling to participate, 136 could not be found and 1,057 were deceased or had moved (Fig 1). An additional 102 subjects were excluded from the study because 71 were physically impaired and 31 were not in the study age range.

Data collection

During both surveys, interviews were conducted at home using a structured STEPwise questionnaire (WHO, 2004). In 2005 the WHO produced a new version of the STEPwise instrument, with some revisions, especially regarding the measurement of physical inactivity (WHO, 2005a). However, we used the 2001 STEPwise instrument for both surveys (WHO, 2004) to ensure comparability.

The STEPwise instrument asked about NCD risk factors. STEP one of the questionnaire asked behavioral questions, STEP two includes physical measurements and STEP three added biochemical assessments. Each STEP had both core and optional parts. The optional parts depend on the resources of the country. STEP three was not included in this study due to financial constraints. Data collection was conducted according to the STEPs field manual guidelines (WHO, 2005b). The questionnaire had previously been translated and validated by a research group in a neighboring province (Ng *et al*, 2006), and had been tried out on 150 respondents in the 2004 survey.

Demographic variables recorded were age, sex and socioeconomic status (SES) and risk factors recorded were fruit and vegetable intake, tobacco use, physi-



BC= Block Census

Fig 1– Sampling procedures for the two study surveys.

cal activity, blood pressure and body-mass index (BMI). To determine the SES, the respondents were asked about their average monthly household income.

Data were collected by trained surveyors. The study was coordinated by two supervisors who checked the validity of the respondents' answers by re-interviewing five percent of the subjects. The data collection procedure and questionnaires were checked periodically for completeness. The completed questionnaires were delivered to the data manager for data entry and data cleaning.

Data analysis

Data were weighted to match the age and gender distribution of the population in Yogyakarta Municipality in 2004 (Central Board of Statistics, 2005) and 2009 (Central Board of Statistics, 2010) to ensure they were representative of the study group (those aged 15-75 years). Age was defined as the age at interview, and grouped into 20 year intervals since the number of respondents did not meet the minimum sample size when stratified into ten year age groups. The SES was categorized into low or high based on the median, low being a monthly household income of ≤600,000 rupiahs in 2004 and 1,000,000 rupiahs in 2009 and high being above those respective medians. Low fruit and vegetable intake was defined as consumption of <4.5 portions per day (Joint WHO and FAO, 2002). Smoking was defined as smoking at least one cigarette per day (WHO, 2005b).

Physical activity was divided into 3 types: work, leisure and transportation. Respondents were classified as working vigorous if their work required them to do heavy lifting, digging or constructions, and moderate if they had to walk briskly or carry light loads for at least 10 minutes at a time on a typical work day. Respondents were classified as having vigorous leisure activity if they exercised by running and moderate if they walked or swam for at least 10 minutes at a time on a typical day. Transportation activity was described as moderate if they walked or rode a bicycle for at least 10 minutes at a time on a typical day (WHO, 2005b). Physical activity was defined as low if the weekly average for vigorous and moderate physical activity was <105 minutes.

Respondents were defined as having elevated blood pressure if their systolic

blood pressure was ≥ 140 mmHg and/ or diastolic blood pressure ≥ 90 mmHg or if they took antihypertensive medication (WHO, 2005b). BMI was calculated as the weight in kg divided by the height in meters squared. Respondents were categorized as being under weight (BMI<18.5), normal weight (BMI=18.5-22.9), overweight (BMI=23-24.99) and obese (BMI≥ 25 kg/m^2) (WHO Expert consultation, 2004).

Predicted CVD risk, both fatal and non-fatal, within the next five years was calculated using a chart developed by Gaziano *et al* (2008) derived from the WHO/ISH risk prediction chart (WHO, 2007) and adapted to suit low and middle income countries. The risk was predicted based on sex, age, systolic blood pressure, smoking status, blood pressure treatment status, history of diabetes mellitus and BMI. Respondents were classified as being at high risk for CVD if their five year risk was greater than 20% (Mendis *et al*, 2007).

The chi-square test was used to evaluate differences in risk factor prevalence between 2004 and 2009. Significance was set at $p<0.05$. Data were analyzed using STATA, version 11 (StataCorp LP, College Station, TX).

Ethical consideration

Ethical clearance for this study was obtained from the ethics committee of the Faculty of Medicine, Gadjah Mada University. Official permission to conduct the study was obtained from the Government of Yogyakarta Municipality. Before participation, written informed consent was obtained from each respondent.

RESULTS

A summary of the respondents' characteristics, lifestyles and physical measurements during the first and second surveys is shown in Table 1. The demographics during the two surveys were similar. However, the prevalence of low fruits and vegetable intake increased significantly ($p=0.008$) from 2004 (81%) to 2009 (85%). Physical inactivity during leisure increased significantly from 15% (2004) to 23% (2009) with a p-value=0.000. Similarly, physical inactivity during transportation also increased significantly from 64% in 2004 to 73% (2009) ($p=0.000$). The average BMI in 2004 was 23.0 and in 2009, 23.2; the difference was significant ($p=0.045$). The mean diastolic blood pressure also increased significantly ($p=0.001$) from 80 mmHg (2004) to 81 mmHg (2009).

The mean diastolic blood pressure increased significantly with a p-value of 0.001 (Table 1) as did the prevalence of elevated blood pressure among men aged ≥60 years from low SES (56% to 73%, $p=0.012$) and from high SES (59% to 73%, $p=0.018$, Table 2). The mean BMI increased significantly from 23.0 kg/m^2 to 23.2 kg/m^2 ($p=0.045$, Table 1) and so the proportion of overweight among men aged 60-75 years from a higher SES (23% to 35%, $p=0.040$, Table 2). The prevalence of daily smoking was still common among men, but did decrease significantly from 2004 (60%) to 2009 (54% $p=0.0234$) (Fig 2). However, this decrease was only seen among young men from a higher SES (57% to 47%, $p=0.0345$) and very old men both from low SES (61% to 37%, $p=0.002$) and high SES from 50% to 24% ($p=0.000$) (Table 2). In 2004 to 2009, respondents with lower fruit and vegetable intakes increased from 81% to 85% $p=0.008$, Table 1), especially among men (82% to 86%, $p=0.022$) (Fig 2). Fewer people were working vigorously or had moderate levels of activity (32% to 23%, $p<0.000$) in 2009 than in 2004 (Table 1), further analysis showed that physically inactive increased among men, aged 50-59 years from a lower

Table 1
Characteristics of respondents by survey year.

Characteristics	2004 (*N*=3,205) $\overline{X}$	2009 (*N*=2,467) $\overline{X}$	*p*-value
Demographics			
Sex			
Men (%)	48	49	0.380
Women (%)	52	51	
Age in years ($X \pm SD$)	34 ± 15.3	34 ± 15.2	0.530
Length of education in years ($X \pm SD$)	11 ± 4.1	11 ± 3.7	0.098
Lifestyle			
Smoking (%)	30	27	0.063
Low fruit and vegetable intake (%)	81	85	0.008*
Physical activity levels			
Physical inactivity (%)	36	38	0.429
Working–vigorous and moderate (%)	32	23	0.000*
Leisure–vigorous and moderate (%)	15	23	0.000*
Transportation–moderate activity (%)	64	73	0.000*
Physical measurements			
Systolic blood pressure	128.4 ± 22.7	129.2 ± 22.6	0.104
Diastolic blood pressure	80 ± 12.4	81 ± 11.8	0.001*
Elevated blood pressure (%)	23	22	0.178
Body mass index	23.0 ± 4.5	23.2 ± 4.7	0.045*
Body mass index category			
Underweight (%)	18	17	
Normoweight (%)	44	42	0.204
Overweight (%)	13	15	
Obese (%)	25	26	

* Significant at $p< 0.05$

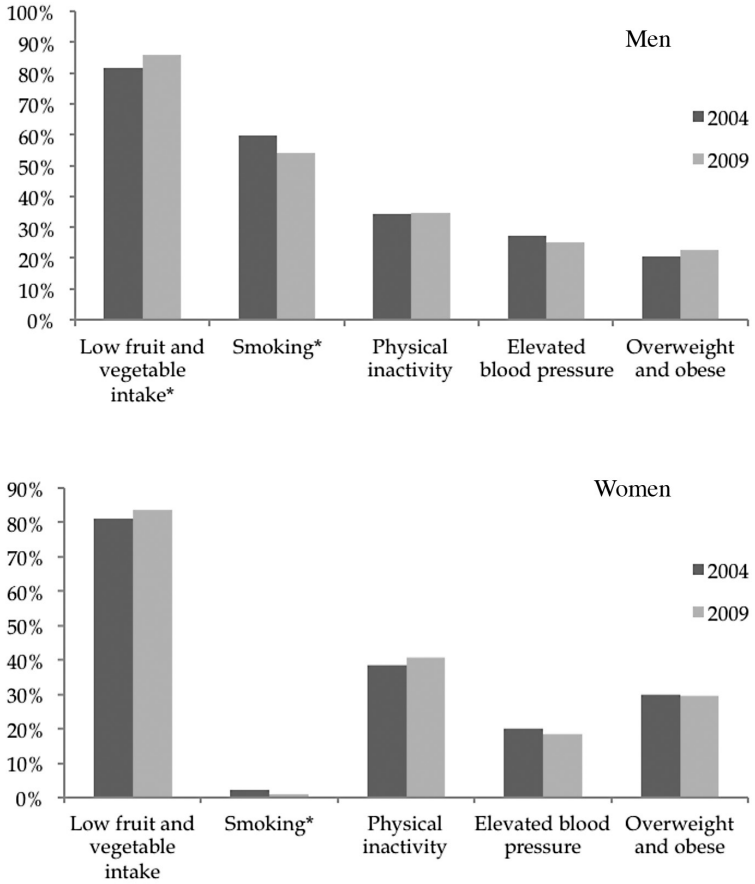
SES (18% to 39%, p=0.002) and among women, aged 15-49 years from a lower SES (31% to 44%, p=0.001; Table 2).

The percentage of those at high risk of getting CVD within the next five years increased significantly (p=0.004) from 6.9% in 2004 to 8.3% in 2009 (Fig 3). The percentage of those at high risk for CVD increased significantly among men from both a low and high SES (8.4% in 2004 to 11.3% in 2009, p=0.000), but decreased insignificantly among women (5.5% to 5.4%, p=0.898 (Fig 3).

In 2004, more men had a high risk of CVD at 50-59 years than woman (24% compared to 9%, Fig 4). The proportion of men aged 50-59 years at high risk for CVD increased significantly from 24% to 36% (p=0.000) between 2004 and 2009 and the proportion of women decreased insignificantly from 9% to 8% (p=0.585) during the same time period.

DISCUSSION

The purpose of this study was to describe the change in CVD risk factors over a five year period in Yogyakarta, Indone-



*significant at $p<0.05$

Fig 2–Cardiovascular disease risk factor prevalences by study year and gender.

sia. The prevalence of some behavioral risk factors increased over the five year study period, especially among men.

Cardiovascular disease risk was higher and started at an earlier age among men than women. Both physical risk factors for CVD (elevated blood pressure and overweight/obesity) and lifestyle risk factors (smoking, physical inactivity and low fruit and vegetable consumption) were common in the study population. Men in some age and SES groups had more risk factors. One benefit was that few women smoked.

In our study the prevalence of smoking remained relatively unchanged over the 5 year study period, similar to an Indonesian national survey where the prevalences of smoking in 2007 and 2010 were 34.2% and 34.7%, respectively (Board of Research and Development, 2007; 2010). The prevalences of smoking in our study were high among men but low among women (54.1% and 0.82%) similar to a study from Purworejo, a district in neighboring province of Indonesia (62.7% and 1.4%) (Ahmed *et al*, 2009).

The prevalence of low fruit and vegetable intake was high in our study in 2004 (81%) and in 2009 (85%), similar to an Indonesian national survey in 2007 (86.1%) (Board of Research and Development in Health, 2007). The prevalence of low fruit and vegetable intake was high among both men and women in our study (85.8% and 83.6%), but lower than a study from Purworejo, Indonesia (93.4% and 89.5% for men and women) (Ahmed *et al*, 2009). Low consumptions of fruits and vegetables were more common (81% and 85% in 2004 and 2009), especially in those from a low SES group. Barber *et al* (2008) found among low SES subjects, the expenditure on cigarettes and on food was equal (both 11% of the total expenditure) (Barber *et al*, 2008). Improving subject knowledge about healthy food could encourage them

Table 2
Cardiovascular disease risk factors by age during both study surveys.

Risk factors and socioeconomic status (SES)	Percent prevalence among age groups after weighting								
	15-49			50-59			60-75		
	2004	2009		2004	2009		2004	2009	
Men									
Smoking									
SES low	64	65		80	64	*	61	37	*
SES high	57	47	*	58	51		50	24	*
Low fruit and vegetable intake									
SES low	85	85		83	91		85	87	
SES high	79	81	*	78	81		72	82	
Physical inactivity									
SES low	35	40		18	39	*	32	32	
SES high	37	37		31	28		33	32	
Elevated blood pressure									
SES low	22	14	*	50	51		56	73	*
SES high	23	17		49	50		59	73	*
Overweight and obese									
SES low	16	16		27	31		20	10	
SES high	27	28		36	46		23	35	*
Women									
Smoking									
SES low	1	1		2	0		2	1	
SES high	3	1		1	0		1	0	
Low fruit and vegetable intake									
SES low	84	81		85	80		83	85	
SES high	75	77		78	76		81	79	
Physical inactivity									
SES low	31	44	*	34	37		39	30	
SES high	43	42		34	26		32	32	
Elevated blood pressure									
SES low	14	10		41	49		59	60	
SES high	10	10		46	42		62	69	
Overweight and obese									
SES low	29	30		47	46		28	34	
SES high	29	28		47	41		39	46	

* Significant at $p<0.05$.

to make better choices for household resource allocations.

Over the five year study period, although leisure and transportation activities increased (15% to 23%) and (64% to 73%), but those activities decreased in the low SES group (data not shown). Estabrook *et al* (2003) found people of low SES tended to live in a neighborhood with limited facilities for physical activity. The prevalences of physical inactivity was high among both men and women (34.6% and 40.7%), higher than in a study from Purworejo (12.3% and 25.6%) (Ahmed *et al*, 2009).

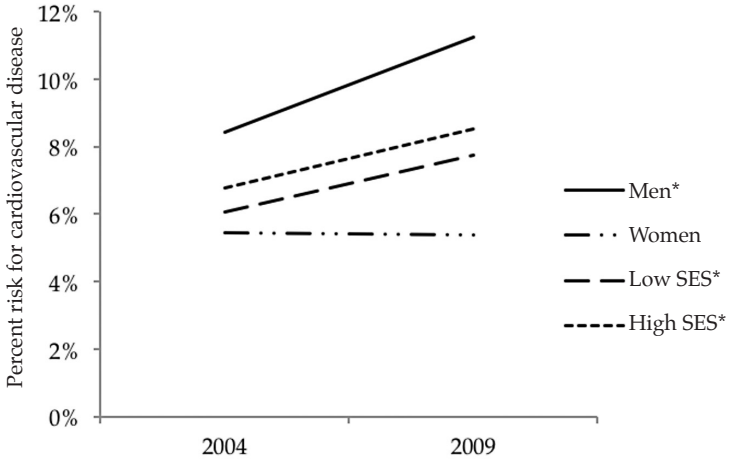


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Fig 3–Calculated cardiovascular disease risk by gender and socioeconomic status level (Gaziano *et al*, 2008).

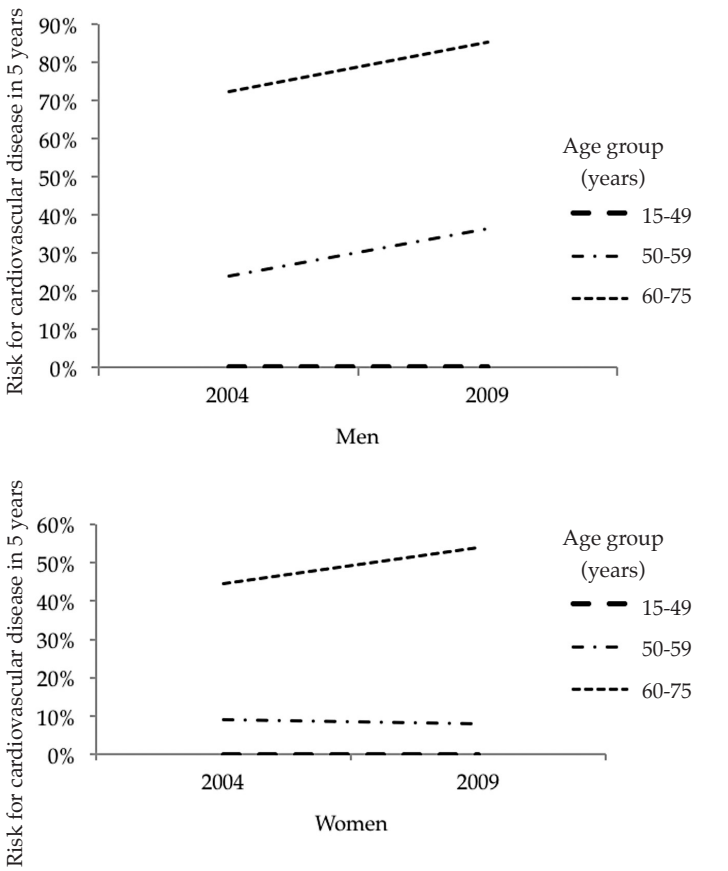

Fig 4–Five year calculated cardiovascular disease risk by age group and gender.

Although the mean of diastolic blood pressure increased during the study period, the prevalences of elevated blood pressure in 2004 and 2009 did not change significantly (23% and 22%, respectively) and was lower than Indonesian national survey in 2007 (35.8%) (Board of Research and Development in Health, 2007). More men suffered from elevated blood pressure (25.2%) than women (18.4%), unlike a study from Purworejo where both men (24.1%) and women (24%) had similar percentages (Ahmed *et al*, 2009). Smoking is a risk factor for hypertension (Venkataraman *et al*, 2013), and smoking is common in Indonesia among men. The deaths due to smoking related diseases are expected to increase for another 40 years because Indonesia may be in the second phase of a tobacco epidemic (Lopez *et al*, 1994).

BMI increased significantly (23.0% to 23.2%) during the five year study period. The prevalence of overweight and obesity was higher among women (29.6%) than men (22.5%) in our study and higher than a survey in Yogyakarta Province (18.7%) (Board of Research and Development, 2010) and higher than a study from Purworejo (24.6% among women and 10% among man) (Ahmed *et al*, 2009). The increase in the mean BMI in our study suggests a problem of overweight and obesity in

the future in this study population. This increasing BMI may be related to less consumption of fruit and vegetables, and less vigorous and moderate physical activity. Although the overall prevalence of overweight and obesity was higher among women, the greatest increase in prevalence over the 5 year study period was among men, aged 50-75 years from the high SES group.

WHO guidelines recommend modifying behavioral risk factors, such as factors influencing blood pressure, blood glucose, lipids, and weight/obesity (WHO, 2005b) by mobilizing multiple sectors at the national level (Bonita *et al*, 2013).

Population wide strategies and high-risk individual strategies need to be combined. High-risk individual strategies treat a smaller number of people at highest risk for CVD, resulting in the greatest benefit to the individual and the public health as a whole (Ahern *et al*, 2008).

CVD risk factors are more prevalent among the poor and proximate risk factors are more prevalent among the rich (Kinra *et al*, 2010). Our findings in Yogyakarta, Indonesia suggest a potential future increase in CVD among the poor in this region.

The prevalences of elevated blood pressure (one fifth of adults studied), and overweight/obesity (one third of adults studied) indicates future chronic disease problems and should be regarded as a serious public health challenge for Indonesia. Singapore's National Healthy Lifestyle Program conducted since 1992, has seen a decline in CVD mortality (Bhalla *et al*, 2006), indicating a successfully launched health promotion program can result in long term benefits. Therefore, it is important to start taking action now in Yogyakarta.

Smoking and hypertension need to be controlled. The Framework Convention on Tobacco Control (FCTC) should be ratified by Indonesia. Promoting salt reduction to control blood pressure (He and MacGregor, 2004) also needs to be promoted in Indonesia to reduce CVD risk.

There were several limitations in this study. Different sampling methods were used between 2004 and 2009. In 2004, due to financial constraints, the only available sampling frame was the list of BCs. According to the WHO (2005b), the Kish sampling method should be used to select individuals who fulfill age and sex criteria. In each BC, whenever the minimum sample size for each 10 year age-group for sex did not meet the criteria, substitutional respondents from adjacent households were selected. This method may have possibly biased the results depending on whether the respondents being replaced had fewer or more CVD risk factors. However, there were no differences in demographic characteristics among the substituted respondents (Dewi *et al*, 2010).

We found an increase in the prevalence of CVD risk factors in urban Yogyakarta, Indonesia. Even if an immediate comprehensive CVD risk intervention was initiated today, the problem of CVD would continue to increase for years before it would improve. Therefore a comprehensive, long term CVD risk interventions program should be initiated immediately and should include a focus on tobacco control. It should involve multiple stakeholders from multiple sectors.

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