

# Preventable risk factors for noncommunicable diseases in rural Indonesia: prevalence study using WHO STEPS approach

Nawi Ng,<sup>a</sup> Hans Stenlund,<sup>b</sup> Ruth Bonita,<sup>c</sup> Mohammad Hakimi,<sup>d</sup> Stig Wall,<sup>b</sup> & Lars Weinehall<sup>b</sup>

**Objective** To gain a better understanding of the health transition in Indonesia, we sought to describe the prevalence and distribution of risk factors for noncommunicable diseases and to identify the risk-factor burden among a rural population and an urban population.

**Methods** Using the protocol of the WHO STEPwise approach to Surveillance (STEPS), risk factors for noncommunicable diseases were determined for 1502 men and 1461 women aged 15–74 years at the Purworejo Demographic Surveillance Site in 2001.

**Findings** Smoking prevalence was high among men (913/1539; weighted percentage = 53.9%) in both rural and urban populations; it was almost non-existent among women. A higher proportion of the urban population and the richest quintile of the rural population had high blood pressure and were classified as being overweight or obese when compared with the poorest quintile of the rural population. Those classified as being in the richest quintile who lived in the rural area were 1.5 times more likely to have raised blood pressure and 8 times more likely to be overweight than those classified as being in the poorest quintile and living in the rural area. Clustering of risk factors was higher among those classified as being in the richest quintile of those living in the rural area compared with those classified as being in the poorest quintile; and the risks of clustering were just 20–30% lower compared with the urban population.

**Conclusion** Both the rural and urban populations in Purworejo face an unequally distributed burden of risk factors for noncommunicable diseases. The burden among the most well-off group in the rural area has already reached a level similar to that found in the urban area. The implementation of the WHO STEPS approach was feasible, and it provides a comprehensive picture of the burden of risk factors, allowing appropriate health interventions to be implemented to address health inequities.

**Keywords** Chronic disease – epidemiology; Risk factors; Cross-sectional studies; Indonesia (*source: MeSH, NLM*).

**Mots clés** Maladie chronique – épidémiologie; Facteur risque; Etude section efficace; Indonésie (*source: MeSH, INSERM*).

**Palabras clave** Enfermedad crónica – epidemiología; Factores de riesgo; Estudios transversales; Indonesia (*fuentes: DeCS, BIREME*).

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Voir page 311 le résumé en français. En la página 312 figura un resumen en español.

يمكن الاطلاع على الملخص بالعربية في صفحة 312.

## Introduction

The epidemiological transition has resulted in a double burden of communicable and chronic noncommunicable diseases in most developing countries. The Global Burden of Disease study has shown that there is an unequal distribution of total disease burden and health expenditure. Nearly 90% of the world's total disease burden occurs in developing countries, while only 10% of health expenditures are allocated there.<sup>1</sup> The burden of noncommunicable diseases affects the poor less than those who are better off; however, these diseases also

contribute to the excess death and disability among the poor in terms of mortality and the loss of disability-adjusted life years.<sup>2</sup>

Most of these noncommunicable diseases share common preventable risk factors, such as tobacco use, high alcohol consumption, raised blood pressure, sedentary lifestyle and obesity.<sup>3</sup> Clustering of these risk factors significantly increases the risk of morbidity and mortality from cardiovascular disease.<sup>4–8</sup>

Not only is the burden of noncommunicable diseases unequally distributed among different social classes, but their risk factors also show variation between

women and men and between different income groups.<sup>9,10</sup> A poorer risk-factor profile among the urban population is associated with migration from rural areas to urban areas.<sup>11</sup> In developing countries, obesity is positively associated with higher socioeconomic status,<sup>12</sup> while in developed countries blood pressure level and obesity are negatively associated with socioeconomic status.<sup>12,13</sup>

To anticipate the epidemic in noncommunicable diseases, WHO has initiated the worldwide surveillance of risk factors using the WHO STEPwise approach to Surveillance (STEPS) of risk factors for noncommunicable diseases.<sup>14</sup>

<sup>a</sup> Department of Public Health, Faculty of Medicine, Gadjah Mada University, IKM Building 3rd Floor, Farmako St. North Sekip, Jogjakarta 55281, Indonesia. Correspondence to this author (email: nawi\_ng@yahoo.com).

<sup>b</sup> Umeå International School of Public Health, Epidemiology and Public Health Sciences, Umeå University, Umeå, Sweden.

<sup>c</sup> Evidence for Information and Policy, World Health Organization, Geneva, Switzerland.

<sup>d</sup> The Community Health and Nutrition Research Laboratory, Department of Public Health, Faculty of Medicine, Gadjah Mada University, Jogjakarta, Indonesia.

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This approach uses standardized instruments and protocols to monitor trends within countries and make comparisons between countries. STEPS focuses on the continual collection of data on key risk factors associated with major chronic diseases. Such information is useful for designing community-based interventions to reduce risk factors in the population. However, longitudinal population-based studies to monitor trends in risk factors for chronic diseases are rare in Indonesia. The aims of this paper are to describe the prevalence of three core risk factors for noncommunicable diseases among residents in Indonesia whose data were captured by the Purworejo Demographic Surveillance System using the STEPS protocol; the risk factors studied were the prevalence of tobacco use, being overweight or obese and raised blood pressure. We also sought to identify the extent to which the rural population is burdened by these risk factors compared with their urban counterparts.

## Methods

The study was conducted in the Purworejo district in 2001. The district, which is located 60 km west of Jogjakarta province in the southern part of Java Island, has a population of 757 000 in an area of 1035 km<sup>2</sup>. Established in 1994, the Purworejo Demographic Surveillance System covers a representative sample of 15 000 households selected using two-stage cluster sampling. The primary sampling unit of the surveillance system (the enumeration areas/clusters developed by the Central Bureau

of Statistics) was selected using a probability proportional to the number of households in the cluster. In the second stage, the same number of households was systematically sampled from each area.<sup>15</sup>

The surveillance system provided the sampling frame and data on household socioeconomic status for this study.<sup>16</sup> For this study, the socioeconomic status of the sample was generated by using the socioeconomic status of households as determined by an asset survey in 1999. The asset survey collected data on the material from which walls, roofs and flooring were made; the source of drinking water; whether toilet facilities were used; and whether a number of durable goods were owned. A weight was assigned to each asset using principal component analysis. The sum of the asset weights for each household was used to categorize households as belonging to the poorest quintile (the lowest quintile of asset distribution), one of the three middle quintiles, or the richest quintile.

The study protocol is based on the WHO STEPS approach. STEPS uses different levels of risk-factor assessment, including collecting information using questionnaires (Step 1), taking physical measurements (Step 2), and taking blood samples for biochemical assessment (Step 3). Each step contains core, expanded and optional items that can be added as needed. The conceptual framework of STEPS, which integrates different levels of risk factor assessment and the completeness of the risk factors assessed, is shown in Table 1.<sup>14</sup>

A total of 3250 participants were randomly selected from the surveillance database from each cluster selected during the first stage of sampling; the final sample represented a 95% response, or 3079 participants (Fig. 1). The aim was to include approximately 250 individuals in each sex and age group (among 15–74 year olds stratified into 10-year intervals) in the final sample to allow estimation of key variables with high precision. Participants between the ages of 15 years and 24 years were included because smoking is now being taken up at a younger age. Adults aged 65–74 years were included because cardiovascular disease has emerged as the leading cause of death in Indonesia, particularly among elderly people.<sup>17</sup> An additional 5% of participants were added to the selected sample in each group to ensure an adequate sample size; among the group of oldest participants, however, an additional 30% of participants were included due to a lower response occurring among this group. Exclusion criteria included severe chronic illness requiring bed rest, physical disability, mental disability and the presence of communication barriers.

This study was approved by the ethical review boards of the Faculty of Medicine of Gadjah Mada University, Indonesia, and Umeå University Hospital, Sweden.

Due to limits on the resources available for the collection of blood samples, only Step 1 and Step 2 were conducted; we did include both core and expanded items for these steps. Questionnaires on core behaviours were

Table 1. WHO STEPwise approach to Surveillance (STEPS) of risk factors for noncommunicable diseases

Measures	Step 1 (Self-report)	Step 2 (Physical examination)	Step 3 (Biochemical assessment)
<b>Core</b>	Socioeconomic and demographic variables including years of education, tobacco and alcohol use, physical inactivity, intake of fruit and vegetables	Measured weight, height, waist circumference, blood pressure	Measurement of fasting blood glucose, total cholesterol
<b>Expanded core</b>	Ethnicity, educational attainment, occupation, income, use of smokeless tobacco, fat consumption, types of physical activity, history of high blood pressure, history of diabetes, treatment for diabetes, treatment for high blood pressure	Hip circumference, pulse rate	Fasting high-density lipoprotein cholesterol and triglycerides
<b>Optional (examples)</b>	Other health-related behaviours, mental health status, disability, injury	Objective measurement of physical activity (e.g., timed walk, use of pedometer), measurement of skinfold thickness	Oral glucose tolerance test, urine examination

Source: Ref. 14.

translated into Indonesian and then back-translated into English. Participants were classified as current daily smokers if they smoked > 1 cigarette per day. Instruments for anthropometry and blood pressure measurements were standardized and routinely calibrated. Trained field staff measured each participant's weight and height while participants were barefoot and wearing in lightweight clothing. Weight was measured to the nearest 10 grams using an electronic scale (Seca GmbH, Hamburg, Germany). Height was measured to the nearest 0.1 cm using a portable stadiometer. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Participants were classified as overweight or obese if they had a BMI > 25.<sup>18</sup>

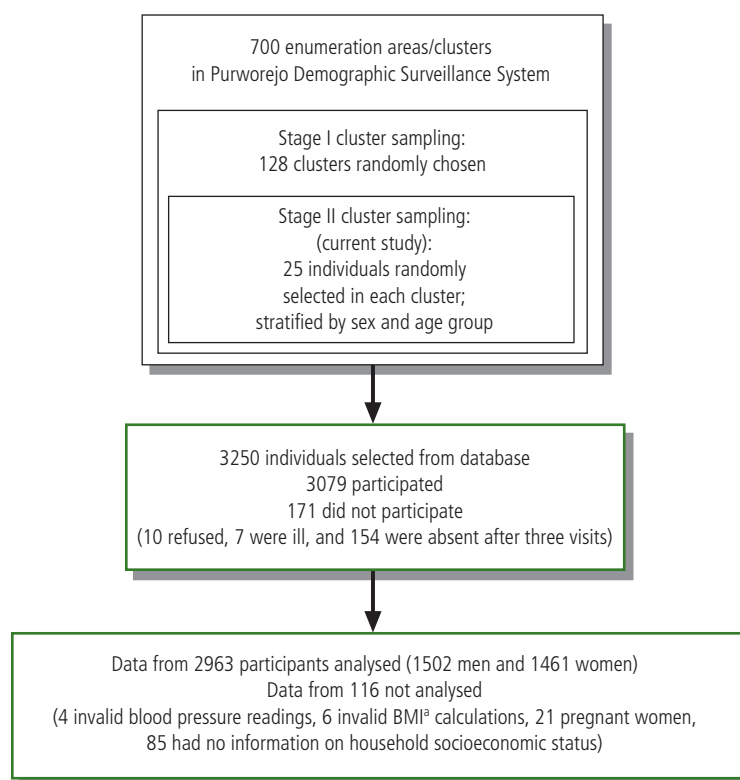
Blood pressure was measured twice with the right arm at heart level while the participant was seated; a standardized protocol was used.<sup>14,19</sup> In 2001, only manual blood pressure equipment was available for use. In a follow-up study in 2002 among the same participants, blood pressure was measured using automated devices (Omron M4-I, Omron Healthcare Europe BV, Hoofddorp, Netherlands); these measurements were used as proxies for blood pressure in 2001. For participants for whom there were no digital measurements in 2002, we estimated blood pressure by calculating the regression between the 2001 and 2002 values and predicting the digital measurement. The prediction was based on a regression equation that included a random component to reflect variation in blood pressure at specific levels, and was done separately for the different sex and age groups. Participants were defined as having raised blood pressure if the systolic pressure was > 140 mmHg and/or diastolic pressure was > 90 mmHg or if they were taking antihypertensive medication.<sup>20</sup>

Data cleaning and data entry were performed in the Purworejo field office. Data were analysed using Stata software, version 8 (StataCorp, College Station, TX).

### Data analysis

In total 3079 people participated in the study, but data on only 2963 individuals (1502 men and 1461 women) were included in the analysis. Among those excluded were 4 participants with invalid blood pressure readings, 6 participants with invalid BMI calculations, 21 pregnant women for whom BMI was not obtained and 85 participants for whom

Fig. 1. Sampling and flow of participants through the study



<sup>a</sup>BMI = Body mass index.

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information on household socioeconomic status was unavailable.

Multinomial logistic regression with three levels of the dependent variable (no risk factors, single risk factor and multiple risk factors) was used to estimate the odds ratio for each socioeconomic class adjusted for age and sex. We estimated the relative risk of having risk factors for each socioeconomic group.

### Findings

A total of 363 participants were classified as living in an urban area (186 men, 177 women) and 2600 were classified as living in a rural area (1316 men, 1284 women). Results were weighted using the data on age and sex distribution from the Purworejo surveillance conducted in 2000. Table 2 displays the sociodemographic distribution of study participants. Due to the small sample size, participants living in urban areas were treated as a single group.

In general, participants aged < 45 years had higher educational attainment when compared with participants aged > 45 years. About 90% of urban participants and 70% of the rural participants

classified as being from the richest quintile were not farmers, and 70% of participants from the poorest quintile living in rural areas were farmers (data not shown).

The age-adjusted and sex-adjusted prevalences of smoking, raised blood pressure, and overweight and obesity are shown in Table 3. The prevalence of smoking was high among men at all ages, and there was almost no tobacco use among women (53.9% of men used tobacco versus 1.7% of women). The prevalence of raised blood pressure was similar among men and women (prevalence among men = 22.4%, 95% confidence interval (CI) = 20.3–24.7% versus 21.9% among women, 95% CI = 19.9–24.0%). Even though the prevalence decreased by half when a higher cut-off point of 160/95 was used, a significantly higher prevalence of raised blood pressure was observed among women compared with men (12.2%, 10.9–13.7% versus 9.8%, 8.5–11.3%) (data not shown). Men in all age groups, except those aged 65–74 years, had higher mean systolic and diastolic blood pressure compared with women. Women in all age groups had higher mean BMIs and thus a higher

Table 2. Sociodemographic information on participants in study of noncommunicable diseases, Purworejo district, Indonesia, 2001

Sociodemographic variables	Age (years)						Total no. of participants	Proportion
	15–24	25–34	35–44	45–54	55–64	65–74		
<b>Sex</b>								
No. (%) men	241/468 <sup>a</sup> (51.5)	239/474 (50.4)	247/483 (51.1)	241/484 (49.8)	243/495 (49.1)	291/559 (52.1)	1502	49.9 (±0.5) <sup>b</sup>
No. (%) women	227/468 (48.5)	235/474 (49.6)	236/483 (48.9)	243/484 (50.2)	252/495 (50.9)	268/559 (47.9)	1461	50.1 (±0.5)
<b>Total</b>	<b>468</b>	<b>474</b>	<b>483</b>	<b>484</b>	<b>495</b>	<b>559</b>	<b>2963</b>	
<b>Socioeconomic status</b>								
No. (%) urban dwellers	63/468 (13.5)	67/474 (14.1)	51/483 (10.6)	61/484 (12.6)	67/495 (13.5)	54/559 (9.7)	363	12.4 (±3.0)
No. (%) in richest quintile in rural area	60/468 (12.8)	47/474 (9.9)	71/483 (14.7)	68/484 (14.0)	56/495 (11.3)	72/559 (12.9)	374	12.7 (±1.4)
No. (%) in 3 middle quintiles in rural area	284/468 (60.7)	298/474 (62.9)	279/483 (57.8)	281/484 (58.1)	297/495 (60.0)	353/559 (63.1)	1792	60.4 (±2.6)
No. (%) in poorest quintile in rural area	61/468 (13.0)	62/474 (13.1)	82/483 (17.0)	74/484 (15.3)	75/495 (15.2)	80/559 (14.3)	434	14.5 (±1.8)

<sup>a</sup> Values are numerators/denominators (weighted percentages). Please see text for information on weighting.

<sup>b</sup> Values in parentheses are the standard errors.

prevalence of being overweight or obese compared with men.

Smoking was most common among participants living in rural areas in the poorest quintile (Table 4). Conversely, the prevalences of both raised blood pressure and being overweight were more common among those living in urban areas and those classified as being in the richest quintile in rural areas. When the higher blood pressure cut-off point was used, we observed a similar gradient of risk-factor clustering across the different socioeconomic groups. Treatment of high blood pressure cannot explain the difference in prevalence observed between the rural and urban populations since we observed no difference in the proportion of those receiving treatment between these two groups (data not shown).

Risk factors tended to cluster among urban participants (16.6% of those in the urban area had two or more risk factors compared with 7.3% of those classified as being in the poorest quintile in the rural areas). We observed a trend of risk increasing across socioeconomic groups in rural areas (Table 4). The risk of a clustering of risk factors was highest among the richest quintile in rural areas when compared with the poorest quintile in rural areas, and the risk was only 23–35% lower among the rural population than the urban population.

Table 5 shows that there is a gradient of risk for raised blood pressure even in rural areas. The risk was 1.5-fold higher (95% CI = 1.2–1.9) for the richest rural quintile when compared with the poorest rural quintile. This pattern persisted even when we used the higher blood pressure cut-off point of 160/95: there was a 1.4-fold increase in risk for men and a 1.8-fold increase for women (data not shown).

Similar patterns were observed for both sexes for the risk of being overweight or obese. The risk of being overweight or obese among women classified as being in the richest rural quintile was 8.5 times higher (95% CI = 4.1–17.9) than that for women classified as being in the poorest rural quintile. Among men, being overweight or obese increased the risk of raised blood pressure by 1.7 (95% CI = 1.30–2.22) and among women by 1.6 (95% CI = 1.28–1.98). The risk was even greater when the higher blood pressure cut-off point was used.

## Discussion

This study supports findings from other studies showing that rural populations are not spared from the emerging burden of risk factors for chronic noncommunicable diseases. Once regarded as diseases of the affluent, noncommunicable diseases now burden populations

in developing countries that have not yet finished tackling poverty-related diseases.<sup>1,12,13</sup>

## Smoking

The high prevalence of smoking among men supports the findings of several surveys in Indonesia.<sup>21–23</sup> The higher prevalence of smoking among men in lower socioeconomic groups suggests that Indonesia is currently in the second stage of the smoking epidemic.<sup>24</sup> A cause-specific mortality study conducted in Purworejo in 2000 found that the majority of deaths occurring among men were due to noncommunicable diseases, especially heart disease, stroke and chronic pulmonary diseases (N. Ng, unpublished data, 2000). Those data suggest that if the smoking epidemic model applies, a further increase in smoking-related morbidity and mortality is to be expected in the coming decades.<sup>24,25</sup>

The high prevalence of smoking among men should raise concerns about environmental tobacco exposure and the potential influence of paternal smoking on youths. A study of young adolescents in Purworejo district and Yogyakarta clearly showed that smoking was more prevalent among young rural adolescents than among urban adolescents.<sup>26</sup> This may be explained by their low socioeconomic status, limited exposure to

Table 3. Prevalence and mean levels of risk factors for noncommunicable diseases stratified by sex and age group of participants from Purworejo district, Indonesia, 2001

Age (years)	Risk factor					
	Daily smoker <sup>a</sup>	Systolic blood pressure <sup>b</sup>	Diastolic blood pressure <sup>b</sup>	Raised blood pressure <sup>c</sup>	Body mass index <sup>d</sup>	Overweight or obese <sup>e</sup>
<b>Men</b>	53.9 (51.1–56.7)	126.6 (125.6–127.6)	76.3 (75.7–77.0)	22.4 (20.3–24.7)	20.2 (20.1–20.4)	4.8 (3.8–6.1)
15–24	31.2	119.2	72.3	7.7	19.4	0.8
25–34	54.9	121.3	74.5	12.2	20.7	9.3
35–44	62.6	125.6	78.5	21.3	21.0	5.1
45–54	66.4	129.8	78.7	29.9	21.1	8.6
55–64	71.6	137.2	80.6	41.2	20.2	6.4
65–74	67.4	140.0	79.0	49.3	19.4	3.0
<b>Women</b>	1.7 (1.1–2.6)	123.4 (122.3–124.5)	75.5 (74.9–76.2)	21.9 (19.9–24.0)	20.9 (20.7–21.1)	12.0 (10.3–14.0)
15–24	0.0	111.4	70.3	2.6	19.9	3.0
25–34	0.4	113.3	73.0	7.1	21.6	12.9
35–44	0.8	119.9	75.9	16.3	22.1	18.7
45–54	1.6	126.8	78.7	29.0	22.1	19.4
55–64	5.0	136.5	79.6	39.1	20.4	14.0
65–74	4.3	146.3	80.9	60.3	19.6	10.1
<b>Total</b>	<b>27.6 (26.1–29.2)</b>	<b>124.9 (124.2–125.7)</b>	<b>75.9 (75.4–76.4)</b>	<b>22.1 (20.7–23.6)</b>	<b>20.6 (20.4–20.7)</b>	<b>8.5 (7.3–9.8)</b>

<sup>a</sup> Values are percentages (95% confidence intervals).

<sup>b</sup> Values are given in mmHg; values in parentheses are 95% confidence intervals.

<sup>c</sup> Raised blood pressure was defined as blood pressure > 140/90 mmHg or the use of an antihypertensive drug. Values are percentages (95% confidence intervals).

<sup>d</sup> Body mass index was calculated as the participant's weight in kilograms divided by height in meters squared.

<sup>e</sup> Participants with a body mass index > 25 were classified as being overweight or obese. Values are percentages (95% confidence intervals).

Table 4. Clustering of risk factors for noncommunicable diseases by socioeconomic group in Purworejo district, Indonesia, 2001

	Urban (all socioeconomic quintiles) <sup>a</sup>	Richest quintile in rural area	Middle 3 quintiles in rural area	Poorest quintile in rural area
<b>Men</b>				
No. of men	186	179	917	220
% daily smokers	52.0 (42.9–61.0)	48.2 (40.3–56.2)	54.2 (50.8–57.5)	59.7 (51.8–67.2)
% with raised blood pressure <sup>b</sup>	28.9 (22.5–36.4)	26.6 (20.9–33.3)	21.7 (19.2–24.4)	16.5 (12.5–21.7)
% overweight or obese <sup>c</sup>	13.3 (9.6–18.1)	10.1 (6.2–16.1)	3.1 (2.2–4.3)	0.7 (0.2–2.9)
Clustering of risk factors				
% with no risk factor	32.4	36.7	36.5	35.0
% with 1 risk factor	44.7	44.0	48.5	53.0
% with > 2 risk factors	23.0	19.2	15.0	12.0
Odds ratio for > 2 risk factors vs no risk factor <sup>a</sup>	1.00	0.77 (0.45–1.31)	0.55 (0.36–0.84)	0.40 (0.24–0.67)
<b>Women</b>				
No. of women	177	195	875	214
% daily smokers	2.1 (1.0–4.3)	0.3 (0–2.4)	1.7 (1.0–2.7)	3.1 (1.4–6.7)
% with raised blood pressure <sup>b</sup>	22.2 (17.8–27.2)	27.4 (22.0–33.6)	21.3 (18.6–24.3)	18.3 (14.2–23.2)
% overweight or obese <sup>c</sup>	23.7 (19.6–28.4)	19.6 (14.5–26.1)	10.2 (8.3–12.5)	2.6 (1.2–5.8)
Clustering of risk factors				
% with no risk factor	62.5	59.7	70.9	78.4
% with 1 risk factor	27.3	33.3	25.0	19.2
% with > 2 risk factors	10.2	7.0	4.0	2.4
Odds ratio for > 2 risk factors versus no risk factor <sup>a</sup>	1.00	0.65 (0.32–1.36)	0.26 (0.15–0.47)	0.12 (0.05–0.31)

<sup>a</sup> Values in parentheses are 95% confidence intervals.

<sup>b</sup> Raised blood pressure was defined as having blood pressure >140/90 mmHg or taking an antihypertensive drug.

<sup>c</sup> Participants with a body mass index > 25 were classified as being overweight or obese.

tobacco-related information at school and the high proportion of paternal smoking.<sup>26–28</sup>

Tobacco is an important and influential industry in Indonesia; government efforts to control tobacco use have been ineffective in their implementation.<sup>29</sup> Indonesia is one of the WHO Member States that has not signed the WHO Framework Convention on Tobacco Control. Without sustained political will, the public health approach to preventing smoking and encouraging cessation might be ineffective.<sup>30</sup>

### Overweight or obesity

The prevalence of being overweight or obese among women is consistent with a previous study on reproductive-age women in Purworejo<sup>31</sup> that found a prevalence of 11.6% in 1996 and 14.3% in 1997.

Urbanization,<sup>11,32</sup> improvement in socioeconomic status, better food availability,<sup>12</sup> the adoption of eating habits similar to those in developed countries (e.g., an increasing proportion of nutrition is obtained through the consumption of fats and proteins) and moves towards a more sedentary lifestyle have led to the increased prevalence of obesity in developing countries.<sup>33</sup> Similarly, our study found an increased risk of being overweight or obese occurring among those in the richest quintile compared with those in the poorest quintile; this may reflect changing dietary habits in Indonesia. The ratio of energy contribution from carbohydrate, protein and fat in Indonesia has changed over the past 16 years; there has been an increase in the consumption of fat and protein (the ratio of carbohydrate:protein:fat in 1983 was 81:8:11 and in 1999 it was 59:19:23).<sup>34</sup>

Gender-specific social factors act differently in moderating the relationship between BMI and behavioural factors.<sup>35</sup> However, it is not possible to interpret sociodemographic and health-behaviour factors separately using our data on overweight or obesity. Further studies are needed to capture social factors more systematically to provide such an analysis.

### Raised blood pressure

Our study suggests that raised blood pressure has become a major public health problem for all age groups, especially elderly people living in rural areas.

Table 5. Multivariate analysis of background factors with different dependent risk factors in study of noncommunicable diseases, Purworejo district, Indonesia, 2001

	Risk factor <sup>a</sup>		
	Daily smoking	Being overweight or obese	Raised blood pressure
<b>Men</b>			
Age	1.01 (1.01–1.02)	1.02 (1.01–1.03)	1.04 (1.03–1.04)
Socioeconomic status <sup>b</sup>			
Richest quintile in rural area	0.90 (0.72–1.12)	0.74 (0.42–1.30)	0.90 (0.67–1.20)
Middle 3 quintiles in rural area	1.02 (0.86–1.20)	0.23 (0.14–0.39)	0.78 (0.61–1.00)
Poorest quintile in rural area	1.11 (0.92–1.34)	0.06 (0.01–0.23)	0.61 (0.43–0.86)
Overweight/obese <sup>c</sup>			
Yes	0.87 (0.68–1.11)	NA <sup>d</sup>	1.70 (1.30–2.22)
Smoker <sup>e</sup>			
Yes	NA	0.76 (0.48–1.20)	1.00 (0.83–1.20)
<b>Women</b>			
Age	NA	1.02 (1.01–1.02)	1.05 (1.05–1.06)
Socioeconomic status <sup>b</sup>			
Richest quintile in rural area	NA	0.80 (0.55–1.17)	1.21 (0.88–1.66)
Middle 3 quintiles in rural area	NA	0.41 (0.30–0.57)	0.98 (0.75–1.28)
Poorest quintile in rural area	NA	0.11 (0.05–0.24)	0.83 (0.58–1.19)
Overweight/obese <sup>c</sup>			
Yes	NA	NA	1.60 (1.28–1.98)
Smoker <sup>e</sup>			
Yes <sup>f</sup>	NA	NA	NA

<sup>a</sup> Values are relative risk (95% confidence interval).

<sup>b</sup> The urban population is the reference category.

<sup>c</sup> Not overweight/obese is the reference category.

<sup>d</sup> NA = not applicable.

<sup>e</sup> Being a non-smoker is the reference category.

<sup>f</sup> Because the prevalence of smoking among women was so low, smoking was not included in the analysis for women.

The age-adjusted prevalence of hypertension was less than that in more developed countries (such as Australia, Japan and New Zealand), but it was similar to findings from other developing countries such as China, India, the Islamic Republic of Iran and the Gambia.<sup>36–38</sup>

Although the prevalence of hypertension was higher among the urban population, the richest quintile in the rural area also had a higher risk of hypertension compared with the poorest rural quintile. The inclusion of blood pressure medication in the definition of raised blood pressure did not change the prevalence. Being overweight or obese increases the risk of being hypertensive by 60–70% in our setting. Colhoun et al.<sup>13</sup> found that a higher prevalence of obesity and higher salt and alcohol intake among wealthier socioeconomic groups might explain the direct association between socioeconomic status and high blood pressure. However, alcohol might not be the explanation in our setting because of the low prevalence of

daily alcohol use (data not shown).

The blood pressure of a population does not shift over short periods; therefore we do not think that bias was introduced by our use of estimated blood pressure for participants in the subsample measured manually. Even though the groups with and without automatic measurements had similar distributions of sex, BMI and socioeconomic status, they differed in terms of occupation (a surrogate for physical activity that is likely to be an important correlate of blood pressure). The subsample measured manually had lower blood pressure when compared with the group with automatic measurement. This further justifies our decision to interpolate the missing values because it was necessary to include both groups in the analysis to maintain the representativeness of the sample.

Because the most common causes of death in the study population are vascular diseases, the management of the three major cardiovascular risk factors (smoking, hypertension, cho-

lesterol levels) should be initiated at the primary-care level.<sup>30</sup> Secondary prevention strategies should include interventions tailored to increase people's awareness of raised blood pressure and to ensure that medicines are taken correctly. However, it is unlikely that a strategy aimed solely at increasing levels of awareness will bring about a measurable improvement.<sup>39,40</sup> A broader community-oriented prevention strategy, for example to try to encourage a reduction in salt consumption, should also be a priority in interventions to reduce blood pressure among the population.<sup>30</sup>

### Clustering of risk factors

This study suggests that obesity and hypertension tend to cluster among the urban population in general and among those in the richest quintile in rural areas when compared with those in the poorest rural quintile. The risk of cardiovascular disease increases significantly as risk factors cluster.<sup>5-7</sup> Health interventions that aim to control risk factors at the population level should be planned and implemented in order to slow the progress of the coming

epidemic in noncommunicable diseases.<sup>41,42</sup> The integrated management of risk factors at the level of the public health centre, as well as the promotion of healthy lifestyles — for example by encouraging people to stop smoking, eat well and engage in physical activity — are among the intervention strategies directed at controlling risk factors at the individual level and the population level.<sup>30</sup> By providing information about the level of key risk factors for noncommunicable diseases, the WHO STEPS approach enables the appropriate tailoring of population-level interventions and those aimed at high-risk groups. The continual nature of data collection using the STEPS approach allows for further monitoring of trends to evaluate the impact of interventions.<sup>14,30</sup>

### Conclusion

Our study reveals that the epidemiological transition is occurring in Purworejo district, Indonesia. The rural population already has a high burden of risk factors for noncommunicable diseases, especially smoking. The study shows

that the rural population is facing an increasing burden from hypertension, being overweight and being obese. The transition of risk-factor clustering from richer populations to poorer populations within a country should concern health authorities. It was feasible to use the WHO STEPS approach in our demographic surveillance setting, and it will allow for a better understanding of trends in risk factors over a longer period. In future, the use of this approach will aid in developing a programme of integrated management of risk factors, which takes into consideration the unequal distribution of risks occurring in different socioeconomic groups. ■

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**Competing interests:** Ruth Bonita was among the group who initiated the work on the WHO STEPS approach. Nawi Ng participated in three STEPS meetings and has contributed to the development of STEPS.

## Résumé

### Facteurs de risque évitables de maladies transmissibles dans une zone rurale d'Indonésie : étude de prévalence par la méthode STEPS de l'OMS

**Objectif** Afin de mieux comprendre la transition sanitaire en Indonésie, nous avons cherché à dresser un tableau de la prévalence et de la distribution des facteurs de risque de maladies non transmissibles et à évaluer le poids de ces facteurs dans une population rurale et une population urbaine.

**Méthodes** En suivant le protocole de la méthode de surveillance STEPS de l'OMS, on a déterminé en 2001 les facteurs de risque de maladies non transmissibles chez 1502 hommes et 1461 femmes âgés de 15 à 74 ans sur le site de surveillance démographique du district de Purworejo.

**Résultats** La prévalence du tabagisme était forte chez les hommes (913/1539; pourcentage pondéré = 53,9 %) dans la population rurale comme dans la population urbaine ; elle était quasiment nulle chez les femmes. Chez une proportion plus importante de la population urbaine, ainsi que dans le quintile le plus riche de la population rurale, on a relevé une tension artérielle élevée et ces sujets ont été classés comme présentant une surcharge pondérale ou une obésité comparativement à ceux

du quintile le plus pauvre de la population rurale. Les habitants de la zone rurale appartenant au quintile le plus riche avaient 1,5 fois plus de chances de présenter une HTA et 8 fois plus de présenter une surcharge pondérale que les ruraux du quintile le plus pauvre. L'accumulation des facteurs de risque était plus importante chez les sujets classés dans le quintile le plus riche de la population rurale que chez ceux qui appartenaient au quintile le plus pauvre de cette population et le risque d'une telle accumulation n'était que de 20 à 30 % inférieur à celui que l'on observait dans la population urbaine.

**Conclusion** Les facteurs de risque de maladies non transmissibles pèsent d'un poids inégal dans les populations urbaines et rurales du district de Purworejo. Chez les ruraux les plus aisés, le poids de ces facteurs est déjà comparable à celui qu'on observe en milieu urbain. Grâce à l'application de la méthode STEPS de l'OMS, on a pu dresser un tableau complet de ces facteurs de risque, ce qui permettra de prendre les mesures sanitaires appropriées pour corriger les inégalités dans ce domaine.

## Resumen

### Factores de riesgo prevenibles de enfermedades no transmisibles en la Indonesia rural: estudio de prevalencia basado en el método progresivo PASOS de la OMS

**Objetivo** A fin de comprender mejor la transición sanitaria en Indonesia, decidimos describir la prevalencia y distribución de los factores de riesgo de enfermedades no transmisibles y determinar la carga de factores de riesgo en una población rural y en una población urbana.

**Métodos** Utilizando el protocolo del método progresivo de la OMS para la vigilancia (PASOS), en 2001 se determinaron los factores de riesgo de enfermedades no transmisibles en una muestra de 1502 hombres y 1461 mujeres de 15 a 74 años en el Centro de Vigilancia Demográfica de Purworejo.

**Resultados** La prevalencia de tabaquismo era elevada entre los hombres (913/1539; porcentaje ponderado = 53,9%) en las dos poblaciones, rural y urbana, mientras que era casi nula entre las mujeres. Entre la población urbana y el quintil más rico de la población rural, había una proporción mayor que presentaban hipertensión y sobrepeso u obesidad en comparación con el quintil más pobre de la población rural. Las personas clasificadas en el

quintil superior que vivían en la zona rural tenían 1,5 veces más probabilidades de sufrir hipertensión y 8 veces más probabilidades de tener sobrepeso que las del quintil más pobre de la zona rural. La acumulación de factores de riesgo fue mayor entre las personas clasificadas en el quintil más rico de la zona rural, en comparación con los clasificados en el quintil más pobre; y el riesgo de acumulación fue sólo un 20% - 30% inferior en comparación con la población urbana.

**Conclusión** Las poblaciones rural y urbana de Purworejo padecen ambas una carga desigualmente distribuida de factores de riesgo de enfermedades no transmisibles. La carga en el grupo más acomodado de la zona rural ha alcanzado ya un nivel semejante al observado en la zona urbana. La aplicación del método PASOS de la OMS resultó viable, y permite obtener una imagen detallada de la carga de factores de riesgo, e implementar así intervenciones sanitarias apropiadas para corregir las desigualdades en materia de salud.

## ملخص

### عوامل الاختطار التي يمكن توقُّعها للأمراض غير السارية في أرياف إندونيسيا: دراسة معدل الانتشار باستخدام أسلوب منظمة الصحة العالمية التدرجي

1.5 ضعفاً و زيادة في الوزن بمقدار 8 أضعاف عما هي الحال في المجموعات السكانية الأشد فقراً ممن يعيشون في المناطق الريفية. وإذا أخذت عوامل الخطر كمجموعات عنقودية فإنها ستكون أكثر لدى من يصنفون على أنهم من الشريحة الأكثر غنى ممن يعيشون في المناطق الريفية، وذلك عند مقارنتهم بمن صنّفوا على أنهم من الشريحة الأقل غنى. أما اختطار تجميع هذه العوامل فلم يتجاوز النقص فيه عن 20 - 30% مقارنةً بالسكان في المدن.

**الاستنتاج:** يواجه السكان في كل من المناطق الريفية والحضرية في منطقة بوروريجو أعباء غير متساوية التوزيع من عوامل الاختطار للأمراض غير السارية. فالأعباء التي تنوء تحتها المجموعات الأكثر ثراءً في المناطق الريفية قد وصلت في شدتها لمستوى يشبه ما يعاني منه سكان المناطق الحضرية. وقد كان تنفيذ أسلوب منظمة الصحة العالمية التدرجي مجدياً، وقدم لنا صورة متكاملة عن الأعباء التي تلقي بها عوامل الاختطار، وسمحت لنا بتنفيذ التدخلات الصحية الملائمة لمواجهة انعدام العدالة الصحية.

**الهدف:** للحصول على فهم أفضل للتحوُّل الصحي في إندونيسيا، حاولنا وصف معدلات الانتشار والتوزع لعوامل اختطار الأمراض غير السارية والتعرُّف على عبء عوامل الاختطار هذه بين السكان في الريف وفي المدن. الطريقة: لقد استخدمنا بروتوكول منظمة الصحة العالمية لأسلوب التدرج في الترسُّد للتعرف على عوامل الاختطار للأمراض السارية لدى 1502 رجلاً و 1461 امرأة ممن تتراوح أعمارهم بين 15 و 74 عاماً في موقع الترسُّد الديموغرافي في بوروريجو في عام 2001.

**الموجودات:** لقد كان معدل انتشار التدخين بين الرجال 913 من بين 1539، مما يعادل نسبة مئوية موزونة 53.9% في كل من المجموعات السكانية في الأرياف وفي المدن. ولم يكن هناك أي انتشار تقريباً للتدخين بين النساء. وقد كان لدى نسبة مئوية كبيرة من المجموعات السكانية في المدن ولدى المجموعات الأكثر ثراءً في الأرياف ارتفاع في ضغط الدم مع تصنيفهم ضمن المصاين بزيادة الوزن أو بالبدانة. وإذا ما قورنوا بمن يعيش في المناطق الريفية، فإن لديهم زيادة في ارتفاع ضغط الدم بمقدار أكثر من

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