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ASSESSING SOCIO-ECONOMIC INEQUALITIES OF HYPERTENSION AMONG WOMEN IN INDONESIA'S MAJOR CITIES

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Abstract

While hypertension has been recognized as one of the major public health problems, few studies address economic inequality of hypertension among urban women in developing countries. To assess this issue, we analysed data for 1400 women from four of Indonesia’s major cities – Jakarta, Surabaya, Medan, and Bandung. Women were aged 15 years and over (mean age 35.4 years), and were participants in the 2007/2008 Indonesia Family Life Survey. The prevalence of hypertension measured by digital sphygmomanometer among this population was 31%. Using a multivariable logistic regression model, socio-economic disadvantage (based on household assets and characteristics), as well as age, Body Mass Index (BMI), and economic conditions, were significantly associated with hypertension (p<0.05). Applying the Fairlie decomposition model, results showed that 14% of the inequality between less and more economically advantaged groups could be accounted for by the distribution of socio-economic characteristics. Education was the strongest contributor to inequality, with lower education levels increasing the predicted probability of hypertension among less economically advantaged groups. This work highlights the
importance of socio-economic inequality in the development of hypertension, and particularly the effects of education level.

Key words: hypertension; health inequality; socio-economic position; urban women; developing countries; decomposition
Introduction

The high prevalence of hypertension and its associated risks with chronic disease make it an important public health issue, recognised by the World Health Organisation as a “global health crisis”. Hypertension is no longer mainly a problem in high-income countries, with mortality and morbidity from heart disease and stroke increasing rapidly in many low and middle income countries, largely due to undetected and uncontrolled hypertension.

As in many other developing countries, the prevalence of hypertension in Indonesia has increased over past decades. The prevalence of raised blood pressure among adults aged 15 years and over in Indonesia was 31.7% in 2007, with significant variations across different economic groups. In 2008, the prevalence of raised blood pressure among women aged 25 years and over reached 29.2%, higher than the overall prevalence rate of 24.4% for the South East Asia region.

This increase in hypertension occurs in the context of rapid economic development, urbanization and increased rates of poverty, and widening inequity. In Indonesia, around 11% of the national population live below the poverty line. The poverty growth in urban areas is directly correlated with economic growth, possibly due to economic disadvantaged
groups migrating to urban areas and creating informal working 
sectors\(^7\) and/or the unequal distribution of the benefits of 
-economic advancement.\(^8\)

Rates of hypertension are higher in urban areas compared to 
rural; and in metropolitan areas compared to surrounding 
suburbs.\(^9\)-\(^11\) In major cities, the physical and social 
environment places urban residents at greater risk of engaging 
in unhealthy behaviours, such as alcohol consumption, 
smoking and an unhealthy diet, which lead to higher 
prevalence of obesity and hypertension.\(^12\)-\(^14\) People in larger 
cities may also have limited social networks having migrated 
from rural areas or smaller towns, which may restrict their 
access to information about health care.\(^15\)

The adverse effects of urban living may be particularly 
important for women. Currently, more women than men 
migrate from rural to urban areas.\(^16\) Many of these women 
move with the hope of finding better lives, better access to 
education and health facilities, and for other social 
advantages. However, most of these women end up living in 
urban areas where there are threats to their safety or where 
access to resources and services do not match their needs.\(^17\). 
These risks also have a broader effect, as women’s health
plays an important role in determining health at all levels of the community.\textsuperscript{18}

Few studies address economic inequality of hypertension among urban women in developing countries, particularly in Indonesia. However, some studies have identified that the economic disadvantaged group has a higher risk of elevated blood pressure compared to the more advantaged group, even after adjusting for other strong predictors, such as obesity.\textsuperscript{2,19,20}

We conducted the current study to investigate the socioeconomic inequality of hypertension among women residing in Indonesian major cities – Jakarta, Surabaya, Medan, and Bandung – and its contributing factors. These cities are selected as they are the four largest cities in the country with high urbanization rates, which could lead to greater socio-economic disadvantage and inequity in health status.\textsuperscript{21}

\section*{Methods}

\textit{Population Data}

We analysed data from the 2007/2008 Indonesia Family Life Survey (the 4\textsuperscript{th} wave of IFLS, or IFLS-4). The IFLS is designed to provide data on changes to health behaviours resulting from social, economic, and demographic changes. In addition it also aims to measure health outcomes and inequalities resulting
from changing trends in Indonesia’s development by assessing multiple indicators at both individual and household levels.\textsuperscript{22} The sampling and survey methods for the IFLS have been described in detail elsewhere.\textsuperscript{22} Briefly, participants in IFLS were selected from the 13 most populated provinces in Indonesia, which covered about 83% of the population in 1993.\textsuperscript{22} In IFLS-4, 90.6% of target households were successfully re-contacted with the lowest re-contact rate in Jakarta (80.3%). The sample from IFLS-4 contains over 30 000 individuals living in 13 of the 27 provinces in the country (in 1990), and includes people from urban and rural locations.\textsuperscript{22} The IFLS has been analysed mostly to assess economic status, but also to assess child health, childhood malnutrition, fertility and family planning, smoking behaviour, aging, and health care costs.\textsuperscript{23} The IFLS-4 data are open for public use after registration on their website (\url{http://www.rand.org/labor/FLS/IFLS/ifls4.html}). The use of the data set for this study has also been approved by the Human Research Ethic Committee, University of Newcastle (Approval Number H-2014-0168). Selections of participants for this study was based on sex, age, and residential place (province and district codes). We included all women aged 15 years or over who were residing
in four major cities in Indonesia – Jakarta Raya (consist of
North Jakarta, West Jakarta, South Jakarta, East Jakarta, and
Centre Jakarta), Surabaya, Medan and Bandung.

Blood Pressure and Anthropometric Measurement

All IFLS-4 participants aged 15 years and over had their blood
pressure measured at home by specially trained nurses, using
self-inflating sphygmomanometers with a digital read-out. In
this analysis, a participant was categorized as having
hypertension if mean Systolic Blood Pressure (SBP)>140mmHg
or mean Diastolic Blood Pressure (DBP)>90mmHg on three
measurements. Measurement of height and weight was also
calculated.

Economic advantage

Participants’ economic conditions were grouped (less
advantaged – 1st and 2nd quintile – and more advantaged – 3rd
to 5th quintile) according to household assets and household
characteristics using Principal Component Analysis.

Household assets included in the matrix are house and land
occupied by the household, other house/building, land (not
used for house or farm), vehicles (cars, boats, bicycles,
motorbikes), household appliances (radio, tape recorder,
television, fridge, sewing or washing machine, VCD player,
mobile phone, and others), savings/certificate of deposits/stocks, jewellery, and household furniture and utensils. Household characteristics included in the matrix are access to pipe water, both for drinking and other household needs, access to toilet, access to electricity, and cooking with electric/gas stove.

Other explanatory variables

Other explanatory variables selected for this analysis included age (in years), BMI, education attainment (primary or less, secondary education or tertiary education), employment status (being in paid work or not in paid work), religion (Moslem or non-Moslem), ethic group (have Javanese background or non-Javanese background), migration status (migrant or non-migrant), smoking status (current smoker or non-current smoker).

Statistical Analyses

A weighted prevalence of hypertension was calculated by using the sampling weight factor constructed by RAND22 to correct sample attrition from 1993 to 2007 and to allow use of the dataset for cross sectional analysis. Next, we applied both single and two-level logistic regression models with random intercept to identify factors associated with hypertension. Individual characteristics, such as BMI, economic status, and
other explanatory variables mentioned above, were treated as
the first level and subdistrict as the second level, allowing the
examination of the impact of variance between subdistricts on
the variance of hypertension and assuming the impact of
predictors is similar for each subdistrict. Model building
commenced by including all explanatory variables into the
model. Then, applying the backward elimination method, we
excluded the predictor with the highest p-value at each step.

Next, we investigated disparities in hypertension between two
different economic groups (less advantaged and more
advantaged). First, the distribution of predictor variables and
their associations with hypertension among both groups were
calculated and compared. Next, we applied Fairlie
decomposition analysis\textsuperscript{26} - an extension of Blinder-Oaxaca
decomposition\textsuperscript{27} which allows decomposition to be applied
directly for comparing two groups which have unequal
categorical outcomes. We applied this method to quantify the
contribution of different predictors to the unequal distribution
of hypertension between the two groups to identify factors
contributing most strongly to the inequality. Since the sample
size of the two comparison groups was unequal, the pooled
coefficient was used to predict the probability of hypertension
in both groups.\textsuperscript{26}
Results

SBP and DBP were measured for 1,400 women aged 15 – 90 years old (mean; SD = 35.4; SD = 14.3). The mean SBP and DBP among participants are 124.9 (SD 19.7) mmHg and 80.6 (SD 9.4) mmHg, respectively. The weighted prevalence of hypertension (SBP≥140 mmHg or DBP≥90 mmHg) among the study population is 31%.

A total of 1,375 women who had no missing values on blood pressure measurement, and economic conditions (household assets and household characteristics) were included in the regression model. Three different logistic regression models are shown in Table 1, multilevel logistic regression model assuming all the predictors have the same strength of association in each subdistrict (Model 1-8), multilevel logistic regression model allowing economic condition to have different associations with hypertension in each subdistrict (Model 9), and single level logistic regression (Model 10). Significance level was set at p<0.05. Based on Model 8, 9, and 10, those who are older, have higher BMI, and from the less advantaged economic group have a higher risk of having hypertension (p<0.05).

The likelihood ratio test comparing the null-level multilevel model with a single level model revealed the existence of
between subdistrict variance on hypertension (p<0.05), with 3.13% of the total variance of hypertension in the population attributed to the between subdistrict variance (Variance Partition Coefficient, VPC=0.313). The risk of hypertension for an individual from a high prevalence subdistrict is 36% higher than the risk in the lowest prevalence subdistrict (Median Odds Ratio, MOR=1.36).

When we assume that all predictors have similar associations with hypertension in each subdistrict, after adjusting for age, BMI, economic quintiles, and migration status, the VPC and MOR are 0.70% and 1.16, respectively. Allowing economic conditions to have a different impact on hypertension in different subdistricts increased the VPC to 3.88% and MOR to 1.42. However, when we compared these two multilevel models (Model 8 and Model 9) with single-level logistic regression model (Model 10), the Likelihood Ratio test shows that between subdistrict variance on hypertension no longer existed (p>0.05). The results combined with small VPC suggested that the variance of hypertension is greater within subdistrict compared to between subdistricts. Thus, single level logistic regression is preferred instead (Model 10).

Further analysis was conducted to investigate the inequality of hypertension between the less advantaged economic group
and the more advantaged economic group. Prior to the decomposition analysis, we compared the distribution of predictors (Table 2) and their effects (Table 3) between the two groups.

Age standardized hypertension was used in decomposition analysis to eliminate the unequal age structures between the less economically advantaged and more economically advantaged group. The standardization was based on the overall age structure. While the prevalence of hypertension between the two groups was not significantly different (p>0.05), the prevalence of aged standardized hypertension is significantly higher among the less advantaged group compared to the more advantaged group (p<0.05). Table 4 shows the contribution for each predictor to this inequality.

As shown in Table 4, 14% of the inequality of hypertension between the two groups can be accounted for by different
effects of characteristics in both groups described in Table 3.

Among the predictors, different distributions of BMI and education were significant contributors to inequality (p<0.05).

While higher BMI among the more advantaged groups reduced the inequality by making the hypertension morbidities higher in the more advantaged group (accounted for -18% of the inequality), lower education among the less advantaged group was responsible as the greatest contributor to hypertension inequality, making the prevalence higher among the less advantaged group (accounted for 30% of the inequality).

Discussion

This work demonstrates that hypertension is a major public health problem among women in major cities in Indonesia, using women residing in Indonesia’s four largest cities as an example. Almost one-third of the study population was found to have raised blood pressure (31%). Rapid urbanization, vast city development and industrialization involve both physical and social environment changes, which could lead to worsening health conditions of urban inhabitants. However, the impact of urban living conditions on hypertension and its treatment rate might vary for different subgroups of population, for example across different
Here, we found that the risk of having hypertension varied across different subdistricts. Along with being older, having higher BMI and belonging to a lower economic group poses a higher risk for developing hypertension. However, these area differences were eliminated once the model was adjusted with age, BMI and social factors. The possible reason for this was that the impact of social environment might vary for different subdistricts. In addition, there could be other contributing factors, such as physical environment or access to healthcare.

This study focused on the association between economic conditions and hypertension. We found that less economically advantaged women have a higher risk of having hypertension. Previous studies in different populations showed inconsistent results for the relationship between socio-economic level and hypertension. While some studies demonstrate that socio-economic disadvantaged adults have a higher risk of having hypertension, a study by Mendez et al., demonstrated that the prevalence of hypertension in developing countries are similar for all economic groups. Therefore, we argue that there is a strong indication that economic conditions have different impact on hypertension in various populations.
Even though the economically less advantaged group has a younger mean age (33.3 years old) compared to the more advantaged group (36.4 years old), the prevalence of hypertension was higher among the less advantaged group (even after adjustment for age). When other associated factors were examined, our findings indicate the importance of improving education levels. Not only is lower education an important risk factor for hypertension, but it is also a major contributor to inequality in hypertension. This finding underscores the role of education as an important social determinant of hypertension. Not only can education have a direct impact in increasing health knowledge and access to health, education can potentially increase socioeconomic welfare so that people are more able to maintain their health.33

On the other hand, higher BMI in the more advantaged group is also worth attention. In addition to higher BMI among this group, the effect of BMI on hypertension among the more advantaged group is also higher than its effect in the less advantaged group.

Knowing the high prevalence of hypertension among women in Indonesia’s major cities, it is important to recognize the impact of urban living conditions – physical, social
environment – to chronic disease risk factors, including hypertension. However, public health programs will not be able to achieve optimal results without collaborating with other sectors. As demonstrated in this study, education plays an important role in hypertension morbidity, particularly in economic disadvantaged groups. The higher prevalence of hypertension among the economic disadvantaged groups (even though the population is younger) should receive special attention due to the indication of higher burden in the future and its associated consequences in the later life. On the other hand, obesity was found to be an important factor to be addressed in the more economically advantaged group. Thus, the study supports community based interventions directed at health literacy in poorer urban communities, and at the obesogenic environment in richer urban areas.

This study assessed inequalities in hypertension as a major public health problem among women, a vulnerable group in big cities, and underlines the importance of identifying and addressing important social determinants of hypertension among different sub-groups. The study did not address biological determinants of hypertension or medication history, each of which might affect the results. The prevalence of hypertension may also be underestimated since we did not
include cases where the blood pressure was well controlled on medications. This study can therefore be considered to mostly measure inequality in uncontrolled hypertension. We also did not include diet and physical activity in this study. We did include BMI, which is associated with both diet and physical activity.

In summary, addressing hypertension requires not merely treating the condition but more importantly addressing the associated factors. However, it is possible that one risk factor will have varying effects in different subgroups of the population. Therefore, in developing public health programs, it is important to recognize the social and biological characteristics of the population target before implementing health programs or policy. In addition, multi-sectoral collaboration should also be encouraged to address the underlying factors.

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Conflict of Interest

The authors declare no conflict of interest.

Summary Table

<table>
<thead>
<tr>
<th>What is known about topic</th>
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<tr>
<td>• There were inconsistent results for the relationship between socio-economic level and hypertension.\textsuperscript{20, 31, 32}</td>
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<tr>
<td>• The impact of urban living conditions on hypertension and its treatment rate might vary for different subgroups of population.\textsuperscript{10, 30}</td>
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<th>What this study adds</th>
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<tr>
<td>• In Indonesia’s major cities, less economically advantaged women have a higher risk of having hypertension compared to the more economically advantaged.</td>
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<tr>
<td>• Education was the strongest contributing factor to the inequality of hypertension between less and more</td>
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economically advantaged groups.

- Intervention to address hypertension could be directed at improving health literacy in poorer urban communities, and at modifying the obesogenic environment in richer urban areas.
References


