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Working Paper

Urbanization and inequality in hypertension diagnosis and medication in Indonesia

ADB Working Paper, No. 556

Provided in Cooperation with:

Asian Development Bank Institute (ADBI), Tokyo

Suggested Citation: Helble, Matthias; Aizawa, Toshiaki (2016) : Urbanization and inequality in hypertension diagnosis and medication in Indonesia, ADB Working Paper, No. 556, Asian Development Bank Institute (ADBI), Tokyo

This Version is available at:

<https://hdl.handle.net/10419/161436>

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ADB Working Paper Series

Urbanization and Inequality in Hypertension Diagnosis and Medication in Indonesia

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No. 556
January 2016

Asian Development Bank Institute

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Suggested citation:

Helble, M., and T. Aizawa. 2016. Urbanization and Inequality in Hypertension Diagnosis and Medication in Indonesia. ADBI Working Paper 556. Tokyo: Asian Development Bank Institute. Available: <http://www.adb.org/publications/urbanization-and-inequality-hypertension-diagnosis-and-medication-indonesia/>

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Abstract

Urbanization has been progressing quickly in Indonesia and the consequences on health and health inequities are still not well understood. In this paper, we present new empirical evidence on the differences in the utilization of health care services between rural and urban areas as well as for the respective health inequities. Exploiting the rich dataset of the Indonesian Family Life Survey, this paper measures the socioeconomic inequality of health care utilization for the case of the diagnosis of hypertension and its medication. In the Indonesian Family Life Survey, about 45% of all respondents over the age of 39 were found to suffer from hypertension (average systolic blood pressure higher than 140). However, more than half of the people with hypertension have never been diagnosed by a health care professional, and only a small fraction of the people suffering from hypertension are taking medicine for it. Our analysis further shows that diagnosis and medication rates are significantly higher in urban areas than in rural areas, implying that urban areas offer better access to health care services and medicines. Calculating concentration indices, we find that underdiagnosis of hypertension is more prevalent among the poor and this health inequality is more pronounced in rural areas. For the case of medication, we are unable to detect strong evidence of inequality either in rural or urban areas, as most Indonesians with hypertension do not take medicine irrespective of their socioeconomic status. Finally, decomposition analysis shows that the inequality in education, access to health care centers, living standards, and the possession of a television can explain a large fraction of the inequality of diagnosis and medication.

JEL Classification: I14, I15, I18

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1. INTRODUCTION

Noncommunicable diseases such as cardiovascular disease, cancer, and diabetes have overtaken infectious diseases as the world's leading causes of mortality (WHO 2013). High blood pressure is one of the most well-known causes of life-threatening complications such as heart attacks, strokes, kidney failure, and premature mortality. According to the World Health Organization (WHO) (2013), hypertension is responsible for at least 45% of deaths due to heart disease and 51% of deaths due to strokes. Every year, 9.4 million people die around the world because of complications of hypertension (Lim et al. 2012) with around 80% of the deaths due to cardiovascular disease occurring in low- and middle-income countries (WHO 2013).

Hypertension is commonly known as a silent, invisible killer because it seldom causes symptoms at an early stage and people are hardly aware of its possible danger, and thus tend to postpone medical examination and/or treatment. However, it is dangerous to ignore high blood pressure, as raised blood pressure increases the risk of chronic conditions, and early detection and treatment are key to reducing the risks. In low- and middle-income countries, which typically have weak health systems, the proportion of people who are underdiagnosed, undertreated, and undercontrolled for hypertension is higher than in high-income countries (WHO 2013).

Hypertension is epidemiologically closely related to lifestyle choices and in most cases preventable to some extent or at least controllable by medication. Therefore, people with hypertensive conditions should receive proper diagnosis and seek advice from medical professionals before it gets too late. Late detection on account of underdiagnosis over a long period of time can have considerable negative social and economic impacts on a country's welfare as well as lead to high medical costs for patients (WHO 2013). Treatment costs for chronic conditions attributable to hypertension are far larger than preventive costs of hypertension. If hypertension goes untreated for years, it is more likely to cause complications, which can make cardiac bypass surgery and dialysis necessary. Since the early detection of raised blood pressure and timely treatment are key to reducing the risk of life-threatening diseases, access to medical services is as important as early detection.

The relationship between hypertension and socioeconomic status has been extensively studied. For advanced countries, the literature finds strong evidence that hypertension disproportionately affects the poor. In other words, hypertension has a negative association with socioeconomic status. Colhoun (1998) points out that 42 out of 50 studies covering advanced countries find lower socioeconomic status to be correlated with a higher probability of being hypertensive, with a stronger and more consistent relationship for women. A recent study by Van den Berg et al. (2013) looks at the socioeconomic inequalities in hypertension of children in Amsterdam. The authors find that children with mid- or low-educated mothers were more likely to have prehypertension. For low- and middle-income countries, the correlation is not always consistent and displays heterogeneity. Whereas, Gulliford, Mahabir, and Bocké (2004) find a negative association of systolic blood pressure with increasing income in women in Trinidad and Tobago. Mendez et al. (2003) report for the case of adults in Jamaica that raised blood pressure levels were elevated both in low- as well as high-income groups. For the case of Indonesia, Witoelarm, Strauss, and Sikoki (2009) were unable to detect a significant relation between schooling history and hypertension. However, Christiani et al. (2015) assess the socioeconomic inequalities of hypertension among women living in major cities in Indonesia and show that economically advantaged women have a lower risk of being hypertensive than women with a less advantaged

socioeconomic status. Their study reveals that education was the strongest factor contributing to the inequality of hypertension among women.

As well as inequity in health, inequality in health care access has also been well documented in several countries. A recent study by Dorjdagva et al. (2015), for example, evaluates income-related inequalities in health care utilizations and their changes from 2007/08 to 2012 in Mongolia, employing the Erreyger's concentration index as a measurement of inequality in health service utilization. Barraza-Lloréns, Panopoulou, and Diaz (2013) measure income-related inequalities and inequities in the distribution of health care utilization in Mexico between 2000 and 2006. They show that the utilization of curative visits and hospitalization is more concentrated among the better-off in the country and find no significant change during the period. Macinko and Lima-Costa (2012) research the case for Brazil. They examine inequality in 1998, 2003, and 2008 and find that healthcare utilization in Brazil, which had a pro-rich orientation, became increasingly equitable during the period. Inequality in health care utilization is also found in European countries. According to van Doorslaer, Koolman, and Jones (2004), wealthier and higher educated people are more likely to see a specialist than the less well-off in spite of their lower needs for care. This pro-rich trend was found in all 12 countries studied by them.

One major difficulty of the studies on inequalities in health care utilization is that lower income groups might suffer from poorer health compared to higher income groups. When comparing health care utilization, researchers need to control for differences in health care needs. Wagstaff and van Doorslaer (2000) proposed two methodologies to implement a correction for differences in health care needs: direct and indirect standardization approaches.¹ We take account of the difference in needs by the direct standardization, using the data on hypertension directly recorded by the survey.² We thus have an objective measure of the presence of hypertension across different socioeconomic groups, which allows us to analyze horizontal differences in health care utilization in an unbiased way. Studying the case of hypertension in Indonesia, our main research question is thus whether people with a less advantaged socioeconomic status forego necessary health diagnoses more than people with an advantaged one.

The major contribution of our paper to the literature is that we study the differences between rural and urban population groups in terms of three variables: first, prevalence of hypertension; second, health care utilization; and finally, medication. In addition, we address the question of health inequity and health care inequality for all three topics.

The reason for studying the difference between rural and urban areas is straightforward. According to the United Nations (UN 2014), in Asia only about half of the population are currently living in urban areas, which is substantially lower than in all other regions in the world, except for Africa (40%). Given the relatively low share of urbanized people in Asia, the UN expects that in Asia urbanization will rapidly increase and reach 64% by 2050. Indonesia is no exception. The share of urban dwellers in Indonesia has increased from 25% in 1990 to 35% in 2000 and 45% in 2015. Urbanization is typically a simultaneous source and consequence of economic growth.

¹ The difference is succinctly explained by Fleurbaey and Schokkaert (2012). The following explanation is based on their paper. The direct standardization calculates for each individual how much medical care he/she would have received if he/she had had the same degree of need as the sample as a whole. The indirect method considers the hypothetical situation indicating for each individual the amount of medical care he/she would have received if he/she had been treated like others with the same need characteristics. For further details, see Wagstaff and van Doorslaer (2000).

² In the Indonesian Family Life Survey, the interviewer measures the blood pressure of the respondent and reports the results in the answer of the questionnaire.

The demand for cheap labor in urban areas often triggers a movement of labor from rural areas to urban centers. With productivity in manufacturing and services sectors in urban centers being higher than in agriculture, urbanization propels economic growth. However, urbanization is also associated with risks. Ill-planned urbanization can result in a shortage of adequate housing, unaffordable housing prices, and substantive traffic congestion.

In terms of public health, urbanization offers opportunities and risk. Urbanization might help to facilitate access to health care services and pharmaceuticals. On the other hand, urban crowding and slum development have deleterious health effects. It is also well documented that urbanization leads to a change in the living environment and the lifestyle of residents and common diseases. Dye (2008) and Deaton (2013) mentioned that historically, urbanization has shifted the burden of illness from acute childhood infections to the chronic noncommunicable diseases of adults. In developing countries, diets have changed dramatically and intakes of saturated fat and energy imbalances have increased as economies have developed (Popkin and Du 2003). The structure of diet among rural regions and urban regions are distinctly different (Popkin 2001). Naturally, differences in lifestyles affect the health of people differently. For example, van de Poel, O'Donnell, and van Doorslaer (2009) refer to the fact that being overweight and suffering from hypertension, which are major causes of chronic diseases, are more prevalent in urban areas in the People's Republic of China. Urbanization and hypertension are not independent, because urbanization may create an unhealthy environment where a sedentary lifestyle, consumption of fast food, lack of physical activity, and persistent exposure to stress are commonly seen, which favors the development of hypertension. On the other hand, urbanization can improve access to health care services, as the latter are typically more easily accessible in urban areas than rural areas.

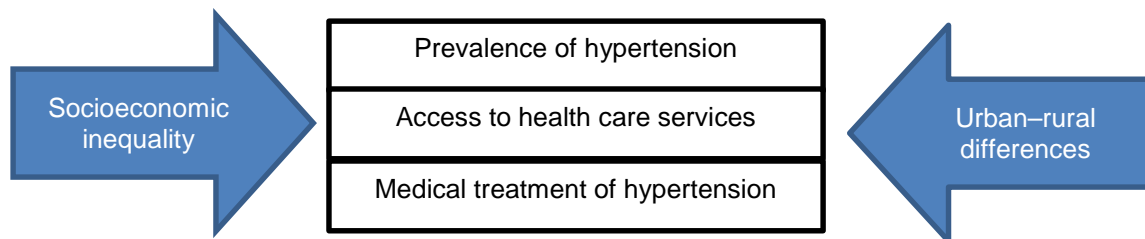
However, improvement in accessibility may not necessarily guarantee the situation where whoever needs medical treatment can have it equally. Van de Poel, O'Donnell, and van Doorslaer (2007) argue that urban areas have greater socioeconomic gradients in health outcomes and attribute these to the greater economic inequality in urban areas. Socioeconomic inequality in hypertension and its treatment in Indonesia was firstly referred to by Witoelar, Strauss, and Sikoki (2009), who suggested that among women with hypertension, those who have some elementary education have a lower likelihood of being underdiagnosed compared to those with no schooling. However, they report that attaining higher levels of schooling does not help to reduce underdiagnosis. Interestingly, their results show that higher per capita expenditure increases the risk of having hypertension and reduces the probability of being underdiagnosed among hypertensive women. In this paper, we provide a more thorough analysis of underdiagnosis in Indonesia by using a quantitative measurement of the inequality, by exploring the determinants of it, and by discussing the differences between rural and urban districts.³ In addition, we also study the differences in medication. The subjects of our research are the respondents of the Indonesian Family Life Survey who suffer from hypertensive conditions. We will measure the degree of horizontal inequality only among the hypertensive respondents.

Figure 1 provides a graphical illustration of the main research questions of this paper. The focus of the paper is on the prevalence of hypertension, access to health care services, and the medical treatment of hypertension in Indonesia. First, we are interested in the social gradient of all three variables caused by wealth inequality.

³ Underdiagnosis is defined as the case in which those who have high blood pressure have never been diagnosed with hypertension by a health care professional.

Second, we would like to know the difference between rural and urban areas for all three variables.

Figure 1: Main Research Questions



Source: Authors.

In the final section of the paper, we attempt to explain the distribution of the underdiagnosis and undermedication for hypertension by decomposing the inequality in the treatment for high blood pressure into inequalities in various socioeconomic endowments, such as education or access to water and sanitation. The purpose of this decomposition is to measure the relations between each inequality and to better understand the factors contributing to the inequality in health care utilization. In particular, we are interested in studying what percentage of the inequality can be explained by inequalities in educational achievement and health insurance status. Based on the results of the decomposition analysis, we will discuss the effective policies to alleviate the inequality.

To the best of our knowledge, this research is the first attempt to study the socioeconomic horizontal inequality in the diagnosis and medication of hypertension in Indonesia and show the differences in the determinants of the inequality found in rural and urban neighborhoods. We hope that this research constitutes an important contribution to the research on inequality in health care utilization in developing economies. Our analysis provides useful insights for policy makers in developing countries trying to mitigate the inequality and encourage inclusive growth and sustainable development. Since health is one of the important determinants of human well-being (Stiglitz, Sen, and Fitoussi 2010), addressing health inequality should be of great interest to all policymakers.

The structure of this paper is as follows. The next section introduces the data used in this research, establishes the definitions of hypertension, its underdiagnosis, and undermedication, and discusses the descriptive statistics. In Section 3, we explain the econometric method to measure the inequality in health and health care utilization. Section 4 summarizes and interprets the results of our analysis. Before concluding, in Section 5 we discuss the policy implications of our research.

2. DATA

2.1 The Indonesian Family Life Survey

The Indonesian Family Life Survey (IFLS) is an ongoing, multipurpose longitudinal household survey launched in 1993/94. Each wave covers around 30,000 individuals living in 13 of the 27 provinces in the country. We use cross-sectional data of the fourth wave, which was completed in 2007/08. We only exploit data of the fourth wave, because it is the only wave that has information as to whether or not respondents have ever been diagnosed with hypertension by a health care professional. In addition, the

fourth wave of the IFLS measured the blood pressure of respondents three times during the interview (instead of only one time in previous waves). In this paper, we take the simple average of the three measures and use it to objectively assess whether the respondent suffers from hypertension.

Since in our study we are mainly interested in hypertension caused by lifestyle rather than innate hypertension, we limit our sample to adults aged over 39. The number of respondents aged over 39 suffering from hypertension is 5,054 of the total 11,217. This group of people aged over 39 was chosen because their risk of chronic diseases attributable to hypertension is much higher than that of younger people. Generally, the older a person becomes, the more likely he/she is to suffer from hypertension, and an adequate treatment is then even more important for the reduction of the risk. In other words, underdiagnosis and not taking medication against hypertension is perilous especially for middle-aged and older people.

As a measure of socioeconomic status, various studies use measurements such as income, expenditure, education level, and wealth. It is true that any indicator works as long as it is possible to rank people from low to high socioeconomic status, but different indicators generally give different results and the choice ultimately depends on researchers' interests (Fleurbay and Schokkaert 2012). In this paper, we use family size adjusted household wealth, which includes values of various items commonly found in the house, and has some advantages over others.⁴ The reason we do not use income as a socioeconomic status is that we may not be able to correctly observe employment income if households make their livings by family-owned businesses, such as farm administration. Furthermore it would be difficult to rank retired people when we discuss the degree of inequality as they typically have very little or no employment income. We hope, however, that wealth as an accumulation of income overcomes these shortcomings. Educational levels, which are widely recognized as another form of socioeconomic status, may also not be suitable for this study because of the difficulty in assessing a respondent's educational qualifications or achievements by a continuous number, and therefore hinder us from ranking people when illustrating the concentration curve and deriving the concentration index.

2.2 Hypertension

In this paper we follow the WHO definition of hypertension, defined as the condition where the average systolic blood pressure is equal to or greater than 140 millimeters of mercury (mmHg) or average diastolic blood pressure is equal to or greater than 90

⁴ Wealth is defined as the aggregated total value of the following assets, with the values divided by the number of family members:

1. House and land occupied by a household
2. Other house/building (including land)
3. Land (not used for farming)
4. Poultry
5. Livestock/fishponds
6. Hard stem plants not used for farm or non-farm business
7. Vehicles (cars, boats, bicycles, motorbikes)
8. Household appliances (radio, tape recorder, TV, fridge, sewing or washing machine, video and CD player, hand phone, etc.)
9. Savings/certificates of deposits/stocks
10. Receivables
11. Jewelry
12. Household furniture and utensils
13. Others

mmHg (WHO 2013). We additionally define another stage of hypertension: severe hypertension, when the average systolic blood pressure is equal to or greater than 160 mmHg or the average diastolic blood pressure is equal to or greater than 100 mmHg. Classifications of the levels of hypertension used in this paper are shown in Table 1.

Table 1: Definition of Hypertension

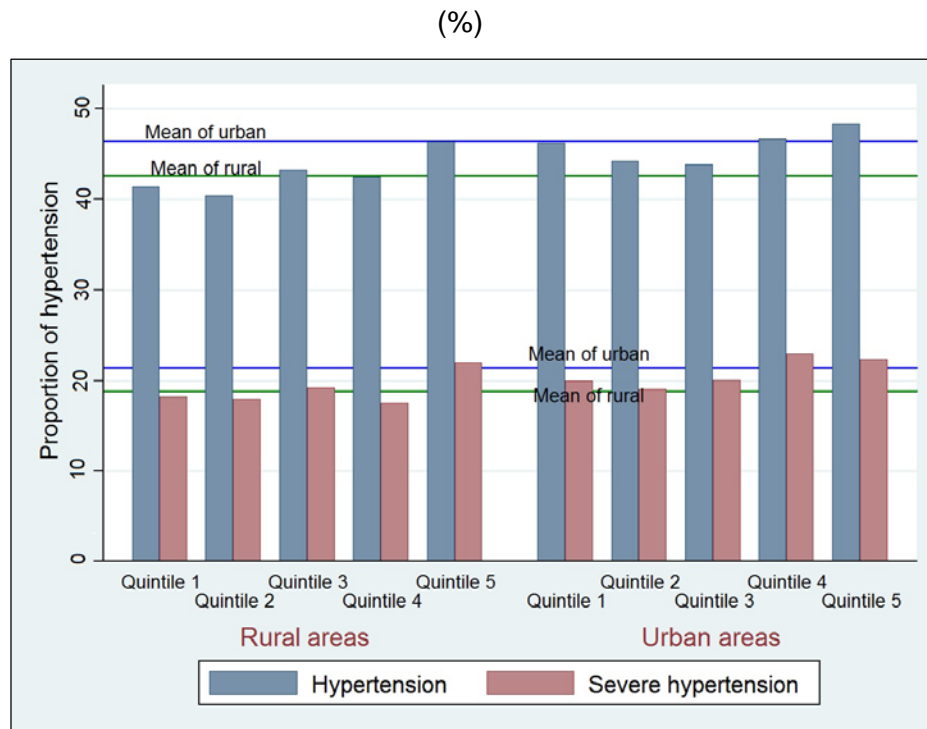
Hypertension Type	Definition	
	Systolic (mmHg)	Diastolic (mmHg)
Hypertension	≥ 140	≥ 90
Severe hypertension	≥ 160	≥ 100

mmHg = millimeters of mercury.

Source: Authors.

We separate the whole sample into rural and urban groups. Figure 2 shows the average rate of people with hypertension across quintile levels of household wealth in rural and urban areas. In rural areas, the figure suggests that hypertension is slightly more prevalent among the wealthy, but quintile 2 and quintile 4 have lower rates compared to their neighboring poorer quintiles. For severe hypertension, we find a similar pattern where hypertension increases with wealth, but with some exceptions. In urban areas, interestingly, the prevalence of hypertension shows a U-shape relationship, which means that the poorest and the wealthiest have a higher probability of suffering from hypertension. For severe hypertension we cannot find a consistent strong wealth-related gradient of hypertensive conditions.

Figure 2: Proportion of People with Hypertension Aged over 39 in Rural and Urban Areas



Source: Authors.

Sample means of the proportion of hypertension are shown in Table 2. People in urban regions have a higher probability of having hypertension (0.47 vs. 0.43, $p < 0.01$) and severe hypertension (0.22 vs. 0.19, $p < 0.01$). For health care utilization, urban districts have lower rates of underdiagnosis and undermedication than rural districts and their

differences are statistically significant at the 1% level. We will closely look at these differences in the following subsections.

Table 2: Descriptive Statistics

Conditions	All			Rural			Urban		
	Obs	Mean	Std. dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Hypertension	11,217	0.45	0.50	5,544	0.43	0.50	5,673	0.47	0.50
Severe hypertension	11,217	0.20	0.40	5,544	0.19	0.39	5,673	0.22	0.41
Underdiagnosis of hypertension	4,665	0.68	0.46	2,208	0.72	0.45	2,457	0.65	0.48
Underdiagnosis of severe hypertension	2,072	0.55	0.50	969	0.61	0.49	1,103	0.50	0.50
Undermedication for hypertension	5,054	0.95	0.22	2,389	0.97	0.17	2,665	0.93	0.25
Undermedication for severe Hypertension	2,298	0.92	0.27	1,065	0.95	0.21	1,233	0.89	0.31

Source: Authors.

2.3 Diagnosis and Medication

2.3.1 Underdiagnosis

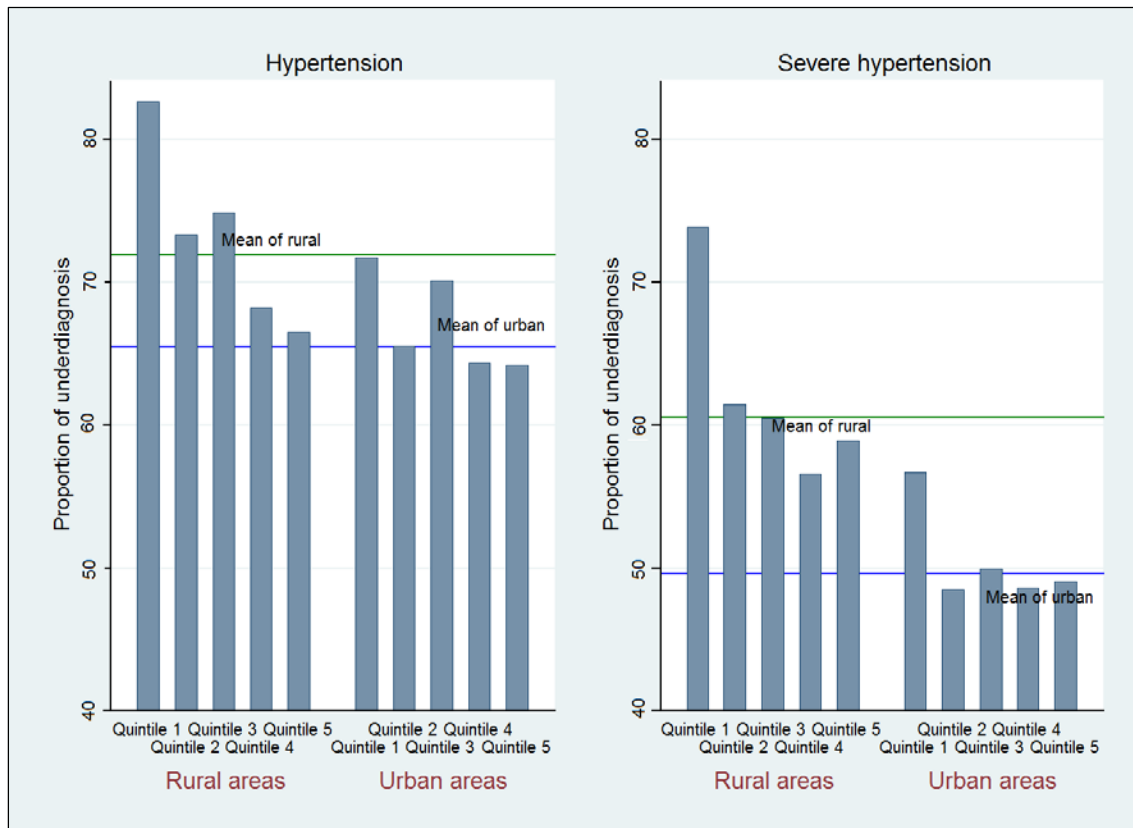
Access to health care and utilization of health services are typically not equally provided to everybody in Indonesia. Figure 3 (left-hand side) illustrates the proportion of people that are underdiagnosed with hypertension across quintile levels of household wealth in rural and urban areas. The results are rather striking. In rural Indonesia, 72% of those who suffer from hypertension go undiagnosed. In urban areas the percentage falls to around 65%. The rate of underdiagnosis in urban areas is thus significantly lower compared to rural areas ($p < 0.01$), which provides first evidence that urban areas facilitate access to health care services. Severe hypertension (right-hand side of Figure 3) remains also very much underdiagnosed in Indonesia. In rural areas, more than 60% of severely hypertensive patients remain undiagnosed. In urban areas, the percentage drops to less than 50%. We thus find again a health advantage for urban dwellers in terms of diagnosis.

When we study the health inequality in terms of underdiagnosis, we find that better-off groups are less likely to remain undiagnosed. In other words, the more wealth a person possesses, the more likely it is that she/he will undergo medical checkups regularly and thus hypertension is more likely to be detected at an early stage. In Figure 3 we can see that the proportion of underdiagnosed hypertension lies above 82% in the poorest quintile in rural areas, whereas about two thirds of people in the highest quintile are likely to be undiagnosed. When studying the problem of underdiagnosis of hypertension in the urban areas, we also find differences across wealth groups, however, these are less pronounced than in rural areas and the overall level of underdiagnosis is lower.

For severe hypertension the social gradient is similar. Whereas 73% of rural residents in the lowest wealth group remain undiagnosed despite suffering from severe hypertension, the proportion drops to less than 60% for the highest wealth groups. In urban centers the respective probabilities are 66% and 58%. Overall, we thus find evidence that residing in urban areas increases the chance of being diagnosed for hypertension. As for health inequality, our analysis shows that in urban centers health inequality is similar in rural areas, suggesting the possibility that urbanization could help to improve access to necessary health care without sacrificing the equality of

health care utilization. The degree of inequality will be measured and discussed in detail in Section 4.

Figure 3: Proportion of Underdiagnosed People in Rural and Urban Areas
(%)



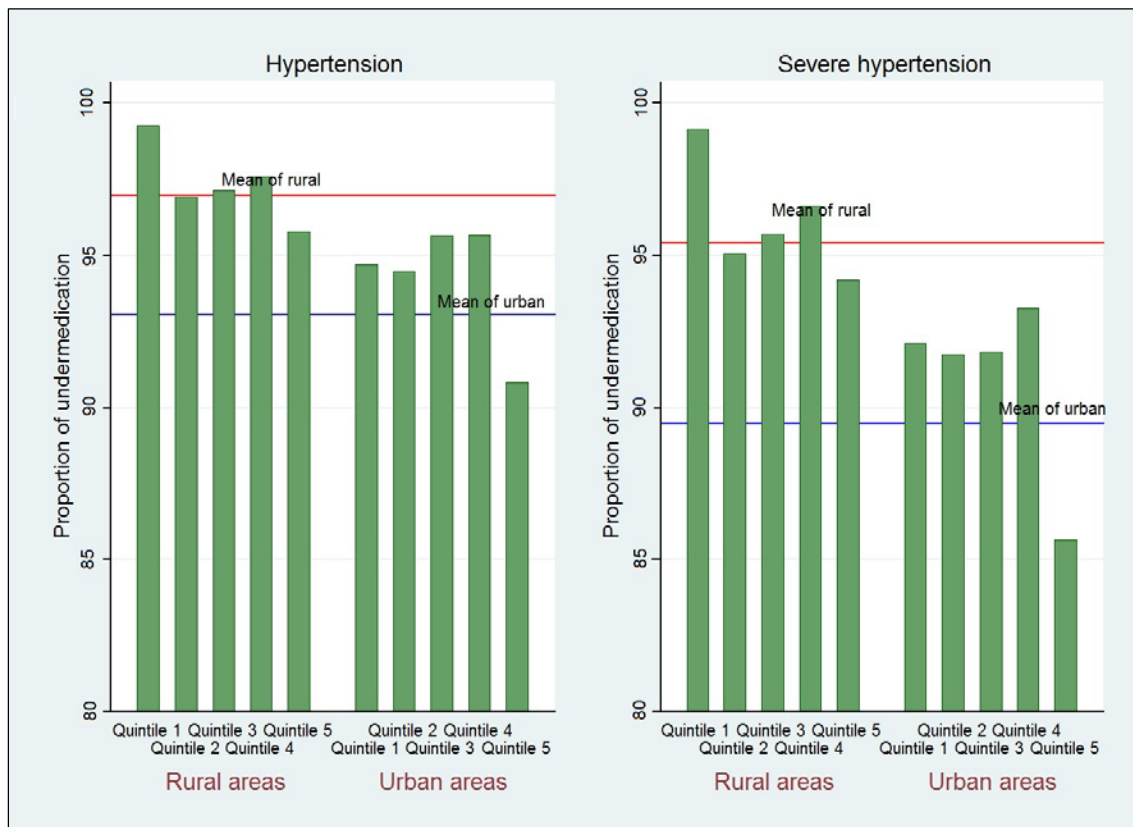
Source: Authors.

2.3.2 Undermedication

We define undermedication as the case where people do not take any medicine for hypertension, despite being hypertensive. Figure 4 shows the case for undermedication. Among hypertensive people overall (left side of Figure 4), undermedication is seen more frequently among the lower wealth groups. In rural areas, almost 98% of hypertensive patients do not take any medication. This percentage drops to 96% for the richest quintile. In urban areas, the percentages are 94% and 91%, respectively. In urban neighborhoods, the percentage of undermedicated people is thus lower than that in rural counterparts on average and the difference is statistically significant ($p < 0.01$).

The right side of Figure 4 shows the case for severe hypertension. We see again that people in the lowest wealth quintile rarely take medication. Patients in higher wealth groups with severe hypertension tend to take medicine more often. However, even the richest quintile is less likely to take medicine compared to the poorest quintile in urban areas, which is a compelling result. In urban areas the problem of undermedication falls as we move toward wealthier groups (except quintile 4). Overall, we observe that for the case of severe hypertension, the gap of the average of the undermedication rate between rural and urban regions is larger than for general hypertension.

Figure 4: Proportion of People Not Taking Medicine for Hypertension in Rural and Urban areas
(%)



Source: Authors.

2.4 Regression Analysis

This subsection studies the socioeconomic determinants of the hypertensive condition and its treatment using a simple regression analysis. Estimating a probit model with province cluster covariance estimators, we regress the three binary variables (hypertensive condition, underdiagnosis, and undermedication) on demographic factors, insurance subscription, educational achievement, province dummies, and wealth. The estimations yield compelling results, which are summarized in Table 3. First, age shows a positive significant effect on hypertension and severe hypertension (columns 1 and 2). At the same time, age lowers the probability of letting hypertension go untreated (column 3-6).

Our estimations further indicate that women are more likely to be hypertensive ($p < 0.01$), but less likely to forgo their diagnosis ($p < 0.01$). People living in urban regions are more likely to suffer from hypertension than those who reside in rural regions by 3.2% ($p < 0.01$), but the result shows that urban people are more likely to be diagnosed by 4.3% ($p < 0.01$) and take medicine for hypertension by 3.1% ($p < 0.01$). Married people tend to be diagnosed appropriately more than single or divorced people (column 4, $p < 0.01$), but a significant difference between them was not found for medication. As it is well known, obese people are more likely to suffer from hypertension ($P < 0.01$), but we cannot find significant relationship between obesity and diagnosis/medication. Furthermore, those who subscribe to insurance are more likely to take medicine by

1.7% ($p < 0.01$) and 2.5% ($p < 0.05$) for hypertension and severe hypertension, respectively. Insurance also shows significance for undermedication (column 3).

Second, the results show the crucial relationship between education and undergoing medical treatment. Particularly, fundamental education, such as primary school education and junior high school education, significantly lessens the probability of forgoing diagnosis of hypertension by 7.4% ($p < 0.01$) and 9.5% ($p < 0.01$), respectively. The significant effect of primary education on the reduction of undermedication for general hypertension is also confirmed (column 5). Secondary education shows significance for undermedication (column 5, $p < 0.05$). Tertiary education, on the other hand, only shows significance at the 10% level for undermedication. These results imply the role of primary education in raising the awareness of people to seek diagnosis and take antihypertensive medicine.

Finally, in our results, wealth is a determinant of the hypertensive condition. At the same time it significantly influences the likelihood of undergoing treatment. The more wealthy the household, the more likely the person is to be diagnosed and treated. In other words, the decision to utilize medical services is influenced by a household's financial situation. We thus find that wealth, as an accumulation of income, is a source of inequality in health care utilization.

While the regression analysis clarifies the importance of insurance and education in promoting the diagnosis and medication for people with hypertension and shows evidence of the existence of socioeconomic inequality in medical treatment, it does not yield a measurement of the degree of inequality in health care utilization. The following sections of the paper gauge the degree of wealth-related inequality of health care utilization by calculating the concentration index.

Table 3: Regression Results for Hypertension and Its Treatment

	(1) Hypertension	(2) Severe hypertension	(3) Underdiagnosis for hypertension	(4) Underdiagnosis for severe hypertension	(5) Undermedication for hypertension	(6) Undermedication for severe hypertension
Age	0.0109*** (0.000501)	0.00761*** (0.000356)	-0.00410*** (0.000948)	-0.00362** (0.00143)	-0.00197*** (0.000303)	-0.00219*** (0.000762)
Male	-0.0416*** (0.0133)	-0.0617*** (0.00992)	0.166*** (0.0138)	0.157*** (0.0221)	0.0106 (0.00705)	-0.00313 (0.0155)
Urban	0.0324** (0.0128)	0.0242** (0.00952)	-0.0430*** (0.0141)	-0.0806*** (0.0202)	-0.0311*** (0.00611)	-0.0556*** (0.0155)
Married	-0.0372*** (0.00696)	-0.00715 (0.00634)	-0.0296 (0.0181)	-0.0616** (0.0297)	0.00694 (0.00957)	0.00299 (0.0186)
Obesity	0.185*** (0.0194)	0.0903*** (0.0228)	-0.0228 (0.0200)	0.0190 (0.0270)	-0.00962 (0.00836)	-0.0111 (0.0205)
Insurance	0.0115 (0.0121)	0.0185** (0.00799)	-0.0524*** (0.0184)	-0.0299 (0.0249)	-0.0174*** (0.00583)	-0.0245* (0.0129)
Tertiary education	0.0212 (0.0205)	-0.00112 (0.0148)	0.00445 (0.0576)	0.0566 (0.0566)	-0.0203* (0.0119)	-0.0382* (0.0219)
Secondary education	-0.0146 (0.0153)	-0.0106** (0.00533)	0.0154 (0.0183)	0.0231 (0.0407)	-0.0171** (0.00706)	-0.00205 (0.0161)
Primary education	-0.0154 (0.0194)	0.00369 (0.0136)	-0.0745*** (0.0196)	-0.0945*** (0.0246)	-0.0179** (0.00832)	-0.0169 (0.0126)
ln(Wealth)	0.00710** (0.00355)	0.00328 (0.00375)	-0.0145** (0.00629)	-0.0153 (0.00971)	-0.00446* (0.00263)	-0.0102** (0.00457)
Observations	9165	9157	3980	1755	3703	1649

Notes: Standard errors are in parentheses.

Standard errors are cluster robust to heteroskedasticity.

Estimations include province fixed effects (not reported in the table).

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Age: age of the respondent; Male: a sex dummy; Urban: a dummy that becomes 1 if a respondent lives in an urban district; Married: a marital status dummy equal to 1 if a respondent is married; Obesity: a dummy that becomes 1 if a respondent's body mass index exceeds 30; Insurance: a health insurance subscription dummy that becomes 1 if a respondent subscribes to health insurance; Tertiary education, Secondary education, and Primary education: educational background dummies that equal 1 if a respondent completed those schooling levels; ln(wealth): the logarithmic amount of family-size adjusted wealth of a household.

Source: Authors.

3. METHODOLOGY OF THE MEASUREMENT OF INEQUALITY

3.1 The Concentration Curve and the Concentration Index

The measurement of inequality in health care utilization in this paper is based on the concentration curve and the concentration index. The concentration curve is also known as a generalized Lorenz curve and its main difference from the Lorenz curve is that people are ranked by their socioeconomic status, not by their health conditions. The concentration curve plots the cumulative percentage of the health variable against the cumulative percentage of the population ranked from poorest to richest (Kakwani 1977; Kakwani, Wagstaff, and van Doorslaer 1997; Wagstaff, Paci, and van Doorslaer 1991).

The concentration index is then calculated in the same way as the Gini coefficient. The differences between the Lorenz curve and the concentration curve, and between the

Gini coefficient and the concentration index are succinctly explained by Carr-Hill and Chalmers-Dixon (2005). The most important difference is that while the Gini coefficient ranges from 0 to 1 (0 means perfect equality and 1 represents perfect inequality), the concentration index ranges from -1 to 1 . If health is equally distributed, the concentration curve coincides with the 45-degree line and the index becomes 0. If the index for health is negative, then it means that poorer groups are disproportionately affected by certain health conditions compared to advantaged groups. For example, stunting of growth in children is typically more prevalent among poorer groups than among wealthier groups. If the index is positive, then it means that higher-income groups are relatively more likely to suffer from certain health conditions. In our paper, one of the health variables is health care utilization. As we have seen above, we find that wealthier groups are more likely to seek medical diagnosis and treatment.

The concentration index can be calculated simply by equation (1) or alternatively it can be obtained from the coefficient of regression equation (2). For the derivation of equation (2), see Wagstaff, van Doorslaer, and Watanabe (2003) and Kakwani, Wagstaff, and van Doorslaer (1997).

Equation (1) and (2) are as follows:

$$CI = \frac{2}{N\mu} \sum_{i=1}^n h_i r_i - 1 \quad (1)$$

where h_i is the health index of individual i , μ is its mean. $r_i = i/N$ is the fractional rank of individual i in economic status based on household wealth.

$$2\sigma_r^2 \left(\frac{h_i}{\mu} \right) = \alpha + CIr_i + \varepsilon_i \quad (2)$$

where σ_r^2 is the variance of the fractional rank. The coefficient of the rank is an estimate of the concentration index, which is numerically equivalent to the value from equation (1) (O'Donnell et al. 2008).

People in urban and rural regions are likely to have different demographic characteristics, which may confound the estimate. In our samples, urban regions have younger residents than rural ones ($p < 0.01$), and the difference of the male–female ratio between regions does not show statistical significance at the 5% level. Equation (3) yields the demographic standardized concentration index, which controls for the difference of the age and sex structures (O'Donnell et al. 2008).

$$2\sigma_r^2 \left(\frac{h_i}{\mu} \right) = \gamma + \widetilde{CI}r_i + \sum_j \delta_j x_{ji} + v_i \quad (3)$$

where the estimated \widetilde{CI} is called the indirectly standardized concentration index, which is obtained after controlling for confounding demographic effects, x_{ji} , such as sex and age.

When the health outcome is a binary or cardinal variable, it is known that the feasible range of values that the index can take shrinks as the mean of the outcome value increases (Wagstaff 2005). In this paper we provide both the original concentration index and the normalized concentration index proposed by Erreygers (2009a). Equation (4) is the normalized index introduced by Erreygers (2009a) and calculated as follows;

$$\widetilde{\widetilde{CI}} = \frac{4\mu}{b-a} \widetilde{CI} \quad (4)$$

where a and b are the lower and upper bounds of the health variable, h_i , respectively.

As the choice of the different indices, ultimately, boils down to an ethical choice between different normative ideas (Fleurbaey and Schokkaert 2012), in this paper, we provide both the original concentration index and the Erreygers concentration index. For more details, see Erreygers, (2009a), Wagstaff (2009) and Erreygers (2009b).

3.2 Decomposition of the Concentration Index

Inequalities in health or in access to health care across the socioeconomic-related distribution can be decomposed into their contributors (Wagstaff, van Doorslaer, and Watanabe 2003). The basic idea is based on the assumption that the inequality of interest stems from inequalities in the determinants of the health variable of interest. For example, the decomposition allows us to answer the following type of question: What is the relative contribution of the inequality of education in explaining the inequality of health care access? The decomposition helps us identify policy areas for intervention to reduce the inequality.

Assume any additive linear regression model of health outcome (h_i), such as

$$h_i = \alpha + \sum_k \beta_k x_{ki} + \varepsilon_i \quad (5)$$

where x_k is a determinant of h_i .

Wagstaff, van Doorslaer and Watanabe (2003) introduced the following decomposition method:

$$CI = \sum_k \frac{\beta_k \bar{x}_k}{\mu} CI_k + \frac{GCI_\varepsilon}{\mu} \quad (6)$$

The concentration index is decomposed into two parts. The first part is the deterministic component, which is equal to the weighted sum of the concentration indices of the explanatory variables, x_k (CI_k). The weight is the elasticity of the health index in respect to each factor, x_k , which measures the share of variables explaining the concentration index of interest. The product of the elasticity and CI_k reflects the contribution made by x_k . The second part is called the generalized concentration index for residual components (GCI_ε) (O'Donnell et al. 2008). The second part captures the inequality that cannot be explained by x_k . The percentage of the contribution of the inequality in x_k to the inequality in h_i can be calculated as follows:

$$\% \text{ contribution}_{x_k} = \left\{ \frac{\beta_k \bar{x}_k}{\mu} CI_k / CI \right\} * 100 \quad (7)$$

As potential contributing factors, we use the inequalities listed in Table 4. Among these inequalities, our main interest lies in health insurance and education. Both are areas where policy makers could possibly intervene and are actually intervening. In January 2014, the Indonesia government introduced a compulsory national health insurance system with the aim of making basic care available to all by 2019.⁵ As we will see later, our results suggest that the mitigation of health insurance status inequality could indeed improve the equality in health service utilization. We decompose the concentration indices of underdiagnosis and undermedication of hypertension and see how much of them are explained by the inequality of health insurance status and schooling.

⁵ <http://www.theguardian.com/global-development-professionals-network/2015/may/15/indonesias-universal-healthcare-insurance-verdict>

Table 4: Possible Contributing Factors to the Health Inequality

Contributing Factors	Description
Education	Completing elementary school
Living standards	Access to electricity and clean water, possessing a gas stove, access to basic sanitation, vehicles, appliances
Television	Possessing a television
Health insurance	Being a holder/beneficiary of public or private health insurance
Accessibility	Number of health care centers (<i>puskesmas</i>) per 1 million people, minutes to the nearest health care center.

Note: Appliances are radios, tape recorders, refrigerators, sewing or washing machines, video and CD players, hand phones, etc.

The data for number of health care centers (*puskesmas*) were obtained from the Ministry of Health of Indonesia (2010).

Source: Authors.

4. RESULTS

4.1 Concentration Index

The concentration indices for the distribution of underdiagnosis and undermedication of severe hypertensive conditions are shown in Table 5. The normalized concentration index is created by adjusting the boundary of the index by the method proposed by Erreygers (2009a). We only present the results for the case of severe hypertension. One reason for this is that some people suffering from moderate hypertension are not told to take hypertensive medicine. Furthermore, untreated severe hypertension is far more perilous, and people suffering from it are strongly recommended to undergo a proper diagnosis and to take antihypertensive medicine. For underdiagnosis, the concentration index shows a negative value, which suggests evidence that underdiagnosis is more frequently found among the poor. Dividing the sample into two subsamples, rural and urban, reveals that the urban sample shows the smaller degree of inequality. For undermedication, the concentration index calculated from the data in all regions has a negative value with a small standard error, implying the existence of inequality, but the degree of inequality is smaller than the inequality found for underdiagnosis. When we next look at the two subsamples, the index for urban areas shows a larger absolute value than the value calculated from the rural sample, indicating a higher degree of health inequality in the medication of hypertension.

To sum up, overall, the results show that wealthier groups enjoy a higher probability of being diagnosed by a health care professional and taking medicine for hypertension than patients in lower wealth groups. To put it another way, the poor are more likely to forego diagnosis and to let hypertension go untreated. When we look at the subsample results, we find evidence for larger inequality in access to diagnosis in rural areas. Urbanization can thus help provide better access to medical services for those who need it and mitigate health inequality in diagnosis. However, urbanization does not seem to help to reduce the inequality in terms of undermedication. We find higher levels of inequality in urban areas compared to rural areas.

Table 5: Concentration Index of Underdiagnosis and Undermedication for Severe Hypertension

Outcome	Areas	Concentration index	Standard error	Erreygers CI	Standard error
Underdiagnosis	All	-0.0391	0.0150	-0.084	0.032
	Rural	-0.0370	0.0190	-0.088	0.045
	Urban	-0.0219	0.0233	-0.043	0.046
Undermedication	All	-0.0149	0.0050	-0.055	0.019
	Rural	-0.0042	0.0055	-0.016	0.021
	Urban	-0.0196	0.0082	-0.070	0.029

CI = concentration index

Source: Authors.

4.2 Decomposition

Finally, we decompose the inequality in the diagnosis and medication of severe hypertension and discuss the differences of the contributing factors between rural and urban regions. Figure 5 shows the contributing factors to the inequality of diagnosis and medication for severe hypertension. Detailed information of the components of the factors is reported in Table 6 and Table 7, respectively. Tables 6 and 7 list in detail all the variables used for the decomposition analysis. We observe that all factors have a positive concentration index except for distance to health care centers.

The decomposition of the inequality of diagnosis illustrates that most of the inequality can be explained by the inequalities in the living standards. Nevertheless, the inequality in schooling still explains around 9.9% of the inequality in diagnosis. It thereby yields evidence that expanding the opportunity to complete primary education for less advantaged groups can potentially mitigate the inequality in diagnosis. A more equal chance to have basic education could reduce health inequality, and its relative effectiveness is larger in urban areas compared to rural areas. Our estimations further show that inequality in possessing a television accounts for a considerable share of the inequality in diagnosis. We might conjecture that being able to watch TV might help to gain insights into healthy lifestyles. However, before making a conclusive statement, more research is needed to fully understand the role of TV in creating health inequities.

The inequality in health insurance fails to explain the inequality in diagnosis, which implies that the inequality in health insurance does not exacerbate the inequality in diagnosis of hypertension. This is because of the positive association (positive elasticity value) between underdiagnosis and health insurance.

Inequality in access to medical facilities turns out to be one of the largest contributors to inequality in diagnosis. Its contribution is larger in urban regions; the inequality in the number of health centers per 1 million people and in distance explains 16.3% of the inequality in underdiagnosis seen in the regions.

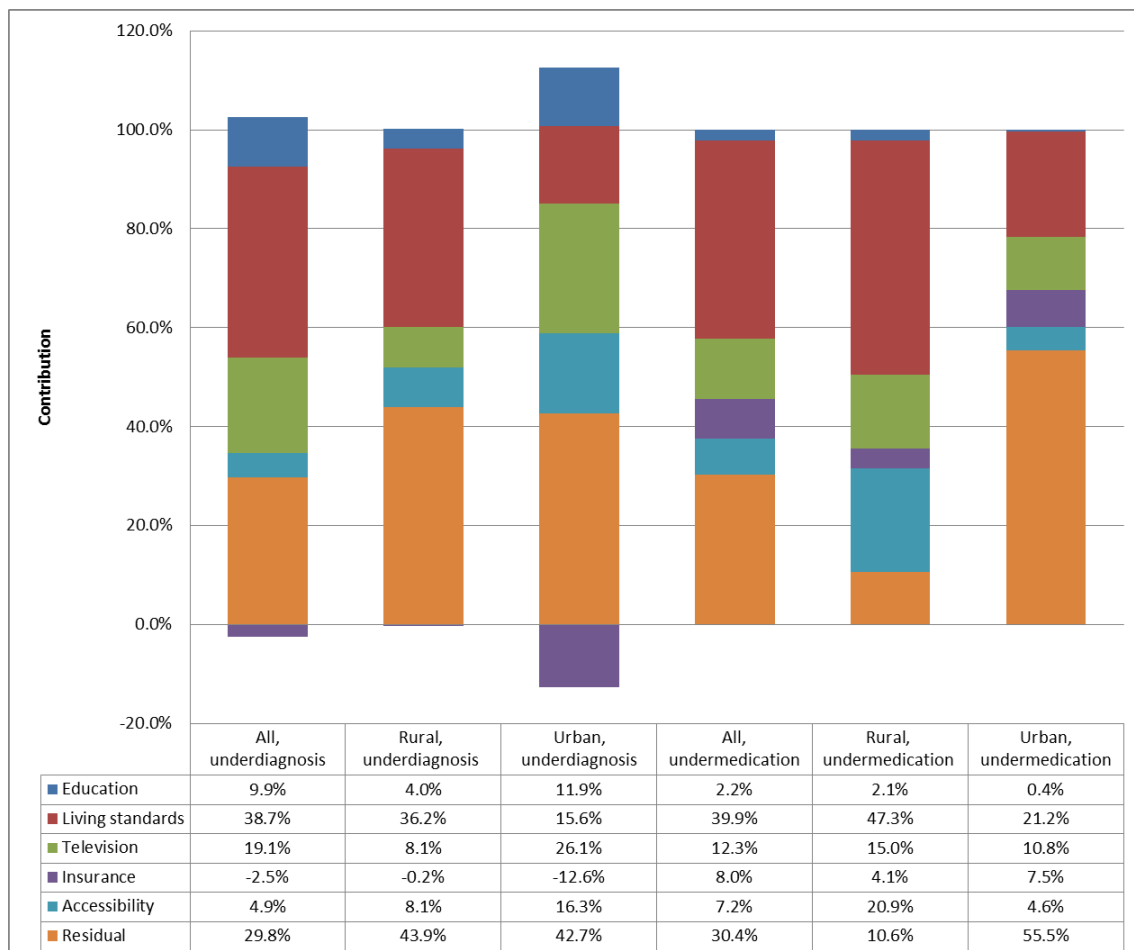
The three, right-hand bars in Figure 7 show the decomposition results for undermedication. As we have seen in the decomposition analysis for underdiagnosis, inequality in living standards is the major factor contributing to the inequality of undermedication. An obvious implication of this result is that improving the overall living conditions of the poor could be an effective way to reduce the unequal distribution of diagnosis and medication.

Similar to the inequality of diagnosis, the inequality in medication can be attributed partially to the unequal distribution of primary education. As argued above for the case of underdiagnosis, giving the opportunity to receive primary education to everyone seems to be an appropriate measure to lessen the inequality in medication. However, its proportion is now smaller compared to the case of underdiagnosis. In the case of medication, we do find a significant effect of health insurance. The inequality in health insurance subscription explains around 4.1% and 7.5% of the inequality in medication in rural and urban neighborhoods, respectively. Establishing social health insurance that makes health insurance compulsory for everyone could thus mitigate the inequality in medication.

Furthermore, our estimations uncover that some proportion of inequality in medication can be explained by the inequality in access to health care centers. Its degree is more prominent in rural regions and it explains 20.9% of the concentration index of undermedication.

Finally, it has to be noted that the parts not explained by the above factors are treated as residuals, which reflect the inequality due to the amount of wealth and other factors that are not included in the decomposition process. The urban area has a much larger residual for undermedication, probably because there are more urban-specific factors contributing to the urban inequality in medication, such as housing conditions, which we are unable to incorporate in our model.

Figure 5: Decomposition of the Inequality in Diagnosis and Medication



Source: Authors.

Table 6: Decomposition Detailed Results for Diagnosis

Individual contributing factors	Total				Rural				Urban			
	Elasticity	CI	Contribution	Contribution %	Elasticity	CI	Contribution	Contribution %	Elasticity	CI	Contribution	Contribution %
Primary education	-0.099	0.039	-0.0039	9.89%	-0.095	0.015	-0.0015	3.96%	-0.062	0.042	-0.0026	11.90%
Access to electricity	-0.151	0.016	-0.0024	6.04%	-0.130	0.019	-0.0025	6.80%	-0.095	0.008	-0.0007	3.34%
Gas stove	0.001	0.116	0.0002	-0.40%	0.001	0.093	0.0001	-0.28%	0.020	0.065	0.0013	-5.96%
Clean water access	-0.014	0.435	-0.0062	15.73%	-0.012	0.575	-0.0070	18.90%	-0.010	0.332	-0.0034	15.43%
Basic sanitation	-0.012	0.197	-0.0024	6.17%	0.005	0.432	0.0020	-5.39%	0.001	0.080	0.0001	-0.31%
Vehicle	0.001	0.120	0.0001	-0.35%	-0.050	0.093	-0.0047	12.64%	0.087	0.106	0.0092	-42.09%
Appliances	-0.104	0.043	-0.0045	11.52%	-0.037	0.035	-0.0013	3.49%	-0.274	0.036	-0.0099	45.21%
Television	-0.072	0.104	-0.0075	19.14%	-0.027	0.111	-0.0030	8.05%	-0.076	0.075	-0.0057	26.13%
Insurance	0.010	0.095	0.0010	-2.47%	0.004	0.018	0.0001	-0.20%	0.029	0.094	0.0028	-12.62%
Distance to Puskesmas	-0.007	-0.117	0.0009	-2.22%	-0.013	0.070	-0.0009	2.40%	-0.004	-0.278	0.0012	-5.28%
Number of Puskesmas	-0.238	0.012	-0.0028	7.16%	-0.239	0.009	-0.0021	5.72%	-0.274	0.017	-0.0047	21.58%
Residual			-0.0117	29.80%			-0.0162	43.91%			-0.0093	42.66%
Total			-0.0391	100.00%			-0.0370	100.00%			-0.0219	100.00%

CI = concentration index

Source: Authors.

Table 7: Decomposition Detailed Results for Medication

Individual contributing factors	Total				Rural				Urban			
	Elasticity	CI	Contribution	Contribution %	Elasticity	CI	Contribution	Contribution %	Elasticity	CI	Contribution	Contribution %
Primary education	-0.008	0.039	-0.0003	2.23%	-0.006	0.015	-0.0001	2.13%	-0.002	0.042	-0.0001	0.40%
Access to electricity	-0.026	0.016	-0.0004	2.71%	-0.019	0.019	-0.0004	8.50%	-0.046	0.008	-0.0004	1.82%
Gas stove	0.002	0.117	0.0002	-1.58%	0.002	0.094	0.0002	-5.05%	0.007	0.065	0.0004	-2.19%
Clean water access	-0.004	0.435	-0.0019	12.54%	-0.003	0.575	-0.0018	43.11%	-0.004	0.332	-0.0012	5.99%
Basic sanitation	-0.014	0.198	-0.0029	19.15%	0.002	0.432	0.0008	-18.90%	-0.026	0.080	-0.0021	10.51%
Vehicle	-0.002	0.120	-0.0002	1.52%	-0.004	0.094	-0.0004	9.91%	0.004	0.106	0.0004	-2.16%
Appliances	-0.019	0.043	-0.0008	5.59%	-0.012	0.034	-0.0004	9.75%	-0.039	0.036	-0.0014	7.23%
Television	-0.018	0.104	-0.0018	12.32%	-0.006	0.112	-0.0006	14.96%	-0.028	0.075	-0.0021	10.78%
Insurance	-0.012	0.095	-0.0012	7.96%	-0.009	0.019	-0.0002	4.08%	-0.016	0.094	-0.0015	7.53%
Distance to Puskesmas	-0.002	-0.117	0.0003	-1.95%	0.001	0.071	-0.0001	-1.53%	-0.005	-0.278	0.0013	-6.78%
Number of Puskesmas	-0.118	0.012	-0.0014	9.17%	-0.112	0.008	-0.0009	22.41%	-0.129	0.017	-0.0022	11.38%
Residual			-0.0045	30.35%			-0.0005	10.63%			-0.0109	55.48%
Total			-0.0149	100.00%			-0.0042	100.00%			-0.0196	100.00%

CI = concentration index

Source: Authors.

5. DISCUSSION AND CONCLUSION

In this paper, we measure the inequality of health care utilization in terms of the diagnosis of hypertension and its medication. Developing countries face increasing levels of hypertension and in parallel an increase in chronic diseases. Indonesia is no exception. In our paper we find evidence that hypertension is inadequately addressed in Indonesia. More than half of the people with hypertension have never been diagnosed and only a small fraction of people are taking medicine against raised blood pressure. In the People's Republic of China, by contrast, the proportion of people who are diagnosed and take medication is reported to be 75%–80%, which is much higher than Indonesian people (Witoelar, Strauss, and Sikoki 2009).

Our research produced several new insights. First, on the difference between rural and urban areas in terms of access to health care we find that underdiagnosis of hypertension in urban areas is significantly lower than those in rural areas, implying that urban areas offer better access to health care services. Furthermore, hypertension goes untreated less often in urban areas compared to rural areas, suggesting that access to medication is also easier in urban areas. Second, as for the health care inequalities, our study shows that underdiagnosis of hypertension is more prevalent among the less wealthy groups. These results highlight the risk that poor households face: Undiagnosed severe hypertension enhances the risk of life-threatening complications, including coronary heart disease, stroke, kidney failure, etc. Several of these conditions can lead to sudden death or catastrophic health expenditures. Lower

wealth groups are thus confronted with a higher risk of facing extremely high medical expenditures, which further impoverishes them and keeps them in poverty.

As for the health inequality in terms of medication against hypertension, we are unable to find strong evidence of health inequality. Our results indicate that most of the Indonesian people with hypertension do not take medicine no matter how wealthy they are. In other words, Indonesians are equally not taking medicine against hypertension. Our survey shows that 92% of people who are severely hypertensive do not treat their hypertension with medicine. Since the difference in the rate of not taking medicine is extremely low across all groups, we could not find strong socioeconomic related variations.

Finally, the decomposition analysis reveals that most of the inequality of health care utilization is due to different living conditions and accessibility to health care centers (*puskesmas*). Increasing living conditions and improving access to health care centers are two obvious areas for mitigating health inequities. We also find from the regression analysis that completing primary education raises the probability of being diagnosed (Table 3). A more equal distribution of education would also help to mitigate the inequality in health care utilization. Our study also provides evidence that the rollout of a general health insurance system contributes to the mitigation of the inequality in medication. As the universal health care system in Indonesia is currently in the making, there is hope that the development of universal health insurance would help to further lessen the inequality in medication.

Our research illustrates that urbanization can help to improve access to health services. As this paper offers evidence only for the care of hypertension diagnosis and its medication, further research is needed to generalize this statement. Urbanization could lessen the number of people who go underdiagnosed, without exacerbating the inequality in diagnosis. However, our results indicate that urbanization might make the inequality in medication slightly worse, although it would help to improve the underdiagnosis. Again, more research for other health conditions is needed to study this issue.

Despite the fact that urbanization could improve healthcare access, it cannot be a panacea to improve health, especially for the prevalence of the treatment of hypertension. As alluded to in the beginning, urbanization often goes hand-in-hand with a less healthy lifestyle and more exposure to unhealthy living conditions, such as air pollution or overcrowding. For the case of Indonesia, we found that the rates of hypertension are slightly higher in urban areas ($p < 0.01$). The health benefits of urbanization are thus unclear. Worse health conditions of urban dwellers might be outweighed by better access to health care services and possibly medication. More research is needed to better understand how to make urbanization beneficial for public health.

Promoting people with hypertensive conditions to have necessary diagnoses and take medicine *pro re nata* will be one of the essential policies for the government in Indonesia to reduce the future runaway cost of health care and ameliorate the equity of health of the population, as early detection and appropriate treatment is considerably less costly both for patients and the country than the treatment of complications due to untreated hypertension.

REFERENCES*

- Barraza-Lloréns, M., G. Panopoulou, and B. Y. Díaz. 2013. Income-related Inequality in Health and Health Care Utilization in Mexico, 2000-2006. *Rev Panam Salud Publica* 33(2): 122–130.
- Carr-Hill, R., and P. Chalmers-Dixon. 2005. *The Public Health Observatory Handbook of Health Inequalities Measurement*. Oxford, UK: South East England Public Health Observatory.
- Christiani, Y., J. E. Byles, M. Tavener, and P. Dugdale. 2015. Assessing Socioeconomic Inequalities of Hypertension among Women in Indonesia's Major Cities. *Journal of Human Hypertension* 29(11): 1–6.
- Colhoun, H., H. Hemingway, and N. R. Poulter. 1998. Socio-economic Status and Blood Pressure: An Overview Analysis. *Journal of Human Hypertensions* 12: 91–110.
- Deaton, A. 2013. *The Great Escape: Health, Wealth, and the Origins of Inequality*. New Jersey: Princeton University Press.
- Dorjdagva, J., E. Batbaatar, B. Dorjsuren, and J. Kauhanen. 2015. Income-related Inequalities in Health Care Utilization in Mongolia, 2007/22008-2012. *International Journal for Equity in Health* 14: 57.
- Dye, C. 2008. Health and Urban Living. *Science* 319: 766–769.
- Erreygers, G. 2009a. Correcting the Concentration Index. *Journal of Health Economics* 28: 504–515.
- Erreygers, G. 2009b. Correcting the Concentration Index: A Reply to Wagstaff. *Journal of Health Economics* 28: 521–524.
- Fleurbaey, M. and E. Schokkaert. 2012. Equity in Health and Health Care. In *Handbook of Health Economics, Volume 2*, edited by M. V. Pauly, T. G. McGuire, and P. P. Barros. North Holland: Elsevier.
- Guardian. 2015. Indonesia's Universal Health Scheme: One Year On, What's the Verdict? <http://www.theguardian.com/global-development-professionals-network/2015/may/15/indonesias-universal-healthcare-insurance-verdict> (retrieved 01 December 2015).
- Gulliford, M. G., D. Mahabir, and B. Rocke. 2004. Socioeconomic Inequalities in Blood Pressure and its Determinants: Cross-sectional Data from Trinidad and Tobago. *Journal of Human Hypertension* 18: 61–70.
- Kakwani, N. 1977. Measurement of Tax Progressivity: An International Comparison. *The Economic Journal* 87(345): 71–80.
- Kakwani, N., A. Wagstaff, E. van Doorslaer. 1997. Socioeconomic Inequalities in Health: Measurement, Computation, and Statistical Inference. *Journal of Econometrics* 77: 87–103.
- Lim, S. S., et al. 2012. A Comparative Risk Assessment of Burden of Disease and Injury Attributable to 67 Risk Factors and Risk Factor Clusters in 21 Regions,

* The Asian Development Bank Refers to China by the name People's Republic of China.

- 1990-2010: A Systematic Analysis for the Global Burden of Disease Study 2010. *Lancet* 380: 2224–2260.
- Macinko, J., and M. F. Lima-Costa. 2012. Horizontal Equity in Health Care Utilization in Brazil, 1998-2008. *International Journal for Equity in Health* 11: 33.
- Mendez, M. A., R. Cooper, R. Wilks, A. Luke, and T. Forrester. 2003. Income, Education, and Blood Pressure in Adults in Jamaica, a Middle-income Developing Country. *International Journal of Epidemiology* 32: 400–408.
- O'Donnell, O., E. van Doorslaer, A. Wagstaff, and M. Lindelow. 2008. Analyzing Health Equity Using Household Survey Data: A Guide to Techniques and Their Implementation. Washington, DC: World Bank.
- Popkin, B. M. 2001. The Nutrition Transition and Obesity in the Developing World. *The Journal of Nutrition* 131: 871S–873S.
- Popkin, B. M., and S. Du. 2003. Dynamics of the Nutrition Transition toward the Animal Foods Sector in China and its Implications: A Worried Perspective. *The Journal of Nutrition* 133: 3898S–2906S.
- Stiglitz, J. E., A. Sen, and J. P. Fitoussi. 2010. *Mis-measuring Our Lives: Why GDP Doesn't Add Up*. New York: The New Press.
- United Nations. 2014. *World Urbanization Prospects: The 2014 Revision*. New York: United Nations Department of Economic and Social Affairs.
- Van de Poel, E., O. O'Donnell, and E. van Doorslaer. 2007. Are Urban Children Really Healthier? Evidence from 47 Developing Countries. *Social Science and Medicine* 65: 1986–2003.
- Van de Poel, E. O. O'Donnell, E. van Doorslaer. 2009. Urbanization and the Spread of Diseases of Affluence in China. *Economics and Human Biology* 7: 200–216.
- Van den Berg, G., M. van Eijnden, F. Galindo-Garre, T. G. M. Vrijkotte, and R. J. B. J. Gemke. 2013. Explaining Socioeconomic Inequalities in Childhood Blood Pressure and Prehypertension, The ABCD Study. *Hypertension* 61: 35–41.
- Van Doorslaer, E., X. Koolman, and A. M. Jones. 2004. Explaining Income-related Inequalities in Doctor Utilization in Europe. *Health Economics* 13: 629–647.
- Wagstaff, A. 2005. The Bounds of the Concentration Index when the Variable of Interest Is Binary, with an Application to Immunization Inequality. *Health Economics* 14(4): 429–432.
- Wagstaff, A. 2009. Correcting the Concentration Index: A Comment. *Journal of Health Economics* 28: 516–520.
- Wagstaff, A., E. van Doorslaer. 2000. Measuring and Testing for Inequity in the Delivery of Health Care. *Journal of Human Resources* 35(4): 716–733.
- Wagstaff, A., E. van Doorslaer, and N. Watanabe. 2003. On Decomposing the Causes of Health Sector Inequalities, with an Application to Malnutrition Inequalities in Vietnam. *Journal of Econometrics* 112(1): 207–223.
- Wagstaff, A., P. Paci, and E. van Doorslaer. 1991. On the Measurement of Inequalities in Health. *Social Science and Medicine* 33(5): 545–557.
- Witoelar, F., J. Strauss, and B. Sikoki. 2009. Socioeconomic Success and Health in Later Life: Evidence from the Indonesia Family Life Survey. RAND Labor and Population working paper series WR-709. Available at: <http://ssrn.com/abstract=1677456>

World Health Organization (WHO). 2013. A Global Brief on Hypertension: Silent Killer, Global Public Health Crisis. World Health Day 2013.