p-ISSN 2086-6380
e-ISSN 2548-7949

**Jurnal Ilmu Kesehatan Masyarakat, Jul 2020, 11(2):171-184**
DOI: https://doi.org/10.26553/jikm.2020.11.2.171-184
Available online at http://ejournal.fkm.unsri.ac.id/index.php/jikm

# THE RISK OF HYPERTENSION ON THE INCIDENCE OF CORONARY HEART DISEASE IN URBAN AND RURAL COMMUNITIES INDONESIA (LONGITUDINAL ANALYSIS OF IFLS 2007-2014)

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## *ABSTACT*

*Coronary heart disease (CHD) is a leading cause of death globally with a mortality rate of nearly 17.5 million annually. Hypertension accounts for 31% of all deaths from cardiovascular disease. High blood pressure (hypertension) is one of the main risk factors for CHD which is a serious problem that needs to be addressed in Indonesia and the world. The purpose of this study was to assess the risk of hypertension in the incidence of coronary heart disease in urban and rural communities in Indonesia. This research is using a retrospective cohort study design. The data used are secondary data from the Indonesian Family Life Survey (IFLS-4 and IFLS-5 data for 2007-2014) with a total sample of 22,656 population respondents aged ≥18 years. The Cox regression multivariable method was used to estimate the risk of CHD (RR) and its 95% confidence interval. Multivariate analysis results after adjusting for cholesterol history showed that respondents with hypertension in urban communities were at 1.36 times more risk (95% CI; 1.05-1.77) had coronary heart disease compared to respondents who were not hypertensive/normal in Indonesia 2007-2014. Whereas in rural communities, there was no significant relationship between hypertension and CHD with RR values of 1.07 (95% CI = 0.78-1.48).*

***Keywords:*** *Hypertension, Coronary Heart Disease, Urban and Rural, IFLS*

## ABSTRAK

Penyakit jantung koroner (PJK) merupakan penyebab utama kematian secara global dengan angka kematian hampir 17,5 juta setiap tahunnya. Hipertensi menyumbang 31% dari semua kematian akibat *cardiovascular disease*. Tekanan darah tinggi (hipertensi) adalah salah satu faktor risiko utama PJK yang menjadi masalah serius yang perlu ditangani di Indonesia maupun dunia. Tujuan penelitian ini adalah untuk menilai risiko hipertensi terhadap kejadian penyakit jantung koroner pada masyarakat perkotaan dan pedesaan di Indonesia. Penelitian menggunakan desain studi kohort retrospektif. Data yang digunakan yaitu data sekunder *Indonesian Family Life Survey* (Data IFLS-4 dan IFLS-5 tahun 2007-2014) dengan total sampel 22.656 responden penduduk yang berusia ≥18 tahun. Analisis data dengan *cox regression* dan besar risiko dinyatakan dalam *risk rasio* (RR) dengan *confidence interval* (CI) 95%. Data dianalisis menggunakan *software* pengolah data. Hasil analisis multivariat setelah dikontrol berdasarkan riwayat kolesterol didapatkan bahwa pada masyarakat perkotaan, hipertensi 1.30 kali (95% CI = 1.00-1.68) lebih berisiko mengalami PJK dibandingkan dengan tidak hipertensi, sedangkan pada masyarakat pedesaan, tidak ada hubungan antara hipertensi dan PJK dengan nilai RR 1.07 (95% CI = 0.78-1.48).

**Kata Kunci:** Hipertensi, Penyakit Jantung Koroner, Perkotaan dan Pedesaan, IFLS

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***Received : July 4, 2020 Accepted : July, 30, 2020 Published: July, 31, 2020***

## Introduction

Coronary heart disease (CHD) is the biggest cause of death in developed countries and is one of the main causes of the burden of disease in developing countries.[1] According to the World Health Organization (WHO) that an estimated 17.9 million people died of cardiovascular disease in 2016, representing 31% of all global deaths. Of these deaths, 85% are caused by heart attacks and strokes. More than three-quarters of deaths from cardiovascular disease occur in low and middle-income countries.[2]

Based on the Global Burden of Disease data in 2010 that deaths due to CHD between 1990 and 2010 in Southeast Asia increased to 77.7% ranked third after East and South Asia. Deaths from CHD in China, India, sub-Saharan Africa, Latin America, and the Middle East are expected to increase from 9 million to 19 million in 1990 to 2020.[3] In Indonesia, the burden of non-communicable diseases (NCD) remains a major public health problem. One of the non-communicable diseases that cause death and disability is CHD.[4] CHD in Indonesia continues to increase, according to Riskesdas in 2018, the prevalence of heart disease based on a doctor's diagnosis that is 1.5% has increased compared to the results of Riskesdas 2013 which is 0.5% .[5,6] Based on age groups, the prevalence of heart disease has increased along with the increasingly increasing age, namely respondents aged 15-24 years (0.7%), ages 25-34 years (0.8%), ages 35-44 years (1.3%), ages 45-54 years (2.4%), ages 55-64 years ( 3.9%), age 65-74 years (4.6%), age 75+ (4.7%). Based on residential groups, the prevalence of heart disease in urban areas (1.6%) is higher than in rural areas (1.3%).[5] One of the risk factor is unhealthier lifestyles among urban communities.[7]

Many factors can affect the occurrence of CHD. Modifiable factors such as physical activity, tobacco use, diet, "bad fat" in the blood, hypertension, and obesity; while non-modifiable risk factors include the patient's family history, the presence or absence of diabetes mellitus, and demographic characteristics such as age, sex, ethnicity, and socioeconomic status.[8]

Hypertension is an important risk factor Hypertension accounts for 31% of all deaths from cardiovascular disease. In 2012, around 17.5 million people died and were expected to increase to 1.56 billion adults with hypertension by 2025. High blood pressure (hypertension) is a major risk factor for chronic heart disease, stroke, and coronary heart disease. Increased blood pressure (BP) is positively correlated with the risk of stroke and coronary heart disease. In addition to coronary heart disease and stroke, complications include heart failure, peripheral vascular disease, kidney disorders, retinal bleeding, and vision problems.[9,10]

CHD is assumed to be the proportion of "epidemics" in many other developing countries. The prevalence rate can be estimated from several studies over the past few decades ranging from

1.6% to 7.4% in rural populations and 1% to 13.2% in urban populations. Although this disease is more prevalent in urban populations, this disease is increasing in rural populations in terms of absolute numbers.[11]

In India, the prevalence of hypertension has increased about 30 times among the urban dwellers and about ten times in the rural communities. The prevalence of hipertension differs between urban and rural communities, being higher in urban areas.[12] In China, the difference in the relative prevalence of hypertension in urban and rural areas has decreased, especially in the northern regions.[13,14]

Based on the description, we want to examine the risk of hypertension on the incidence of CHD in urban and rural communities in Indonesia using the longitudinal data of IFLS-4 and IFLS-5 in 2007-2014.

## Method

This type of observational analytic study uses a retrospective cohort design looking at hypertension for the incidence of coronary heart disease. This study uses secondary data from the Indonesian Family Life Survey (IFLS) longitudinal study with characteristics of panel data that can be downloaded on the web https://www.rand.org/.[15] IFLS-4 data (2007) and IFLS-5 (2014) in this study were collected from direct interviews to respondents used questionnaires and direct health measurements. At the same time respondents of IFLS-4 and IFLS-5 before being interviewed and examined are asked to fill out the Informed Consent sheet. The confidentiality of the respondent's identity is ensured by using a code number. Ethical approval was obtained from the ethics committee of research and community service at the Indonesian University.

At the beginning of observations in 2007, those with coronary heart disease (CHD) were excluded from the study. The measurement of hypertension was carried out in 2007 using IFLS-4 data in the population aged ≥18 years, then followed up by the same individual in the 2014 IFLS-5 data related to the status of coronary heart disease. Secondary data used are secondary data from the Indonesian Family Life Survey 2007-2014 (IFLS-4 & IFLS-5).

Indonesian Family Life Survey (IFLS) data is a continuing health survey that began in 1993 with the next four rounds of data collection with a sample representing 83% of the Indonesian population (1997/1998; 2000; 2007/2008; 2014/2015). The original sampling framework is based on households from 13 provinces in Indonesia namely North Sumatra, West Sumatra, Riau, Jambi, Riau Islands, Bangka Belitung, South Sumatra, Lampung, all provinces in Java, Bali, NTB, all provinces in Kalimantan, Sulawesi South and West Sulawesi with a representation of around 83% of Indonesia's population.[15]

The dependent variable (outcome) of the study is coronary heart disease (CHD). CHD is defined as respondents diagnosed with coronary heart disease by health workers (Doctor/Paramedic/Nurse/Midwife) in accordance with the IFLS-5 questionnaire (2014) Book IIIB Section CD (Chronic Conditions). The independent variable (exposure) of the study was hypertension. Hypertension is defined as the result of measuring average blood pressure in 2 measurements according to the IFLS-4 questionnaire (2007) US Book (Health Measurement). Classification of hypertension if blood pressure ≥140/90 mmHg and not hypertension/normal if blood pressure <140/90 mmHg.[16,17] The covariate variables were age, sex, education, obesity, smoking, cholesterol history, physical activity, history of diabetes mellitus, and occupation. Data analysis was performed using data processing software. Link analysis between independent and dependent variables uses multivariate analysis at cox regression, and for major risk ratio with RR and CI (confidence interval) by 95%.

The population in this study was the population aged ≥ 18 in Indonesia in 2007 (IFLS-4) which was then longitudinally observed until 2014 (IFLS-5). The target population in this study is the population aged ≥ 18 years in Indonesia in 2007. The source population in this study is the population age ≥ 18 years in Indonesia who were respondents in IFLS-4 in 2007. The Eligible population in this study were respondents who experienced the disease of coronary heart disease (CHD) at the beginning of the study was excluded.

The measurement of hypertension was carried out in 2007 using data of population aged ≥18 years in Indonesia who were respondents in IFLS-4 in 2007 who met the inclusion and exclusion criteria. The sample in this study was residents aged ≥ 18 years in Indonesia who were respondents in IFLS-4 (2007) who were then interviewed again at IFLS-5 (2014) who had complete data in accordance with the variables to be studied. Sampling was taken by total sampling, which is an overall sampling that meets the study inclusion and exclusion criteria.

The flow of sampling in this study are as below on chart 1 shows that in 2007 (IFLS-4) there were 26.737 respondents aged ≥18 years, then followed up in 2014 (IFLS-5) so that a sample that met the inclusion and exclusion criteria was 22.656 respondents. In urban communities, the number of samples was 13.211 respondents, while in rural communities, there were 9.445 respondents. The inclusion criteria in this study were the population aged ≥18 years in 2007 (IFLS-5) and had blood measured at least 2 times. Blood pressure used is the average blood pressure from the first measurement and the second measurement. While the exclusion criteria in this study were respondents with coronary heart disease (CHD) in 2007 (IFLS-4), missing data from 2007 to 2014, and if the respondent could not be followed (loss to follow up) until 2014 (IFLS-5).

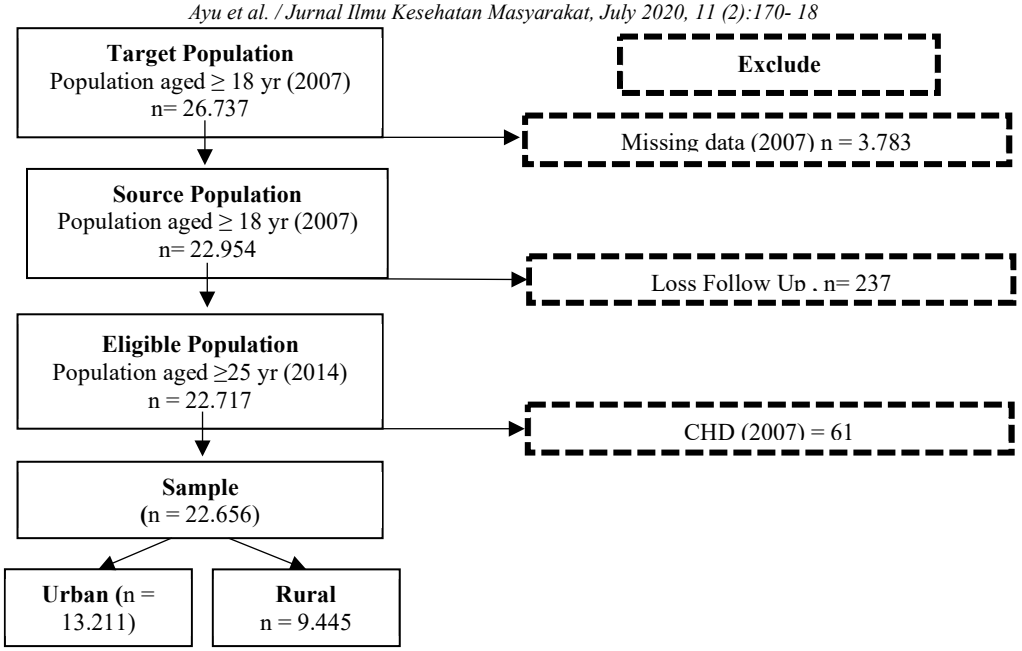


**Chart 1. Sampling Flow**

## Results

Table 1 is a description of the characteristics of respondents from several variables in the study

**Table 1. Distribution of Characteristics of Risk Factors for Coronary Heart Disease in Urban and Rural Areas Indonesian 2007-2014**

| Characteristic | Urban CHD | | | Rural CHD | | |
|---|---|---|---|---|---|---|
| | Yes | No | Total | Yes | No | Total |
| **Hypertension** | | | | | | |
| Yes | 138 (2.09%) | 6,472 (97.91%) | 6,610 | 79 (1.70%) | 4,563 (98.30%) | 4,642 |
| No | 97 (1.74%) | 6,504 (98.53%) | 6,601 | 72 (1.50%) | 4,731 (98,50%) | 4,803 |
| **Age** | | | | | | |
| ≥ 40 years | 161 (2.62%) | 5,973 (97.38%) | 6,134 | 110 (2.40%) | 4,479 (97.60%) | 4,589 |
| < 40 years | 74 (1.05%) | 7,003 (98.95%) | 7,077 | 41 (0.84%) | 4,815 (99.16%) | 4,856 |
| **Sex** | | | | | | |
| Women | 144 (2.03%) | 6,937 (97.97%) | 7,081 | 95 (1.86%) | 5,006 (98.14%) | 5,101 |
| Men | 91 (1.48%) | 6,039 (98.52%) | 6,130 | 56 (1.29%) | 4,288 (98.71%) | 4,344 |
| **Education** | | | | | | |
| ≤Junior High School | 117 (1.80%) | 6,395 (98.20%) | 6,512 | 116 (1.66%) | 6,860 (98.34%) | 6,976 |
| ≥Senior High School | 118 (1.76%) | 6,581 (98.24%) | 6,699 | 35 (1.42%) | 2,434 (98.58%) | 2,469 |
| **Obesity** | | | | | | |
| Yes (≥27kg/m$^2$) | 81 (2.47%) | 3,203 (97.53%) | 3,284 | 33 (1.97%) | 1,638 (98.03%) | 1,671 |
| No (<27kg/m$^2$) | 152 (1.54%) | 9,730 (98.46%) | 9,882 | 118 (1.52%) | 7,630 (98.48%) | 7,748 |
| **Smoking** | | | | | | |
| Yes | 79 (1.63%) | 4,758 (98.37%) | 4,837 | 54 (1.42%) | 3,760 (98.58%) | 3,814 |
| No | 156 (1.86%) | 8,218 (98.14%) | 8,374 | 97 (1.72%) | 5,534 (98.28%) | 6,631 |
| **Cholesterol History** | | | | | | |
| Yes | 41 (4.83%) | 807 (95.17%) | 848 | 32 (11.43%) | 248 (88.57%) | 280 |
| No | 194 (1.57%) | 12,169 (98.43%) | 12,363 | 119 (1.30%) | 9,046 (98.70%) | 9,165 |
| **Physical Activity** | | | | | | |
| Lack | 86 (1.71%) | 4,936 (98.29%) | 5,022 | 67 (2.02%) | 3,256 (97.98%) | 3,323 |
| Enough | 149 (1.82%) | 8,040 (98.18%) | 8,189 | 84 (1.37%) | 6,038 (98.63%) | 6,122 |
| DM History | | | | | | |
| Yes | 25 (5.58%) | 423 (94.42%) | 448 | 12 (8.05%) | 137 (91.95%) | 149 |
| No | 210 (1.65%) | 12,553 (98.35%) | 12,763 | 139 (1.50%) | 9,157 (98.50%) | 9,296 |
| **Occupation** | | | | | | |
| No | 91 (2.51%) | 3,534 (97.49%) | 3,625 | 52 (2.43%) | 2,092 (97.57%) | 2,144 |
| Yes | 144 (1.50%) | 9,442 (98.50%) | 9,586 | 99(1.36%) | 7,202 (98.64%) | 7,301 |

There are 22,656 samples were observed, the proportion of CHD in hypertension respondents in urban communities in Indonesia 2007-2014 (2.09%) is higher than in rural communities in Indonesia 2007-2014 (1.70%). The proportion of CHD among respondents aged ≥ 40 years in the urban communities in Indonesia 2007-2014 (2.62%) was higher than in rural communities in Indonesia 2007-2014 (2.40%). The proportion of CHD among women respondents in the urban communities in Indonesia 2007-2014 (2.03%) was higher than in rural communities in Indonesia 2007-2014 (1.86%). The proportion of CHD in respondents with ≤JHS education in urban communities in Indonesia 2007-2014 (1.80%) is higher than in rural communities in Indonesia 2007-2014 (1.66%). The proportion of CHD in obese respondents in urban communities in Indonesia 2007-2014 (2.47%) is higher than in rural communities in Indonesia 2007-2014 (1.97%). The proportion of CHD among respondents smoking in urban communities in Indonesia 2007-2014 (1.63%) is higher than in rural communities in Indonesia 2007-2014 (1.42%). The proportion of CHD among respondents who have a history of cholesterol in rural communities in Indonesia 2007-2014 (11.43%) is higher than in urban communities in Indonesia 2007-2014 (4.83%). The proportion of CHD among respondents who lack physical activity in rural communities in Indonesia 2007-2014 (2.02%) is higher than in urban communities in Indonesia 2007-2014 (1.71%). The proportion of CHD among respondents who have a history of DM in rural communities in Indonesia 2007-2014 (8.05%) is higher than in urban communities in Indonesia 2007-2014 (5.58%). The proportion of CHD among respondents who did not occupation in urban communities in Indonesia 2007-2014 (2.51%) was higher than in rural communities in Indonesia 2007-2014 (2.43%).

**Table 2. Analysis of Stratification Relationship Hypertension with Coronary Heart Disease in Urban and Rural Areas Indonesian 2007-2014**

| Factors | Category | RR | Urban | RR | Rural |
|---|---|---|---|---|---|
| | | | 95% CI | | 95% CI |
| **Age** | ≥40 years | 1.56 | 1.13-2.14 | 1.21 | 0.84-1.76 |
| | <40 years | 1.03 | 0.66-1.63 | 1.04 | 0.56-1.91 |
| **Sex** | Women | 1.28 | 0.92-1.77 | 0.97 | 0.65- 1.44 |
| | Men | 1.73 | 1.13-2.66 | 1.49 | 0.88-2.54 |
| **Education** | ≤Junior High School | 1.36 | 0.94-1.96 | 1.11 | 0.78-1.60 |
| | ≥Senior High School | 1.48 | 1.03-2.13 | 1.19 | 0.62-2.31 |
| **Obesity** | Yes (≥27kg/m$^2$) | 1.42 | 0.91-2.22 | 1.61 | 0.79-3.30 |
| | No (<27kg/m$^2$) | 1.38 | 1.01-1.90 | 1.02 | 0.71-1.46 |
| **Cholesterol History** | Cholesterol | 1.06 | 0.58-1.96 | 1.45 | 0.73-2.90 |
| | Normal | 1.43 | 1.08-1.90 | 0.99 | 0.69-1.42 |
| **Physical Activity** | No | 1.81 | 1.16-2.81 | 1.42 | 0.88-2.29 |
| | Yes | 1.25 | 0.90-1.71 | 0.95 | 0.62-1.45 |
| **History of DM** | DM | 1.56 | 0.66-3.65 | 1.35 | 0.42-4.28 |
| | Normal | 1.35 | 1.03-1.78 | 1.09 | 0.78-1.51 |
| **Occupation** | No | 2.50 | 1.57-3.96 | 1.31 | 0.75-2.27 |
| | Yes | 1.01 | 0.73-1.40 | 1.00 | 0.68-1.48 |

Based on table 2, analysis of stratification by age, in urban areas where respondents with age <40 years with hypertension risk to CHD is 1.03 (95% CI = 0.66-1.63) meanwhile, aged ≥40 years with hypertension have a risk of 1.56 (95 % CI = 1.13-2.14) times of CHD. In rural areas where respondents with age <40 years with hypertension risk to CHD is 1.04 (95% CI = 0.56-1.91), meanwhile aged ≥40 years with hypertension have a risk of 1.21 (95% CI = 0.84-1.76) times of CHD.

Based on stratification analysis by sex, in urban areas where respondents men with hypertension risk to CHD is 1.03 (95% CI = 1.13-2.66) meanwhile, women with hypertension have a risk of 1.28 (95% CI = 0.92-1.77) times of CHD. In rural areas where respondents women with hypertension risk to CHD is 0.97 (95% CI = 0.65-1.44) meanwhile, men with hypertension have a risk of 1.49 (95% CI = 0.88-2.54) times of CHD.

Based on stratification analysis by education, in urban areas where respondents ≤JHS education with hypertension have a risk of 1.36 (95% CI = 0.94-1.96) times of CHD meanwhile, ≥SHS education with hypertension have a risk of 1.48 (95% CI = 1.03-2.13) times of CHD. In rural areas where respondents ≤JHS education with hypertension risk to CHD is 1.11 (95% CI = 0.78-1.60), meanwhile in ≥SHS education with hypertension risk to CHD is 1.19 (95% CI = 0.62-2.31).

Based on stratification analysis by obesity, in urban areas where obese respondents with hypertension have a risk of 1.42 (95% CI = 0.91-2.22) times of CHD, meanwhile non-obese with hypertension have a risk of 1.38 (95% CI = 1.01-1.90) times of CHD. In rural areas where respondents obese with hypertension have a risk of 1.61 (95% CI = 0.79-3.30) time of CHD meanwhile, non-obese with hypertension risk to CHD is 1.02 (95% CI = 0.71-1.46).

Based on stratification analysis by cholesterol history, in urban areas where respondents with cholesterol history with hypertension risk to CHD are 1.06 (95% CI = 0.58-1.96) meanwhile, no cholesterol history with hypertension have a risk of 1.43 (95% CI = 1.08-1.90) times of CHD. In rural areas where respondents' cholesterol history with hypertension has a risk of 1.43 (95% CI = 1.08-1.90) time of CHD meanwhile, no cholesterol history with hypertension risk to CHD is 0.99 (95% CI = 0.69-1.42).

Based on stratification analysis by physical activity, in urban areas where respondents with lack physical activity with hypertension have a risk of 1.81 (95% CI = 1.16-2.81) times of CHD meanwhile, enough physical activity with hypertension have a risk of 1.25 (95% CI = 0.90-1.71) times of CHD. In rural areas where respondents with a lack of physical activity with hypertension have a risk of 1.42 (95% CI = 0.88-2.29) time of CHD meanwhile, enough physical activity with hypertension risk to CHD is 0.95 (95% CI = 0.62-1.45).

Based on stratification analysis by DM history, in urban areas where respondents with DM history with hypertension have a risk of 1.56 (95% CI = 0.66-3.65) time of CHD meanwhile, no

DM history with hypertension have a risk of 1.35 (95% CI = 1.03-1.78) times of CHD. In rural areas where respondents DM history with hypertension have a risk of 1.35 (95% CI = 0.42-4.28) time of CHD meanwhile, no DM history with hypertension risk to CHD is 1.09 (95% CI = 0.78-1.51).

Based on stratification analysis by occupational, in urban areas where respondents do not occupation with hypertension have a risk of 2.50 (95% CI = 1.57-3.96) time of CHD meanwhile, occupation with hypertension risk of CHD is 1.01 (95% CI = 0.73-1.40). In rural areas where respondents do not occupation with hypertension have a risk of 1.31 (95% CI = 0.75-2.27) time of CHD, meanwhile occupation with hypertension risk to CHD is 1.02 (95% CI = 0.71-1.46).

**Tabel 3. Final Model Multivariate Analysis of the Risk of Hypertension in the incidence of Coronary Heart Disease in Urban and Rural Communities Indonesia 2007-2014**

| | Urban | | | Rural | | |
|---|---|---|---|---|---|---|
| **Variable** | **RR** | **95% CI** | **P*value*** | **RR** | **95% CI** | **P*value*** |
| Hypertension* | | | | | | |
| Normal | 1 | - | - | 1 | - | - |
| Hypertension | 1.36 | 1.05-1.77 | 0.020 | 1.07 | 0.78-1.48 | 0.669 |

*Note: *adjusted by cholesterol history*

Based on table 3 the final model of multivariate analysis with cox regression after controlling for confounding variables, it was found that respondents who had hypertension in urban communities were at 1.36 times more risk (95% CI = 1.05-1.77) had coronary heart disease compared to respondents who were not hypertensive/normal in Indonesia 2007-2014. Whereas in rural communities, there was no significant relationship between hypertension and CHD with RR values of 1.07 (95% CI = 0.78-1.48).

## Discussion

The study was based on the Indonesian Family Life Survey (IFLS) which was a longitudinal study with a nearly 83% of Indonesian-scattered Indonesians in 13 provinces, where the data collection was done in 2007 (IFLS-4) with baseline is a population of approximately 18 years of age who then had the same individual take back data collection in 2014 (IFLS-5). The process of data collection in the same cohort for 7 years was the strength in the design of this study. However, this research is inseparable from the shortcomings and limitations.

Some considerations using this data because the research was conducted throughout Indonesia in the hope of representing the population in Indonesia aged ≥18 years with the aim to determine the risk of hypertension against the risk of coronary heart disease in urban communities and in Indonesia. The weakness of using this data is that the variables studied must adjust to the

available IFLS data, where other variables that are risk factors that might affect the research outcome cannot be examined.

The cumulative incidence of coronary heart disease in hypertension among urban communities in this study (1.78%) is higher when compared with rural communities (1.60%). Based on the results of the Basic Health Research in 2018, where the prevalence of coronary heart disease in urban communities (1.60%) is higher when compared with rural communities (1.30%).[5] This shows that the IFLS data used can adequately describe the coronary heart disease population in Indonesia is due to the approximately equal prevalence of coronary heart disease in urban and rural communities.

Increased blood pressure is a heavy burden on the heart, which causes hypertrophy in the left ventricle or myocardial infarction. High and persistent blood pressure will cause direct trauma to the walls of the coronary arteries, making coronary atherosclerosis easier. This causes angina pectoris. High blood pressure continuously causes damage to the arterial system of the arteries, with the artery slowly also caused by increased levels of cholesterol in the blood, this process constricts the lumen in the blood vessels so that blood flow becomes blocked.[18]

We observed that the cumulative incidence of coronary heart disease in hypertension was higher in urban than in rural (Table 1). This occurred, probably because the distribution of CHD risk factor characteristics was more dominant in urban areas than in rural areas such as age, sex, education, obesity, smoking, and occupation are significantly higher in the urban population. While cholesterol history, DM history, and physical activity are more common in rural areas.

As in table 2 above shows the analysis of stratification relationship hypertension with CHD in urban and rural areas based on risk factor categories, it can be seen that the category of CHD risk factors is more dominated in urban areas such as age, sex, education, physical activity, DM history, occupation significantly higher in urban populations, while obesity and a history of cholesterol are more common in rural areas. The final model of multivariate analysis (Table 3) show hypertension in urban communities were at 1.36 times more risk (95% CI; 1.05-1.77) had coronary heart disease compared to respondents who were not hypertensive/normal. While in rural communities , there was no significant relationship between hypertension and CHD with RR values of 1.07 (95% CI = 0.78-1.48).

The results of a study conducted by Biswas, Singh, & Singh., stated that in India, the prevalence of coronary heart disease in urban communities (1.4%) was higher than in rural communities (0.8%) in 2011-2012. In his research also showed that after the OR was adjusted for socioeconomic and demographic variables, hypertension was found to be five times more likely (OR = 5.09, P <0.01) for the occurrence of coronary heart disease compared with no hypertension.[8]

Multivariate logistic regression analysis study identified an increase in age, a history of hypertensive parents, smoking, chewing tobacco, physical activity, a high estimate of salt consumption per capita, and a BMI ≥27.5 kg / m2 as an independent predictor for hypertension in urban populations, while in rural populations, increasing age, physical activity, central obesity, chewing tobacco and smoking are independent predictors of hypertension.[12]

Research conducted by Zeidan *et al.* , that the prevalence among urban men is 7.30% (95% CI = 5.70-8.90) and 13.40% (95% CI =s 11.20-15.60) among urban women is higher than the prevalence of coronary heart disease among men rural men, namely 3.40% (95% CI = 1.60-5.20) and 7.40% (95% CI = 4.70-10.10) among rural women. The results of the binary logistic regression analysis found that after adjusted OR value of 1.26 (95% CI = 0.96-1.65) means that hypertension is at risk of 1.26 times having coronary heart disease compared with no hypertension/normal.[19]

Research conducted by Bodkhe *et al.,* which conducted a community-based cross-sectional study of the epidemiology of coronary heart disease confirmed among populations over 60 years in rural central India, found that hypertension was found to be the only independent risk factor for coronary heart disease, in the results of bivariate and regression analyzes logistic (after adjusted OR value of 7.07 (95% CI = 3.28-15.25) means that respondents who have hypertension are at risk of 7.07 times having coronary heart disease compared with respondents who are not hypertensive.[20]

Case-control research conducted by Amisi *et al* shows that hypertension is associated with the occurrence of CHD where respondents who suffer from hypertension are more at risk of 2.67 times suffering from CHD than those who do not suffer from hypertension.[21] As for research conducted by Dwi, Ferry, & Irwan., stated that there was a relationship between hypertension duration with CHD (p = 0.028) and hypertension duration 11-15 years at 2.96 times the risk of CHD compared to hypertension duration 1-10 years. There is a long-standing effect of hypertension on CHD, the longer hypertension, the higher the risk of CHD.[22] In a prospective cohort study conducted by Huang *et al* that pre-hypertension increases the risk of 1.43 times for coronary heart disease (RR 1.43; 95% CI = 1.15-1.61).[10]

The prevalence of CHD in Kerala has increased over the past two decades, largely supported by coronary risk factors. There is a high prevalence of CHD among young individuals (2%) compared to western data (1.2%). Contrary to most of the previous Indian data, there was no difference between the prevalence of urban (15.1%) and rural CAD (16.2%) in this study.[23] A cross-sectional study showed that in rural communities suffering from hypertension as much as 43.8% while in urban communities suffering from hypertension as much as 46.2%, there was no difference between the prevalence between urban and rural areas with a p-value = 0.874.[24]

Research results from 22,093 participants, 6,455 (29.2%) had a high cardiovascular risk, defined as the presence of coronary heart disease, stroke or other atherosclerotic diseases; Estimated ten years 30% CVD risk, or an estimated 10-year CVD risk of between 10% and 29%

combined with a systolic blood pressure> 140 mmHg. The high CVD risk prevalence is greater at urban (31.6%, CI 30.7-32.5%) than in semi-urban (28.7%, CI 27.3-30.1%) and rural areas (26.2%, CI 25.2-27.2%).[25] The quality of the data in this study is largely determined by data collection officers or enumerators in the field in controlling selection bias and information bias. There is missing data that requires data to be dropped out so that it will lose exposure and outcome which also means the loss of research respondents (samples). The strength of the physical examination of some of the variables used in this study was carried out by competent health workers such as doctors, nurses or midwives, however, measuring instruments used such as blood pressure measuring devices cannot be ascertained because the blood pressure measuring device used is a digital tensimeter. so that the results will tend to be more than they should be, but even though this happens it will apply equally to both groups, both the exposed group and the non-exposed group, the measurement is carried out through interviews where the answer comes from the respondent's honesty or the respondent does not understand the questions asked such as the activity variable physical.

## Conclusion

Respondents with hypertension in urban communities were at 1.36 times more risk (95% CI; 1.05-1.77) had coronary heart disease compared to respondents who were not hypertensive/normal in Indonesia 2007-2014. Whereas in rural communities, there was no significant relationship between hypertension and CHD with RR values of 1.07 (95% CI = 0.78-1.48).

## Acknowledgment

The author would like to thank for all who helped in this research.

## Funding:

There is no funding for research.

## Conflict of Interest:

The authors declare that they have no conflict of interest.

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