

# Factors Affecting Uncontrolled Blood Pressure among Elderly Hypertensive Patients in Pekanbaru City, Indonesia

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## Abstract

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**BACKGROUND:** The highest prevalence of hypertension is among older adults. Although older adults with hypertension have already controlled their blood pressure by taking antihypertensive drugs, hypertension will still occur when not balanced with a healthy lifestyle. Data from Pekanbaru Municipality Health Department in 2016 showed that hypertension was the most common disease in Pekanbaru City.

**AIM:** The purpose of this study was to determine the factors that influence uncontrolled blood pressure among elderly patients with hypertension at Harapan Raya Pekanbaru Health Center in 2017.

**MATERIAL AND METHODS:** The study employed a cross-sectional design. The sample size comprised 116 elderly patients with hypertension who visited Harapan Raya Community Health Center. The sample criteria were patients aged  $\geq 60$  years and taking hypertension medication, and subjects were selected using consecutive sampling. The variables collected were demographic characteristics of elderly patients (age, education, sex, and occupation), physical activity, smoking habit, coffee and tea consumption and sodium intake. Statistical analysis involved the chi-square test and multiple logistic regressions.

**RESULTS:** The proportion of elderly hypertensive patients with uncontrolled blood pressure was 52.6%. The most influential variables concerning uncontrolled blood pressure were smoking habit (P-value: 0.004, OR: 5.2 95% CI: 1.71-15.8), no routine for taking antihypertensive drugs (P-value = 0.029 OR = 2.96 95% CI: 1.11-7.86) and sodium intake (P-value: 0.044 OR: 0.264 95% CI: 0.072-0.967).

**CONCLUSION:** The dominant factor influencing uncontrolled blood pressure among the elderly was smoking. Health workers at the Community Health Center are expected to provide education and counselling for elderly patients with hypertension to control their blood pressure by taking antihypertensive drugs regularly and quitting smoking.

## Introduction

Hypertension is a medical condition characterised by increased constriction of arterial blood vessels resulting in blood flow resistance that increases blood pressure in blood vessels [1]. The classification of hypertension according to Joint National Committee VII is systolic and diastolic blood pressure over 140/90 mmHg [2]. Elderly hypertensive patients are naturally susceptible to stroke and other cardiovascular complications [3]. Hypertension is a chronic and asymptomatic disease, requiring optimal control and medication adherence especially among

the elderly to reduce the risk of cardiovascular, cerebrovascular and renal diseases [4].

Blood pressure increases with age and is a common condition among the elderly. The Framingham Heart Study reported that the prevalence of hypertension increased from 27.3% among patients under 60 years to 74.0% among those over 80 (5). A Global Brief on Hypertension Report, WHO (2013) showed that nearly one billion people worldwide suffer from high blood pressure (hypertension), and two-thirds of them occur in developing countries [6]. Indonesia is one of the developing countries with a prevalence of hypertension of 25.8%, while in Riau it

totals 20.9% [7]. Based on the 2016 Pekanbaru City Health Office report from 20 health centres in Pekanbaru City, the highest number of cases of hypertension in Harapan Raya Health Center was 5570 [8]. Visits of elderly patients with hypertensive to Harapan Raya Health Center in 2016 amounted to 35.2% of all elderly visits [9].

The purpose of the study was to determine the factors that influence uncontrolled blood pressure among elderly patients with hypertension at Harapan Raya Health Center in 2017.

## Material and Methods

### *Study Design and Sampling Procedure*

The study employed a cross-sectional design. The study was conducted at Harapan Raya Public Health Center, Pekanbaru City from May to July 2017. The population in this study was determined based on the average number of monthly elderly visits. The elderly visits at Harapan Raya Public Health Center in 2016 totalled 4,213, of which 1,482 were elderly patients with hypertensive. The subjects in this study comprised elderly patients with hypertension living in the work area of Harapan Raya Health Center Pekanbaru City, aged 60 years and over and taking antihypertensive drugs. The determination of sample size was based on a hypotheses test for population proportion (one side test) from Lameshow (1997) [10] with respect to  $\alpha = 5\%$ ,  $\beta = 20\%$  and related research conducted by Wahyuningsih and Astuti, resulting in a minimum sample of 116 elderly subjects [11].

### *Instrument Development and Data Collection Procedures*

The sampling technique used in this study comprised consecutive sampling, conducted by selecting elderly subjects by inclusion criteria and domiciles in the work area of Harapan Raya Public Health Center. Inclusion criteria comprised elderly subjects aged 60 years and over and willing to be a respondent by signing a consent form. They should have a history of hypertension and be taking antihypertensive drugs. The history of hypertension and antihypertensive drug data were obtained from medical records of Harapan Raya Community Health Center. The dependent variable was uncontrolled blood pressure among elderly patients with hypertension. The independent variables collected were socio-demographic characteristics, taking antihypertensive drugs, smoking habit, coffee and tea consumption, physical activity, and sodium intake. Data were collected by interview questionnaires and checking blood pressure using a stethoscope. Uncontrolled blood pressure was defined when elderly

systolic blood pressure is  $> 140$  mmHg, and diastolic is  $> 90$  mmHg [2].

Smoking habits were obtained from interviews about the behaviour of elderly smokers in the past year. Physical activity was determined using a daily elderly activity measured using the calculation of PAL (Physical Activity Level) and Physical Activity Ratio (PAR). Food and Agriculture Organization (FAO)/World Health Organization (WHO)/United Nation University (UNU) [12] stated that the magnitude of physical activity performed by a person within 24 hours is stated in PAL. PAR was defined as the amount of energy spent over a certain time conducting an activity. The classification level of physical activity was defined as lighter when the PAL was  $< 1.7$ , moderate when the value of PAL was 1.7 to 1.99 and heavy when the value of PAL was  $> 1.99$  [12]. Sodium intake was obtained from food recall in 2 x 24 hours by calculating how much sodium in milligrams was consumed daily by recording an over the standard when sodium intake was  $\geq 2400$  mg/day and sufficient when it was  $< 2400$  mg/day [13]. Coffee and tea consumption was obtained from interviews using questionnaires about coffee and tea consumption habits, using sufficient and over the standard categories. Over the standard category was determined when the elderly subjects confirmed a habit of drinking three glasses or more of tea or coffee daily. Otherwise, it was categorised as sufficient [14].

### *Ethics Considerations*

Data were collected after obtaining permission from the study program and the Riau Province Unity Board. A research permit was also obtained from the Pekanbaru Municipality Health Department to collect data at Harapan Raya Community Health Center. Before collecting the data, the researcher explained to respondents about the steps of implementing the data collection. When the respondents agreed, then they would sign a consent form.

### *Data Processing and Analysis*

The data were collected and checked by the researcher to assess the completeness and clarity of the respondents' answers. The next step was to encode each variable. Data were processed using a computer program including data on sodium intake. The data were analysed using univariate analysis to determine the distribution of the characteristic frequency of each variable and bivariate analysis using the chi-square test. Simple logistic regression was employed to screen for multivariate modelling ( $p < 0.25$ ). Multivariate analysis used multiple logistic regressions to identify dominant factors that influenced uncontrolled blood pressure among the elderly. The significance level used was  $p < 0.05$ .

## Results

### Sociodemographic Characteristics

Table 1 shows that respondents in this study totalled 116 elderly subjects. The proportion of elderly patient with hypertension with uncontrolled blood pressure was 52.6%. The average age of the elderly was 64.05 years ranging from 60 to 77 years. The majority obtained low education levels, elementary and junior high school, 72.4%, and most were women (57.8%). The elderly generally did not work (72.4%). Most elderly did not take antihypertensive drugs routinely (70.7%). The majority reported low physical activity levels (90.5%). Most elderly were nonsmokers in the past one year (70.7%). The elderly had a habit of consuming coffee or tea at the sufficient category (74.1%) and consuming sodium at the sufficient category (65.5%). Bivariate analysis with chi-square test showed that factors significantly correlated with uncontrolled blood pressure among elderly patients with hypertension were age, the routine of taking antihypertensive drugs, smoking status and sodium intake ( $p < 0.05$ ).

**Table 1: Sample characteristics and factors associated with uncontrolled blood pressure among elderly patients with hypertension (n = 116)**

| Characteristics                  | Blood Pressure |      |              |      | Total |       | P value        | OR <sub>crude</sub> (95% CI) |
|----------------------------------|----------------|------|--------------|------|-------|-------|----------------|------------------------------|
|                                  | Controlled     |      | Uncontrolled |      | n     | %     |                |                              |
|                                  | n              | %    | n            | %    |       |       |                |                              |
| Elderly                          | 55             | 47.4 | 61           | 52.6 | 116   | 100.0 |                |                              |
| Age (years)*                     |                |      |              |      |       |       |                |                              |
| ≤ 62                             | 36             | 61.0 | 23           | 39.0 | 59    | 50.9  | 0.005          |                              |
| > 62                             | 19             | 33.3 | 38           | 66.7 | 57    | 49.1  | (1.465-6.691)  |                              |
| Education level                  |                |      |              |      |       |       |                |                              |
| Low                              | 36             | 42.9 | 48           | 57.1 | 84    | 72.4  | 0.166          |                              |
| High                             | 19             | 59.4 | 13           | 40.6 | 32    | 27.6  | (0.224-1.174)  |                              |
| Sex                              |                |      |              |      |       |       |                |                              |
| Male                             | 19             | 38.8 | 30           | 61.2 | 49    | 42.2  | 0.160          |                              |
| Female                           | 36             | 53.7 | 31           | 46.3 | 67    | 57.8  | (0.258-1.153)  |                              |
| Occupation status                |                |      |              |      |       |       |                |                              |
| Unemployed                       | 42             | 50.0 | 42           | 50.0 | 84    | 72.4  | 0.487          |                              |
| Working                          | 13             | 40.6 | 19           | 59.4 | 32    | 27.6  | (0.641-3.335)  |                              |
| Routinely antihypertensive drugs |                |      |              |      |       |       |                |                              |
| Yes                              | 21             | 61.8 | 13           | 38.2 | 34    | 29.3  | 0.046          |                              |
| No                               | 34             | 41.5 | 48           | 58.5 | 82    | 70.7  | (1.005-5.175)  |                              |
| Physical Activity                |                |      |              |      |       |       |                |                              |
| Moderate                         | 8              | 72.7 | 3            | 27.3 | 11    | 9.5   | 0.147          |                              |
| Low                              | 47             | 44.8 | 58           | 55.2 | 105   | 90.5  | (0.827-13.101) |                              |
| Smoking status                   |                |      |              |      |       |       |                |                              |
| Nonsmoker                        | 45             | 54.9 | 37           | 45.1 | 82    | 70.7  | 0.022          |                              |
| Smoker                           | 10             | 29.4 | 24           | 70.6 | 34    | 29.3  | (1.240-6.873)  |                              |
| Coffee and tea consumption       |                |      |              |      |       |       |                |                              |
| Sufficient                       | 44             | 51.2 | 42           | 48.8 | 86    | 74.1  | 0.247          |                              |
| Overstandard                     | 11             | 36.7 | 19           | 63.3 | 30    | 25.9  | (0.770-4.253)  |                              |
| Sodium intake                    |                |      |              |      |       |       |                |                              |
| Sufficient                       | 27             | 35.5 | 49           | 64.5 | 76    | 65.5  | 0.001          |                              |
| Overstandard                     | 28             | 70.0 | 12           | 30.0 | 40    | 34.5  | (0.104-0.538)  |                              |

\* mean ± sd: 64.05 ± 4.6 median: 62 min-max: 60-77 95% CI: 63.2-64.9.

Multivariate analysis with multiple logistic regressions was used to determine the dominant factors that influenced controlled blood pressure among elderly patients with hypertension. Multivariate modelling with 6 models found that dominant variables influencing uncontrolled blood pressure among elderly with hypertension were not taking antihypertensive drugs routinely and smoking and sodium intake. Smoking was a dominant variable for uncontrolled blood pressure affecting the elderly. Elderly smokers had 5 times the risk of uncontrolled blood pressure than nonsmokers (OR: 5.203). The elderly who did not

take antihypertensive drugs routinely were 3 times more at risk of uncontrolled blood pressure than the elderly who regularly took medicine (OR: 2.963). Sodium intake had an inverse association relationship. Education and age of the elderly were confounding variables. The Omnibus test value obtained was  $p < 0.001$  meaning that the result of multivariate modelling was relevant. These five independent variables (age, education level, taking antihypertensive drugs routinely and sodium intake) could explain uncontrolled blood pressure among elderly patients with hypertension by 31.6%.

**Table 2: Multivariate analysis with binary logistic regression of factors affecting uncontrolled blood pressure among elderly patients with hypertension**

| Variable                         | Category     | B      | p-value | Adj OR | 95% CI       |
|----------------------------------|--------------|--------|---------|--------|--------------|
| Age                              | ≤ 62 y       | 1      |         | Ref    |              |
|                                  | > 62 y       | 1.250  | 0.066   | 3.490  | 0.921-13.224 |
| Education                        | Low          | 1      |         | Ref    |              |
|                                  | High         | 0.453  | 0.438   | 1.573  | 0.501-4.945  |
| Routinely antihypertensive drugs | Yes          | 1      |         | Ref    |              |
|                                  | No           | 1.086  | 0.029   | 2.963  | 1.117-7.860  |
| Smoker                           | Not a smoker | 1      |         | Ref    |              |
|                                  | Smoker       | 1.649  | 0.004   | 5.203  | 1.714-15.798 |
| Sodium intake                    | sufficient   | 1      |         | Ref    |              |
|                                  | Overstandard | -1.333 | 0.044   | 0.264  | 0.072-0.967  |

Omnibus Test (Chi Square)  $p < 0.001$ ; Cox & Snel R Square: 0.237; Nagelkerke R Square: 0.316; Hosmes-Lemeshow (GoF): 2.620 (7)  $p > 0.05$ .

## Discussion

The results showed that the proportion of uncontrolled blood pressure among elderly patients with hypertension was 52.6%. Based on multivariate analysis with multiple logistic regressions, the dominant factor affecting uncontrolled blood pressure was smoking. Other significantly related variables included taking antihypertensive drugs irregularly. Sodium intake in this study demonstrated an inverse association. The level of elderly education was a confounding variable of the smoking habit.

Hypertension will become a serious health problem if uncontrolled. Controlling hypertension among the elderly as self-care for hypertensive patients includes consuming recommended antihypertensive drugs, monitoring blood pressure regularly and modifying lifestyle to maintain health such as performing physical activities, stopping smoking, reducing salt consumption and increasing intake of vegetables and fruit [15]. However, implementing self-care by hypertensive patients had not been maximised. The study of Oliveria suggested that although knowledge of hypertension is quite good, hypertensive patients do not have a thorough understanding of their blood pressure conditions, such as a lack of awareness in blood pressure control [16]. At least 50% of patients receiving prescribed antihypertensive drugs do not take them as recommended [17]. Irregularity in taking antihypertensive drugs will have an impact on

elevating blood pressure [17].

The prevalence of hypertension increases with increasing age. One-half of people aged between 60 and 69 years have hypertension, and this increases to 60 to 70% among people over age 70 [18]. Research by Hazarika et al., and Alam et al., showed the trend of increasing prevalence of hypertension in the age group over 60 years [3], [19]. Hypertension is highly prevalent among the elderly. Several epidemiological surveys conducted in the USA and Europe concluded that hypertension prevalence among the elderly ranged between 53% and 72% [20]. Arterial stress (decrease in arterial wall adherence) is considered an inevitable consequence of ageing which causes elevated blood pressure levels [21]. Among older people with hypertension, endothelial cell damage increases with systolic blood pressure and fibrinogen levels indicate prothrombotic status. The condition shows that uncontrolled hypertension among the elderly causes organ damage [22].

Smoking increases blood pressure [23]. Several studies have shown a significant association of smoking with the incidence of hypertension [23], [24]. Toxic chemicals such as nicotine and carbon monoxide exploited through cigarettes entering the bloodstream can damage the endothelial lining of the arteries, resulting in the process of atherosclerosis and high blood pressure [20]. Research by Ragueneau showed smoking caused a significant increase in systolic blood pressure and diastolic by +7% and 10%, respectively [26]. Blood pressure and heart rate increase during smoking. This effect is particularly associated with nicotine.

The increase in blood pressure is caused by increased cardiac output and total peripheral vascular resistance. A rise in blood pressure immediately occurs before any increase in circulating catecholamine. Among hypertensive patients, blood pressure decreases the effect of partial beta-blockers that can be eliminated by tobacco smoking, whereas alpha-receptor inhibitors seem to retain antihypertensive properties among smokers. This creates a paradox that smoking increases blood pressure [26].

Elderly hypertensive sufferers are required to take antihypertensive drugs to control their blood pressure. Controlling blood pressure by taking antihypertensive drugs is an attempt to prevent the occurrence of hypertension among the elderly. Antihypertensive medication use and blood pressure control among US adults with hypertension significantly has increased over the past 10 years [27]. In this study, the elderly who did not regularly take antihypertensive drugs totalled 70.1%. Reducing systolic and diastolic blood pressure can be achieved by non-pharmacological (lifestyle measures) as well as pharmacological means [27]. The commitment of the elderly in taking medicine according to a doctor's

recommendation is needed to control blood pressure and prevent complications of hypertension.

The success of therapy is not only determined by the correct diagnosis and drug selection, but also by adherence to the therapy. To improve health and prevent the occurrence of diseases caused by hypertension, the elderly need to perform self-care by taking medications by the prescription, monitoring blood pressure and reducing sodium intake [28]. Various efforts are required to improve patient adherence to the consumption of antihypertensive drugs to control their blood pressure and prevent complications of hypertension. Research by Yang showed that 44.6% of elderly hypertensive patients could control their hypertension. Many hypertensive patients do not know their condition, and the level of control and treatment remains relatively low, most likely due to improper use of antihypertensive drugs and unhealthy lifestyle choices [29].

In this study, an inverse association was found between sodium intake and controlled blood pressure. The possibility of bias in recalling information of sodium consumption might be due to the subjects' age and educational background, making it difficult to gather information related to what was actually consumed by them daily. In addition, it would be likely caused by the elderly routine in taking antihypertensive medication although the intake of sodium was high.

The proportion of elderly with uncontrolled blood pressure at Harapan Raya Community Health Center, Pekanbaru City was 52.6%. Factors associated with uncontrolled blood pressure among elderly hypertensive patients included smoking habit, irregularity in taking antihypertensive drugs and sodium intake. In this study, sodium intake exhibited an inverse association relationship. Education and age of the elderly were confounding variables. Awareness of elderly patients with hypertension to consume antihypertensive drugs remains low. More effort is needed by health workers at the Public Health Center is to provide more intensive education and counseling on the importance of controlling blood pressure, regularly taking antihypertensive drugs and quitting smoking.

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