ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 5, Issue 6 , June 2018

Topography Influences to the Hypertension Grade Through the Saturation in Primary Hypertension Patients

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ABSTRACT: Primary hypertension is the cause of mortality of cardiovascular disease. Patients with primary hypertension who have high grade hypertension if not done then will cause various dangerous diseases, so it is necessary to prevent the increase of hypertension grade or blood pressure by analyzing hypertension grade risk factors. This research is quantitative research with observation method with cross sectional design. The number of samples in this study was 346 respondents taken with total sampling. Analysis of multivariate data using PLS. the results showed that there is a topographic influence on hypertension grade through saturation, with coefficient path value 0.012 t-statistic 1,987 (t statistic> significance t table 1.96). The higher the topography, the saturation value tends to decrease causing an increase in hypertension grade. Suggestions for primary hypertension sufferers to be aware of the effect of altitude on the cardiovascular system.

KEYWORDS: Topography, Saturation, Grade Hypertension.

I. INTRODUCTION

Indonesia faces a double burden of infectious diseases that remain high and non-communicable diseases are getting higher. Changes in socioeconomic, environmental and community status that have adopted less healthy lifestyles such as smoking, lack of physical activity lead to an increase in non-communicable diseases (PTM). Projected the number of morbidity caused by PTM will increase and PM will decrease. PTM such as diabetes mellitus, coronary heart disease, and other chronic diseases will increase drastically by 2030, while PMs such as tuberculosis, HIV / AIDS, malaria, diarrhea and other infectious diseases are predicted to decline by 2030 (Soeparji, 2012) .

One type of PTM is a very serious health problem that is hypertension (Soeparji, 2012). Primary hypertension is the leading cause of death from cardiovascular disease. Hypertensive disease if the blood pressure is not done to overcome it will cause various dangerous diseases such as stroke, heart failure, myocardial infarction that can cause disability and death. A meta-analysis of 61 epidemiological studies involving 1 million people concluded that for every 20/10 mmHg increase in blood pressure, there was a twofold increase in risk factor for cardiovascular mortality, so efforts were needed to prevent blood pressure rise by analyzing hypertensive grade risk factors (Think, 2015).

Coastal, urban, and mountain topography are unique. Coastal communities have some characteristics that adapt to their natural state, ie most of the coastal population have livelihoods as fishermen due to the oceans, the frequent consumption of foods high in salt, coastal environments have a hot environmental temperature, so the body adapts to require foods that prevent dehydration (Sumampouw and Harahap, 2015). Urban topography has high carbon monoxide (CO) gas than other topography (Silbernagl and Lang, 2008), some of which are diverse urban, socio-economic communities in urban communities. Mountains have high levels of airborne oxygen in the mountains (plateau) lower than lowland areas (urban and mountain) (Guyton and Hall, 2010). Cold environments in the mountains cause people tend to have a habit of eating foods high in cholesterol.

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International Journal of Advanced Research in Science, Engineering and Technology
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Patients with primary hypertension on the three topography is very necessary efforts to prevent risk factors as an effort to control blood pressure so that no complications occur. It is important to know the risk factors that affect the hypertension grade in primary hypertension sufferers in the topography topography namely coastal, urban, and mountain topography, especially topography and saturation.

II. METHOD

The type of this research is analytic observational with cross sectional design. This research was conducted simultaneously in the working area of Kedungrejo health clinic (coastal topography), mojopanggung community clinic (urban topography) and slippery clinic (topography of mountains). Data collected were 100 respondents from Community Health Centers kedungrejo, 100 respondents from Community Health Centers mojopanggung and 146 respondents from the work area of the Community Health Centers Licin, so the total sample is 346 respondents. Sampling method in Community Health Centers with cluster randome sampling, while sampling at respondent by using total sampling. Data collection methods for saturation variables with oximeter, topographic variables using the application Measure Distance Map, Altimeter and grade hypertension using digital tensimeter. Multivariate data analysis using PLS with Smart PLS 3.2.7 application

III. RESULT

The results of the study were 346 respondents of primary hypertension in Kedungrejo health center (coastal topography), mojopanggung community clinic (urban topography), and slippery clinic (topography of the mountains).

A. Descriptive Analysis

Table 1. Distribution of Respondents Frequency Based on Saturation in the Work Area of Kedungrejo Community Health Centers, Mojopanggung Public Health Center and Slippery Public Health Center

			Community Health Centers			
			Kedungrejo	Mojopanggung	Licin	Total
Saturation	*Critical Range* (Critical)	Frequency	0	0	6	6
		% Based on Saturation	0,0%	0,0%	100,0%	100,0%
		% Based on Community Health Centers	0,0%	0,0%	4,1%	1,7%
	Decreased range (decreased)	Frequency	3	3	9	15
		% Based on Saturation	20,0%	20,0%	60,0%	100,0%
		% Based on Community Health Centers	3,0%	3,0%	6,2%	4,3%
	Normal	Frequency	97	97	131	325
		% Based on Saturation	29,8%	29,8%	40,3%	100,0%
		% Based on Community Health Centers	97,0%	97,0%	89,6%	93,9%
Total		Frequency		100	146	346
		% Based on Saturation		28,9%	42,2%	100,0%
		% Based on Community Health Centers		100,0%	100,0%	100,0%

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Respondents in the work area of Kedungrejo Community Health Centers(almost 97%) have normal saturation values. Respondents in the working area of Mojopanggung Community Health Centers are almost entirely (97%). Respondents in the mostly Slick Public Health Centers (89.6%) had normal saturation values. A small number (4.1%) of respondents living in the mountains have saturation values in the critical (critical) category. A small number (6.2%) of respondents in the mountains have saturation in the category of declin.

Table 2. Frequency Distribution of Respondents by Saturation to Hypertension Grade in Work Area of Kedungrejo Community Health Centers, Mojopanggung Community Health Centers and Community Health Centers

			Grade			
			1 (Low)	2 (Medium)	3 (High)	Total
Saturation	*Critical Range*	Frequency	0	2	4	6
		% Saturation-based	0,0%	33,3%	66,7%	100,0%
	Decreased range	Frequency	1	4	10	15
		% Saturation-based	6,7%	26,7%	66,7%	100,0%
	Normal	Frequency	165	87	73	325
		% Saturation-based	50,8%	26,8%	22,5%	100,0%
Total		Frequency		93	87	346
		% Saturation-based		26,9%	25,1%	100,0%

Most (66.7%) of respondents who have saturation in the critical range category are respondents who have grade 3 hypertension (severe hypertension). Some respondents who have normal saturation are the respondents who have a grade of hypertension 1 (mild). A small proportion of respondents who had normal saturation had a grade of hypertension 3 (severe hypertension).

B. Multiariat Analysis

1.Outer Model Test a. Convergent Validity

Table 3. Results of Convergent Validity

Construct	Indikator	*Outer Loading*	Note
Topography	Topografi surface	0,977	Signifikan
	Ketinggian tempat	0,957	Signifikan
	Jarak dari tepi laut	0,972	Signifikan
Saturation	Saturasi	1,000	Signifikan
Hypertension Class	Grade Hipertensi	1,000	Signifikan

Evaluation of measurement model of latent variable with reflective indicator is analyzed by seeing the convergent validity on PLS can be seen from the amount of outside loading each indicator to the latent variable. Outside loading above 0.70 Highly recommended, however, loading values from 0.50 - 0.60 can still be tolerated. The external model or measurement model used is the validity and reliability of the research variables (Garson, 2016). The result of calculating the measurement model in Table 1 shows that the three indicators are surface topography, the distance from the sea is valid in reflecting the topographic variables as evidenced by external values greater than 0.50.

ISSN: 2350-0328
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b. Composite reliability

Table4. Composite reliability

	Composite Reliability	AVE
Saturation	1,000	1,000
Grade Hypertension	1,000	0,712
Topography	0,979	0,918

Measure the reliability of the construct with the value of composite reliability. Rule of the thumb the value of composite reliability must be greater than 0.7 or the value of 0.6 is still acceptable (Garson, 2016), so it can be concluded that all constructs in this study all constructs have composite reliability value more than 0.6, so the conclusion of all constructs in this study reliable.

2. ModelInner

a. $R^2$for endogenous latent variables

Table 5. Testing Results of Structural Model Evaluation

Model Structure	R-square
Saturation	0,167
Grade Hypertension	0,262

b. Line Coefficient Estimation

Table 6. T-Statistics Value on Inner Model Effect of Salt Consumption on Grade Hypertension

	Original sample	*Statistik*	*T-Value*
Topography →Saturation → Grade Hypertension	0,012	1,987	0,050*

Based on the information from table 5 that there is a topographic effect on hypertensive grade through saturation in primary hypertensive patients, (t statistics> significance t table 1.96).

IV. DISCUSSION

The results of research in the working area of Kedungrejo Community Health Centers (coastal topography), Mojopanggung Community Health Centers (urban topography), and Slick Community Health Centers (mountain topography) indicate that there is a topographic influence on hypertension grade through saturation as a mediator. Based on descriptive data indicate that the percentage of respondents who have normal saturation value in Community Health Centers Licin (upland) with percentage 89%, the value is lower than the respondents in the lowland that is 97.0%. All respondents (100%) who have saturation in decreased range criteria and critical range are respondents who have grade 3 hypertension (severe hypertension), while 51.1% of respondents who have normal saturation are respondents who have grade hypertension 1 (mild hypertension). The lower the saturation decreases then has a tendency to have high grade hypertension.

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Humans make the process of body adaptation to the environment one of which is acclimatization. A person living on high ground, acute compensatory responses in the form of increased ventilation and increased cardiac output are gradually replaced within a few days by slower-appearing compensatory measures that allow adequate oxygenation to the tissues and then normal acid-base balance. The formation of red blood cells (HR) increases, stimulated by erythropoetin in response to reduced delivery of O2 to the kidneys (Sherwood, 2014).

A decrease in the delivery of O2 to the kidneys (EPO) stimulates the kidneys to release the erythropoetin hormone into the blood and this hormone in turn stimulates erythropoiesis by the red marrow. The kidneys detect a decrease in blood capacity carrying O2. If O2 is supplied to the kidney is reduced, the kidneys secrete erythropoietin into the blood. Erythropoietin stimulates erythropoiesis by the red bone marrow. Supplemental erythrocytes in the circulation increase the blood's ability to transport O2. Increased blood carrying capacity of O2 eliminates the ability of the blood carrying O2 to eliminate the initial stimulation that triggers the secretion of erythropoietin. Erythropoietin works on unequaled stem cell derivatives that will become HR, stimulate proliferation to become HR, stimulate proliferation and maturation of these cells into mature erythrocytes. This increase in erythropoietic activity increases the amount of human blood in the blood so that the blood carrying capacity of O2 increases and the delivery of O2 to the tissue returns to normal. Distribution of O2 to the normal kidney, the secretion of erythropoietin is stopped until it is needed again (Sherwood, 2014). According to Sherwood (2016) about the effects of height on the body states that atmospheric pressure is progressively reduced with increasing altitude somewhere. The atmospheric pressure at an altitude of 1800 feet above sea level is only 380 mmHg, the value being half its value at sea level. The inspiratory air pitch at this altitude is 21% of 380 mm Hg or 80 mmHg, with the alveolar PO2 being lower at 45 mm Hg. At each altitude above 10,000 feet, the arterial PO2 descends to the steeper part of the O2 - Hb curve, below the safe range of the flat region, so that the% saturation of Hb in the arterial blood is reduced sharply with increasing altitude. Humans living in the highlands do a normal life due to the process of acclimatization. High humans, acute compensatory responses in the form of increased ventilation and increased cardiac output are replaced within a few days by slower-appearing compensatory measures that allow adequate oxygenation to the tissues and restoration of normal acid-base balance. The formation of red blood cells (HR) increases, stimulated by erythropoietin in response to reduced delivery of O2 to the kidneys. Increasing the number of human resources increases the ability of blood to transport O2. Hypoxia also promotes the synthesis of BPG (2,3-bisphosphoglycerate) in HR so that O2 is more easily released from Hb to the tissues.

The amount of capillaries in the tissues increases, reducing the distance O2 must travel when diffusing from the red blood cells to reach the cell. Altitude also affects endothelial cells to release nitric oxide (NO) 10 times more than those released near the altitude at sea level. This additional NO blood flows twice as much in the individual at altitude. Acclimatized cells are able to use O2 more efficiently through increased mitochondria, the energy organelle. The kidney restores the arterial pH to near normal by retaining the acid normally removed by urine. Such compensatory action causes an increase in the number of human resources (red blood cells) thereby increasing the viscosity (making the blood thick) blood so that resistance to blood flow increases. Increased resistance causes the heart to work harder to pump blood so that it increases the grade of hypertension (Guyton and Hall, 2010).

V. CONCLUSION

Based on the results and discussion of this research, that there is influence topography on hypertension grade through saturation. The higher the topography, the saturation value tends to decrease causing an increase in hypertension grade.For people with primary hypertension to be aware of the effect of altitude of place to grade of hypertension so that can avoid the effect of complication of hypertension disease.

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ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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