Path Analysis on the Effectiveness of Chronic Disease Prevention Program using Health Belief Model

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ABSTRACT

Background: Chronic disease prevention program is a proactive health service system on chronic diseases which can affect the hypertension control. This study aimed to determine the effect of chronic disease prevention program and the construction of Health Belief Model (HBM) on the prevention of elderly hypertension with path analysis method.
Subjects dan Method: This study used observational analytical study with retrospective cohort study approach. This study was conducted in four community health centers in Ngawi Regency, East Java, in April-May 2019. The total sample of 200 elderly aged 60-74 years was divided into2 groups, such as group which participated inchronic disease prevention program(case) and group which did not participate inchronic disease prevention program(control) based on fixed exposure sampling. The dependent variable of this study was hypertension control. The independent variables in this study were participation in chronic disease prevention program, perceived vulnerability, perceived seriousness, perceived benefits, perceived barriers, cues to action, and self-efficacy. Variable data collection used questionnaires and analyzed using path analysis.
Results: Hypertension control was directly and positively affected by chronic disease prevention program(b= 2.85; 95%CI= 0.48 to 5.22; p= 0.018), perceived vulnerability (b= 1.35; 95%CI= 0.16 hingga 2.53; p= 0.025), perceived seriousness (b= 0.83; 95%CI= 0.04 to 1.62; p= 0.039), and self-efficacy (b= 0.99; 95%CI= 0.14 to 1.85; p= 0.023). Hypertension control was indirectly affected by perceived benefits, perceived barriers, and cues to action.
Conclusion: Hypertension control in the elderly is directly and positively affected by participation in chronic disease prevention program, perceived vulnerability, perceived seriousness, and self-efficacy. Hypertension control is indirectly affected by perceived benefits, perceived barriers, and cues to action.

Keywords: Hypertension, chronic disease, prevention, Health Belief Model, path analysis

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BACKGROUND

Hypertension is one of the causes of mortality and morbidity without initial symptoms, so that hypertension is called as silent killer (Susilo, 2011; Chen and Hu, 2014). Hypertension can have a negative effect on public health and socio-economic condition in developed and developing countries (Triyanto, 2014; Asibey et al., 2018). Hypertension can affect various ages and rates of people with high hypertension above 18 years of age (Basic Health Research, 2018).

In the aging process, there are various decreases in body function both biologically and psychologically. Biological aging is characterized by a decrease in theorgans function which can be a cause of various diseases, such as hypertension.

According to Savitri (2017), one out of ten adults in the world has the potential to suffer from hypertension. The prevalence of

hypertension in Asia continues to increase by 19.6% in 2005, increasing to 23.1% in 2015 (Du et al., 2017). The highest prevalence of hypertension is at the age of 75-84 years and quite low at the age of 45-74 years in the American population of Chinese descent (Chen and Hu, 2014).

Health awareness in Indonesia is still low, most of people with hypertension do not realize that they suffer from hypertension. The prevalence of hypertension in Indonesia has increased by 25.8% in 2013, increasing to 34.1% in 2018. Lack of physical activity and consumption of fruits and vegetables are the cause of an increase in the prevalence of hypertension (Basic Health Research, 2018).

In 2018, the percentage of hypertension in East Java Province increased by 20.43% (1,828,669 people) with a proportion of 20.83% (825,412 people) men and 20.11% (1,003,257 people) women (East Java Provincial Health Office, 2018). Ngawi Regency, as one of the Regencies in East Java Province had a significant increase in hypertension patients in 2018 by 167,992 (Ngawi Regency Health Office, 2018).

The increasing prevalence of hypertension is the basis of the government (Asibey et al., 2018) to have hypertension control through BPJS Kesehatan (Healthcare and Social Security Agency) to reduce the increase of hypertension care costs (Ma, 2018).

The chronic disease prevention program is a means of controlling hypertension through a proactive and integrated approach involving participants, health facilities, and BPJS Kesehatan. This program aims to achieve optimal quality of life with effective and efficient health services cost (BPJS Kesehatan, 2014). This program encourages participants with chronic diseases with an indicator of 75% of registered participants visiting First Level Health Care Facility with type 2 diabetes mellitus type 2 and hypertension according to clinical guidelines, so it can prevent the occurrence of disease complications (BPJS Kesehatan, 2014). Complication prevention behaviors of hypertensive patients are doing physical activity, regulating diet, quitting smoking, taking medications regularly, maintaining weight, and controlling blood pressure regularly in health services (Perumareddi, 2019; Petrides et al., 2019).

One model of changes in health behavior is Health Belief Model (HBM). HBM is a method for knowing the basic healthy behavior of an individual. HBM consists of five constructs such as perceived vulnerability, perceived seriousness, perceived benefits, perceived barriers, cues to action, and self-efficacy (Sulaeman, 2017; Ma, 2018).

This study aimed to determine the effect of participation in chronic disease prevention program and the construction of Health Belief Model (HBM) which affects the hypertension control in the elderly.

SUBJECTS AND METHOD

a. Study Design

This study used observational analytical study with retrospective cohort study approach. The population was identified into 2 groups, such as group which participated in chronic disease prevention program (case) and group which did not participate in chronic disease prevention program (control). This study was conducted in four different community health centers in Ngawi Regency, East Java, in April-May 2019.

b. Population dan Samples

The target population of this study was the elderly aged 60-74 years in four community health centers, Ngawi Regency, East Java. The community health centers were Jogorogo, Teguhan, Paron, and Geneng commu-

nity health centers. A sample of 200 elderly aged 60-74 years was selected by fixed exposure sampling.

c. Study Variables

The dependent variable of this study was hypertension control. The independent variables in this study were participation in chronic disease prevention program, perceived vulnerability, perceived seriousness, perceived benefits, perceived barriers, cues to action, and self-efficacy.

d. Operational Definition of Variables

Participation in chronic disease prevention program. Participation in chronic disease prevention program in medical consultation, health education, and gymnastics were carried out every one month. The data were collected by questionnaires. Scale of measurement was continuous. The scale was converted into a dichotomy for analyzing.

Perceived vulnerability. Perceived vulnerability was an assessment of the risk of hypertension. The data were collected by questionnaires. The scale of measurement was continuous. The scale was converted into a dichotomy for analyzing.

Perceived seriousness. Perceived seriousness was an assessment of the severity of hypertension.The data were collected by questionnaires. The scale of measurement was continuous. The scale was converted into a dichotomy for analyzing.

Perceived benefits. Perceived benefits were assessment of perceived benefits in carrying out health behaviors. The data were collected by questionnaires. The scale of measurement was continuous. The scale was converted into a dichotomy for analyzing.

Perceived barriers. Perceived barriers were assessment of the obstacles to do health behaviors (cost, transportation, and distance). The data were collected by questionnaires. The scale of measurement was continuous. The scale was converted into a dichotomy for analyzing.

Cues to action. Cues to action was stimulation or encouragement to do health behaviors, such as family support, friends, and health workers. The data were collected by questionnaires. The scale of measurement was continuous. The scale was converted into a dichotomy for analyzing.

Self-efficacy. Self-efficacy was a belief on the ability to do health behaviors. The data were collected by questionnaires. The scale of measurement was continuous. The scale was converted into a dichotomy for analyzing.

Hypertension control. Hypertension control was activities which were conducted to prevent health complications such as doing physical activity, regulating diet, quitting smoking, and stop consuming alcohol. The data were collected by questionnaires. The scale of measurement was continuous. The scale was converted into a dichotomy for analyzing

e. Study Instrument

Data collection of independent and dependent variables was collected using a set of questionnaire.

f. Data Analysis

Univariate analysis described the characteristics of variables based on the results of the study. Bivariate analysis was conducted to determine the correlation between the dependent and independent variables using t test. Multivariate analysis used path analysis to determine the direct and indirect effects of a variable with 5 stages of path analysis (model specification, model identification, suitability model, parameter estimation, and model re-specification).

g. Research Ethics

Research ethics in this study include approval sheets, anonymity, confidentiality, and ethical feasibility. Ethical feasibility in this study came from the Health Research

Ethics Committee in Dr. Moewardi Hospitalnumber: 448 / III / HREC / 2019.

RESULTS

1. Univariate Analysis

Table 1 and Table 2 show the characteristics of respondents and other variables, using continuous data and categorical data.

Table 1. Sample characteristics (continuous data)

Characteristics	(n)	Mean	SD	Min.	Max.
Hypertension control	200	6.8	0.9	5	8
Systolic blood pressure (mmHg)	200	157.3	12.2	140	200
Diastolic blood pressure (mmHg)	200	92.5	4.3	90	100
participation in chronic disease prevention program	200	9.2	3.1	4	14
Perceived vulnerability	200	3.6	1.3	1	6
Perceived seriousness	200	4.4	1.2	2	6
Perceived benefits	200	4.3	1.2	1	5
Perceived barriers	200	3.9	1.1	2	5
Cues to action	200	3.2	0.8	1	4
Self-efficacy	200	2.9	1.3	1	5

Table 2. Sample characteristic (categorical data)

Variables	Frequency(n)	Percentage(%)
Hypertension control		
Good (score≥ 7)	127	63.5
Poor (score< 7)	73	36.5
Participation in chronic disease prevention program		
Yes (score> 9)		
No (score ≤ 9)	70	35
	130	65
Perceived vulnerability		
High (score> 4)	81	40.5
Low (score≤ 4)	119	59.5
Perceived seriousness		
High(score> 4)	108	54
Low(score≤ 4)	92	46
Perceived benefits		
High(score> 4)	147	73.5
Low(score≤ 4)	53	26.5
Perceived barriers		
High(score> 4)	99	49.5
Low(score≤ 4)	101	50.5
Cues to action		
High(score> 3)	91	45.4
Low(score≤ 3)	109	54.5
Self-efficacy		
High (score> 3)	62	31
Low (score≤ 3)	138	69

Tables 1 and 2 show that the study subjects who had lower perceived vulnerability were119 people (59.5%). Meanwhile, the study subjects who had a high perceived vulnerability were 81 people (40.5%). The study subjects who had higher perceived

seriousness were 108 people (54%). Meanwhile, the study subjects who had low perceived seriousness were 92 people (46.5%). The study subjects who had low cues to action were 109 people (54.5%). Meanwhile, the study subjects who had high cues to action were 91 people (45.5%). The study subjects who had lower self-efficacy were 138 people. The study subjects with good hypertension control were 127 people (63.5%). Meanwhile, the study subjects with poor hypertension control were 73 people (36.5).

2. Bivariate Analysis

Bivariate analysis explained the effects of one independent variable on one dependent variable. The analytical method used was the t test which showed the results of participation in chronic disease prevention program (Mean difference= -3,5; p< 0.001), perceived vulnerability (Mean difference= -1.5; p <0.001), perceived seriousness (Mean difference)= -1; p <0.001) (Mean difference=-1; p<0.001), perceived barriers(Mean difference=0.9; p<0.001),cues to action (Mean difference= -0.4; p<0.001), and self-efficacy (Mean difference= -0.4; p=0.002).

Table 3 The t test on the correlation between independent and dependent variables

Variables of the study	Hypertension control	N	Mean	Mean diff	p
Participation in chronic disease prevention program	Good	127	7	-3.5	<0.001
	Poor	73	10.5		
Perceived vulnerability	Good	127	2.6	-1.5	<0.001
	Poor	73	4.1		
Perceived seriousness	Good	127	3.7	-1	<0.001
	Poor	73	4.8		
Perceived barriers	Good	127	3.5	0.9	<0.001
	Poor	73	4.4		
Cues to action	Good	127	3.4	-0.4	<0.001
	Poor	73	2.9		
Self-efficacy	Good	127	3	-0.4	0.002

3. Path Analysis

a. Model Specification

Model specification described the correlation between the variables studied. In this study, there were eight observed variables, such as participation in chronic disease prevention program, perceived vulnerability, perceived seriousness, perceived benefits, perceived barriers, cues to action, self-efficacy, and hypertension control.

b. Model Identification

The observed variables were:

1) Number of observed variables : 8
2) Endogenous variables : 2
3) Exogenous variables : 6
4) Number of parameter : 8

Degree of freedom (df) = number of observed variables x (number of observed variables + 1) / 2 – (endogenous variables + exogenous + number of parameter)

df = (72/2) – (16)

df = 36 – 16

df = 20

The result ofdegree of freedom (df)was 20, which means that the *over identified*of path analysis could be conducted.

Table 4 shows the result of path analysis. Table 4 shows that hypertension control was directly affected by participation in chronic disease prevention program, perceived vulnerability, perceived seriousness, and self-efficacy. The elderlies who

participated in chronic disease prevention program had logodd of good hypertension control 2.85 units higher than the elderlies who did not participate in chronic disease prevention program (b= 2.85; 95% CI = 0.48 to 5.22; p= 0.018). The elderlies with high perceived vulnerability had logodd of good hypertension control 1.35 units higher than the elderlies with low perceived vulnerability (b= 1.35; 95% CI = 0.16 to 2.53; p= 0.025). The elderlies with high perceived seriousness had logodd of good hypertension control 0.83 units higher than the elderlies with low perceived seriousness (b= 0.83; 95% CI = 0.04 to1.62; p = 0.039). The elderlies with high self-efficacy had logodd of good hypertension control 0.99 units higher than the elderlies with low self-efficacy (b= 0.99; 95% CI = 0.14 to1.85; p= 0.023).

Hypertension control was indirectly affected by perceived benefits, perceived barriers, and cues to action.

Perceived benefits affected hypertension control through participation in chronic disease prevention program, perceived vulnerability, and self-efficacy. The elderlies with high perceived benefits had logodd of participated in chronic disease prevention program 2.48 units higher than the elderlies who did not participate in chronic disease prevention program (b= 2.48; 95% CI = 0.88 to 4.09; p<0.001). The elderlies with high perceived benefits had logodd of high perceived vulnerability 1.24 units higher than the elderlies with low perceived vulnerability (b= 1.24; 95% CI = 0.50 to 1.98; p=0.001). The elderlies with high perceived benefits had logodd of high self-efficacy 1.18 units higher than the elderlies with low self-efficacy (b= 1.18; 95% CI = 0.36 to 2.00; p =0.005).

Perceived barriers indirectly affected hypertension control through participation in chronic disease prevention program and cues to action. The elderlies with high perceived barriers had logodd of participated in chronic disease prevention program 4.15 units lower than the elderlies who did not participate in chronic disease prevention program (b= -4.15; 95% CI = -5.47 to -2.84; p<0.001). The elderlies with high perceived barriers had logodd of cues to action 2.02 units higher than the elderlies with low cues to action (b= -2.02; 95% CI = -2.65 to -1.38; p <0.001).

Cues to action indirectly affected hypertension control through perceived seriousness. The elderlies with high cues to action had logodd of perceived seriousness 1.76 units higher than the elderlies with low perceived seriousness (b= 1.76 ; 95% CI = 0.99 to 2.53; p= <0.001).

Perceived seriousness indirectly affected hypertension control through perceived vulnerability. The elderlies with high perceived vulnerability had logodd of high perceived seriousness 1.62 units higher than the elderlies with low perceived seriousness (b= 1.62; 95% CI = 0.81 to 2.44; p <0.001).

Self-efficacy indirectly affected hypertension control through participation in chronic disease prevention program. The elderlies with high self-efficacy had logodd of participated in chronic disease prevention program 1.16 units higher than the elderlies who did not participate in chronic disease prevention program (b= 1.16; 95% CI = 0.18 to 2.14; p <0.001).

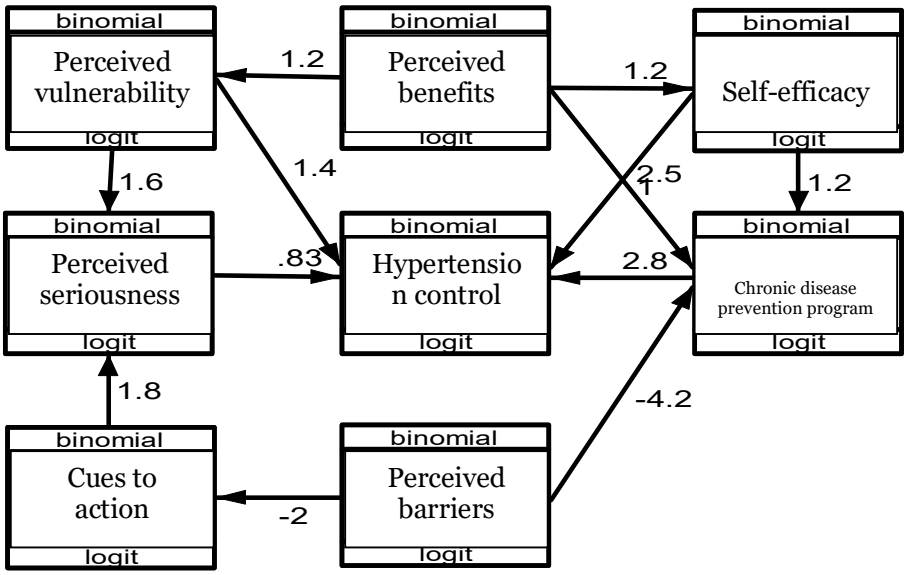

Figure 1.The structural model of path analysis

Table 4. The result of path analysis of chronic disease prevention program on hypertension control

Dependen variables	Independent variables	b	CI (95%)		p
			Lower limit	Upper limit	
Direct effect					
Hypertension control	← Participation	2.85	0.48	5.22	0.018
	← Perceived vulnerability	1.35	0.17	2.53	0.025
	← Perceived seriousness	0.83	0.04	1.62	0.039
	← Self-efficacy	0.99	0.14	1.85	0.023
Indirect effect					
Participation	← Perceived barriers	-4.15	-5.47	-2.84	<0.001
	← Perceived benefits	2.48	0.88	4.09	<0.001
	← Self-efficacy	1.16	0.18	2.14	<0.001
Perceived vulnerability	← Perceived benefits	1.24	0.50	1.98	0.001
Perceived seriousness	← Perceived vulnerability	1.62	0.81	2.44	<0.001
	← Cues to action	1.76	0.99	2.53	<0.001
Cues to action	← Perceived barriers	-2.02	-2.65	-1.38	<0.001
Self-efficacy	← Perceived benefits	1.18	0.36	2.00	0.005
N observation = 200					
Log likelihood = -616.15					

DISCUSSION

1. The Effects of Chronic Disease Prevention Program on Hypertension Control

The result of this study indicated that chronic disease prevention program had direct and positive effects on hypertension control which were statistically significant. Chronic disease prevention program is a health service and proactive system in maintaining the health of chronic sufferers to achieve optimal quality of life (BPJS Kesehatan, 2014).

Based on a study conducted by Dyanneza et al. (2017), chronic disease prevention program as a government program

to improve hypertension control which includes blood pressure monitoring, gymnastics, home visits, and health education has effects on controlling blood pressure in hypertensive patients.

Efforts to control hypertension are important to prevent complications of cardiovascular disease. Managing a healthy lifestyle can be used as a basis for controlling hypertension (Mills et al., 2016).

Physical activity such as gymnastic in chronic disease prevention program activities can be used to control the blood pressure of hypertensive patients, thus reducing blood pressure (Mills et al., 2016).

Home visit is one of the activities in chronic disease prevention program. The result of a study conducted by Dyanneza et al. (2017) showed that there was a statistically significant effect of home visits on systolic blood pressure in hypertensive patients. Hypertensive patients who received home visits had systolic blood pressure 22 mmHg lower than hypertensive patients who did not receive home visits.

Every individual has different affordability on medicine and health care, so that the government creates an effective health-based program to expand public health services, especially at the primary care level. The basis of this effective program is adopting a healthy lifestyle to prevent, treat, and control public health, especially for people with hypertension (Yang et al., 2016; Setiyaningsih et al., 2017)

Schiffrin et al. (2016) explains that the availability of public health systems by the government can be used effectively to control blood pressure in hypertensive patients. The development of a hypertension control program in Canada is called the Canadian Hypertension Education Program (CHEP) which is designed to increase blood pressure monitoring. The Canadian Hypertension Education Program recommends the health workers to use electronic devices (oscillometrics) specifically in measuring blood pressure rather than manual auscultation to improve the accuracy of blood pressure measurements, especially in hypertensive patients.

2. The Effects of Perceived Vulnerability on Hypertension Control

The result of this study indicated that there were direct and positive effects of perceived vulnerability on hypertension control which were statistically significant. Perceived vulnerability also indirectly affected hypertension control through perceived seriousness.

This study is in line with a study by Noumani et al. (2019) that patient's beliefs about health, vulnerability to a disease, and ways of health care have effects on medication adherence as one of the controls for chronic diseases including hypertension.

According to Setiyaningsih et al. (2017), there is an indirect effect between perceived vulnerability and hypertensive prevention behavior. Perceived vulnerability refers to subjective assessment of risks for health problems. The belief that she/he is susceptible to diseases that can threaten health will encourage individual to conduct health behaviors in preventing the occurrence of the disease complications (Puspita et al., 2017).

This is in accordance with the theory of Health Belief Model developed by Rosenstock (1994) that the individual assumption of getting a disease will make them aware of the prevention and protection (Murti, 2018). HBM illustrates a person who has a perception that he is susceptible to experience a disease will have a greater possibility of taking action to prevent the occurrence of the disease. However, a person who has a low perceived vulnerability to experience a disease has

low possibility to take action to prevent the occurrence of disease. These individuals are more likely to engage unhealthy or risky behavior (Murti, 2018).

3. The Effects of Perceived Seriousness on Hypertension Control

The result of this study indicated that there were direct and positive effects of perceived seriousness on hypertension control which were statistically significant.

The result of this study is in line with a study conducted by Al-Noumani et al. (2019) that the seriousness felt by an individual can affect the prevention and treatment of a disease. One of the diseases is hypertension because hypertension does not show symptoms like other diseases.

Perceived seriousness refers to a individual subjective assessment of the severity of a disease and the potential which can occurs if it is not treated or prevented. Someone who considers a disease seriously, will has a greater possibility to take an action needed to prevent the occurrence of the disease, or reduce the severity (Murti, 2018). The construction of perceived seriousness concerns the individual's beliefs about the seriousness or severity of the disease. Meanwhile, perceived seriousness is often based on medical information or knowledge. It can also come from a individual's belief that she/he will get difficulties due to disease and it affects on her/his life (Sulaeman, 2017).

4. The Effects of Self-Efficacy on Hypertension Control

The result of this study indicated that there were direct and positive effects of self-efficacy on hypertension control which were statistically significant. Self-efficacy also has indirect and positive effects on hypertension control through chronic disease prevention program.

Based on a study conducted by Setiyaningsih et al. (2017), self-efficacy increases control of individual's behavior in doing health behaviors. Self-efficacy refers to individual's belief which can estimate her/ his ability to take action needed to achieve certain results.

Based on a study conducted by Yue et al. (2015), self-efficacy significantly affected the control of a disease. Every single unit that increases self-efficacy will improve hypertension prevention behavior (Puspita et al., 2017).

High self-efficacy affects someone to do physical activity, regulate diet as a form of health behavior change (Yang et al., 2016). The effectiveness of a disease control health program can be improved by strategies to adjust the ability to change individual's personal health behavior (Schiffrin et al., 2016).

5. The Effects of Perceived Benefits on Hypertension Control

The result of this study indicated that there were indirect and positive effects of perceived benefits on hypertension control through perceived vulnerability which were statistically significant. Perceived benefits have indirect and positive correlation on hypertension control through self-efficacy which were statistically significant. Perceived benefits were also indirectly and positively related to hypertension control through chronic disease prevention program which were statistically significant. Based on a study conducted by Setiyaningsih et al. (2017), benefits felt by someone have positive effects on hypertension control behavior.

The theory of Health Belief Model states that behavior which is related to health is also affected by an individual's perception of the benefits of taking healthy actions or behaviors. The benefits felt by an individual will affect preventive action (Murti, 2018). The perceived benefits refer to an individual's assessment of value or

involvement in promoting health behavior to reduce the risk of disease. If an individual believes that certain actions can reduce vulnerability on health problems or reduce seriousness, the individual tends to engage in behavior, aside from objective facts about the effectiveness of an action (Sulaeman, 2016).

Based on a study conducted by Yue et al. (2015), perceived benefits show significant results on the prevention of a disease. Increasing perceived benefits to avoid a disease can affect on improving individual's self-efficacy, so that the tendency of someone's ability in health behavior will be better.

6. The Effects of Perceived Barriers on Hypertension Control

The result of this study indicated that there were indirect and negative effects of perceived barriers on hypertension control through cues to action which were statistically significant.

The result of this study is in line with Setiyaningsih et al. (2016) that perceived barriers have negative effects which are statistically significant on hypertension control behavior.

Another study conducted by Yue et al. (2015) explains that perceived barriers significantly affect medication adherence as a form of hypertension control.

Perceived barriers refer to various factors, including costs, transportation, and discomfort feeling which affect an individual in doing health behaviors. Reducing perceived barriers can be used as a basis for increasing the effectiveness of a disease prevention program (Puspita et al., 2017).

7. The Effects of Cues to action on Hypertension Control

The result of this study indicated that cues to action were indirectly and positively related to hypertension control through perceived seriousness which was statistically significant.

The result of this study is in line with a study conducted by Yue et al. (2015) that cues to act significantly affect medication adherence as a form of hypertension control.

Cues to action are needed to encourage individual involvement in health behavior. Cues to action can come from internal and external factors. Internal factors are symptoms or health complaints. External factors are information from friends, family, health workers, and media (Setiyaningsih et al., 2017).

Based on a study conducted by Yue et al. (2016), external factors such as social support from families and health workers increase an individual's belief in doing health behavior. Elderly people who get family support have better health behaviors. Support from family and health workers can be used as a health promotion strategy in controlling a disease (Jannah et al., 2018).

HBM shows that behavior is affected by cues to action. Cues to action are events, people, or things that move to change behavior (Sulaeman, 2016). Cues to action are encouragement to do health behavior (Murti, 20-18).

AUTHORS CONTRIBUTION

Nafi'ah Aprilia is the main researcher who plays a role in collecting and processing the data of the study. Didik Gunawan Tamtomo examined the conceptual framework and methodology of the study. Endang Sutisna Sulaeman examined data analysis and interpretation of the results of the analysis.

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CONFLICT OF INTEREST

There was no conflict of interest.

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