



Behavioral Examination of Blood Pressure and Cholesterol Levels in Survivors of Non-communicable Diseases in Monitoring Health in the Early Period of the Covid 19 Pandemic: A Study in Bogor in 2021

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Abstract. The global pandemic of COVID-19 has greatly affected the lives of People Living with Non-Communicable Diseases (PLWNCDs), which in Indonesia are known as *Orang yang Hidup dengan Penyakit Tidak Menular*. Cardiovascular disease and other major NCDs share similar modifiable risk factors, namely lifestyle and metabolic factors. This study aims to determine whether people living with NCDs have the ability to monitor their blood pressure and cholesterol level to maintain healthy metabolism at the beginning of the pandemic. Data were collected using an online survey in September–October 2020 from Bogor cohort NCD study respondents with Coronary heart disease, Stroke, Hypertension, and comorbidity between those NCDs. These data were collected from the study baseline until 2019 (referred to as “old cases”), with additional NCD cases from respondent information in 2020 (referred to as “new cases”). SPSS was used to conduct cross-sectional analyses of univariate, bivariate, and multivariate for descriptive and analytical purposes. Dependent variables in this analysis are nominal variables with three categories. Therefore, logistic multinomial regression analysis is used to conduct the statistical analysis. Over half of the 1460 respondents with at least one NCD stated that they did not do regular blood pressure and cholesterol checks during the pandemic (62%). Only a small percentage of respondents (10.6%) checked their blood pressure and cholesterol at least once a month. This means that for every ten people with cardiovascular disease, only one checked their blood pressure and cholesterol levels during the pandemic. The multivariate regression analysis revealed that NCD survivors with hypertension had the highest odds and did not monitor blood pressure and cholesterol (OR adj = 3.34; 1.833–6.095) compared to non-hypertension NCD survivors.

Additionally, people living with NCDs who lack health insurance, have a low level of education and are young (>50 years old) contribute to non-monitoring behaviour. Only one in ten people living with NCDs (CHD, stroke, hypertension, and a combination of the three diseases) monitored their blood pressure and cholesterol regularly during the COVID-19 pandemic. Those who monitor blood

pressure and cholesterol are carried out during health control at health service facilities and Posbindu PTM. Only a small percentage (5–11%) do it independently (at home or anywhere other than the health facility/UKBM).

Keywords: monitoring · blood pressure · cholesterol levels · PLWNCDS

1 Introduction

Cardiovascular disease, including heart disease, is a disease of the brain and vascular system's blood vessels. More than 17.3 million people die annually from cardiovascular disease as the leading cause. Cardiovascular diseases can be distinguished, namely those caused by atherosclerosis (ischemic heart/coronary heart, cerebrovascular disease or stroke, aortic and arterial disease such as hypertension), and other cardiovascular diseases such as congenital heart disease, rheumatic heart, cardiomyopathy, and cardiac arrhythmias [2].

Hypertension, or high blood pressure, is a severe health condition with a significantly increased risk of heart attack, stroke, heart failure, and blindness. It is the leading cause of death in the world. It is estimated that there are 1.13 billion people with hypertension, and it is estimated that 1 in 5 is uncontrolled hypertension. The main contributors to the increasing prevalence of hypertension in low-middle-income countries include an unhealthy diet, exceptionally high sodium and low potassium intake, low physical activity, and alcohol consumption [3].

The COVID-19 pandemic is an event that spreads the 2019 coronavirus disease (Coronavirus disease 2019-COVID-19) throughout the world to all countries. This disease is caused by a new type of coronavirus named SARS-CoV-2 [4]. The COVID-19 outbreak was first detected in Wuhan City, Hubei Province, China, on December 1, 2019, and was declared a pandemic by the World Health Organization (WHO) on March 11, 2020 [5]. Until February 24, 2021, there were 111,419,939 confirmed cases of COVID-19 globally, of which 2,470,772 ended in death [6].

In March 2020, the first confirmed case of COVID-19 in Indonesia occurred in Depok, West Java, when two Indonesian citizens were infected by Japanese visitors [7]. Ten months later, that number surpassed the one million confirmed cases of COVID-19 [8]. This spike and increase in cases from time to time have made special referral hospitals and general hospitals focus on handling cases of this infectious infection and its comorbidities without eliminating health services for cases of other diseases. In January 2021, at least ten provinces recorded an ICU and bed occupancy ratio (BOR) above 60% for COVID-19 patients, meaning that more than half of the inpatient capacity was dedicated to treating COVID-19 patients [8].

The global coronavirus disease (COVID-19) pandemic has dramatically affected People Living with Non-communicable Diseases (PLWNCDS) which in Indonesia are known as *Orang yang Hidup dengan Penyakit Tidak Menular* [1]. There are at least four main types of NCDs that account for the most mortality and morbidity globally, namely cardiovascular disease (including stroke and heart attack), cancer, chronic respiratory disease (such as chronic obstructive pulmonary disease and asthma), and diabetes. The World Health Organization recently conducted an assessment stating that since the

COVID-19 outbreak, people living with non-communicable diseases have become more susceptible to becoming seriously ill or dying due to COVID-19. In Italy, among those who died from COVID-19 in hospital, 68% had hypertension, and 31% had type 2 diabetes. While in Spain, among patients with severe COVID-19 disease, 43% had cardiovascular disease [9].

Cardiovascular disease and other diseases in the major NCDs share common risk factors. There are two types of risk factors, namely modifiable risk factors and non-modifiable risk factors. Risk factors that can be changed are lifestyle and metabolic risk factors. Smoking behaviour, lack of physical activity, unhealthy eating pattern, and alcohol consumption are lifestyle risk factors. Obesity, increased blood pressure, blood glucose, and blood fat are four fundamental changes in body metabolism that raise the risk of NCDs [10]. High blood pressure is the most significant metabolic risk factor influencing mortality globally, followed by obesity and increased blood glucose [11].

One of the strategies for preventing and controlling NCDs in Indonesia has been regulated by the Minister of Health regulation number 71 of 2015 [12]. Among others, early detection of NCD is carried out on individuals and/or groups who are at risk or not at risk regularly through interviews, measurements, and examinations. Then, depending on the early detection results of individuals who are positively at risk for NCD, risk factors control must be implemented. Individual or group activities for early detection, monitoring, and follow-up of NCD risk factors can be carried out under the supervision of the local primary healthcare facilities.

Most of the combined community efforts for monitoring and early detection of NCD could not be carried out in Indonesia during the COVID-19 epidemic, which lasted up to a year. The government advises that screening and early detection be carried out independently using the available examination equipment. Information technology can communicate the results online with doctors or Posbindu cadres [13]. This study aims to determine whether people living with NCDs have the understanding and ability to monitor their blood pressure and cholesterol level to maintain healthy metabolism at the beginning of the pandemic.

2 Materials and Methods

The primary data source was data from the study “The impact of mental health disorders and treatment-seeking related to NCDs during the COVID-19 pandemic on the respondent of the NCDs Risk Factor Cohort Study”. The study used a cross-sectional design, and the data was collected from September 28–October 9 2020, using an online survey.

The sample framework used the NCDs Risk Factor Cohort Study 2019 sample. The NCDs cohort sample was taken from 5 urban villages (Kebon Kelapa, Babakan Pasar, Babakan, Ciwaringin, and Panaragan) in Central Bogor District, Bogor City, West Java, Indonesia [14]. Online surveys were carried out after updating the data of the NCDs Risk Factor Cohort Study respondents. Because it uses the same sample frame, the data from the two studies can be integrated.

The sample criteria in this study were NCD survivor respondents, namely those diagnosed as survivors of one or more NCDs such as coronary heart disease (CHD), stroke, hypertension, and their combination. The subject was diagnosed from 2011 to

2019 as old cases. Additional new cases in 2020 were only based on the respondent's admission without any examination by the health professional during the COVID-19 pandemic. The number of old cases from baseline to eighth follow-up in 2019 that had been diagnosed with CHD, hypertension, and stroke and their combination was added along with new cases (respondents' claims in 2020) are the sample in this analysis, which contained 1,460 people.

The operational definition of *monitoring* as the dependent variable in this study was the respondent's admission regarding (1) checking blood pressure at least one time every month and conducting routine blood pressure/hypertension checks at least one time a month during the COVID-19 pandemic, and (2) checking cholesterol levels during the COVID-19 pandemic. The dependent variable was divided into three categories, (1) code 0 if neither check is performed; (2) code 1 if doing one of the checks (blood pressure or cholesterol); (3) code 2 if doing both.

The categories used in the independent variables were as follows: (1) age group 30–50 years and age group above 50 years; (2) insurance ownership (have, do not have); (3) employment or working status (working, not working); (4) the number and types of diseases suffered by NCD-cardiovascular (one NCD, experiencing more than one NCDs or complications); (5) education level of moderate-high (junior high school graduation, senior high school and graduated from college), low (no school, did not finish elementary school and finished elementary school); and (6) health insurance (BPJS, National insurance of health-Jamkesmas, insurance of health by local government -Jamkesda, KIS (Healthy Indonesia Card), private insurance) ownership (have do not have).

Data analysis used SPSS 24 statistical tool with serial number 6a455010 54a0b0c57002. The dependent variable in this study was a nominal variable with three categories; therefore, the analysis uses multinomial logistic regression. The coding value on the independent variable is adjusted to the dependent variable, which means that the highest code is a reference during analysis. The significance value and odds risk are statistical values used to describe the relationship between variables.

The ethical approval was obtained from the Research Ethics Commission of the NIHRD of the Ministry of Health number LB 02.01/2/KE511/2020.

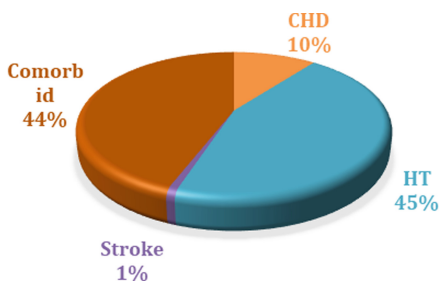
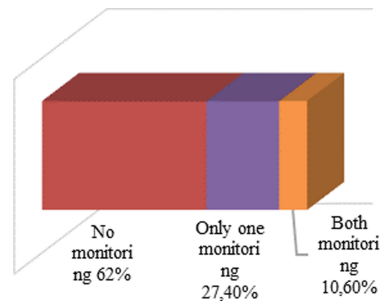
3 Results

The average age of the 1,460 participants in this study with NCDs was 54 ± 9.3 years, with the youngest and oldest participants being 30 and 74 years old. Table 1 describes the characteristics of the respondents in this analysis. Based on gender, it was dominated by women and a quarter of the total respondents were male. The majority (61.5%) of responders with the highest education level completed junior high, senior high school, and college. Most respondents were older than 50 and considered a group based on their age (65%). Most of the respondents did not work or did not have a reliable source of income. According to the respondents' statements, 90% hold a health insurance card. In the distribution of samples of NCDs survivors in this analysis, hypertension was most common (45%) and slightly smaller in people who had a combination of cardiovascular NCDs (comorbid). The proportion was 44% (Fig. 1).

More than half of the 1,460 people said they did not do their monthly blood pressure and cholesterol checkups because of the pandemic (62%). During the pandemic, only

Table 1. Sample distribution by demographic characteristic

Variable	n	%	95% CI
Gender			
Male	321	21.9	19.8–24.1
Female	1,139	78.0	75.8–80.1
Education level			
Low	563	38.5	36.0–41.0
Moderate-High	897	61.5	58.9–63.9
Age group			
Young (less than 50 years old)	502	34.4	31.9–36.8
Old (more than 50 years old)	958	65.6	63.1–68.0
Occupational status			
Working	253	17.3	15.3–19.3
Not working	1,207	82.7	80.7–84.6
Insurance			
Have insurance	114	7.8	6.4–9.1
Do not have insurance	1,346	92.2	90.8–93.5

**Fig. 1.** Sample distribution by type and number of NCDs**Fig. 2.** Distribution of NCDs monitoring behaviors

10.6% of respondents monitored their blood pressure and cholesterol at least once a month (see Fig. 2). This means that out of 10 people with cardiovascular risk, only one checks their blood pressure and cholesterol during the pandemic.

In the group that carried out both examinations, more were carried out in health facilities (primary health facilities (Puskesmas), hospitals, clinics) than those who carried out in Posbindu or independently (home/office/mall). The pattern of checkpoints was similar for only blood pressure or cholesterol examinations (Fig. 3).

The NCD survivor group with hypertension had the highest percentage of people who did not monitor their blood pressure and cholesterol during the COVID-19 pandemic

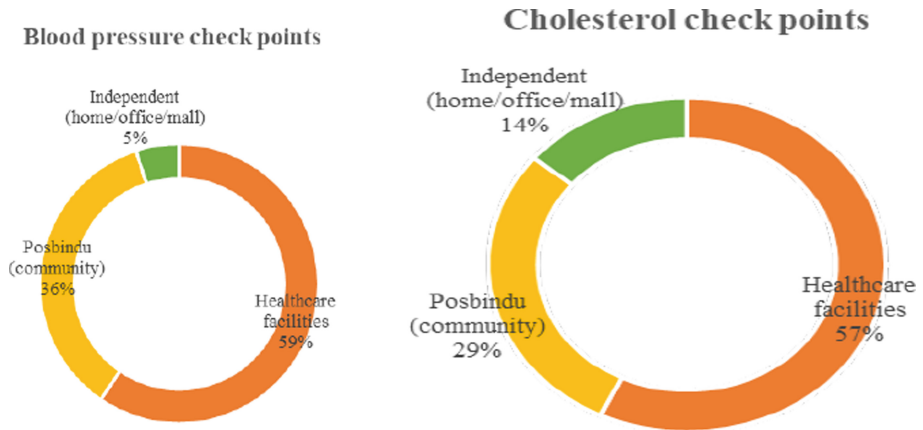


Fig. 3. Distribution of the proportion of blood pressure and cholesterol examination checkpoints

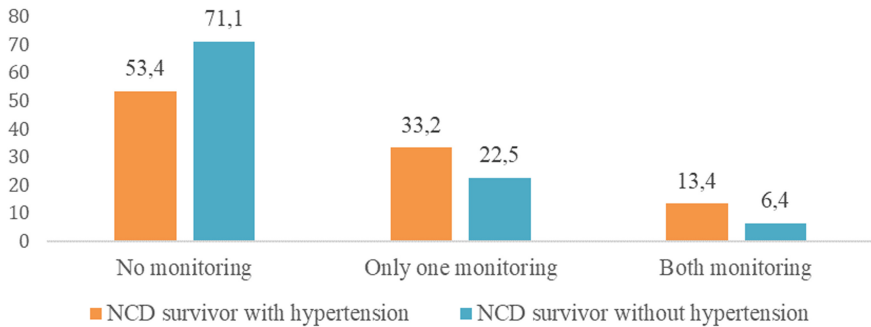


Fig. 4. Distribution of blood pressure and cholesterol monitoring behaviour by cardiovascular problems in Bogor City in 2020

(53.4%). Meanwhile, in the NCD survivor group without hypertension, not monitoring blood pressure and cholesterol also had the most significant proportion (71.1%) (Fig. 4).

During the COVID-19 pandemic, 65.3% of people in the younger age group did not monitor blood pressure and cholesterol. Compared to working status, monitoring is mainly carried out by groups that do not earn or do not work. Non-adherence to monitoring blood pressure and cholesterol has occurred more in the group that does not have health insurance.

In the NCDs survivor group with hypertension, the proportion who monitored blood pressure and cholesterol checks regularly during the pandemic was only 13.4%. The percentage was lower in the survivors who did not have hypertension. 6.4% regularly did both monitorings (Table 2).

The results of the multivariate analysis are shown in Table 3. Factors that have a significant relationship were age, sex, occupation, education, insurance, and history of cardiovascular NCDs problems with or without hypertension. In the group that did not

Table 2. Relationship of Blood Pressure and Cholesterol Monitoring Behavior with Demographic Characteristics and Comorbid History in NCDs Survivors

	Blood pressure and cholesterol monitoring								N total	P
	Not monitoring both			Only one monitoring			Monitoring both			
	%	p	OR crude (CI)	%	p	OR crude (CI)	%	OR crude (CI)		
Age group										<0,01
30–50 years old	65.3	< 0,01	2.447 (1.67; 3.58)	26.9	0.051	1.499 (0.99 2.25)	7.8	REF.	502	
More than 50 years old	50.9		Reff	34.2		Reff	14.8		968	
Gender										0,267
Male	59.8	0.22	1.284 (0.85;1.92)	29.3	0.783	1.063 (0.68;1.63)	10.9	REF.	321	
Female	54.8			32.4			12.8		1.139	
Occupational status										0,082
Working	61.7	0.04	1.624 (1.01;2.60)	29.2	0.297	1.307 (0.79;2.16)	9.1	REF.	253	
Not working	54.7		Reff.	32.2		Reff.	13.1		1.207	
Education level										0,293
Low	57.5	0.07	1.362 (0.96;1.91)	32.0	0.139	1.315 (0.91;1.89)	10.5	REF.	563	
Moderate-high	54.8		Reff.	31.5		Reff	13.5		897	
Insurance ownership										0,005
No	69.3	0.04	2.049 (1.00;4.16)	22.8	0.746	1.137 (0.52;2.47)	7.9	REF.	114	
Yes	54.8		Reff.	32.5		Reff.	12.8		1.34	
NCD type										<0,01
NCDs without hypertension	71.1	0.001	2.793 (1.54;5.04)	22.5	0.296	1.426 (0.75;2.70)	6.4	REF.	204	
NCDs with hypertension	53.4		Reff.	33.2		Reff	13.4		1.256	

monitor blood pressure and cholesterol, the highest odds were for NCDs survivors with a history of hypertension, which was 3.34 times compared to non-hypertensive NCDs survivors. Younger groups were less likely to check their blood pressure and cholesterol than older survivors. More details are in Table 3.

The age group under 50 has a 3.12 times chance of not doing any monitoring compared to people over 50 years old. Low-education survivor has a 1.81 times greater chance of not doing any monitoring than NCDs survivors with moderate to high education in the city of Bogor.

Table 3. Multivariable Model of Blood Pressure and Cholesterol Monitoring Behavior in Cardiovascular Problem during the COVID-19 pandemic, Bogor City in 2020

	Not monitoring both			Only one monitoring		
	OR-adj	95% CI	p	OR-adj.	95% CI	P
30–50 years old	3.12	2.10–4.64	<0.005	1.68	1.11–2.56	0.014
More than 50 years old	Reff					
Low education	1.81	1.26–2.60	0.001	1.47	1.01–2.15	0.041
Moderate-high education	Reff					
Do not have insurance	2.11	1.03–4.34	0.041	1.16	0.53–2.53	0.707
Have insurance	Reff					
Male	1.62	1.067–2.465	0.024	1.20	0.77–1.87	0.406
Female	Reff					
NCD with hypertension	3.34	1.833–6.095	<0.005	1.53	0.80–2.93	0.191
NCD without hypertension	Reff					

4 Discussion

The analysis results show that several factors influence the behaviour of not monitoring blood pressure or cholesterol in NCDs survivors, especially patients with CHD, stroke, and hypertension in Bogor City early in the COVID-19 pandemic. Male NCDs survivors were less likely to comply with routine blood pressure and cholesterol monitoring if they had a history of hypertension, were in the young adult age group, did not have health insurance, and had low education levels. In a study conducted in Korea, where men make up a smaller percentage of young adults than women, the findings indicated that the relationship between non-adherence and hypertension control was practically identical. The contrary, however, occurs after age 60 [15].

It is anticipated that an unknown or uncontrolled increase in blood pressure will occur if NCDs survivors fail to check their blood pressure frequently. Increased blood pressure is estimated to cause about 7 million premature deaths worldwide and 4.5% of the disease burden [16]. According to the findings, the one that neglected the monitoring behaviour was affected by age and gender, namely young adult males. Although age and gender were non-modifiable or irreversible factors, these factors were closely related to other modifiable factors [17]. Education and insurance ownership were other variables in this situation that are modifiable.

For those who have survived NCDs, most cardiovascular problems could be prevented or, at the very least, keep from getting worse. It was hoped that by routinely checking blood pressure and cholesterol levels, survivors would be able to determine whether their medical conditions were under control. Since regulated blood pressure and cholesterol levels were 2 of the 7 factors that could reduce the risk of cardiovascular disease [17]. Controlled blood sugar levels, a healthy diet, regular physical activity, avoiding smoking and exposure to cigarette smoke, and maintaining body weight were other variables.

4.1 Monitoring at Primary Health Facilities Versus Independent Monitoring

Based on this study, it was found that a small proportion of those who had monitored blood pressure and cholesterol, most of them did it in health facilities (59% for blood pressure checks, 57% for cholesterol checks), and a quarter monitored it at integrated service posts (Posbindu)-Participation in community-based health interventions (CBHIs)-driven by the collaboration of cadres and local healthcare professionals. Self-monitoring of cholesterol and blood pressure was still extremely low in percentage. Awareness about hypertension already exists in those who were active in Posbindu, although this awareness was not followed by routine hypertension treatment [18]. Based on a meta-analysis of randomized clinical trials (RCT), J.P. Sheppard (2020) proposed that independent blood pressure monitoring could be an effective approach for NCDs survivors with hypertension [19]. Since the COVID-19 epidemic, early diagnosis or independent blood pressure checkups have been recommended in Indonesia, especially for NCDs survivors [20]. Based on this analysis, only 5% of respondents follow this recommendation to independently monitor their condition. This becomes a challenge and an opportunity to increase the importance of routine independent monitoring for people with the equipment at home or community empowerment (Upaya Kesehatan Berbasis Masyarakat), especially for NCDs survivors.

Self-monitoring blood pressure (SMBP) is one strategy that can help lower the risk of death or disability in patients with uncontrolled hypertension. Patients identified by physicians as having uncontrolled hypertension may be considered for further clinical intervention. SMBP is a tool designed for medical practitioners to help patients actively participate in managing their blood pressure [21]. This independent monitoring complements the routine monitoring conducted by healthcare facilities and UKBM.

However, an independent blood pressure monitoring application in Ethiopia in 2020 was identified as having potential barriers to the respondents' inability to do the monitoring. These barriers include not understanding how to operate the device, not being able to afford a device, not knowing the importance of monitoring blood pressure, readings that were felt to be inaccurate, and was never asked by a doctor to self-monitor his blood pressure [22]. Therefore, this independent blood pressure monitoring alternative needs the support of existing healthcare facilities as implementing strategy makers in each region.

4.2 Policy Implication

Emphasize the importance of routinely checking blood pressure and cholesterol at the healthcare facilities and UKBM. Encourage the local government's provision of blood pressure devices and rapid cholesterol tests to be used and maintained by the community, especially NCDs survivors.

4.3 Study Strengths and Limitations

This research was a non-communicable disease cohort study encompassing five villages in one sub-district of Bogor City, with several fixed and recurring subjects. Health professionals use interviews and physical examinations to determine whether a person has

one of the non-communicable diseases; thus, the validity was relatively high. The study's online nature presented a limitation because data collecting was still in its early stages during the COVID-19 outbreak (there are social restrictions).

5 Conclusion

During the Covid-19 pandemic, the NCDs survivor group with hypertension exhibited a propensity for lax blood pressure and cholesterol monitoring. Additionally, despite being survivors, the pre-elderly age group tends to be less disciplined regarding monitoring. Both groups should take actions to prevent an increase in health problems. Improving health knowledge and insurance coverage is expected to increase health efforts.

Research on the combination of independent monitoring of blood pressure and cholesterol with mobile applications in addition to examination at health facilities and UKBM conducted by NCDs survivors to maintain health during the COVID-19 pandemic.

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