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Risk factors associated with uncontrolled blood pressure among patients with non-dialysis chronic kidney disease in Vietnam

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Abstract

Background: Uncontrolled blood pressure rates are high in patients with non-dialysis chronic kidney disease, worsening the disease progression and leading to end-stage renal disease. However, studies on uncontrolled blood pressure in patients with non-dialysis chronic kidney disease and its associated factors in Vietnam are scarce.

Objectives: This study aimed at identifying uncontrolled blood pressure rates and risk factors associated with uncontrolled blood pressure among Vietnamese patients with non-dialysis chronic kidney disease.

Methods: A cross-sectional, correlational study design was employed among 182 participants coming to follow up at two tertiary hospitals in Vietnam. The participants were selected by a convenience sampling technique. Data were collected using Participant Demographic Information Form, Clinical Characteristics Form, Alcohol Use Disorders Identification Test, Pittsburgh Sleep Quality Index, Charlson Comorbidity Index, and an automated office oscillometric upper arm device. Descriptive statistics, Chi-square, Fisher's Exact Test, and binary logistic regression were used to analyze the data.

Results: 63.2% of the participants could not control their BP less than 130/80 mmHg. Poor sleep quality (*OR* 2.076, 95%*CI* 1.059-4.073, *p*=.034) and severe comorbidities (*OR* 2.926, 95%*CI* 1.248-6.858, *p*=.013) were risk factors associated with uncontrolled blood pressure among Vietnamese patients with non-dialysis chronic kidney disease. Interestingly, the study found a high rate of awareness toward the importance of blood pressure control but a low rate of known blood pressure targets.

Conclusion: Uncontrolled blood pressure rates among Vietnamese patients with non-dialysis chronic kidney disease were high. Sleep quality and comorbidity severity were significantly associated with uncontrolled blood pressure in this population. To achieve blood pressure targets, nurses and other healthcare providers should pay more attention to the patients with poor sleep quality and severe comorbidities.

Keywords

blood pressure; comorbidity; renal insufficient, chronic; sleep; nursing; Vietnam

Chronic kidney disease (CKD) prevalence has become large and is on the rise due to significant growth in the number of non-communicable diseases (NCDs) and other risk factors (Haileamlak, 2018). It is estimated that 11%-13% of worldwide people suffer from CKD (Hill et al., 2016). Additionally, within a two-year period from 2015 to 2017, the Global Burden of Disease (GBD) study reported a double elevation in the global prevalence of CKD (GBD 2015 disease and injury incidence and prevalence collaborators, 2016; GBD 2017 disease and injury incidence and prevalence collaborators, 2018). Similarly, Vietnam has also reached a relatively high CKD prevalence (Tran et al., 2017). Consequently, CKD now contributes to 1.2 million deaths over the world and has

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become the sixteenth leading cause of global years lost of life (GBD 2017 disease and injury incidence and prevalence collaborators, 2018).

In parallel with the high prevalence of CKD, blood pressure (BP) often elevates in patients with CKD, occupying 60%-90% (Ku et al., 2019). Moreover, previous studies illustrated the high rate of patients with Non-Dialysis CKD (NDCKD) who could not control their BP less than 130/80 mmHg as recommended (Whelton et al., 2018), ranging from 64%-88% (Zheng et al., 2013; Unni et al., 2015; Dharmapatni et al., 2020). Poor BP control increased 1.84-1.93 times of renal progression in patients in the early stages of CKD, leading to end-stage renal disease (ESRD) and the development of cardiovascular diseases (CVDs) (KDIGO, 2012; Chang et al., 2016). Patients at ESRD need renal replacement therapy (RRT) to maintain their life (CDC, 2020). This puts a financial burden on society and the healthcare system because of the tremendous cost of dialysis treatment (Liyanage et al., 2015). Additionally, dialysis also worsens the patients' health-related quality of life regarding physical and mental health (Mollaoglu & Deveci, 2017). Thus, effective BP control should be considered as a cornerstone of the care of patients with NDCKD.

BP is multifactorial which is influenced by lifestyle, response to the environment, physiology, and genetic factors. These factors are presented as four domains in Hypertension Development and Assessment model (HDA) (Frazier, 2000). This model is useful in guiding clinicians and researchers to systematically address risk factors of hypertension (HT) (Frazier, 2000). Therefore, the model was employed as a conceptual framework in this study.

Lifestyles are changeable factors, including alcohol consumption and smoking status (Frazier, 2000; Farhud, 2015). There is the fact that alcohol consumption and smoking status are problematic in Vietnam. Specifically, 43.8% and 22.5% of Vietnamese people are current drinkers and current smokers, respectively (Ministry of Health of Vietnam, 2016; Van Minh et al., 2017). These factors were demonstrated to be positively associated with uncontrolled BP among general and hypertensive populations (Wang et al., 2018; Cherfan et al., 2020). By contrast, no association between these factors and uncontrolled BP was reported among patients with NDCKD (Schneider et al., 2018; Zhang et al., 2019). However, no study has been found to assess associations between these two factors and uncontrolled BP among patients with NDCKD in the Vietnam context.

Similar to lifestyle factors, sleep quality belonging to response to the environmental factors should be concerned as the majority of patients with CKD have poor sleep quality with approximately 80% (Teixeira dos Santos & Moraes de Almondes, 2015). Prior studies illustrated a significant association between sleep quality and uncontrolled BP in general and hypertensive populations (Bruno et al., 2013; Liu et al., 2016). Nevertheless, it is not well established whether this association is significant among NDCKD patients. Regarding physiology factors, previous studies found inconsistent findings between age, diabetes mellitus (DM), and uncontrolled BP. Some studies have proved a significant association between age, DM, and uncontrolled BP (Lee et al., 2017; Yan et al., 2018), but another study proposed an opposite finding (Dharmapatni et al., 2020). For comorbidity, it has been widely known that CKD mostly accompanied with comorbidity. There was one-quarter of CKD populations having three or more comorbidities (Tonelli et al., 2015). The result of a study demonstrated that hypertensive patients with serious comorbidities increased the risk of uncontrolled BP (Paulsen et al., 2012). However, no study was conducted among patients with NDCKD. In terms of genetic factors, mixed results were demonstrated regarding the association between gender and uncontrolled BP in prior studies conducted in different settings (Lee et al., 2017; Dharmapatni et al., 2020). It can be seen that inconsistent findings were found between alcohol consumption, smoking status, age, DM, gender, and uncontrolled BP in previous studies. Additionally, the association between sleep quality, comorbidity severity, and uncontrolled BP among patients with NDCKD has not been explored.

Although there are a number of studies on uncontrolled BP and its associated factors among NDCKD patients, little is known about the Vietnamese population. The difference in terms of culture, habit, lifestyle, and the healthcare system can generate different results. Therefore, understanding uncontrolled BP and its associated factors are important for nurses and other healthcare providers to develop efficient interventions to achieve adequate BP control in this population. Therefore, this study aimed to identify uncontrolled blood pressure rates and risk factors associated with uncontrolled blood pressure among Vietnamese patients with NDCKD.

Methods

Study Design

A cross-sectional, correlational study design was employed among NDCKD patients coming to follow up at Nephro-Urology Department and General Outpatients Department in two tertiary hospitals in Vietnam.

Participants

The convenience sampling technique was used to select participants according to the inclusion and exclusion criteria. Vietnamese male or female patients, ages 18 and above, diagnosed with CKD for three months or over were eligible for inclusion in the study. Participants were required to have an estimated glomerular filtration rate (eGFR) less than 60 ml/min/1.73m^2 and had never undergone RRT. Participants aged 60 or over or/and had eGFR less than 15 ml/min/1.73m^2 were screened for the cognitive impairment by the General of Practitioner assessment of Cognition (GPCOG). Patients who had cognitive impairment, those who were diagnosed with severe diseases/conditions, psychiatric disorders, had been taking medications influencing BP such as cold medicines comprising pseudoephedrine, phenylephrine; analgesics containing NSAIDs; steroid/ immunosuppressive agents comprising cyclosporine, tacrolimus, antacids; and/or oral contraceptives within seven days prior to data collection, and those who had changed hypertensive regimen within three months were excluded.

The sample size was calculated by using G-power software 3.1.9.4 (Faul et al., 2009). A previous similar study found excessive alcohol intake as a predictor of uncontrolled BP (OR 2.9, 95%CI 1.3-6.2) (Adeniyi et al., 2016). Based on this study, the sample size was calculated by using logistic regression with two tails, binominal distribution, probability H1 = .87, probability H0 = .69, X parm π = .4, power = .8, and α = .05. As a result, 182 participants were recruited into the study.

Instruments

Participant Demographic Information Form, Alcohol Use Disorders Identification Test (AUDIT), Pittsburgh Sleep Quality Index (PSQI), Clinical Characteristics Form, Charlson Comorbidity Index (CCI), and an automated office oscillometric upper arm device (OMRON Hem 717) were used to collect data.

Participant Demographic Information Form developed by the researchers was used to collect data of age, gender, marital status, educational level, occupation, and smoking status. Smoking status was classified into two groups: non-smokers and smokers. Non-smokers include adults who have never used cigarettes or have used cigarettes less than 100 in the duration of their life. Smokers include past and current smokers. Past smokers are those adults smoking 100 cigarettes or more in their lifetime but who have quit smoking on interview day. Current smokers are those adults smoking 100 cigarettes or more in their lifetime and currently smoking cigarettes (CDC, 2017).

AUDIT was employed to measure alcohol consumption. This questionnaire was developed by Saunders et al. (1993). It was translated into the Vietnamese language by following back translation procedures by Giang et al. (2005). AUDIT is a self-report questionnaire that has ten items. The first eight questions have scores in the range of 0-4. Questions 9 and 10 have scores of 0, 2, or 4. The total score ranges from 0 to 40 (Babor et al., 2001). In this study, alcohol consumption was categorized into two groups: non-drinker/ low level of alcohol problems with a score of less than 8, and hazardous, harmful alcohol use and alcohol dependence with a score greater or equal to 8.

AUDIT has a high sensitivity (92%) and specificity (94%) in early detecting people with drinking problems (Saunders et al., 1993). AUDIT Vietnamese version has a sensitivity of 81.8%, 100%, and 93.8% for detecting risky drinking, harmful use, and alcohol dependence, respectively. In terms of specificity, AUDIT was able to identify 76.1%, 69.9%, and 87.4% of participants with risky drinking, harmful use, and alcohol dependence, respectively (Giang et al., 2005). The Cronbach's alpha coefficient of AUDIT was .75 in this study.

PSQI was applied to measure sleep quality. The questionnaire was developed by Buysse et al. (1989). It was translated into the Vietnamese language using forward and backward translation by To and Nguyen (2015). PSQI is a self-report questionnaire that consists of ten items classified into seven components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction). However, only the first nine items were used to calculate the total score. The total score ranges from 0 to 21. A score equal to or less than 5 indicates good sleep quality, and conversely, a score greater than 5 demonstrates poor sleep quality (Buysse et al., 1989).

PSQI has high reliability with Cronbach's alpha coefficient of .83 and stability in global and component scores. In terms of validity, PSQI was able to identify accurately 88.5% of all patients with 89.6% of sensitivity and 86.5% of specificity, which are similar to clinical and laboratory measures (Buysse et al., 1989). The PSQI Vietnamese version has a Cronbach's alpha coefficient of .789, showing good internal consistency. The test-retest reliability coefficient was .79 (To & Nguyen, 2015). In this study, PSQI was tested for its reliability. The Cronbach's alpha coefficient of PSQI was .81.

Clinical Characteristics Form, which was developed by the researchers, was used to record clinical characteristics, including CKD stage, comorbidity severity, comorbidities, perceived importance of BP control, and known target BP. Comorbidities were obtained from participants' medical records. eGFR was calculated using the CKD-EPI equation (Levey et al., 2009) and used to classify the CKD stage.

CCI was used to assess comorbidity severity (Charlson et al., 1987). CCI consists of 19 diseases. Scores 1, 2, 3, or 6 were given to each disease depending on its severity. Furthermore, each decade of age over 40 would add 1 point to risk. The sum of comorbidity score and age score was a total score of CCI (Charlson et al., 1987). The severity of comorbidity in this current study included mild comorbidities (0-2 scores), moderate comorbidities (3-4 scores), and severe comorbidities (5-6 scores).

An automated office oscillometric upper arm device (OMRON Hem 717) was used to measure BP according to the standard protocol (Whelton et al., 2018). Participants were instructed to avoid consuming alcohol, caffeine, smoking, or doing exercise for at least 30 minutes, concurrently sit and relax in a chair with back supported and feet flat on the floor for around 3-5 minutes without talking and moving prior to measurement. Two times measurements were performed in both arms. The third measurement was implemented when systolic blood pressure (SBP) or diastolic blood pressure (DBP) was different by greater or equal to 10 mmHg between both arms. The average of two or three measurements was the final BP value. As SBP increases as one age and can strongly predict heart diseases, physicians mostly place emphasis on controlling SBP (LeWine, 2018). Therefore, in this study, SBP was used to categorize uncontrolled and controlled BP groups. Uncontrolled BP was defined when

SBP was greater or equal to 130 mmHg. By contrast, controlled BP was when SBP was less than 130 mmHg.

Data Collection

Data were collected from January 2020 to May 2020. CKD patients coming to follow up at Nephro-Urology Department and General Outpatients Department were first screened for inclusion criteria by staff nurses. Then, all potential participants were informed about the research protocol, benefits, risks, privacy, and confidentiality by the principal investigator (PI). When the potential participants agreed to participate in the study, the PI asked their permission to review medical records to identify exclusion criteria. The potential participants who met the study criteria were recruited and guided to sign an informed consent. Then, the participants aged greater or equal to 60 or eGFR less than 15 ml/min/1.73m^2 were screened for cognitive impairment. The participants having a GPCOG score of less than nine were excluded from the study. After that, BP was measured in all participants, and they were guided to complete questionnaires before meeting with physicians. During data collection, the participants had the right to withdraw from the study at any time without any effect on their treatment. The estimated time for data collection for each respondent was approximately 25-30 minutes.

Data Analysis

Statistical Package for the Social Science version 18.0 licensed by Mahidol University was used to analyze quantitative data. A p-value less than .05 was considered as statistical significance. Descriptive statistics were used to describe participants' characteristics. Frequency and percentage were used to describe categorical data. Continuous data were analyzed using frequency, percentage, mean, and standard deviation (SD). Chi-square test and Fisher's Exact test were performed to test for the association of each independent variable with uncontrolled BP. Then, binary logistic regression analysis by the forward stepwise method was done to identify dominant risk factors associated with uncontrolled BP. Each statistical test was checked for its assumptions.

Ethical Consideration

The study was approved by the Institutional Review Board (IRB), Faculty of Nursing, Mahidol University (COA No.IRB-NS2019/525.0912). Informed consent was obtained before collecting data. The PI informed the potential participants regarding the study's objectives, data collection procedure, risks and benefits of the study, participants' privacy, and confidentiality. Then, the participants voluntarily signed in the informed consent when they did not have any doubt about the research and were willing to participate in the study.

Results

Demographic Characteristics of the Participants

A total of 188 potential participants were approached. However, four patients had cognitive impairment (GPCOG < 9), and two patients refused to participate in the study due to their time limit. As a result, 182 participants were recruited into this study. As shown in **Table 1**, over half of the participants were male (55.5%) and aged 60 or over (53.8%) with a mean age of 58.7 ± 15.33 years. The percentage of the participants finishing secondary school was the highest with 43.4%, followed by high school level, occupying 22.0%.

Table 1 Participants' demographic characteristics

Characteristics	*N* (182)	%
Age (years)		
18-39	28	15.4
40-59	56	30.8
≥ 60	98	53.8
(Mean=58.7, SD=15.33, range=18-88)		
Gender		
Male	101	55.5
Female	81	44.5
Marital status		
Single	6	3.3
Separated/divorced	4	2.2
Widow	18	9.9
Married	154	84.6
Educational level		
Illiterate	1	.6
Primary school	19	10.4
Secondary school	79	43.4
High school	40	22.0
Diploma	11	6.0
College/University	31	17.0
Higher education	1	.6

Table 1 *(Cont.)*

Characteristics	*N* (182)	%
Occupation		
Unemployed	33	18.1
Government officer	10	5.6
Private officer	3	1.6
Own business	12	6.6
Worker	13	7.1
Farmer	39	21.4
Retired	72	39.6

Table 2 Participants' clinical characteristics and blood pressure level

Characteristics	*N* (182)	%
CKD stage		
Stage 3 (30-59 ml/min/1.73m^2)	102	56.0
Stage 4 (15-29 ml/min/1.73m^2)	52	28.6
Stage 5 (<15 ml/min/1.73m^2)	28	15.4
Diabetes		
No	120	65.9
Yes	62	34.1
Diabetes with CKD		
No diabetes with CKD	120	65.9
Diabetes with CKD stage 3	49	26.9
Diabetes with CKD stage 4	8	4.4
Diabetes with CKD stage 5	5	2.8
Comorbidity severity		
Mild	78	42.9
Moderate	48	26.3
Severe	56	30.8
Comorbidities[†]		
Diabetes with end-organ damage	60	33.0
Ischemic heart disease	16	8.8
Heart failure	14	7.7
Others[‡]	5	2.7
Perceived the importance of blood pressure control		
Yes	151	83.0
No	2	1.1
Unknown	29	15.9
Known target blood pressure		
Yes	60	33.0
No	122	67.0
Overall systolic blood pressure		
Mean=138.3, SD=19.46, range=62-176		
Controlled systolic blood pressure (<130 mmHg)	67	36.8
<120	25	37.3
120-129	42	62.7
(Mean=118.3, SD=12.07, range=62-129)		
Uncontrolled systolic blood pressure (≥130 mmHg)	115	63.2
130-139	28	24.3
≥140	87	75.7
(Mean=149.9, SD=12.19, range=131-176)		

[†]Comorbidities listed in Charlson Comorbidity Index; [‡]Chronic obstructive pulmonary disease, Diabetes, Peptic ulcer, Peripheral vascular disease, Cerebrovascular disease, Connective tissue disease, Mild liver disease, Hemiplegia, Any tumor, Leukemia, Lymphoma, Moderate or severe liver disease, AIDS.

Clinical Characteristics and Blood Pressure

As presented in **Table 2**, CKD stage 3 was the most common, occupying 56.0%, followed by 15.4% of the participants having kidney failure. The majority of the participants did not have DM (65.9%). Among the participants having DM, many of them were in CKD stage 3, occupying 26.9%. Many participants had mild comorbidity (42.9%), and DM with end-organ damage was the most common comorbidity, taking up 33.0%. Interestingly, although most participants were aware of the importance of BP control (83.0%), only a few knew about their BP target, which needed to be maintained (33.0%). The mean SBP was 138.3 mmHg ± 19.46, indicating poor BP control. The majority of the participants (63.2%) were not able to control SBP based on their BP target. Additionally, 75.7% of them had SBP of 140 mmHg or over.

Association Between the Study Variables and Uncontrolled BP

As presented in **Table 3**, smoking status, DM, DM with CKD, comorbidity severity, and sleep quality were significantly associated with uncontrolled BP. In contrast, age, gender, and alcohol consumption were not significantly associated with uncontrolled BP.

Table 3 Association between the study variables and uncontrolled blood pressure

Study Variables	Controlled Group *N*= 67 *n (%)*	Uncontrolled Group *N*= 115 *n (%)*	χ2/Fisher's Exact Test	*p*-value
Age (years)			4.786	.091
18-39	13 (46.4)	15 (53.6)		
40-59	25 (44.6)	31 (55.4)		
≥ 60	29 (29.6)	69 (70.4)		
Gender			3.654	.056
Male	31 (30.7)	70 (69.3)		
Female	36 (44.4)	45 (55.6)		
Smoking status			3.897	.048
Non-smokers	45 (42.9)	60 (57.1)		
Smokers	22 (28.6)	55 (71.4)		
Alcohol consumption[f]				.748
Non-drinker/low level	64 (37.2)	108 (62.8)		
Hazardous, harmful/alcohol dependence	3 (30.0)	7 (70.0)		
Diabetes			8.189	.004
No	53 (44.2)	67 (55.8)		
Yes	14 (22.6)	48 (77.4)		
Diabetes with CKD[f]			8.957	.024
No diabetes with CKD	53 (44.2)	67 (55.8)		
Diabetes with CKD stage 3	12 (24.5)	37 (75.5)		
Diabetes with CKD stage 4	2 (25.0)	6 (75.0)		
Diabetes with CKD stage 5	0 (0.0)	5 (100.0)		
Comorbidity severity			12.507	.002
Mild	35 (44.9)	43 (55.1)		
Moderate	22 (45.8)	26 (54.2)		
Severe	10 (17.9)	46 (82.1)		
Sleep quality			8.854	.003
Good	32 (51.6)	30 (48.4)		
Poor	35 (29.2)	85 (70.8)		

[f]Fisher's Exact Test

Risk Factors Associated with Uncontrolled Blood Pressure

In binary logistic regression analysis, the participants with severe comorbidities were more likely to have uncontrolled BP (*OR* 2.926, 95%*CI* 1.248-6.858, *p*=.013). Similarly, the participants having poor sleep quality had increased approximately two times the risk of uncontrolled BP (*OR* 2.076, 95%*CI* 1.059-4.073, *p*=.034), as shown in **Table 4**.

Table 4 Binary logistic regression analysis of uncontrolled blood pressure

Variables	*B*	*S.E.*	*Wald*	*df*	*p-value*	*OR*	95% *CI* for *OR*	
							Lower	Upper
Comorbidity severity								
Mild (reference)	-							
Moderate	-.181	.381	.225	1	.635	.835	.396	1.760
Severe	1.074	.435	6.104	1	.013	2.926	1.248	6.858
Sleep quality								
Good (reference)	-							
Poor	.731	.344	4.517	1	.034	2.076	1.059	4.073
Method = Forward LR								
Hosmer and Lemeshow test χ^2 = .905, df = 4, p = .924								
Cox & Snell R^2 = .094, Nagelkerke R^2 = .128								
Classification Accuracy = 66.5%								

B: coefficient; *S.E.*: standard errors of coefficient; *df*: degree of freedom; *OR*: odds ratio; *CI*: confidence interval

Discussion

The study finding provides an overview of uncontrolled BP rates among patients with NDCKD in Vietnam, which has not been explored before. The study found that 63.2% of the participants were incapable of controlling their BP less than 130/80 mmHg. This finding was consistent with previous studies that demonstrated the uncontrolled BP rates among NDCKD patients were in the range of 63.7%-64.8% (Zhang et al., 2019; Dharmapatni et al., 2020).

This finding could be explained by several possible reasons. Firstly, worse renal function can affect BP control. In this study, up to 44.0% of NDCKD participants were in stages 4 and 5. It was demonstrated that the more severe the CKD stage is, the more difficult BP control is (Zheng et al., 2013; Yan et al., 2018). Another possible reason is older age. This study found over half of the participants (53.8%) were aged 60 or over. Aging causes alteration in the structure and function of the arterial vasculature. Both SBP and DBP increase with age, although at the age of over 60, SBP keeps increasing while DBP decreases afterward because the central arterial stiffness dominates (Oliveros et al., 2020). The third reason probably relates to participants' medication adherence. Due to several reasons such as financial problems, living far from the hospital, and feeling better health conditions, many participants did not regularly follow up. Therefore, they either bought similar medications by themselves or temporarily stopped taking medications. Another possible cause of poor BP control in this study is participants' knowledge relating to BP value that needs to be maintained. Previous studies illustrated a high rate of awareness of BP control among NDCKD patients (Schneider et al., 2018; Yan et al., 2018). However, the percentage of uncontrolled BP in this population is still poor.

Similarly, this study demonstrated a high rate of the participants perceiving the importance of BP control, but noticeably, the majority of the participants did not know or gave an incorrect answer about the BP target that they needed to maintain. The finding highlights that most participants lack knowledge about their disease, such as optimal BP level that needs to be preserved. This probably contributes to poor BP control among NDCKD participants in the current study.

Apart from identifying the rate of uncontrolled BP among patients with NDCKD, this study illustrated that sleep quality and comorbidity severity were two risk factors strongly associated with uncontrolled BP. According to the HDA model, response to the environment is a person's perception and reaction toward the environment, which would lead to increase BP (Frazier, 2000). Consistently, this study found that poor sleepers had a positive association with uncontrolled BP among NDCKD populations. This finding was consistent with previous studies conducted in general and hypertensive populations (Bruno et al., 2013; Liu et al., 2016). It could be explained by an activation of the sympathetic nervous system due to poor sleep quality, which induces high BP (Chouchou et al., 2013). Moreover, poor sleep quality causes an elevation of stress hormones such as cortisol, resulting in a rise in BP (Song et al., 2015; Chrousos et al., 2016). Additionally, inadequate sleep quality acts as a psychological stressor that leads to sodium retaining, pro-inflammatory responses, and endothelial dysfunction, resulting in an increase in BP (Lu et al., 2015).

Similar to sleep quality, comorbidity severity was found to be a significant factor associated with uncontrolled BP among patients with NDCKD. The finding was in line with the HDA model. Elevated BP could possibly relate to older age and more complex health problems in patients with severe comorbidities. CCI is calculated by the sum of the score of age and the score of comorbidities. The older age and the higher score of comorbidities are, the more severe comorbidities are. Therefore, the participants with severe comorbidities would have older age which often accompanies by vascular system change. This leads to an increase in BP, particularly SBP (National Institute on Aging, 2018). Thus, the participants with severe comorbidities were less likely to control BP. Furthermore, the participants with severe comorbidities had complex health problems such as DM with end-organ damage, ischemic heart disease, and heart failure, leading to worse health conditions. Therefore, they were more likely to experience uncontrolled BP.

Contrastingly, the other physiology factors in this study, including age, DM, and DM with CKD, were not risk factors associated with uncontrolled BP, as also described in a previous study of CKD patients (Dharmapatni et al., 2020). Nonetheless, prior studies demonstrated a significant association between these factors and uncontrolled BP (Lee et al., 2017; Yan et al., 2018). In this study, among participants with uncontrolled BP, the number of participants with older age was higher than those of the other age groups. However, no significant association was found. Regarding DM and DM with CKD, having DM leads to macrovascular complications such as atherosclerosis and sympathetic activation, resulting in high BP (Chawla et al., 2016; Climie et al., 2019).

Additionally, advanced stage CKD leads to volume overload and a rise of vascular resistance, which are common causes of BP elevation in patients with CKD (Lee et al., 2017). In this current study, there were significant relationships among DM as well as DM with CKD and uncontrolled BP. However, the percentage of the participants having DM with CKD stages 4 and 5 in the current study were too low, with 4.4% and 2.8%, respectively. This may be a possible reason why DM and DM with CKD were not strong risk factors of uncontrolled BP in this study.

Regarding lifestyle factors, including smoking status and alcohol consumption, a small number of respondents with heavy drinkers participated in this study. It can be explained that the sample had been diagnosed with CKD and other comorbidities. They might adjust their lifestyle by reducing or stopping to consume alcohol. Therefore, the majority of the participants were non-drinker or light alcohol consumption. Consequently, no association was found in this study between alcohol consumption and uncontrolled BP. Likewise, smoking status, as another lifestyle factor in the HDA model, was not a significant risk factor associated with uncontrolled BP in this study. These findings were consistent with previous studies conducted in China (Yan et al., 2018; Zhang et al., 2019). According to genetic factors, gender had no association with uncontrolled BP in the current study. The study finding was congruent with previous research, which revealed no significant relationship between gender disparity and BP control in Chinese patients with NDCKD (Wang et al., 2013). In this study, males tended to have a higher uncontrolled BP rate than females; however, the proportion of uncontrolled BP was not considerably different between males and females.

There were some limitations in this study. Firstly, this study was a cross-sectional, correlational study design, and a convenience sampling technique was employed to collect data. Therefore, the cause-and-effect relationships could not be explored. Secondly, there are differences in lifestyle across areas in Vietnam. In detail, the study found a very low rate of hazardous/harmful alcohol use/alcohol dependence and current smoking among the participants. Thus, the study findings could apply to only populations with similar characteristics to the participants in the current study. Thirdly, other factors that may associate with BP control, such as medication adherence, diet, and physical activities, were not explored in this study. Therefore, longitudinal studies should be conducted in the future to explore the cause-and-effect relationships. Further studies should also be conducted in other settings located in other parts of Vietnam to increase generalizability. Some variables such as medication adherence, diet, and physical activities should be included in future studies. In addition, this study can be considered a foundation for the development of intervention studies that can help optimize blood pressure control.

Optimal BP control is a major goal in providing care to patients with NDCKD all over the world. However, the high rate of uncontrolled BP in this study highlights that controlling BP to target levels remains a challenge. Therefore, to achieve the goal, nurses and other healthcare professionals should closely monitor BP among patients with NDCKD. Furthermore, sleep quality and comorbidity severity were risk factors associated with uncontrolled BP in patients with NDCKD. Therefore, nurses should collaborate with other healthcare personnel to provide efficient interventions to improve sleep quality and control comorbidities in patients with NDCKD. In addition, health education regarding the importance of regular home BP measurement and BP target that needs to be maintained should be emphasized.

Conclusion

The present study demonstrated that the majority of the participants were not able to control BP as recommended with 63.2%. Sleep quality and comorbidity severity were associated with uncontrolled BP among NDCKD patients. The study findings provide more comprehensive risk profiles for improving continuity care to respond to gaps in CKD care in Vietnam. It is recommended that nurses and other healthcare personnel should pay more attention to NDCKD patients having poor sleep quality and severe comorbidities to improve BP control.

Declaration of Conflicting Interest

The authors certify that there is no actual or potential conflict of interest in relation to this article.

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Authors’ Contributions

VTHN developed the research proposal, performed data collection, data analysis, and data interpretation, drafted the manuscript, and critically revised it for important intellectual content. AS and WP supervised the proposal development, ethical approval process, data collection, data analysis, data interpretation and gave essential suggestions and recommendations on the manuscript. All authors have read and approved the final manuscript.

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Data Availability Statement

The datasets generated and analyzed during the current study are not publicly available due to confidentiality and ethical restrictions but are available from the authors on reasonable request.

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