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ORIGINAL RESEARCH

Blood Pressure Control and Its Determinants among Patients with Non-Dialysis Chronic Kidney Disease in Myanmar

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Abstract

Background: Controlling blood pressure is critical for patients with non-dialysis chronic kidney disease to prevent the rapid progression to end-stage renal disease and sudden cardiac death. However, only a limited number of these patients achieve the blood pressure target. No previous study has been observed to evaluate the status of blood pressure control and its determinants among Myanmar patients with non-dialysis chronic kidney disease.
Purpose: This study aimed to identify the rate of blood pressure control and its determinants among patients with non-dialysis chronic kidney disease in Myanmar.
Methods: A total of 150 patients with non-dialysis chronic kidney disease attending the clinics at a tertiary hospital in Myanmar participated in this cross-sectional, correlational predictive study. They were recruited by a convenience sampling method. Data were collected by using Sodium Consumption Behavior Questionnaire, Family-Friends Support Subscale and Doctor-Health Care Team Support Subscale of Chronic Illness Resources Survey, demographic and clinical characteristics data form, and by measuring blood pressure against the target level of less than 130/80 mmHg. Descriptive statistics, Chi-square, Fisher's exact test, and binary logistic regression analysis were performed.
Results: Only 44% of the participants had their blood pressure controlled. Overweight (OR=0.170, 95% CI: 0.058-0.495), obese (OR=0.071, 95% CI: 0.017-0.305), and chronic kidney disease stage 5 (OR=0.070, 95% CI: 0.020-0.244) were the determinants associated with poorly controlled blood pressure. Low sodium consumption behavior (OR=9.065, 95% CI: 3.251-25.277) and high family support (OR=7.799, 95% CI: 2.738-22.215) were the determinants associated with well-controlled blood pressure.
Conclusion: The blood pressure control rate in Myanmar patients with non-dialysis chronic kidney disease was suboptimal. Determinant findings serve as an input to endorse family-based lifestyle modification interventions such as weight control and low sodium dietary for optimizing blood pressure control. Further investigation of other determinants and of lifestyle intervention programs is warranted.

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1. Introduction

Chronic kidney disease (CKD) is a global leading health problem. The global number of adults with CKD has increased to be more than double, from 276 million in 2016 to 698 million in 2017 (GBD Chronic Kidney Disease Collaboration, 2020; Xie et al., 2018). Meanwhile, Myanmar, which is a low-income country, has encountered a significant rise in the prevalence of CKD. These trends towards CKD are estimated to be higher due to a dramatically growing number of non-communicable diseases (World Health Organization [WHO], 2020).

As the prevalence of CKD grows, there is more burden of CKD to be suffered. According to recent data, CKD caused 1.2 million deaths and 35.8 million years of healthy life lost (GBD Chronic Kidney Disease Collaboration, 2020). Moreover, CKD resulted in other physical illnesses and psychosocial disabilities (Ahlawat et al., 2018; Almutary et al., 2016).

Blood pressure (BP) control is the backbone of CKD management and the main means to hinder the undesirable consequences of CKD. Numerous trials have already proved the merits of controlling BP in patients with CKD. Intensive BP control decreased the risk of kidney failure (Lv et al., 2013), as well as the incidence of cardiovascular events and mortality (Cheung et al., 2017). In spite of its benefits, BP control is not adequately practiced in this population. Previous studies have reported the poor rates of BP control at the recommended level (<130/80 mmHg) in patients with Non-Dialysis CKD (NDCKD) (Whelton et al., 2018), accounting for 10%-40% (Kuryata et al., 2019; Zhang et al., 2019; Zheng et al., 2020). Poor BP control can damage kidney function rapidly and eventually, lead to end-stage renal disease (ESRD). Patients reaching the end-stage require dialysis treatment to survive, which induces massive health care costs and poor quality of life (Dąbrowska-Bender et al., 2018; Kusuma et al., 2018). Therefore, the problem of BP control in these NDCKD patients deserves greater attention. However, no previous research has examined the level of BP control in Myanmar patients with NDCKD.

Besides addressing poor BP control, identifying its determinants is also essential so that interventions can focus on such specific factors. Frazier (2000) proposed the Hypertension Development and Assessment (HDA) model to distinguish the risk factors for high BP. This model encompasses four domains affecting BP: lifestyle, response to the environment, physiology, and genetics.

Lifestyle is the critical and dynamic domain. Lifestyle factors, including body mass index (BMI) and sodium consumption behavior, have been observed to be associated with BP control. In a study conducted by Hossain et al. (2019), hypertensive patients who were overweight and obese were less likely to control BP than those who had normal weight. Moreover, Cho et al. (2016) found that salt usage behavior of Myanmar adults was significantly higher and, this was associated with high BP. Nevertheless, these studies were conducted in healthy or hypertensive adults. No study has identified the association between these factors and BP control among Myanmar patients with NDCKD.

The second domain is response to the environment. The HDA model has explained that one's reaction and perception towards social support can affect BP (Frazier, 2000). Perceived family support and health professional support have also been noticed to be linked with BP control. Ojo et al. (2016) revealed that patients who perceived good support from family members had well-controlled BP. Besides, Khadoura et al. (2021) mentioned that patients perceiving high health professional support had better medication adherence and improved health outcome. While these studies were investigated among hypertensive subjects, no study was found in patients with NDCKD in Myanmar.

For the physiological domain, including age, comorbidity, diabetes mellitus (DM), and CKD stage, there have been inconsistent findings. Some studies found older age (Schneider et al., 2018), presence of comorbidity (Abegaz et al., 2018), DM, and advanced CKD stage (Yan et al., 2018), significantly influence BP control, while some found no association between age (Yan et al., 2018), comorbidity, DM, CKD stage (Schneider et al., 2018), and BP control. Hence, previous studies could not provide an exact explanation of the relationship between these determinants and BP control.

Similarly, in the genetic domain, gender has not yet been clearly identified as a determinant of BP control. Researchers found that gender disparity had a significant impact on BP control (Lee et al., 2017; Schneider et al., 2018). By contrast, another study from China found that being male or female had no association with controlling BP (Yan et al., 2018). Thus, the role of gender on BP control is also ambiguous.

In conclusion, BP control is the cornerstone for NDCKD patients to prevent disease progression. Adequate BP control reserves renal function and delays advanced renal impairment requiring renal replacement therapy (RRT). Myanmar is a resource-constrained country and is facing challenges related to the cost of renal care and the availability of RRT modalities. Thus, BP control is the optimal care to prevent Myanmar patients with NDCKD from disease progression and premature death. Many previous studies have investigated BP control and its determinants in Western and other developed countries like Australia and China, and the results were mixed. Moreover, little is known about which factors contribute to poor BP control. No study has been found to assess the status of BP control among Myanmar patients with NDCKD. The existing findings may not apply to patients living in Myanmar where exists different contexts. The differences in religion, culture, lifestyle, and health care system may have different impacts on BP control. Accordingly, this study aimed to identify the rate of BP control and its determinants among patients with NDCKD in Myanmar.

2. Methods

2.1 Research design

This study employed a cross-sectional, correlational predictive design to explore the rate of BP control and its determinants among patients with NDCKD in Myanmar.

2.2 Setting and participants

This study was conducted among NDCKD patients at the out-patient clinics in a tertiary hospital, Myanmar, from February to May 2020. The samples were recruited using a convenience sampling method with the following inclusion criteria: diagnosed with CKD at least 3 months earlier, estimated glomerular filtration rate (eGFR) <60ml/min/1.73m2, never underwent renal replacement therapy, and able to communicate in Burmese. The exclusion criteria were patients who suffered from psychiatric illnesses or severe physical conditions, had changes in an antihypertensive drug regimen in the past three months, were taking medications that affect BP (i.e., cold medicines, analgesics, immune-suppressants, antacids, oral contraceptives), or who were recognized as cognitively impaired by the General Practitioner Assessment of Cognitive (GPCOG) Patients Examination test.

The potential participants who met the inclusion criteria were identified by staff nurses at the clinics. Next, they were introduced to the researcher and explained the details of the study including objectives, data collection process, risks, and benefits with the participant information sheet. Those who gave written informed consent were recruited into the study.

The sample size was computed based on the odds ratios of study variables. The maximum calculation was obtained from a previous similar study which found a predictive power of family support on controlled BP (OR=4.51) (Ojo et al., 2016). Then, G Power software 3.1.9.4 was used to calculate the prescribed sample size assuming α=0.05, power=0.90, OR=4.51 and x parm π=0.2. A sample size of 150 patients was prescribed for the current study.

2.3 Measurement and data collection

The Sodium Consumption Behavior Questionnaire was used to measure the sodium consumption behavior of participants. It was developed in 2009 and revised in 2020 (Piaseu et al., 2020). The revised version's content validity has been checked by nutritionists and experts. Its reliability coefficient value was 0.78 (Piaseu et al., 2020). In the present study, the questionnaire was translated into the Burmese language by using the back-translation method proposed by Maneesriwongul and Dixon (2004). Then, the content validity index (CVI) of the Burmese version was tested by linguists and nursing experts. It was valid with a CVI value of 0.95. The reliability test was carried out among 30 patients who had similar characteristics to the sample. The result showed a Cronbach's alpha value of 0.82 in this study. The questionnaire consists of 13 items with 3 subscales, including use of nutrition labels, consumption of food containing sodium, and use of seasonings. The answers were rated on a 5-point Likert scale, ranging from "never" (1) to "regularly" (5). A total score was classified into three levels based on the percentage: high (≥80%: 52-65 points), moderate (50-79.9%: 33-51 points), and low (<50%: 13-32 points).

The Family-Friends Support Subscale (FFSS) and Doctor-Health Care Team Support Subscale (DHSS) of Chronic Illness Resources Survey (CIRS) were used to assess the two variables, family support and health professional support. The original CIRS scale was developed by Glasgow et al. (2000). The internal consistency (Cronbach's alpha value) was 0.90, and test-retest reliability was 0.83 (Glasgow et al., 2000). Additionally, the validation and reliability of CIRS have been tested across various cultures, including Spain, China, and Thailand. In this study, the original versions of FFSS and DHSS were translated into Burmese versions by following the back-translation method (Maneesriwongul & Dixon, 2004). The Burmese versions of FFSS and DHSS were valid (FFSS CVI=0.95, DHSS CVI=0.94). The reliability coefficient values were also excellent; 0.87 for the FFSS and 0.83 for the DHSS. There are eight items in the FFSS and seven items in the DHSS. The items have been constructed to assess the level of perceived support in terms of informational, emotional, and tangible support. Responses were scored on a 5-point scale from "not at all" (1) to "a great deal" (5). A total score was formed by computing the mean scores and it was dichotomized at the median of the distribution into high (≥ median distribution) and low (< median distribution).

The demographic and clinical characteristics data form developed by the researcher was applied to collect the participant's demographic characteristics (age, gender, marital status, education, occupation, monthly income, household status) and clinical characteristics (BMI, comorbidity, DM, CKD stage). The CKD stage was classified according to the updated eGFR as follows: stage 3 CKD with eGFR of 30-59 ml/min/1.73m^2; stage 4 CKD with eGFR of 15-29 ml/min/1.73m^2; and stage 5 CKD with eGFR of < 15 ml/ min/1.73m^2.

A calibrated scale was applied to measure participant's body weight and height. Then, body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. BMI was classified into three groups: normal weight (< 23 kg/m^2), overweight (23-27.4 kg/m^2), and obese (BMI ≥ 27.5 kg/m^2), based on the WHO BMI classification for Asian population (WHO Expert Consultation, 2004).

An automated Upper Arm BP Monitor (OMRON HEM 7130-L) was used to measure BP. In addition, the 2017 ACC/AHA BP measurement procedure was followed (Whelton et al., 2018). All participants were asked to avoid alcohol, tea, or coffee, smoking, and exercise for at least 30 minutes before measurement. Then, their BP was measured in a sitting position after 3-5 minutes of rest, with legs uncrossed and back supported. Two times measurements in both arms (i.e., a measurement in one arm followed by the other arm) were performed at 1-minute interval. Third time measurement was done when the former two systolic or diastolic BP readings were different from ≥10 mmHg. After two or three measurements, all systolic and diastolic BP values were averaged. Based on the criteria from the 2017 ACC/AHA BP management guideline (Whelton et al., 2018), a BP target <130/80 mmHg was adopted. However, only systolic blood pressure (SBP) was considered to categorize participants into two groups; controlled (SBP <130 mmHg) and uncontrolled (SBP ≥130 mmHg) since SBP is the best indicator for cardiovascular risk and is widely emphasized by physicians.

Data were collected at one time by the principal investigator. All participants' BP, body weight, and height were measured at the time of routine BP measurement. After that, participants were asked to fill in the self-administered questionnaires during their waiting time. If they were not able to read and/or write or had visual impairment, they were interviewed face-to-face. The clinical characteristics, including eGFR, were collected from their medical records with permission. The data collection process took approximately 20 minutes per participant. No data were missing from the current study. Data collection flowchart was presented at Figure 1.

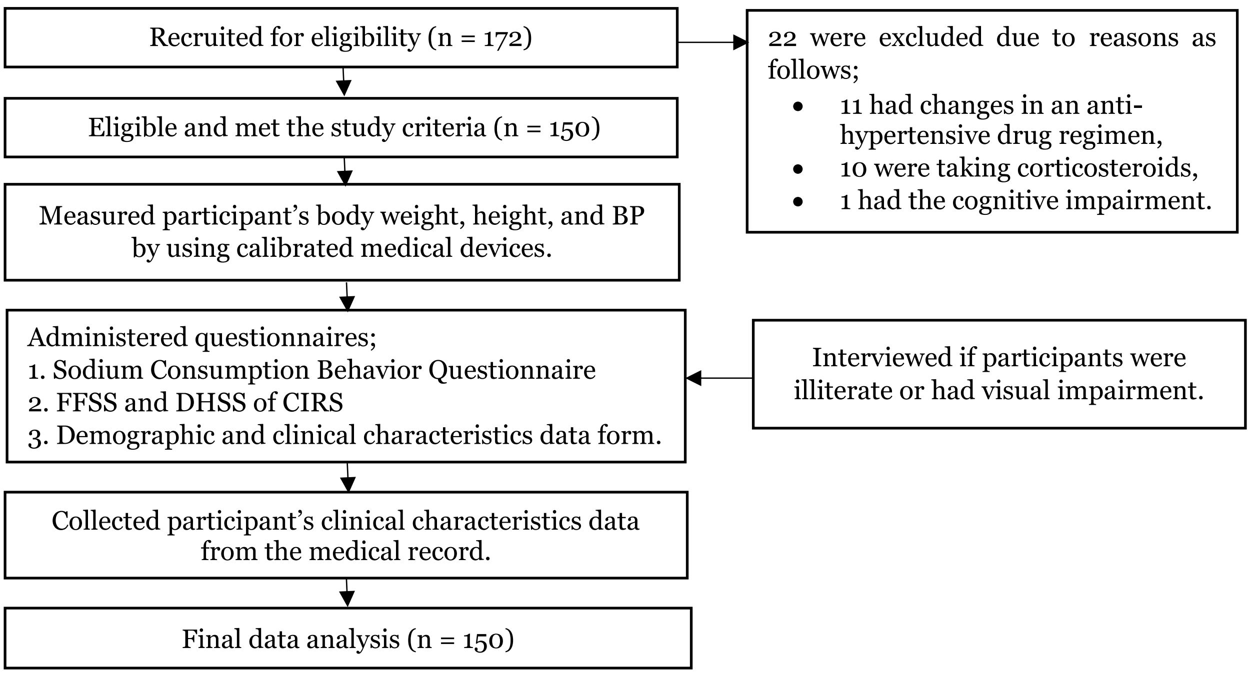

Figure 1. Data collection flowchart

2.4 Data analysis

The obtained data were analyzed by using Statistical Package for the Social Science (SPSS) software (version 18.0, SPSS, Inc., Chicago, IL) licensed by Mahidol University. Descriptive statistics were expressed as means for continuous variables, and frequencies and percentages for categorical variables. The Chi-square and Fisher's exact tests were used to analyze the association between BMI, sodium consumption behavior, family support, health professional support, age, comorbidity, DM, CKD stage, gender, and BP control. Then, the significant variables were entered into binary logistic regression analysis using the enter method to determine the determinants of BP control by odd ratios (ORs) and 95% confidence intervals (CIs). P-values were 2-sided, and α=0.05 was considered statistical significance. Assumptions were checked for each statistical test.

2.5 Ethical considerations

The study protocol was approved by the Institutional Review Board (IRB), Faculty of Nursing, Mahidol University, Bangkok, Thailand (COA No. IRB-NS2019/524.0912), and the Institutional Review Board (IRB), University of Public Health, Yangon, Myanmar (UPH-IRB. 2020/Research/2). Written informed consent was obtained from each participant who was willing to participate voluntarily in the study.

3. Results

3.1 Demographic and clinical characteristics of participants

In the current study, the participants had an average age of 58.4 years (SD=12.6) with a slight male dominance (58.0%). The majority were married (86.0%), completed primary school (81.3%), were employed (58.7%), and lived with their spouses and children (59.2%). The mean family monthly income was 181.8 USD (SD=125.6). Regarding clinical characteristics, almost half of the participants were overweight (30.0%) and obese (14.7%). About 92.7% of them had comorbidities. More than half were suffering from DM (56.7%). Furthermore, many of them were in CKD stage 4 (28.0%) and 5 (32.0%). Detailed information on participants' demographic and clinical characteristics is described in Table 1.

Table 1. Demographic and clinical characteristics of participants

Characteristics	Frequency	Percentage
Age (years)		
≤40	17	11.3
41-60	59	39.3
>60	74	49.4
(Mean = 58.4, SD = 12.6, Range = 23-90)		
Gender		
Female	63	42.0
Male	87	58.0
Marital status		
Single	21	14.0
Married	129	86.0
Education		
Not completed primary school	28	18.7
Completed primary school	122	81.3
Occupation		
Unemployed	62	41.3
Employed	88	58.7
Monthly income (USD)		
40-259	120	80.0
260-479	24	16.0
≥480	6	4.0
(Mean = 181.8, SD = 125.6, Range = 42-706)		
Household status		
Living alone	6	4.0
Living with spouses/parents/children	38	25.4
Living with spouses and children	89	59.2
Living with relatives and others	17	11.4

Table 1. Continued

Characteristics	Frequency	Percentage
BMI		
Normal weight (< 23 kg/m²)	83	55.3
Overweight (23-27.4 kg/m²)	45	30.0
Obese (≥ 27.5 kg/m²)	22	14.7
(Mean = 22.8, SD = 4.4, Range = 13.3-38.0)		
Comorbidity		
Yes	139	92.7
No	11	7.3
DM		
Yes	85	56.7
No	65	43.3
CKD stages		
Stage 3 (30-59 ml/min/1.73m²)	60	40.0
Stage 4 (15-29 ml/min/1.73m²)	42	28.0
Stage 5 (< 15 ml/min/1.73m²)	48	32.0
(Mean = 26.6, SD = 17.1, Range = 2-59)		

3.2 BP level of participants

As shown in Table 2, only 44.0% of the participants could control their BP at the target level. The overall mean of systolic BP (SBP) was 137.6 mmHg (SD=21.9), suggesting poorly controlled BP. Moreover, more than two-thirds (84.5%) had SBP 140 mmHg or above.

Table 2. BP level of participants

BP level	Mean (SD)	N	%
Overall systolic BP (mmHg)	137.6 (21.9)	150	100.0
Controlled systolic BP (< 130)	117.6 (8.9)	66	44.0
90-119		28	42.4
120-129		38	57.6
Uncontrolled systolic BP (≥ 130)	153.3 (15.2)	84	56.0
130-139		13	15.5
140-210		71	84.5

3.3 Association between independent variables and controlled BP

Findings showed that BMI (χ^2=8.859, p=0.012), sodium consumption behavior (χ^2=24.066, p<0.001), family support (χ^2=19.044, p<0.001), health professional support (χ^2=10.823, p=0.001), and CKD stage (χ^2=8.744, p=0.013), had a significant association with controlled BP (Table 3). Thus, these significant variables were entered binary logistic regression analysis.

Table 3. Association between independent variables and controlled BP

Study variables	Controlled group (N = 66) n (%)	Uncontrolled group (N = 84) n (%)	χ^2/Fisher's exact	*P*-value
Age (years)			5.671	0.059
≤ 40	8 (47.1)	9 (52.9)		
41-60	19 (32.2)	40 (67.8)		
> 60	39 (52.7)	35 (47.3)		
Gender			0.182	0.670
Female	29 (46.0)	34 (54.0)		
Male	37 (42.5)	50 (57.5)		
BMI			8.859	0.012
Normal weight	45 (54.2)	38 (45.8)		
Overweight	16 (35.6)	29 (64.4)		
Obese	5 (22.7)	17 (77.3)		

Table 3. Continued

Study variables	Controlled group (N = 66) n (%)	Uncontrolled group (N = 84) n (%)	χ²/Fisher's exact	*P*-value
Sodium consumption behavior			24.066	<0.001
Moderate	13 (20.6)	50 (79.4)		
Low	53 (60.9)	34 (39.1)		
Family support			19.044	<0.001
Low	13 (22.0)	46 (78.0)		
High	53 (58.2)	38 (41.8)		
Health professional support			10.823	0.001
Low	23 (30.7)	52 (69.3)		
High	43 (57.3)	32 (42.7)		
Comorbidity[f]				0.060
Yes	58 (41.7)	81 (58.3)		
No	8 (72.7)	3 (27.3)		
DM			2.133	0.144
Yes	33 (38.8)	52 (61.2)		
No	33 (50.8)	32 (49.2)		
CKD stages			8.744	0.013
Stage 3	33 (55.0)	27 (45.0)		
Stage 4	20 (47.6)	22 (52.4)		
Stage 5	13 (27.1)	35 (72.9)		

[f] Fisher's exact test

3.4 Determinants of controlled BP

According to binary logistic regression analysis, overweight (OR=0.170, 95% CI:0.058-0.495), obese (OR=0.071, 95% CI: 0.017-0.305), and CKD stage 5 (OR=0.070, 95% CI:0.020-0.244) were the determinants of poorly controlled BP. Low sodium consumption behavior (OR=9.065, 95% CI:3.251-25.277) and high family support (OR=7.799, 95% CI:2.738-22.215) were the determinants of well-controlled BP (Table 4).

Table 4. Determinants of controlled BP

Variables	B	S.E.	Wald	95% CI	OR	*P*-value
BMI						
Normal weight	Ref.	-	-	-	-	-
Overweight	-1.773	0.546	10.556	0.058-0.495	0.170	0.001
Obese	-2.640	0.741	12.698	0.017-0.305	0.071	< 0.001
CKD stages						
Stage 3	Ref.	-	-	-	-	-
Stage 4	-0.684	0.549	1.550	0.172-1.481	0.505	0.213
Stage 5	-2.656	0.635	17.482	0.020-0.244	0.070	< 0.001
Sodium consumption behavior						
Moderate	Ref.	-	-	-	-	-
Low	2.204	0.523	17.752	3.251-25.277	9.065	< 0.001
Family support						
Low	Ref.	-	-	-	-	-
High	2.054	0.534	14.792	2.738-22.215	7.799	< 0.001
Health professional support						
Low	Ref.	-	-	-	-	-
High	0.159	0.479	0.110	0.459-2.997	1.172	0.740

Hosmer and Lemeshow Test; χ^2 = 4.715, df = 8, p = 0.788, Cox & Snell R^2 = 0.394, Nagelkerke R^2 = 0.528, overall percentage of correct classification = 80%, OR = odds ratios, CI = Confidence Interval

4. Discussion

The present study was designed to assess the BP control status of Myanmar patients with NDCKD. The results showed that the BP control rate was still suboptimal. Some potentially significant determinants of controlled BP were also identified and discussed below.

4. 1 BP control

As shown in the previous section, only 44% of the participants achieved the BP target. No study has been found to examine the rate of BP control in other resource-constrained countries where are similar to Myanmar. However, when compared to studies conducted in high-income countries, e.g., Korea and China, the control rate is apparently lower than that reported in those studies, which were 51.5% and 61.5%, respectively (Lee et al., 2021; Wang et al., 2013). A patient's ability to control BP might differ depending on his or her disease severity. In this study, a majority of participants belonged to CKD stage 5, and 72.9% of them had poorly controlled BP. It is possible that many patients in Myanmar seek health care only at the late stage of disease. Dialysis facilities are also insufficient for Myanmar people. While an estimated number of 10,800 patients with ESRD need RRT, 85%-90% are unable to access treatment (Than, 2018). Furthermore, Hyodo et al. (2020) also stated that in 2017, only 328 hemodialysis (HD) machines could operate normally at 52 nationwide HD centers. In addition, dialysis therapy is impossible for patients living in poverty. The national government subsidized only 40% of the total cost (20 USD) (Hyodo et al., 2020). HD patients needed to pay 30 USD out-of-pocket each time for their dialysis. This estimated HD expense (60 USD/week) was beyond the participant's average income. Accordingly, many Myanmar ESRD patients have difficulties receiving dialysis treatment. This might have caused, in the current study, the larger contribution of ESRD patients and the lower rate of BP control.

According to the study result, BP is not adequately controlled among Myanmar patients with NDCKD. This finding notifies the health care team to pay more attention to the problem of BP control in this population. Physicians and nurses should monitor BP levels and provide persistent health care related to improving BP control.

4. 2 Determinants of controlled BP

Besides classifying the rate of BP control, this study identified significant determinants of controlled BP. Higher BMI (lifestyle factor) and CKD stage 5 (physiological factor) were determinants of poorly controlled BP. Low sodium consumption behavior (lifestyle factor) and high family support (response to the environment factor) were the determinants of well-controlled BP.

As mentioned earlier, higher BMI could significantly predict poorly controlled BP. Patients with overweight and obese were less likely to have controlled BP than those with normal weight. This finding is consistent with a previous study that used the same BMI criteria among a South Asian hypertensive population (Hossain et al., 2019). These days, many patients are reluctant to maintain a healthy weight. The sedentary lifestyle and frequent consumption of unhealthy food can be barriers. Evidence also suggests that an irregularly active lifestyle increases the risks for obesity (Back et al., 2018). Similarly, in a study conducted in Myanmar, frequent fast-food consumption and less physical activity were risk factors of overweight and obesity (Thike et al., 2020). Further, Myanmar inhabitants already have consumption habits of too much carbohydrate and fat in the form of rice and cooking oil. These conditions might lead almost half of the respondents in this study to be overweight or obese, and then to have poorly controlled BP. Multiple mechanisms in obesity, insulin resistance, vascular endothelial dysfunction, sodium reabsorption, and impaired glomerular filtration, significantly cause poorly controlled BP (DeMarco et al., 2014).

Meanwhile, this study found inadequately controlled BP among Myanmar patients in CKD stage 5. The more severe kidney disease they had, the poorer BP control they experienced. This result is similar to a recent study conducted in China which found CKD stage as the factor behind less controlled BP (Yan et al., 2018). In line with the HDA model, increasing severity of kidney disease can notably cause poorly controlled BP by means of vascular stiffness (Frazier, 2000). As swiftly as renal function declines, volume expansion and peripheral vascular resistance are more likely to increase, thereby devastating BP (Banasik, 2016). As a result, patients with end-stage CKD find it more difficult to control their BP and require more therapeutic interventions.

Nevertheless, one study in Germany revealed that the CKD stage did not significantly relate to controlled BP (Schneider et al., 2018). Incongruently, that study enrolled the patients under nephrology specialist care for at least one year. Therefore, those patients might have a higher disease awareness and obtained more intensive therapies to delay disease progression than the patients in this study. This might be the reason why the results were different between studies.

The results of this study also displayed low and moderate levels of sodium consumption behavior among NDCKD participants. No participant reported a high level of sodium consumption behavior. This can be explained by their increasing awareness about the importance of lower sodium consumption. At the initial and every clinic visit, they had received health education about sodium consumption reduction. With good awareness, they might have practiced better compliance with low salt dietary instructions. This study also revealed a positive relationship between low sodium consumption behavior and well-controlled BP. Patients who had low sodium consumption behavior were likely to have better BP control than those who had moderate sodium consumption behavior. This finding is supported by Meuleman et al. (2017) who reported sodium restriction could decrease BP among CKD patients. Humalda and Navis (2014) also stated that low dietary sodium improved controlling BP by adding the effect of antihypertensive drugs. Moreover, low sodium intake assists to maintain normal cellular homeostasis, renin angiotensin aldosterone system (RAAS), sympathetic activity, and BP level.

Similarly, patients with strong family support had increased odds for controlled BP. Patients who perceived high family support had their BP controlled better than those who perceived low family support. Although there are limited data on the CKD population, this report is congruent with that of a former study undertaken in a hypertensive population (Ojo et al., 2016). Generally, Myanmar citizens prefer to be cared for and supported by their significant others, including parents, spouses, and offspring. In this research, most of the respondents lived together with their parents, spouses, and children. As such, they perceived a high level of family support for a healthy diet and medication adherence, as well as active listening about health concerns. It is evident that perceiving good support can augment health care management and reduce negative emotional feelings such as anxiety, stress, and depression (Hill et al., 2014). Thus, these facts probably help the participants with perceived high family support to improve BP control.

5. Implications and limitations

The findings in this study show that controlling BP remains a major challenge among Myanmar patients with NDCKD. Hence, health care providers, including nurses, should monitor BP more closely, and strengthen continuity of care with regard to controlling BP. Furthermore, this study highlights the more important clinical determinants of controlled BP. Higher BMI and advanced CKD stage were determinants of poorly controlled BP. Thus, physicians and nurses should regularly screen patients with these characteristics, and provide effective interventions for optimizing BP control. In addition, low sodium consumption behavior and high family support were found to be associated with well-controlled BP. As such, health care personnel should continue to provide health education about low sodium consumption, and should encourage family members to be involved in the BP management intervention programs.

There are some limitations of this study. First, this study employed a cross-sectional, correlational predictive study design. Therefore, the study findings may not provide causal inferences. Measuring the BP once may not accurately determine BP control since BP potentially alters by days. Second, this study was done in NDCKD patients visiting the clinics at a tertiary hospital in Myanmar. Thus, the study results may not necessarily apply to populations with different backgrounds or in different settings. Third, the study applied a self-administered questionnaire to collect the data on sodium consumption behavior. Hence, there is a need to measure the actual amount of sodium intake. Last, only patient-level factors were focused in this study, other level factors that are essential to controlling BP are not included. Though, these prescribed limitations provide an opportunity for further researchers to conduct longitudinal cohort studies in other health sectors of Myanmar.

6. Conclusion

This correlational predictive study underlines that the BP control rate in Myanmar patients with NDCKD did not reach an optimal level. The study also identified some potentially significant determinants of controlled BP. Higher BMI and advanced CKD stage were determinants of poorly controlled BP, and low sodium consumption behavior and high family support were predictors of well-controlled BP. Therefore, this study has added to the body of knowledge on BP control and its determinants in Myanmar. Based on the study findings, health care teams should develop strategies and intervention protocols to improve BP control. In addition, further research should address other health care providers and system related determinants, such as treatment intensification pattern, adherence to BP management guidelines, and health insurance status, on BP control. It is also necessary to investigate lifestyle modification trials to promote BP control among patients with NDCKD in Myanmar.

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Author contribution

ESM developed the research proposal, implemented data collection, data analysis, and data interpretation, drafted the manuscript, and revised it critically for the important intellectual content. AS and WP provided supervisions, essential suggestions, and recommendations throughout the research process. All authors have read and approved the final manuscript.

Conflict of interest

All authors declare no conflict of interest in relation to this paper.

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