Journal of Health Research
eISSN 2586-940X

Volume 38 | Issue 1 Article 1

2024

Knowledge and performance on diabetes control among primary health workers: A baseline survey of quasi experimental study in Naypyitaw, Myanmar

Kyi Thar
College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand

Sathirakorn Pongpanich
College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand

Min New Tun
Novo Nordisk Myanmar, Yangon, Myanmar

Zaw Myo Aung
Ministry of Health, Naypyitaw, Myanmar

Knowledge and Performance on Diabetes Control Among Primary Health Workers in Naypyitaw, Myanmar

Kyi Thar [a], Sathirakorn Pongpanich [a,*], Min N. Tun [b], Zaw M. Aung [c]

[a] College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand
[b] Novo Nordisk Myanmar, Yangon, Myanmar
[c] Ministry of Health, Naypyitaw, Myanmar

Abstract

Background: **Diabetes is a growing public health problem. Due to a paradigm shift in diabetes control from hospitals to communities, improving the knowledge and performance of primary health care (PHC) providers with regards to diabetes is essential. Although Myanmar has a high prevalence of diabetes, the knowledge and performance of PHC providers has not been properly assessed before. This study assessed PHC knowledge and performance on diabetes control in two townships in Naypyitaw, Myanmar.**

Methods: **In this cross-sessional descriptive study, PHC providers, including midwives, lady health visitors (female nurse supervisors), and public health supervisors were selected. Their socio-demographic variables, as well as knowledge and performance related to five domains of diabetes control were assessed.**

Results: **100 PHC providers participated in the study. A majority of the respondents (54%) had average knowledge, while less (8%) had good knowledge. Most respondents had poor performance (63%). A significant correlation was observed between knowledge and performance scoring ($p = 0.01$). The knowledge scoring was significantly associated with sex, designation (working rank level), and exposure to diabetes control training among participants. The performance scoring was associated with sex, designation, number of postings, level of facilities, exposure to diabetes training and campaigns.**

Conclusion: **Since majority of respondents had poor performance, the study recommended possible solutions to improve diabetes control including: revising targets and strategies for diabetes screening, designing tailored training to improve treatment and referral services, and piloting web-based tools to improve diabetes knowledges and a diabetes registry during the post COVID-19 pandemic health system recovery.**

Keywords: Diabetes control, Primary health care, Web-based application

1. Introduction

Diabetes is a chronic and silent killer, which ranks among the top 10 leading causes of deaths worldwide. An estimated 1.5 million deaths were directly caused by diabetes, while 2.2 million deaths were attributable to high blood glucose [1]. The prevalence of diabetes was estimated to be 9.3% of global population in 2019. Almost half a billion people are currently living with diabetes; and the number is projected to increase by 25% in 2030 and 51% in 2045 [2]. Diabetes has become a public health problem in many countries, especially in low-income ones. In low-income countries, the incidence is increasing, yet the resources for prevention and control is dwindling. In addition, the absolute global economic burden of diabetes is estimated to increase from $1.3 trillion to $2.2 trillion from 2015 to 2030 [3].

According to studies conducted in 35 developing countries, diabetes patients have a high risk of catastrophic medical expenditures. Often, their health insurance systems cannot provide adequate treatment for diabetes complications [4]. Consequently, researchers have suggested a paradigm shift in diabetes prevention and control from the hospital to the community level. In order to improve the access and utilization of diabetes

Received 1 December 2022; revised 13 February 2023; accepted 13 March 2023.
Available online 14 September 2023

* Corresponding author.
E-mail address: sathirakorn.p@chula.ac.th (S. Pongpanich).

https://doi.org/10.56808/2586-940X.1054

services in communities, empowering health care providers with knowledge and optimizing their performance at the primary health care level (PHC) is crucial [5]. However, previous global diabetes studies were focused on patient-centered information; many studies have often neglected to assess the knowledge and performance of care providers, especially at primary health care setting. Furthermore, researchers recommended further studies to enhance surveillance and reporting systems for diabetes prevention and control at the primary care level [6−8].

In Myanmar, the published report related to non-communicable diseases (NCD) was available only up to 2014. The National STEPwise approach to NCD risk factor surveillance survey (STEP Survey 2014) evaluated 8757 individuals nation-wide (age group: 25−64 years). The survey highlighted that a high proportion of respondents never had diabetes screening [9]. The national survey on diabetes prevalence and risk factors in 2014 indicated that prevalence of diabetes among adults was 10.5% [10]. Thus, these survey results indicated diabetes prevalence in Myanmar was higher than average diabetes prevalence (9% of adult population) in the WHO South East Asia Region [11]. Yangon, the former capital, had the highest diabetes prevalence; the prevalence of diabetes among elderly increased from 14.6% to 31.9% in between 2004 and 2014 [12]. The high prevalence was linked to the changes in lifestyle, as well as poor knowledge and awareness on diabetes. Further studies related to the screening for diabetes among high-risk populations is the required due to demographic changes [13].

The Ministry of Health (MOH) established NCD programme to expand NCD prevention and care in Myanmar since after the STEPS survey 2014. Basic health staffs (BHS) who are frontline health workers responsible for NCD and diabetes control at the PHC level include midwives (MW), lady health visitors (LHV) (female nurse supervisors), and public health supervisors (PHS). The World Diabetes Foundation supported the NCD programme to implement the WHO Package of Essential (PEN) interventions for NCD including diabetes control at PHC centers. By 2019, PEN covered 242 out of 330 townships. Through PEN, 1400 staffs were trained for NCD prevention and control [14]. While PEN project was initiated, BHS faced some challenges to provide efficient services due to insufficient skills [15]. Furthermore, implementation of PEN package was interrupted in some townships during COVID-19 pandemic due to public health emergency response. We herein aimed to assess the knowledge and performance regarding diabetes prevention, control, and registry among BHS at PHC settings in Naypyitaw, the new capital of Myanmar. All BHSs in the study townships are covered by PEN package; however, their knowledge and performance has not been properly assessed before.

2. Methods

2.1. Study area and population

Naypyitaw is the new capital located in central Myanmar. The former capital, Yangon, is largely urban and a commercial center of the country. In contrast, Naypyitaw has been undergoing rapid urbanization, increasing population density, changing lifestyle on one side, while still having large rural areas, mountains, and remote villages on the other side. The primary health care system of Naypyitaw comprises of 40 rural health centers and 169 sub centers with 586 Basic Health Staff members (BHS). The BHS members include 271 MW, 179 LHV, and 94 PHS. A majority of population is poor; many residents cannot afford the medical expenses for treatment of NCDs and diabetes. We selected Naypyitaw based on the STEPS Survey 2014 findings; two-thirds of the respondents were at high-risk of diabetes, and >75% of respondents had unknown diabetes status. Out of 7 townships, the Leway and Tatkone townships were selected for the study because of the diversity of populations; they contain urban, rural, and remote villages. Both study townships are covered by the WHO PEN package, a minimum standard for NCD care. The PEN package integrates scaled up care for diabetes, heart disease, stroke, cancer and chronic pulmonary disease at the PHC level. All BHS members who were responsible for diabetes control and who willing to participate in the study were selected. BHS who was absent from duty, not healthy enough for the interview, or not approved by the local authorities were excluded.

2.2. Study design

A cross-sectional descriptive study was conducted in between 10−15 September 2022 to explore the level of knowledge and performance for diabetes prevention and control as well as the socio-demographic characteristics of BHS. The lowest effect size for skill performance (0.25) was taken as a reference value for this study [16]. The sample size was calculated using G power (version 3.1.9.2) program. We used the t-test for correlation. We assumed a point biserial model between knowledge

and performance with effect size p = 0.25 (one group) at 80% power and a 95% confidence interval. Based on the calculation, a total minimum sample size of 95 was required for the study. Our study recruited 100 respondents considering a 5% dropout rate.

2.3. Data collection and measurement tools

Quantitative survey methodology was applied for data collection. Primary data was collected from primary health care staffs using key informant interviews and self-administered questionnaires. The authors developed questionnaires for socio-demographic data, as well as knowledge and performance data by referencing WHO/National diabetes guidelines [17]. The questionnaire covered five aspects: (i) health promotion for diabetes, (ii) identification of high-risk and screening diabetes, (iii) diabetes care and treatments, (iv) referral of complicated patients, and (v) diabetes registry and reporting. Knowledge and performance variables were measured by 3-point Likert scales; the scores were categorized as "good, average and poor" according to the standards of WHO/National diabetes guidelines. The authors established a review team with experts from the diabetes programme, township health officers and medical expert from Novo Nordisks, a pharmaceutical company providing diabetes medication, to validate the questionnaires by using Item Objective Congruence (IOC) index. The mean of expert score was 0.6. The reliability of questionnaire was moderate, based on tests by repeated pre-test measures (Kappa value of 0.68). The data accuracy of primary data was double checked by secondary data from township health system records. Authors also provided an orientation session and ongoing meetings with research assistants to check the data accuracy and consistency, to investigate missing data, to support interviews, and to clarify the questions if they were not clear to respondents.

2.4. Data analysis

Data analysis was conducted using SPSS version 22. The mean and standard deviations (SD), minimum, maximum and quartile data were calculated for continuous variables; while frequency and percentages were calculated for categorical variables. Knowledge and performance scoring were cross analyzed within sociodemographic variables by using independent t-tests and Analysis of Variance tests (ANOVA). The Pearson's correlation coefficient was used to explore association between knowledge and performance scoring levels. A p-value of 0.050 and 95% confidence intervals were used as the level of significance for association between variables and outcomes as well as differences in distribution of outcomes by variables.

2.5. Ethical issues

The study was approved by the Ethics Review Committee of Chulalongkorn University (090.2/64, COA No 177/2022) and the Department of Health, Naypyitaw Council (NPT/NCD/007-2021/5925).

3. Results

A cross-sessional descriptive survey was conducted among BHS from Leway and Tatkone townships. Data from 100 respondents was analyzed. The analysis covered 14 socio-demographic variables related to the diabetes control program (Appendix 1). Knowledge and performance scorings were measured by 3-point Likert scales in five areas according to the WHO Diabetes Guideline as mentioned in the previous section.

3.1. Socio-demographic characteristics

Majority of respondents were female (86%), in between the ages of 25 and 40 years old (56%), married, (68%) and graduates from colleges or universities (75%). With regards to their employment, 62% have more than 5 years of government services, 60% have been relocated during their services, and 54% are native to Naypyitaw. With regards to their duty stations, 63% were stationed at sub-center level and 43% were assigned to remote areas (>10 miles away from the township). Among the respondents, 71% had received diabetes control training, 51% had received diabetes registry training, and 60% had exposure to diabetes campaigns. All respondents had exposure to Internet applications. 70% of BHS were equipped with mobile tablets distributed by the MOH.

3.2. Knowledge and performance

The mean knowledge scoring was 85.0, with highest score of 98.0, lowest score of 26.0, median score of 87.0 and a standard deviation of 9.7. A majority of respondents had average knowledge scoring (54%); a small percentage had good knowledge scoring (8%); a sizable percentage had poor

knowledge scoring (38%). Large proportions of respondents had poor knowledge on care and treatment (58%), diabetes screening (48%) and referral (47%). The mean performance scoring was 72.3, with highest score of 123.5, lowest score of 2, median score of 77.5 and a standard deviation of 32.2. Among BHS, 7% had good performance scoring, 30% had average performance scoring, and 62% had poor performance scoring. Further in-depth analysis on performance revealed that respondents had poor performance scoring on referral (87%), care and treatment (70%), and screening (67%). Details of knowledge and performance scoring are described in Tables 1 and 2.

3.3. Association of socio-demographic variables with knowledge and performance

We analyzed the association between knowledge and performance scoring with categorical variables by independent t-tests for 2 variables and ANOVA tests for more than 2 variables (Table 3 and Table 4). The total knowledge scoring had statistically significant associations with sex ($p = 0.001$), achieving diabetes control training ($p = 0.023$), and designations (working level ranks) ($p = 0.009$). Similarly, the total performance scoring was had statistically significant associations with sex ($p = 0.043$), having diabetes control training ($p = 0.020$), having diabetes registry training ($p = 0.021$),

Table 1. Knowledge scoring among respondents by World Health Organization (WHO) diabetes control guidelines (n = 100).

Knowledge scoring[a]	Good[a]		Average[a]		Poor[a]	
	n (%)	Score	n (%)	Score	n (%)	Score
Health Promotion	14 (14%)	(>22)	65 (65%)	(22–18)	21 (21%)	(<18)
Risk identification/screening	11 (11%)	(>24)	41 (41%)	(24–20)	48 (48%)	(<20)
Care and treatment support	6 (6%)	(>22)	36 (36%)	(22–18)	58 (58%)	(<18)
Referral of complicated cases	9 (9%)	(>17)	44 (44%)	(17–15)	47 (47%)	(<15)
Reporting and registry	11 (11%)	(>17)	50 (50%)	(17–15)	39 (39%)	(<15)
Total Knowledge Scoring	8 (8%)	(>95)	54 (54%)	(94–85)	38 (38%)	(<85)

[a] *WHO diabetes control guidelines.*

Table 2. Performance scoring among respondents by World Health Organization (WHO) diabetes control guidelines (n = 100).

Performance scoring[a]	Good[a]		Average[a]		Poor[a]	
	No. (%)	Scores	No. (%)	Scores	No. (%)	Scores
Health Promotion	18 (18%)	>13	37 (37%)	13–10	45 (45%)	<10
Risk identification/screening	7 (7%)	>15	31 (31%)	15–12	62 (62%)	<12
Care and treatment support	15 (15%)	>65	15 (15%)	65–55	70 (70%)	<55
Referral of complicated cases	6 (6%)	>13	7 (7%)	13–10	87 (87%)	<10
Reporting and registry	31 (31%)	>15	12 (12%)	15–12	57 (57%)	<12
Total Performance Scoring	7 (7%)	>110	30 (30%)	110–90	62 (62%)	<90

[a] *WHO diabetes control guidelines.*

Table 3. Association between sociodemographic variables and the knowledge scores (n = 100).

No	Socio-demographic variables	Groups	n (%)	Knowledge Scoring	
	Independent T-Test			t	p-value
1	Sex	Male	14 (14%)	3.520	0.001
		Female	86 (86%)		
2	Training Received Before (DM Control)	Received	71 (71%)	2.311	0.023
		Not received	29 (29%)		
	ANOVA Test	**Groups**	**n (%)**	**F**	**p-value**
3	Designation (Working rank level)	LHV	8 (8%)	6.839	<0.001
		MW	59 (59%)		
		PHS	33 (33%)		

Significant at p-value 0.05 level (2-tailed).
Abbreviations: DM = diabetes mellitus; LHV = lady health visitors (female nurse supervisors); MW = midwives; PHS = public health supervisors.

Table 4. Association between sociodemographic variables and the performance scores (n = 100).

No	Socio-demographic variables	Groups	n (%)	Performance Scoring	
	Independent T-Test			t	p-value
1	Sex	Male	14 (14%)	2.055	0.043
		Female	86 (86%)		
2	Training Received Before (DM Control)	Received	71 (71%)	2.339	0.021
		Not received	29 (29%)		
3	Training Received Before (DM Registry)	Received	51 (51%)	2.359	0.020
		Not received	49 (49%)		
4	DM Campaign experiences	Have	60 (60%)	2.731	0.007
		Have not	40 (40%)		
	ANOVA Test	**Groups**	**n (%)**	**F**	**p-value**
5	Designation	LHV	8 (8%)	4.049	0.009
		MW	59 (59%)		
		PHS	33 (33%)		
6	Number of postings	1st posting	37 (37%)	2.883	0.027
		2nd-5th posting	36 (36%)		
		>5th posting	27 (27%)		
7	Level of facilities	Township	19 (19%)	4.165	0.018
		Rural Health Center	21 (21%)		
		Sub-Center	60 (60%)		

Significant at p-value 0.05 level (2-tailed).
Abbreviations: DM = diabetes mellitus; LHV = lady health visitors (female nurse supervisors); MW = midwives; PHS = public health supervisors.

and previous experiences to diabetes campaign ($p = 0.007$). Furthermore, there were statistically significant differences in performance scoring based on the BHS's designation of work ($p = 0.009$), number of postings ($p = 0.025$), and level of facility ($p = 0.018$). We also analyzed the association between knowledge and performance scoring with continuous variables, including age and duration of services, using Pearson's correlation coefficient test. There were no statistically significant associations between knowledge and performance scoring with age ($p = 0.120$ and $p = 0.421$, respectively), nor with duration of services ($p = 0.520$ and $p = 0.101$, respectively).

3.4. Correlation between knowledge and performance

The study also explored the correlation between knowledge and performance scorings on five domains using Pearson's correlation coefficients. Results were reported with 95% confidence interval (95% CI) in Table 5. There was a significant correlation between total knowledge and total performance scoring ($p = 0.010$). According to further in-depth analysis, significant correlations was observed between knowledge and performance scorings with screening ($p = 0.009$), referral patients ($p = 0.022$) and diabetes reporting and registry ($p = 0.026$) (see Table 6).

Table 5. Correlation between knowledge and performance scoring of respondents.

Correlations between knowledge and performance scoring			
		K*_TOTAL	P*_TOTAL
K* TOTAL	Pearson Correlation	1	0.256[a]
	Sig. (2-tailed)		0.010
	N	100	100
P* TOTAL	Pearson Correlation	0.256[a]	1
	Sig. (2-tailed)	0.010	
	N	100	100

K* Knowledge scoring, P* Performance scoring.
[a] Correlation is significant at p-value 0.05 level (2-tailed).

4. Discussion

This study clearly revealed level of knowledge and performance, as well as their association with socio-demographic factors on diabetes control, among BHS in the PHC setting. The American Medical Association (AMA) applied similar approach, called M.A.P strategy, to explore the effect of knowledge and performance about diabetes control at the community level. M.A.P strategy accurately measures and aims to obtain actionable data, acts precisely on decisions, and partners with patients and community members to provide effective diabetes management [18]. Therefore, results and findings from this study coincide with globally accepted strategies to generalize the knowledge and performance on diabetes control at the PHC setting. Furthermore, all facilities included in the study townships were covered by PEN project. There was no variation of basic requirements for NCDs between urban and rural health facilities. Similarly, the PEN package provided diabetes training to various level of BHS. This broad availability of diabetes

Table 6. In-depth analysis of socio-demographic variables among study participants and their association with knowledge and performance scoring (n = 100).

No	Socio-demographic variables	Groups	n (%)	Knowledge		Performance	
	(Independent T-Test)			**t**	**p-value**	**t**	**p-value**
1	Sex	Male	14 (14%)	3.520	0.001	2.055	0.043
		Female	86 (86%)				
2	Marital status	Single	32 (32%)	0.121	0.904	0.755	0.452
		Married	68 (68%)				
3	Race/ethnicity	Native	55 (55%)	0.124	0.901	0.531	0.597
		Non-native	45 (45%)				
4	Ministry of Health (MOH) mobile tablet	Have	70 (70%)	0.241	0.810	0.724	0.471
		Do not have	30 (30%)				
5	Training Received Before (DM Control)	Received	71 (71%)	2.311	0.023	2.339	0.021
		Not received	29 (29%)				
6	Training Received Before (DM Registry)	Received	51 (51%)	0.855	0.395	2.359	0.020
		Not received	49 (49%)				
7	DM Campaign experiences	Have	60 (60%)	0.725	0.470	2.731	0.007
		Have not	40 (40%)				
	(ANOVA Test)			**F**	**p-value**	**F**	**p-value**
8	Educational Status	Secondary	1 (1%)	0.767	0.467	0.857	0.428
		High school	24 (24%)				
		Graduate	75 (75%)				
9	Designation	LHV-	8 (8%)	6.839	0.000	4.049	0.009
		MW-	59 (59%)				
		PHS-	33 (33%)				
10	Number of postings	1st posting	37 (37%)	2.053	0.093	2.883	0.027
		2nd-5th posting	36 (36%)				
		>5th posting	27 (27%)				
11	Level of facilities	Township	19 (19%)	2.688	0.073	4.165	0.018
		RHC	21 (21%)				
		Sub Center	60 (60%)				
12	Distance from township	<5 miles	33 (33%)	0.369	0.692	0.150	0.861
		5-10 miles	24 (24%)				
		>10 miles	43 (43%)				
12	Duration of internet usage	<3 years	35 (35%)	0.365	0.695	0.809	0.448
		3–5 years	16 (16%)				
		>5 years	49 (49%)				
	(Pearson's Correlation Test)			**F**	**p-value**	**F**	**p-value**
13	Age			0.157	0.12	0.081	0.421
14	Years of service			0.195	0.052	0.165	0.101

Abbreviations: LHV = lady health visitors (female nurse supervisors); MW = midwives; PHS = public health supervisors.
Statistically significant at p-value <0.05.

training may help control the confounding factors of sex, education, and experiences among various levels of BHS. Consequently, the observations in the study are truly significant.

4.1. Association of socio-economic condition and knowledge and performance

This study explored that sex, designations (working rank levels), and exposure to training associated to knowledge and performance on diabetes control. Similarly, the study in Fiji demonstrated socio-economic and health system factors influenced perception of diabetes management among various health workers [19]. Roglic highlighted national initiatives for diabetes care in Sri Lanka that targeted a lower socio-economic group through capacity building initiatives. One initiative included diabetes educator nursing officers (DENOs) as supplementary human resources [20]. Therefore, developing policy and capacity building initiatives for health workers, appropriate to their socio-economic status, is essential to scale up the performance of diabetes control at PHC setting.

4.2. Health promotion

According to the findings, 79% of BHS had an average and good knowledge on health promotion. The study revealed that only 55% of respondents have average and good performance. According to

systematic review of 7 studies, health promotion in diabetes consists of a complex and multicomponent intervention mostly targeting health care professionals. The quantitative indicators measuring the value of health promotion focus on representativeness of stakeholders, knowing various target audiences, addressing knowledge and socio-economic conditions of participants, as well as understanding organizational levels and determinants of diseases [21]. A study related to Korean National Health and Nutrition Survey (K-NHANES 2002-2005) demonstrated that health promotion for a high-risk population had significant positive effects on good management of a diabetes control programme [22]. Through health promotion, utilization of diagnosis significantly improved; consequently, the undiagnosed population was significantly reduced. Another study also emphasized the pathways to improve diabetes knowledge by motivation through community nurses and provision of mass campaigns [23]. Taking account into this scenario, the target setting of health promotion should be considered beyond service providers for diabetes control. Accordingly, patients, family, and policy makers should partner with BHS to improve diabetes control in the community health system.

4.3. Identification of high-risk person and screening

This study highlighted 48% of respondents have poor knowledge and 62% have poor performance on screening and identification of high-risk people for diabetes. Corresponding to the findings of many studies from the United States, the diabetes screening guidelines triggers strong positive association with diagnosis [24]. Furthermore, a study in Iran indicated that setting cut-off points for blood glucose can increase sensitivity and specificity of blood tests; consequently, cut-off points help reduce the unnecessary diagnoses [25]. Therefore, consideration of specific cut-off points and modification of screening strategy or diagnosis guidelines will be necessary to improve the performance of BHS. Similarly, identification of risk factors and screening appropriately to the priority targets will guide the health workers to reduce unnecessary testing.

4.4. Care and treatment

With regards to diabetes care and treatment, a majority of responds showed poor knowledge (58%) and poor performance (70%). Furthermore, a majority of BHS in this study were not familiar with insulin treatment. Due to the complex nature of diabetes, care and treatment alone by health provider may not be sufficient. Satisfactory knowledge about diabetes and best practices for diet control, physical activity, medication, and blood glucose monitoring was correlated with training on self-care of diabetes. Diabetes knowledge was also significantly correlated to blood sugar level [26]. Therefore, designing patient-tailored diabetes educational interventions yield better diabetes control [27]. A patient's knowledge about diabetes care may be limited in regards to the preventive measures [28]. Furthermore, studies reflected that diabetes knowledge was significantly lower in women [29]. Consequently, identifying variables for the self-care process, addressing gender during care and treatment, identification of a targeted and tailored education program, and orientation of treatment protocol will be required at the PHC level for both providers and patients to scale up diabetic care and treatment.

4.5. Complication and referral

Although 53% of BHS had average and good referral knowledge, 87% showed poor performance on patient referrals in this research study. A study in North India revealed a significant gap in between knowledge and referral practice for hypoglycemia and insulin treatment among nurses. Similarly, the nurses did not clearly understand the pathology of diabetes, nor how diabetes was linked to its complications [30]. The study in UK demonstrated that interaction with RE-AIM framework (Reach, Effectiveness, Adoption, Implementation and Maintenance) is necessary for referral route to specialized diabetes care. The study also proved that a nurse-facilitated route integrated more easily into existing clinical process [31]. However, there may be external factors influencing the referral of diabetes patients in addition to the performance of health care in low-income countries. Factors that influence patient referrals may include difficulties in transport, economic conditions, and other health seeking norms. This study recommends further sustainable hands-on training for BHS on management of complications and timely referrals of patients to appropriate tertiary care centers considering the above external factors.

4.6. Registry and reporting

Diabetes registry and reporting is one of the essential interventions leading to a successful diabetes control programme. In this study, 61% of BHS have average and good knowledge on reporting, while 43% of BHS have good performance regarding the diabetes registry. Over half of the countries used diabetes registry not only for surveillance, but also for improving management, quality of care, research, governance and accountability worldwide. Furthermore, countries can standardize their data and prevent errors in data collection, if the registry covers over 75% of people with diabetes [32]. According to meta-analysis of 12 countries, national diabetes registries conferred clear insights into diagnostics, complications and treatment. Consequently, diabetes registries enhanced the allocation of resources and prioritized resource to the other needs [33]. However, there are several limitations of diabetes registries. The sample sizes of diabetes registry in some countries were significantly reduced due to the COVID-19 pandemic [34]. The value of the diabetes registry depends on the quality of documentation available at PHC. It is also unclear to what extent the diabetes registry influences the national healthcare policy. Since almost all of BHS in this study utilize the Internet, a web-based diabetes registry could help improve access and quality of data during the pandemic situation.

5. Conclusion

A significant proportion of BHS in this study have average and above knowledge scoring (54% average and 8% good). However, a majority of respondents have poor performance scoring (62%). The knowledge and performance levels were significantly related to some sociodemographic factors such as sex, designations (working level ranks), number of postings, and level of facility to which BHS were appointed. Similarly, knowledge and performance levels were associated with previous exposure on diabetes control training and diabetes campaigns. Knowledge and performance scoring of BHS were also significantly correlated to each other ($p = 0.01$). Generally, the findings are valid to the Naypyitaw region. However, there are some limitations to generalizing these findings to the entire country. Since the participants represent only to Naypyitaw, not to entire country, there may be some selection bias according to geographical situation. There is a lack of biological markers to measure the performance among diverse populations; for instance, blood sugar level of diabetes patients among various socio-economic status. Furthermore, some BHS missed the trainings on diabetes control, despites the fact that the study areas were covered by PEN package. Consequently, a nationwide survey is required to collect more detailed, accurate data about PHC knowledge and performance. Taking account our present knowledge about diabetes control at primary health care settings, we recommend policy makers set broader targets and update screening strategies to improve diabetes screening. Similarly, gender-based education for care and treatment is essential because majority of BHS are female, and there is significant association of knowledge and sex. Furthermore, sustainable hands-on training will be required to improve the performance for referral of diabetes complications. During COVID-19 pandemic, the conventional paper-based diabetes registry and reporting system faced many challenges. Therefore, designing a web-based diabetes registry may be an innovative solution leading to more robust diabetes reporting and registry system in the post COVID-19 pandemic recovery phase.

Conflict of Interest

None.

Acknowledgements

This publication arises from the authors' contribution in collaboration with the National Diabetes Control Programme. The study is funded by authors' own contribution for academic research and sole responsibilities lies with the authors. We would like to express additional thank to the College of Public Health Sciences, Chulalongkorn University, National Diabetes Control Programme, Department of Health Naypyitaw Council and Novo Nordisk Myanmar for provision of necessary technical support.

Appendix

Appendix-1 Variables for knowledge and performance scoring

No	Domain of Diabetes Program	Variables for Knowledge (Scoring)	Variable for Performance (Scoring)
1	Health promotion for diabetes prevention and control	• Nature of diabetes • Type of diabetes • Risk factors of diabetes • Signs and symptoms of DM • Steps for health promotion	• Conduct health promotion • Conduct specific promotion • Number of participants receiving general health promotion • Number of participants receiving health promotion about DM • Counseling sessions
2	Identification of high-risk persons screening diabetes	• Screening criteria • Symptoms related to diagnosis • Detection of high-risk • Understanding of blood glucose test • Essential tools for diagnosis • Steps to conduct blood test	• Identifying high-risk • Ways to detect high-risk • % of high-risk persons • % of cases detected • Pregnancy and screening • Case detection rate
3	Care and treatment for diabetes patients	• Risk factor management • Treatment algorithm • Target blood sugar level • Diabetes control drugs • Implication of insulin	• Follow-up rate • Blood Pressure monitoring % • Body Weight and Body Mass Index monitoring % • Physical activity monitoring % • % of patients who received dietary advice • BP target setting % • Rate of medication given • Rate of insulin given
4	Complication and referral of diabetes patients	• Understanding hypoglycemia • Understanding complication • Referral criteria • Understanding referral mechanism	• % Referral for further screening • % Referral with complications • % Referral with hypoglycemia • % Referral of uncontrolled DM • % Referral of specific diseases
5	Diabetes registry and reporting	• Why BHS need to register/report DM • Physical requirements of DM registry • Data requirements of DM registry • Roles and responsibilities of BHS for DM programme	• Update registry • Report registry to RHC/THD • Use patient index • Analyze diabetes registry • Calculate prevalence, incidence • Update socio-demographic and referral data

Abbreviations: BP = blood pressure; BW = body weight; BMI = body mass index; DM = diabetes mellitus; BHS = basic health staff; RHC = Rural Health Center; THD = Township Health Department.

References

[1] World Health Organization [WHO]. WHO diabetes fact sheet [cited 2022 Dec]. Available from: https://www.who.int/news-room/fact-sheets/detail/diabetes.

[2] Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: results from the international diabetes federation diabetes Atlas. Diabetes Res Clin Pract 2019;9:107843. https://doi.org/10.1016/j.diabres.2019.107843. 157.

[3] Bommer C, Sagalova V, Heesemann E, Manne-Goehler J, Atun R, Barnighausen T, et al. Global economic burden of diabetes in adults: projections from 2015 to 2030. Diabetes Care 2018;41(5):963–70. https://doi.org/10.2337/dc17-1962.

[4] Smith-Spangler CM, Bhattacharya J, Goldhaber-Fiebert JD. Diabetes, its treatment, and catastrophic medical spending in 35 developing countries. Diabetes Care 2012;35(2):319–26. https://doi.org/10.2337/dc11-1770.

[5] Molaei S, Hosseini M, Tabatabaee SM, Tafreshi MZ. Designing, producing and evaluating of educational multimedia application for the self-care of patients with type 2 diabetes. Indo Am J Pharmaceut Sci 2017;4(5):1313–8. https://doi.org/10.5281/zenodo.802637.

[6] Keller M, Blench M, Tolentino H, Freifeld CC, Mandl KD, Mawudeku A, et al. Use of unstructured event-based reports for global infectious disease surveillance. Emerg Infect Dis 2009;15(5):689–95. https://doi.org/10.3201/eid1505.081114.

[7] Rosewell A, Ropa B, Randall H, Dagina R, Hurim S, Bieb S, et al. Mobile phone-based syndromic surveillance system, Papua New Guinea. Emerg Infect Dis 2013;19(11):1811–8. https://doi.org/10.3201/eid1911.121843.

[8] Ramalingam B. Real-time monitoring in disease outbreaks: strengths, weaknesses and future potential. IDS evidence report 181. Brighton: IDS; 2016.

[9] World Health Organization [WHO]. WHO STEPS survey. Yangon. Myanmar: WHO; 2018.

[10] Latt TS, Aye TT, Ko K, Myint Y, Thant MM, Myint KNS, et al. Myanmar diabetes care model: bridging the gap between urban and rural healthcare delivery. J ASEAN Feder Endocr Soc 2015;30(2):105−17.
[11] World Health Organization [WHO]. Global report on diabetes. Geneva: WHO; 2016.
[12] Aung WP, Bjertness E, Htet AS, Stigum H, Kjollesdal MKR. Trends in diabetes prevalence, awareness, treatment and control in Yangon region, Myanmar, between 2004 and 2014, two cross-sectional studies. Int J Environ Res Publ Health 2019;16(18):3461. https://doi.org/10.3390/ijerph16183461.
[13] Latt TS, Zaw KK, Ko K, Hlaing MM, Ohnmar M, Oo ES, et al. Measurement of diabetes, prediabetes and their associated risk factors in Myanmar 2014. Diabetes Metab Syndr Obes 2019;12:291−8. https://doi.org/10.2147/DMSO.S156270.
[14] World Diabetes Foundation. Expanding and improving capacity within NCD prevention, care and monitoring in Myanmar through implementation of the WHO PEN model with a focus on primary level care [updated 2019; cited 2022 Dec]. Available from: https://www.worlddiabetesfoundation.org/projects/myanmar-wdf15-1286.
[15] Latt NN, Myat Cho S, Htun NM, Yu Mon S, Myint MN, Aoki F, et al. Healthcare in Myanmar. Nagoya J Med Sci 2016;78(2):123−34.
[16] Brown SA. Effects of educational interventions in diabetes care: a meta-analysis of findings. Nurs Res 1988;37(4):223−30.
[17] World Health Organization [WHO]. WHO package of essential noncommunicable (PEN) disease interventions for primary health care. Geneva: WHO; 2020.
[18] American Medical Association [AMA]. Tools for physicians, prevent type 2 diabetes in your patients [cited 2022 Dec]. Available from: https://amapreventdiabetes.org/clinical-overview.
[19] Kumar L, Mohammadnezhad M. Health care workers' perceptions on factors affecting diabetes self-management among type 2 diabetes mellitus patients in Fiji: a qualitative study. Front Public Health 2022;10:779266. https://doi.org/10.3389/fpubh.2022.779266.
[20] Roglic G, Varghese C, Thamarangsi T. Diabetes in South-East Asia: burden, gaps, challenges and ways forward. WHO South East East Asia. J Public Health 2016;5(1):1−4. https://doi.org/10.4103/2224-3151.206546.
[21] Sorensen M, Korsmo-Haugen HK, Maggini M, Kuske S, Icks A, Rothe U, et al. Health promotion interventions in type 2 diabetes. Ann Ist Super Sanita 2015;51(3):192−8. https://doi.org/10.4415/ann_15_03_05.
[22] Lee J, Smith JP. The effect of health promotion on diagnosis and management of diabetes. J Epidemiol Community Health 2012;66(4):366−71. https://doi.org/10.1136/jech.2009.087304.
[23] Missiriya S. Knowledge and practice of selfcare management on diabetes mellitus among urban people. Int J Pharmaceut Sci Rev Res 2016;41(1):237−41.
[24] Dallo FJ, Weller SC. Effectiveness of diabetes mellitus screening recommendations. Proc Natl Acad Sci U S A 2003;100(18):10574−9. https://doi.org/10.1073/pnas.1733839100.
[25] Kianpour F, Fararouei M, Hassanzadeh J, Mohammadi M, Dianatinasab M. Performance of diabetes screening tests: an evaluation study of Iranian diabetes screening program. Diabetol Metab Syndrome 2021;13(1):13. https://doi.org/10.1186/s13098-021-00632-9.
[26] Moraes NM, Souza GFP, Brito FI, Antonio Júnior ME, Cipriano AE, Costa NSV, et al. Knowledge and self-care in diabetes mellitus and their correlations with sociodemographic, clinical and treatment variables. Diabetes Updates 2020;6:1−6. https://doi.org/10.15761/DU.1000145.
[27] Bukhsh A, Khan TM, Sarfraz Nawaz M, Sajjad Ahmed H, Chan KG, Goh BH. Association of diabetes knowledge with glycemic control and self-care practices among Pakistani people with type 2 diabetes mellitus. Diabetes Metab Syndr Obes 2019;12:1409−17. https://doi.org/10.2147/dmso.S209711.
[28] Gulabani M, John M, Isaac R. Knowledge of diabetes, its treatment and complications amongst diabetic patients in a tertiary care hospital. Indian J Community Med 2008;33(3):204−6. https://doi.org/10.4103/0970-0218.42068.
[29] Nkoka O, Ntenda PAM, Phiri YVA, Mabuza GN, Dlamini SA. Knowledge of diabetes among Gambian adults: evidence from a nation-wide survey. BMC Cardiovasc Disord 2022;22(1):145. https://doi.org/10.1186/s12872-022-02591-z.
[30] Gharsangi K, Himral P, Vishwachander Bhawani R. Knowledge, attitude and practices regarding diabetes and its complications among health care workers in medical college of North India. Int J Collab Res Intern Med Public Health 2021;13(6):1−7.
[31] Knowles S, Cotterill S, Coupe N, Spence M. Referral of patients to diabetes prevention programmes from community campaigns and general practices: mixed-method evaluation using the RE-AIM framework and Normalisation Process Theory. BMC Health Serv Res 2019;19(1):321. https://doi.org/10.1186/s12913-019-4139-5.
[32] World Health Organization [WHO]. Registries and information systems for diabetes care in the WHO European Region: preliminary findings for consultation. Denmark, Copenhagen: WHO Regional Office for Europe; 2021.
[33] Bak JCG, Serné EH, Kramer MHH, Nieuwdorp M, Verheugt CL. National diabetes registries: do they make a difference? Acta Diabetol 2021;58(3):267−78. https://doi.org/10.1007/s00592-020-01576-8.
[34] Ministry of Health Malaysia. National diabetes registry report 2020. Putrajaya, Malaysia: Ministry of Health; 2020.