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Determine the perceived level of involvement and factors affecting diabetes management by community pharmacy professionals at drug retails in northwestern amhara region, Ethiopia

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ABSTRACT

Background: Pharmacists in community drug retail outlets (CDROs) have significant involvement in diabetes prevention and management by providing more direct interventions in medication education, preventive measures, and disease management. This study examined the perceived level of involvement of community pharmacy professionals (CPPs) in diabetes management at CDROs in Northwest Ethiopia.

Methods: A multicenter cross-sectional study was conducted among CPPs in Northwest Ethiopia between September 1 and 30, 2022. The Statistical Package for Social Science (SPSS) version 26 was used to analyzed the data, which had been gathered using a self-administered structured questionnaire. An independent sample *t*-test and one-way ANOVA were used to examine the mean perceived involvement score difference between CPPs. The association between CPPs' involvement and other sociodemographic variables was examined using linear regression analysis. At a 95% confidence interval (CI), a p-value <0.05 was considered statistically significant.

Results: The study included 184 (94.3%) of 195 CPPs approached. The overall mean perceived involvement score of CPPs in diabetes management was 3.80 ± 0.63 out of 5. CPPs with a bachelor's degree or higher [$\beta = 3.065$, 95% CI: 2.704, 3.641; $p < 0.001$], CPPs with a higher monthly income ($\geq$5000 ETB) [$\beta = 0.242$, 95% CI: 0.112, 0.596; $p = 0.034$], and those who provided more than 8 hours of service per day [$\beta = 0.163$, 95% CI: 0.051, 0.332; $p = 0.043$] had higher perceived involvement in the management of diabetes compared with their counterparts.

Conclusions: This study found that most CPPs had a high level of perceived involvement in diabetes management. Higher educational backgrounds, a higher monthly salary, and working longer hours were associated with an increased level of perceived involvement. Promoting the educational background of CPPs may be crucial to enhance their active involvement in the management of diabetes.

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1. Introduction

Globally, pharmacy practice has evolved to incorporate patient treatment for both acute and chronic illnesses. The prevalence of diabetes mellitus is rising globally as a result of social changes, unhealthy physical conditions, and lifestyle choices [1]. With 41 million deaths per year and 74% of all deaths globally attributed to noncommunicable chronic illnesses (NCDs), such as diabetes, they are the main cause of death worldwide [2]. According to the World Health Organization (WHO), 77% of all NCD deaths occurred in LMICs (low- and middle-income countries) [2]. Every year, diabetes kills 2 million people worldwide [2]. With an estimated 783 million diabetics worldwide by 2045 [3], it continues to be a public health concern. Three-fourths of patients with diabetes are located in LMICs [4]. Additionally, its burden has increased, particularly in LMICs, highlighting the critical need for diabetes control strategies [5,6].

Furthermore, diabetes has also been identified as one of the major public health threats in Africa, with 24 million cases diagnosed up to 2021 and an estimated 55 million by 2045 [3]. Additionally, it has also increased in Ethiopia, where there has been a discernible shift in lifestyle as well as appreciable rises in other risk factors like population and urbanization. There are about 2.5 million adults in Ethiopia who have diabetes [7]. From 3.8% in 2016 to 5.2% in 2017, the estimated prevalence of this condition increased considerably [8]. Furthermore, according to the International Diabetes Federation (IDF), metabolic syndromes, including diabetes, were presented in 17.9% of an otherwise healthy working population in Ethiopia [9]. In order to build practical, multidisciplinary networks of public healthcare experts who actively connect with communities and deliver essential public health services to increase the population's life expectancy, the WHO established the future public health program [10].

Many of the factors that have been associated with diabetes are closely related to sedentary lifestyles, including obesity, physical inactivity, a poor diet, and smoking. NCDs such as dyslipidemia, diabetes, cardiovascular illnesses, renal disorders, and retinopathy may develop as a result of these risk factors [11,12]. Age, alcohol use, and abdominal obesity have all been noted as important risk factors for NCDs, including diabetes, in Ethiopia [13,14]. These hazards can be decreased by addressing modifiable risk factors and changing sedentary lifestyle practices [15]. To decrease the risk of mortality and morbidity and enhance healthcare systems, proper risk factor management has also been devised [16].

In healthcare service provision, one of the most popular and initial sources of interaction for the public are pharmacy professionals. By offering direct interventions in medication education and illness management, they play a critical role in the prevention and control of chronic diseases like diabetes. Pharmaceutical services can be applied directly and immediately to clients in the area. As a result, there may be an increase in medication adherence, intended therapy outcomes, and safe medication use behaviors [17,18]. Community pharmacy professionals (CPPs) play a significant role in many healthcare services, according to prior research [19–24]. They can also aid in the prevention and control of chronic illnesses such as cardiovascular diseases, diabetes, and metabolic syndromes. As a result, patients receive better care [18,20,25–27]. The promotion of community-based care models has lately increased since it is challenging to get in touch with primary care doctors and because healthcare expenses are rising quickly. Diabetes management outcomes improved with community pharmacist-based interventions for individuals with diabetes [28–30].

Studies have investigated the role of CPPs in diabetes prevention and management [20,25,31]. However, evidence is still limited, and the existing literature also lacks comprehensive evidence, particularly in the study area. They are single-centered, use varied measuring tools, and have a relatively small number of participants. Generalizing and drawing conclusions might be difficult. Thus, the current study attempted to present a comprehensive finding using relatively more participants from the three cities in the country. As a result, this study examined the level of perceived involvement and factors affecting diabetes management by CPPs at selected CDROs in Northwest Ethiopia.

1.1. Definition of terms

Community pharmacy professionals: No matter their educational background, it refers to pharmacy professionals who were employed in CDROs found in the selected cities.

Community drug retail outlets (CDROs): CDROs are classified into different levels based on the types of pharmaceuticals and supplies they are intended to dispense as well as the training of their CPPs [25,32]. These are drug vendors, stores, and pharmacies with various roles and responsibilities.

Pharmacy: Pharmacies are now legally allowed to stock and provide any medication and medical supplies. They should be run by licensed pharmacists who have earned a bachelor's degree [25,32].

Drug store: Drug stores, on the other hand, have limited offerings and are not designed to stock and supply all medications. For example, holding narcotic and psychotropic medications in drug stores is prohibited [25,32].

Involvement: indicates the participation and engagement of CPPs in the promotion, counseling, education, and the provision of services in the management of diabetes. The level of the perceived involvement indicates the degree or extent of CPPs' perception of involvement in the management of diabetes.

2. Methods and materials

2.1. Study design, settings and samples

Between September 1 and September 30, 2022, a multicenter cross-sectional survey of CPPs employed by CDROs in Northwest Ethiopia was carried out. The participants were picked at random from CDROs in the cities of Gondar, Bahira Dar, and Debre Tabor

using the lottery technique, despite the fact that there are approximately nine zonal and/or metropolitan cities. The country's other regions and administrative cities were specifically avoided when choosing the Amhara regional state. This was due to the fact that it was conveniently located for data collection and was near the principal investigators' research sites. As of June 2022, these three cities had about 195 licensed CDROs, according to a local report [33]. The approximate number of CPPs who are actively in practice in each city and CDRO, however, is not currently known.

We suggested approaching one participant per CDRO due to the limited number of licensed CDROs that were available in the chosen cities and the fact that we had no idea how many CPPs there were overall or per CDRO. Then, we contacted every active CDRO who had contributed throughout the time of data collection. If there was more than one CPP per CDRO, we conducted a random interview with one CPP volunteer. CPPs who declined to take part in the study or were unavailable during data collection were excluded. Finally, 184 of the 195 CPPs who were reached for the study agreed to take part.

2.2. Data collection instruments and procedures, and data quality control methods

A self-administered, structured questionnaire-based data collection instrument was used to collect the data. Following a review of the literature, a questionnaire was designed [20,25,32]. Initially, the questionnaire was prepared in English and validated by experts in the area. The bilingual language expert was also appointed for translation into the local language (Amharic) using Google Translate; they checked spelling and assured quality. Then, it was translated back into English by another expert to verify consistency. During translation, the message of the original text was maintained as faithfully as possible, accounting for the cultural factors of the target participants. The questionnaire was composed of three parts: (1) the first part consisted of study participants' sociodemographic characteristics; (2) the second part contained items used to assess the awareness of participants regarding diabetes and their role; and (3) the third part was composed of statements used to assess the level of perceived involvement of CPPs in the management of diabetes.

To ensure the instrument's quality, the developed questionnaire was face-validated for its content by two seniors with expertise in the field. Then, in ten CDROs (roughly 5% of the total CDROs in the selected cities), a pretest was conducted. We administered the prepared questionnaire to CPPs from the ten CDROs in the pretest and checked it for readability, clarity, and consistency. Based on comments from the pretest, we then made a few small adjustments to the questionnaire. These modifications were made to avoid repetition, make some phrases clearer, and prevent making lengthy statements. Three graduating clinical pharmacy students collected data after receiving a half-day of instruction in data collection techniques and ethical considerations. Participants were informed of the study's goals before agreeing to participate. Eligible participants who volunteered to participate in this study were given a self-administered questionnaire.

The perceived level of involvement of CPPs in diabetes management was measured using 14 items on a five-point Likert scale (not at all involved = 1, little involved = 2, uncertain = 3, involved = 4, very involved = 5). We used the scale each participant gave for each item to determine the overall mean perceived involvement score (question). Then, after calculating the mean score for each item, we would know the overall mean score of the entire group of participants out of five. This was determined using previous evidence [25, 32]. We also calculated the Cronbach's alpha reliability test, which yielded 0.78 and was within the acceptable ranges.

2.3. Data processing and statistical analysis

The data were gathered, checked for accuracy, consistency, clarity, and cleanliness, and then entered into EPI-info version 8. It was then imported into SPSS version 26 for analysis. To examine whether variables had a normal distribution, histograms and Q-Q plots were used. The data were presented as means and standard deviation (SD) for continuous variables and as frequencies and percentages for categorical variables.

To examine mean score differences amongst CPPs' subgroups regarding their perceived involvement in diabetes management, an independent sample *t*-test and one-way ANOVA were performed. The standardized mean difference of Cohen's d effect size formula for the *t*-test and Cohen's f2 method of effect size in the ANOVA test were used to determine the effect size of each variable. The determined effect size was then divided into three categories: weak (<0.5), moderate (0.5–0.8), and strong (>0.8) [34–36].

Linear regression analysis was used to examine the association between CPPs' perceived involvement and other independent variables. The assumptions (normality test, correlation coefficient test, linearity test, outliers, multicollinearity, and homoscedasticity) of the statistical methods were examined accordingly, and variables with a p-value of ≤ 0.2 in the simple linear regression analysis were analyzed further in multivariable analysis to identify factors potentially related to CPPs' perceived involvement. The mode fitness test was performed and found to be statistically significant ($F = 6.99$, $p < 0.001$). The regression results showed that the model was explained by an adjusted R square of 75.3%, a variance inflated factor (VIF) of <5 for all variables, and a Durbin-Watson score of 1.51. The results of the regression analysis were expressed as unstandardized coefficients. Beta coefficients were expressed and represented the effect size of the average change in the pharmacist's perceived involvement in diabetes management for each unit increase in the predictor variable. At 95% CI, a p-value of 0.05 was considered statistically significant.

3. Results

3.1. Sociodemographic characteristics of the study participants

A total of 184 CPPs took part in the study, yielding a response rate of 94.3%. With a mean age of 32.0 ± 8.1 years, more than half (53.8%) were males. The majority of participants (58.2%) had a lower educational background (diploma level) and 4.5 ± 1.6 years of

work experience. Furthermore, most participants (79.9%) were employed (Table 1).

3.2. Participants' perception and willingness in the prevention and management of diabetes

The majority of participants (93.5%) perceived they would be involved in managing diabetes. Additionally, more than three-fourths (80.9%) of respondents stated they would be happy to offer health promotion and education for managing diabetes. The majority of participants (87%), however, reported barriers to diabetes management (Table 2).

3.3. CPPs' perceived involvement in the management of diabetes

According to the results, the majority of CPPs were regarded as actively involved in managing diabetes, with an overall perceived involvement score of 3.80 ± 0.63 out of 5 (ranging from 1 to 5). In addition, it was estimated that more than three-fourths (76.1%) of CPPs promoted the service of counseling patients on healthy weight loss with a non-weight-bearing diet. Additionally, the majority (>82%) of CPPs were believed to counsel patients on salt limitation, alcohol consumption limits, and physical activity promotion. A perceived involvement score of four or higher out of five was used for this. While screening and measuring blood pressure, weight, and glucose levels, counseling patients to see doctors for further management, and promoting good foot care techniques were all perceived as CPP responsibilities, their perceived involvement in these areas was limited (<65%) (Table 3).

3.4. CPPs' perceived involvement difference in the management of diabetes

To examine the mean score difference between various participant subgroups in terms of overall involvement in diabetes management, an independent sample *t*-test and one-way ANOVA were performed. With a robust effect size (effect size = 0.92), CPPs with a bachelor's degree or higher (Mn = 4.16) had considerably ($p < 0.001$) higher perceived involvement mean scores than CPPs with a diploma (Mn = 3.54). Similarly, CPPs who worked for more than 8 h per day had a substantially higher participation score (Mn = 3.90) than those who worked for less than or equal to 8 h (Mn = 3.69); $p = 0.023$ with a poor effect size (effect size = 0.32). The findings, however, indicated that there was no difference in perceived involvement between other participant subgroups, and their effect size in terms of perceived involvement deference was also weak (Table 4).

3.5. Determinants of CPPs' involvement in the management of diabetes

The multivariable linear regression model was applied to determine variables associated with CPPs' involvement in diabetes management. Consequently, educational level, monthly salary, and service duration per day were found to have a significant linear association with their involvement in diabetes management. As a result, CPPs with a bachelor's degree or higher [$\beta = 3.065$, 95% CI: 2.704, 3.641; $p < 0.001$], those with a higher monthly income (≥5000 ETB) [$\beta = 0.242$, 95% CI: 0.112, 0.596; $p = 0.034$], and those who provided more than 8 h of service per day [$\beta = 0.163$, 95% CI: 0.051, 0.332; $p = 0.043$] were more involved in the management of

Table 1
Sociodemographic characteristics of community pharmacy professionals (N = 184).

Sociodemographic Variables		Frequency (n, %)	Mean ± SD
Sex:	Male	99 (53.8)	
	Female	85 (46.2)	
Mean age in years	–	–	32.0 ± 8.1
Participants enrolled from:	Bahira Dar	84 (45.6)	
	Gondar	73 (39.7)	
	Debera Tabor	27 (14.7)	
Educational level of CPPs:	Druggist (diploma)	107 (58.2)	
	Bachelor's degree and above	77 (41.8)	
CPPs' work experience in years:	<1 year	38 (20.7)	4.5 ± 1.6
	1–5 Years	88 (47.8)	
	>5 years	58 (31.5)	
Employment status of CPPs:	Employee	147 (79.9)	
	Owner	37 (20.1)	
Participants' monthly income (ETB):	1500–2999	50 (27.2)	
	3000–4999	89 (48.4)	
	≥5000	45 (24.4)	
Type of CDROs which CPPs worked:	Drug store	91 (49.5)	
	Pharmacy	93 (50.5)	
Clients served by CPPs per day:	<50 50–100 >100	103 (56)	42.7 ± 15.3
		70 (38)	
		11 (6.0)	
CPPs' working hours/day:	≤8	87 (47.3)	8.8 ± 3.1
	>8	97 (52.7)	
Received on-duty training on diabetes management	Yes	57 (31)	
	No	127 (69)	

Table 2
Community pharmacy professionals' perceptions, willingness, and barriers to diabetes prevention and management.

Variables related to CPPs' willingness and barriers	Frequency (%)	
Diabetes prevention and management are part of pharmacist responsibility	Yes	172 (93.5)
	No	12 (6.5)
The pharmacy curriculum is adequate for offer diabetes prevention and management	Yes	130 (70.7)
	No	54 (29.3)
Willing to provide health education and promotion in the prevention and management of diabetes	Yes	150 (81.5)
	No	34 (18.5)
Are there any barriers preventing you from being involved in the management of diabetes	Yes	160 (87)
	No	24 (13)

Table 3
Community pharmacy professionals' perceived involvement in the management of diabetes in Northwest Ethiopia (N = 184).

Items of health promotion activities	Level of CPPs' response on health promotion activities (n, %)					Mean ± SD score, out of 5 points
	Not involved	Little involved	Uncertain	Involved	Very involved	
Promotion on: Weight reduction by low calorie and non-weight bearing diet	4 (2.2)	25 (13.6)	15 (8.2)	90 (48.9)	50 (27.2)	3.85 ± 1.04
physical activity	5 (2.7)	21 (11.4)	7 (3.8)	93 (50.5)	58 (31.5)	3.97 ± 1.03
Restriction of alcohol consumption	5 (2.7)	17 (9.2)	7 (3.8)	81 (44)	74 (40.2)	4.10 ± 1.02
Cessation of smoking	5 (2.7)	12 (6.5)	9 (4.9)	82 (44.6)	76 (41.3)	4.15 ± 0.98
Salt restriction	5 (2.7)	13 (7.1)	7 (3.8)	76 (41.3)	83 (45.1)	4.19 ± 0.99
Cholesterol-lowering diets consumption	5 (2.7)	23 (12.5)	24 (13)	105 (57.1)	27 (14.7)	3.68 ± 0.96
Vegetables consumption	5 (2.7)	32 (17.4)	21 (11.4)	84 (45.7)	42 (22.8)	3.68 ± 1.09
Good foot care techniques	7 (3.8)	31 (16.8)	32 (17.4)	82 (46.7)	28 (15.2)	3.53 ± 1.06
Over-the-counter drugs or herbal products caution	9 (4.9)	55 (29.9)	16 (8.7)	79 (42.9)	25 (13.6)	3.30 ± 1.18
Maintaining target goals of weight, blood pressure and blood glucose	3 (1.6)	29 (15.8)	4 (2.2)	85 (46.2)	63 (34.2)	3.96 ± 1.07
Involving in measurement of blood pressure, weight, and glucose level	9 (4.9)	48 (26.1)	9 (4.9)	68 (37.2)	50 (27.2)	3.55 ± 1.27
Prescription treatment of diabetes	1 (0.5)	29 (15.8)	12 (6.5)	102 (55.4)	40 (21.7)	3.82 ± 0.98
Encourage patients to adhere treatment	1 (0.5)	18 (9.8)	10 (5.4)	99 (53.8)	56 (30.4)	4.04 ± 0.90
Counseling patients to visit medical practitioners for further management	5 (2.7)	52 (28.3)	23 (12.5)	79 (42.9)	25 (13.6)	3.36 ± 1.11
CPPs' overall perceived involvement score						**3.80 ± 0.63**

diabetes compared with their counterparts (Table 5).

4. Discussion

The goal of this study was to determine how much CPPs are perceived to contribute to the management of diabetes. CPPs play a variety of public health functions, from simple prescription dispensing to more extensive involvement in the delivery of healthcare services [37,38]. Assessing their perceived level of involvement in diabetes management is critical for taking action, such as closely monitoring and providing support. Evidence from all around the world suggests that pharmacists' intervention in patients with diabetes leads to a better glycemic level and a better prognosis [28–30,39]. This study investigated the perceived level of involvement and associated factors among CPPs in managing diabetes at CDROs in Northwest Ethiopia. The majority of CPPs in this study believed themselves to be highly involved in managing diabetes, according to the study's findings. The CPPs' average score of perceived involvement in managing diabetes was 3.80 ± 0.63 out of 5. In comparison to their contemporaries, CPPs with a bachelor's degree or higher, greater monthly incomes, and those who worked more hours per day were thought to be more likely to be involved in the management of diabetes.

In line with previous research, drug dispensing, medication therapy management, health education, diabetes screening, guidance on health risks like quitting smoking, managing weight, checking blood pressure and glucose levels, symptom response, and general medication and health information are just a few of the services that CPPs have offered to the public [20,21,32,40,41]. This could be due to their educational background and motivation to assist patients. This study also revealed that the vast majority of CPPs were eager to provide diabetes management and health education and promotion. This implies that CPPs are perceived to be involved in areas of public health priority. In this study, CPPs were perceived to have high involvement in diabetes management activities. This was similar to other studies [20,25,41–45]. This could be due to their motivation and dedication to serving the community. They were additionally engaged in activities that promoted healthy lifestyle changes, such as quitting smoking and losing weight through low-calorie, non-weight-bearing diets. They also promoted alcohol consumption restrictions. This may indicate that CPPs now have a

Table 4
Tests of mean score perceived involvement differences in the management of diabetes among subgroups of CPPs.

Variables	Category	Independent *t*-test and one-way ANOVA analysis			
		Mean ± SD	t/F	Effect size	p-value
Sex	Female	3.84 ± 0.66	0.82*	0.13	0.411
	Male	3.76 ± 0.60			
Participants enrolled from:	Gondar city	3.84 ± 0.66	0.71**	0.06	0.321
	Bahir Dar	3.80 ± 0.63			
	Debre Tabor	3.76 ± 0.60			
Educational level of CPPs:	Bachler degree and above	4.16 ± 0.66	7.71*	0.92	<0.001
	Druggist	3.54 ± 0.60			
CPPs' work experience in years:	<1	3.75 ± 0.66	1.54**	0.17	0.217
	1–5	3.88 ± 0.60			
	>5	3.71 ± 0.63			
Employment status of CPPs:	Employee	3.81 ± 0.66	0.27*	0.05	0.787
	Owner	3.78 ± 0.60			
Participants' monthly income (ETB):	1500–2999	3.73 ± 0.66	0.49**	0.23	0.061
	3000–4999	3.81 ± 0.63			
	≥5000	3.84 ± 0.60			
Type of CDROs which CPPs worked:	Pharmacy	3.82 ± 0.64	0.45*	0.06	0.654
	Drug store	3.78 ± 0.62			
Clients served by CPPs per day:	<50	3.82 ± 0.60	0.73**	0.14	0.484
	50–100	3.80 ± 0.66			
	>100	3.78 ± 0.63			
CPPs' working hours/day:	>8	3.90 ± 0.62	2.30*	0.32	0.023
	≤8	3.69 ± 0.64			
Received on-duty training on diabetes management	Yes	3.85 ± 0.66	0.67*	0.12	0.503
	No	3.78 ± 0.60			

* Denotes independent sample *t*-test; ** indicates One-way ANOVA; bold letter at p-value indicates $p < 0.05$; t stands *t*-test for equality of means and F stands one-way ANOVA test of a sum of squares; level of effect size: <0.5 = weak, 0.5–0.8 = moderate, >0.8 = strong.

Table 5
Simple and multivariable linear regression analysis for determining the association between CPPs' level of perceived involvement in the management of diabetes and other variables.

Variables		β-coefficient (95% CI)		P-value
		Univariable	Multivariable	
Educational level	Degree and above	3.543 (3.438, 3.648)	3.065 (2.704, 3.641)	<0.001*
	Diploma	Reference		
Working experience in years	≥5	−0.049 (-0.176, 0.280)	–	
	1–5	0.129 (-0.111, 0.368)		
	<1	Reference		
Monthly income (ETB)	≥5000	0.079 (-0.176, 0.334)	0.242 (0.112, 0.596)	0.034*
	3000–4999	0.110 (-0.109, 0.329)	0.222 (-0.017, 0.427)	0.179
	1500–2999	Reference		
Employment status	employee	0.030 (-0.199, 0.258)	–	
	Owner	Reference		
CDRO type	Drug store	−0.042 (-0.225, 0.141)	–	
	Pharmacy	Reference		
Working hours/day	>8	0.210 (0.030, 0.391)	0.163 (0.051, 0.332)	0.043*
	≤8	Reference		
Number of clients/days	<50	0.236 (-0.158, 0.629)	–	
	50–100	0.236 (-0.166, 0.638)		
	>100	Reference		
Receiving training	Yes	0.071 (-0.0127, 0.268)	–	
	No	Reference		

CI, confidence interval**;** CDRO, community drug retail outlets; * indicated p-value <0.05, Adjusted $R^2 = 75.3\%$; $F = 6.99$, $p < 0.001$; VIF <5 for all variables; β-coefficient denotes unstandardized effect size (<0.5 = weak, 0.5–0.8 = moderate, >0.8 = strong).

better understanding of healthcare objectives and diabetes risks, which may encourage them to take part in diabetes management.

According to the current study, the majority of CPPs were perceived to be involved in the majority of important diabetes treatment tasks. This may be the result of those CPPs using patient education and counseling strategies as a result of the national pharmacy education program. Since 2008, there has been and continues to be a paradigm shift from conventional dispensing-only to patient-oriented strategies. Following that, several CPPs employed by CDROs graduated after undergoing training in a range of clinical cases and scenarios. They also received training in effective communication and patient approaches. In this survey, the vast majority of participants agreed that the curriculum is suitable for offering healthcare services like diabetes treatment. This study found that most

CPPs were more engaged in a range of health-related activities relevant to managing diabetes. On the other hand, fewer CPPs received training on methods for managing noncommunicable chronic diseases like diabetes. For CPPs to provide these services as effectively as feasible, this must be addressed. Therefore, it is important for community health organizations, national NCD monitoring organizations, and other interested parties to frequently participate in taking initiatives, supporting training, and promoting the educational backgrounds of CPPs. The inclusion of CPPs in programs and workshops supporting health priorities might be encouraged through collaborations among CDROs, health authorities, and pertinent educational training centers.

Unlike previous studies [46,47], the current study discovered that CPPs were perceived to be far more involved in promoting alcohol consumption restriction and smoking cessation. These results might indicate that the CPPs in this study noticed a rise in sedentary behavior. This led them to spread awareness of the risks associated with unhealthy alcohol consumption and smoking habits. On the contrary, in the current study, CPPs were less involved in some healthcare activities than they had been in earlier studies [46, 48], such as promoting cholesterol-free and cholesterol-lowering diets, offering advice on proper foot care techniques, screening and measuring weight, blood pressure, and glucose levels, and referring patients to medical professionals for additional management. This lower level of involvement may demonstrate CPP limitations due to a lack of skills or commitment by CPPs in these areas. The findings, however, were in line with earlier studies on the management of diabetes [20,31], metabolic syndrome [25], and cardiovascular disorders [32].

The current study also showed that different CPP subgroups had varying levels of perceived involvement in diabetes management. An independent sample *t*-test revealed that CPPs with a bachelor's degree or higher had higher mean perceived involvement scores than CPPs with a lower education level. Linear regression analysis also revealed that a higher degree of education was similarly linked to a higher mean involvement score in the management of diabetes. Along with a statistical correlation, there was a greater effect size difference between degree-and-above holders and diploma-holders. The results were in line with a prior investigation into the roles of CPPs in the management of cardiovascular disease [32]. Higher-educated CPPs might be more involved because they may have updated knowledge and skills to communicate with clients. Additionally, they might be more qualified to engage in healthcare activities than CPPs with less education. Furthermore, it was simple for them to discover the most recent resources and comprehend how to use and modify them practically. They would become more actively involved in managing diabetes as a result. When asked about their involvement in healthcare activities while on attachment, bachelor's degree pharmacy students in the study environment responded in favor of professional training, expertise, and established standards [49]. The majority of CPPs in the current study, however, had less formal schooling. In order to deliver better healthcare services in areas of public health priority, such as diabetes control, CPPs should maintain their education. Through training in health promotion services, they must not only increase their education but also their knowledge, abilities, and confidence.

Although the effect size was poor, this study also demonstrated that working hours per day had a significant association with CPPs' involvement in the management of diabetes. An independent sample *t*-test also revealed that CPPs who worked longer hours (>8 h per day) had a higher mean involvement score than those who worked shorter hours (8 h per day). Given their shorter time on duty, they may encounter fewer patients who require services. This finding may also imply that CPPs could be assigned to the optimal number of clients for enough hours per working day. This would enable them to increase their healthcare activities related to public health priorities such as diabetes management, which requires pharmacist involvement. An earlier study on the role of CPPs in the management of cardiovascular diseases discussed how CPPs would serve an optimal number of clients in their working day to provide patients with better counseling, health promotion activities, and healthcare services [32]. Furthermore, CPPs with a higher monthly income were more likely to be involved than those with a lower monthly income. The finding may imply that those professionals who received better financial access might become committed and involved in public priorities, like engaging in treatment strategies for diabetes. In resource-limited settings like Ethiopia, money from a monthly salary is the source of everything in a family's life. Therefore, professionals need an appropriate and optimal monthly salary to be effective in their routine activities and perform well. In addition, the finding might be justified by the fact that pharmacists with higher monthly incomes might have a better educational background and be more senior academically. Pharmacists with a higher educational background and more seniority might be more likely to be involved.

The effect size difference in perceived involvement among different subgroups of CPPs was also examined, as it indicates a true difference between groups. According to the study findings, the effect size difference in perceived level of involvement among the subgroups of study participants was in the poor range. This was except for the education level. This might be because of the sociodemographic and socioeconomic similarity of study participants across different CDROs in the selected cities. A small effect size difference may indicate that a meaningful difference among the participants might not be present. Most of the CPPs involved in diabetes management were similar. However, there was a strong effect size difference in perceived level of involvement between degree and above holders and diploma holders. This could be because of a fundamental difference in knowledge and engagement in diabetes management due to degree holders having better skills in patient counseling and pharmaceutical care than diploma holders. Thus, improving the educational background of the study participants is critical since a meaningful difference in perceived involvement was observed between these subgroups.

Despite the fact that the majority of participants reported a high level of involvement in diabetes management, a large proportion of CPPs identified barriers to higher involvement. Previous studies on CPPs' practice in various chronic diseases reported numerous barriers, including a lack of an appropriate working area in CDROs, an increased workload and lack of time, a lack of coordination with other healthcare providers, insufficient guidance resources and training, and low management support [19,21,27,32,46,50]. The majority of barriers are avoidable. Thus, a system could be designed to reduce barriers while increasing CPP effectiveness in diabetes management services. Possible systems to reduce barriers might be: offering diabetes management-related training for the CPPs; upgrading CPPs' educational status; and enhancing supervision and support from stakeholders. Providing training and supervision is

imperative because this study revealed that a high proportion of the participants are druggists. The majority of them also didn't receive on-duty diabetes management training. Furthermore, in addition to the formal education they receive, CPPs must improve their knowledge, skills, and confidence through formal and informal training. They could access updated resources.

In general, this study examined the levels and extent of CPPs' involvement in diabetes management. These roles include promoting physical activities, alcohol consumption restrictions, salt restrictions, and cigarette smoking cessation. In addition, they include screening and monitoring of weight, blood pressure, glucose levels, treatment responses, and medication adherence. However, data collection, which depends on participants' honesty and faith in the outcome, may be influenced. This may result in an overestimation or underestimation of current practices and community pharmacists' involvement in diabetes health promotion activities. This study may suggest that the rapid rise in diabetes prevalence and burden in developing countries such as Ethiopia is an urgent call for multisectoral and multidirectional prompt prevention to reduce associated burdens. Indeed, encouraging healthy behaviors among the general public is a vital population strategy for reducing the burden of diabetes, and this may be the impetus for CPPs to provide diabetes management. Finally, the study recommends that future research look into pharmacists' attitudes and beliefs about their role in diabetes management in the study settings. These attitudes and beliefs have been shown to be very important in previous studies.

4.1. Study strengths and limitations

Comprehensive results were found in the current study about the use of CDROs in managing diabetes, their scope of operations, and the variation in effect sizes among CPPs. Practitioners, patients, and other interested parties may benefit from this addition to the corpus of knowledge. The present study, however, has some limitations. Firstly, not all CPPs in the country, especially those in rural areas, may be covered by this study. The study design may not show a true causal relationship. Self-administered data from this study that were based on willingness and trust might not demonstrate a true practice of CPPs in managing diabetes and could lead to an over- or underestimate of the outcome. The results can also point to the necessity for additional analysis, particularly to gauge genuine involvement. The study also recommends future research in rural settings. Moreover, further supervision on-duty and assessment of the association of determinant factors, particularly for variables with strong effect sizes such as educational levels, might be needed to enhance their involvement. Finally, the authors hope that the findings will fill a gap in the literature and contribute to the existing body of knowledge in the field. It can help inform policymakers on how to integrate CDROs into diabetes management practices and nationwide efforts. This will address the country's rising diabetes prevalence and associated burdens.

5. Conclusion and recommendations

This study concluded that most of the CPPs in the selected cities perceived themselves to be involved in diabetes management, and the majority of them had a high level of involvement in management strategies. Differences in educational background, monthly income, and working hours per day had a significant impact on CPP's perception of involvement in diabetes management. As a result, CPPs may benefit from additional training and promotion of their educational backgrounds.

Research ethics approval

The study was ethically approved by the research and ethics committee of the School of Pharmacy at the University of Gondar with a reference number of SOP/257/2022.

Consent to participate

Participants were informed and given written consent forms after the objectives of the study were briefed. Participants involved in the study were in a position to provide informed consent and had a full understanding of the study's purposes. All methods were carried out in accordance with the Helsinki legislation.

Availability of data and materials

All necessary materials are within the manuscript. The datasets generated and/or analyzed during the current study is available upon reasonable request.

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We did not receive funding for this study.

Authors' contributions

AKS: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed materials, analysis tools or data; Wrote the paper.

YBT, AEK and EAB: Performed the experiments; Analyzed and interpreted the data; Contributed materials, analysis tools or data.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e20091.

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