








Current Perspectives, Practices, and Barriers Faced by Community Pharmacists Regarding Pharmaceutical Care Services for Diabetes Mellitus in the United Arab Emirates

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Background: Providing accurate and sufficient information is a crucial requirement for delivering effective diabetes care, making it essential for community pharmacists to possess adequate knowledge of diabetes mellitus (DM) and its management.

Objective: To investigate community pharmacists' level of expertise and engagement in providing counseling and health promotion services for individuals with DM in the United Arab Emirates (UAE).

Methods: A cross-sectional study design was used. The community Pharmacies were chosen via random sampling and researchers then conducted face-to-face interviews with them using the structured questionnaire. The questionnaire included demographic data, 14 questions on the knowledge and 9 questions about the practice concerning pharmaceutical care for Diabetes Mellitus.

Results: The average age \pm SD was 31 ± 6.3 . Of the total 516 community pharmacists recruited in the study, 37.2% ($n=192$) were male and 62.8% ($n=324$) were female. The average knowledge score about DM prevention and management was 9.7 with a 95% confidence interval (CI) [9.5, 9.9] and the average practice score about DM prevention and management was 7.1 with a 95% confidence interval (CI) [6.9, 7.2]. Better knowledge scores were observed in chief pharmacists (OR 1.29; 95% CI 1.08–1.56), pharmacists with 6–10 Years of experience (OR 6.92; 95% CI 3.43–8.86), pharmacist with > 10 years of experience (OR 1.99; 95% CI 1.67–2.36), when the number of patients the pharmacist serve is 5–10 (OR 1.27; 95% CI 1.06–1.53) and being trained on DM prevention and management (OR 2.18; 95% CI 1.92–2.47). Similarly, better practice scores were observed in older participants (OR 1.02; 95% CI 1.001–1.03), chain pharmacies (OR 1.42; 95% CI 1.20–1.68), chief pharmacists (OR 1.56; 95% CI 1.18–2.06), when the number of patients the pharmacists serve was 5–10 (OR 12.26; 95% CI 7.26–16.19), when the number of patients the pharmacists serve was 11–20 (OR 4.23; 95% CI 3.54–5.06) and being trained on DM prevention and management (OR 1.33; 95% CI 1.11–1.59). The most commonly reported barriers to providing counseling and health promotion services for diabetes mellitus (DM) in community pharmacies include a lack of coordination with other healthcare professionals (77%) and insufficient knowledge or clinical skills (68.7%).

Conclusion: Our study revealed that community pharmacy staff members displayed a noteworthy level of involvement in providing pharmaceutical care services for patients with diabetes mellitus. Based on these findings, it is recommended to enhance pharmacy

education by incorporating more advanced, evidence-based training and curricula focusing on disease management and appropriate therapies, particularly for diabetes.

Keywords: diabetes mellitus, knowledge, practice, pharmaceutical care, type 2 diabetes mellitus, diabetes care and community pharmacies

Introduction

Diabetes mellitus (DM) is a chronic condition characterized by elevated blood sugar levels resulting from a lack of insulin synthesis, insulin activity, or both. Prolonged hyperglycemia associated with diabetes can permanently damage various organs and tissues, including the eyes, kidneys, blood vessels, heart, and neural tissue.¹ Over the past two decades, diabetes has witnessed a significant surge, making it one of the top 10 global causes of mortality, with a 70% increase since 2000.² Projections suggest that by 2030, the number of individuals affected by this chronic condition worldwide will exceed 552 million.³ Moreover, diabetes is rapidly spreading across the globe, with Africa and the Middle East experiencing a particularly alarming rise. According to the IDF, the Middle East and North Africa are anticipated to see a 110% increase, while Africa is projected to experience a 156% increase in diabetes cases by 2045.⁴

According to the International Diabetes Federation (IDF), the prevalence of diabetes in the UAE and worldwide is 16.3% and 9.3%, respectively.⁵ Indeed, recent studies have revealed a prevalence of diabetes mellitus of up to 25.1% among UAE nationals in the Northern Emirates and of 19.1% among expatriates.^{6,7} In the Emirate of Dubai, the most recent findings – from the 2014/17 Dubai Household Survey⁸ – indicate an overall 15.2% prevalence of diabetes mellitus. It is imperative to identify individuals with undiagnosed diabetes as failure to diagnose the condition over a long period can increase the risk of related complications as well as healthcare demands and associated costs.^{9–11} According to the Dubai Health Survey of 2017, 10.8% of the Emirate's population did not know their diabetes condition.⁸

The Middle Eastern population bears one of the highest obesity rates globally, which serves as the primary risk factor for developing diabetes and its associated complications. This prevalence of obesity contributes significantly to the sudden increase in diabetes rates observed in the region.^{12,13} To effectively manage diabetes, several strategies have been identified, including efficient screening, proactive management, frequent monitoring, and consistent follow-up.¹⁴

Health education and counseling play a crucial role in enhancing patients' medication compliance, facilitating lifestyle changes, and promoting regular blood glucose monitoring, all of which contribute to improved health outcomes.^{15,16} Moreover, these interventions are particularly valuable in developing programs to prevent undiagnosed diabetes.^{17,18}

In the context of community healthcare, community pharmacies hold a unique position as accessible and widely dispersed healthcare providers. Recognizing their central placement in communities, community pharmacists can make proactive contributions to bridge program gaps, particularly in health promotion and various preventative services.^{19–22} Their role is evolving globally, transitioning from solely medication distribution to actively engaging in public health services and significantly impacting disease management.^{23–27}

There are still fewer registered pharmacists in the UAE per population than the accepted global number. In 2002, the ratio stood at four pharmacists to 10,000 citizens.²⁸ Despite the presence of almost 2000 private pharmaceutical organizations and their multinational workforce of pharmacists and assistant pharmacists,^{29,30} the number of pharmacies in the UAE continues to surge. Rapid population growth is leading to heightened demand for healthcare services from nationals and expatriates, and advanced services are needed to service urban growth across the country. According to a recent report, about 300 pharmacists were registered every year between 2005 and 2010.³⁰

One study³¹ found multiple limitations in terms of both services provided and product availability. More recent data are lacking about how pharmacy services are currently delivered, the challenges to optimizing them, and which factors adversely impact pharmacies' and pharmacists' abilities to serve their communities.^{32–35}

Delving deeper into community pharmacy practices in multiple Arab countries, including the UAE, it becomes clear that the provision of extended community pharmacy services (ECPS) is minimal, if not completely lacking. Among the barriers identified to introducing or providing ECPS are system-related limitations (eg, pharmacists and nurses showing resistance to or fear of change), a shortage of practitioners with advanced practice qualifications, limitations on financial and other resources, shortcomings in education, and miscommunication among – or competition between – professionals.^{36–38}

Studies have found that most pharmacists in the UAE impart information only about the dosage and frequency of drug use and tell patients about possible ADR only when patients make a specific request for this information.^{35,36} Various measures have recently been implemented in the UAE to introduce ECPS.³⁴ For example, in an effort to foster higher-quality healthcare provision, the health authority of Abu Dhabi (HAAD) has incorporated ECPS into its strategy and set up several training programs for community pharmacists.³⁶ In the UAE, about 1300 licensed community pharmacists are engaged in private-sector practice.^{34,39} On average, pharmacies operate a 13-hour working day,³⁹ and it is rare for them to remain open around the clock.³⁶

Extensive research conducted in different parts of the world demonstrates that pharmacist involvement in diabetes management reduces patient cost burden while increasing treatment success and patient satisfaction.^{40–43} However, several obstacles hinder the effective delivery of public health services in settings such as community pharmacies. These challenges include the lack of supportive policies, limited recognition within the healthcare system, patients' reluctance to utilize pharmacy services, insufficient pharmacy staff, and gaps in knowledge and skills among pharmacists.⁴⁴ Addressing these factors is crucial to increase the uptake of pharmacy services and promote the successful implementation of public health initiatives.

This study aimed to assess the knowledge and level of engagement of community pharmacists in delivering pharmaceutical care services, including screening and health promotion, to patients with type 2 diabetes mellitus (T2DM). Additionally, the study aimed to identify the perceived barriers that hinder their active participation in providing these essential services.

Methods and Materials

Study Setting and Design

To gauge the knowledge and practices of community pharmacists regarding the pharmacological management of patients with diabetes mellitus, a cross-sectional study design was employed. Seven proficient pharmacy students in their final year were randomly chosen to conduct in-person interviews at UAE Community Pharmacies between November 2022 and March 2023. These students underwent comprehensive training on questionnaire usage and were familiarized with the scientific vocabulary pertinent to research. This training, based on past experiences demonstrating its efficacy, aimed to enhance interviewer skills and minimize errors during the survey.

Research Instrument Development

The development of a robust questionnaire commenced with an extensive review of pertinent literature.^{45–48} Gradual adjustments were made to align it with the UAE context while preserving the core aspects of the investigation. Input from endocrinology and diabetes specialists ensured the questionnaire's alignment with the research topic. Additionally, six professors from Ajman University's departments of medicine and clinical pharmacy provided insights into content and suitability, leading to minor revisions.

Before pilot testing, Lawshe's content validity was employed to assess questionnaire validity.⁴⁹ Questions with a content validity ratio (CVR) exceeding 0.78 were retained, while those falling below were excluded. All tool questions demonstrated CVR values above 0.78, indicating satisfactory validity. The final tool's content validity index (CVI) was calculated based on the means of questions with acceptable CVR values, yielding an overall CVI value of 0.891, indicating adequate validity.⁵⁰

A pilot study, conducted between November 5, 2022, and November 11, 2022, involved 12 community pharmacists for face validity evaluation; their data were excluded from the final analysis. Nine pharmacists completed the questionnaire satisfactorily. Following the pilot test, questionnaire reliability was assessed, and the primary study's sample size was determined. Cronbach's α was utilized to gauge internal reliability, resulting in a satisfactory score of 0.79.

Research Instrument Sections

The study tool was systematically organized into three distinct sections:

- **Part 1:** Comprising eight questions delving into respondents' demographics, covering aspects such as gender, professional position (chief pharmacist, pharmacist in charge, etc.). Leadership roles in a pharmacy are played by both the chief pharmacist and the pharmacist-in-charge. Typically, the former oversees the entire pharmacy department, while the latter

has responsibility for ensuring the compliance and operational integrity of a specific location within a pharmacy. Other demographics included; years of professional experience, daily patient load, working hours, and whether they had undergone training in diabetes mellitus prevention and management.

- **Part 2:** Encompassing 14 questions designed to assess pharmacists' knowledge on pharmaceutical care for Diabetes Mellitus.
- **Part 3:** Involving nine questions aimed at exploring pharmacists' practice of the pharmacists towards pharmaceutical care for Diabetes Mellitus.
- **Part 4:** involving seven questions about barriers and obstacles to pharmaceutical care for diabetes mellitus services in community pharmacies.

Questionnaire Scoring

The evaluation of diabetes mellitus prevention and management knowledge relied on a 14-item survey adapted from the Michigan Diabetes Research Training Centre Diabetes Knowledge Test.^{51,52} Each question had a singular "correct" response, while all other answers were deemed "incorrect". Every correct response earned one point, contributing to the overall knowledge score, which was computed by summing the points acquired for each question.

The study aimed to evaluate how respondents engaged in the prevention and management of diabetes mellitus through nine questions about specific diabetic care services and practices. Respondents rated their answers on a 5-point Likert scale, where 1="Never" and 5="Always", to indicate how frequently they carried out each practice. "Always" (5) was considered the ideal response. Each participant's practice score was then calculated by summing the scores to all nine questions. Respondents were then divided into "good knowledge" and "good practices" groups according to their calculated median scores. A median knowledge score of 10 indicated that respondents had "good knowledge", while a lower score indicated that they did not. Likewise, a median score of 8 indicated "good practices", while lower scores did not.

Sample Size Calculation

The pilot study provided crucial insights into determining the sample size for the primary research. Seventy-five percent of the pilot study's questions were returned, with the pivotal query being, "Do you provide and practice pharmaceutical care for Diabetes Mellitus?" Approximately 50% of participants responded affirmatively. Employing a five percent alpha level, the study aimed for a ninety-five percent confidence interval (CI), with a maximum CI width of 10% and precision (D) set at 5%. Considering a potential non-response rate of around 30%, the optimal sample size was determined to be 544 subjects.

Target Population

The selection criteria for the main research sample were rigorous. Community pharmacists with a minimum of three months of professional experience, whether in independent establishments or part of a chain, and registered with the Ministry of Health, the Dubai Health Authority, or the Health Authority Abu Dhabi (HAAD) were eligible. Those not registered with these health agencies, with less than three months of professional experience (still on probation), or newly qualified were excluded.

Sampling Technique

To ensure representativeness, researchers employed stratified random sampling. With 2000 community pharmacies operating in the United Arab Emirates, as reported in a 2010 study,⁵³ the researchers gathered location and contact information from local directories and the Yellow Pages. Community pharmacies were categorized into groups or strata based on their locations—Northern Emirates, Dubai, and Abu Dhabi.

An Excel spreadsheet served as the sample frame, recording essential pharmacy details such as name, type, location, phone number, and Email address, each assigned a unique ID number. Subsequently, 544 community pharmacies were selected through a straightforward random sampling process. The chosen pharmacies were then organized based on their location and type for further analysis.

Data Collection

The adept researchers embarked on visits to selected community pharmacies in the United Arab Emirates from November 15, 2022, to March 25, 2023. Upon reaching each pharmacy, the pharmacist was briefed on the study's purpose and then courteously asked to provide their Email address. Subsequently, the researchers employed a structured technique, utilizing a questionnaire, to conduct in-person interviews.

Statistical Analysis

The amassed data underwent analysis using SPSS Version 26. Continuous, normally distributed quantitative variables were presented as mean standard deviation (SD), while categorical variables were summarized in percentages and frequencies. The 95% CI was used to display knowledge and practice score distribution and to assess the internal and external validity of results. Comparison of quantitative variables among groups was executed through one-way ANOVA, unpaired Student's *t*-tests, and non-parametric variations to identify any significant differences. The degree of normality was determined using the Shapiro–Wilk test ($p > 0.05$ indicating normal distribution) or a visual inspection of a Normal Q-Q Plot. Multivariate logistic regression models were applied to identify factors influencing the knowledge and practices of community pharmacists, with statistical significance indicated by *p*-values less than 0.05.

Ethical Considerations

This study received ethical approval from the Institutional Ethical Review Committee at Ajman University (P-H-S-2022-2-11). Prior to data collection, participants were thoroughly briefed on the research's objectives, emphasizing the requirement for their informed consent to complete and submit the questionnaire. Every respondent provided written consent, and utmost confidentiality measures were implemented to protect participants' identities.

Results

Demographics and Baseline Characteristics of the Participants

The average age \pm SD was 31 ± 6.3 . Of the total 516 community pharmacists recruited in the study, 37.2% ($n=192$) were male and 62.8% ($n=324$) were female. The majority of the participants were Bachelor degree holders (84.3%). Independent pharmacies constituted 52.1% of the study sample and 47.9% were chain pharmacies. The majority of participant were pharmacists in charge (70.2%) and 71.7% of them had 6–10 years of experience. Among the total, 160 (31%) had ≤ 8 hours working hours daily and 356 (69%) had >8 hours working hours daily. The number of patients served daily as following: 308 (59.7%) 5 to 10 patients, 94 (18.2%) 11 to 20 patients and 114 (22.1%) more than 20 patients. Of the total, 293 (56.8%) received a training on DM prevention and management (Table 1).

Assessment of Knowledge and Practice of Pharmacist Towards Pharmaceutical Care for Diabetes Mellitus Patient

The average knowledge score about DM prevention and management was 9.7 with a 95% confidence interval (CI) [9.5, 9.9] and the average practice score about DM prevention and management was 7.1 with a 95% confidence interval (CI) [6.9, 7.2]. In general, the level of knowledge and practice of DM prevention and management was good among the community pharmacists.

The results of each question related to knowledge and practice were shown in Tables 2 and 3.

The results of bivariate analysis showed that gender ($P=0.013$), educational level ($P=0.001$), position in the Pharmacy ($P=0.029$), work experience ($P<0.001$), number of patients pharmacists treated ($P<0.001$) and receiving a training on DM prevention and management ($P<0.001$) were statistically significant associated with knowledge about DM prevention and management.

There was a statistically significant relationship between practice on DM prevention and management and pharmacy type ($P<0.001$), position in the pharmacy ($P=0.004$), work experience ($P<0.001$), number of patients the pharmacist serve ($P<0.001$), working hour per day ($P=0.001$) and receiving a training on DM prevention and management ($P=0.001$) (Table 4).

Table 1 Number and Percentages of the Questions on Demographic Information (n=516)

Demographics	Groups	Frequency	Percentages
Gender	Male	192	37.2%
	Female	324	62.8%
Educational level	Bachelor's degree	435	84.3%
	Postgraduate	81	15.7%
Pharmacy type	Independent pharmacy	269	52.1%
	Chain pharmacy	247	47.9%
Position in the pharmacy	Pharmacist in charge	362	70.2%
	Chief pharmacist	85	16.5%
	Assistant pharmacist	69	13.4%
Work experience	1–5 years	71	13.8%
	6–10 years	370	71.7%
	> 10 years	75	14.5%
Working hours/day	≤ 8 hours	160	31%
	>8 hours	356	69%
Numbers of patients served per day	5–10	308	59.7%
	11–20	94	18.2%
	> 20	114	22.1%
Trained on the DM prevention and management.	Yes	293	56.8%
	No	223	43.2%

Abbreviation: DM, Diabetes mellitus.

Table 2 Number and Percentages of the Questions on Knowledge About Pharmaceutical Care for Diabetes Mellitus (Diabetes Knowledge Test (14 Items DKT))

Knowledge Items	Incorrect Answer		Correct Answer	
	F	%	F	%
1. A diabetes diet is	57	11	459	89
2. Which of these contains the most carbohydrate?	132	25.6	384	74.4
3. Which of these contains the most fat?	36	7	480	93
4. Which of these is a “free food”?	291	56.4	225	43.6
5. A1C measures a patient’s average blood glucose level over the past	65	12.6	451	87.4
6. What is the best method for testing glucose at home?	76	14.7	440	85.3
7. How does the consumption of unsweetened fruit juice affect blood glucose?	294	57	222	43
8. Which is not suitable for treating low blood glucose?	23	4.5	493	95.5
9. For a patient who has good control, how does exercise affect their blood glucose?	90	17.4	426	82.6

(Continued)

Table 2 (Continued).

Knowledge Items	Incorrect Answer		Correct Answer	
	F	%	F	%
10. What is the most likely effect of infection on blood glucose?	388	75.2	128	24.8
11. Feet are best taken care of by	287	55.6	229	44.4
12. Consuming low-fat foods decreases the risk of	350	67.8	166	32.2
13. Numbness and tingling are symptoms of what?	66	12.8	450	87.2
14. Which of these do we not usually associate with diabetes?	50	9.7	466	90.3

Notes: Adapted from Fitzgerald JT, Funnell MM, Hess GE, et al. The reliability and validity of a brief diabetes knowledge test. *Diabetes Care*. 1998;21(5):706–710.⁵²
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Abbreviations: F, Frequency; %, Percentages.

Table 3 Number and Percentages of the Questions on Pharmaceutical Care for Diabetes Mellitus

Practice Items	Always		Often		Sometimes		Rarely		Never	
	F	%	F	%	F	%	F	%	F	%
1. Advise patients on appropriate insulin storage, handling and administration	245	47.5	180	34.9	80	15.5	5	1	6	1.2
2. Advise patients on hypoglycemia causes, symptoms, and treatment	344	66.7	119	23.1	43	8.3	10	1.9	0	0
3. Advise patients on stress, tension, and other adverse health factors	257	49.8	184	35.7	66	12.8	7	1.4	2	0.4
4. Advise patients on how over-the-counter and herbal drugs influence diabetes management	307	59.5	153	29.7	49	9.5	7	1.4	0	0
5. Educate patients on why they should continuously screen for nephropathy, neuropathy and retinopathy	439	85.1	54	10.5	19	3.7	4	0.8	0	0
6. Advise patients on techniques for foot care	32	6.2	16	3.1	92	17.8	140	27.1	236	45.7
7. Educate patients on the need to exercise regularly and control their weight and diet as part of diabetes management	42	8.1	58	11.2	108	20.9	100	19.4	208	40.3
8. Inform patients of the need to quit smoking (if appropriate)	76	14.7	26	5.0	69	13.4	146	28.3	199	38.6
9. Inform patients on when they should administer oral antidiabetic drugs and what they should do if they miss a dose	42	8.1	41	7.9	84	16.3	141	27.3	208	40.3

Abbreviations: F, Frequency; %, Percentages.

Factors Influencing the Pharmacist' Knowledge and Practice About DM Prevention and Management

Better knowledge scores were observed in chief pharmacists (OR 1.29; 95% CI 1.08–1.56), pharmacists with 6–10 Years of experience (OR 6.92; 95% CI 3.43–8.86), pharmacist with > 10 years of experience (OR 1.99; 95% CI 1.67–2.36), when the number of patients the pharmacist serve is 5–10 (OR 1.27; 95% CI 1.06–1.53) and being trained on DM prevention and management (OR 2.18; 95% CI 1.92–2.47).

Better practice scores were observed in older participants (OR 1.02; 95% CI 1.001–1.03), chain pharmacies (OR 1.42; 95% CI 1.20–1.68), chief pharmacists (OR 1.56; 95% CI 1.18–2.06), when the number of patients the pharmacists serve was 5–10 (OR 12.26; 95% CI 7.26–16.19), when the number of patients the pharmacists serve was 11–20 (OR 4.23; 95% CI 3.54–5.06) and being trained on DM prevention and management (OR 1.33; 95% CI 1.11–1.59) (Table 5).

Table 4 Comparison of Knowledge and Counselling Practice According to Demographics

Demographics	Knowledge scores (14 Items)				Practice Scores (9 Items)			
	Mean	95% CI		P-value	Mean	95% CI		P-value
Gender								
Male	9.18	8.80	9.56	0.013*	6.93	6.68	7.18	0.103
Female	10.05	9.82	10.28		7.19	7	7.37	
Education level								
Bachelor	9.48	9.27	9.69	0.001*	7.12	6.97	7.28	0.309
Postgraduate	11.04	10.53	11.55		6.91	6.44	7.38	
Pharmacy type								
Independent Pharmacy	9.56	9.29	9.83	0.095	6.69	6.48	6.91	<0.001*
Chain Pharmacy	9.907	9.59	10.22		7.52	7.33	7.72	
Position in the Pharmacy								
Pharmacist in charge	9.84	9.59	10.07	0.029*	7.26	7.08	7.43	0.004*
Chief pharmacist	9.82	9.36	10.29		6.74	6.37	7.11	
Assistant pharmacist	9.023	8.38	9.68		6.67	6.27	7.07	
Work Experiences								
1–5 Years	5.93	5.67	6.19	<0.001*	5.634	5.24	6.03	<0.001*
6–10 Years	9.73	9.59	9.88		7.33	7.16	7.49	
> 10 years	13.29	13.16	13.43		7.32	6.95	7.69	
Numbers of patients served per day								
5–10	10.11	9.88	10.34	<0.001*	8.85	8.78	8.92	<0.001*
11–20	10.06	9.63	10.50		7.49	7.38	7.60	
> 20	8.41	7.91	8.92		4.57	4.36	4.78	
Working hours/day								
≤ 8 hours	9.49	9.12	9.87	0.131	7.29	7.09	7.47	0.001*
>8 hours	9.83	9.59	10.07		6.66	6.43	6.89	
Trained on the DM prevention and management								
Yes	11.38	11.22	11.54	<0.001*	7.30	7.13	7.48	0.001*
No	7.56	7.38	7.73		6.82	6.56	7.07	

Notes: *P-values < 0.05 considered statistically significant, P-values obtained from independent t-test and One Way ANOVA.

Barriers and Obstacles for Pharmaceutical Care for Diabetes Mellitus Services in the Community Pharmacies

Lack of coordination with other health care professionals (77%) and Lack of knowledge or clinical skills (68.7%) followed by Lack of time (47%) and Lack of access to additional training programs (41%) were the most commonly indicated barrier for providing counseling and health promotion services for DM in the community pharmacies (Table 6).

Table 5 Regression Analysis for the Factors Affecting the Knowledge and Practice About DM Prevention and Management

Demographics	Good Knowledge ≥ 10				Good Practice ≥ 8			
	OR	95% CI		P-value	OR	95% CI		P-value
Gender (Ref. Male)								
Female	1.09	0.97	1.24	0.138	1.01	0.83	1.22	0.957
Education level (Ref. Bachelor)								
Postgraduate	0.99	0.84	1.18	0.953	0.89	0.71	1.11	0.302
Pharmacy type (Ref. Independent Pharmacy)								
Chain Pharmacy	1.02	0.91	1.15	0.739	1.42	1.20	1.68	<0.001*
Position in the Pharmacy (Ref. Assistant pharmacist)								
Chief pharmacist	1.29	1.08	1.56	0.006*	1.56	1.18	2.06	0.002*
Pharmacist in charge	1.13	0.97	1.32	0.11	1.05	0.854	1.29	0.644
Experiences (Ref. 1–5 Years)								
6–10 Years	6.92	3.43	8.86	<0.001*	1.25	0.86	1.81	0.242
> 10 years	1.99	1.67	2.36	<0.001*	1.15	0.89	1.48	0.299
Numbers of patients served daily (Ref. > 20)								
5–10	1.27	1.06	1.53	0.009*	12.26	7.26	16.19	<0.001*
11–20	1.09	0.95	1.27	0.201	4.23	3.54	5.06	<0.001*
Working hours/day (Ref. >8 hours)								
≤ 8 hours	1.01	0.89	1.15	0.829	1.02	0.86	1.21	0.828
Trained on the DM (Ref. No)								
Yes	2.18	1.92	2.47	<0.001*	1.33	1.11	1.59	0.002*
Age	1.001	0.992	1.011	0.784	1.02	1.001	1.03	0.033*

Notes: *P-values < 0.05 considered statistically significant, Good knowledge and practice scores were generated by finding the median score.

Table 6 Number and Percentages of the Questions on Barriers for Counseling and Health Promotion Services for DM in the Pharmacy (n=516)

Obstacles and barriers	Frequency	Percentages
Lack of knowledge or clinical skills	354	68.7%
Lack of personnel or resources	168	32.53%
Lack of clinical tools	108	21%
Lack of coordination with other health care professionals	397	77%
Lack of access to additional training programs	211	41%
Lack of time	242	47%
Patients are not interested in preventive activities	150	29%

Discussion

Comprehensive diabetes education and care management are pivotal in enhancing patient outcomes, glucose control, and overall quality of life.⁵⁴ Providing accurate and sufficient information is a crucial requirement for delivering effective diabetes care, making it essential for community pharmacists to possess adequate knowledge of diabetes mellitus (DM) and its management. To the best of our knowledge, this study is among the first to investigate community pharmacists' level of expertise and engagement in providing counseling and health promotion services for individuals with DM in the United Arab Emirates.

The study revealed commendable performance by community pharmacists in terms of their knowledge and experience related to the prevention, treatment, and management of DM. The average scores for knowledge and practice were 69% and 78%, respectively. These results surpass those reported in previous research conducted in Ethiopia⁵⁵ (20.1%), Nepal⁵⁶ (23.5%), Libya⁵⁷ (30.4%), and Qatar⁵⁸ (40%). These findings clearly highlight the critical knowledge and skills gap among service providers, indicating that effective, high-quality patient care cannot be guaranteed.

The lack of ongoing training and education for community pharmacists in managing chronic diseases, including DM, has been identified as a potential cause for the low level of knowledge observed.⁵⁹ The survey results revealed that community pharmacists had relatively limited knowledge in certain areas, including the effects of consuming unsweetened fruit juice on blood glucose (43%), the impact of illness on blood glucose levels, the effects of low-fat foods (32.2%), and pharmaceutical treatments for foot-related issues (44.4%). This lack of awareness emphasizes the importance of implementing diabetic education programs to update pharmacists with the necessary information.

Despite these knowledge gaps, the findings of this study indicated that community pharmacists were moderately active in providing counseling and health promotion services to individuals with diabetes mellitus. It is worth noting that various clinical trials have demonstrated the positive impact of incorporating community pharmacists in the management of diabetes mellitus and other chronic conditions.⁶⁰ In contrast, a previous study conducted among community pharmacists in Ethiopia reported limited involvement in providing pharmacological care for individuals with diabetes.⁵⁵ Moreover, numerous studies conducted in different regions have consistently shown that community pharmacists primarily focus on pharmaceutical dispensing activities and have lesser involvement in public health initiatives.⁶¹

The limited range of responsibilities assigned to community pharmacists in the UAE primarily revolves around medication dispensing, with the rare provision of screening and counseling services for chronic diseases. This could be attributed to the early stages of their roles in managing chronic conditions and promoting health in the region.

As previously mentioned, the lowest scores in this study were observed in pharmacists' practice regarding educating patients on proper foot care, advising them to quit smoking, emphasizing the importance of regular exercise, weight control, and instructing them on the administration of oral antidiabetic medications and what to do in case of missed doses. However, the relatively low rate of lifestyle counseling identified in our study contrasts with the findings of research conducted in Scotland, America, and Norway.^{62,63} In those investigations, factors such as lack of reimbursement, employment restrictions, pharmacy layout, and inadequate training were considered as potential causes for the low counseling rates.⁶³

Notably, this study revealed that pharmacists with more years of experience, fewer patients per day, and specific training in DM prevention and management demonstrated better performance in knowledge and practice tests related to pharmaceutical services for diabetes mellitus, particularly in counseling and health promotion. These findings align with previous research that indicated respondents with over five years of work experience and a postgraduate degree achieved higher mean practice scores than those with less than five years of experience and a diploma degree. As community pharmacists gain more experience in their practice, they are expected to acquire a deeper understanding and become more involved in counseling and health promotion services.⁵⁵

The most commonly reported barriers to providing counseling and health promotion services for diabetes mellitus (DM) in community pharmacies include a lack of coordination with other healthcare professionals (77%) and insufficient knowledge or clinical skills (68.7%). This is followed by time constraints (47%), limited access to additional training programs (41%), and inadequate resources. A previous study conducted in Ethiopia also identified a lack of knowledge or clinical expertise as the primary obstacle to expanding the provision of public health services in community pharmacies.⁵⁵ Similar challenges, such as staffing and time constraints, limited clinical expertise, and resource limitations, have been documented in studies from various regions.⁴⁴

As integral members of the healthcare team, pharmacists bear a significant responsibility in providing patient counseling. Patients with diabetes who receive pharmacist consultations have been shown to reduce healthcare expenditures in health maintenance organizations.⁴⁰ Pharmacist interventions that enhance understanding and glycemic control have demonstrated improved outcomes in diabetes management. Ongoing counseling and monitoring play a crucial role in achieving optimal glycemic control.¹⁴ To enhance the delivery of counseling and health promotion services, it is recommended to provide targeted trainings that effectively address the knowledge and skill gaps in academic and practice settings. By closing these gaps, community pharmacists will be equipped to deliver these services in a more proficient manner than ever before. The provision of a comprehensive range of diabetic care services by community pharmacists has the potential to significantly improve overall health outcomes for patients. Therefore, interventions should focus on overcoming the identified barriers, allowing for better integration of community pharmacies into future disease state management programs and maximizing the contributions of community pharmacy professionals. Additionally, conducting follow-up research to assess the nationwide presence of diabetic care services provided by community pharmacists would be beneficial.

It is important to acknowledge the limitations of our study. Firstly, as a cross-sectional study, our regression models cannot establish causality or provide insights into the underlying causes of the observed results. Therefore, it may not be appropriate to generalize these findings over time. Future longitudinal research is needed to address this knowledge gap. Secondly, self-reported survey responses may be subject to biases related to social desirability and recollection. Third, it is acknowledged that our study is limited by its use of outdated data for sample size calculation. Despite these limitations, the reliability of our results is supported by the significant participation of community pharmacists and the high response rate achieved.

Our study has multiple significant implications for pharmacy practice. In particular, our findings can be leveraged to improve the pharmaceutical services provided to individuals with diabetes mellitus. Firstly, the study reveals the urgent need to improve patient counseling services by tailoring them to bridge the knowledge gaps and meet the specific needs of every patient, which requires both effective communication strategies and the use of appropriate educational materials. Secondly, it underscores the importance of the role played by community pharmacists in health promotion programs, including diabetes screening and counseling patients on lifestyle changes. Such programs can be more effective if carried out in collaboration with local healthcare providers and organizations. Interprofessional collaboration is vital to deliver coordinated care; hence, pharmacists must work toward strengthening their relationships with colleagues in other branches of healthcare provision. Another vital strategy to ensure effective diabetes management is identifying ways to tackle knowledge gaps. One means of doing so is the implementation of standardized protocols and adopting a proactive approach toward patient engagement, which will also be valuable in improving diabetes outcomes and the overall patient care offered by community pharmacies.

Conclusion

Our study revealed that community pharmacy staff members displayed a noteworthy level of involvement in providing pharmaceutical care services for patients with diabetes mellitus. They also exhibited a satisfactory level of knowledge regarding counseling and health promotion. Based on these findings, it is recommended to enhance pharmacy education by incorporating more advanced, evidence-based training and curricula focusing on disease management and appropriate therapies, particularly for diabetes. Implementing and disseminating diabetes care guidelines within community pharmacies would be beneficial.

Data Sharing Statement

All data will be provided upon request. Further inquiries can be directed to the corresponding authors (Ammar Abdulrahman Jairoun and Moyad Shahwan).

Consent for Publication

All authors agree for publication of this manuscript in journal of multidisciplinary healthcare.

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Disclosure

All authors declare that they have no conflicts of interest in this work.

References

- American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care*. 2013;37:S81–S90. doi:10.2337/dc14-S081
- World Health Organization. The top 10 causes of death; 2020. Available from: <https://www.who.int/en/newsroom/fact-sheets/detail/the-top-10-causes-of-death>. Accessed January 16, 2023.
- Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. *Diabet Res Clin Pract*. 2011;94(3):311–321. doi:10.1016/j.diabres.2011.10.029
- Sun H, Saeedi P, Karuranga S, et al. IDF Diabetes Atlas: global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabet Res Clin Pract*. 2022;183:109119. doi:10.1016/j.diabres.2021.109119
- International Diabetes Federation. *IDF Diabetes Atlas*. 9th ed. Brussels, Belgium: International Diabetes Federation; 2020:7–44.
- Sulaiman N, Albadawi S, Abusnana S, Mairghani M, Hussein A, Al Awadi F. High prevalence of diabetes among migrants in the United Arab Emirates using a cross-sectional survey. *Sci Rep*. 2018;8(1):6862. doi:10.1038/s41598-018-24312-3
- Sulaiman N, Mahmoud I, Hussein A, Elbadawi S, Abusnana S, Zimmet P. Diabetes risk score in the United Arab Emirates: a screening tool for the early detection of type 2 diabetes mellitus. *BMJ Open Dib Res Care*. 2018;6:e000489. doi:10.1136/bmjdr-2017-000489
- Alawadi F, Hassanein M, Sulaiman E, et al. The prevalence of diabetes and prediabetes among population: finding from Dubai household survey 2014. *DDE*. 2017;2017:1.
- Immons RK, Griffin SJ, Witte DR, Borch-Johnsen K, Lauritzen T, Sandb KA. Effect of population screening for type 2 diabetes and cardiovascular risk factors on mortality rate and cardiovascular events: a controlled trial among 1,912,392 Danish adults. *Diabetologia*. 2017;60(11):2183–2191. doi:10.1007/s00125-017-4323-2
- Dall TM, Yang W, Halder P, et al. The economic burden of elevated blood glucose levels in 2012: diagnosed and undiagnosed diabetes, gestational diabetes mellitus, and prediabetes. *Diabetes Care*. 2014;37(12):3172–3179. doi:10.2337/dc14-1036
- Harris MI. Undiagnosed NIDDM: clinical and public health issues. *Diabetes Care*. 1993;16(4):642–652. doi:10.2337/diacare.16.4.642
- Kilpi F, Webber L, Musaigner A, et al. Alarming predictions for obesity and non-communicable diseases in the Middle East. *Public Health Nutr*. 2014;17:1078–1086. doi:10.1017/S1368980013000840
- Al-Shudifat AE, Al-Shdaifat A, Al-Abdoun AA, et al. Diabetes risk score in a young student population in Jordan: a cross-sectional study. *J Diabetes Res*. 2017;2017:8290710. doi:10.1155/2017/8290710
- Venkatesan R, Devi AS, Parasuraman S, Sriram S. Role of community pharmacist in improving knowledge and glycemic control of type 2 diabetes. *Perspect Clin Res*. 2012;3(1):26–31. doi:10.4103/2229-3485.92304
- O'Loughlin J, Masson P, Déry V, Fagnan D. The role of community pharmacists in health education and disease prevention: a survey of their interests and needs in relation to cardiovascular disease. *Prev Med*. 1999;28(3):324–333. doi:10.1006/pmed.1998.0436
- Paes AH, Bakker A, Soe-Agnie CJ. Impact of dosage frequency in patient compliance. *Diabetes Care*. 1997;20:1512–1517. doi:10.2337/diacare.20.10.1512
- Echouffo-Tcheugui JB, Mayige M, Ogbera AO, Sobngwi E, Kengne AP. Screening for hyperglycemia in the developing world: rationale, challenges and opportunities. *Diabet Res Clin Pract*. 2012;98:199–208. doi:10.1016/j.diabres.2012.08.003
- Hagstrom B, Mattsson B. Screening for diabetes in general practice. Opportunistic screening for diabetes in general practice is better than nothing. *BMJ*. 2002;324:425–426. doi:10.1136/bmj.324.7334.425/a
- Chua SS, Ramachandran CD, Paraidathathu TT. Response of community pharmacists to the presentation of back pain: a simulated patient study. *Int J Pharm Pract*. 2006;14:171–178. doi:10.1211/ijpp.14.3.0003
- Jairoun AA, Al-Hemyari SS, Shahwan M, et al. Access to community pharmacy services for people with disabilities: barriers, challenges, and opportunities. *Res Social Administrative Pharm*. 2022;18(5):2711–2713. doi:10.1016/j.sapharm.2022.01.009
- Jairoun AA, Al-Hemyari SS, Shahwan M, et al. Top unresolved ethical challenges and dilemmas faced by community pharmacists in providing pharmaceutical care: drawing the line between ethical challenges and the quality of the pharmaceutical care. *Res Soc Admin Pharm*. 2022;2022:1551–7411.
- Jairoun AA, Al-Hemyari SS, Jairoun M, El-Dahiyat F, Al-Ani M, Habeb M. Hidden factors in community pharmacy related to medication safety risks: pushing patient safety to breaking point. *Res Soc Admin Pharm*. 2021;2021:1551–7411.
- Anderson C, Blenkinsopp A, Armstrong M. The contribution of community pharmacy to improving the public's health: summary report of the literature review 1990–2007. Available from: <http://eprints.nottingham.ac.uk/1576/>. Accessed March 11, 2023.
- Dent LA, Harris KJ, Noonan CW. Randomized trial assessing the effectiveness of a pharmacist-delivered program for smoking cessation. *Ann Pharmacother*. 2009;43:194–201. doi:10.1345/aph.1L556
- Mangum SA, Kraenow KR, Narducci WA. Identifying at-risk patients through community pharmacy-based hypertension and stroke prevention screening projects. *J Am Pharm Assoc*. 2003;43:50–55. doi:10.1331/10865800360467042
- Hess KM, Dai CW, Garner B, Law AV. Measuring outcomes of a pharmacist-run travel health clinic located in an independent community pharmacy. *J Am Pharm Assoc*. 2010;50:174–180. doi:10.1331/JAPhA.2010.09204
- Mehuys E, Van Bortel L, De Bolle L, et al. Effectiveness of a community pharmacist intervention in diabetes care: a randomized control trial. *J Clin Pharm Ther*. 2011;36(5):602–613. doi:10.1111/j.1365-2710.2010.01218.x
- World Health Organization 2002. Core health indicators – united Arab Emirates; 2022. Available from: http://www.who.int/whosis/database/core/core_select_process.cfm?country=are&indicators=healthpersonnel. Accessed May 06, 2024.

29. Ministry of Health – UAE 2003. Guidelines and Minimum Standards for Good Pharmacy Practice in UAE Pharmacies; 2022. Available from: http://www.cpdpharma.ae/index.php?option=com_phocadownload&view=category&download=76:ministry-of-healthguideline-and-minimum-standards-for-goodpharmacy-practice-gpp-version-1-2003&id=2:mohpolicies-and-circulars&Itemid=78. Accessed May 06, 2024.
30. Ministry of Health – UAE 2011. Drug registration and control administration statistics 2010–2011; 2011.
31. Awad A, Al-Ebrahim S, Abahussain E. Pharmaceutical care services in hospitals of Kuwait. *J Pharm Pharm Sci.* 2006;9(2):149–157.
32. Sanah H, Hana S, Colin C, Kay S, David K. Community pharmacy in the United Arab Emirates: characteristics and workforce issues. *Intl J Pharm Pract.* 2011;19:392–399. doi:10.1111/j.2042-7174.2011.00134.x
33. Hasan S, Sulieman H, Stewart K, Chapman CB, Hasan MY, Kong DC. Assessing patient satisfaction with community pharmacy in the UAE using a newly-validated tool. *Res Social Adm Pharm.* 2013;9(6):841–850. doi:10.1016/j.sapharm.2012.10.002
34. Hasan S, Sulieman H, Chapman CB, Stewart K, Kong DC. Community pharmacy services in the United Arab Emirates. *Int J Pharm Pract.* 2012;20(4):218–225. doi:10.1111/j.2042-7174.2011.00182.x
35. Majd D. Pharmacy in the United Arab Emirates. *South Med Rev.* 2009;2(1):15.
36. Sadek MM, Elnour AA, Al Kalbani NM, et al. Community pharmacy and the extended community pharmacist practice roles: the UAE experiences. *Saudi Pharm J.* 2016;24(5):563–570. doi:10.1016/j.jsps.2015.03.023
37. El Hajj MS, Al-saeed HS, Khaja M. Qatar pharmacists' understanding, attitudes, practice and perceived barriers related to providing pharmaceutical care. *Int J Clin Pharm.* 2016;38(2):330–343. doi:10.1007/s11096-016-0246-0
38. Abdi AM, Zarouri AT, Saloumi L, Basgut B. North Cyprus pharmacist's cognition and practice of pharmaceutical care. *J Pharm Res Int.* 2018;21:1–9. doi:10.9734/JPRI/2018/39051
39. Alzubaidi H, Saidawi W, Mc NK. Pharmacist views and pharmacy capacity to deliver professional services in the United Arab Emirates. *Int J Clin Pharm.* 2018;40(5):1106–1115. doi:10.1007/s11096-018-0662-4
40. Gerber RA, Liu G, McCombs JS. Impact of pharmacist consultations provided to patients with diabetes on healthcare costs in a health maintenance organization. *Am J Manag Care.* 1998;4(7):991–1000.
41. The R, Chen T, Krass I. Consumer perspectives of pharmacist delivered health promotion and screening services. *Int J Pharm Pract.* 2001;9:261–267.
42. Armour CL, Taylor SJ, Hourihan F, Smith C, Krass I. Implementation and evaluation of Australian pharmacists' diabetes care services. *Medscape;* 2004. Available from: <http://www.medscape.com/viewarticle/487477>. Accessed February 14, 2023.
43. Reddy PV, Kapoor KV. Impact of patient counseling on knowledge of diabetes mellitus and its management. *Ind J Hospital Pharm.* 2005;42:96–99.
44. Dhippayom T, Fuangchan A, Tunpichart S, Chaiyakunapruk N. Opportunistic screening and health promotion for type 2 diabetes: an expanding public health role for the community pharmacist. *J Public Health.* 2013;35:262–269. doi:10.1093/pubmed/fds078
45. Shrestha M, Maharjan R, Prajapati A, Ghimire S, Shrestha N, Banstola A. Assessment of knowledge and practice of community pharmacy personnel on diabetes mellitus management in Kathmandu district: a cross sectional descriptive study. *J Diabetes Metab Disord.* 2015;14:1–6. doi:10.1186/s40200-015-0205-7
46. Upadhyay DK, Alurkar VM, Mishra P, Palaian S. Evaluation of knowledge, attitude and practice of newly diagnosed diabetes patients-a baseline study from Nepal. *Internat J Pharm Teach Pract.* 2012;3(2):1–8.
47. Qamar M, Iqbal RR, Ahmad S, Shaikh FA, Ismail NE. Awareness of diabetes mellitus among general public in Shah Alam, Malaysia: a cross-sectional study. *Asian J Pharm Clin Res.* 2017;10(9):192–196. doi:10.22159/ajpcr.2017.v10i9.17747
48. Ramesh R, Kumar SV, Gopinath S, Gavaskar B, Gandhiji G. Diabetic knowledge of rural community and drug utilization pattern in a tertiary care hospital. *Int J Pharm Life Sci.* 2011;2:1.
49. Lawsh C. A quantitative approach to content validity. *Pers Psychol.* 1975;28:563–575. doi:10.1111/j.1744-6570.1975.tb01393.x
50. Polit DF, Beck CT, Owen SV. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Res Nurs Health.* 2007;30(4):459–467. doi:10.1002/nur.20199
51. Alhaiti AH, Alotaibi AR, Jones LK, DaCosta C, Lenon GB. Psychometric evaluation of the revised Michigan diabetes knowledge test (V. 2016) in Arabic: translation and validation. *J Diabet Res.* 2016;2016:1–7. doi:10.1155/2016/9643714
52. Fitzgerald JT, Funnell MM, Hess GE, et al. The reliability and validity of a brief diabetes knowledge test. *Diabetes Care.* 1998;21(5):706–710. doi:10.2337/diacare.21.5.706
53. Emirates News Agency. UAE has over 2000 private pharmacies, 4000 professionals. 2010 Available from: <http://wam.ae/en/details/1395228626943>. Accessed May 06, 2024.
54. McMurray SD, Johnson G, Davis S, Mc Dougall K. Diabetes education and care management significantly improve patient outcomes in the dialysis unit. *Am J Kidney Disease.* 2002;40:566–575. doi:10.1053/ajkd.2002.34915
55. Erku DA, Belachew SA, Mekuria AB, et al. The role of community pharmacists in patient counseling and health education: a survey of their knowledge and level of involvement in relation to type 2 diabetes mellitus. *Integrat Pharm Res Pract.* 2017;19:137–143. doi:10.2147/IPRP.S140777
56. Eades CE, Ferguson JS, O'Carroll RE. Public health in community pharmacy: a systematic review of pharmacist and consumer views. *BMC Public Health.* 2011;11:582. doi:10.1186/1471-2458-11-582
57. Bisheya AF, El-Mijbri SB, Beshyah SA, Sherif I. Community pharmacists' knowledge, attitude and practice towards diabetes care in Tripoli, Libya. *Ibnosina J Med Biomed Sci.* 2011;3(3):89–95. doi:10.4103/1947-489X.210877
58. Basri MA, Yousef SE, ElHajj M. *Diabetes Mellitus Care in the State of Qatar: A Survey of Pharmacists' Activities, Attitudes and Knowledge.* Qatar: Qatar University; 2013.
59. Chen HY, Lee TY, Huang WT, Chang CJ, Chen CM. The short-term impact of a continuing education program on pharmacists' knowledge and attitudes toward diabetes. *Am J Pharm Educ.* 2004;68(5):1–5. doi:10.5688/aj6805121
60. Snella KA, Canales AE, Irons BK, et al. Pharmacy- and community based screenings for diabetes and cardiovascular conditions in high-risk individuals. *J Am Pharm Assoc.* 2006;46:370–377. doi:10.1331/154434506777069598
61. Laliberté MC, Perreault S, Damestoy N, Lalonde L. Ideal and actual involvement of community pharmacists in health promotion and prevention: a cross-sectional study in Quebec, Canada. *BMC Public Health.* 2012;12:192. doi:10.1186/1471-2458-12-192
62. Abdulkarem AR, Sackville MA, Morgan RM, Sackville MP, Hildreth AJ. Views and practices of community pharmacists regarding services for people with type 2 diabetes. *Int J Pharm Pract.* 2003;11:161–168. doi:10.1211/0022357021990
63. Kotecki JE, Elanjian SI, Torabi MR. Health promotion beliefs and practices among pharmacists. *J Am Pharm Assoc.* 2000;40(6):773–779. doi:10.1016/S1086-5802(16)31124-X

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