


BMJ Open Diabetes and cardiovascular disease risk screening model in community pharmacies in a developing primary healthcare system: a feasibility study

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ABSTRACT

Objectives This study aimed to develop an evidence-based community pharmacist-delivered screening model for diabetes and cardiovascular disease (CVD), and assess its feasibility to identify and refer patients with elevated risk.

Design A feasibility study.

Setting A purposive sample of 12 community pharmacies in three cities in the United Arab Emirates (UAE).

Participants Adults 40 years of age and above who have not been previously diagnosed with either diabetes or CVD.

Intervention Pharmacist screening of adults visiting pharmacies involved history, demographics, anthropometric measurements, blood pressure and point-of-care testing including glycated haemoglobin (HbA1c) levels and lipid panel. Participants with a 10-year CVD risk $\geq 7.5\%$, HbA1c level $\geq 5.7\%$ or American Diabetes Association (ADA) risk score ≥ 5 points were advised to visit their physician.

Primary and secondary outcome measures The primary outcomes were (1) development of UAE pharmacist-delivered screening model, (2) the proportion of screened participants identified as having high CVD risk (atherosclerotic CVD 10-year risk defined as $\geq 7.5\%$) and (3) the proportion of participants identified as having elevated blood glucose (high HbA1c level $\geq 5.7\%$ (38.8 mmol/mol)) or high self-reported diabetes risk (ADA risk score ≥ 5 points). Secondary outcome is participants' satisfaction with the screening.

Results The first UAE pharmacist-delivered screening model was developed and implemented. A total of 115 participants were screened, and 92.3% of the entire screening process was completed during a single visit to pharmacy. The mean duration of the complete screening process was 27 min. At-risk individuals (57.4%) were referred to their physicians for further testing, while 94.5% of participants were at least satisfied with their screening experience.

Conclusions The community pharmacist-delivered screening of diabetes and CVD risk is feasible in the UAE. The model offers a platform to increase screening capacity within primary care and provides an opportunity for early detection and treatment. However, pathways for the integration of the pharmacist-delivered screening service with physicians in primary care are yet to be explored.

Strengths and limitations of this study

- An expert panel was used to adapt an international screening and develop the first contextually tailored pharmacy screening model for diabetes and cardiovascular diseases risk in the United Arab Emirates.
- Lipid panel and glycated haemoglobin level were measured using a finger-prick point-of-care testing device (Roche Cobas b 101 POC dual system).
- Follow-up with physicians on referral outcomes of participants at risk could not be determined due to the fragmented healthcare system. We relied on patient self-report data.
- Patient recruitment heavily relied on a direct invitation from pharmacists.
- Follow-up times with screened participants were short and may not have encompassed all results regarding follow-up with physicians.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVD) are the leading contributors to the global burden of disease, although with distinct long-term trends.¹ Diabetes, a rapidly growing global epidemic, affects all countries and is substantially caused by rapidly increasing rates of obesity over recent decades.² By 2040, T2DM will affect an estimated 642 million people; 10.4% of the adult population, compared with 8.8% in 2015.²⁻⁴ Age-standardised CVD trends are more geographically nuanced—generally, the incidence has declined markedly in highly developed countries over several decades, but this decline has now plateaued.⁵ Likewise, some middle-income regions have experienced declines in CVD mortality, but in most regions of the developing world, a rapid increased incidence has recently prevailed.⁵ Globally, in 2015, there were an estimated 422.7 million prevalent cases of CVD, and ischaemic heart disease and stroke remained



the leading causes of death.⁵ A combination of an ageing western society and increasing CVD mortality rates in many developing regions has resulted in increasing CVD-related deaths from 12.6 million in 1990 to 17.9 million in 2015.⁵ Both CVD and diabetes represent major public health challenges in all countries. Globally, CVD affects 32.2% of all persons with T2DM.⁶

An estimated 45.8% (174.8 million) of adult diabetes cases worldwide are undiagnosed, ranging from 24.1% to 75.1% in different countries.⁷ Overall, the prevention and delay of diabetes complications are facilitated by combining early detection of undiagnosed diabetes using population or opportunistic screening approaches with effective prevention interventions.^{8–10}

In Arabic-speaking countries, the prevalence of T2DM is at alarming levels with high morbidity and mortality rates.¹¹ Six Arabic-speaking countries (Kuwait, Lebanon, Qatar, the United Arab Emirates (UAE), Saudi Arabia and Bahrain) lead the world in the prevalence of T2DM, affecting approximately one in five people.¹² There is an urgent need to increase capacity for the detection of diabetes and to reduce its burden in these Arabic-speaking countries. Previous research has identified negative health beliefs, poor health-seeking behaviours and intentional delay in accessing available medical services are commonplace in Arabic-speaking communities, hence the need for proactive and opportunistic population screenings.^{13–15}

The feasibility of pharmacist-delivered screening, for a variety of conditions including diabetes and CVD, is well supported by evidence.^{16 17} Such screening interventions identified at-risk individuals and increased rates of disease diagnosis, reduced disease risk factors, improved health behaviours, enhanced quality of care and increased patient knowledge and awareness.¹⁸ Community pharmacists have face-to-face contact with around 90% of the population annually and appear to interact regularly with those who have elevated risk of diabetes and CVD, or undiagnosed diabetes.¹⁹ The potential, therefore, exists for pharmacists to improve access to health screening services and promote public health awareness.

In the UAE, a substantial number of people with diabetes and a high prevalence of overweight and obesity are currently thought to remain undiagnosed.²⁰ There are around 2500 licensed community pharmacies in UAE that are generally open 7 days per week, easily accessible and have an average working day of 13 hours^{21 22}; this potentially makes pharmacies an effective setting to offer screening for diabetes and CVD within the primary care system. To our knowledge, no systematic diabetes and CVD screening programme exist in the primary care setting in the UAE, meaning these diseases continue to be undiagnosed precluding the opportunity to initiate early prevention and treatment.

The aim of this study was to test the feasibility of pharmacist-delivered diabetes and CVD risk screening model in the UAE. The specific objectives were to

1. Develop locally appropriate pharmacist-delivered diabetes and CVD risk screening model for the community pharmacies in UAE.
2. Evaluate the feasibility of implementing diabetes and CVD risk screening model in the selected community pharmacies in the UAE.

METHODS

Study design

The study was conducted in three phases: phase I (formative phase) explored development of a suitable model for diabetes screening and CVD risk assessment in community pharmacies in the UAE, phase II (implementation phase) assessed the feasibility of the screening model and phase III (evaluation phase) tested the impact of the screening model.

Phase I: formative phase

A systematic approach was used to develop the intervention of diabetes and CVD screening.²³ The formative phase commenced with identifying the needs for diabetes and CVD risk screening programme. After identifying the suitability of community pharmacies for providing screening services, a literature review of pharmacist-delivered screening models was conducted to identify useful and effective approaches to screening. The Australian Cardiovascular Absolute Risk Screening Study (CARS) was considered an appropriate template model to inform the development of the first UAE pharmacy-based screening programme.²⁴ Two local health professionals were consulted to determine the adaptation of CARS into the local context and acceptability of the proposed protocol prior to presenting the model to an expert panel. In the absence of national guidelines and frameworks regarding risk assessment and management for diabetes and CVD in the UAE, an expert panel forum was tasked to develop a consensus on the proposed screening programme. Prospective panelists were identified through extensive online search; evaluating experts' specialty, experience and research involvement. Shortlisted experts, including two cardiologists, two endocrinologists and two senior clinical pharmacists, were invited to participate in the forum. The Delphi technique was used to help arrive at a consensus on a specific question in one or more rounds—supportive documents were created to aid in voting and to calculate the level of agreement.²⁵ The Delphi discussion focused on locally appropriate methods for absolute cardiovascular and diabetes risk assessment, including use of absolute CVD risk assessment and other multifactorial risk algorithm cut-offs; selection of screening tools; and risk factor thresholds for physician referrals. The following questions were discussed during the forum:

1. When should the participant's blood pressure (BP) measurement be taken? Moreover, what is the minimum time interval needed between taking the two BP readings?

2. Which tool to use to calculate participants' absolute CVD risk?
3. Which method would be most suitable for calculating the participants' absolute CVD risk in the community pharmacy setting?
4. Which self-reported tool to use to determine the participants' risk of having T2DM? What absolute CVD risk threshold should be used when deciding to refer a participant to a physician?
5. At what glycated haemoglobin (HbA1c) level should a participant be referred to a physician?
6. Should at-risk participants who are referred to physicians for further testing be contacted to ask about any lifestyle modifications and outcomes of a visit to a physician? And should the physicians whom the referred participants visited be contacted?

The screening model planning involved the development of resources in supporting pharmacists-delivered screening including training manual, data collection tools and patient follow-up documents. These were developed through a process of co-production in consultation with the international co-researchers who had previous experience in pharmacist-delivered screening services. To ensure local context applicability, study materials were sent to three local community pharmacists for feedback and comments.

Phase II: implementation phase

Community pharmacists were trained through a face-to-face workshop that lasted for 3 hours on the study protocol, and on how to (1) approach potential participants, (2) use point-of-care testing devices, (3) handle refusals to participate, (4) collect data, (5) communicate risk assessment results to participants, (6) engage and refer at-risk individuals to physicians, (7) counsel participants on required lifestyle changes and (8) respond to participants' questions.

Study setting and participants

A purposive sample of 12 community pharmacies (with necessary infrastructure) in the three emirates of Dubai, Sharjah and Ajman in the UAE was selected. The recruited sites represented chain pharmacies. Study pharmacists were offered a small monetary incentive (AED 23 (equivalent to US\$6)) per screening in appreciation of their time and effort.

Recruitment of participants

Pharmacy-based advertising, including posters and flyers, were used to recruit participants. Individuals were mainly invited directly by the pharmacists to participate based on their judgement of the individual's age. Interested voluntary participants were prescreened by the pharmacists to determine their eligibility. Eligible participants were given written patient information sheet and they signed a consent form.

Inclusion criteria

- ▶ Arabic or English speaking.

- ▶ Aged between 40 and 74 years. There is no international consensus on the age range for diabetes screening; however, 40 years is recommended in several guidelines and was therefore considered appropriate.

Exclusion criteria

- ▶ Previous diagnosis of diabetes or CVD.
- ▶ Use of medications for treatment of diabetes, hypertension or any other CVD at the time of screening.
- ▶ Pregnancy.
- ▶ Terminal illness.
- ▶ Severe mental illness.

Data collection and risk factor assessment

To document the screening process, participating pharmacists completed brief paper-based records of each screening undertaken. This provided patient risk assessment data, documentation of patient counselling (eg, lifestyle factors assessed, targets specified and criteria for referral to a physician) and logistical information (eg, time taken to conduct screening and counselling, number of visits required, reasons for deviating from suggested screening schedule).

After checking eligibility and obtaining consent, trained pharmacists screened participants with the following measurements:

- ▶ Anthropometric measurements: weight, height and waist circumference were measured along with body mass index (BMI) calculations.
- ▶ Point-of-care testing: total cholesterol (TC), high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) plasma levels and glycated haemoglobin (HbA1c) level were measured using a finger-prick point-of-care testing device (Roche Cobas b 101 POC dual system). Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured after participants rested for 5 min using the Omron 1A1B automated blood pressure (BP) monitor. Pharmacists advised participants to seek immediate medical attention if SBP was ≥ 180 mmHg or DBP ≥ 110 mmHg. Pharmacists also reminded at-risk individuals that point-of-care tests may not have the same sensitivity and specificity as laboratory-based equipment, and hence, the need to refer to the medical practice for confirmation.
- ▶ CVD risk assessment: projected 10-year atherosclerotic CVD (ASCVD) risk was calculated for each participant.
- ▶ Diabetes risk assessment: in addition to HbA1c level, the American Diabetes Association (ADA) T2DM risk questionnaire was completed.
- ▶ Patient history: detailed sociodemographic information, brief medical history, family history of diabetes, smoking status, physical activity and dietary behaviours. Patients referral and follow-up: participants at high risk, defined as having any of the following: (1) 10-year ASCVD risk $\geq 7.5\%$, (2) HbA1c level ≥ 5.7 ,

(3) ADA T2DM risk questionnaire ≥ 5 points, were advised to visit their physician. All participants identified, by pharmacists, as at high risk for either CVD or diabetes were given a referral letter summarising pharmacy screening results to the physician for further testing. A rapid phone follow-up of all participants was conducted (within 2 weeks of screening) by a member of the research team to determine participants' satisfaction and experience with the pharmacy screening service. Participants were asked about perceived depth and clarity of pharmacist explanation of diabetes and CVD risk; their satisfaction with the risk assessment and the quality of testing and advice; instructions on the need for further evaluation by a physician; and the perceived length of the screening. They were also asked about their opinion on community pharmacies as a venue of the screening service, whether screening should be routinely provided by community pharmacists, and their willingness to pay for future pharmacist-delivered screening.

The follow-up also included questions about self-reported health status, frequency and pattern of physician visits in the past year. Participants were asked if they had undergone an assessment of lifestyle that affects diabetes and/or CVD risk by any healthcare professional in the past year or whether they were advised of the need to reduce their diabetes or CVD risk. The research team members identified themselves as such to the participants and informed them that their responses would not be communicated to the pharmacists who performed the screening.

Outcomes

1. Development of UAE pharmacy-based screening model.

A consensus statement from the expert panel detailing the screening processes, cut-off points/levels and referral mechanisms to physicians, all suited to the community pharmacy context in the UAE.

2. Feasibility assessment.

- a. The proportion of screened participants identified as having high CVD risk (ASCVD 10-year risk defined as $\geq 7.5\%$ as determined by the expert panel, see the Consensus statement on screening intervention section).
- b. The proportion of participants identified as having elevated blood glucose (high A1c level $>6.5\%$ (48mmol/mol)) or high self-reported diabetes risk (T2DM risk questionnaire score ≥ 5 points—as determined by the expert panel, see the Consensus statement on screening intervention section).
- c. Participants' acceptability and satisfaction with the pharmacist-delivered screening.

Patient and public involvement

We did not involve patients or the public in our work.

Data analysis

The data were entered into Microsoft Access and 10% of participant files were randomly selected for validation. Stata V.14 (StataCorp, College Station, Texas, USA) was used for data analysis.²⁶ Normally distributed continuous variables were described using means and SD (such as participants' age, visits to physicians and nutritional habits). Categorical variables were described using counts and frequencies (such as demographic data, BMI (grouped) and medical history). The χ^2 test was used to test differences in risk factors by age and gender. A *p* value of <0.05 was considered statistically significant.

RESULTS

Consensus statement on screening intervention

The expert panel reached a consensus on the use of absolute risk assessment and other multifactorial risk algorithm cut-offs, screening tools and risk factor thresholds. Panel members unanimously agreed on taking two seated measurements of BP after a 5 min rest and separated by 2 min. If the two SBP and DBP readings differed by ≥ 10 mm Hg or ≥ 6 mm Hg, respectively, a third measurement would be needed, and the two closest readings would be used to calculate mean BP. Regarding the calculation of 10-year ASCVD risk score, the American College of Cardiology/American Heart Association (ACC/AHA) pooled cohort equations CVD risk calculator should be used. Participants having a 10-year risk $\geq 7.5\%$ were classified as high risk and had to be referred to a physician for further testing. The official ASCVD Risk Estimator Plus smartphone application with off-line feature was deemed most feasible to perform the calculation. Other criteria that independently necessitated referral to a physician were an HbA1c level exceeding 5.7% (pre-diabetes) or a score above five points on the ADA questionnaire to measure the risk of T2DM.

Regarding the determination of uptake of referral and physician action on the results of the screening, the panellists identified the impracticality of contacting physician's offices; instead, it was agreed that uptake of referral and physician action would be best reported by participants themselves during follow-up calls. Clinical training manual and implementation resources were developed to ensure systematic approaches for the execution of pharmacist-delivered screening and to minimise variability among participating pharmacists. Data collection tools and consent forms were adapted from the CARS project. [Figure 1](#) illustrates the final screening model.

Sociodemographic and health characteristics

From 15 December 2017 to 8 May 2018, 120 consenting participants were screened for CVD and T2DM from the population visiting the 12 participating community pharmacies (which had sufficient/appropriate space to accommodate the screening service, and had high volume and variability in clientele). Five participants were excluded for not meeting the study criteria. Sociodemographic and

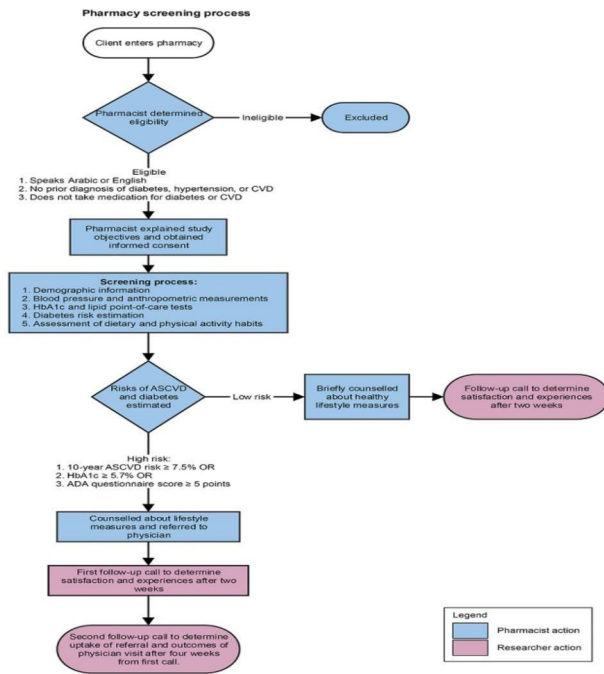


Figure 1 Pharmacy screening model in the United Arab Emirates (UAE). ADA, American Diabetes Association; ASCVD, atherosclerotic cardiovascular disease; CVD, cardiovascular disease; HbA1c, glycated haemoglobin.

health characteristics of the 115 screened participants are summarised in [table 1](#). Gender representation was almost equal, with most participants having been born in Syria and Egypt. When participants were asked about their present state of health, 32% reported being ‘excellent’. On average, participants visited a physician three times a year. Twenty-four per cent of participants reported having regular physicians, while 18.6% had regular clinic but visited different physicians, and 38.6% visited different clinics. In the past 12 months, only 6.4% reported undertaking a detailed examination of lifestyle factors by a health professional.

Implementation fidelity

Of the screened participants, 57.4% were identified as high risk for diabetes and/or CVD. After each screening encounter, pharmacists completed a checklist that documented the screening process ([table 2](#)). Most participants (91.7%) were screened immediately following their recruitment and the signing of informed consent, and the remainder were given appointments for a later time. In the majority of cases (92.3%), the entire screening process was completed during a single visit to the pharmacy.

A total of 12 participants did not undergo a complete assessment as per the screening protocol. A full lipid profile was not obtained in four cases, and four other participants did not obtain an HbA1c measurement. Furthermore, pharmacists did not perform a waist circumference measurement for three participants and BP measurement for one participant. Pharmacists documented the reasons for incomplete assessments for these 10 participants: a technical error in the POC device

Table 1 Demographic and health characteristics (n=115)		
Characteristic	N	(%)
Gender		
Female	60	(52.1)
Age (years)		
Mean±SD	47.23	±7.3
Nationality		
Syria	32	(27.8)
Egypt	23	(20.0)
India	11	(9.5)
Jordan	7	(6.0)
Pakistan	7	(6.0)
Other	35	(30.4)
Education		
Not educated	2	(1.7)
Primary/middle school	15	(13.0)
High school	37	(36.2)
University	50	(43.4)
Marital status		
Married	103	(89.5)
Single	8	(6.9)
Divorced	3	(2.6)
Widowed	1	(0.8)
Employment		
Full-time	67	(63.2)
Part-time	6	(5.6)
Home duties	25	(23.5)
Other	17	(14.7)
Self-reported health status*		
Excellent	24	(32.0)
Good	41	(54.6)
Average	10	(13.3)
No. of visits to a physician in the past year*		
Mean±SD	3.05	±4.1
Patterns of physician use		
Have a regular physician	18	(24.0)
Have a regular clinic but often see different physicians	14	(18.6)
Visit different physician clinics	29	(38.6)
Rarely or never visit a physician	14	(18.6)
Source of advice to reduce risk of diabetes and CVD risk in the past 12 months (apart from pharmacy screening visit)*		
A physician	13	(17.5)
A dietitian	1	(1.3)
A specialist physician	5	(6.7)

Continued

Table 1 Continued

Characteristic	N	(%)
A pharmacist	2	(2.7)
Others practitioners	9	(12.1)
A family member	7	(9.4)
Examination of lifestyle factors that affect diabetes and CVD risk by a health professional during the past 12 months*	7	(6.4)

*Number of participants is 75 (first follow-up phone call). CVD, cardiovascular disease.

prevented the measurement in nine cases, and the participant objected to the measurement in one case. Assessments of diabetes risk as per the ADA questionnaire, dietary habits and physical activity habits were completed for all participants. On average, assessment and testing took 27±9.4 min.

In all cases where pharmacists documented post-assessment counselling, pharmacists explained the meaning of participants' ASCVD and ADA questionnaire risk scores and the targets for suboptimal blood test results. HbA1c test results were explained to 96.3% of participants. Regarding lifestyle behaviours, the pharmacists documented counselling 85.8% and 81.1% of participants about healthy diet and physical activity, respectively. Finally, pharmacists reported informing 87.9% of participants of the need for confirmatory testing at the physician's office. Pharmacists reported that post-assessment counselling lasted 11.6±6.5 min on average.

Uptake of referral

A total of 71 (61.7%) at-risk individuals were referred to their physicians for further testing; 37 participants (52.1%) completed the second follow-up survey to determine uptake of referral (table 3). Only nine of these participants (24.3%) had visited their physician following the screening, 29.7% had not visited their physician yet but intended to do so. Conversely, 43.2% did not visit their physician and made no such plans (table 3).

Five participants told their physicians about the pharmacy screening results; four of the five cases reported that physicians took the results seriously. Physicians ordered follow-up tests for 77.7% of the participants, including TC and blood sugar levels (57.1% each), HDL levels and BP (42.8% each).

When asked about lifestyle changes that participants adopted following the screening, 63.1% reported improved diet, 57.8% attempted to lose weight and 40% started new medications since the screening (table 3).

Participants' experiences, feedback and satisfaction with the screening service

All participants were contacted by telephone to determine their experiences and satisfaction with the pharmacy screening service (table 4). A total of 75 participants

Table 2 Pharmacist-documented components of screening model completed (n=112)

Component of screening model	N	(%)
Timing of screening		
Immediately following recruitment	100	(91.7)
By appointment on same day	3	(2.8)
By appointment on another day	6	(5.5)
No. of visits needed to complete screening		
One visit	103	(92.3)
Two visits	4	(3.7)
Assessments and measurements completed		
Anthropometric measurements	110	(100.0)
Diabetes risk assessment	111	(100.0)
ASCVD risk score calculation	110	(100.0)
Dietary habits assessment	111	(100.0)
Physical activity habits assessment	111	(100.0)
Tests and measurements not completed		
Lipid profile	4	(33.3)
HbA1c	4	(33.3)
Waist circumference	3	(25.0)
Blood pressure	1	(8.33)
Reason for not completing test/measurement		
Technical error in device	9	(90.0)
Participant objection*	1	(10.0)
Assessment, testing and measurement duration		
Mean duration±SD (min)	27.0±9.4	
10–20	34	(30.9)
21–30	53	(48.2)
31–40	19	(17.3)
Over 40	4	(3.6)
Post-assessment counselling		
ASCVD risk score interpretation	110	(100.0)
ADA questionnaire score interpretation	107	(100.0)
HbA1c result interpretation†	79	(96.3)
Guideline targets for suboptimal blood test results	107	(100.0)
Lifestyle behaviours (top two covered aspects)		
Dietary behaviours	91	(85.8)
Physical activity	86	(81.1)
Need for further/confirmatory testing at physician's office	87	(87.9)
Post-assessment counselling duration		

Continued

Table 2 Continued

Component of screening model	N	(%)
Mean duration \pm SD (min)	11.6 \pm 6.5	
1–10	39	(33.9)
11–20	36	(31.3)
21–30	3	(2.6)
Not reported	37	(32.2)

*One participant objected to waist circumference measurement.
 †Documentation was missing for 30 participants.
 ADA, American Diabetes Association; ASCVD, atherosclerotic cardiovascular disease; HbA1c, glycated haemoglobin.

completed the follow-up survey (65.2%). In 68% of the cases, the pharmacist-initiated the conversation about the screening service. Other participants reported learning about the service from personal acquaintances (17.3%) and social media (10.7%).

Almost all participants reported that the pharmacists' explanation of their risk of developing diabetes or CVD were either 'very clear' or 'clear enough' and that pharmacists explained the various lifestyle causes of increased CVD or diabetes risk 'very comprehensively' or 'discussed several issues'.

At the conclusion of the screening, 94.5% of participants reported that pharmacists made sure participants understood all key points, and 89.3% indicated that pharmacists provided participants with a written screening report.

Most participants (94.5%) reported either being 'satisfied' or 'very satisfied' with the risk assessment undertaken by the pharmacists and the quality of the pharmacists' advice.

Eighty-six per cent of participants thought pharmacies are good venues for conducting screening tests, and 86.6% thought pharmacists should routinely provide CVD and diabetes risk screening. Most participants (82.7%) indicated they would be willing to pay for pharmacist-delivered screening services should it be provided in the future (table 3).

DISCUSSION

This study is the first in an Arabic-speaking country (UAE) to assess the feasibility and performance of an evidence-based pharmacist-delivered screening programme for T2DM and CVD. The screening model, adapted from the CARS model with the advice of local experts, was successfully implemented in community pharmacies and resulted in the identification and referral of at-risk individuals.²⁴

The proportion of screened participants identified with high diabetes or CVD risk in this study was higher compared with reported rates in the international pharmacy screening literature. This could be partially explained by the higher prevalence of diabetes and CVD in the UAE.^{20 27} The high referral rate (61.7%) in this

Table 3 Outcomes of at-risk participants' referral (n=37)

	N	(%)
Participants completed uptake of referral follow-up	37	(52.1)
Participants visited a doctor to discuss pharmacist-delivered screening results	9	(24.3)
Visited doctor straight away	6	(16.2)
Made some changes and went to doctor later	1	(2.7)
Discussed results at routine visit	2	(5.4)
Participants who did not visit a doctor	28	(75.6)
Have not visited doctor yet but intend to	11	(29.7)
Did not think it was necessary	1	(2.7)
Have not visited doctor yet and made no plans	16	(43.2)
Physician knew about pharmacy screening	5	(55.5)
Referral letter given to the doctor	2	(40.0)
Told doctor about pharmacy screening	3	(60.0)
Doctor treated the results of pharmacy screening seriously	4	(80.0)
Follow-up tests were undertaken by the physician	7	(77.7)
Blood pressure	3	(42.8)
Total cholesterol	4	(57.1)
HDL cholesterol	3	(42.8)
Blood sugar level	4	(57.1)
Waist	1	(14.2)
Weight	2	(28.5)
Other	4	(44.4)
Lifestyle changes since screening		
Increased regular exercise	7	(36.8)
Attempted to lose weight	11	(57.8)
Improved diet	12	(63.1)
Started new medications	4	(40.0)

HDL, high-density lipoprotein.

study is consistent with the recent trend towards higher rates of referral.¹⁷ Without systematic diabetes and CVD screening programme in the primary care setting in the UAE, lack of universal healthcare coverage, all in tandem with poor health-seeking behaviour and the delay in access to medical services these conditions are likely to continue to be undiagnosed. The potential, therefore, exists for community pharmacists who have regular contact with the population to improve access to health screening services and promote public health awareness.

Several pharmacy and pharmacist-level factors at selected pharmacies contributed to the success of implementing pharmacist-delivered screening, these include (1) the necessary infrastructure (such as sufficient/appropriate space) to accommodate the screening service, (2) motivation of the pharmacist to learn about and perform

Table 4 Participants' experiences, feedback and satisfaction with screening (n=75)

		N	(%)
Experience and feedback on pharmacist-delivered screening			
Person who initiated the conversation about screening between participant and pharmacist	Another participant in the project	1	(1.3)
	Pharmacist	51	(68.0)
	Pharmacy staff	2	(2.7)
	Acquaintance	13	(17.3)
	Social media	8	(10.7)
Clarity of pharmacist's explanation of risk of developing diabetes and CVD	Very clear	59	(78.7)
	Clear enough	14	(18.7)
	Some parts clear	1	(1.3)
	Generally unclear	1	(1.3)
Depth of pharmacist's exploration of possible lifestyle causes of increased diabetes and CVD risks	Very comprehensive	57	(76.0)
	Discussed several issues	13	(17.3)
	Discussed only one issue	7	(9.3)
Steps undertaken following screening	The pharmacist provided you with a written report of your results	67	(89.3)
	The pharmacist made sure that you understood everything	69	(94.5)
	The pharmacist clearly stated when the physician follow-up was required	24	(33.8)
Quality of the testing carried out in pharmacy	Excellent	53	(70.7)
	Above average	12	(16.0)
	Average	6	(8.0)
	Slightly below average	4	(5.3)
Perceived length of the diabetes and CVD risk screening process	Much too long	2	(2.7)
	A little long	12	(16.0)
	About right	58	(77.3)
	A little short	3	(4.0)
Satisfaction with the pharmacist-delivered screening			
Satisfaction with health risk assessment	Very satisfied	43	(58.9)
	Satisfied	26	(35.6)
	Average	3	(4.1)
	Dissatisfied	1	(1.4)
Satisfaction with the quality of advice provided in the pharmacy	Very satisfied	40	(54.1)
	Satisfied	27	(36.5)
	Average	5	(6.8)
	Dissatisfied	2	(2.7)
Willingness to pay for the future pharmacist-delivered screening service			
Yes		60	(80.0)
Acceptable amount to be paid	≤50 AED (≤USD 13.6*)	34	(56.7)
	51–100 AED (USD 13.6–27.2*)	19	(31.7)
	101–150 AED (USD 27.2–48.8*)	6	(10.0)
	>150 AED (>USD 48.8*)	1	(1.7)
Reasons for unwillingness to pay for future pharmacist-delivered screening service	Cannot afford it	2	(14.3)
	Does not think it is worth it	3	(21.4)
	Thinks it should be free	3	(21.4)
	Other	6	(42.9)

CVD, cardiovascular disease.

the screening and (3) the high volume and variability in clientele.

The purposive sampling of community pharmacies and the exploratory study design might have limited the generalisability of study results. However, equally, it could be argued that the somewhat driven community pharmacists in this study would have been representative of the expected pharmacists in future programme roll-out. The study was designed to demonstrate the feasibility of pharmacist-delivered screening and to understand how implementation support and processes might have been optimised to enable such a health service. Follow-up with physicians on pharmacist-delivered screening was not carried out as per the expert panel advice due to the complexity of access to physician services and different health coverage/schemes, lack of integration and communication between services provided at the government and private institutions, the current lack of integration of pharmacy services with other health-care services and the scattered primary care structure in the country. Such lack of follow-up with physicians is not uncommon in studies exploring early stages of pharmacy-based screening given the complexity of the primary care setting. To optimise the health impacts of a screening service, a more effective referral pathway will need to be established in further discussions between pharmacists and physicians. Better uptake of screening may have been achieved with training of other staff in the pharmacy to aid in recruitment. A focused advertising campaign, including advertorials in local media, may also have boosted uptake. A better follow-up rate may have been achieved if the pharmacist him/herself followed up screened participants several weeks after the referral was advised. In this follow-up, the pharmacist could check if at-risk screened individuals had taken up the referral or prompt them to act on it if had they not done so. It may also have been helpful to send a copy of the referral directly to the referred individual's nominated physician. It could also have been that participants still questioned the validity of the risk screening process carried out in community pharmacies, and that they could have taken its results more seriously had it been carried out in a clinic or a more traditional care setting. Patient and physician reservations about services being provided in community pharmacies have been reported in the literature. In the UAE, reasons cited for this included doubt about pharmacist competence to provide the services, a business image rather than a healthcare image of community pharmacy that prevails in the country, little privacy in the pharmacy setting and lack of effective collaboration between pharmacists and physicians.^{28–30} For community pharmacies to be an acceptable setting for providing screening services in the UAE, the service model in the pharmacy will need to assure minimum expectations of patients including patient privacy and properly trained pharmacists. We acknowledge that the focus of this trial was on determining feasibility from a health service perspective. However, it seems relevant to point out that the

original CARS model, which we adapted, did engage with a diverse range of Australian consumers (n=46) before design completion to support model acceptability and patient engagement. This included 20 Arabic-speaking migrants, 10 male and 10 female in separate focus groups facilitated by the lead investigator HA, to explore various aspects of a pharmacy screening service from a culturally and linguistically diverse consumer perspective. This process established the generally acceptable parameters for a pharmacist-delivered service from the perspective of Middle Eastern adults, arguably validated by the strong satisfaction with the intervention reported in patient surveys. In these focus groups, there were a number of comments suggesting greater confidence and trust in Arabic pharmacists and pharmacy systems than their Australian counterparts. What this process missed was consumer guidance regarding their specific support needs in the context of this model being operated in within the UAE health system. We have relied on health professionals and experts for guidance on this because of the complexity of the health system, absence of primary care and the novelty of the intervention, which required a significant level of insight and extensive engagement to determine a model that might work. We fully acknowledge that we need to engage UAE consumers further before scaling up this intervention.

Participant selection was heavily based on pharmacist perception of their age. Until screening becomes known and accepted as a community pharmacy service in UAE, the most likely pathway to uptake of screening in community pharmacy in the UAE is by direct invitation from a pharmacist. It is also likely to yield more individuals at high risk and in need of further testing and diagnosis. This has also been the case in other screening trials (Krass *et al.*,³¹ CARS trial). Once such service becomes established, it is likely that consumers may request it themselves in response to advertising, posters in the pharmacy and so on. The six-dollar per participant was an incentive for the pharmacists to engage in the study, and it was not based on a calculation of what an actual service would cost. Future studies should aim to establish effectiveness of the pharmacist-delivered screening model for diabetes and CVD in the UAE, and generate evidence of its cost-effectiveness. Then pharmacists' remuneration would eventually need to be negotiated with government and private insurance. At this point, this was not within the scope of this study.

The research team, at the planning phase, aimed to document the proportion of patients approached, the proportion of those who consented to be screened and the reason(s) for individual refusal to be screened. However, pharmacists reported that this would be an added work and preferred not to collect such data. The short follow-up period with patients was perhaps inadequate to capture all further diagnostic and management activities as a result of pharmacist-delivered screening. This feasibility study was continued on a larger scale to evaluate the efficacy of pharmacist-delivered screening in

identifying participants with high diabetes and/or CVD risk in the UAE. Additional future studies should evaluate strategies to establish closer links between community pharmacy and physicians in primary care, creating structured referral pathways and emphasis on interprofessional coordination between pharmacists and physicians.

CONCLUSIONS

It is feasible for community pharmacists to screen and refer individuals for diabetes and CVD risks in the UAE. The successful implementation of the screening model in community pharmacy, in terms of identifying at-risk individuals and advising them to visit their physicians for further evaluation, offers a new platform to increase screening capacity within the primary care setting, and represents a key opportunity for the early detection and intervention to tackle the increasing burden of both diseases. However, pathways for the integration of the pharmacist-delivered screening service with physicians in primary care are yet to be explored.

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Contributors HTA designed the study, supervised data collection process, assisted with data analysis, wrote, reviewed and edited the entire manuscript. SC and RC analysed data, reviewed and edited manuscript. SH wrote parts of manuscript. KM and IK assisted with designing of the study, reviewed the methods and data analysis contributed to the discussion, and reviewed all drafts.

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