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Impact of Diabetes Continuing Education on Knowledge and Practice of Diabetes Care among Health Care Professionals in Yemen

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: This study aimed to evaluate the Impact of diabetes continuing education on knowledge and practice of diabetes care among health care professionals in Yemen.
Methods: A quasi-experimental study was carried out among health care professionals. The original questionnaire consisted of 22 multiple choice questions. A total of 73 HCPs received continuing education (CE) intervention. Knowledge attitude and practice (KAP) was assessed using a validated questionnaire.
Results: The result showed that majority of the HCPs has a good general knowledge on diabetes and its managements prior to the CE program. Evaluation of the general knowledge score of the HCPs found some improvement in the knowledge score, however the improvement was not significant (p=0.31). The result of this study found that HCPs has good knowledge on monitoring the sign, symptoms and laboratory parameters.
Conclusion: Evaluation of the knowledge score on Goal of Diabetes Management of HCPs found significant (p=0.024) improvement in the knowledge score. The results indicated that the lab values were rated as the most important in the goal for the treatment of diabetes patients. The study also found no significant difference in practice score after CE program among HCPs.

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1. INTRODUCTION

Inadequate education among patients with diabetes is disheartening, yet heath care professionals (HCPs) can accept this challenge. However, a deficiency in knowledge and understanding of diabetes among HCPs can damper this resolve [1]. Bjork and colleagues reported that both patients and healthcare providers had an overall lack of comprehension regarding the need of regular monitoring and tight glycemic control in selected patients with diabetes [2]. Holt et al. surveyed healthcare professionals in 17 countries and found that up to one third of healthcare professionals in some countries indicated that they never received any formal diabetes training [3]. Health-care professionals need to have an adequate knowledge on drug therapy including its regimen that are presently available in the market which might be possible though continues education [4]. In addition, diabetes education is considered as an essential factor that helps to improve self-care and glycemic control [5]. In the 1980s, patients with diabetes were educated with regard to their disease. Providers of diabetes education increased their efforts to assist patients with diabetes. Unfortunately, these efforts did not equate into effective control of the disease [6] In 1995, more efforts were made in the teaching process of diabetes [7].

The Certified Diabetes Educator(CDE®) program has a specific characteristic of providing continuing professional diabetes-related education and is open to all health care professionals. The CDE® program can apply to physicians, pharmacists, nurses, dieticians and others who have completed a diabetic certification program and possess distinct specialized knowledge of diabetes self-management. A certification program also allows health care professionals to apply their disease management skills to educate their patients [8]. On the other hand, continuing medical education (CME) is defined as education programs that have been designed to facilitate clinical practice for health care professionals in order to increase their knowledge and skills for helping patients to manage their disease [9]. The CME program is used to help health care providers update their knowledge and can be in the form of conferences, videos, workshops, and online educational websites. Meanwhile, CME is an essential part of improving the care provided to patients with type 2 diabetes [10]. Health care providers who were trained in diabetes education either through CDE or CME have better patient contact, which results in improvements in clinical outcomes [11,12]. Chen and colleges conducted a prospective cohort pre- and post-interventional study among pharmacists (n=72), evaluating the effectiveness of CME on pharmacists' knowledge and attitude towards diabetes. Mandarin versions of the Diabetes Knowledge Test (DKT-M) and the Diabetes Attitude Scale (DAS-M) were used. All subjects completed a questionnaire before and after the intervention. The CME was designed to contain general knowledge on diabetes diagnosis, pathophysiology, and management of diabetes, as well as the skills needed to provide effective diabetes pharmaceutical care. The final findings of this study revealed that pharmacists' knowledge levels, as well as their attitudes, increased immediately after the CME intervention [13]. Young (2011) conducted an intervention study among nurses in Pennsylvania, USA, to assess the effect of continuing education (CE) on knowledge on diabetes among nurses. Ten nurses attended the live presentation on diabetes and 50 accessed the online education intervention. The contents of CE were pathophysiology of diabetes, risk factors for hyperglycemia, complications and management of diabetes. The CE was evaluated by a validated knowledge quiz questionnaire. This study found an improvement in the nurses' knowledge in both interventions, but the online intervention yielded better results than the didactic presentations [14].

A pre- and post-group analysis was carried out in India by Murugesan et al among 3,023 physicians (male= 2,311 and female =712) to explore the effects of a training program on physicians' knowledge on the management of diabetes. All the physicians attended a training program in diabetes care. The effects of the intervention were tested by a pre- and post-test questionnaire. They filled in a questionnaire at baseline and immediately after the intervention, but did not mention the validation of the questionnaire, which may have affected the validity of their findings. The training program was designed to include general knowledge on diabetes diagnosis, pathophysiology, complications, and the management of diabetes. The results of this study revealed that physicians' knowledge significantly improved immediately

after the intervention (45% to 60 %, p<0.001) [15]. Therefore, this study aimed to evaluate the Impact of diabetes continuing education on knowledge and practice of diabetes care among health care professionals in Yemen.

2. MATERIALS AND METHODS

This study was carried out using a quasi-experimental design. It examined the impact of the intervention on the Knowledge, Attitude, and Practice (KAP) of diabetes care among health care professionals, which was measured by a pre-test/post-test design. A single group of individuals, health care professionals (including doctors, pharmacists, and nurses) were given a pre-test and post-test survey.

2.1 Sample Size

The target population for this study included all doctors, pharmacists, and nurses listed in Mukalla city, Yemen. The Health Office in the Hadramout Governorate estimated the total numbers of specified health care professionals (HCP) to be 291doctors, 45 pharmacists and 100 nurses. Therefore, the target population for this study was 436. According to Raosoft Inc., if the accepted error rate was 5 %, and 95% confidence levels were employed, the sample size should be 205. The study selected 300 health care professionals using a stratified random selection method where the population of HCPs, were divided into subgroups (i.e. doctors, nurses, and pharmacists) before selection. The health care providers were invited to attend the CE using a special invitation card.

2.2 Participants

On the day of the CE program, all participants were briefed on the study, its objectives and the expectations of the researchers. They were informed that they had to complete a pre-test, attend the CE program, and complete the post-test. In addition, they were informed about the follow-up that would be conducted following the program of up to 6 months. Those who consented to participate in the study had to write their name, working address, and signature on a piece of paper provided by the researcher. Participants who refused to participate in the research were also allowed to attend the CE, but they did not have to complete the pre- and post-test.

2.3 Description of the Intervention

All participants filled out a questionnaire before the intervention (pre-test). This questionnaire was used to measure the general knowledge; attitudes, and practices of the participants on diabetes. After the pre-test, an interventional program was given in the form of a seminar. The duration of this presentation was 4 hours (9:00 to 1:00 pm) and was delivered in English by the clinical pharmacist in August 2009. This program included the pathophysiology of the disease, diagnosis, signs and symptoms, complications, review of medications, patient monitoring, and self-care. During the CE, the lecture discussed the disease, including the diagnostic approach, various laboratory investigations, signs and symptoms, all types of therapy including both oral anti diabetic agents and insulin regimens, aspects of patient education (including medications, dietary control, physical exercise, foot care and self-monitoring blood glucose levels), and diabetes complications (such as retinopathy, nephropathy, neuropathy, alteration of lipid profile, cardiovascular problems, stroke and diabetic foot ulcers).

2.4 The Questionnaire

Data was collected by using three questionnaires. The diabetes knowledge test (DKT) was modified from [16]. The original questionnaire consisted of 22 multiple choice questions. Two clinical pharmacists confirmed its face validity. In addition, a pilot study was done among 25 subjects for the reliability test and Cronbach's alpha was calculated =0.711. The final questions for the DKT consisted of 12 multiple choice questions. Each correct answer for the diabetes knowledge questions was given 1 point and incorrect answers were given 0 points. The scores were calculated by adding all the correct answer for diabetes knowledge questionnaire and the maximum score was 12. The questionnaire for the goal of diabetes management was modified from(Oja, 2005) . It consisted of five Likert scale questions that measured the importance. The measurement of importance was very important, important, not important and not important at all. The knowledge score on the diabetes management, the HCPs ranking on each goal were combined as was given a score for combination of very important and important being "1", whereas the combination of not important and not important at all was given "0". The diabetes management scores were calculated by adding all the correct

answer for diabetes management's knowledge questionnaire and the maximum score was 5. The reliability test indicated a Cronbach's Alpha of 0.649 with the five final questions related to knowledge. The final questions for knowledge on the goal of diabetes consisted of five multiple choice questions. Although the normal acceptable cut-off point for Cronbach's Alpha is 0.7, alpha values ranging from 0.5 to 0.6 are considered adequate in exploratory studies [17].

2.5 Diabetes Practice Measurements

The questionnaires for practice were modified from Ivika Oja (2005) [18]. All were Likert scale questions. It composed of 14 questions measuring participant response with frequencies ranging from: once a month, once a quarter, at least once a year, less often and not necessary. The reliability test showed a Cronbach's Alpha of 0.649 with the eight final questions for the practice. All of these questions were multiple choice questions. All correct answers for the diabetes practice questions was given 1 score. The diabetes knowledge scores were calculated by adding all the correct answer for the diabetes practice questionnaire. The maximum score was eight.

2.6 Data Analysis

The data was keyed into SPSS version 15 for Windows (SPSS) for analysis. Both descriptive and analytic statistics were applied. For the descriptive analysis, results were expressed as numbers, percentages, and mean (± SD and 95% CI). The Wilcoxon signed rank test was used to compare the differences between pre-intervention and post-intervention. The Mann-Whitney U test and the Kruskal-Wallis test were used to assess intergroup differences. A repeated Mann-Whitney with Benferroni's adjustment method were utilized to determine the difference between subgroup.

3. RESULTS

A total of 300 healthcare providers were invited to the Continuous Education program on diabetes; however, only 73 (24%) attended. There was no reason given by those who failed to attend the program. All 73 healthcare providers who attended the program and all completed the pre-test. Out of those 73, there were 19 pharmacists (26%), 37 doctors (50.7%), and 17 (23.3%) nurses. At the end of the program, 67 (91.7%) of them completed the post-test whereas the other six did not return the questionnaire. Table I. shows the demographic data of the participants.

3.1 Comparison of Diabetes Knowledge at Pre- and Post-intervention

The comparisons of the answers on pre-intervention and post-intervention diabetes knowledge are given in Table II. Only one item out of 12 items, the type of lifestyle modification, showed significant difference between pre- and post-intervention (p=0.029).

3.2 Change in Diabetes Knowledge Score among Healthcare Professionals

At baseline, the healthcare professionals had a mean score of 8.4 out of 12 (median=9) whereas a post-test mean score of 8.6 out of 12 (median=9) was recorded (Table III). The general knowledge scores did not change significantly between the pre-intervention and post-intervention scores (Wilcoxon signed rank test p=0.31).

Table I. Distribution of demographic data of health care professional by groups

Age in years	Physicians N (%)	Pharmacists N (%)	Nurses N (%)	Cumulative numbers (%)
20 – 29	14 (37.8)	5 (26.3)	3 (17.6)	22 (30.1)
30 – 39	22 (59.5)	5 (26.3)	5 (29.4)	32 (43.8)
40 –49	0	7 (36.8)	8 (47.1)	15 (20.5)
50 – 59	1 (2.7)	2 (10.5)	1(5.9)	4 (5.5)
Total	37 (50.7)	19 (26.0)	17(23.3)	73 (100)
Gender				
Male	22 (59.5)	18 (94.7)	16 (94.1)	56 (76.7)
Female	15(40.5)	1 (5.3)	1(5.9)	17 (23.3)
Total	37	19	17	73

Table II. Comparison of correct rate in diabetes knowledge at pre- and post-intervention

No	Items	Pre-test Correct answer (%)	Post-test Correct answer (%)	P*
1	The symptom(s) of diabetes	97.3	97.0	1.0
2	In a diabetic patient, high blood pressure can increase or worsen	93.0	91.6	0.76
3	A patient with diabetes should measure his or her blood pressure	70.8	56.1	0.144
4	The lifestyle modification(s) required for a patient with diabetes include	83.3	94.0	0.029
5	The important factors that help in controlling blood sugar level include	94.4	97.0	0.48
6	The well-balanced diet includes	44.4	39.1	0.34
7	For proper foot care, a diabetic patient	43.7	50.0	0.71
8	Treatment of diabetes comprises	75.5	78.1	0.96
9	Diabetes cannot be treated with	87.5	89.6	0.46
10	What percentage of the daily insulin requirement does basal insulin generally account for	33.9	40.0	0.317
11	Diabetic ketoacidosis (DKA) can develop in	53.6	43.1	0.25
12	Prolonged hyperglycemia can cause	74.6	83.1	0.27

McNemar test

Table III. Knowledge score for health care professionals at pre- and post-intervention

Items	Pre intervention Mean (median)	Post intervention Mean (median)		P*
General knowledge test	8.4(9)	8.6(9)	1103.5	0.31

Wilcoxon test

3.3 Change in Diabetes Knowledge Score within Healthcare Professional Groups

Table IV presents the mean (median) score for healthcare provider groups at pre-test and post-test. The pharmacists group had a mean score of 8.0 out of 12 (median=9) at pre-test whereas post-test mean score was 9.4 and there was no significant change in diabetes knowledge score (p=0.065).

As regards to medical doctors, the mean score was 8.9 (median=8) at pre-test and post-test mean score was 8.3 (median=8). No significant change in diabetes knowledge scores in the physician group (p=0.332) was noted. Nursing practitioners had a mean score of 8.3 (median=9) at baseline and a post-test mean score of 8.5. Nurses also showed no significant change in diabetes knowledge score from pre-test to post-test (p =0.52).

Table IV. Diabetes knowledge score within health care professional from pre- and post-intervention

Providers category	Pre intervention Mean (median) Maximum 12	Post intervention Mean (median) Maximum 12	P*
Pharmacists	8.0 (9)	9.4 (9)	0.065
Doctors	8.9 (8)	8.3 (8)	0.332
Nurse	8.3 (9)	8.5 (9)	0.52

Wilcoxon test

3.4 Comparison of Change in Diabetes Knowledge Score between Healthcare Professional Groups

The Kruskal-Wallis test was used to test the differences in the diabetes knowledge score levels at pre-intervention and post-intervention among healthcare professional groups as shown in Table V. No significant difference was found; however, between the healthcare professional groups (p=0.0827). The diabetes knowledge scores between healthcare professional groups after intervention showed no significant differences (p=0.253), as shown in Table V.

3.5 Knowledge on Goal of Diabetes Management

For knowledge on goal of diabetes management, healthcare professionals were asked to evaluate selected treatment goals. Healthcare providers were required to state their opinion on the importance of the five listed goals of the management of diabetes. The healthcare professionals had to designate one of the importance levels provided for each statement. The levels ranged from very important to not important at all.

3.6 Assessment of the Important of the Goal of Diabetes Managements at Post-test

After the intervention, the number of healthcare providers agreed that most of the goals of diabetes management were very important increased from the pretest. This was evident by the increase of the percentage of HCPs ranking the goal of therapy as very important. Table VI shows the ranking of the goal of therapy after the CE by the HCPs (Table VI).

3.7 Score for Knowledge on Diabetes Management

In assessing the knowledge score on diabetes management, the HCPs' rankings of the importance of each goal were combined and given a score of "1" for very important and important whereas the combination of not important and not important at all was rated "0". At baseline, the healthcare professionals had a mean score of 4.3 (median=5) whereas post-test mean score of 4.7(median= 5). There was significant change in score from pre- intervention to post-intervention preformed (p = 0.024) (see Table VII).

Table V. Diabetes knowledge score between health care professional groups pre-intervention and post-intervention

Providers category	Pretest Mean (median)	P*	Post test Mean (median)	P*
Pharmacists	8(9)		9.4(9)	
Doctors	8.9(8)	0.827	8.3(8)	0.253
Nurse	8.3(9)		8.5(9)	

Kruskal-wallis test

Table VI. HCP's rank on the important of the goal of therapy at post-test

Item	Very important N (%)	Important N (%)	Not important N (%)	Not important at all N (%)
Elimination of symptoms	36 (56.3)	23 (35.9)	5 (7.8)	
Absence of glycosuria	21 (32.3)	38 (58.5)	5 (7.7)	1(1.5)
Keeping blood glucose in normal range	48 (72.7)	18 (27.3)		
Achieving and maintenance of body weight	28 (42.4)	37 (56.1)	1 (1.5)	
Absence of ketonuria	33 (51.6)	27 (42.2)	4 (6.2)	

Table VII. Knowledge score on diabetes management between health care professional from pre-intervention and post-intervention

Items	Pre intervention Mean (median)	Post intervention Mean (median)	P*
Assessing managements	4.5(5)	4.7(5)	0.024

Wilcoxon test

Table VIII. Knowledge score on diabetes management score within health care professional groups pre-intervention and post-intervention

Providers category	Pre intervention Mean (median)	Post intervention Mean (median)	P*
Pharmacists	4.1 (4)	4.7 (5)	0.256
Doctors	4.6 (5)	4.7 (5)	0.328
Nurse	4.5 (5)	5.0 (5)	0.102

Wilcoxon test

Table IX. Knowledge score on diabetes management score between healthcare professional groups pre-intervention and post-intervention

Providers category	Pretest Mean (median)	P*	Post test Mean (median)	P*
Pharmacists	4.1(4)		4.7(5)	
Doctors	4.6(5)	0.53	4.7(5)	0.233
Nurse	4.5(5)		5.0(5)	

Kruskal-Wallis Test

3.8 Change of Knowledge on Diabetes Management Score within Healthcare Professional Groups

Table VIII shows the mean scores of the knowledge on diabetes management among healthcare professional groups. Doctors had the highest score at pre-test assessment (4.6). On other hand, pharmacists had the lowest practice in knowledge scores (4.1). No healthcare professionals showed significant change after intervention. There were no significant differences in the scores within pre-intervention and post-intervention for any HCP group (Table VIII).

3.9 Change of Knowledge on Diabetes Management Score between Healthcare Professional Groups

The comparison between healthcare professional groups (pharmacists, doctors, and nurses) is given in Table IX. There was no significant difference between the HCPs (p=0.233).

3.10 The HCP Practice Score

In assessment of the practice of HCPs, the score "1" was given to the correct answer and "0" to the wrong answer. The total of correct answers was considered as the practice score. The practice score of the HCPs did not change significantly before or after the CE program (p = 0.51).

3.11 Change of Practice Score within Healthcare Professional Groups and between Healthcare Professional Groups

The changes in the practice within HCPs varied. Doctors showed some improvement, pharmacists did not show any changes, and nurses had a decrease in the practice score. The changes however were not significant. The changes in the practice score between the HCPs were also not significant at both pre-test and post-tests.

4. DISCUSSION

After the CE (post-test), the level of general knowledge seemed to decrease slightly for most of the questions. Most likely this was due to the fact the sample size deceased after the CE. This study, however, did not explore the reasons for the reduction in the HCPs' knowledge at post-test. Other studies comparing the general knowledge of HCPs on diabetes and its management showed improvement or no change in the level of knowledge at post-intervention[13,1519,20] . Evaluation of the general knowledge score of the HCPs found some improvement in the knowledge score, but the improvement was not significant (p=0.31). This difference could be related to the total amount of correct answers given by the HCPs to the statements on general knowledge. This finding corresponded to the finding of other studies [13]. Evaluation of the scores on general knowledge according to healthcare provider groups found that the pharmacists and nurses

showed improvements in scores. This improvement could be related to the content of the CE, as the topics covered could be new to pharmacists and nurses, but not to doctors. Although pharmacists and nurses showed improvement in general knowledge, the evaluations of different HCP groups showed no significant differences between the knowledge scores of the doctors, pharmacists, and nurses at both pre- and post-CE assessments.

The healthcare professionals showed significant increases in the diabetes knowledge scores after intervention, where the mean pre-intervention score was 4.3 and increased to 4.7 after the CE. The improvement in knowledge scores, was significant (p=0.024). The analysis of the diabetes knowledge score within HCP groups found that each HCP (pharmacists, doctors, and nurses) showed improvements on the knowledge score after the intervention. Similarly, none of the differences were significant. In addition, the analysis of different groups of HCP also found no significant differences in the improvement of diabetes knowledge scores. This showed that all HCPs have gained some knowledge from the CE, and most of them understood the importance of the monitoring of patients with diabetes. The results immediately after the CE (post-test) found that there was some reduction in the percentage of HCPs who agreed to monitor glycemic control every visit, but most of them agreed to monitor at least quarterly. This is in line with the guidelines, which suggest monitoring of uncontrolled patients quarterly, and controlled patients at least biannually [21]. The changes in the practice scores from pre-test to post-test showed no significant improvement for either among HCP groups or between HCP groups. The changes, however, showed some improvement in the practice scores for doctors, no change for pharmacists, and some reduction for nurses. This finding, however, may not affect the overall patient care, as most of the parameters involved in the practice questionnaires were mainly related to doctors' activities in diabetes care. Pharmacists and nurses were mainly involved in counseling on body weight control, smoking cessation, and general information on home monitoring [19-21].

5. LIMITATIONS OF THE STUDY

The first limitation was the small sample size. Therefore, the results of this study cannot be generalized beyond Mukalla city. The second limitation was the medium of communication used in this study. The presentation was delivered in the English language, however, Arabic is the main language used in Yemen. Therefore, the use of the English language could be a barrier to the study's effectiveness. The final limitation is the nature of continuing education programs provided to the HCPs. In this study the CE was given in the form of a 3-hour lecture using a set of slides. Although the coverage was adequate, a program that includes hands-on activities may be better suited improve the HCPs' knowledge, attitudes, and practices.

6. CONCLUSIONS

This is the first study carried out to determine the effect of diabetes education programs on the knowledge, practices, and attitudes toward diabetes among healthcare professionals in Yemen. The current study showed that healthcare professionals had good knowledge regarding diabetes. There were no significant differences in knowledge scores. Evaluation of the knowledge score on the Goal of Diabetes Management assessment of HCPs found significant (p=0.024) improvement in the knowledge score of professionals. On the other hand, pharmacists had a higher knowledge score than either doctors or nurses after intervention, but no significant differences were found between healthcare professional groups (pharmacists, doctors, and nurses) towards the knowledge of diabetes.

7. RECOMMENDATIONS

The findings of this study underscore the importance of CE for healthcare providers in order to improve patient outcomes. Therefore, it is recommended that policy makers include CE in the requirements for the professional practice licensure. A CE guide on diabetes could be designed to include all aspects of diabetes such as the diagnostic criteria, guidelines for managing the disease, lifestyle modification, pharmacologic management, diabetic complications and its preventions, diabetic monitoring and other relevant information. An interactive self-learning and hands-on CE could be made available as required. In addition, a larger study involving a control group is recommended in order to confirm the findings of this study.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

This research project was approved by the Research Ethic Committee of ministry of health Hadramout, Yemen

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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