Chronic Care Model Impact on Type 2 Diabetes Care in Primary Care Setting in the Gulf Countries: A Scoping Literature Review

Abstract

Background: The Chronic Care Model (CCM) improves glycemic management, blood pressure, lipid profile, and complication rate at a lower cost.

Objective: This study aimed to investigate how implementing CCM principles may improve the quality of care for people with type 2 diabetes in the primary care setting in the Gulf Cooperation Council (GCC) nations.

Methods: The search included Medline Central, Embase, Science Direct, Cochrane, Scopus, and gray literature. The search covered the period from January 1999 to March 2023. Then, the formulation of the data occurred.

Results: The largest number of studies assessing the components of the Collaborative Chronic Care Model (CCM) were conducted in Kuwait, while Oman only conducted one study. Two studies conducted in Gulf countries, specifically Qatar and Saudi Arabia, covered all elements of CCM. The United Arab Emirates (UAE) had the largest number of participants in its studies. Most studies focused on self-care management practices, while decision support received the least attention.

Conclusion: CCM had a significant positive effect by controlling HbA1c level, Blood pressure, and lipid profile, and is considered an important aspect of managing type 2 diabetes in primary care settings. The effectiveness of self-care management is influenced by factors such as patient literacy and awareness of the symptoms and complications associated with type 2 diabetes. Improving patient

and healthcare provider participation and empowering patients are two key components of promoting self-care management among patients with type 2 diabetes.

Keywords: Diabetes; chronic care model; CCM.

Introduction

Diabetes mellitus is a metabolic disorder that lasts for a long time. It is characterized by high blood sugar (hyperglycemia) caused by problems with insulin production, insulin action, or both [1,2]. If diabetes isn't treated effectively, it may cause hyperglycemia, which leads to damage to the body's blood vessels, eyes, heart, nerves, and kidneys. According to Meo et al., people in the four Gulf nations with the greatest per-capita GDP (Qatar, Kuwait, UAE, and Saudi Arabia) consumed a large number of calories per day (>3000 kcal) [3]. So, they are predisposed to metabolic disorders, especially diabetes mellitus.

Globally, around 415 million people worldwide have diabetes, and by 2040, that number is predicted to rise to 642 million. According to epidemiological modeling, the prevalence rate of T2DM in the Saudi population rose from 8.5% in 1992 to 39.5% in 2022. In Oman, the prevalence of T2DM among adults over 20 years of age ranged from 10.4% to 21.1%, and by 2025, this percentage is projected to rise by 174%. In Qatar, a prognostic study on diabetes was done. In comparison to data from 2012, this study forecasts diabetes prevalence by 2050. This study makes estimates Compared to 16.7% in 2012, this study predicts that 24% of adult Qataris will have diabetes. The prevalence peaked among people aged 55 to 64 (35% of T2DM patients), and it then began to decline among elderly (those over 65). Among the six GCC nations, Kuwait has the highest prevalence of diabetes, with 22% of its population between 20 and 79 years old, according to the IDF 2019 report. In contrast to the other GCC nations, Saudi Arabia has the highest reported number of diabetes-related deaths [4].

Some of the most significant risk factors for developing Type 2 diabetes in the Gulf countries which include: The prevalence of overweight or obesity has significantly increased worldwide since 1975, with a threefold rise, affecting around 13% of adults in 2016. It is projected that obesity-related deaths will impact approximately 36 million people annually. Physical inactivity is a prevailing issue in the Gulf Cooperation Council (GCC) countries, with lower levels of physical activity compared to many developed nations, and a substantial proportion of adults in the GCC are obese. Unhealthy dietary patterns are prevalent in the GCC countries, with higher per capita calorie intake, increased consumption of sugar, white bread, and excessive fat, and decreased availability of nutritious foods.[5,6]

The Gulf Cooperation Council (GCC) was created by an agreement reached on May 25, 1981 in Riyadh, Saudi Arabia, between Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE in light of their geographic proximity, similar political systems based on Islamic beliefs, shared destiny, and shared goals. It currently covers 2,672,700 sq km in total. Arabic is used in government [7]

Chronic Care Model design have established due to ordinary care practice insufficiency in the management of chronic diseases, Wagner and his team established new way of care for chronic illness [5].

Improved care [in terms of glycemic control, blood pressure, lipid profile, and complication rate] may be achieved at a reduced cost with the Chronic Care Model (CCM) [8,9]. There are six components that make up the CCM: Healthcare institutions have a vital role in securing necessary resources and removing obstacles to patient care. Support for self-management empowers individuals by enhancing their skills and control over their lives. Decision support facilitates the use of evidence-based medicine in healthcare, while system design aims to coordinate patient care effectively. Clinical information systems track progress and provide results to patients and healthcare providers.

Community resources and policies support continuing care through community-based resources and public health policies. [9].

It wasn't until 1997 that Wagner and his colleagues in the United States devised the first model of care, sometimes known as a chronic care model, for people with Type 2 diabetes [10]. In addition, in 2002, large, randomized control studies confirmed the benefits of CCM in diabetes care compared to usual ordinary care; these benefits included a lower total cost for diabetes management, lower HbA1c level, blood pressure, control of lipid profile, and improvement in patient satisfaction, as well as a lower rate of complications like cardiovascular complications, nephropathy, and retinopathy [11].

Many systematic reviews, meta-analyses, and randomized controlled trials (RCTs) have been performed in countries including the United States, Belgium, and China to verify the CCM's purported benefits. Additionally, regional systematic reviews covering places like Europe and South Asia have compiled data from several research. All of this might significantly alter diabetic treatment in the Gulf.

This research aims to investigate how implementing CCM principles may improve the quality of care for people with type 2 diabetes in the primary care setting in the Gulf Cooperation Council (GCC) nations. Our goals are to locate published works about chronic care models and type 2 diabetes treatment in the Gulf States. In addition to verification of the beneficial effects of incorporating CCM features on diabetes management and complication prevention.

Methods

An effective way to map the literature on new or developing subjects and spot gaps is using a scoping review. It might be the first step before starting any kind of study or reviewing process, such a systematic review. Keep in mind that the methodological approach allows teams to go back to

previous phases as the study progresses, and plan out how your research team will execute each step and who will be engaged in each stage before beginning your scoping review [12]. To examine the literature on the components of the chronic care model for diabetes patients in Gulf nations, we used the scoping review approach first outlined by Arksey and O'Malley [13] and modified by Levac, Colquhoun, and O'Brien [14]. To express the scope and depth of a topic of study, researchers in the health sciences often use scoping reviews, a specific sort of review technique [13]. Scoping reviews are especially important in developing fields because they let researchers go on both scholarly and grey literature in order to answer research questions and better grasp the state of the art [14].

To better inform research and decision-making, scoping reviews are being used more often to identify and assess relevant material. Information from any research approach, as well as information from non-research sources like policy, is used in scoping reviews. By providing a more general perspective than standard systematic assessments of efficacy or qualitative evidence, scoping reviews may answer a wider range of review issues. The PRISMA-ScR reporting standard was created in tandem with the rising need for scoping reviews. The JBI Scoping Review Methodology Group first drafted recommendations for scoping reviews in 2014; the document was revised somewhat in 2017 and again in 2020. The changes reflect major and continuing shifts in how scoping reviews are conducted and reported. Because of this, the JBI Scoping Review Methodology Group realized they needed to update the recommendations to reflect the most recent findings and accepted reporting practices in the field of evidence synthesis [15]. We adhered to the PRISMA-SCR guidelines specialized for scoping reviews which were published by JBI (The Joanna Briggs Institute) [16]. The PRISMA-SCR guidelines were developed according to published guidance by the EQUATOR (Enhancing the Quality and Transparency Of health Research) Network for the development of reporting guidelines [17].

The initial stage in any review project should be the formulation of a research topic. The review's manageability and scope will suffer if the question is either too wide or too narrow. If a scoping

review has been done on the issue and if there is enough literature to constitute a scoping review, a preliminary literature search may assist define the scope of the inquiry. whether you're not sure whether a scoping review is the right approach or if there's enough or too much literature, talking to a librarian may assist[12]. In other stages of the scoping review, the authors describe the steps involved in identifying relevant studies, selecting studies to be included in the review, charting the data, and collating, summarizing, and reporting the results. They emphasize the importance of early consultation with a librarian to build a search strategy and refine it based on the papers found. They also highlight the need to read both the title and abstract of papers during the screening process, as well as the importance of defining inclusion and exclusion criteria and developing a data extraction form. The authors mention the need for pilot testing and calibration of the extraction form, as well as conducting numerical and thematic analyses of the extracted data. They discuss the use of codes, categories, and themes in the analysis process, and the importance of reflexivity and memos to capture thoughts and interpretations. The research team is encouraged to engage in discussions to refine codes, clarify definitions, and develop themes[12].

Eligibility criteria

The studies had to have been published after the official commencement of the original CCM (1999) (5), employ one of the CCM components (7), and explain CCM-based treatments to manage and treat diabetes in the settings of the Gulf nations if they were to be included. Research conducted outside the Gulf region, studies that only provided secondary data, and reviews of the relevant literature were all excluded.

Information sources

We searched Medline Central, Embase, Science Direct, Cochrane, and Scopus. In addition, we searched the gray literature, including non-published studies from Research Gate and additional thesis library sources. We searched for articles published between January 1999 and March 2023.

Search

Our research question here is how the chronic care model of diabetes was applied in the Gulf countries. The search strategy used was diabetes AND (chronic care model OR CCM OR health education OR Self-care management practice OR organization of health care OR Decision support) AND (Gulf countries OR Kuwait OR Oman OR Saudi Arabia OR UAE OR Qatar) for the PubMed database.

Selection of sources of evidence

After the search, we screened the obtained abstracts at the first step of selection. Then, we did the full text screening. We refined the articles obtained according to their alignment with the CCM components.

Data charting process

We have made an Excel spreadsheet that has data extraction items. We have piloted this sheet on two studies, which we have completed. This process was done and reviewed again to assure the accuracy of the data.

Data items

Our data items included the author's name and year of publication. State, Part of CCM covered, Number of participants, The mean age of the participants, Study duration, Main outcomes, Baseline characteristics, Results after the follow-up and using questionnaires.

Synthesis of the results

We analyzed the data collected through the spreadsheet and added figures and pie charts through Microsoft illustration to map the CCM components published in various Gulf countries. We went through basic qualitative analysis and descriptive statistics using Excel.

Results

Selection of sources of evidence

We identified 750 studies (Figure 1) through the search process in databases such as PubMed, Cochrane, Embase, and Science Direct. Then, we reviewed them in three steps. First, we screened the abstracts; 35 manuscripts met inclusion criteria, and 715 were excluded because most of them dealt with complications of type 2 diabetes such as nephropathy, retinopathy, and macrovascular complications, while few studies talked about type 1 diabetes or gestational diabetes. Through the gray literature, we got only one study from Research Gate. We then reviewed the full articles; 13 articles were retained because they discussed one of the elements or the sum components of CCM impact on Type 2DM, and 23 were excluded because they were conducted outside the Gulf region, such as regional studies in the Middle East or Asian Countries. Also, a few studies about the CCM related to other chronic diseases like Hypertension and Cardiovascular diseases were excluded. After additional review, we retained only 13 articles for data extraction.

Characteristics of sources of evidence

We had 13 studies which implemented various approaches of CCM. Studies characteristics are shown in table 1. The number of studies done in each country is shown in figure 2. We had four studies done in Kuwait [18–21], One study in Oman [22], two studies in Qatar [23,24], three studies in Saudi Arabia[25–27], three studies in United Arab Emirates (UAE) [28–30].

Results of individual sources of evidence

Each study's scope and aim are listed in Table 2. The main results of each study are shown in Table 3. The sample size and age of participants in each study are shown in Table 4. The total number of participants in all included studies is 4290.

Synthesis of results

The largest number of studies assessing the CCM components were done in Kuwait; however, Oman has done only one study, as shown in figure 2. Two studies on the collaborative chronic care model were done in Gulf countries, one in Qatar and the other in Saudi Arabia, as shown in Figure 3. The UAE had the largest number of participants in its studies, as shown in Figure 4. Most of the studies focused on self-care management practices. Decision support had the least interest, as shown in Figure 5. Six studies used questionnaires to reach their results. Those questionnaires include the Diabetes Self-Management Questionnaire (DSMQ), the Michigan Diabetes Knowledge Scale for T2DM patients, the Short Test of Functional Health Literacy in Adults (STOFHLA), the Assessment of Chronic Illness Care (ACIC), and the Patient Assessment of Chronic Illness Care (PACIC-5A). The distribution of those questionnaires on various CCM components is shown in figure 5. Figure 6 shows a map of the Gulf countries.

Summary of included studies.

After searching Kuwaiti databases, I came across four papers, one of which mentioned Alibrahim's cohort study's emphasis on self-care management, which includes such practices as good food, healthy coping, exercise, medicine, and frequent glucose testing. In a study of 271 people, with a mean age of 56.8, who were diagnosed with type 2 diabetes mellitus (T2DM), the effects of diabetes self-management education (DSME) on HbA1c were evaluated by measuring the change in HbA1c

levels, body mass index (BMI), waist circumference (WC), and blood pressure measurements over the course of 12 months. The participants' baseline HbA1c was 7.6%, and it was reduced to 6.3% after 12 months Hussain at EL in Kuwait conducted two cross-sectional studies on the effects of health education on people with type 2 diabetes: one in 2018 (sample size 359, median age 50) and a follow-up study in 2022 (sample size 353, median age 50) to examine the correlation between health literacy and HbA1c. We found that over 45.5% of T2D patients had poor health education and were linked to an uncontrolled diabetes condition, confirming previous research showing that individuals with low health literacy are more likely to have uncontrolled HbA1c. Alsaeed conducted a qualitative study in order to better understand the relationship between type 2 diabetes remission and TDR from the perspective of dietitians in Kuwait in order to better identify implementation challenges and suggest solutions using a sample size of only 17 T2D patients.

Only one cohort research describing shifts in self-efficacy (SE) and social support (SS) was found in Oman, and it was done by the Algafriis group. Self-efficacy and social support were shown to have a significant influence on raising physical activity in T2DM patients 12 months following the MOVEdiabetes study, an intervention aimed to enhance PA among people with type 2 diabetes mellitus in Oman (sample size: 174, mean age: 44).

A cross-sectional study in Qatar found that 35% of patients achieved target glycemic control, compared to the Behavioral Risk Factor Surveillance System (BRFSS) benchmarks. The study involved 643 patients aged 44-65, and the results were compared to the American Diabetes Association's 2017 guidelines. An additional 27.7% had a HbA1c of 7% to 7.9%. Nearly 30% of patients had inadequate glycemic control, with a HbA1c >9% being recorded in 20.9%. In order to determine CCM's worth in diabetes treatment at a primary healthcare institution, Abdulrhim and colleagues in Qatar conducted cohort research (n=12 healthcare professionals, median age = 47) concerning the model and all its parts. Patients' glycemic control improved when CCM was

implemented, leading to fewer trips to the emergency room owing to "fluctuations in their blood glucose level." However, cross-sectional research by Alodhayan et al. and a cohrot study by Ahyaek et al., both conducted in Saudi Arabia, were shown to have had a substantial influence on the field of self-care management as of 2021. In Saudi Arabia, Hani and his colleagues conducted a large cross-sectional study (237 patients and 27 physicians) to investigate how well diabetes care services align with the CCM's six elements from the perspectives of healthcare providers and people with diabetes. While the results showed apparent high adherence to the CCM, some high scores were for elements that were not included in the study. We ended up with three studies in the UAE. Both the Abuelmageds study (761 participants) and the Adualrahamans study (200 participants) were cross-sectional studies regarding self-care management practice, and both revealed a substantial benefit on glycemic control. The MARJOLIS team published their final UAE-based research, a cohort study, in 2003. The purpose of this study is to evaluate the relative merits of the RIC and the RTC models of primary health care provision for the elderly in the United Arab Emirates. Compared to the RTC (9.5 2.0, p 0.001), the HbA1c was considerably reduced at the RIC (7.7 1.4). Unfortunately, my search did not turn up any recently published studies from Bahrain.

Discussion

To the best of our knowledge, Diabetes is a great challenge to physicians and dietitians in the Gulf countries. Application of the chronic care model has a promising application in the Gulf countries and, our study is the first scoping review in this region. Based on the selected studies, there is a great deal of inconsistency in the distribution of the research between nations (Table 1, figure 2), however, some studies had a greater sample size with powerful results (figure 3). In general, the selected programs encompassed all pillars of CCM almost equitably, with a few providing a focus (figure 4). All components of the chronic care model were represented in Saudi Arabia and the United Arab of Emirates. The most represented item of the Chronic care model (CCM) is the self-care management

practice in all Gulf countries except Oman. In terms of HA1C change [18,26] two studies were successful in achieving change after the application of Self-care management practice by Al-Hayek and Alibrahim. This gives a promising application of this component in diabetes management. No one model can be transplanted directly to a different healthcare system or organization because of fundamental disparities between them. The research was graded in three ways: process-oriented, result-oriented, and comprehensive. Table 2 in the appendices provides a comprehensive display of the parameters. Inadequate data prevented a thorough examination of cost structures and their size since the evaluation studies all focused on the delivery of the care approaches. Future cost-effective and patient-centered care will be a need; hence this point is crucial.

Given the heterogeneity of the current sources and the varying nature of the research framework, it is not feasible to isolate a single model that fits all needs. Current CCM evaluation methods (ACIC minus PACIC) [31] have not been used in all mentioned investigations, rendering them insufficient for a comprehensive evaluation. Only one study assessed the outcome using the PACIC by Hani et al [27]. They concluded that while the surveys revealed high CCM adherence, several high ratings were for features that were not present, indicating that the ACIC and PACIC-5A should be used with care. In other respects, the survey data indicated that CCM was being followed, although not in its "original" form but rather in a way that reflected local customs and values. Because of this, adjusting the CCM to a context/culture and enforcing the CCM as initially described both become significant issues for implementation and its monitoring [27].

Self-care management is regarded as a cornerstone in CMM in type 2 diabetes treatment in primary care settings, with half of studies confirming substantial benefit and good impact. individuals with type 2 diabetes in Saudi Arabia have access to good evidence of self-care management glycemic control thanks to the work of Alodhayani and his colleagues, who performed cross-sectional investigations including 352 individuals [25]. Patients' awareness of the seriousness of their symptoms

and the risk of consequences from T2DM was shown to have a direct correlation with their ability to self-manage their treatment, which in turn had a substantial influence on glycemic control. But there are major takeaways that provide support to both the behaviors and the method for fostering self-care management habits among T2DM patients. The research also points out the need of boosting patients' sense of agency and improving their healthcare providers' participation in self-care management practices. However, results from the questionnaire showed that self-care management roles had the greatest impact on glycemic control, followed by the effect of physical activity, and that gender and marital status also had an effect on glycemic control, with female patients showing greater adherence to management plans and self-care than male patients [25].

Our study strength was that the design of the scoping review depended on searching various databases and screening from more than one author. It is the first scoping review concerning diabetes in the Gulf countries, which included 4290 patients. We searched grey literature to complete our results. Our results are limited by the fact that most of the studies considered in the analysis introduced discrepancies. Differences in CCM implementation and study context make it difficult to draw meaningful conclusions from the few studies that have been chosen. Only in the case of PACIC and ACIC were tangible outcomes determined. There can be no standard evaluation due to the wide variety of medical parameter criteria. While absolute values were employed in some research, in others, dynamic changes in the parameters were observed. The obtained data was challenging to properly categorize in tables. The research also varied widely in terms of sample size and storage capacity.

Conclusion

In conclusion, several studies have shown that the Chronic Care Model is successful in the treatment of type 2 diabetes when all its components are used. Patients with type 2 diabetes may have a major

effect on CCM via self-care management of glycemic control. It is regarded as a cornerstone in primary care for the overall treatment of type 2 diabetes.

Self-care management of type 2 diabetes may be successful depending on the patient's degree of literacy and understanding of the severity of symptoms and consequences. Improving patient and healthcare provider participation and empowering patients are two key components of promoting self-care management among patients with type 2 diabetes.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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References

1. Babazadeh T, Dianatinasab M, Daemi A, Nikbakht HA, Moradi F, Ghaffari-Fam S.

Association of Self-Care Behaviors and Quality of Life among Patients with Type 2 Diabetes Mellitus: Chaldoran County, Iran. *Diabetes Metab J*. 2017;41(6):449-456. doi:10.4093/dmj.2017.41.6.449

2. Association AD. Diagnosis and classification of diabetes mellitus. *Diabetes Care*. 2011;34 Suppl 1(Suppl 1):S62-S69. doi:10.2337/dc11-S062

3. Meo SA, Usmani AM, Qalbani E. Prevalence of type 2 diabetes in the Arab world: impact of GDP and energy consumption. *Eur Rev Med Pharmacol Sci*. 2017;21(6):1303-1312.

4. Gan D. Diabetes atlas. Brussels (BL): International Diabetes Federatio. In: ; 2003.

5. Aljulifi MZ. Prevalence and reasons of increased type 2 diabetes in Gulf Cooperation Council Countries. *Saudi Med J*. 2021;42(5):481-490. doi:10.15537/SMJ.2021.42.5.20200676

6. Aguirre F, Brown A, Cho NH, et al. IDF diabetes atlas. Published online 2013.

7. The Gulf Cooperation Council [GCC] Riyadh, Saudi Arabia between: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE. In: ; 2021.

8. Bongaerts BWC, Müssig K, Wens J, et al. Effectiveness of chronic care models for the management of type 2 diabetes mellitus in Europe: A systematic review and meta-analysis. *BMJ Open*. 2017;7(3). doi:10.1136/bmjopen-2016-013076

9. Bodenheimer T, Wagner EH, Grumbach K. Improving Primary Care for Patients With Chronic Illness. *JAMA*. 2002;288(15):1909. doi:10.1001/jama.288.15.1909

10. de Jonge P, Huyse FJ, Stiefel FC. Case and care complexity in the medically ill. *Med Clin*.

2006;90(4):679-692.

11. Bongaerts BWC, Müssig K, Wens J, et al. Effectiveness of chronic care models for the management of type 2 diabetes mellitus in Europe: a systematic review and meta-analysis. *BMJ Open*. 2017;7:13076. doi:10.1136/bmjopen-2016

12. Mak S, Thomas A. Steps for Conducting a Scoping Review. *J Grad Med Educ*. 2022;14(5):565-567. doi:10.4300/JGME-D-22-00621.1

13. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*. 2005;8(1):19-32. doi:10.1080/1364557032000119616

14. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci*. 2010;5(1):69. doi:10.1186/1748-5908-5-69

15. Peters MDJ, Marnie C, Tricco AC, et al. Updated methodological guidance for the conduct of scoping reviews. *JBI Evid Synth*. 2020;18(10):2119-2126. doi:10.11124/JBIES-20-00167

16. Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med*. 2018;169(7):467-473. doi:10.7326/M18-0850

17. Schultz KF. CONSORT statement: updated guidelines for reporting parallel group randomised trials. *BMC med*. 2010;8:18-27.

18. Alibrahim A, AlRamadhan D, Johny S, Alhashemi M, Alduwaisan H, Al-Hilal M. The effect of structured diabetes self-management education on type 2 diabetes patients attending a Primary Health Center in Kuwait. *Diabetes Res Clin Pract*. 2021;171.

doi:10.1016/j.diabres.2020.108567

19. Alsaeed D, Guess N, Al Ozairi E. Remission of type 2 diabetes: Perspectives of dietitians in Kuwait. *PLoS One*. 2022;17(10):e0276679-e0276679. doi:10.1371/journal.pone.0276679

20. Hussein SH, Almajran A, Albatineh AN. Prevalence of health literacy and its correlates among patients with type II diabetes in Kuwait: A population based study. *Diabetes Res Clin Pract*. 2018;141:118-125. doi:10.1016/j.diabres.2018.04.033

21. Hussein SH, Albatineh AN, Almajran A, Ziyab AH. Association of health literacy and other risk factors with glycemic control among patients with type 2 diabetes in Kuwait: A cross-sectional study. *Prim Care Diabetes*. 2021;15(3):571-577. doi:10.1016/j.pcd.2021.01.011

22. Al-Ghafri TS, Al-Harthi S, Al-Farsi Y, Craigie AM, Bannerman E, Anderson AS. Changes in self-efficacy and social support after an intervention to increase physical activity among adults with type 2 diabetes in oman a 12-month follow-up of the movediabetes trial. *Sultan Qaboos Univ Med J*. 2021;21(1):e42-e49. doi:10.18295/squmj.2021.21.01.006

23. Attal S, Mahmoud MH, Aseel MT, et al. Indicators of Quality of Clinical Care for Type 2 Diabetes Patients in Primary Health Care Centers in Qatar: A Retrospective Analysis. Published online 2019. doi:10.1155/2019/3519093

24. Abdulrhim S, Sankaralingam S, Izham M, et al. Collaborative care model for diabetes in primary care settings in Qatar: a qualitative exploration among healthcare professionals and patients who experienced the service. doi:10.1186/s12913-021-06183-z

25. Alodhayani A, Almutairi KM, Vinluan JM, et al. Association between self-care management practices and glycemic control of patients with type 2 diabetes mellitus in Saud Arabia: A

cross –sectional study. *Saudi J Biol Sci*. 2021;28(4):2460-2465. doi:10.1016/j.sjbs.2021.01.047

26. Al Hayek A, Robert AA, Al Dawish M. Impact of the FreeStyle Libre flash glucose monitoring system on diabetes- self-management practices and glycemic control among patients with type 2 diabetes in Saudi Arabia: A prospective study. *Diabetes Metab Syndr Clin Res Rev*. 2021;15(2):557-563. doi:10.1016/j.dsx.2021.02.027

27. Alghamdi H. Alignment of primary care services for people with type 2 diabetes in Saudi Arabia with the Chronic Care Model (CCM): A mixed methods study. Published online 2022.

28. MARGOLIS SA, CARTER T, DUNN E V, REED RL. Primary health care services for the aged in the United Arab Emirates: A comparison of two models of care. *Asia Pac Fam Med*. 2003;2(2). doi:10.1046/j.1444-1683.2003.00058.x

29. Abdulrahman M, Husain ZSM, Abdouli KA, Kazim MN, Sayed Mahdi Ahmad F, Carrick FR. Association between knowledge, awareness, and practice of patients with type 2 diabetes with socio-economic status, adherence to medication and disease complications. *Diabetes Res Clin Pract*. 2020;163. doi:10.1016/j.diabres.2020.108124

30. Abuelmagd W, Afandi B, Håkonsen H, Khmidi S, Toverud EL. Challenges in the management of Type 2 Diabetes among native women in the United Arab Emirates. *Diabetes Res Clin Pract*. 2018;142:56-62. doi:10.1016/j.diabres.2018.04.018

31. Chmiel C, Giewer I, Frei A, Rosemann T. Four-year long-term follow-up of diabetes patients after implementation of the chronic care model in primary care: a cross-sectional

study. *Swiss Med Wkly*. 2017;147:w14522.

Table discription:

Table 1: Studies Characteristics.

Table 2 Scope and aim of each study.

Table 3: Main Results pre and post the Follow-up.

Table 4: Sample size and mean age of participants

Figure legend:

Figure 1 PRISMA flow diagram

Figure 2: The number of studies done in each country.

Figure 3: The number of studies done in each country.

Figure 4 Distribution of the CCM covered parts in different countries.

Figure 5 'Part of the CCM covered': Self-care management practice accounts for the majority of 'Number of participants'.

Figure 6 Used questionnaire for assessment of different components of the CCM.

Figures

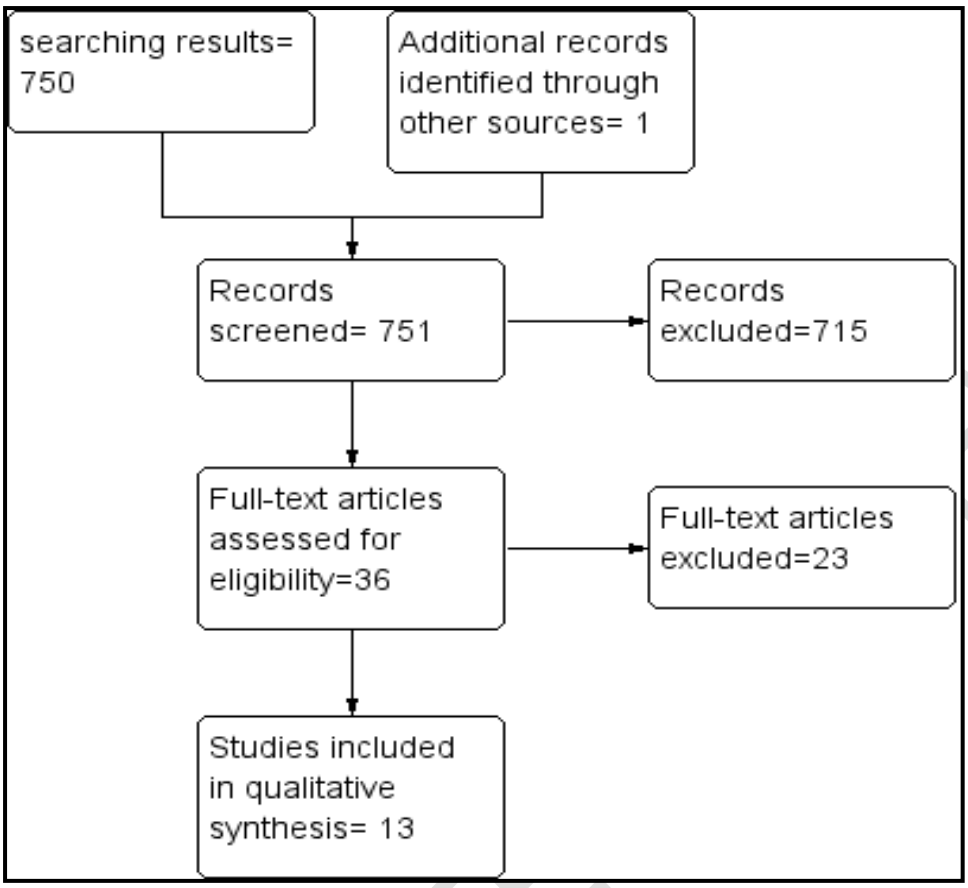

Figure 1 PRISMA flow diagram

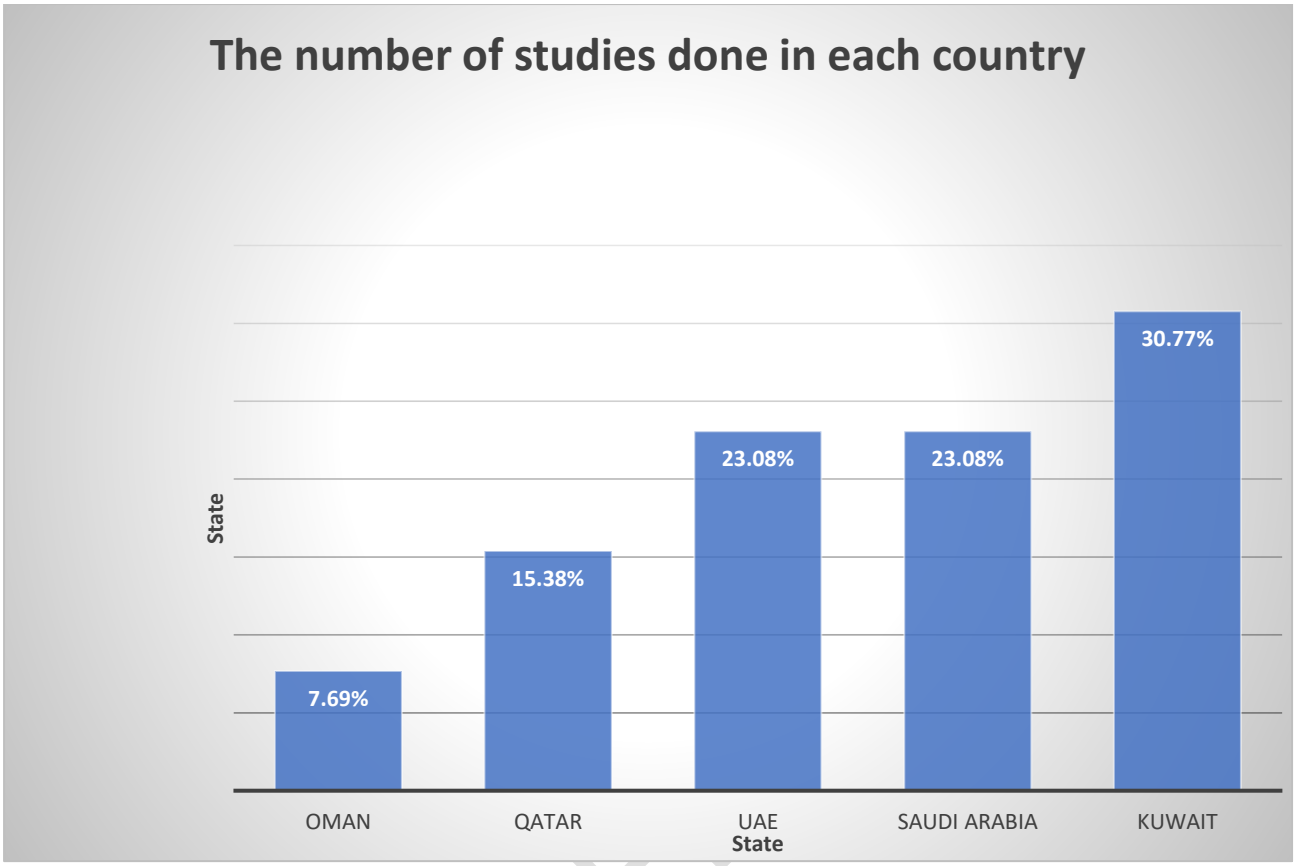

Figure 2: The number of studies done in each country.

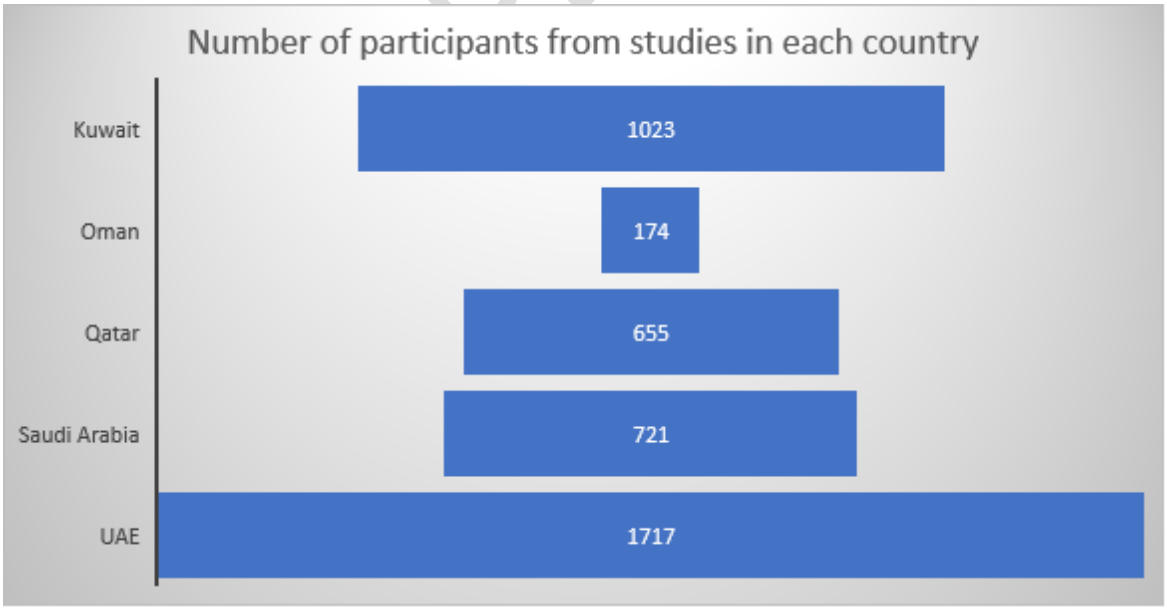

Figure 3: The number of studies done in each country.

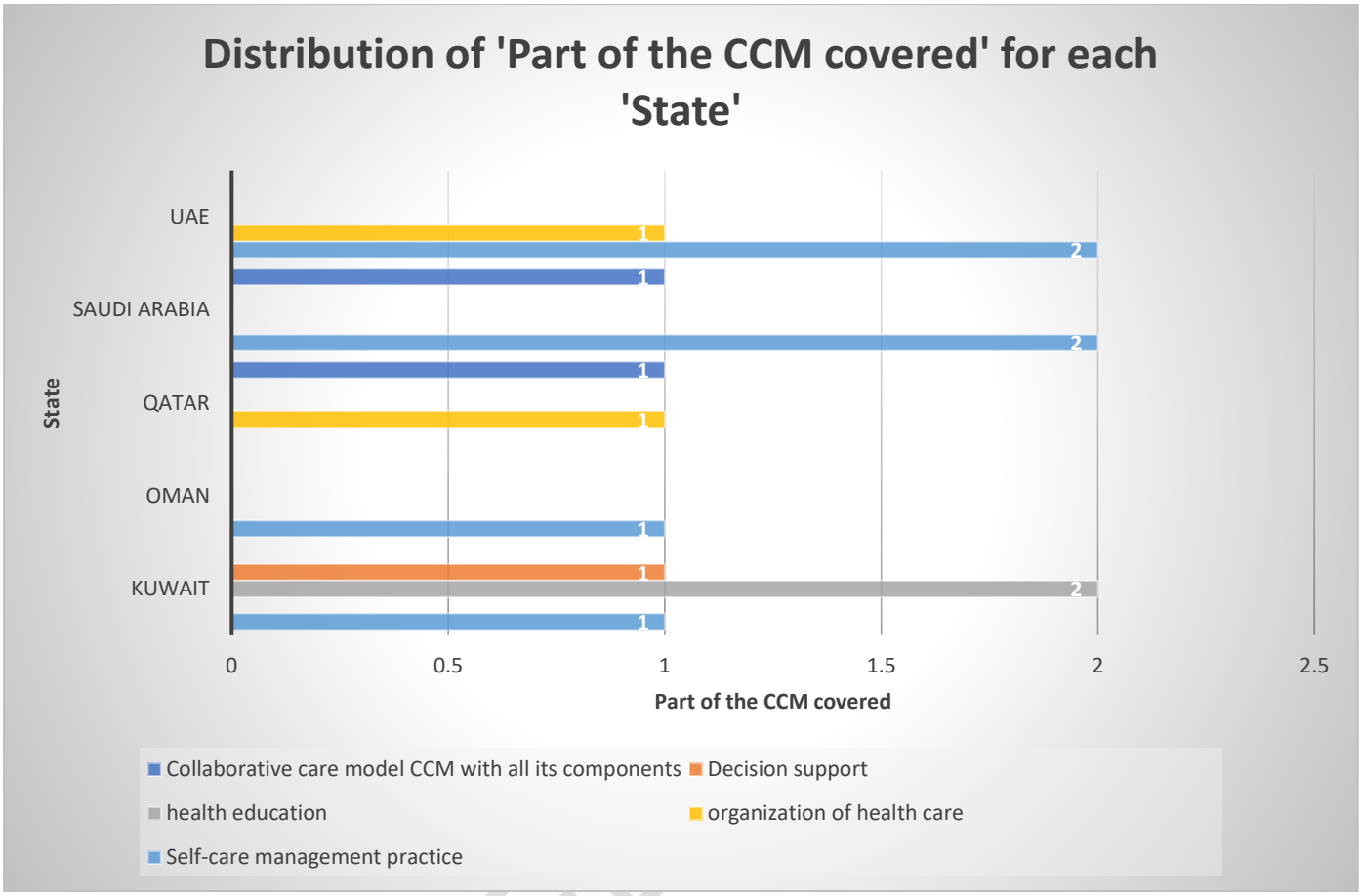

Figure 4 Distribution of the CCM covered parts in different countries.

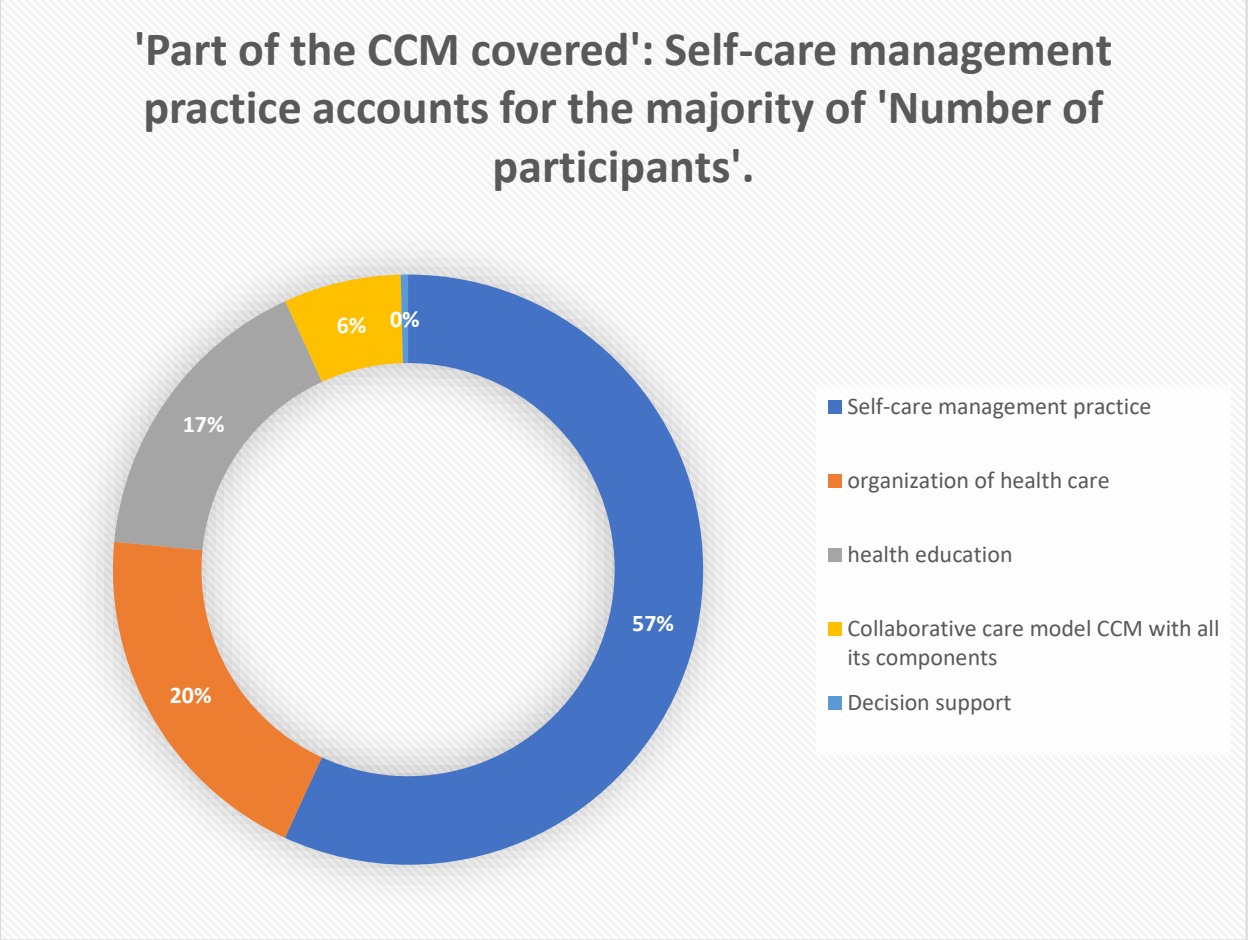

Figure 5 **'Part of the CCM covered': Self-care management practice accounts for the majority of 'Number of participants'.**

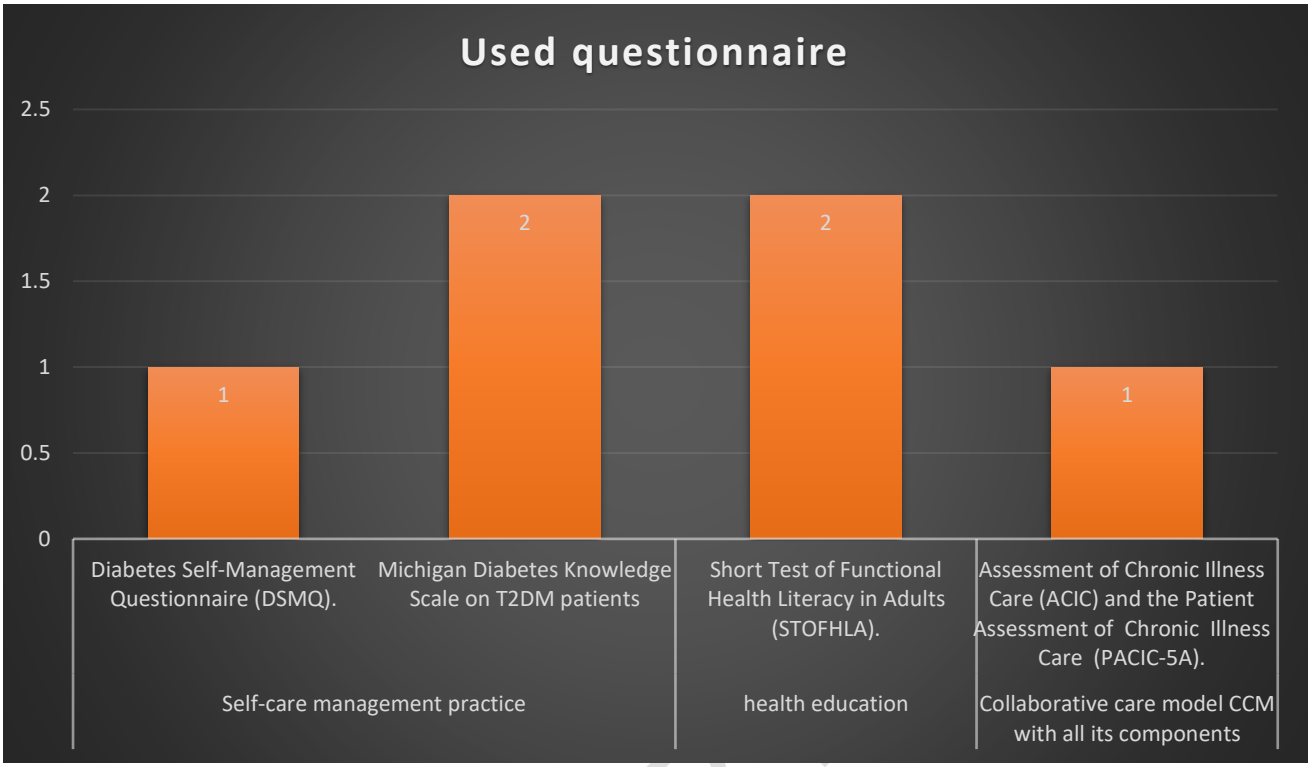

Figure 6 Used questionnaire for assessment of different components of the CCM.

Tables

Table 1: Studies Characteristics

Author / year	Study design	Part of the CCM covered	State
Alibrahim et al 2021	Cohort	Self-care management practice	Kuwait
Alsaeed et al 2022	qualitative design	Decision support	Kuwait
Hussein et al 2018	cross sectional	health education	Kuwait
Hussein et al 2021	cross sectional	health education	Kuwait

Al-Ghafri et al 2021	Cohort	Self-care management practice	Oman
Attal et al 2019	cross sectional	organization of health care	Qatar
Abdulrhim et al 2021	Cohort	Collaborative care model CCM with all its components	Qatar
Abouelmagd et al 2018	cross sectional	Self-care management practice	UAE
Al Hayek et al 2021	Cohort	Self-care management practice	Saudi Arabia
Hani et al 2022	cross sectional	Collaborative care model CCM with all its components	Saudi Arabia
Alodhayani et al 2021	cross sectional	Self-care management practice	Saudi Arabia
MARGOLIS et al 2003	cross sectional	organization of health care	UAE
Abdulrahman et al 2020	cross sectional	Self-care management practice	UAE

Table 2 Scope and aim of each study

Author / year	**Scope and aim**

Alodhayani et al 2021	the association of self-care management practices and glycemic control of type 2 diabetes mellitus
Abouelmagd et al 2018	Overall assessment of T2DM patients on their knowledge, and attitude toward their diabetes
Alibrahim et al 2020	To assess the effects of diabetes self-management education (DSME) on HbA1c in Kuwaiti natives and foreigners with type 2 diabetes mellitus (T2DM) by measuring 12 months change in HbA1c levels, body mass index (BMI), waist circumference (WC), and blood pressure measurements
MARGOLIS et al 2003	To compare the quality of aged care provided by two different models of primary health care services in the United Arab Emirates, resource intensive center (RIC) and the other resource thrifty center (RTC).
Attal et al 2019	The comparison of the results of diabetes clinical indicators, adopted by the Ministry of Public Health in Qatar from the American Diabetes Association (ADA) 2017 guidelines to the reference benchmarks in the Behavioral Risk Factor Surveillance System (BRFSS), which is an annual nationwide telephone surveillance survey published by the Centers of Disease Control and Prevention (CDC).
Alsaeed et al 2022	To explore and understand remission of type 2 diabetes and TDR from the perspectives of dietitians to identify challenges and recommend solutions for implementation in Kuwait.
Al-Ghafri et al 2021	To describe changes in self-efficacy (SE) and social support (SS) 12 months after the MOVEdiabetes trial, an intervention designed to increase physical activity (PA) among adults with type 2 diabetes mellitus in Oman
Abdulrhim et al 2021	to explore the value of CCM in diabetes care at a primary healthcare

Abdulrahman et al 2020	to assess the knowledge, attitude, and practice toward diabetes among T2DM patients in the UAE,
Al Hayek et al 2021	to examine the efficacy of Freestyle Libre Flash Glucose Monitoring System (FGMS) on Diabetes Self-Management Practices (DSMP) and glycemic control among patients with type 2 diabetes (T2D).
Hussein et al 2018	to investigate the association between Health literacy and glycated hemoglobin (HbA1c) among patients with T2DM
Hussein et al 2022	to estimate the prevalence of health literacy among patients with type II diabetes and investigate its association with several covariates
Hani et al 2022	to examine the alignment of diabetes care services with the six elements of the CCM from the perspectives of healthcare providers and people with diabetes.

Table 3: Main Results pre and post the Follow-up

Author / year	**Main results**	**Results after the follow-up**
Alodhayani et al 2021	most of the participants 271 had good glycemic control below 7	-
Abouelmagd et al 2018	poor glycemic control (HbA1c 7) (270, 48%)	-
Alibrahim et al 2020	baseline HbA1c 7.6% (60 mmol/mol)	HbA1c 6.3% (46 mmol/mol)
MARGOLIS et al 2003	The quality of health outcomes for the two chronic diseases, hypertension and diabetes, appeared	The HbA1c was significantly lower at the RIC (7.7 ± 1.4)

	significantly higher at the RIC, when compared with the RTC	than at the RTC (9.5 ± 2.0, $p < 0.001$).
Attal et al 2019	35.5% of patients attained the desired level of glycemic control (HbA1c<7.0%). A further 27.7% had HbA1c between 7.0 and 7.9%. &ere was poor glycemic control in almost 30% of patients, with 20.9% recording HbA1c≥9.0%.	-
Alsaeed et al 2022	Findings have identified dietitians' perspectives on the acceptability of using TDR to achieve diabetes remission in Kuwait. Various challenges were identified and suggestions to tailor approaches to meet patient needs were provided	
Al-Ghafri et al 2021		significant and positive changes were observed in SE and SS
Abdulrhim et al 2021	After the implementation of CCM, patients are having better glycemic control and hence fewer emergency visits due to "fluctuations in their blood glucose level"	
Abdulrahman et al 2020	Overall assessment of T2DM patients on their knowledge, and attitude toward their diabetes were good in the majority of participants (544, 76%; 570, 76% respectively). However, adherence to diabetic self-care practices was fair in the mainstream (437, 57%). The compliance to medication (527, 70%) and eye care practice (475, 63%), were quite high; yet regular checking blood sugar at home 330 (44%) and	

	the foot care practice 336 (45%) were not satisfying.	
Al Hayek et al 2021	baseline HbA1c 8.2%	HbA1c 7.9%
Hussein et al 2018		Half of T2DM with inadequate or marginal HL have uncontrolled HbA1c. 45.27% of patients have inadequate HL of which 36.1% have uncontrolled diabetes; 19.19% have marginal HL of which 14.6% have uncontrolled diabetes; and 35.53% have adequate HL of which 26.9% have uncontrolled diabetes.
Hussein et al 2022		In this study, 45.5% T2D patients have inadequate HL, 19% have marginal HL and 35.5% have adequate HL

Hani et al 2022	the surveys showed apparent high adherence to the CCM, some high scores were for elements that were not actually present, suggesting that the ACIC and PACIC-5A need to be used with caution. In other elements, the adherence reported in the survey was not to the “original” CCM, but to a locally and culturally modified version of it. This creates an important issue for implementation and its measurement between adapting the CCM to a context/culture and enforcing the CCM as originally specified.

Table 4: Sample size and mean age of participants

Author / year	Number of participants	The mean age of the participants
Alodhayani et al 2021	352	51.89
Abouelmagd et al 2018	761	aged above 60 years (413, 55%)
Alibrahim et al 2020	291	56.8
MARGOLIS et al 2003	200	72.7
Attal et al 2019	643	The majority (71.7%) of patients were aged 40–64 years
Alsaeed et al 2022	17 diettitions	
Al-Ghafri et al 2021	174	The mean age was 44.2 ± 8.1 years
Abdulrhim et al 2021	12 health care providers	47
Abdulrahman et al 2020	756	aged above 60 years (413, 55%)
Al Hayek et al 2021	105	45.1
Hussein et al 2018	356	Median age 50

Hussein et al 2022	359	Median age 50
Hani et al 2022	237 patients and 27 physicians	