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SELF-MANAGEMENT FOR PATIENTS WITH DIABETES MELLITUS BASED ON THE CHRONIC CARE MODEL: A FEASIBILITY ASSESSMENT AT THE KARANTINA PRIMARY HEALTH CARE CENTER

by
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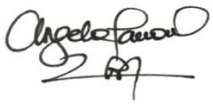

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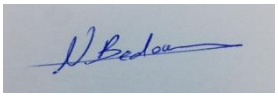

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ABSTRACT

OF THE PROJECT OF

Nanor Michan Bedweyan for Master of Science in Nursing
Major: Community Nursing and Public Health Track

Title: Self-Management for Patients with Diabetes Mellitus Based on the Chronic Care Model: A Feasibility Assessment at the Karantina Primary Health Care Center

Diabetes mellitus (DM) is a complex metabolic disease characterized by chronic elevated blood glucose levels. Globally, the number of patients with diabetes is on the rise. According to the International Diabetes Federation, in 2021, 537 million adults worldwide, aged between 20 and 79 years old, had diabetes compared to 463 million adults back in 2019. There are two major types of DM: T1DM and T2DM. T1DM also known as insulin dependent or juvenile diabetes, is caused by the destruction of the Beta cells of the pancreas and thus no insulin production. On the other hand, T2DM is caused by several pathologic pathways; mainly due to the decrease in the production of insulin and insulin resistance. T2DM constitutes the majority of diabetes cases in the World. As per the World Health Organization (WHO), more than 95% of people with DM have T2DM.

T2DM is a multisystem disease and causes many complications, macrovascular and microvascular. Management of such a complex disease requires both pharmacologic and non-pharmacologic interventions. The primary healthcare delivery system in Lebanon lacks a structured care delivery system for patients with T2DM. A protocol is proposed based on the Chronic Care Model (CCM) of self-management as an evidence-based model. It was developed by Wagner in the United States. In the literature, CCM has shown to improve blood glucose control, prevent serious complications, and improve the quality of life of patients with diabetes. The American Diabetes Association guidelines are utilized as the clinical guide of this protocol. The proposed protocol was later on piloted by the Advanced Public and Community Health Nurse (APCHN) at the Karantina Primary Health Care Center. SWOT analysis done showed the feasibility of applying the CCM for the care of patients with T2DM.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS 1

ABSTRACT 2

ILLUSTRATIONS 6

INTRODUCTION 7

A. Background 7

B. Purpose of this Project 9

LITERATURE REVIEW 11

A. Types of Diabetes, Symptoms and Diagnosis 11

B. T2DM Epidemiology: Global, MENA and Lebanon 11

C. T2DM Pathophysiology 13

D. Risk Factors for T2DM 15

E. T2DM Complications 16

METHODOLOGY 18

RESULTS 20

A. Description of the CCM elements 20

1. Organization of Healthcare 20
2. Decision Support 20
3. Delivery System Design 21
4. Self-management Support 22
5. Clinical Information System 23

6. Community Resources and Policies 23

B. Approaches for Implementing CCM 24

C. Impact of the CCM 25

D. Proposed Protocol 26

1. Organization of Healthcare 26
2. Decision Support 27
3. Delivery System Design 30
4. Self-management Support 33
5. Clinical Information System 33
6. Community Resources and Policies 34

DISCUSSION 35

A. Setting Description 35

B. Target Population 36

C. SWOT Analysis 36

1. Organization of Healthcare 36
2. Decision Support 39
3. Delivery System Design 40
4. Self-management Support 43
5. Clinical Information System 45
6. Community Resources and Policies 46

CONCLUSION 49

APPENDIX I 50

APPENDIX II 51

APPENDIX III 55

REFERENCES 57

ILLUSTRATIONS

Figure

1. ADA Abridged Guidelines.....27

2. Standards of Medical Care in Diabetes- 2021, Abridged for Primary Care Providers.....29

CHAPTER I

INTRODUCTION

A. Background

Diabetes Mellitus (DM) is a common chronic, non-communicable metabolic disease, characterized by chronic elevated levels of blood glucose known as hyperglycemia. DM can occur when an autoimmune condition leads to lack of or inadequate production of insulin, referred to as Type 1 Diabetes Mellitus (T1DM); or when the body is not able to efficiently use the insulin, or Type 2 Diabetes Mellitus (T2DM) (IDF, 2019). T2DM being the most common and accounts for 95% of people with diabetes (WHO, 2021).

A complex combination of modifiable and non-modifiable risk factors interacts with one another leading to T2DM and the associated complications of the disease. The modifiable risk factors include obesity, low physical activity, and unhealthy diet (Galicia-Garcia et al., 2020) (El-Kebbi et al., 2021). Thus, T2DM can be averted or controlled through adequate self-management of lifestyle practices. The major non-modifiable risk factors include ethnicity and genetic predisposition. Being aware of those risk factors can reduce their complications.

T2DM has serious mortality and multisystem morbidity (Costanian et al., 2014). Uncontrolled blood glucose may damage many organs of the body including the heart, eyes, kidneys, nerves, and vasculature (Galicia-Garcia et al., 2020). It is crucial that patients with diabetes be empowered to self-manage their disease by following

pharmacological and non-pharmacological recommendations to control their blood glucose and avoid complications.

Important elements of self-management include adherence to medications, monitoring of blood sugar levels at home, foot care, managing sick days, eating a healthy diet, and exercising. Empowering patients to self-manage their disease and take responsibility of their health and well-being is an important aspect of the healthcare delivery system.

There are several challenges in our current management of DM in primary health care centers in Lebanon. First, the system is designed to attend for chronic diseases, such as diabetes, as if they are acute diseases. Second, there is more emphasis on pharmacological, i.e. medication adherence, and little emphasis on empowering diabetic patients to self-manage the non-pharmacological recommendations. Third, the healthcare system is unable to integrate multidisciplinary collaborative interventions of other healthcare professionals, such as nutritionist, podiatrist, etc… Fourth, the system lacks lifestyle counselling and health promotion, as well as healthy lifestyle policies or environmental regulations that are supposed to be present to foster a supportive environment for patients with chronic diseases. Thus, the system delivers suboptimal care to patients with diabetes (Zablith at al., 2021).

We observed DM management in one of the primary health care centers in Lebanon, the Karantina primary healthcare center in Beirut. During our rounds, we found that during the patient's visit to the endocrinologist, which lasts about 10 minutes, the following process occurs: the nurse takes vital signs upon arrival and the physician assesses the patient, orders laboratory examinations when needed, and prescribes or renews the

medications. During the visit, the physician would give general instructions about healthy lifestyle behaviors like decreasing consumption of carbohydrates and sugar, exercising, and losing weight. On few occasions, they refer patients to other specialists like an ophthalmologist, nephrologist, cardiologist, dentist, or nutritionist.

The need for a well-organized approach to restructure the healthcare delivery system of patients with T2DM is imperative. In order to address the multilevel challenges for improving self-management, the Chronic Care Model (CCM) by Wagner has been proposed as an evidence-based approach for empowering patients (Kong et al., 2019). The CCM was developed in the 1990s in the United States of America by Ed Wagner (See Appendix A). The aim of the model is to restructure healthcare to yield better patient outcomes through productive interactions between informed and activated patients and a prepared proactive team of healthcare professionals. Informed and activated patients are those patients who are motivated enough to take responsibility of their own health and engage in healthy lifestyle behaviors to self-manage their disease. Thus, CCM targets both the healthcare system and the community. The model improves six interlinked elements of the healthcare system including organization of healthcare, self-management support, decision support, delivery system design, clinical information system, and community resources and policies.

B. Purpose of this Project

The purpose of this project is to propose a protocol for empowering T2DM patient self-management based on the Chronic Care Model in Karantina Primary Healthcare Center

(PHC) in Lebanon and to assess the feasibility of implementing this protocol. There are three objectives to this project:

1. Provide an in-depth description of the CCM model elements, best approaches for implementation, and effectiveness on patient outcomes.
2. Propose an implementation protocol for incorporating the processes of care involved in the delivery of self-management based on the CCM.
3. Discuss the feasibility and identify potential strengths, weaknesses, opportunities, and threats for adopting this plan in the PHC.

CHAPTER II

LITERATURE REVIEW

A. Types of Diabetes, Symptoms and Diagnosis

There are two types of diabetes mellitus: T1DM and T2DM. The former is characterized by the immune system attacking the Beta cells of the pancreas thus no insulin secretion. The latter is an interplay of genes and lifestyle factors that lead to the disease. It is characterized by the progressive decrease of insulin production by the beta cells of the pancreas or insulin resistance (Galicia-Garcia et al., 2020). T2DM constitutes more than 95% of people with diabetes (WHO, 2021). The classic symptoms include polyuria, polydipsia, blurred vision, nocturia and weight loss (ADA, 2020).

Diabetes diagnosis is made upon the presence of the classic symptoms and a random of blood glucose level of equal to or above 200 mg/dL. In patients who are not symptomatic, two tests should be done of the following three to confirm diagnosis: fasting blood glucose of more than 126 mg/dL, A1C of more than 6.5%, plasma glucose level of equal to or more than 200 mg/dL after two hours of ingesting oral glucose (ADA, 2022).

B. T2DM Epidemiology: Global, MENA and Lebanon

The diabetes epidemic is alarmingly on the rise. According to the International Diabetes Federation (IDF), in 2019, 463 million people, aged between 20 and 79 years old, had diabetes worldwide (IDF Diabetes Atlas, 2019). In 2021, IDF has reported

approximately 537 million adults worldwide, aged between 20 and 79 years old, living with diabetes. One in 10 adults had diabetes. These numbers are estimated to reach 643 million by 2030 and 783 million adults by 2045. Three in four adults with diabetes live in low and middle income countries. Diabetes has caused 6.7 million deaths, or 1 every 5 seconds (IDF Diabetes Atlas, 2021).

In Middle East and Northern Africa (MENA) region, the number of people with diabetes has increased significantly, from 54.8 million in 2019, to 73 million in 2021 and estimated to increase to 95 million people by 2030 and 135.7 million by 2045. In 2021, 1 in 6 adults has diabetes in the MENA region, the highest proportion of all IDF regions. Moreover, deaths attributable to diabetes have increased from 418,900 in 2019 to approximately 796,000 deaths in 2021 (IDF Diabetes Atlas, 2019) (IDF Diabetes Atlas, 2021).

Arabic speaking countries have seen a significant rise in T2DM numbers within the past few decades. The rapid economic growth in many of these countries played a crucial role in the development of Western-style fast food, modernization, and access to affordable migrant labor (Badran & Laher, 2012). These have led to significant modifications in dietary and lifestyle behaviors in these countries and thus increase in diabetes prevalence (Badran & Laher, 2012).

According to the IDF, Kuwait and Saudi Arabia, two Arabic speaking countries, have the highest diabetes prevalence percentages in the Middle East in 2021. In Saudi Arabia in 2021, 4,274,000 people, aged between 20 and 79 years old, have diabetes that makes it 1 in 6 adults with a 17.7% prevalence. In Kuwait in 2021, diabetes prevalence in the same age group is 25.5%; 1 in 4 adults (IDF Diabetes Atlas, 2021). In Lebanon, in

2021, 396,000 people, aged between 20 and 79 years old, live with diabetes; 1 in 11 adults. Concluding a diabetes prevalence of 8.9% in this group age in Lebanon (IDF Diabetes Atlas, 2021).

C. T2DM Pathophysiology

There are many hormones that play a role in glucose homeostasis; insulin and glucagon are the two major ones (Padhi, Nayak & Behera, 2020). Beta cells of the pancreas are responsible of insulin production. Insulin is primarily synthesized as pre-proinsulin. This pre-proinsulin should be matured in order to become insulin. Pre-proinsulin goes through conformational modification in the endoplasmic reticulum (ER) to become proinsulin. Later on, proinsulin moves from the ER to the Golgi apparatus, entering immature secretory vesicles and become C peptide and insulin (Galicia-Garcia et al., 2020). Once insulin is matured, it is stored in granules and when glucose concentration in the blood increases, it causes a trigger and thus insulin is released. There are other elements that also trigger insulin release like hormones, amino acids and fats. These Beta cells take in the circulating glucose through glucose transporter 2 (GLUT2), a protein carrier, in order to achieve glucose homeostasis (Galicia-Garcia et al., 2020). Then glucose catabolism starts in the cell, thus increasing ATP/ADP ratio intracellularly. There are other factors that play a role in altering Beta cell function and release of insulin like Cyclic AMP (cAMP) and extracellular ATP (Galicia-Garcia et al., 2020).

Diabetes is mainly caused by the combination of two main factors; deficient insulin production by the Beta cells due to Beta cell dysfunction and inability of cells that are sensitive to insulin to respond efficiently to insulin and this is known as insulin resistance

(IR). Beta cell dysfunction was traditionally associated with cell death. However, recent evidence has revealed that there are complex interactions between the environment and molecular pathways that lead to Beta cell dysfunction. Obesity, hyperlipidemia, and hyperglycemia cause excessive nutritional state that exert toxic pressure such as inflammation, inflammatory stress, metabolic stress and amyloid stress (Christensen & Gannon, 2019, as cited in Galicia-Garcia et al., 2020). Such pathogenic conditions disrupt the integrity or organization of the Beta cells leading to poor communication between its cells and as a result lead to poor release of insulin and glucagon. When these faulty mechanisms occur, insulin does not meet the metabolic needs of the body and imbalance happens and leads to chronic hyperglycemia and thus the pathogenesis of diabetes mellitus (Galicia-Garcia et al., 2020).

The other factor as mentioned earlier that plays a major role in the pathogenicity of diabetes is insulin resistance (IR). IR is defined as the "decrease in metabolic response of insulin-responsive cells to insulin" (Czech, 2017, as cited in Galicia-Garcia et al., 2020). There are three categories of IR; diminished insulin secretion by Beta cells, insulin antagonists in plasma and "impaired insulin response in target tissues" (Pearson et al., 2016, as cited in Galicia-Garcia et al., 2020). The ratio of insulin to glucagon plays a major role in the homeostasis of glucose in the blood. Excessive secretion of catecholamines and glucocorticoids may lead to IR too (Wilcox, 2005, as cited in Galicia-Garcia et al., 2020) (Nussey & Whitehead, 2001 as cited in Galicia-Garcia et al., 2020). As mentioned earlier about mechanism including insulin sensitive target tissues include the skeletal muscle, adipose tissue and the liver (Galicia-Garcia et al., 2020).

D. Risk Factors for T2DM

A complex combination of modifiable and non-modifiable risk factors interact with one another and lead to T2DM. Westernization of dietary habits and change to a more sedentary lifestyle play a major role in the increase in prevalence of T2DM (Khattab et al., 2012, as cited in El-Kebbi et al., 2021). The major non-modifiable risk factors include ethnicity and family history and genetic predisposition. The modifiable risk factors include obesity, low physical activity and unhealthy diet (Galicia-Garcia et al., 2020).

Obesity defined as a body mass index (BMI) of equal to or above 30 kg per m2 (Galicia-Garcia et al., 2020). Zabetian and his colleagues (2013), conducted a systematic review to identify risk factors of diabetes in the Middle East and Northern Africa (MENA) region; they found that obesity has been strongly associated with diabetes making it the most common risk factor of T2DM (Zabetian et al., 2013) (Bellou et al., 2018 as cited in Galicia-Garcia et al., 2020). Unhealthy diets include diets high in calories, saturated fats, simple carbohydrates and low fiber intake (Zabetian et al., 2013). A study done in Lebanon, compared the incidence of metabolic syndrome and hyperglycemia in people who consumed ‘minimally processed’ foods to people who consumed ‘ultra-processed’ foods. ‘Minimally processed’ foods mainly include legumes, vegetables, fruits, bread, cheeses and fats. ‘Ultra-processed’ foods include snacks, fast food, meat, nuts, liquor and sweets (Nasreddine et al., 2018). Another review done in Lebanon, showed that people nowadays are shifting towards ‘atherogenic diet’ characterized by the increased consumption of energy from fat and animal products and decrease in carbohydrates and cereals. This type of diet explains the alarming increase in the obesity prevalence and parallel increase in prevalence of diabetes, hypertension and hyperlipidemia (Nasreddine et al., 2014). Joseph

and his colleagues, assessed the association between physical activity, sedentary lifestyle and incidence of diabetes mellitus in patients without diabetes over a period of 10 years from 2002 to 2012. Results showed that incidence of diabetes was lower in people who reported some physical activity. Sedentary behavior and television watching was higher in people who developed diabetes (Joseph et al., 2016).

E. T2DM Complications

T2DM is a multisystem disease. It is crucial that blood glucose levels are well controlled, since over time hyperglycemia may damage many organs of the body; heart, eyes, kidneys, nerves and vasculature (Galicia-Garcia et al., 2020). The complications can be categorized into two major categories; macrovascular and microvascular complications. Macrovascular complications include coronary artery disease, peripheral vascular disease (PVD) and peripheral artery disease (PAD). Microvascular complications include retinopathy and nephropathy.

T2DM is strongly correlated with cardiovascular disease development (Gast et al., 2012 as cited in Galicia-Garcia et al., 2020). Dyslipidemia (DL) is a common feature of DM characterized by elevated triglycerides, small dense LDLs and decreased HDL. There is no clear pathway that describes the pathophysiology of DL in DM, however, several factors like IR, hyperglycemia, hyperinsulinemia are involved. Diabetic dyslipidemia causes increase in the production of VLDL (Reavan, 2012 as cited in Galicia-Garcia et al., 2020). In the ER milieu, insulin's capacity to inhibit the secretion of VLDL decreases and quantity of HDL particles not only decrease but become dysfunctional. Such an atherogenic lipid profile leads to the development of atherosclerotic cardiovascular disease (Guyton et al.,

2013 as cited in Galicia-Garcia et al., 2020). Similar pathways which caused IR and hyperglycemia cause endothelial dysfunction and lead to other macrovascular complications like PAD and PVD (Galicia-Garcia et al., 2020).

Retinopathy is a common microvascular complication of DM and is a leading cause of vision loss and blindness globally (IDF, 2017). Increased blood glucose levels damage the retina. There are many factors that lead to this complication through altered retinal blood flow, basement membrane thickening and impaired vascular permeability (Duh et al., 2017).

Diabetic nephropathy is characterized by persistent albuminuria and the reduction in glomerular filtration rate in the absence of kidney diseases or urinary tract infections (Muthuppalaniappan, 2015 as cited in Sifuentes-Franco, 2018). There are many factors that lead to the development of diabetic nephropathy; oxidative stress that alters renal hemodynamics (Forbes et al., 2008, as cited in Sifuentes-Franco, 2018) and hyperglycemia that causes tissue and endothelial damage to the kidneys (Sifuentes-Franco, 2018).

CHAPTER III

METHODOLOGY

To address our objectives, we provide the method used for each specific objective.

First objective is to provide an in-depth description of the CCM model principles, elements, approaches for implementation, and effectiveness on patient outcomes.

For this objective, I conducted a narrative review to identify evidence-based studies in the literature discussing the CCM. Its aim is to identify and understand existing research and projects about the Chronic Care Model (CCM), the impact the CCM has on the care of patients with chronic diseases such as T2DM. Moreover, its aim is to identify best approaches for the application of the six elements of the model in the community. This understanding of the different elements of self-management for patients will help us adapt CCM for our own context.

Several databases from the AUB library such as PubMed, ProQuest, UpToDate, CINAHL and Google Scholar were used to identify articles for the literature review using the ancestry approach. The keywords used in the review include; diabetes mellitus type 2, diabetes self-management, chronic care model.

Second objective is to propose an implementation protocol incorporating the processes of care involved in the delivery of self-management based on the CCM and by adopting the guidelines from the American Diabetes Association, “Standards of Medical Care in Diabetes” 2021 as a guide for this project. Those guidelines provide physicians, nurses, healthcare providers and patients worldwide with evidence-based and current

clinical practice recommendations for treatment goals and tools to improve and evaluate quality of care provided to patients with T2DM.

Third objective is to discuss the feasibility of the proposed protocol in Karantina Primary Healthcare Centers (PHC) and to identify potential strengths, weaknesses, opportunities and threats (SWOT) for adopting this protocol. The specific location was chosen because there was an ongoing project addressing chronic diseases. It is worth exploring the elements of the CCM that were addressed or not. To achieve the third objective for this project, I visited the center and used observation and did interviews. Observation was used to assess the process of care of the PHC. Interviews were done with T2DM patients, family medicine resident and other Advanced Public and Community Health Nurse (APCHN) to identify the contextual factors and other factors influencing the implementation of the CCM.

CHAPTER IV

RESULTS

A. Description of the CCM elements

1. Organization of Healthcare

For an organizational change to be successful, it is important that providers at first "buy in" the new system or change. Healthcare providers should acknowledge the importance of investing time in chronic care management. There should be support for changing the flow of care and approaches used in the delivery of care to patients with diabetes. This support can be achieved through hiring staff and providing resources (Piatt et al., 2006).

Piatt and his colleagues suggest that one way to get the buy-in from the organization of the healthcare is that the investigator meets with each one of the providers to determine needs (Piatt et al., 2006). Coordination and communication between different departments or service providers and managers are important elements of organizing the delivery of efficient care. Moreover, the healthcare system should incorporate approaches to ease changes, manage errors and quality problems to deliver a safe and high quality of care to patients (Wagner, 1998).

2. Decision Support

Healthcare professionals used evidence-based guidelines to better manage chronic diseases. Guidelines and protocols must be tailored to the specific population and the input

of these patients is valuable in order to yield guidelines and protocols that are more realistic and achievable.

3. Delivery System Design

Multidisciplinary team is an essential component of designing the delivery system. This starts with choosing members of the multidisciplinary team in the management of the chronic disease and clearly defining the roles of each member of the team.

Some PHCs had a volunteer or recruited a certified diabetic educator (Stroebel et al., 2005). Others held sessions to train healthcare providers about diabetes cases and management and report from chart audits was presented to them with recommended processes as compared to ADA (Piatt et al., 2006).

In a free medical center, in which physicians were volunteers, nurses organized the delivery of care in an efficient way (Stroebel et al., 2005). They focus more on online, by phone or by email consultations in order to utilize physician resources effectively especially for visits that did not require hands-on physician assessment such as medication management or adjustments (Stroebel et al., 2005). In another implemented CCM model in a community center, they dedicated days only for diabetes patients to visit and named these days as “diabetes days”. Organizers thought that this would help healthcare providers be more focused on diabetes on these days. On these assigned days, there was a certified diabetes educator (CDE) on service available for consultation for the providers and to educate patients. Providers were encouraged to refer patients to the CDE (Piatt et al., 2006).

4. Self-management Support

The goal of this element of the CCM is to educate and empower patients to take responsibility for their own care, manage their chronic disease and become proactive individuals to prevent the serious complications of their disease. Goal setting is a crucial element of self-management (Baptista et al., 2016).

At the beginning of every visit, the patient underwent through the 5As of the Behavior Change Model. It is an evidence based behavioral strategy to empower patients with chronic diseases like diabetes to self-manage their disease. The 5As include; assess, advise, agree, assist and arrange (Sturgiss et al., 2022). The first step of the model is about "***assessing***" beliefs, knowledge of the patient and the barriers through asking questions such as; "what do you know about diabetes?", "what are barriers or challenges in managing your chronic disease?", "what is most important to you about self-managing your disease?". Medical records need to capture behavior status of patients by assessing activities such as smoking, exercising and weight management at each patient visit. During the second step, the diabetes nurse "***advises"*** the patient using relevant individualized recommendations. Emphasizing the importance of behavioral change and relating patient symptoms or tests to their behaviors is part of this step. Behavioral change in the form of prescription is given to patients and evidence based guidelines presented to motivate patients. The next step of the model is about "***agreeing"*** with the treatment plan provided. Collaborative goal setting is an important element of this step. Identifying patient's support system and engaging them is helpful for creating a supportive environment and enhancing sustainability. The fourth step is to "***assist***" patients; helping them create strategies to overcome their challenges and barriers such as helping them to evidence-based education,

support groups, counseling session. The last step of the model is "***arranging"*** which is following up on patients to ensure compliance with action plans (Glasgow et al., 2006) (Vallis et al., 2013).

5. Clinical Information System

A chronic disease registry of diabetes patients is important in order to effectively manage and track patients and their outcomes.

The registry was created in a simple way using Microsoft Excel to record demographic and clinical information about patients. Other information as per evidence based guidelines were added to organize data collection and ease appropriate management. Test results that did not meet treatment goals were highlighted. This excel sheet was saved only on one computer with a password on it to restrict access and ensure confidentiality. The registry maintenance was the responsibility of one registered nurse. This helped in pre-visit planning for enrolled patients (Stroebel et al., 2005). Without the availability of computers in healthcare provider offices, this would be kind of challenging to work on (Piatt et al., 2006).

6. Community Resources and Policies

The goal of this element of the CCM is to develop programs that help both patients and improve healthcare policies (Baptista et al., 2016). Partnerships and collaborations between universities and local community leaders for example physicians, clubs were usually done to enhance chronic disease management in the communities (Piatt et al., 2006).

B. Approaches for Implementing CCM

Self-management support is usually provided by a diabetes educator or a nurse trained in the management of diabetes. A certified diabetes educator (CDE) would be available for both patients and providers for consultation for specific “diabetes days”.

Patient education can be individualized but also in groups. Patients can attend sessions on a weekly basis about diabetes self-management and take part of monthly support groups for a period of 1 year (Piatt et al., 2006). CDE works with the patients to establish collaborative goals of self-management and follow-up on patients through phone calls, SMS, emails (Stroebel et al., 2005). Schillinger et al. proposed automated telephone self-management support (ATSM) to patients with diabetes for 9 months. During this period, patients received weekly pre-recorded calls of health educational messages and/or nurse follow up. It usually lasted six to ten minutes. Results showed that patients who received ATSM, had better functional outcomes; reported that diabetes stopped them for doing daily activities, and behavioral outcomes such as foot care, engaged in more physical activity (Schillinger et al., 2009).

An important element in self-management of a chronic disease like diabetes is to identify challenges like depression. One of the studies done in Malawi, South Africa, tested the PHQ-9 tool in two non-communicable diseases (NCD) clinics treating patients with diabetes mellitus type II. The tool was tested against the Structured Clinical Interview for DSM IV (SCID) and revealed 64% sensitivity and 94% specificity in detecting depression cases. Thus, showing it is accurate in identifying the cases and can be used by healthcare workers to screen patients and then refer them for further investigation and diagnosis

(Udedi et al., 2019).

C. Impact of the CCM

The CCM has been adapted in many community centers in different countries with promising results. A pilot study by Piatt and colleagues of the CCM model in an underserved community has shown that A1C values have decreased with a P value of 0.01 compared to the results of groups that only received provider education. Participants in the CCM had improved scores on the Diabetes Knowledge Test and Diabetes Empowerment Scale. This showed that CCM helped achieve better clinical, behavioral and diabetes knowledge outcomes and empowered patients to self-manage their disease (Piatt el al., 2006). Another study adopted the CCM at the Salvation Army Free Clinic in Rochester, Minnesota to determine feasibility and effectiveness. The clinic was a free one with limited resources and delivered care for uninsured population. The study showed that 53% of the participants had reduced HbA1C values by at least 1% at the end of the 22nd month (Stroebel et al., 2005).

In Hangzhou, China, the CCM was adopted in twelve communities of a Community Health Service Center. 300 participants from these twelve communities aged 18 years or older with at least 1 year duration of T2DM were recruited. At the end of the study, primary and secondary outcomes were compared between the intervention CCM group, and the control group, who received the conventional care. Primary outcomes included health behaviors like smoking, drinking, physical activity and eating habit. At the end of 9 months, participants in the intervention group more likely engaged in exercise and followed a light

diet compared to the control group. The intervention group participants had lower waist circumference 83.14 cm to 79.66 cm and lower HbA1c from 7.17% to 6.60%, participants in both groups had lower diastolic blood pressure and fasting blood glucose. Health-related quality of life (HRQoL) assessed by the SF-36 showed improved results in the intervention group (Kong et al., 2019).

In the June of 2010, in Tuscany (Italy), the Regional Health Ministry launched a "Project for proactive health care implementation at community level" based on the CCM model. All six elements of the model were implemented. The Guideline Composite Indicator (GCI), a diabetes care indicator, was utilized that showed, adherence of general practitioners' compliance with the guidelines of care. Results showed 8.1% increase in the GCI indicator scores after the first year, followed by an additional increase of 1.6%. These results show that the CCM model is effective in improving monitoring of the disease, achieving good standards of care and sustainability (Barletta et al., 2017).

D. Proposed Protocol

1. Organization of Healthcare

The first step is to meet with the administration to introduce the model and provide evidence on its effectiveness on improving patient outcomes and reducing the economic burden of diabetes. It is important to identify key implementing partners from the health care team including the Advanced Public and Community Health Nurse (APCHN) as the project coordinator and family medicine physician; other members for referral include dietitian, endocrinologist, ophthalmologist, nephrologist and cardiologist. The APCHN

needs to meet with the team to introduce the model, discuss their engagement in the process and in which capacity, and discuss the flow of care.

2. Decision Support

The APCHN and physician are recommended to use evidence-based practice and guidelines when delivering care to patients. We propose to use the Standards of Medical Care in Diabetes, 2021 from the ADA, a quick guide to remind of the different clinical pathways that T2DM patients need to receive.

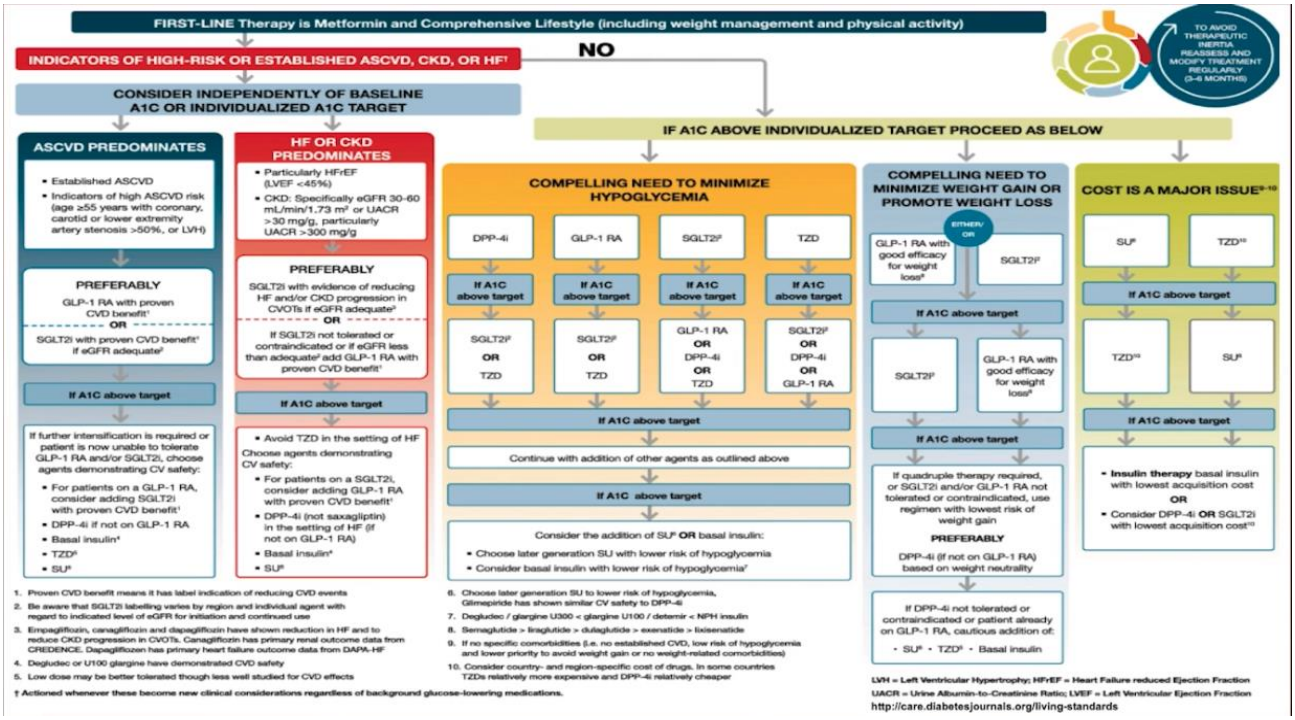


Figure 1 ADA Abridged Guidelines

We highlight here the recommendations by the ADA related to self-management:

- Make sure that treatment decisions are prompt, depend on evidence-based guidelines, and are goals are set collaboratively with patients based on individual prognoses, comorbidities and preferences. (Evidence B)
- Set the approaches to management with the Chronic Care Model. This model stresses person-centered team care, integrates long-term treatment approaches to diabetes and comorbidities, and ensures ongoing collaborative communication and goal setting between all team members. (Evidence A)
- Care systems should ease team-based care and utilization of patient registries, decision support tools, and community collaboration to meet the needs of patients. (Evidence B)
- Assess diabetes health care maintenance using valid and applicable data measurement to improve processes of care and health outcomes, with attention to care costs. (Evidence B)
- Tailor treatment for the social context:
    - Assess food insecurity, housing insecurity, financial limitations, and social capital/social community support and relate information assessed to treatment decisions. (Evidence A)
    - Refer T2DM patients to available local resources in the community. (Evidence B)
    - Refer patients to available self-management support from health coaches and community health workers. (Evidence A)

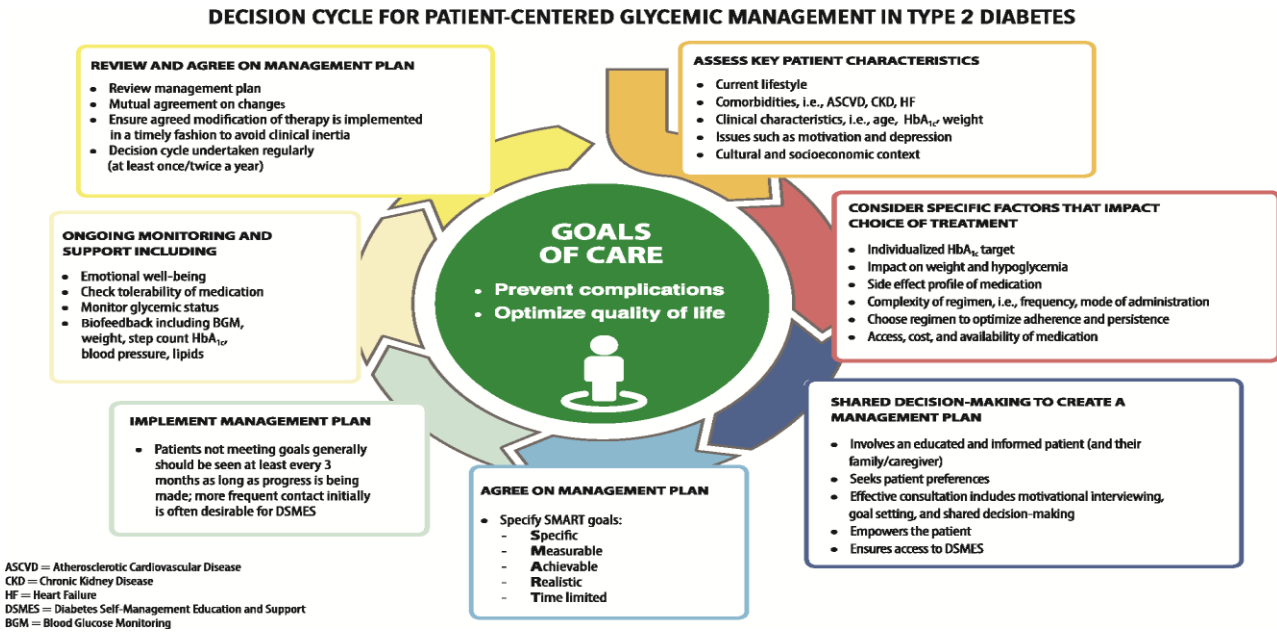


Figure 2 Standards of Medical Care in Diabetes- 2021, Abridged for Primary Care Providers

The guideline discusses self-management behaviors that should be incorporated in the daily life of a T2DM patient; healthy eating, weight management, exercising, hypoglycemia management, self-monitoring of blood glucose, diabetes distress, managing sick days, foot care, medication adherence, frequent laboratory tests and important referrals.

- Medical nutrition therapy discusses healthy eating behaviors and type of food that should be limited.
- Physical activity discusses the importance of T2DM patient's engagement in a minimum of 150min of moderate activity per week with less time spent sedentary. It is crucial that patients with multiple comorbidities consult a physician before any physical activity.

- Hypoglycemia is a serious side-effect of some oral antidiabetic medications and especially insulin. Knowing the signs and symptoms of hypoglycemia and managing it is important aspect of self-management to prevent serious complications.
- Diabetes distress is common in this population. Patients are reminded of stress management techniques and the importance of seeking help from professionals if needed.
- Patients are taught to manage sick days by not skipping their medications.
- Another very important self-care activity for patients with diabetes is to perform daily foot assessment and daily care.
- Due to diabetes affecting many systems of the body, patients are recommended to visit specialists; ophthalmologist, cardiologist, annually.

3. Delivery System Design

Healthcare team members are recommended to work in a multidisciplinary approach.

The roles of the core members of the team need to be well defined in order to organize the care delivery system. The APCHN is responsible for coordinating the project, data entry, self-management support, following up on patients. The family medicine physician is responsible of assessing, diagnosing and prescribing medications to the patient. Team members are recommended to meet during specific intervals and to discuss topics of

diabetes, how diabetes care is being provided, how it impacts their care, how can care be improved and other topics.

Assigning diabetes days to engage both healthcare professionals and patients in diabetes care is recommended. During those days, all involved healthcare team members will be present to attend for the holistic needs of patients.

a. Initial Office Visit

i. History:

- Symptoms (polyuria, polydipsia, etc..), symptoms of chronic complications;
- Behavioral activities: eating habits; physical activity; alcohol/drug abuse
- Psychosocial, cultural, and economic factors that might influence the management of diabetes
- Risk factors for diabetes: smoking, hypertension, dyslipidemia
- Family history of diabetes, cardiovascular disease, cerebrovascular disease, hyperlipidemia
- Gestational history
- Current medications including over-the-counter (OTC) medications, dietary supplements and alternative therapies with a focus on medications known to induce diabetes-type states (e.g. steroids, atypical antipsychotics)

ii. Physical Examination:

- Weight, height, body mass index (BMI), blood pressure
- Cardiovascular system
- Feet
- Other examinations: Neurological symptoms, Mental health

iii. Evaluation: blood tests, urinalysis and spot urine microalbumin

b. Ongoing Care

- Assess glycemic control- frequency and severity of hyperglycemia and hypoglycemia attacks
- Check for complications-targeted history and physical exam
- Check for adherence and lifestyle modifications
- Check for outcome measures- referral to specialist; lab tests; physical exam; frequency of the visits every 3 months until HbA1c is controlled and every 6 months if HbA1c is controlled

c. Interdisciplinary Flow of Care

Before the visit, **the receptionist** will ensure that the laboratory results from the previous visit are readily available.

During the visit, the **APCHN** will check the patient's vitals and ask whether they had any complaints and will ensure that assessment form is filled.

The patient then will visit the **physician** (family physician preferably, if not endocrinologist) for a follow-up visit, laboratory tests or referrals based on the ADA guidelines (ophthalmologist, nutritionist, etc…).

After that, the **APCHN** will meet with the patient again to discuss the after visit summary and proceeds with the self-management education and support.

4. Self-management Support

The APCHN will utilize the 5As of the behavior change model to focus on the following elements:

- The pathophysiology of diabetes mellitus and the psychosocial impact of living with a chronic disease
- Patient's responsibilities for self-care
- Risks for complications of the disease
- Diet and meal planning
- Regular physical activity and exercise
- Medication adherence
- Regular appointments with medical provider(s)
- Advise about symptoms and treatment of hypoglycemia
- Self-monitoring of blood glucose and ketones in urine
- Instruct about insulin injections if on insulin

5. Clinical Information System

Comprehensive evaluation and assessment forms created on Microsoft Word by the APCHN will guide in data collection and assessment during two visits; initial visit (Appendix B) and follow up visit (Appendix C). The forms are developed for guidance, better resource and time utilization. The following data and assessments are collected; demographic data, past medical and family history, lifestyle behaviors (eating pattern, physical activity, sleeping pattern, complications of the disease (microvascular,

macrovascular), medications the patient is currently on and vaccinations, use of technology, self-management skills, physical examination and laboratory tests.

Use of the above data to measure the following outcome measures:

- Percentage of patients attaining pre-set desired outcomes (e.g. with HbA1c < 7%)
- Percentage of patients with HbA1c measured every 6 months.
- Percentage of patients with a lipid profile every 12 months.
- Percentage of patients with microalbumin tested within the last 12 months.
- Percentage of patients with eye examination documented within the last 12 months.
- Percentage of patients with foot examination documented within the last 12 months.
- Percentage of patients without contraindications who regularly use aspirin.
- Percentage of patients with tobacco use documented.
- Percentage of current tobacco users given advice to quit.

6. Community Resources and Policies

Patients will be referred to diabetes resources in the community such as the Ministry of Public Health Website to follow up on their activities regarding T2DM.

CHAPTER V
DISCUSSION

A. Setting Description

The Primary Health Care Center is located in the heart of Beirut City, in Karantina region. It constitutes part of Karantina's governmental hospital. Many patients from the region or outside refer to as their main healthcare center. The PHC of the hospital caters to many nationalities and provides safe, quality, specialized and affordable care.

The PHC center provides services like family medicine, cardiology, nephrology, and endocrinology. Patients at this center also receive specific medications for chronic diseases provided by the Ministry of Health at very affordable costs.

On August 4, 2020, the day the Beirut port exploded, the Karantina's government hospital became out of service including its PHC due to the massive destructions of its premises. On January 2021, it returned to service as a result of the generous donations of international organizations.

On February 2021, a multidisciplinary team from two universities, AUB and Lebanese University, started the chronic disease clinic using the Karantina PHC premises. The team was made of two APCHNs, family medicine residents, one registered nurse, and a faculty from American University of Beirut, Hariri School of Nursing.

The main mission was to provide comprehensive chronic care disease management for eligible residents of Karantina community based on the principles of the CCM.

B. Target Population

For the sake of this project, we will discuss T2DM patients, aged 20 till 79 years old living in Karantina community. Only a small percentage of the population had any form of formal health coverage either National Social Security Fund (NSSF), or governmental coverage or any other types.

C. SWOT Analysis

We conducted strengths, weaknesses, opportunities, and threats (SWOT) analysis to assess feasibility of implementing the proposed protocol in Karantina PHC. SWOT is an effective tool to use for quality improvement and developing strategic plans. The purpose of it is to determine what factors of the protocol were strong and which should be addressed to achieve better outcomes. We address each element of the CCM separately.

1. Organization of Healthcare

a. Strengths

We were able to get the support from the organization to use the premises of the PHC for the chronic disease clinic. We met with the decision-makers at Karantina and informed them about the project.

We also secured the approval by the Chair of the Department of Family Medicine at the Lebanese University to have their residents provide the services.

We were allocated to a clinic and the permission to refer patients to other Karantina services when needed, including access to their electronic medical records.

We were provided with all the essential supplies and equipment needed to run the clinic: datascope, examination table, etc...

b. Weaknesses

We had only one clinic-room, which limited our capacity to accommodate all intended services. Patients were assessed, clinically examined, and then provided self-management support all in one location.

We were moved more than one time from our initial location, which was disrupting patients' flow.

c. Opportunities

We received funds to subsidize consultation fees, nurses' salaries, laboratory and diagnostic tests, referral fees, medications, etc…

Simultaneously, another international non-governmental organization (International Orthodox Christian Charities (IOCC) was providing services for other patients for a subsidized fee. We were occasionally able to refer our patients to them.

Laboratory tests were more affordable than other centers, which allowed us to get more services for less costs.

d. Threats

We faced several challenges with the administration in terms of being able to promote CCM approach for chronic disease patients outside our clinic. The challenge was the lack of staff.

We had limited funds to continue the project. Hence, we had to stop the clinic in December 2021.

Some services, such as psychiatrist or psychologist, were not available on site, hence we were not able to cover them for T2DM patients.

The economic instability in the country was a major barrier for meeting all needed services for patients. We had to ration the services that they would receive.

e. Recommendations

To be able to pursue this endeavor, there is a need to:

- Improve the buy-in from the PHC administration
- Increase the nursing staff at the PHC and involve them in the running of the CCM clinic
- Conduct a one day training to the multidisciplinary team at the PHC to introduce the CCM and get their perspective on how to best adopt this approach
- Secure more funding to sustain the project

2. Decision Support

a. Strengths

The family medicine residents were using the American Society of Family Physician guidelines for treating patients. Hence, their management of T2DM was evidence-based.

The APCHN was also ensuring that patient interventions were based on evidence regarding self-management support. She was trained on the 5As.

b. Weaknesses

There was no written protocol specific to diabetes, nor was it discussed by the health care team prior to starting the clinic.

We were not fully aware of what guidelines other specialists in the clinic were using.

A major caveat was also in the referral. Once patients were referred to a specialist, we were not given any feedback, unless we specifically asked for a report back. We believe that their feedback could help in the delivery of self-management support.

c. Opportunities

The Lebanese Ministry of Public Health (MOPH) has an accreditation system for PHCs with a list of requirements. Such accreditation emphasizes the need to use evidence-based guidelines in the delivery of services, including T2DM.

d. Threats

The economic situation in the country prompted physicians to cut down on certain tests or prescribe medications that are available in the market, not necessarily optimal for the patient. Physicians were obliged to prescribe medications that are available to the public at low costs or are funded by the MOPH.

At the same token, poor salary and increase in the cost of living were major deterrents for excellence at work, but rather providing the minimum necessary.

e. Recommendations

To improve the decision-support system, there is a need to:

- Work as a team to adapt evidence-based guidelines that are feasible and acceptable by the PHC center.
- Display a poster for the guidelines to be visible to all
- Train the staff and engage them in the decision-making to increase the buy-in.

3. Delivery System Design

a. Strengths

Having a one-day clinic for chronic diseases including diabetes was a good way to utilize resources efficiently. The APCHN was hired for that purpose on a part-time basis.

All patients knew that the clinic day is Wednesday and hence they were visiting the center, at times to ask a question only, since they knew we were around.

One of the APCHN working on this project was responsible for identifying patients, scheduling their appointment and reminding them the day before to come to the clinic. She also instructed them to bring all recent tests, prescriptions, and medications they were taking when they come to the clinic, which enabled us to avoid duplication of efforts and to avoid complications due to polypharmacy.

The day of the visit, the second APCHN and the Family Medicine resident, both conducted the assessment, including physical, lifestyle practices, and major complaints of patients. They filled all the documentation and kept a record of them. The APCHN took the vital signs, while the physician did a complete physical assessment. Once done, they discussed together the plan of action.

Thereafter, the APCHN took about 10 minutes at the end of the visit, to address the 5 As. She documented the goal(s) that patients committed to accomplish by the next visit. She also ensured that those who are referred for tests, their fees are paid, and for specialists, their consultations are covered. At the end, the APCHN requested the patients to purchase the medications, if not available at the center and to bring the receipt to be reimbursed.

One week after, the first APCHN called the patient to check on their conditions, the success in getting their goals achieved, and if they managed to secure all their medications, or went for their consultations.

Most patients were scheduled for a follow-up visit. Some had their follow-up in one week if they had pending tests/consultations that need immediate attentions. Others with less urgent needs, were called in a month later.

b. Weaknesses

The person-centered care approach adopted in this clinic limited us from attending for a large number of new patients, as we had to fill-in half of the clinic hours with follow-up visits. However, the benefits of those follow-ups out pass this weakness.

We could have involved other trainees from other professions to assist such as nutrition, psychiatry or psychology. They would be essential in the delivery of self-management to T2DM patients.

c. Opportunities

Most community members were grateful for this person-centered care and expressed their satisfaction with the services they received.

While attending for diabetes, we diagnosed other co-morbidities that needed immediate attention. For example, one of the diabetic patients, we found that he had anemia. Therefore, we referred him to a hematologist for follow-up.

d. Threats

A few of the patients refused to be followed-up out of fear of the diagnosis. For example, refusing to be seen by an oncologist.

e. Recommendations

We believe that the person-centered approach needs to be sustained. Therefore, there is a pressing need to do the following:

- Conduct a study to examine the perspective of both patients and providers about this approach
- Create more opportunities for conducting person-centered approach and disseminate their impact to key stakeholders
- Document the impact of the proposed delivery of care on outcomes, especially, that we are capturing quality indicators for such proposition

4. Self-management Support

a. Strengths

The APCHN is educated and has the skills to empower patients about diabetes self-management. Patients showed interest and enthusiasm about self-management. The interaction between the nurse and the patient was the beginning of an authentic therapeutic relationship. In fact, patients verbalized that they learnt new information regarding their diseases and expressed they are more satisfied after the support.

The family medicine physician emphasized the importance of self-management to the patient and the necessity of taking responsibility of one's health. This helped patients become more interested to know about self-management.

In a very short period of time, some patients adopted healthier lifestyle practices. Some reduced smoking, others became physically active. A few were monitoring their blood glucose closely and documenting them.

b. Weaknesses

Self-management support covered a lot of materials, patients found it overwhelming at times. More time was needed and the information should be spread over more visits. No group education was conducted.

c. Opportunities

The current economic crisis has a silver lining. Fear from complications coupled with less affordability is a cue to action for patients. They embraced the non-pharmacological interventions readily to avoid medications, hospitalizations or any complications from the disease.

d. Threats

There is a lack of self-management culture in our health care services. We lack personnel trained in diabetes self-management. Even if nurses are trained to deliver self-management support to T2DM patients, their number PHC is scarce, and the economic situation of the country prevents from employing new nurses into the center to deliver self-management support to patients.

e. Recommendations

The most important recommendation is to put less emphasis in the clinical encounter on pharmacological intervention, and more emphasis on non-pharmacological. This approach needs to be promoted for all chronic diseases.

5. Clinical Information System

a. Strengths

All patients encounter were documented. This informational continuity enabled us to follow-up the patient care management.

b. Weaknesses

Unfortunately, from the very first visit, we realized that the PHC electronic medical record was not functional. The system was stalling most of the time despite the repeated efforts to use it. The center lacks computers. The paper-based format will lose the purpose of clinical information system and can jeopardize patient's confidential information. Referral reports were not available, unless upon personal request. This is a caveat in the information system that is disrupting the care.

c. Opportunities

The assessment form developed by the APCHN is clear and organized. It took around 10 minutes to complete it. It did not require a complicated system and could be

easily saved on the computer and team members could get back to the initial assessment for the next visit. This helped track the care and self-management support given to patients.

d. Threats

The internet connection in the country is laggy, which makes it harder to send and receive data or even implement an electronic health record.

e. Recommendations

The PHC needs to conduct quality improvement projects. One of the future projects would be advised to be shifting from paper based to an electronic medical record system that can have many benefits on the overall delivery of care to patients.

There also needs emphasis on improving the quality of documentation. Patient records need to be complete, accurate and clear. The data collected needs to be available for all team member involved in the care of patients.

A patient portal system to communicate with beneficiaries is also needed.

6. Community Resources and Policies

a. Strengths

The main strength is the community itself. We had key individuals who were identifying patients in need for diabetes care. We anchored our outreach activity on those individuals.

We used the IOCC as a community resource to support additional services.

We also used other NGOs to secure medications, such as Mubadala.

b. Weaknesses

We may have missed on a certain population groups that were not identified by the key stakeholders.

c. Opportunities

Patients were referred to the MOPH website to follow up on activities and campaigns done by the MOPH for T2DM patients. These activities are free of charge and support patients in the management of their chronic disease. Through the MOPH, patients can be introduced to other centers that deliver care to this specific population funded by the ministry itself.

MOPH has been very supportive for this initiative all along. We are encouraged to approach them to implement similar initiatives in other centers.

d. Threats

The country lacks national policies for healthy lifestyle behaviors such as smoking policy, obesity control etc… Even if there were, the government does not assure their implementation.

e. Recommendations

It is highly recommended that the way forward health care policies be person-centered, self-management supporter.

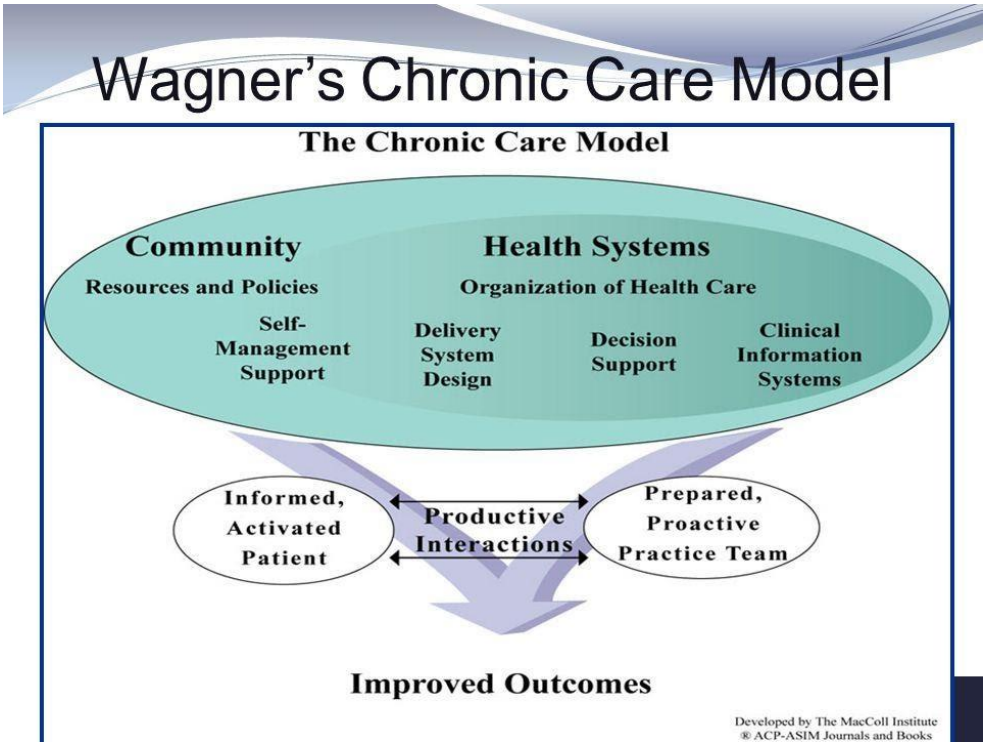
There is a strong need for central strategies focusing on important risk factors affecting chronic diseases including diabetes. Strategy to combat smoking and arguile, poor physical activity, healthy diets, etc…

CHAPTER VI
CONCLUSION

Diabetes is a chronic complex disease which affects many systems of the body causing serious long-term complications. According to the IDF, the number of patients with diabetes is on the rise. In addition to pharmacologic treatment, self-management is crucial in order to limit these complications and improve the quality of life of these patients. The Lebanese healthcare system lacks a structured healthcare delivery system that meets the holistic needs of patients with chronic diseases especially diabetes. The Chronic Care Model by Wagner, developed in the 1990s, is utilized to propose an implementation plan to restructure the delivery of care to T2DM patients in primary healthcare centers. The proposed protocol's feasibility was assessed in Karantina PHC by performing SWOT analysis of each of the elements of the CCM. There were many strengths to this proposed implementation plan. The strengths outweighed the weaknesses. Thus, we conclude that this plan can be implemented in the Karantina PHC and other PHCs in Lebanon. This project opens doors to conduct a study assessing the impact of implementing the CCM in PHCs in Lebanon.

APPENDIX I

CHRONIC CARE MODEL



APPENDIX II

COMPREHENSIVE EVALUATION AND EXAMINATION OF PATIENT WITH DIABETES MELLITUS

FORM A-INITITAL VISIT

I. Demographic Information

Triple Name

Nationality

Date of Birth

Marital Status

Address

Telephone Number

Completed by:

II. Past Medical and Family History

A. Diabetes History

Characteristics at onset

Review of previous treatment plan and response

Past hospitalizations (frequency, cause, severity)

B. Family History

Family history of diabetes in first degree-relative

Family history of autoimmune disorder

C. Personal History of Complications and Common Comorbidities

Macrovascular

Microvascular

Hypoglycemia (frequency, causes, timing, awareness)

Presence of anemia

High blood pressure

Abnormal lipids

Last dental visit

Last dilated eye visit

Visit to specialists (specify)

III. Lifestyle Factors

Eating patterns

Weight history

Physical activity

Sleep behavior

Tobacco use

Alcohol use

IV. Medications and Vaccinations

Current Medications

Daily Medications					
Name	**Dosage**	**Frequency**	**Route (PO,IV,SQ,IM)**	**Timing**	**Intolerance /side effects**

Vaccination

V. Technology Use

Utilization of applications

Online education

Glucose monitoring instrument

Insulin pump settings and use

VI. Self-management Skills

A. Psychosocial Conditions

Screen for depression, anxiety, eating disorder (Refer if needed)

Identify social support

B. Diabetes self-management Education and Support

History of any educational sessions or visits

Assess diabetes self-management skills and barriers

VII. Physical Examination

Height

Weight

BMI

BP

Fundoscopic examination (by ophthalmologist)

Thyroid palpation

Skin examination

Foot examination (skin color, integrity, temperature, sensation, toenails, pulses)

IX. Laboratory Evaluation

HbA1c	Total Cholesterol	LDL	HDL	TG	LFT	Cr	VitB12 *	K**	Urine spot Albumin/ Cr ratio

*If patient on metformin

** If patient on ACE, ARB, diuretic

APPENDIX III

COMPREHENSIVE EVALUATION AND EXAMINATION OF PATIENT WITH DIABETES MELLITUS

FORM B-EVERY FOLLOW-UP VISIT

I .Past Medical and Family History

Personal History of Complications and Common Comorbidities

Visit to specialists (specify)

Changes in medical or family history since last visit

II .Lifestyle Factors

Eating patterns

Weight history

Physical activity

Sleep behavior

III. Medications and Vaccinations

Current Medications

Daily Medications					
Name	**Dosage**	**Frequency**	**Route (PO,IV,SQ,IM)**	**Timing**	**Intolerance /side effects**

IV. Technology Use

Glucose monitoring instrument

Insulin pump settings

V. Self-mangement Skills

Diabetes self-management Education and Support

History of any educational sessions or visits

VI. Physical Examination

Height

Weight

BMI

BP

Skin examination

VII. Laboratory Evaluation

HbA1c (if not available within the last 3 months)

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