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Chronic care model for the management of diabetes mellitus: A systematic review

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Abstract
The population of diabetes mellitus (DM) patients is increasing every year. The Chronic Care Model (CCM) provides an integrated management approach for DM. This study aims to identify the CCM that is suitable for DM management. This systematic review begins by identifying literature from scientific articles published between 2020 and 2024 in international databases, including ScienceDirect, DOAJ, Proquest, Springer, and Pubmed. The selection was conducted using the PRISMA flow diagram and screened with the JBI checklist format tools. Nine relevant articles were identified for analysis in this systematic review, comprising 2 articles from ScienceDirect, 4 articles from Proquest, 2 articles from Springer, and 1 article from Pubmed. The CCM offers programs for healthcare service users, organized healthcare systems, self-management of DM, DM management, DM evaluation, and integrated DM information technology.

Keywords: Chronic, management, diabetes, mellitus, systematic, CCM, DM

Introduction
The population of diabetes mellitus (DM) patients has been increasing every year. Approximately 422 million people suffer from diabetes, the majority of whom live in low- to middle-income countries, with a mortality rate of 1.5 million deaths annually. The number of cases and the prevalence of diabetes have continued to rise dramatically over the past three decades (WHO, 2024).

Diabetes mellitus (DM) is a chronic metabolic disease (Fan, Cui, Ye, Li, & Deng, 2022) [13]. This disease has become a major factor threatening human health today (GAO, WANG, SUN, JI, & Changizi, 2023) [17]. DM is also known as the "silent killer" because high blood glucose levels can lead to various health problems. The manifestation of DM includes poorly controlled blood glucose levels, which can cause various chronic complications, such as retinopathy, nephropathy, neuropathy, and cardiovascular issues like myocardial infarction, stroke, and peripheral artery disease, directly affecting personal safety and quality of life (Lin *et al*., 2022) [25].

The increase in DM cases demands that countries provide access to general and comprehensive primary healthcare services for individuals (Gayatri, 2023) [18]. Chronic non-communicable diseases pose challenges for the healthcare system. The complexity of pathology, management difficulties, and limited participation in care result in the healthcare system seeking new strategies to engage DM patients (Martin-Delgado, Guilabert, & Mira-Solves, 2021) [26]. The management of chronic diseases is mostly carried out in primary healthcare services and needs to be controlled through appropriate management and interventions (Fan *et al*., 2022) [13].

The Chronic Care Model (CCM) provides integrated management and guidelines for DM (Danhieux, Buffel, Remmen, Wouters, & Van Olmen, 2023) [10]. The CCM integrates six key elements to optimize care coordination and treatment, as well as patient information and motivation for those with multimorbidity. The CCM design was developed with the primary goal of improving healthcare systems and assisting individual and population health interventions (Ansari, Harris, Hosseinzadeh, & Zwar, 2022) [4]. CCM also emphasizes patient-centered care, patient empowerment, and self-management support (Ansari *et al*., 2022) [4].

This requires integrated care to reduce patient service fragmentation, improve continuity, and integrate primary and secondary services (Murtagh *et al*., 2021) [29]. The current configuration of healthcare services faces challenges in reorienting the healthcare model to address chronic conditions (Burgos-Esteban *et al*., 2022) [9]. As a chronic disease, DM requires a paradigm shift in treatment and healthcare systems from an acute disease-based approach to one that addresses chronic conditions (Molayaghobi, Abazari, Taleghani, & Iraj, 2022) [28]. The purpose of this systematic review is to determine whether the CCM is suitable for managing diabetes mellitus

Literature Review

Concept of CCM (Chronic Care Model)

The CCM identifies and integrates essential components within the healthcare system that promote the best possible care for chronic diseases (see Figure 1), which was developed in the 1990s. The CCM is an evidence-based approach to reorganizing primary healthcare services, incorporating and implementing key components that enable primary care to provide proactive responses to patients with chronic diseases (Boehmer, Abu Dabrh, Gionfriddo, Erwin, & Montori, 2018) [6].

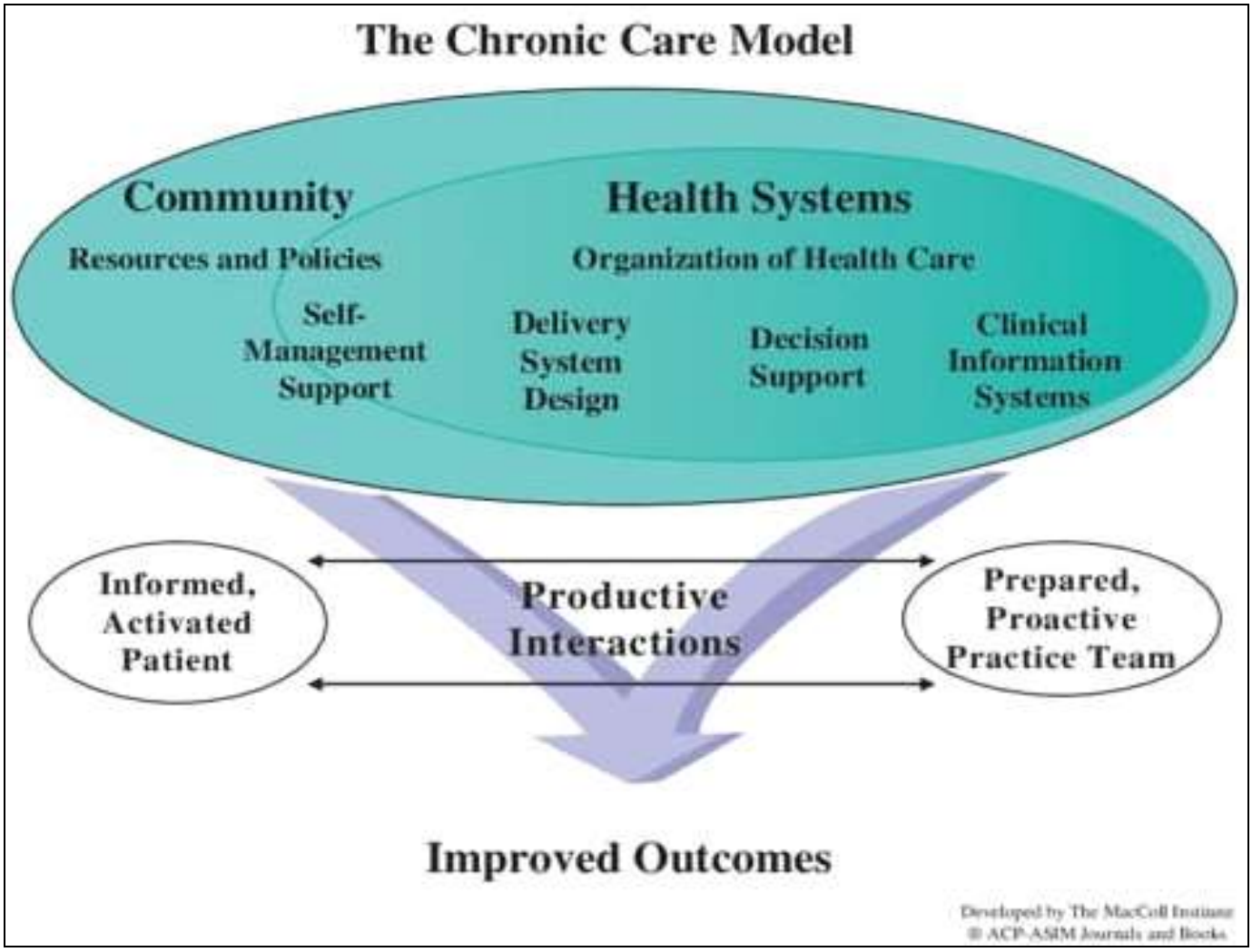

Fig 1: Chronic Care Model adapted by Wagner, EH (1998)

According to Davy *et al*. (2015) [11], several components of the CCM make it a successful model for chronic disease management within primary healthcare systems. In its original form, these components include facilitating patient self-management, implementing patient-centered and evidence-based care, mobilizing and utilizing community resources, effectively utilizing demographic/patient data, promoting qualitative care, providing coordinated services, health promotion, and cultural competence. Six CCM components can be applied to reduce the prevalence of chronic diseases:

Community Resources

Community resources refer to the mobilization and development of community resources and policies. These efforts support healthy lifestyles and the needs of patients, aiming to keep chronically ill patients active within the healthcare system. Patients are encouraged to participate in community programs, and partnerships are formed with community organizations to support necessary interventions and advocate for policies that enhance patient services (Goh, Siah, Tam, Tai, & Young, 2022) [20].

The community resources component involves mobilizing community resources to meet patient needs through community programs and partnerships between healthcare organizations and community organizations (Bodenheimer, Wagner, & Grumbach, 2002) [5]. Community resources are engaged in prevention activities that are essential for developing a holistic and community-centered approach. By leveraging local knowledge, support networks, and outreach

programs, healthcare professionals can enhance preventive actions, increase access to services, and improve overall community well-being. The goal of this component is to create initiatives that benefit patients and enhance healthcare service policies.

Healthcare Organization

The healthcare system aims to create a quality-oriented culture in safe services. Physician leaders are encouraged to support organizational improvements, comprehensive system improvement strategies, open handling of errors, service quality-based incentives, and care coordination agreements within the organization. The goal is to enhance overall service delivery and treatment quality (Goh *et al*., 2022) [20].

Efficient coordination among healthcare professionals ensures a comprehensive approach to managing DM and eye complications (Levengood *et al*., 2019) [24]. Collaborative efforts among multidisciplinary teams optimize resource utilization, contributing to more efficient patient care. In line with public health initiatives, integrated eye care services implement targeted awareness campaigns, fostering a culture of proactive eye health management among individuals with DM. Strong health information exchange mechanisms, standardized protocols, collaboration with insurance systems, workforce development, and the integration of research collectively contribute to a comprehensive strategy that maintains eye health within the broader framework of diabetes treatment (Kamalu *et al*., 2024) [22].

Self-Management Support

Self-management support refers to empowering patients to manage their own healthcare. Patients are encouraged to set goals, identify barriers, and monitor their health conditions. Some various tools and resources assist patients in managing their health by providing visual reminders (Goh *et al*., 2022) [20].

This element serves as a foundational framework for actively empowering individuals (Kamalu *et al*., 2024) [22]. This component also encourages proactive health management through comprehensive education, individualized care plans, collaborative goal setting, and skill development. Building support networks, cultural competence, and collaboration with healthcare providers enhance patient empowerment and foster a sense of ownership (Adams, Greiner, & Corrigan, 2004) [1].

Delivery System Design

Delivery system design refers to effective, efficient care and self-management support in service provision. This element features characteristics such as proactive routine visits, the utilization of diverse team skills, planned interactions, clinical case management services for complex patients, routine follow-ups by the care team, and culturally understood and agreed-upon care by patients (Goh *et al*., 2022) [20]. Systems should be implemented to facilitate smooth transitions between healthcare providers and care settings, ensuring consistent and well-coordinated care, which is particularly important in managing complex conditions such as diabetic retinopathy. The integration of evidence-based guidelines and decision-support tools aids healthcare providers in making informed decisions regarding the diagnosis, treatment, and management of diabetic retinopathy. Utilizing electronic health records and technology enhances communication, secures patient information sharing, and tracks outcomes, ensuring continuity and timely interventions.

Clinical Decision Support (CDS)

Clinical decision support refers to the enhancement of consistent medical services, which should include evidence-based care guidelines and patient preferences. This involves physicians' access to the latest guidelines, continuous education, integration of guidelines into clinical practice, sharing information with patients, effective educational methods, and collaboration between specialists and general practitioners (Goh *et al*., 2022) [20]. Collaborative clinical decision-making through patient understanding and involvement in discussions is crucial for effective care. Healthcare professionals can utilize various tools and guidelines to inform decisions in evidence-based clinical practice provided by organizations (Kamalu *et al*., 2024) [22].

Clinical Information Systems

Clinical decision support refers to organizing data for efficient and effective care, which includes healthcare systems using technology to provide doctors with lists of patients with chronic diseases, timely reminders, identification of relevant subpopulations, facilitation of individual care planning, information sharing, and monitoring of practice team performance and care systems (Goh *et al*., 2022) [20]. This component of the model involves organizing patient data to facilitate efficient and effective vision care. Clinical information systems utilize technology to provide physicians with comprehensive registries of DM patients. Integration enhances coordination among healthcare providers for comprehensive management of diabetic retinopathy (Kamalu *et al*., 2024) [22].

According to Dufour *et al*. (2023), healthcare providers need support to interact optimally with patients, based on the four main components of the CCM:

a. The CCM emphasizes that primary healthcare services should be organized to support self-management, focusing on enhancing the skills of patients and their families so they can effectively manage their conditions.
b. Care and services should be designed to optimize task allocation within the team and offer follow-ups that meet the specific needs of patients with chronic conditions. Optimal follow-up can be achieved through flexibility in appointment scheduling and by facilitating follow-up according to the changing needs of patients. The ability of professionals to conduct such follow-ups depends on strong continuity and existing coordination mechanisms.
c. Emphasizing the need for provider support in delivering services based on best practices. This is achieved using guidelines, ongoing education, access to training, decision support tools, and enhanced interactions with specialists.
d. Clinical information systems must be an integral part of primary healthcare services. These systems can be used to facilitate care planning, information transfer, and provide reminders to professionals, as well as offer continuous feedback on their performance to support their capacity to improve their practices.

Concept of Diabetes Mellitus

Diabetes Mellitus is a group of chronic metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The disease is marked by elevated blood glucose levels, which over time lead to serious damage to the heart, blood vessels, eyes, kidneys, and nerves. The most common type is type 2 diabetes mellitus (T2DM), which typically occurs in adults when the body becomes resistant to insulin or does not produce enough insulin (WHO, 2024).

The classification of DM was initially divided into only two categories: juvenile-onset diabetes mellitus, now referred to as type 1 diabetes mellitus (T1DM), and adult-onset diabetes mellitus, known as type 2 diabetes mellitus (T2DM) (Genuth, Palmer, & Nathan, 2021) [19]. there are three types of diabetes and a prediabetic condition:

a. T1DM happens when the amount of insulin produced by pancreatic cells is insufficient, requiring insulin to be injected from external sources to maintain the body's glucose levels. This type of diabetes typically affects younger age groups.
b. T2DM happens when the body's metabolism is unable to properly digest food, leading to elevated blood sugar levels. Genetics can also be a contributing factor to this type of diabetes. It usually affects older age groups between 45 and 60 years.
c. Gestational diabetes occurs due to hormonal changes and high insulin production during pregnancy, which can trigger diabetes.
d. Prediabetes, also known as borderline diabetes, means that blood sugar levels are high but not yet at the level that can be diagnosed as diabetes.

Methodology

The development of this systematic review involved formulating the research question using the PEO method (P: patients with diabetes mellitus; E: chronic care model; O: management of diabetes mellitus). The resulting research question was: What is the appropriate chronic care model for managing diabetes mellitus? Subsequently, the keywords were determined as management diabetic mellitus AND "chronic care model." The databases chosen for this review included Science Direct, DOAJ, Proquest, Springer, and PubMed. Inclusion and exclusion criteria were also established. The inclusion criteria were the management of diabetic mellitus and the chronic care model (CCM). The exclusion criteria included the cost of DM care, the economic burden of DM, the impact of DM, blood glucose prediction, and DM care plans.

The search process, conducted for the years 2020-2024 using the keywords "diabetic mellitus" AND "chronic care model," yielded the following results: 28 articles from the Science Direct database, 11 articles from the DOAJ database, 204 articles from the Proquest database, 29 articles from the Springer database, and 43 articles from the PubMed database. This process was part of the identification phase through the PRISMA framework. Next, the titles and abstracts of each article were reviewed. The number of articles selected for the next process based on their titles and abstracts were: 6 articles from the Science Direct database, 3 articles from the DOAJ database, 27 articles from the Proquest database, 5 articles from the Springer database, and 19 articles from the PubMed database. This screening process was part of the PRISMA framework. Subsequently, the full texts of the selected articles were downloaded and read to determine their inclusion based on the criteria of management of diabetic mellitus and the chronic care model (CCM). This step, part of the eligibility and inclusion phases of PRISMA, involved analyzing the articles. The Joanna Briggs Institute (JBI) checklist format was used as the tool for the article selection process. After identifying and excluding duplicate articles (2 articles), a total of 9 articles were included in the review.

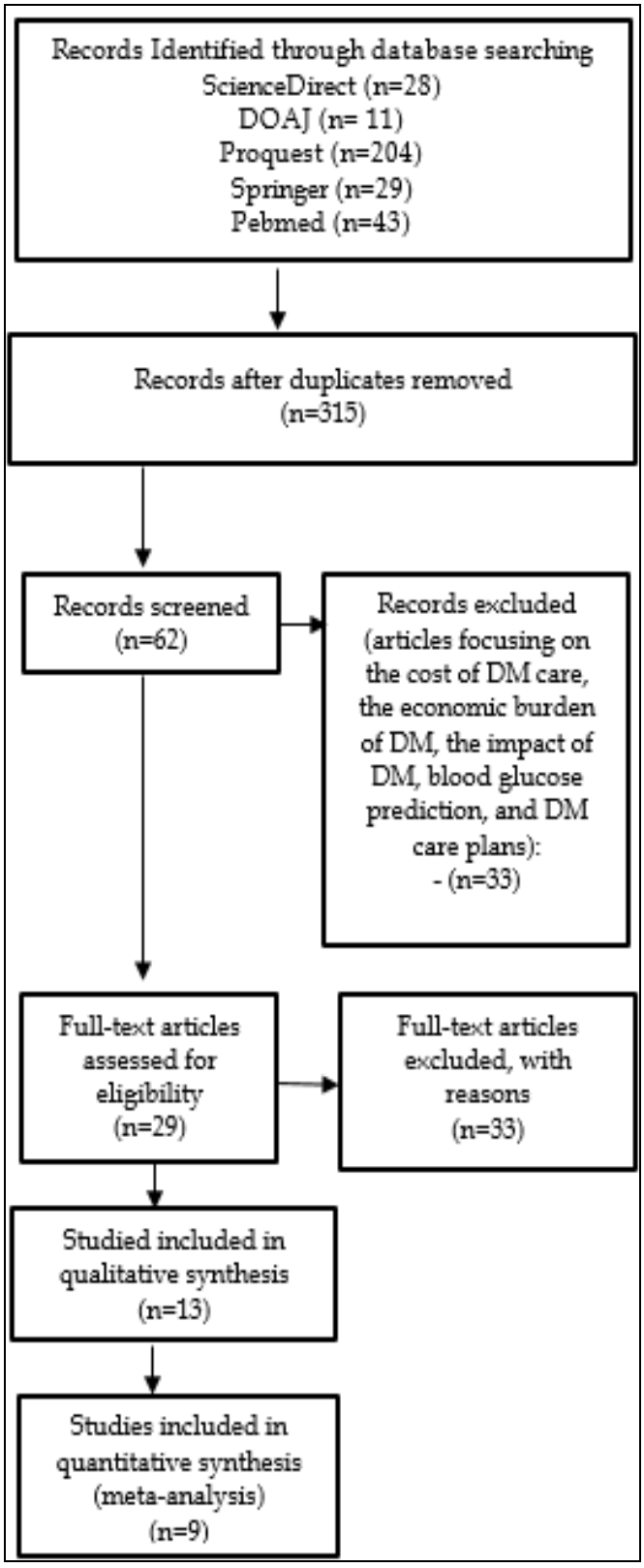

Fig 2: PRISMA Flow Diagram for Literature Identification

Table 1: Summary of Research Findings on CCM Suitable for Diabetes Mellitus Management

Author (Year)	Level (JBI)	Objective	Method	Sample	Intervention	Data Analysis	Research Results
Nittari *et al*. (2023)	3.b	Evaluate the quality & efficiency of telemedicine in managing chronic diabetic ulcers. Provide an overview of the main medico-legal implications of telemedicine management for diabetic foot complications.	Quantitative research method with a cohort study design.	50 T2DM patients registered at the diabetic foot outpatient clinic in Cyprus.	1. Complete demographic data survey. 2. Answer Patient Assessment Chronic Illness Care (PACIC) questions.	Descriptive	Research results indicate: 47% of participants chose "yes" for PACIC statements: 23% preferred video calls, 18% preferred text messages, and 6% preferred email. For telemedicine questions: 9 patients chose remote services due to mobility issues, 9 found it the most convenient and fastest option compared to visiting the outpatient clinic physically, and 7 were attracted to the innovative nature of the practice.
Shao *et al*. (2023)	2.c	Evaluate the impact of non-face-to-face chronic care management (NFFCCM) reimbursement on healthcare utilization among Medicare beneficiaries with T2DM in Louisiana.	Quantitative research method with a quasi-experimental study design.	Using electronic health records from 3 health systems of the Research Action for Health Network in Louisiana.	1. Define the treatment group as patients with at least one NFFCCM record and the first NFFCCM code date as the start date. 2. Randomly assign initiation dates for untreated patients based on the initiation date distribution in the treated population.	Linear Regression	Research results indicate: Increased outpatient visits by 657 per 1000 patients per month, decreased inpatient admissions by 3 per 1000 patients per month, and decreased emergency room visits by 4 per 1000 patients per month after 24 months of follow-up since the initial NFFCCM encounter.
Han *et al*. (2023) [21]	3.b	Compare structured telemedicine-assisted self-monitoring of blood glucose (SMBG) with traditional blood glucose meter (BGM) tools in T2DM.	Quantitative research method with a prospective study design.	136 participants in the intervention group and 101 participants in the control group at Zhongshan Hospital Qingpu Branch, China.	1. Receive a management guide and a blood glucose meter (BGM). 2. Structured monitoring consisting of 6 points.	Chi-squared Test	The research results indicate: 64% of participants in the intervention group and 49% of participants in the control group completed the intervention over 3 months. 31% of participants in the control group and 54% of participants in the intervention group completed the follow-up period of 6 months.
Kopelowicz *et al*. (2023) [23]	1.c	Explore how care for T2DM patients can be more efficiently organized in the Belgian healthcare setting through the diabetes self-management education (DSME) model.	Quantitative research method with a randomized controlled trial design.	2,300 T2DM patients in the Aalst region (Flanders, Belgium).	1. Tomando control. 2. The Tomando control approach (TC) focuses on family. 3. Multigenerational problem-solving group approach.	Generalized Linear Mixed Model (GLMM)	Groups led by RNs did not achieve better outcomes compared to subjects in groups led by promoters.
Lin *et al*. (2022) [25]	**4.b**	Investigate the correlation between sociodemographic characteristics, self-management, and glycated hemoglobin (HbA1c) levels in T2DM patients treated with insulin.	Quantitative research method with a cross-sectional study design.	300 T2DM patients treated with insulin at a medical center in Southern Taiwan.	1. Use a 20-item diabetes self-management scale. 2. Use a 4-point Likert scale to evaluate each item.	Analysis of Variance (ANOVA)	Research results indicate: 60.96% of participants showed that the better the self-management of the study population, the lower the HbA1c levels.
Wongrith,	4.b	Identify predictors of	Quantitative	282 participants	1. Use the Thai version of the Assessment of Chronic Illness	Multiple	Research results indicate:

Author (Year)	Level (JBI)	Objective	Method	Sample	Intervention	Data Analysis	Research Results
Thirarattanasunthon, and Kaewsawat (2021)		diabetes self-management in the family care team's chronic care model. Analyze factors associated with glycemic control.	research method with a cross-sectional study design.	consisting of 16 healthcare providers, 128 healthy volunteers, and 138 T2DM patients at the hospital in Pak Phun City, Thailand.	Care (ACIC) 3.0 (translated from ACIC version 3.5, copyright 2000; MacColl Institute for Healthcare Innovation, Seattle, WA, USA) with 34 items scored on a 1–11-point scale across six perspectives. 2. Use the Patient Assessment of Chronic Illness Care (PACIC) (26-item PACIC+) for T2DM patients regarding the healthcare received for their diabetes over the past 6 months. 3. Use the Diabetes Self-Management Scale (DSMS) with 33 items to assess the aspects VHV helped patients with self-management. 4. Evaluate self-efficacy and social support for diabetes control using a 1–10-point semantic differential scale. Self-efficacy was measured with 13 items regarding the patient's ability to control their diabetes self-management across six aspects, and social support consisted of 11 items.	Linear Regression	76.8% of participants had high self-management levels. 38% of A1C was predicted by self-efficacy, 40.8% by social support, 22.8% by healthcare providers evaluated with the Assessment of Chronic Illness Care (ACIC), and 17% by patient perceptions based on the Patient Assessment of Care for Chronic Conditions.
Alexandre, Vallet, Peytremann-Bridevaux, and Desrichard (2021) [3]	4.b	Identify DSM profiles in a large community-based group of adult diabetes patients.	Quantitative research method with a cross-sectional study design.	316 adult diabetes patients in the Vaud region, Switzerland	1. Self-management behavior of diabetes was measured using four out of six subscales from the Summary of Diabetes Self-Care Activities (SDSCA) questionnaire. 2. Self-efficacy was assessed using the Diabetes Self-Efficacy questionnaire developed by the Sanford Patient Education Research Center. 3. Empowerment was assessed from patients' feelings of empowerment caused by DSM using eight items from the Diabetes Empowerment Scale–Short Form (DES-SF). 4. Stress was assessed from the emotional stress experienced by patients due to disease management using the Problem Areas In Diabetes (PAID-5) instrument. 5. Quality of life was assessed from patients' perceptions of their quality of life using the Audit of Diabetes-Dependent Quality of Life (ADDQoL) questionnaire	Analysis of Variance (ANOVA)	The research results indicate: . 44% of participants demonstrated a good balance between self-reported performance of care activities and psychological adjustment to the disease. 29.4% of participants seemed to be minimally affected by the disease and the stress associated with disease management, with a smaller impact on their quality of life compared to patients with a stress profile. 13.9% of participants highlighted higher levels of self-efficacy and empowerment compared to limited and stressed engagement.
Qi *et al.* (2021) [30]	4.b	Assess the quality of life and disruptive factors in a patient population.	Quantitative research with a cross-sectional design.	571 T2DM patients aged over 60 years from two community clinics in Heilongjiang Province, China.	1. Review and evaluate chronic disease records of T2DM patients. 2. Encourage elderly patients with T2DM to participate in the program after explaining the research objectives. 3. Schedule appointments for participants to complete the questionnaire.	Structural Equation Modeling (SEM)	The research results indicate: 65.32% had normal fasting plasma (FPG). 9.8% had high-risk FPG. 15.94% showed good self-management behavior. 22.07% had glucose-poor social support.
Yao *et al.* (2020)	4.b	Investigate the utilization of community-based diabetes management care services. Identify factors related to the utilization of diabetes management services by patients.	Quantitative research with a cross-sectional design.	63 patients in primary health institutions (PHIs) in Shandong Province, Eastern China.	Utilization of community-based diabetes management care by patients was assessed using self-reports on the EPHS services received, both in terms of content and quantity.	Logistic Regression	The research results indicate: 49.6% of patients reported using diabetes management care services.

Discussion

The Chronic Care Model (CCM) is a framework that provides high-quality care for patients with chronic diseases, improves clinical outcomes, and prioritizes patient-centered care and long-term therapeutic management (Al-Qahtani, 2024) [2]. Therefore, it is an effective way to handle and provide integrated management for non-communicable diseases and has been successfully applied to diabetes mellitus. The model has been developed using the six components of the CCM as a basic concept and has become an effective method for managing patients with chronic conditions, especially those with diabetes mellitus (Boocha & Ploylearmsang, 2022) [7]. The CCM is also used as a foundational idea in designing a plan, assigning responsible individuals, gathering resources, and planning key activities among community networks (Boocha & Ploylearmsang, 2023) [8].

Community resource elements meet patient needs through health service user programs (Bodenheimer *et al*., 2002) [5]. Louisiana reported that non-face-to-face chronic care management (NFFCCM) is used for diabetes care and can be sustained through the integration of modern technology, which can enhance clinical benefits. Thailand indicated that family care teams play a crucial role in reducing diabetes complications. The integration of community resources is essential in preventing diabetic retinopathy with a holistic and community-centered approach. Through partnerships between community organizations, support groups, and educational institutions, diabetic retinopathy prevention strategies can be synchronized with local cultures. This collaboration enhances early detection and care for individuals at risk, promoting participation in preventive actions through program support.

Health organization elements involve transforming disease-centered organized health systems into community-centered integrated health services. Kemajuan dalam infrastruktur teknologi informasi, komunikasi, dan perangkat medis yang terhubung dapat membantu penyedia layanan untuk mengevaluasi, mendiagnosis, dan merawat pasien dari jarak jauh. Cyprus indicated that telemedicine aids in managing chronic patients, such as those with diabetes, by reducing resource burdens and maintaining service quality. However, healthcare workers must be experienced with medical-legal implications. The integration of telehealth expands accessibility, assists remote areas, and facilitates consultations for patients (Gajarawala & Pelkowski, 2021) [16]. Health professionals collaborate efficiently in integrated diabetes care (IDC) programs to manage diabetes and eye complications. Through eHealth platforms, these programs improve patient clinical outcomes compared to usual care in primary health services. Integrating IDC into primary health services can enhance clinical outcomes in countries with similar care (Fang *et al*., 2024) [14].

The main components of the self-management support element include educational initiatives about diabetic retinopathy, the importance of regular eye examinations, easy-to-use blood glucose monitoring tools for active glucose management, nutritional guidance, physical activity, and medication adherence to control diabetes and reduce the risk of complications. Research results by Han *et al*. (2023) [21] in China indicated that structured self-monitoring of blood glucose (SMBG) with telemedicine assistance helps doctors and patients achieve desired glycemic control, minimize hypoglycemia, and is beneficial in managing T2DM. Similarly, research results by Lin *et al*. (2022) [25] in Southern Taiwan found that the lower the HbA1c values, the better the self-management of T2DM patients treated with insulin, using assessment tools to enhance the self-management abilities of T2DM patients. The results of this study are also in line with the statement by Kopelowicz *et al*. (2023) [23] in Belgium that Diabetes Self-Management Education (DSME) helps practitioners choose the optimal approach to enhance diabetes self-management in T2DM patients. According to Alexandre *et al*. (2021) [3], identifying self-management in care that is acceptable according to the chronic care model helps healthcare professionals gain a better understanding of the various realities faced by diabetes patients, and identify patients at risk of poor outcomes related to diabetes self-management (DSM).

The element of delivery system design in the prevention and management of diabetic retinopathy emphasizes the importance of delivery system design. Managing the health of individuals with chronic diabetes requires a shift toward proactive and holistic care centered on individuals and families to enhance well-being (Bodenheimer *et al*., 2002) [5]. Aligning the delivery system with the Chronic Care Model (CCM) can improve the patient-oriented approach to diabetic retinopathy care. Restructuring healthcare services is necessary to create a patient-centered experience, involving collaborative teams of ophthalmologists, endocrinologists, and diabetes educators (Mathur *et al*., 2019) [27]. A study conducted Eastern China highlighted the need to enhance human resources in primary health institutions (PHI) to improve healthcare services. Patient knowledge and self-efficacy also positively affect the acceptance of services. Providing health education and promoting diabetes management can increase service utilization. Community health management strategies, proactive outreach, risk stratification, and interventions are crucial in improving health. Actively empowering patients in eye care means involving them in shared decision-making, goal-setting, and continuous support to enhance self-efficacy in managing diabetic retinopathy (Kamalu *et al*., 2024) [22].

The clinical decision support element has several success factors in its implementation, including program validation, assimilation of evidence and knowledge, user input, cooperation with stakeholders, and program impact evaluation. Research by Alexandre *et al*. (2021) [3] in Switzerland states that continuous efforts are needed to optimize DM care in hospitals and transition care, including designing comprehensive programs to evaluate the impact of clinical decision support (CDS) on DM care and related clinical outcomes. These study results are consistent with research by Qi *et al*. (2021) [30], which mentions that doctors must provide meaningful and individualized support to elderly patients with T2DM in terms of medication, blood glucose monitoring, and exercise. Healthcare service evaluations highlight the importance of empowering doctors through technology platforms to enhance clinical services (Frontoni *et al*., 2020) [15].

The clinical information system element can be linked with information and communication technology to facilitate clinical and professional integration in primary healthcare services for patients with complex care needs. Integrating patient data into electronic health records (EHRs) helps optimize diabetic retinopathy management by providing timely notifications, identifying different subpopulations,

developing personalized care plans, and facilitating information exchange between patients and healthcare providers. This process enhances healthcare coordination and communication among specialists for comprehensive management.

Conclusion and Recommendations

The Chronic Care Model (CCM) provides integrated management in the treatment of diabetes mellitus (DM). This model has been expanded using the six components of CCM as the basic concept, becoming an effective way to manage patients with chronic conditions such as DM. The CCM offers health service user programs, organized health organization systems, self-management of DM, DM management, DM evaluation, and integrated DM information technology.

In healthcare systems worldwide, patient care for chronic diseases has improved through healthcare service innovations. When chronic care is based on the Chronic Care Model (CCM), it becomes a crucial part of the overall strategy to enhance chronic care and can help providers overcome several barriers to change. We must continue to synergize to improve services for patients with chronic conditions so they can live healthier and more productive lives.

Future Research

The results of this systematic review are expected to serve as a reference for future research related to chronic care models for patients with diabetes mellitus (DM). The authors recommend conducting original research on patient satisfaction with DM care or the barriers encountered in managing DM concerning the six elements of the Chronic Care Model (CCM).

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