

How Do Hospitals Organize Diabetes Services? A Comparative Study

Abstract

Most patients with diabetes will present to hospital for a reason not directly related to their diabetes. When a person with diabetes is not cared for properly, hospitalization can become complicated and lead to worse consequences for the patient. In fact, it is important to know how to manage a diabetic patient while in hospital. Therefore, a special organization is needed in hospitals for adaptation to chronic diseases such as diabetes. This study intends to help hospital adaptation to the special needs of diabetic patients by identifying patterns of care delivery in selected countries. This comparative study was performed in 2021. The data collection was conducted by searching in PubMed, Web of Knowledge, Scopus, Science Direct, Springer, Proquest, and also the websites of the selected countries hospitals. Based on the sampling method, three countries, Turkey, United Kingdom, and the United States, were selected from the countries with eligibility. However, during the study, according to the good practices about special diabetic care of countries such as Australia and Denmark, they were also examined. In this review study, we organized and compared the effective measures taken in selected countries in relation to the management of these patients in the hospital, focusing on the dimensions of service package, human resource, process, structure, equipment/technology, and information system required by diabetic patients.

Keywords: Diabetes care, diabetes mellitus, hospital, organization, service delivery

Introduction

Diabetes mellitus is one of the most common international health crises of the 21st century and is one of the top ten deadly diseases.^[1] According to the International Diabetes Federation (IDF) report (2017), approximately 425 million people worldwide have diabetes. Among them, about 8.8% adults are in the age group of 20 to 79 years, and about 79% belong to low- and middle-income countries. If this trend hangs on, about 629 million people are expected to develop diabetes by 2045.^[2] The prevalence of this disease and its complications are increasing unmanageably.^[3] Diabetes is a chronic disease caused by disorders of the body's metabolism of sugar, fat, and protein. The disease usually gets worse over time and may include a wide range of complications that impair the quality of life. For example, people with type 2 diabetes are more likely to develop cardiovascular disease, eye disease, foot and leg ulcers, and kidney disease. Meanwhile, living with diabetes has major psycho-social consequences.^[4] In

addition, having physical effects, diabetes can also have detrimental impacts on mental health.^[5] Therefore, there are countless compelling arguments for trying harder for many patients with diabetes and for a large group of people at risk for diabetes in hospital.^[4] Also, sub-optimal management of diabetic patients may incur serious complications, even death.^[6] Therefore, according to the complex needs of these patients, safety and quality care should be provided in the hospital.^[7] Most people with diabetes go to the hospital for reasons that are not directly related to their diabetes. When care for a person with diabetes is not considered, hospitalization can become complicated, leading to poorer patient outcomes and longer hospital stays. In fact, it is really important to know how to manage a patient's diabetes while in the hospital.^[8]

Because today's world is a world of rapid change and the health care sector, like other active socio-economic sectors in countries, seeks to adapt to these momentary changes, they must be given special attention to adapt to change. What different countries have in common in terms of anticipated or possible future changes is the recognition

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that hospitals need to be reviewed and re-designed. Therefore, a special organization is needed in hospitals for adaptation to chronic diseases such as diabetes. This study intends to help hospital adaptation to the special needs of diabetic patients by identifying patterns of care delivery in selected countries.

Methods

This was a comparative study conducted in 2021. The data collection was conducted by searching valid sources, including PubMed, Web of Knowledge, Scopus, Science Direct, Springer, Proquest, Google Scholar, and also the websites of hospitals in selected countries. This comparative study was performed to identify systems of care delivery to diabetic patients in the hospital. In this study, the purposive sampling method was used, and countries that have been successful in providing services to diabetic patients were surveyed. Therefore, their experiences can be used to improve the health system of Iran. Based on the sampling method, three countries, Turkey, United Kingdom, and the United States, were selected from the countries with eligibility. Turkey is a country similar to and close to Iran (in terms of population, size, culture, and health system); the United Kingdom and the United States were selected as two developed countries that are stylists in providing special services to diabetic patients (according to the initial search), and their information is accessible. However, during the study, because of the good practices of countries such as Australia and Denmark, in the field of special care for diabetic patients, these countries were also examined.

The search was performed using the keywords of diabetes, DM, Diabetes Mellitus, diabetes care, service delivery, diabetic management, hospital, inpatient, model, standard, and organization, with combination with countries' names. The needed data published from 2000 to 2021 were collected. Inclusion criteria for studies were as follows: (1) All articles and reports related to diabetes care in selected countries, (2) articles published between 2000 and 2021, and (3) articles published in English and Persian language. After evaluating the preliminary search results, similar and unrelated articles were removed among 139 research articles and annual reports, and then the inclusion criteria were applied. Finally, 55 articles and reports were selected, and the full texts were studied. The flow chart of the search strategy is in Figure 1. An example of the search strategy using PubMed is as follows: (((((((U.S[Title/Abstract]) OR (U.K[Title/Abstract]) OR (Turkey[Title/Abstract]) OR (Australia[Title/Abstract]) OR (Denmark[Title/Abstract]) OR (united state[Title/Abstract]) OR (united kingdom[Title/Abstract]) AND (((diabetes[Title]) OR (DM[Title])) OR (diabetes mellitus[Title])) AND (((model[Title/Abstract]) OR (standard[Title/Abstract])) OR (oragani*[Title/Abstract])) AND (((care[Title/Abstract]) OR (service[Title/Abstract]))

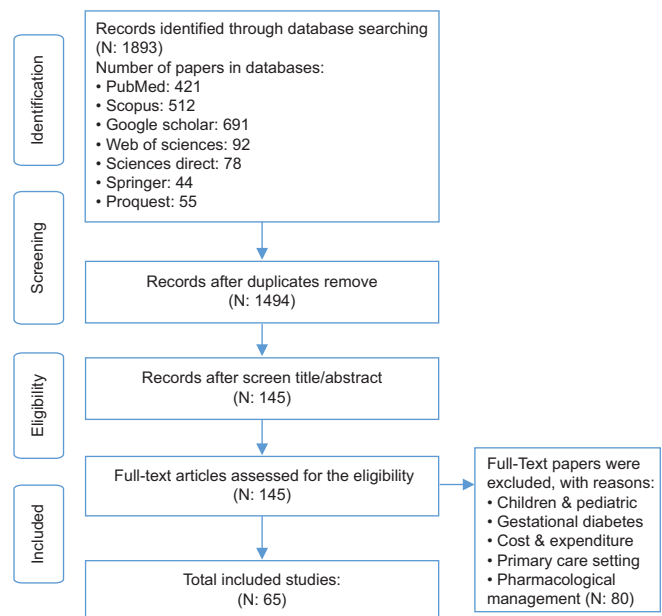


Figure 1: Flow diagram of our review process

OR (management[Title/Abstract])) Filters: from 2000 to 2021.

Based on the literature review and also the opinions of the research team, the studied variables and data extraction form were designed. The model used in this study was Bereday and Hilker model. It includes four stages of description, interpretation, proximity, and comparison. According to the model, in the first place, the factors affecting the systems of care delivery to diabetic patients in the hospital in selected countries were collected, and the various components considered in this study were identified, reviewed, and analyzed.

Stages and features of the Bereday and Hilker model:

1. Description of the subject based on the available evidence and information and noting them in order to collect data for reviewing in the next stage
2. Interpretation and review of the data obtained from the description stage
3. Adjacent classification of the data obtained from the two stages of description and interpretation and creating a framework to show the points of commonality and difference in the comparison stage
4. Comparison of the research problem by considering the points of commonality and differentiation and answering the research questions

These variables included the dimensions of service package, human resource, process, structure, equipment/technology, and information system required by diabetic patients. Structure dimension in this study refers to the organization chart in the diabetes department, such as creating a special unit or department in providing care better. The information about each country was then arranged classified based on the components of the analysis (six dimensions mentioned).

The similarities and differences of each element of systems between all studied countries were determined and compared.

In addition to studying the articles, the management of diabetic patients in hospital web pages of selected countries was also examined.

Results

In this comparative study, the extracted data were classified according to the analysis components and then were organized as comparative tables. First, we report the general profile of the selected countries in relation to diabetic patients in Table 1, Also, the number of articles and hospitals studied by each country is given in Table 2.

As shown in Table 1, USA, with a diabetic patient population of about 34.2 million, and Denmark, with a population of 372,000, had the highest and lowest diabetic patient populations, respectively.

Actions taken in selected countries in relation to dimensions such as service package, human resource, process, structure, equipment/technology, and information system and comparison of the summary of the results in the form of a comparison table are presented in Table 3.

Human Resource

The 2006 Diabetes Roundtable noted that the growing prevalence of type 2 diabetes requires creative and participatory management models that maximize patient support and use a multi-disciplinary team to optimize management. The key function of a multi-disciplinary team is to provide ongoing and accessible care focusing on the needs of people with diabetes.^[9] All hospitals should have a specialized diabetes team to support diabetic patients and their caregivers. The input of the diabetes specialist team is essential to ensure the safe and effective management of diabetics during their hospital stay. The role of the hospitalized diabetes team also varies depending on the size of the team.^[10] A multi-disciplinary team approach is used to provide better care compared to individual patient–physician care. It can meet the needs of patients by making the best use of resources. When it is implemented properly, this team approach produces positive measurable consequences.^[11-15]

Table 1: General profile of selected countries (2020)

Country	US	UK	Turkey	Australia	Denmark
Number of diabetic patients	34200000	4900000	6500000	1800000	372000

Table 2: Number of articles and Hospitals

	US	UK	Turkey	Australia	Denmark
Number of articles	19	18	8	10	10
Number of hospitals*	10	12	11	5	5

*Names of hospitals in selected countries are in Appendix 1

In the field of manpower, the use of the “multidisciplinary team” of diabetes was mentioned in all the studied documents, especially in the United States. Findings show that the composition of this team varies from country to country. This team consists of at least a doctor, a nurse who specializes in diabetes, an endocrinologist, an internal medicine specialist, a nutritionist, a pediatric diabetes specialist, and a clinical psychologist. In addition, pharmacist consultants on diabetes in the UK and the US, diabetes educators in the United States and Australia and social workers, pediatric nurses specializing in diabetes at Mayo clinic and New York University Hospital in the United States, specialist teams for diabetic foot in Turkey and UK, use of an ophthalmologist and care manager in Denmark, and general surgeons in Turkey were among the specialties employed in this team. The diabetic foot team includes physiotherapists, wound care nurses, and physicians from the departments of orthopedics, infectious diseases, plastic surgery, interventional radiology, and cardiovascular surgery. Hospitals focusing on a team and multi-disciplinary approach include Northwestern Memorial Hospital in Chicago, New York-Presbyterian University Hospital, Johns Hopkins Hospital, Koç University Hospital, and Al Hayat International Hospital in Turkey.

Process

Staff education on diabetes was the most action taken in the field of process in the studies and hospitals investigated. This education can be for physicians, specialists, nurses, and even non-medical staff. The knowledge of physicians and other front-line staff has been raised as a major concern by health care professionals and people with diabetes. Therefore, to strive to improve care, hospitals should increase diabetes education for medical and nursing staff so that they can better manage diabetes, understand the needs and concerns of people with diabetes, and support them to manage themselves at appropriate times.^[7] If we can increase the workforce’s ability to best manage diabetes, we can reduce errors and other acute complications and improve the patient experience. In this regard, training of medical staff is one of the measures taken in the studied countries, especially in the Royal Derby Hospital of England, which is performed on a monthly basis.^[16] Hospitals and other health care institutions should have regular mandatory diabetes education.^[7] It is true that medical staff have the necessary specialized knowledge, but this knowledge must be updated and they must ensure that their knowledge meets the needs of patients.

Integrated care was another action for diabetics. In the UK, diabetes care integration frameworks have been pursued for more than 15 years.^[5] The goal of integrating diabetes care is to re-focus services on the individual, remove barriers between specialties and organizations, and introduce an approach that will lead to results for individuals and value

Table 3: Dimensions of care delivery to diabetic patients in the selected countries

Country	Human Resource	Process	Equipment/ Technology	Service Package	Information System	Structure
UK	specialized diabetes team, using multidisciplinary teams, diabetic foot team, diabetes specialist nurse (DSNs)	Training of medical staff, integration of services, re-design of services, screening of patients, and diabetic team evaluation	network glucose monitorin, flash monitoring systems, insulin pump, and micro guide DiAppbetes	Obesity prevention and management programs, diabetic foot services, patient follow-up, mental health, social services. discharge planning, self-management programs, structured patient education	Sharing electronical record, Sharing system, Electronic prescription	Create virtual units for diabetes
U.S	diabetes specialist team, multidisciplinary teams, diabetic foot team, diabetes nurse, diabetes educator, pediatric diabetes specialist	development and evaluation of multidisciplinary approaches, integration of clinical teams in decision making, staff training, integration of services, use of PCMH model in diabetes, performance evaluation, patient-based approach, patient partnership	Continuous glucose monitoring (CGM), continuous subcutaneous insulin infusion (CSII), GlucoScout and OptiScanner, insulin pump therapy, CoMac system	Psychosocial care, patient navigation program, diabetes education, diabetes prevention program, structured discharge program, follow-up of patients, Preparing different diets for different diabetic patients, patient empowerment programs, screening tests, on-site retinal screening, obesity care	comprehensive reports via dashboards (LibreView, Dexcom CLARITY) data management and monitoring programs, clinical decision support system software, web-based reporting systems	Multidisciplinary steering committee, diabetes research unit, research and education center
Denmark	specialized diabetes team multidisciplinary teams, ophthalmologist	using Danish model of diabetes care, patient-based care, specialist training, coordination of different specialists, integrated care	-	Educational and nutrition services, rehabilitation and follow-up, self-management programs, eye screening, psychosocial support	DD2 project as a data source for diabetics, launching DAMD database, web-based information sharing systems	Obesity Research Unit
Australia	specialized diabetes team, multidisciplinary teams, diabetes specialist nurse, diabetes educator	use of CCM model, integrated and multidisciplinary diabetes care, specialized staff training, standardization of approaches for patient identification, workforce empowerment, using patient-centered approach	Networked glucose meters	Patient education, diabetes screening, diabetic foot disease, gestational diabetes, neuropathic pain, diet therapy, psychosocial care, DM complication assessment, regular examination of heart, eye, foot and nervous system	Decision information systems	diabetic foot unit
Turkey	specialized diabetes team, multidisciplinary teams, diabetic foot team, primary care physician	remote diabetes hospitalization management, care integration, patient interaction with Specialists, patient-centered services approach, participatory approach to diabetes,	Tele-consultation management system, Pyxis Drug Management System	Nutrition therapy, blood sugar monitoring, diabetes self-management training (DSMT), patient follow-up, diabetic examinations, diabetic neuropathy screening	website for interacting with patients	educational units for diabetic patients, obesity clinics in hospitals, home care units, multidisciplinary council

for the system. Many regions in the United Kingdom as well as in Wales, Scotland, and Northern Ireland have taken the initiative to improve the delivery of diabetes care services through integration.^[17]

Discharge planning is another process. Hospital discharge planning is a complex aspect of health care and is part of the nursing process. However, it has not received priority among nurses' activities. It is an inter-disciplinary process.

However, the nurse has a key role to play in identifying the patient's needs, educating his or her relatives, and thus coordinating the discharge program.^[18] When patients leave the hospital, they need adequate support to help them take care of their diabetes and prevent them from staying longer in the hospital. Good planning for discharge includes making sure that people who need to control their blood sugar immediately after discharge are identified before discharge. These patients should be followed up regularly by a team of diabetics to check their blood sugar results and change treatment if necessary.^[9] The UK performed better in discharge planning. Sheffield Hospital, for example, had advanced discharge programs for diabetics. Leicester Hospital also uses a safe discharge program for diabetics.^[19] In other studies, the need for a structured discharge program for each patient was mentioned.^[9,20] Discharge planning should begin as soon as the patient enters the hospital and be updated as patient needs change.^[20]

Standardizing approaches to identifying and screening patients with diabetes (to better understand who is at risk for hypoglycemia during their hospital stay) are important. It is also important to identify at-risk patients for easy access to specialized care in a timely manner.^[8] Having a care plan from the beginning of hospitalization is what patients want and minimizes the risk of complications. At York Hospital, patients can identify all people with diabetes at the time of admission through retinal screening services.^[9] Screening of patients upon arrival at the hospital was considered in several studies.^[8,21]

Other findings include service re-design (re-organizing services by making changes to the chronic care model),^[17,22,23] team competency assessment (conduct an organized competency assessment for all staff in contact with hospitalized patients with diabetes),^[24-26] patient participation (creating effective patient engagement to motivate and empower people with type 2 diabetes to control their condition),^[27] focus on innovation (the use of innovative therapies in the treatment of insulin according to the needs of patients with diabetes),^[28] and patient interaction with specialists (productive relationship between the patient and specialist including continuity, access to health professionals, patient participation, and care planning).^[23,29]

Equipment/Technology

Diabetes technology is a term used to describe the hardware, devices, and software that people with diabetes use to manage their condition, from lifestyle to blood glucose levels. Diabetes technology, along with education and follow-up, can improve the lives and health of people with diabetes.^[30]

These technologies include blood glucose monitoring, continuous glucose monitoring, insulin injection devices, insulin pumps, insulin pumps with sensor systems, and

digital diabetes management programs. Two examples of diabetes management programs are the "Think Glucose" program and the MicroGuide "DiAppbetes" smartphone program. The Think Glucose program is a national initiative to improve patient care for diabetes in the UK, launched in 2008,^[31] including the use of a "traffic light" system to guide hospital staff on what patients should refer to the in-patient diabetes specialist team (IPDST), a tool developed by the NHS to support better management of patients with diabetes in the hospital.^[32] The program is being tested in a number of Scottish hospitals. The purpose is to improve diabetes care in hospitals, especially insulin management, to providing the right insulin to the right patient at the right time.^[33]

The DiAppbete "MicroGuide" program was launched in the UK in 2016 and serves as a "Pocket Diabetes Guide" for clinical staff (e.g., brief guide on insulin dosing and regulation, diabetes medications, hyperglycemic management).^[34] DiAppBetes acts as a decision support tool and is concise, so key information can be easily and quickly accessed by smartphone or computer. It also provides tips on how to manage hypoglycemia, depending on the severity of the hypoglycemia and the person's condition.^[35] Various studies have addressed the importance of using the mentioned technologies in diabetes care.^[9,36-38] The use of technology should be based on the needs, wants, skill levels of patients, and availability of devices. Just having a device or program does not change the results unless one engages with it to create positive health benefits.^[30]

Service Package

Many services are provided for diabetic patients in the hospital. These services are listed in the attached table. In relation to this dimension, three types of special services that can be used to improve the provision of services in Iran's hospitals are explained:

Psycho-social services

Providing psycho-social support for people with diabetes is very important for improving the welfare, psychological elements, self-management of diabetes, and its consequences. International guidelines indicate the need to address the psycho-social aspects of routine diabetes care. The need for psycho-social support and its integration into routine diabetes care has been addressed in many studies.^[3,26,39-41]

Patient navigator

To improve care coordination, some organizations in the United States have implemented a non-clinical program called Patient Navigation to continue care and improve outcomes. This program can improve blood sugar control and use health services for patients with diabetes.^[42]

Navigators work with patients to identify and remove barriers to care. Their tasks are to establish personal

contact with the patient, provide psycho-social support, and provide basic clinical information about diabetes self-management.^[42] The patient navigation model is a promising and acceptable strategy for patient transplantation, PCP, and community resources to improve lifestyle in people living with or at risk for type 2 diabetes.^[43]

Patient education and empowerment

According to the American Diabetes Association (ADA), all people with diabetes should participate in diabetes self-management training to acquire the knowledge, skills, and competencies needed to care for diabetes.^[44] Successful implementation of self-management behaviors improves metabolic control in patients with diabetes and delays the onset of chronic complications.^[44] Queen Alexandra Hospital in Portsmouth, England, has launched JIGSAW¹ training programs for people with type 1 diabetes and structured training programs such as DAFNE² in St. Vincent and Bridlington District Hospital as well as structured and advanced patient skills training courses. Supervision and self-management are also provided at Royal Surrey County Hospital. There are also comprehensive patient education programs at Dubbo Hospital in Australia.

Information System

Most reference was made to the information dimension regarding the importance of creating electronic health records.^[9,16,20] Two valid EHR tools are diabetes registration and clinical decision support systems.^[45] An electronic health record (EHR), which stores all of a patient's health information, can be effective in improving care.^[26] Denmark has performed better in this regard. A network of stand-alone systems using shared standards allows physicians to manage medication lists, share clinical notes, view diagnostic images and laboratory results, and send reminders to patients. General practitioners connect to specialists, pharmacies, laboratories, and hospitals through electronic clinical messaging systems. This service is connected to a national online health portal.^[46] The use of patients' electronic records, if properly organized, can significantly reduce medication errors. Introducing electronic prescription and drug management (EPMA) at Roral Derby Hospital in the United Kingdom also reduced prescription errors.^[9] At Royal Surrey County Hospital in the United Kingdom, patient records can also be viewed electronically in primary/secondary care. Making details accessible to all healthcare professionals for complete, delay-free viewing makes individual care a package that is accessible to all.

There are other findings taken in the field of information related to information sharing systems (sharing information between providers as well as between providers and

people with diabetes),^[46,47] use of integrated information technology systems (support for presentation care by tracking clinical indicators over time, providing electronic reminders, and providing an up-to-date overview of relevant services available),^[17,48] a web-based reporting system (data collection from any Internet-connected computer terminal and data entry in the system by physicians, pharmacists, nurses, and other staff and central tracking of trends and errors by an analyst),^[11,49] website creation (a dedicated website with information and facilities for interaction with other patients),^[23] and dashboards (access to data, patterns, trends, and glucose levels and sharing them among physicians using tools such as LibreView, Dexcom CLARITY).^[37]

Structure

In Turkey, hospitals are required to set up chronic care units to assess and educate patients with a wide range of chronic diseases and to establish separate training units for diabetics and patients with metabolic syndrome at risk of diabetes. Some hospitals set up obesity clinics. Some public hospitals also have home care units to manage post-discharge care for patients who are diagnosed and treated in hospital.^[50] Another unit that has been considered in hospital settings is the diabetic foot unit, which has developed in Australia, especially at the Royal Melbourne Hospital. In this unit, the expert team is led by an endocrinologist and pediatrician and is supported by staff from endocrinology, podiatry, vascular surgery, rehabilitation, radiology, clinical psychology, orthopedics, diabetes education, nutrition, and nursing.^[51] Based on findings, the establishment of an obesity unit for diabetic patients in Turkish hospitals was more prominent. Examples include Acıbadem Hospital and Sultan Mehmet Teaching Hospital in Istanbul. This may be because of the fact that Turkey has the highest prevalence of obesity and type 2 diabetes in Europe.^[52] Creating a diabetic foot unit is also one of the important measures in the organizational dimension that can help in providing services to diabetic patients in the hospital. Australia has performed well in this area, and in addition to the Royal Melbourne Hospital, we can mention the extensive diabetic foot services provided at Fremantle, Fiona Stanley, and Townsville hospitals in this country. Establishing a diabetes education unit for people with diabetes and their families in the hospital can also play an important role in improving patient care. Flinders Hospital in Australia has established a Diabetes Education Unit to provide information, support, and assistance to promote shared responsibility for health and well-being and to prevent the complications of diabetes. A research and education center for diabetics has also been set up at Johns Hopkins and Massachusetts Hospitals in US.

Discussion

The mentioned countries in this study derived the conclusion that a multi-disciplinary team has key

1 JIGSAW is a programme that seeks to assist people with Type 1 diabetes to improve their day-to-day lives and glycemic control

2 Dose Adjustment For Normal Eating

functions to provide ongoing and accessible care focusing on the needs of people with diabetes.^[25,53,54] Specialists involved in the delivery of diabetes care must work in multi-disciplinary teams for care to be truly effective. Also, Dankoly *et al.*^[55] (2021) emphasizes the need for allied health professionals such as physiotherapists, dieticians, and psychologists with expertise in diabetes care.

In relation to the process dimension, most studies considered staff training^[9,56-58] and providing integrated care.^[40,59-61] Although nurses have the most contact with patients, all health care providers need adequate knowledge of diabetes to provide safe and competent care to people with diabetes. The process of staff education on diabetes is followed seriously in USA. Integration of care has also been emphasized in all countries.

Patient education and mental health services were among the most important services provided in the studied hospitals; equipment dimension was more noticeable in US and Turkey hospitals.

In Iran also, the study conducted by Karimi *et al.* (2014) measured the quality of care provided to patients with type 2 diabetes by CQMH³ model. This study, which used the perspectives of clients and caregivers to assess quality, pointed to the self-management of patients with diabetes.^[62] Also, a review study conducted by Taheri *et al.*^[63] (2016) has addressed the importance of empowerment-based interventions to increase control and self-care in diabetes in people with diabetes.

Regarding the information dimension, most of the studies referred to electronic health records,^[9,16,64] but there were the main databases related to diabetic patients in Denmark. Moghaddasi *et al.*'s^[65] (2016) study on the development of open control systems based on information technology show that decision-making systems for insulin therapy indicators of glycemic control help to improve the quality of treatment of hospitalized patients. This is consistent with our results. Also, the study conducted by Mottaqi (2010) considered the creation of a comprehensive and up-to-date database of diabetic patients in the Armed Forces and the development of medical file management software,^[66] which is consistent with the results of the present study in the field of integrated information technology systems.

In structure dimension, there were units such as research, diet therapy, education, and diabetic foot unit in different countries. Of course, these units have been created according to the needs and facilities of the countries in question, which can be helpful considering the conditions of using them in providing services to diabetic patients in Iran.

Conclusions

As a result, in order to achieve a special organization in hospitals to cope with chronic diseases such as diabetes, the

necessary support must be provided in specialized services based in the hospital to enable them to manage people with more complex needs so that they can be more involved in managing diabetics. It is also essential that there are sufficient staff in the hospital-based specialist services so that they can manage and support people with diabetes in multi-disciplinary teams. The use of staff training processes, patient screening, and special planning for their discharge can improve the provision of services to diabetic patients in hospitals. Information systems focusing on electronic health records, improving service delivery, especially psycho-social services, educating and empowering patients, and better access to diabetic technologies based on patients' needs, wants, and skill levels are also among the priority areas required. We hope that the findings of the present study will help the hospital to adapt the hospital to the specific needs of diabetic patients by using effective measures taken in selected countries and organizing it focusing on the dimensions of services, manpower, process, organization, equipment, and information required by diabetic patients.

Limitation

It should be noted that the information obtained from the hospitals was only through visits to the websites of these centers and the researcher's access to this information was limited.

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Ethical consideration

The present study is part of the results of a PhD thesis entitled "Organizing hospital for Diabetic Patients and developing a model for Iran" with ethical code IR.MUI.RESEARCH.REC.1399.395 in Isfahan University of Medical Sciences.

Author contributions

H. S-E: Performed the literature search, assessed the literature, extracted data and wrote the manuscript.

F.M: designed the study, revised the paper

A. R and M. J: Scientific consultation

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Conflicts of interest

There are no conflicts of interest.

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Appendix 1

UK	US
Royal Derby Hospital	Mayo Clinic (Rochester, MN)
Royal Liverpool University Hospital	Cleveland Clinic (Cleveland, OH)
St George's Hospital	Massachusetts General Hospital (Boston, MA)
Royal Sussex university hospitals	Johns Hopkins Hospital (Baltimore, MD)
Queen Alexandra Hospital	UCSF Medical Center (San Francisco, CA)
Bridlington Hospital	New York-Presbyterian University Hospital of Weill Cornell (New York, NY)
Royal Surrey County Hospital	Yale-New Haven Hospital (New Haven, CT)
Sheffield Teaching Hospital	Northwestern Memorial Hospital (Chicago, IL)
North west London	UCLA Medical Center (Los Angeles, CA)
Leicester General Hospital	University of Washington Medical Center (Seattle, WA)
Queen Alexandra Hospital	
New Cross Hospital	
	Australia
Turkey	St Vincent's Hospital
Anadolu Medical Center	Royal North shore Hospital
LIV Hospital	Townsville Hospital and Health Service
Medipol Mega University Hospital	Sydney Adventist Hospital
Medicana Atasehir Hospital	Beleura Private Hospital
Memorial Bahceievler hospital Istanbul	Royal Melbourne Hospital
Memorial Sisli hospital Istanbul	Denmark
Acibadem Taksim Hospital	Herlev Hospital
Koç university hospital	Aarhus university hospital
Al Hayat International Hospital	Odense University hospital
Yeditepe University Hospital	Copenhagen University hospital
Kadikoy diabetes and obesity hospital	Aalborg University hospital
Sultan Mehmet Teaching Hospital	