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Corresponding author:
Xue-Jun Li

xmlixuejun@163.com

Author Affiliation:
THE FIRST AFFILIATED HOSPITAL OF XIAMEN UNIVERSITY.

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A scoping review protocol for application status, challenges and prospects of clinical decision support systems in diabetes

Li, XJ[1]; Huang, S[2]; Liang, YZ[3]; Li, JR[4].

Review question / Objective: This scoping review has three objectives: 1. To describe the application status of clinical decision support systems (CDSS) in management of diabetes in China and western countries, including purpose, forms, effects, coverage of hospitals and involved technology companies, etc.; 2. To describe the research status of CDSS in management of diabetes in China and western countries, including the number of studies, the distribution of publication years, distribution of publication areas, etc.; 3. To describe the challenges and prospects of CDSS application in management of diabetes, including development trends, challenges and opportunities, etc..

Rationale: It has been found that no matter in western countries where CDSS application is relatively mature, or in China where it is still at an early stage, most studies on CDSS in diabetes mainly focus on its application effect. There is still a lack of systematic and comprehensive description. Hence, we will conduct a scoping review to comprehensively review studies reporting CDSS application in the management of diabetes, with aims to describe and summarize: 1) the application status; 2) the research status; 3) future challenges and application prospects of CDSS in China and western countries. Results of the current study shall fill the existing knowledge gaps, and provide valuable insights on application of CDSS in the clinical management of diabetes.

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 14 September 2022 and was last updated on 14 September 2022 (registration number INPLASY202290061).

INTRODUCTION

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of hospitals and involved technology companies, etc.; 2. To describe the research status of CDSS in management of diabetes in China and western countries, including the number of studies, the distribution of publication years, distribution of publication areas, etc.; 3. To describe the challenges and prospects of CDSS application in management of diabetes, including development trends, challenges and opportunities, etc..

Background: Due to the multi-cross, highly complex and dynamic characteristics of clinical information, it is difficult for medical care service staff to fully understand the medical knowledge and patient information, and make decisions. In order to make full use of existing medical knowledge and clinical evidence, to assist medical professional to make correct clinical decisions, and to provide patients with high-quality medical care services, the Decision Support System (DSS) proposed by Scott Morton was adopted. The concept of DSS was innovatively applied to the medical field, which then developed to Clinical decision Support System (CDSS). DSS is a computer application system that assists decision-makers to make semi-structured or unstructured decisions by data, model and knowledge. CDSS is a subsystem of DSS application in the medical field, which aims to link patient information with medical knowledge base and provide auxiliary decision-making suggestions based on patient characteristics, so as to improve quality of medical care service. Its functions mainly include auxiliary diagnosis and treatment, warning, disease management and monitoring, medical advice management and use, drug control, etc. However, there is still no recognized definition of CDSS. According to the definitions presented by Shortliffe et al., Sim et al. and Jiancheng Dong et al., CDSS refers to any computer system that can provide support for clinical decision making, and this system makes full use of available and appropriate computer technology, matching individual patient characteristics with a computerized clinical knowledge base for semi-structured or unstructured medical

problems to improve and enhance the efficiency of decision-making of healthcare providers through human-computer interaction. At present, in developed countries like the United Kingdom and the United States, CDSS has been relatively mature in the field of medical services and widely used in chronic disease management, with significant effects in assisting chronic disease screening, diagnosis and decision making, prescription drug management and several other aspects. In the community service system, medical professionals have a strong willingness to provide medical services for chronic patients using CDSS. In particular, diabetes accounted for the largest number of CDSS studies in the field of chronic diseases, up to 40%. According to the International Diabetes Federation (IDF) in 2021, approximately 537 million adults (20-79 years old) suffer from diabetes worldwide, resulting in 6.7 million related deaths and a total associated health expenditure of $966 billion ($1,838.4 per capita). Although the management and treatment of diabetes is a complex task, CDSS can significantly improve the effectiveness of interventions on diabetes care. At present, the development and application of CDSS for diabetes in developed countries mainly includes evidence-based drug selection, complication screening and improvement of self-management ability of patients, covering the whole diagnosis, treatment and nursing process of diabetes patients. Among them, CDSS has been widely used as an adjunct to insulin injection, which is a potentially advantageous method recommended by several clinical guidelines. In 2018, the National Health Commission of China issued the Notice on Further Promoting the Informatization Construction of Medical Institutions with Electronic Medical Records as the Core in order to standardize the clinical use and management of electronic medical records. In China, the development and application of CDSS in chronic disease management represented by diabetes is still at an early stage. At present, many researchers in China have built information platforms for diabetes, such as diabetes medication

decision assistance and risk prediction platform, but most of them are still under designing status and not yet applied in real clinical practice. In addition, these systems are mainly designed to manage one single symptom, and there is still a lack of comprehensive management system for diabetes.

Rationale: It has been found that no matter in western countries where CDSS application is relatively mature, or in China where it is still at an early stage, most studies on CDSS in diabetes mainly focus on its application effect. There is still a lack of systematic and comprehensive description. Hence, we will conduct a scoping review to comprehensively review studies reporting CDSS application in the management of diabetes, with aims to describe and summarize: 1) the application status; 2) the research status; 3) future challenges and application prospects of CDSS in China and western countries. Results of the current study shall fill the existing knowledge gaps, and provide valuable insights on application of CDSS in the clinical management of diabetes.

METHODS

Strategy of data synthesis: 1. Information sources - Electronic databases and platforms will be used for identifying the studies included in the scoping review, including PubMed, Embase, Cochrane Library, Web of Science, China national knowledge infrastructure (CNKI), Wanfang, VIP and databases of academic conferences such as International Diabetes Federation (IDF), American Diabetes Association (ADA), European Association for the Study of Diabetes(EASD), Chinese Diabetes Society (CDS), Chinese Society of Endocrinology (CSE) and International Society of Pharmacoeconomics and Outcomes Research(ISPOR), etc.
2. Search strategy - The final searches will be conducted from database establishment to June 30, 2022. The search keywords will be "Clinical Decision Support System*"、 "Decision Support System*"、"Diabetes". More details about search terms could be

found below.
(1)PubMed: #1 "clinical decision support system*" OR "cdss*" OR "decision support system*" OR "dss" OR "computer-assisted".ti.ab; #2 "diabetes" OR "DM".ti.ab; #3 #1 AND #2
(2)Embase: #1 'clinical decision support system*' OR 'cdss*' OR 'decision support system*' OR 'dss' OR 'computer-assisted':ti,ab,kw; #2 'diabetes' OR 'dm':ti,ab,kw; #3 #1 AND #2
(3)Cochrane Library: #1 "clinical decision support system*" OR "cdss*" OR "decision support system*" OR "dss" OR "computer-assisted". ti ab kw; #2 "diabetes" OR "DM". ti ab kw; #3 #1 AND #2
(4)Web of Science: #1 (TI=("clinical decision support system*" OR "cdss*" OR "decision support system*" OR "dss" OR "computer-assisted")) OR AB= ("clinical decision support system*" OR "cdss*" OR "decision support system*" OR "dss" OR "computer-assisted"); #2 (TI=("diabetes" OR "DM")) OR AB=("diabetes" OR "DM"); #3 #1 AND #2
(5)CNKI: #1 SU="临床决策支持系统" OR TKA="临床决策支持系统"; #2 SU="糖尿病" OR TKA="糖尿病"; #3 #1 AND #2
(6)Wanfang: #1 主题:("临床决策支持系统") OR 题名或关键词:("临床决策支持系统") OR 摘要:("临床决策支持系统"); #2 主题:("糖尿病") OR 题名或关键词:("糖尿病") OR 摘要:("糖尿病"); #3 #1 AND #2
(7)VIP: #1 M="临床决策支持系统" OR R="临床决策支持系统"；#2 M="糖尿病" OR R="糖尿病"; #3 #1 AND # 2
(8)ISPOR Presentations Database: Disease/Disorder: Diabetes / Endocrine / Metabolic Disorders; Topics: ALL; Conference: ALL
(9)Academic conferences in China (Baidu Scholar): #1 "糖尿病"; #2 "临床决策支持系统"; #3"中华医学会糖尿病学会" OR "CDS" OR "中华医学会内分泌学会" OR "CSE"; #4 #1 AND #2 AND #3
(10)International academic conferences (Google Scholar): #1 "clinical decision support system" OR "cdss" OR "decision support system" OR "dss" OR "computer-assisted"; #2 "diabetes" OR "DM"; #3 "International Diabetes Federation" OR "IDF" OR "American Diabetes Association"

OR "ADA" OR "European Association for the Study of Diabetes" OR "EASD"; #4 #1 AND #2 AND #3.

Eligibility criteria: The eligibility criteria studies will be based on the Participants, Concept, Context (PCC) strategy: Participants: Studies related to the clinical application of CDSS for management of diabetes will be included. No restrictions on CDSS features, such as countries, regions or technical basis will be applied. Concept: CDSS in this scoping review refers to any computer system that can provide support for clinical decision making, and this system makes full use of available and appropriate computer technology, matching individual patient characteristics with a computerized clinical knowledge base for semi-structured or unstructured medical problems to improve and enhance the efficiency of decision-making of healthcare providers through human-computer interaction. Context: This study will focus on the clinical application of CDSS in diabetes.

1. Inclusion criteria
Studies of any date, design, setting or duration will be included as long as they report clinical application of CDSS for management of diabetes.

2. Exclusion criteria
1) Studies published in language other than Chinese or English;
2) Studies relating to technologies, algorithms, theories used by CDSS or not directly relating to clinical decision support (e.g., apps that provide data from clinical practice, remote management);
3) Studies using data other than clinical data (such as genomic or protein data) or simulated data sets.
4) Conference abstracts published before June 30 2020 without poster and full text;
5) Overlapping publications, research plans, reviews and commentary, etc.

Source of evidence screening and selection: Screening and selection will be conducted using NoteExpress. The two-stage screening process will be performed by two reviewers, independently, including title and abstract screening, and full-text screening. For excluded studies, the reason for exclusion will be documented. Two reviewers will discuss and resolve conflicts during the both stage. If no consensus can be reached, the third researcher will be consulted for evaluation. The final report will describe the search results and screening process, and this information will be presented in a flow chart.

Data management: 1. Data extraction - Data extraction will be completed using Excel. The retrieved information will be cross-checked. Any disagreement will be discussed and a third reviewer will be involved if necessary. If a study was published more than once, the most informative and complete study will be extracted. If important variables/ information are missing, attempts will be made to contact the authors of the included studies.
2. Data item - A pre-designed data extraction table will be used to extract all data related to the research problem. The extracted information based on different objectives will include but not limited to the following: authors, study publish year, location (country or region), research type, study aims/objectives, study design, target population, sample size, characteristics of enrolled patients, application form of CDSS, primary/ secondary outcomes, results, conclusions, study strengths and limitations, application challenges and opportunities, related technology companies/hospitals, funding, etc.

Reporting results / Analysis of the evidence: According to the objectives, we will make a narrative summary and descriptive analysis of the extracted data, and present in the form of charts. For the textual data such as the study aims/ objectives, study strengths and limitations, application challenges and opportunities, etc., we will present all these information by the way of narrative summary. For the numerical data such as the sample size, the demographic baseline of the enrolled patients (e.g, age) , etc., we will conduct descriptive analysis by mean, standard deviation or median and interquartile interval. For the categorical data such as target population, research type,

application form, related technology companies, etc., frequency with percentage will be used to present the result. Subgroup analyses will be conducted based on the extracted results by the research characteristics and research design, when necessary. The standard of subgroup analyses will depend on the specific characteristics of the extracted data.

Language restriction: English and Chinese.

Country(ies) involved: China.

Keywords: CDSS; diabetes; scoping review.

Contributions of each author:
Author 1 - Xue-Jun Li.
Email: xmlixuejun@163.com
Author 2 - Shan Huang.
Email: hs1147@126.com
Author 3 - Yu-Zhen Liang.
Email: liangyuzhen26@163.com
Author 4 - Jia-Rui Li.
Email: lijiarui_06@126.com

Organisational affiliation of the systematic review: THE FIRST AFFILIATED HOSPITAL OF XIAMEN UNIVERSITY; Shanghai Tongren Hospital Affiliated to Shanghai Jiaotong University; THE SECOND AFFILIATED HOSPITAL OF GUANGXI MEDICAL UNIVERSITY; Cangzhou Central Hospital.