Chinese Nursing Research 3 (2016) 71–76

Contents lists available at ScienceDirect

Chinese Nursing Research

journal homepage: http://www.journals.elsevier.com/chinese-nursing-research

Original article

# Effect of case management on patients with type 2 diabetes mellitus: a meta-analysis

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ARTICLE INFO

*Article history:*
Received 21 January 2016
Received in revised form
12 February 2016
Accepted 11 March 2016
Available online 18 June 2016

*Keywords:*
Case management
Type 2 diabetes mellitus
Meta-analysis
Systematic review

ABSTRACT

**Background:** Case management is a term used to describe the activities performed by a physician or other health care professional to ensure the coordination of medical services required by a patient. Managed care requires the incorporation of information pertaining to patient evaluation, treatment planning, referrals, and follow-up care to ensure that payment for services is received and that care is ongoing and comprehensive. The objective of this review was to assess the efficacy of case management in patients with type 2 diabetes mellitus with respect to outcomes such as glycosylated hemoglobin ($HbA_{1c}$), systolic blood pressure (SBP), diastolic blood pressure (DBP), and low-density lipoprotein (LDL).
**Methods:** Databases including PubMed, Embase, Web of Science, the Cochrane Library, the China National Knowledge Infrastructure (CNKI), VIP, Wan Fang and the Chinese Biomedical Literature Database (CBM) were searched for randomized controlled trials (RCTs) dating as late as Jan, 2015. Reference sections of the included studies were also searched.
**Results:** Twelve studies, involving 11 RCTs that evaluated a total of 4000 patients, were included in this analysis. Two of the 12 studies evaluated the same RCT. Seven of the 12 studies reported $HbA_{1c}$ as an outcome, and three trials reported changes in SBP, DBP and LDL levels as outcomes. The pooled results indicated that statistically significant improvements in $HbA_{1c}$ (MD = −0.35, 95% *CI* (−0.68, −0.02), $P = 0.04$) and LDL levels (MD = −2.49, 95% *CI* (−4.04, −0.93), $P = 0.002$) were associated with the case management group compared with control group; however, no statistically significant differences in DBP (MD = −0.08, 95% *CI* (−0.68, 0.52), $P = 0.8$) and SBP (MD = −0.96, 95% *CI* (−5.77, 3.84), $P = 0.69$) were observed.
**Conclusions:** Case management was effective in improving $HbA_{1c}$ and LDL levels in patients with type 2 diabetes mellitus. Although no statistically significant differences in DBP and SBP between the case management group and the control group were observed, further research is required to draw a conclusion about the effect of managed care on these outcomes. Based on this meta-analysis of clinical trials, we conclude that case management offers an effective clinical method for the treatment of type 2 diabetes.


## 1. Introduction

Diabetes imposes a heavy burden on health-care systems and on patients and their families. The World Health Organization (WHO) reports that the worldwide prevalence of diabetes will reach 366 million by 2030, with many new cases of diabetes occurring in developing countries, especially in Southeast Asia and among the working class.[1] Thus, the implementation of diabetes prevention programs and intervention programs to improve glycemic control in people with diagnosed diabetes is a public health problem worth prioritizing. The condition of impaired glucose tolerance also represents a serious public health problem that requires more attention. This is exemplified by the fact that approximately 70% of people with impaired glucose tolerance have the potential to develop diabetes, and diabetes is associated with an increased risk of cardiovascular disease. Many ethnic minorities are at an increased risk of developing type 2 diabetes

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Peer review under responsibility of Shanxi Medical Periodical Press.

http://dx.doi.org/10.1016/j.cnre.2016.06.008

and of developing the disease at an earlier age. Furthermore, higher morbidity and mortality rates are associated with diabetes in these populations.[2,3] Therefore, it is imperative to identify measures that address these serious problems. Case management has been considered an effective approach for improving the condition of diabetic patients. An earlier study[4] reported the results of a meta-analysis evaluating the effect of case management on $HbA_{1c}$in patients with diabetes. The results demonstrated that case management intervention was associated with substantial improvements in $HbA_{1c}$ from baseline compared with control groups[4] that were not involved in a case management intervention program. Many studies evaluating the effect of case management programs on $HbA_{1c}$, however, are controversial.[5–7] Furthermore, a systematic review of the effect of case management specifically for patients with type 2 diabetes mellitus has not been performed. Therefore, the aim of this meta-analysis was to evaluate the effect of case management, as assessed by multiple treatment outcomes, in patients with type 2 diabetes. The main objective of this review was to summarize the evidence associated with the effect of case management on clinical outcomes, such as $HbA_{1c}$, SBP, DBP and LDL levels, in patients with type 2 diabetes mellitus.

## 2. Methods

### 2.1. Inclusion criteria

#### 2.1.1. Participants

Patients over the age of 18 years who were diagnosed with type 2 diabetes mellitus were included in this review. Ethnicity and comorbidities were not parameters of the inclusion criteria.

#### 2.1.2. Interventions

This analysis included studies employing multiple types of case management intervention programs, such as telephone-based intervention and face-to-face instruction.

### 2.2. Outcomes

#### 2.2.1. Primary outcome

Glycated hemoglobin ($HbA_{1c}$) measured after the intervention phase was the primary outcome of this study.

#### 2.2.2. Secondary outcomes

SBP, DBP, LDL, HDL, total cholesterol, and some additional variables were analyzed quantitatively or qualitatively, depending on the variable being evaluated.

### 2.3. Study design

Randomized controlled studies meeting the inclusion criteria were considered for analysis, regardless of the outcomes they evaluated in the study.

### 2.4. Search strategy

We searched eight electronic databases, namely, PubMed, Embase, Web of Science, CENTRAL, CNKI (China National Knowledge Infrastructure), VIP, Wan Fang and CBM, using combinations of Mesh and the following entry terms: “NIDDM”, “Maturity-Onset Diabetes”, “Diabetes Mellitus, Noninsulin-Dependent”, “Diabetes Mellitus, Adult-Onset”, “Adult-Onset Diabetes Mellitus”, “Diabetes Mellitus, Adult Onset”, “Diabetes Mellitus, Ketosis-Resistant”, “Diabetes Mellitus, Ketosis Resistant”, “Ketosis-Resistant Diabetes Mellitus”, “Diabetes Mellitus, Maturity-Onset”, Diabetes Mellitus, “Non Insulin Dependent”, “Diabetes Mellitus, Non-Insulin-Dependent”, “Non-Insulin-Dependent Diabetes Mellitus”, “Diabetes Mellitus, Noninsulin Dependent”, “Diabetes Mellitus, Slow-Onset”, “Diabetes Mellitus, Slow Onset”, “Slow-Onset Diabetes Mellitus”, “Diabetes Mellitus, Stable”, “Stable Diabetes Mellitus”, “Diabetes Mellitus, Type II”, “Maturity-Onset Diabetes Mellitus”, “Maturity Onset Diabetes Mellitus”, “MODY”, “Type 2 Diabetes Mellitus”, “Noninsulin- Dependent Diabetes Mellitus”, “type 2 Diabetes Mellitus”, “case management” and random. We manually searched the references of included articles to identify any additional relevant literature.

### 2.5. Review methods

The systematic review and meta-analysis was designed according to guidelines described in the Cochrane Handbook for Systematic Reviews of Interventions.[8] Searches and data extraction were performed by two individual investigators (ZZ and ST). Each trial identified in the search was evaluated for relevant domains, including author, number of participants, year published, allocation method, age of included patients, disease duration, intervention and control measures, length of treatments, patient inclusion and exclusion criteria, baseline values and outcome measures. Any disagreement between investigators was resolved through discussion with a third investigator (SGM). All remaining articles were viewed as full text. A quality assessment of the trials included in this study was performed independently by two reviewers according to the criteria described in the Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0.[8] Evaluation domains for the quality assessment included randomization sequence generation, allocation concealment, blinding of participants and study personnel, blinding of outcome assessment, incomplete outcome data, selective reporting and other biases. Based on the information extracted from the primary studies, each parameter was rated as “high risk”, “unclear risk” or “low risk”. All studies included in this meta-analysis were reviewed for heterogeneity in clinical factors and methodology. If clinical heterogeneity existed, data could not be combined. All extracted data were entered into RevMan 5.3 (Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2013) for statistical analysis. All extracted data pertained to continuous outcomes. If more than two treatment groups were evaluated, data associated with the most intensive or effective intervention group and with the control group were used for analysis. Standard mean differences (SMDs) with 95% confidence intervals (Cis) for continuous outcomes were selected for calculating the pooled effects. The $I^2$ test was used to calculate the percentage of total variation across studies due to heterogeneity. Values greater than 50% indicate a substantial level of heterogeneity. In the absence of clinical heterogeneity and the presence of statistical heterogeneity ($I^2$ greater than 60%), we used a random effects model. If studies were similar enough to consider for pooled analysis, we used a fixed effect model for low to moderate levels of heterogeneity ($I^2$ values were 0–60%).[9]

Endpoint data were used to calculate the summarized results. Subgroup analysis was performed if any sources of heterogeneity were identified.

## 3. Results

A total of 212 trials were identified in the initial literature search, and an additional two studies were identified from other sources. Twelve studies[10–21] that included data from 11 clinical trials with a total of 4000 participants were selected for further analysis according to inclusion and exclusion criteria. The duration of these