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Understanding Medication-Related Belief in Patients with Type 2 Diabetes: a Meta-Analytic Review

ABSTRACT

Background: The medication belief and appropriate and on-time medication usage are crucial determinants of diabetes control. The present systematic review has been conducted to examine the status of the medication beliefs of patients with type 2 diabetes based on a meta-analysis.

Materials and methods: This study is a systematic review based on a meta-analysis conducted in 2021. Keywords "Medication belief", "BMQ (Belief in Medication Questionnaire)", "patients with type 2 diabetes", "diabetes mellitus" were searched in Google Scholar, PubMed, Scopus, Web of Science, Science direct, Magiran, SID, and Irandoc database from 2010 to 2021. The pooled score of medication belief and its dimensions were estimated through a random-effects meta-analysis using STATA 15. Also, heterogeneity across the articles was determined with the I^2 statistic.

Results: Out of 584 articles, 8 studies were selected and analyzed. Based on estimates obtained from the random effects method, the pooled score of medication belief was obtained at 2.877 (95% CI: 2.22–3.53). Also, the pooled scores of specific necessity, specific concern, general harm and general overuse were calculated at 3.60 (95% CI: 2.92–4.06), 3.02 (95% CI: 2.19–3.85), 2.26 (95% CI: 1.50–3.02) and 2.54 (95% CI: 1.96–3.12) respectively.

Conclusions: Health policymakers and economists need to take steps to increase the health literacy of patients with type 2 diabetes and improve the medication belief dimensions to reduce the disease costs to provide a better quality of life for patients with type 2 diabetes. Various programs are underway in developed countries. Public education about the side effects of diabetes drugs, narcotics, and drug dependence reduces patients' worries and anxieties, which in turn reduces their anxious thoughts and brings relief to patients. (Clin Diabetol 2022, 11; 3: 200–209)

Keywords: medication belief model, patients with type 2 diabetes, BMQ, systematic review, meta-analysis

Introduction

Worldwide, one of the biggest challenges for health systems is the rising rate of chronic diseases. Chronic diseases affect most or all of a person's life. Cardiovascular diseases, cancer, AIDS, chronic respiratory diseases, gastrointestinal diseases, diabetes, neurocognitive disorders, and autoimmune diseases are some examples [1]. Diabetes is a metabolic disorder that causes high blood sugar levels [2] People with type 1 diabetes are forced to inject insulin or use an insulin

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pump due to a lack of normal insulin production. Type 2 diabetes is caused by the cell's resistance to insulin. Gestational diabetes causes high blood glucose levels without a prior diagnosis of diabetes. All types of diabetes cause serious long-term complications, including retinal damage, chronic kidney disease, cardiovascular disease, and amputation [3]. Diabetes puts significant pressure on society in terms of high medical costs, reduced productivity, and indirect costs such as reduced quality of life [4]. A 2017 study in the United States found that a quarter of health care costs are spent on patients with type 2 diabetes, and more than a half are directly related to diabetes. Also, the average cost of treating patients with type 2 diabetes is two-thirds higher than the cost of treating non-diabetics [5]. According to the World Health Organization (WHO), medication belief means the manner and amount of medication taken, adherence to the diet, and lifestyle changes in accordance with the recommendations of the health care provider [6]. According to the World Health Organization, the prevalence of diabetes in 2019 was about 463 million people (9.3% of the world's population), and the number is projected to reach 578 million (10.2% of the world's population) by 2030 and 700 million (10.9% of the world's population) by 2045 [7, 8]. Health behaviors generally include all actions and behaviors that are devoted to creating, and maintaining health. These behaviors include medical services (visits, vaccinations, screening), adherence to a variety of medical regimens, and lifestyle (exercise, smoking, or alcohol) [9]. The medication Belief Questionnaire is one of the valid tools for measuring patients' beliefs about medication [10]. This questionnaire is a summary of two questionnaires: BMQ-General and BMQ-Specific. BMQ-Specific is designed to assess key beliefs about a patient's interactions with prescribed medications. This includes two scales: specific necessity and specific concerns. Specific necessity assesses the patient's beliefs about the individual need and requirement for the prescribed medications and the importance of usage, while specific concerns depend on treatment concerns. BMQ-General assesses social beliefs about medications. The first, this questionnaire includes two scales to assess beliefs about the harmfulness of medications (General-Harm) and addictive medications that prescript more than usual (General-Overuse). The General-Benefit Scale was later added to assess understanding of the benefits of medications [11]. The questionnaire's reliability was examined and approved in the literature [12]. Diabetes is a chronic and long-term disease and patients with type 2 diabetes need constant care to avoid irreversible complications. Providing ongoing care to these patients imposes huge costs on health systems. Proper use of diabetes-related medications is one of the most important ways to alleviate complications. Medication belief as a shaper of medication use behavior is a significant concept in patients with type 2 diabetes. Optimal medication belief can be effective in controlling diabetes and reducing the direct and indirect costs associated with the disease for both health care providers and patients. This systematic review has been conducted with the aim of examining the status of medication beliefs of patients with type 2 diabetes based on a meta-analysis.

Materials and methods

Design

This system was based on a meta-analysis in the field of medication belief of patients with type 2 diabetes in 2021. A literature review was performed based on the PRISMA tool (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) [13].

Search strategy

Keywords "Medication belief", "BMQ", "patients with type 2 diabetes", "diabetes mellitus" were searched in Google Scholar, PubMed, Scopus, Web of Science, Science direct, Magiran, SID, and Irandoc databases and some key journals using the AND, OR and NOT Booleans. The search was conducted from January 2010 to February 2021 (App. Tab. A).

Inclusion and exclusion criteria

Inclusion criteria include (1) research on the status of medication beliefs of patients with type 2 diabetes in the last ten years, (2) articles that used BMQ questioner, (3) articles and reviews in English and Persian. Exclusion criteria also include (1) studies related to the medication belief status of patients without type 2 diabetes, (2) studies that do not report the dimensions of Medication Belief Questioner, (3) articles without mean and standard deviation of medication belief BMQ's dimensions, (4) secondary data.

Review process

Found articles were collected in EndNote X8. Duplicate records and irrelevant titles were removed. Abstracts in terms of meeting the objectives of the study were examined and irrelevant publications were extracted. The remaining articles were compiled into a list and their full text was reviewed, at which point some unrelated studies were omitted.

Quality assessment and data extraction

Three researchers matched the articles with the 22 Contents of the STROBE tool that assesses the quality of

observational studies [14]. At this stage, articles that did not conform more than 50% to this tool were removed. Then, data including author name/year of publication, study setting, sample size, and the mean and standard deviation of medication belief dimensions were extracted from articles that were of sufficient quality.

Data analysis

The pooled score (PS) of medication belief and its dimensions was estimated by random-effects meta-analysis, performed using STATA 15. The analysis results were reported at a 95% confidence interval. The possibility of heterogeneity between studies was examined by I2 statistics (I2 ≥ 50% indicates heterogeneity). Results were reported through a forest plot. Publication bias was assessed by Egger test. The reported score for medication belief and its dimensions was not in the range of 1 to 5 in some studies. Hence, the scores of the variables were normalized between 1 and 5.

Ethical approval

The present study has ethical approval from the ethics committee of Qazvin University of Medical Sciences (ethics code IR. QUMS. REC. 1399. 123).

Results

Out of 584 studies found from databases, 196 publications were duplicates and were deleted. In addition, 319 titles and abstracts were not in line with the objectives of the study and were omitted. After reviewing the full text of the articles and assessing the quality, 61 articles were rejected. Finally, 8 studies met the objectives of the research and were reviewed (App. Fig. A).

The characteristics of the studies used in the meta-analysis, including author name/year of publication, study setting, sample size, and the mean and standard deviation of medication belief dimensions, are summarized in Table 1. The highest level of specific necessity (4.406 ± 0.57) is related to Fall's study, Specific concern (4.446 ± 0.2364), General harm (3.39 ± 0.3404) and General overuse (3.202 ± 0.323) are related to Olorunfemi's study. The lowest level of specific necessity (1.8 ± 0.44), Specific concern (2.26 ± 0.64), General harm (0.84 ± 0.38) and General overuse (1.24 ± 0.44) are related to Adeniran's study. Among them, Specific concern and General harm were the strongest and weakest dimensions, respectively.

Figure 1 shows the frequency of studies entered by year of publication. The highest percentage of articles was published in 2014 and 2015.

The results of the heterogeneity assessment of studies by dimension are shown in Appendix Table B.

Table 1. Characteristics of Studies Included in the Meta-Analysis

Author	Year	Setting	N	Specific necessity		Specific concern		General harm		General overuse		Medication belief	
Ref No				Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Salama et al. [15]	2020	Egypt	82	3.72	0.7	2.84	0.86	2.2	0.6	2.44	0.56	2.8	0.68
Olorunfemi et al. [16]	2019	Nigeria	180	4.14	0.20	4.44	0.23	3.39	.034	3.20	0.32	3.79	0.27
Holmestruscott et al. [17]	2016	Australia	313	3.7	0.7	2.5	0.7	2.2	0.7	2.8	0.9	2.8	0.75
Adeniran et al. [18]	2015	South Nigeria	223	1.8	0.44	2.26	0.64	0.84	0.38	1.24	0.44	1.53	0.47
Sweileh et al. [19]	2014	Palestine	405	3.7	0.8	2.8	0.86	2.1	0.74	2.4	0.66	2.75	0.76
Wei et al. [20]	2017	China	315	3.75	0.4	3.15	0.58	2.95	0.5	3.12	0.5	3.24	0.49
Fall et al. [21]	2014	France	253	4.40	0.57	3.11	1.04	1.94	0.66	2.30	0.70	2.94	0.74
Schüz et al. [22]	2011	Germany	309	3.73	1.24	3.11	1.09	2.43	0.99	3	1.01	2.81	1.08

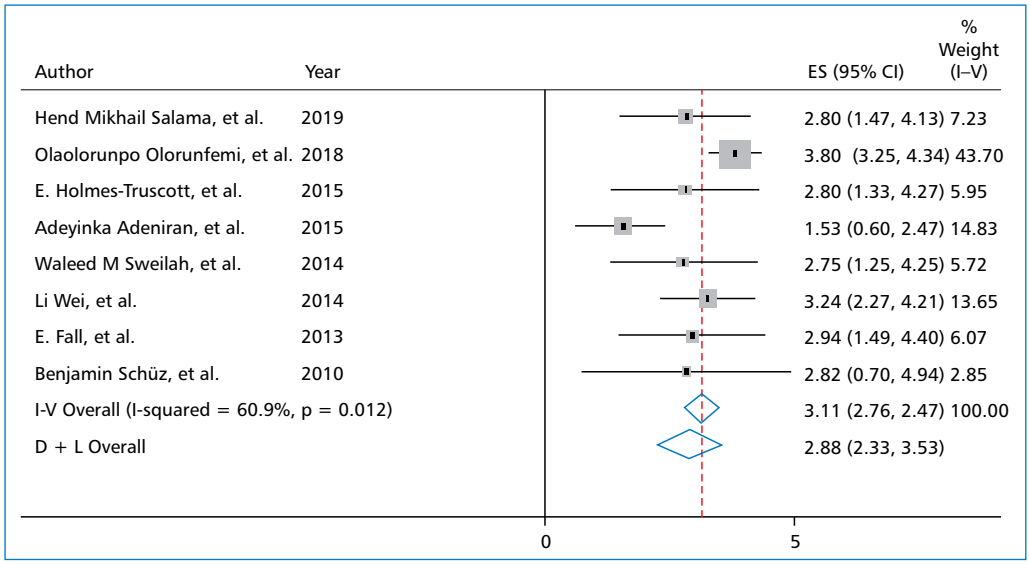

Figure 1. Forest Plot of Medication Belief

I-squared (the percentage of variation in PS attributable to heterogeneity) for the three dimension's specific necessity, specific concern and general harm is approximately 70% ($p < 0.05$), while its value for dimension general overuse is a little more than 50% ($p < 0.05$). Therefore, the pooled score (PS) of the dimensions was estimated through the random effects method. As well as the hypothesis that the PS = 0 was rejected ($p < 0.05$). I-squared for the medication belief is around 61% ($p < 0.05$).

Forrest plots of medication belief and its dimensions are illustrated in Figures 2 and 3 respectively. Based on estimates obtained from the random effects method, the pooled score of medication belief was obtained at 2.877 (95% CI: 2.22–3.53). Also the pooled scores of specific necessity, specific concern, general harm and general overuse were calculated at 3.60 (95% CI: 2.92–4.06), 3.02 (95% CI: 2.19–3.85), 2.26 (95% CI: 1.50–3.02) and 2.54 (95% CI: 1.96–3.12) respectively.

Egger test shows that the bias coefficient is significant only for dimension-specific concerns ($p < 0.05$) and the bias coefficient is not significant for medication belief and dimensions-specific necessity, general harm and general overuse. Thus the test provides weak evidence for the presence of small-study effects s(App. Tab. C).

Discussion

Patients with type 2 diabetes should follow medication prescriptions to reduce the acute complications of the disease, prevent the progression of diabetes, and decrease the costs. This depends on the patient's medication belief. In this regard, this systematic review and meta-analysis have examined the average score of the medication belief and its dimensions among patients with type 2 diabetes. Results showed that the pooled score of medication belief was obtained at 2.877. Also, the pooled scores of specific necessity, specific concern, general harm and general overuse were calculated at 3.60, 3.02, 2.26 and 2.54 respectively. The highest level of specific necessity dimension (4.406 ± 0.57) was related to France, the highest level of Specific concern (4.446 ± 0.2364), General harm (3.39 ± 0.3404), and General overuse (3.202 ± 0.323) were related to Nigeria. The lowest level of specific necessity (1.8 ± 0.44), Specific concern (2.26 ± 0.64), General harm (0.84 ± 0.38), and General overuse (1.24 ± 0.44) were related to South Nigeria.

According to the findings of the study in Brazil, based on the reported score of the BMQ questionnaire, participants are divided into four categories in terms of medication belief: skeptical, ambivalent, indifferent, and accepting, by which this classification determines patient's attitudes and beliefs [23].

A study in Australia showed that there is a relationship between medication beliefs and medication adherence. It also reported that patients with "acceptance" belief showed the highest rate of medication adherence and patients with "doubt" belief showed the lowest rate of medication adherence. Performing clinical interventions and targeted counseling can make a positive change in beliefs and medication adherence [24]. Chin et al. (2021) demonstrated that Health-related knowledge and health literacy lead people to use the medication more wisely [25]. In a study examining the medication beliefs of pregnant women with chronic

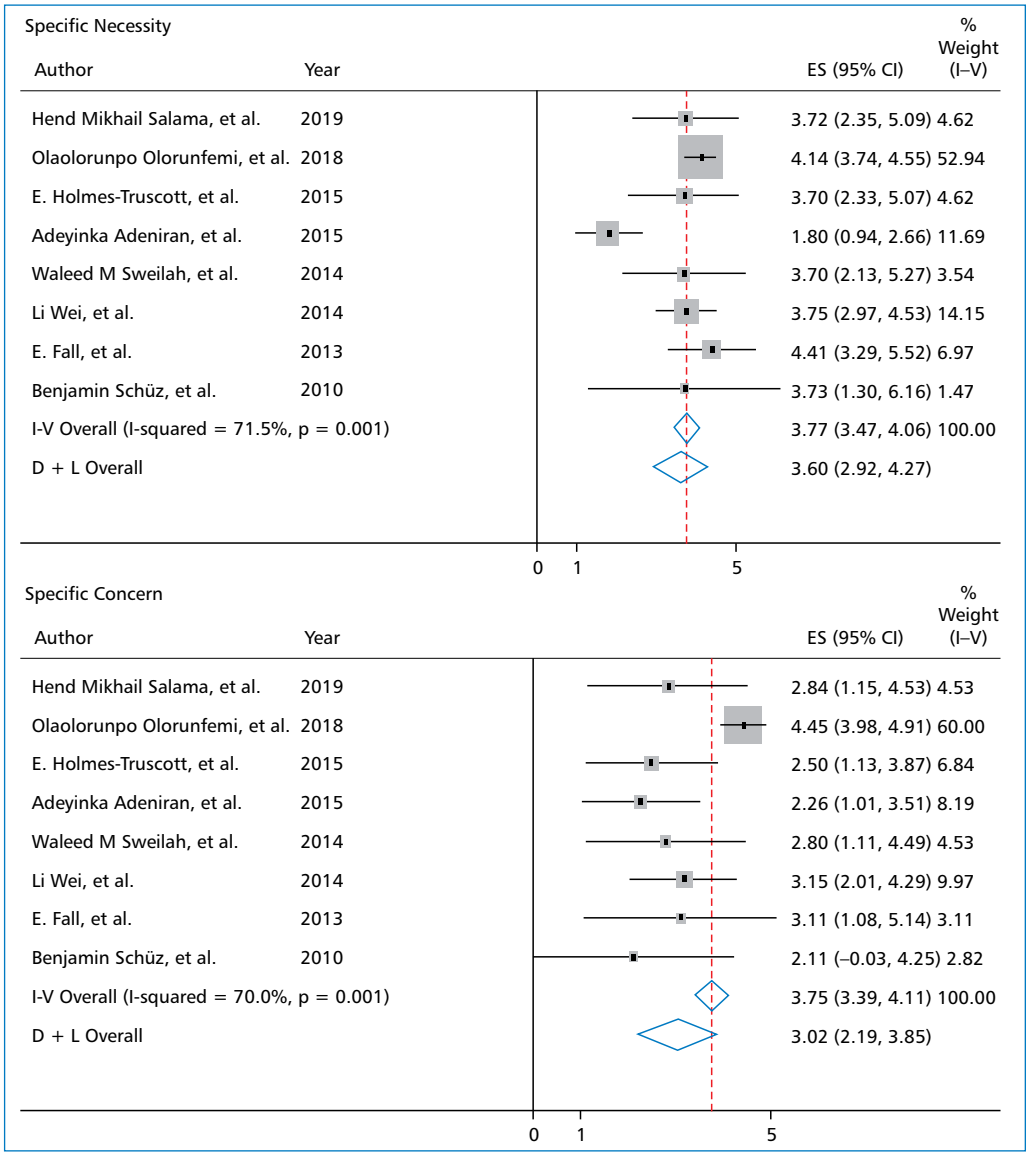

Figure 2. The BMQ-Specific Mean Based on the Random Effect Model

diseases in 18 countries in Europe, the United States, and Australia, Women with low scores on medication belief stopped taking the medication, while women with high scores, used their prescribed medications well [26]. Patients' positive medication experiences and beliefs, increase medication adherence as Ibrahim et al. reported in their 2021 study in the United States [27].

In this meta-analysis, the strongest dimension was a specific necessity (3.77), which indicates the favorable status of this dimension. Contrary to this finding, a study in Pakistan, reported that the level of specific necessity dimension is moderate. So, the patient's beliefs about medication were negative and less than desirable. In order to strengthen this dimension and form positive beliefs about medication, it is necessary to increase patients' knowledge about diabetes, education, and have meetings with a health care provider [28]. A study in Singapore reported a 3.43 score for specific necessity. And also pointed out that Understanding the necessity for medicine corresponds to the realization of the importance of chronic disease and anxiety about the disease's effect on a patient's medication beliefs [29]. In a study conducted in Brazil, the majority of patients with acceptable and ambivalent medication beliefs had a particularly good necessity score. The dimension's score increases with age and the number of medications used, and if the patient had a child or his family members suffered from the same disease; this score will decrease [26].

The specific concern dimension score in the present study was 3.75, which is an acceptable level. In contrast, the dimension's score in a study in Pakistan is

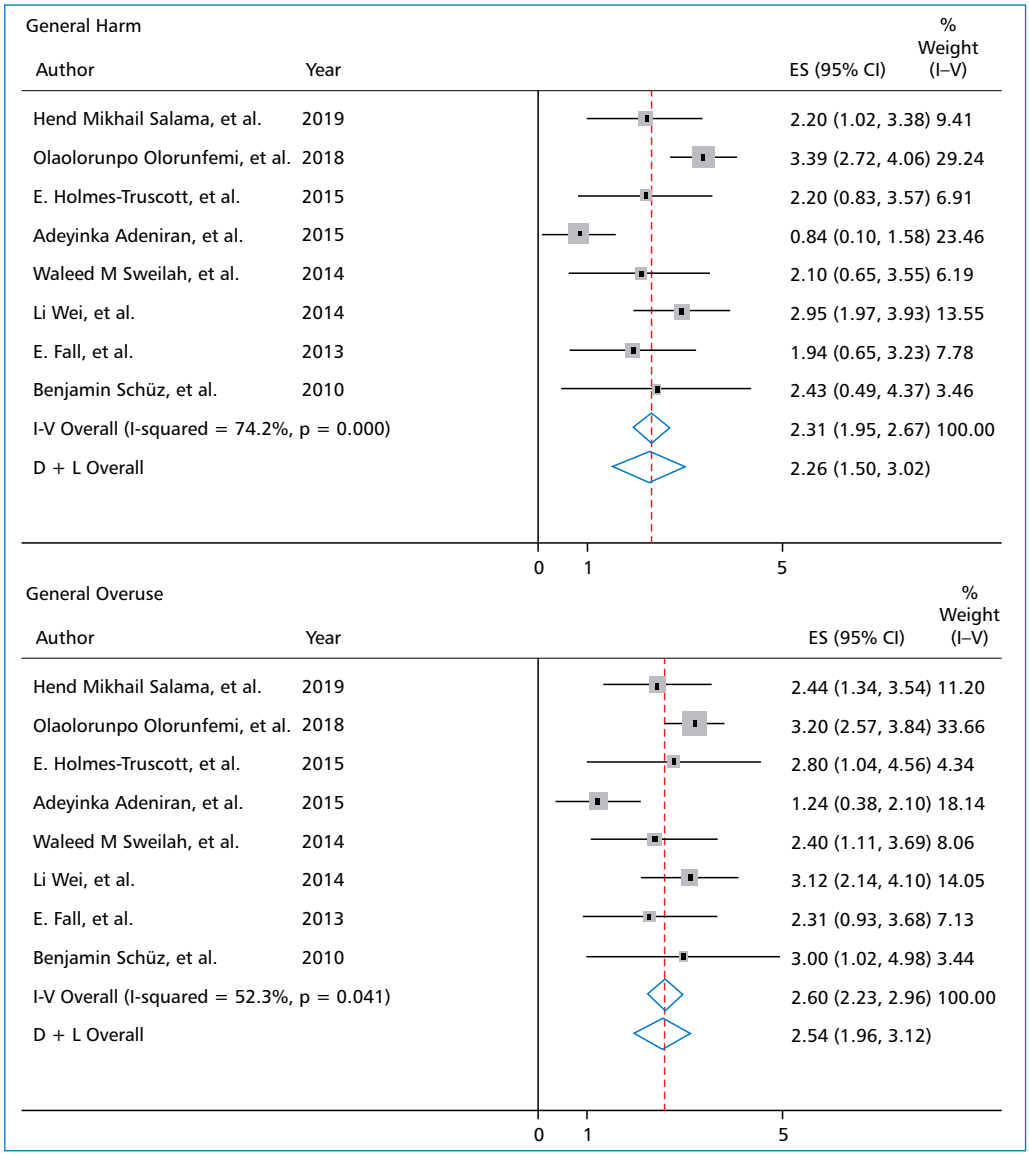

Figure 3. The BMQ-General Mean Based on the Random Effect Model

moderate and low than the desired level. This inconsistency of results is due to the greater concern of people about the long-term use of the medication and its dependence. Negative thoughts such as the impossibility of living without medications, the severe dependence of their future health on medications, and their rescue from the acute stage of the disease by medications have a direct impact on this dimension [15]. A study in Singapore reported a score of 2.67 for specific concerns in patients with asthma. This score indicated that patients were less concerned about medications and had more control over the disease [29]. A study in China of patients with ischemic stroke pointed to the indirect and mediated effects of medication beliefs on medication adherence. It is also noted that perceived concerns about the ill effects of medications and patients' beliefs about the disease affect medication use [30].

The general overuse dimension has a score of 2.60 in the present study. In this regard, a study in Europe, the United States, and Australia showed that this dimension is at a moderate level, which is probably due to the lack of appropriate training programs, and the right and timely guidance [28]. A study conducted in Germany also reported a moderate value for this dimension because of the lack of knowledge about the existence of addictive drugs in the country [31] .

In the present review, the weakest dimension was General harm (2.31). In this regard, a study conducted in Europe has reported a moderate level for this dimension, this may be due to the lack of social support

and appropriate awareness-raising interventions [28]. An article in Germany has shown this to be desirable. This amount may be due to patients believing that the benefits of drugs outweigh their harms [31].

Positive attitude towards treatment, illness, family support as well as the patient's view of the health care team and the patient's symptoms in diagnosis time, the ability to understand and accept medication, understanding the concern of the doctor and having a regular life has a positive effect on medication belief and adherence to medication [32, 33]. Social factors and negative attitudes toward medications, diseases and health care, multi medications, inappropriate relationship with the doctor and multiple visits, cultural beliefs, side effects of medications, uncontrolled diet, feelings of fear, and the feeling of neglect of health are factors that overshadow the belief in medicine and disrupt the proper use of medicine [32, 34]. Strengthening medication beliefs requires increasing knowledge, and literacy and improving the quality of life of patients with type 2 diabetes through appropriate educational programs, patient-centered interventions such as patient-specific counseling, social support, and close follow-up [34, 35].

Health policymakers and economists need to take steps to increase the health literacy of patients with type 2 diabetes and improve the medication beliefs dimensions to reduce the disease costs to provide a better quality of life for patients with type 2 diabetes. Various programs are underway in developed countries. Public education about the side effects of diabetes drugs, narcotics, and drug dependence reduces patients' worries and anxieties, which in turn reduces their anxious thoughts and brings relief to patients. Consultation with a health care provider and regular follow-up by a physician is recommended to increase medication belief. In the field of education, it should be possible to increase the patient's understanding of the disease's acceptance and the benefits of complementary and prescribed medications. In addition, psychotherapy sessions are also recommended to get to know the patient better, reduce negative thoughts and change the person's attitude towards themselves, illness and treatment. Counseling sessions with the patient's family to increase family support, and change the family's attitude and level of literacy towards the disease are key factors for the patient to use prescription medication. Controlling diabetes which is a progressive problem requires long-term and low-cost measures. Finding low-cost and high-efficiency solutions requires more effort, energy, and concentration.

Conclusions

The results of the meta-analysis showed that medication belief and its dimensions are moderate in the reviewed studies. Public education, increasing the patients' and their family's health literacy levels, changing people's attitudes toward disease and treatment, as well as taking diabetes seriously as a global problem, significantly increase patients' positive health behaviors such as appropriate medication usage. Maintaining the current status and improving the medication belief dimensions is necessary to increase patients' belief and adherence to the medication. Training courses related to the benefits and side effects of drugs, regular meetings with a doctor or health care provider, and holding counseling sessions with patients and families, paying attention to social concerns, cultural beliefs of the people, and understanding the attitude of the population and explaining the serious relationship between taking medication and increasing the quality of life and diabetes control are some interventions to improve medication beliefs. Limitations of this study include: firstly, some databases were not accessible; secondly, the full text of some articles was not available; and thirdly, studies related to the medication belief of other diseases were not reviewed.

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Conflict of interests

None declared.

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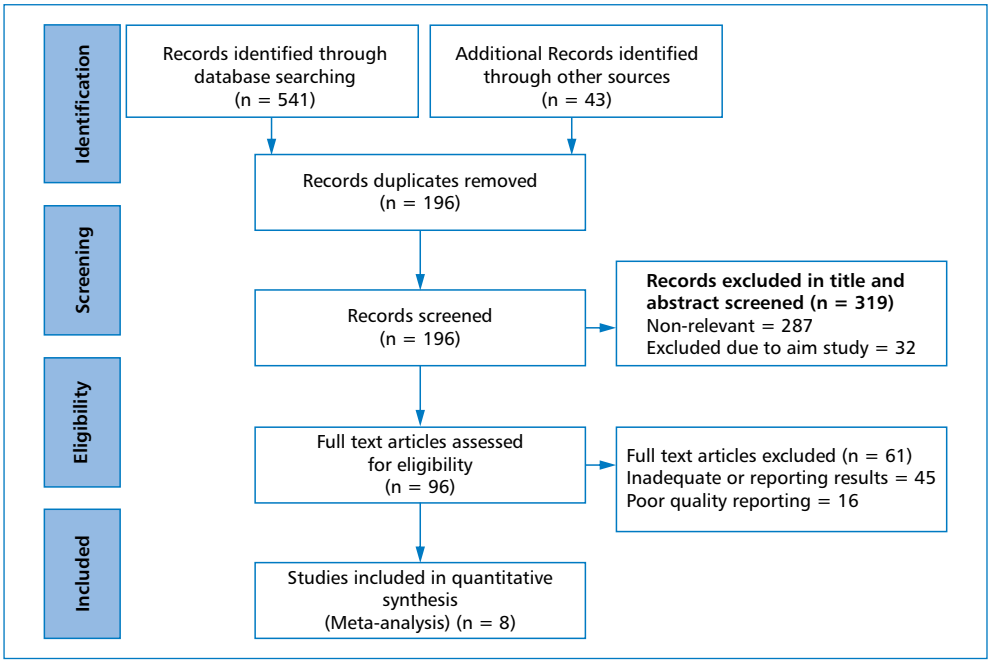
Supplementary appendix



Appendix Figure A. The Flow Diagram of the Literature Search

Appendix Table A. Search Strategy

Data bases	Search strategy
Web of sciences	TS= (diabetes OR "diabetes mellitus") AND TS=("patient" And "medication" And "belief" And "BMQ") AND LANGUAGE: (English) AND DOCUMENT TYPES: (Article)Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=2010-2021
Pub med	(((((diabetes[Title/Abstract]) OR (Diabetes mellitus[Title/Abstract])) AND (patient[Title/Abstract])) AND (medication[Title/Abstract])) AND (belief[Title/Abstract])) AND (BMQ[Title/Abstract]) And ("2010/01/01"[PDat] : "2021/01/01"[PDat] AND "humans"[MeSH Terms] AND English[lang])
Scopus	TITLE-ABS-KEY ("diabetes") OR TITLE-ABS-KEY ("diabetes mellitus") AND TITLE-ABS KEY (patient) And TITLE-ABS KEY ("medication") And TITLE-ABS KEY ("belief")) AND TITLE-ABS KEY ("BMQ") AND DOCTYPE (ar) AND PUBYEAR > 2010 AND (LIMIT-TO (LANGUAGE , "English"))
Google scholar	"diabetes" OR "diabetes mellitus" AND "patient" And "medication" And "belief" And "BMQ" ,Limit: English[lang] AND ("2010/01/01"[PDat] : "2021/01/01"[PDat]
Science direct	Title, abstract or author-specified keywords: "medication belief " AND "BMQ" AND "patient" And "diabetes" OR "diabetes mellitus". Title: "health" And "diabetes" Refine by: years 2010-2021
Other	Medication belief OR BMQ AND diabetic patients OR diabetes mellitus. 2010-2021. Persian and English Lang.

Appendix Table B. Heterogeneity Assessment of Studies by Dimensions of Belief

Statistic	Specific necessity	Specific concern	General harm	General overuse	Medication belief
Variation in ES attributable to heterogeneity	71.5%	70%	74.2%	52.3%	60.9%
Heterogeneity chi-squared	24.55	23.33	27.14	14.66	17.92
d.f	7	7	7	7	7
Heterogeneity P	0.001	0.001	0.001	0.041	0.012
Z (ES = 0)	25.05	20.48	12.56	13.86	17.03
P (ES = 0)	0.000	0.000	0.000	0.000	0.000

Appendix Table C. Egger Test for Publication Bias

Dimensions	Std eff.	Coef.	Std. err	t	P > (t)	95% CI	
Specific necessity	Slope	4.12	0.58	7.03	0.000	2.68	5.55
	bias	–0.94	1.37	–0.69	0.517	–4.31	2.42
Specific concern	Slope	5.05	0.29	17.25	0.000	4.33	5.76
	bias	–2.25	0.56	–5.21	0.002	–4.33	–1.56
General harm	Slope	2.61	1.20	2.17	0.073	–0.33	5.56
	bias	–0.61	2.31	–0.26	0.801	–6.26	5.05
General overuse	Slope	2.88	0.85	3.38	0.015	0.79	4.96
	bias	–0.56	1.61	–0.35	0.736	–4.50	3.36
Medication belief	Slope	3.99	0.67	5.96	0.001	2.35	5.63
	bias	–1.85	1.29	–1.43	0.202	–5.02	1.31

CI — confident interval