

Review

The predictors to medication adherence among adults with type 2 diabetes: a meta-analysis

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Abstract

This study aimed to investigate predictors of medication adherence among adults with type 2 diabetes. This article was compiled using a systematic review and meta-analysis study conducted by searching for articles from databases in electronic form, including EMBASE, PubMed, and Science Direct. The inclusion criteria for this study were full articles using a cross-sectional study, with the publication year until 2022. The analysis of articles in this study using RevMan 5.3 software. A random-effect model was used when heterogeneity was observed to pool the studies, and the results were reported via adjusted odds ratio and corresponding 95% confidence interval (CI). A total of 5 articles reviewed in the meta-analysis (consisting 4 articles in each variable) showed that respondents with a strong belief in anti-diabetic medicines (AOR=0.53; 95% CI=0.38 to 0.75; p=0.0003) and high knowledge of diabetes mellitus (AOR=0.85; 95% CI=0.79 to 0.93; p=0.0005) had a lower level of non-adherence to anti-diabetic medication. A strong belief in anti-diabetic medicines and a high knowledge of diabetes mellitus can lower non-adherence to anti-diabetic medication.

Keywords: diabetes mellitus type 2, medication adherence, predictors.

Introduction

Globally, diabetes mellitus (DM) has increased from 424.9 million in 2017 to 628.6 million by the year 2045 [1, 2]. It was a progressive disease characterized by the intensification of therapy over time. Diabetes medication regimens are often complex, with multiple agents, varied dosages, and frequent administration [3]. Non-adherence to treatment has been a major huddle in the management of diabetes by healthcare providers. Also, the efforts made to explain and improve patients' adherence to their treatment are only sometimes effective [4]. Patients' adherence to their anti-diabetic medications is critical in preventing undesirable complications and reducing healthcare resource utilization [5].

Poor adherence to therapies is common, especially when comorbidities exist [6], and is believed to be influenced by several factors divided into five categories: patient-centered factors, therapy-related factors, health care system factors, social and economic factors, and disease-related factors [7–9]. There have been several studies that have explored medication adherence to anti-diabetic medications with varying results. Some factors found to be associated with non-adherence to anti-diabetic medication include financial difficulties, forgetfulness, younger age, level of education, existing diabetes complications and difficulties in taking the medications alone [9–12].

Realizing the importance of medication adherence as mentioned above, the opportunity for early disease



control in patients with DM, and the need to prioritize limited healthcare resources in the face of the rising DM epidemic, this study examined the determinants of medication non-adherence in adults with DM.

Material and methods

Data sources and search strategy

This systematic review and meta-analysis was conducted according to the Preferred Reporting Items for Systematic Review and Meta-analyses (PRISMA) guidelines [13]. An electronic search of Embase, PubMed/Medline, and Science-Direct was conducted from their inception to 30th April 2022 with only English language-based literature using the search string: (medication adherence OR non-adherence) AND (predictors OR factors) AND (diabetes mellitus OR diabetes type 2). In addition, we manually screened the cited articles of previous meta-analyses, cohort studies, and review articles to identify any relevant studies.

Study selection

All studies were included if they met the following eligibility criteria: (a) articles on anti-diabetic medication adherence or non-adherence; (b) independent variables influencing medication adherence or non-adherence was a belief in anti-diabetic medication and knowledge about diabetes; (c) associations measured by an adjusted odds ratio; and (d) respondents were general adults with diabetes mellitus. Furthermore, the strategy for research was PECOS: 1) P (population): adults with diabetes mellitus; 2) E (exposure): a strong belief in anti-diabetic medication and high knowledge of diabetes mellitus; 3) C (control): a weak belief or none in anti-diabetic medication and little knowledge of diabetes mellitus; 4) O (outcome): non-adherence of anti-diabetic medication; 5) S (Studies): cross-sectional studies published in English only. Cohorts, case series, case reports, human-based randomized controlled trials, literature reviews, editorials, and studies not meeting the inclusion criteria were excluded.

Data extraction and quality assessment of studies

Two reviewers independently searched the electronic databases. Studies that were searched were exported to EndNote Reference Library software version 20.0.1 (Clarivate Analytics), and duplicates were screened and

removed. Two reviewers performed data extraction and quality assessment of included studies simultaneously and independently. The Newcastle–Ottawa Scale (NOS) was used to assess the quality of the cross-sectional studies. A NOS score of 1–5 was considered high risk for bias, 6–7 was moderate, and a score >7 was considered low risk of bias (details of scoring are provided in Table 1).

Statistical analysis

Review Manager (version 5.3. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014) was used for all statistical analyses. The data from studies were pooled using a random-effects model. Results were analyzed using the adjusted odds ratio (AOR) with respective 95% confidence intervals (CI). As per Higgins et al., the scale for heterogeneity was considered as follows: $I^2=25-60\%$ – moderate; $50-90\%$ – substantial; $75-100\%$ – considerable heterogeneity, and $p<0.1$ – significant heterogeneity [14]. A $p<0.05$ was considered significant for all analyses.

Results

Literature search results

The initial search of the three electronic databases yielded 5380 potential studies. After exclusions based on titles and abstracts, the full texts of 85 studies were read for possible inclusion. A total of 6 studies remained for quantitative analysis. Figure 1 summarizes the results of our literature search.

Study characteristics

Table 2 provides the basic characteristics of the included studies. Our analysis included 5 published studies [15–19]. All were cross-sectional studies. In total, 1796 respondents with DM were involved in this analysis. One study was from Uganda, one was from Ethiopia, one was from Australia, one was from Iran, and one was from Palestine. Four studies examined the association between belief in medication and high knowledge of diabetes mellitus with medication adherence.

Publication bias and quality assessment

The studies included less than 10, so publication bias could not be assessed. One study has a moderate risk of bias [17], while the other four have a low risk of bias [14–19].

Table 1: Quality assessment of cross-sectional studies using the Newcastle–Ottawa scale.

Studies	Selection			Comparability The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled.	Outcome		Total score
	Representativeness of the sample	Sample size	Ascertainment of exposure		Non-respondents	Assessment of outcome	
Ali <i>et al.</i> , (2017)	0	1	2	1	1	1	8
Dhippayom & Krass, (2015)	0	1	2	1	1	1	8
Kalyango <i>et al.</i> , (2008)	0	1	1	1	1	1	7
Pirdehghan & Poortalebi, (2016)	1	1	2	1	1	1	9
Sweileh <i>et al.</i> , (2014)	0	1	2	1	1	1	8

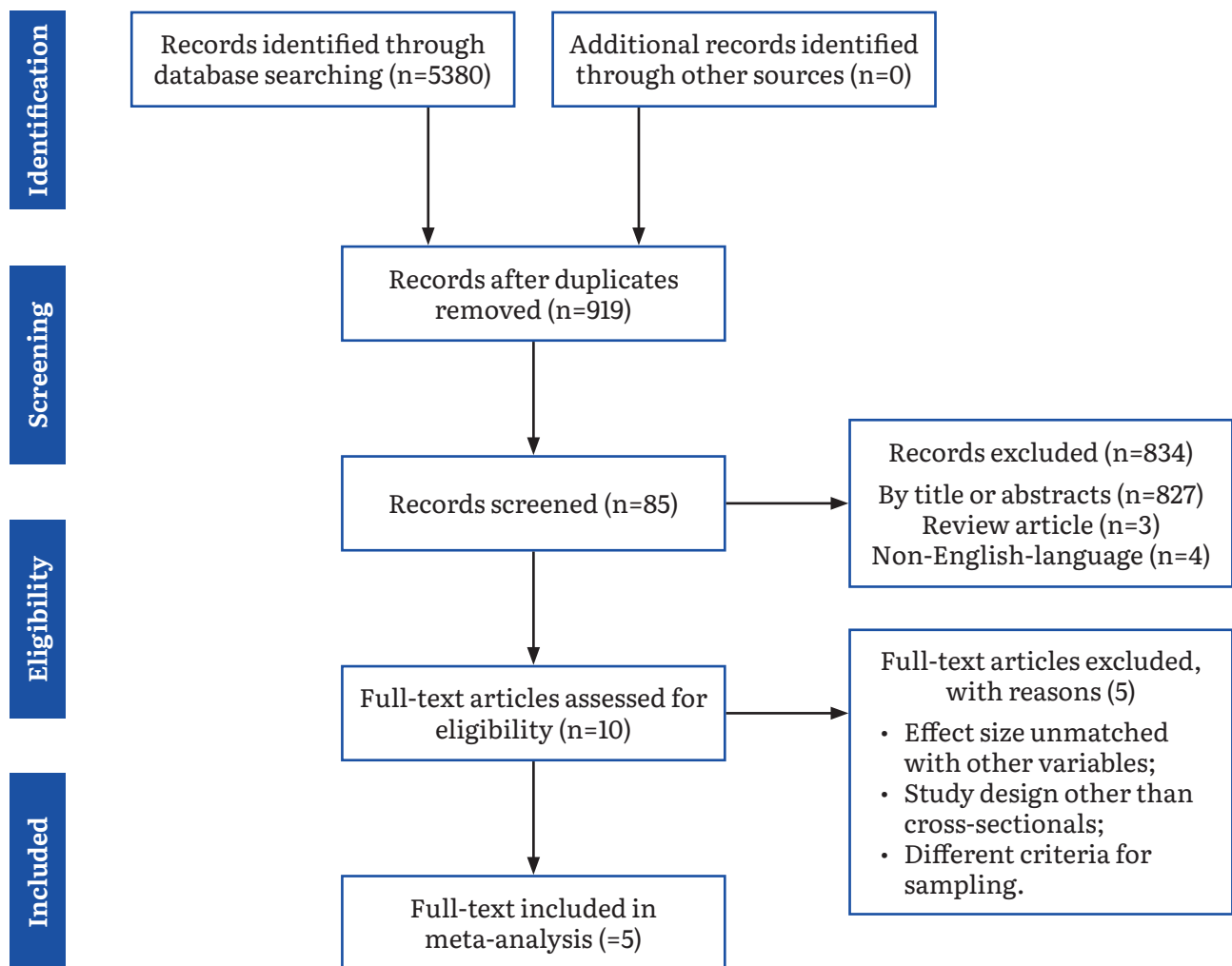


Figure 1: PRISMA flow diagram for systematic reviews and meta-analysis, which included searches of databases.

Results of the meta-analysis

A detailed forest plot (Figure 2) outlines the association between belief in medicines and medication non-adherence to anti-diabetes. Four studies were used to conduct the analysis. The random analysis of pooled AOR suggests there is a strong association between

strong belief in medicines with lower medication non-adherence of anti-diabetic medicines compared to weak belief in medicines and it was statistically significant (AOR=0.53; 95% CI=0.38 to 0.75; $p=0.0003$). The heterogeneity (I^2) showed a substantial category with a value of 97% and it was significant $p<0.00001$. The fixed analysis of pooled AOR from 3 studies suggests there is

Table 2: Basic characteristics of selected studies.

Study (year)	Country	Study design	Total sample	Mean age (years±Standard Deviation)	Exposure	Control	AOR Extracted (CI 95%)
Ali et al. (2017)	Ethiopia	Cross-sectional	146	46.5±14.7	Strong belief in medicines	Weak belief in medicines	1.955 (0.453–8.44)
Dhippayom & Krass, (2015)	Australia	Cross-sectional	543	63.0±10.6	Strong belief in medicines; High knowledge of DM	Weak belief in medicines; Little knowledge of DM	0.91 (0.87–0.96); 0.85 (0.73–0.99)

Table 2: Continued.

Study (year)	Country	Study design	Total sample	Mean age (years±Standard Deviation)	Exposure	Control	AOR Extracted (CI 95%)
Kalyango <i>et al.</i> , (2008)	Uganda	Cross-sectional	402	50.0±13.8	High knowledge of DM	Little knowledge of DM	0.51 (0.27–0.95)
Pirdehghan & Poortalebi, (2016)	Iran	Cross-sectional	300	55.84±10.39	Strong belief in medicines	Weak belief in medicines	0.02 (0.01–0.07)
Sweileh <i>et al.</i> , (2014)	Palestine	Cross-sectional	405	58.3±10.4	High knowledge of DM; Weak belief in medicines	Little knowledge of DM; Weak belief in medicines	0.87 (0.78–0.97); 0.93 (0.88–0.99)

a moderate association between high knowledge of diabetes mellitus with lower medication non-adherence to anti-diabetic medicines compared to little knowledge of diabetes mellitus and it was statistically significant (AOR=0.85; 95% CI=0.79 to 0.93; p=0.0005). The heterogeneity (I^2) showed a moderate category with a value of 24% and it was not significant p=0.27 (Figure 3).

Discussion

In 2021, around 537 million adults are living with diabetes worldwide. Diabetes mellitus is the most com-

mon type of diabetes, accounting for over 90% of all diabetes worldwide [20]. DM strongly influences the quality and length of patients’ lives and puts a significant financial burden on them [21, 22]. Diabetes is a chronic condition with many complications, and its management requires sufficient levels of knowledge, self-care behaviors and adherence to medications [23, 24]. Excellent medication adherence decreases morbidity, mortality, and healthcare costs. Medication non-adherence places a significant cost burden on healthcare systems [25, 26].

The result of this study suggests that a strong belief in anti-diabetic medicines will lower medication

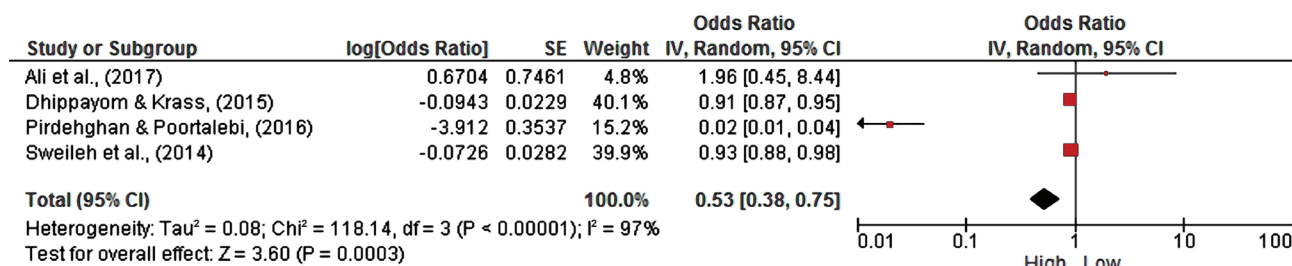


Figure 2: Forest plot showing association between beliefs in medicines with medication non-adherence to anti-diabetic medicines.

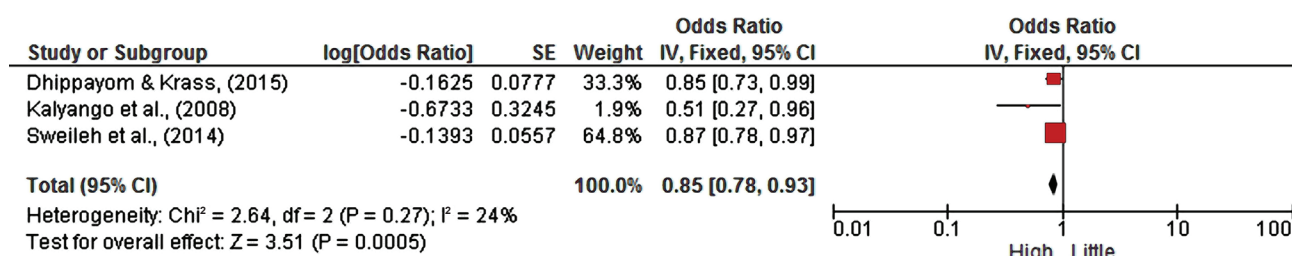


Figure 3: Forest plot showing an association between knowledge of diabetes mellitus with medication non-adherence to anti-diabetic medicines.

non-adherence to anti-diabetic medicines. We compared the group with a high or strong belief in anti-diabetic medicines to the group with a low or weak belief in anti-diabetic medicines. This result was similar to a study by Schoenthaler et al. (2012). It was stated that patient beliefs about the need for their medications were associated with better adherence to oral hypoglycemic medications [27]. The study by Alatawi et al. (2016) also supported their conclusion that perceived medication benefits were significant predictors of medication adherence [28].

Diabetes has no cure so far, but appropriate self-management contributes to delaying or controlling its progression [29]. For effective management and in order to have good glycemic control, patients need to have adequate levels of knowledge of diabetes regarding self-care. This concept can foster adherence to medications [30, 31]. Our study also suggests that high knowledge of diabetes mellitus can lower medication non-adherence to anti-diabetic medicines compared to little knowledge of diabetes mellitus. It was supported by Bagonza et al. (2015). They stated that adherence was associated with receiving diabetic health education [32]. A study by The Mexican American Trial of Community Health Workers (MATCH) found a significant benefit of a community health workers' intervention over written educational material in improving glycemic control in an ethnic minority population [33].

There are several limits to this study. Our study aimed to address the relationship between belief in medicines and high knowledge of diabetes towards medication adherence. This present study should be evaluated with caution due to the evidence of heterogeneity. The number of primary studies included in this meta-analysis was still limited. Then, the literature search was carried out only over three databases, and the included studies were only in the English language, potentially needing more relevant information. In addition, we did not conduct the subgroup analysis because of the limited data available from the primary studies. Future studies should allow for a larger number of primary studies and also conduct subgroup analyses.

Conclusion

To our knowledge, this is the first paper that explored the relationship between belief in medicines and high knowledge of diabetes towards medication adherence among adults with DM, and the results of the meta-analysis suggested that a strong belief in

anti-diabetic medicines and high knowledge of diabetes mellitus can lower non-adherence to anti-diabetic medication. The evaluation of the eligibility of the identified studies was based on predefined criteria and done independently by the two researchers, who examined in detail the quality of those studies. This study highlighted the factors we must consider while developing health promotion activities. Further, health literacy, counseling, and education programs must be developed in clinical and community settings.

Conflict of interest

The authors declare no conflict of interest.

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