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Prevalence of anxiety and depression in patients with diabetes and their impact on glycemic control: a systematic review and meta-analysis

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 31 December 2025 and was last updated on 31 December 2025.

INTRODUCTION

Review question / Objective To systematically evaluate (i) the prevalence of depression and anxiety in people with diabetes and (ii) the quantitative associations between these psychological conditions and glycaemic control (HbA1c).This meta-analysis provides updated pooled estimates of depression and anxiety prevalence among people with diabetes and quantifies their associations with HbA1c. It identifies study design, measurement tools, and sex composition as key sources of heterogeneity influencing reported rates and correlations.

Condition being studied Depression and anxiety are common psychological comorbidities in diabetes and have been linked to poor glycemic control, yet reported prevalence and effect sizes vary widely across studies due to methodological and population differences.

METHODS

Participant or population We systematically searched PubMed, Web of Science Core Collection, Embase, and APA PsycInfo from database inception to 15 March 2025, with no language or publication-status restrictions. Search strategies combined controlled vocabulary and free-text terms for diabetes, depression, anxiety, HbA1c, and prevalence/association outcomes.

Intervention Two reviewers independently screened titles/abstracts and then full texts in Covidence/Excel; disagreements were resolved by a third reviewer. PRISMA numbers for the consolidated search set. The PRISMA flow diagram (Figure 1) documents each stage.

Comparator A piloted form captured: study design, country/setting, sample characteristics (n, age, male), diabetes type, scales/thresholds, prevalence data (numerator/denominator), HbA1c metrics, adjusted covariates, and effect sizes for

associations (β, OR/RR, r). For trials enrolling high-symptom participants, baseline prevalence was extracted "trial baseline".Where counts/SEs were missing, we calculated them from reported proportions/CI or contacted authors when feasible.

Study designs to be included We conducted a systematic review and meta-analysis to (i) estimate the prevalence of depression and anxiety in people with diabetes and (ii) quantify the associations between depression/anxiety and glycaemic control (HbA1c). Methods followed PRISMA 2020 guidance(8). A protocol (search strategy, PICOS, analysis plan) was finalized before screening and is available upon request.

Eligibility criteria Studies were eligible if they enrolled individuals with type 1 or type 2 diabetes, including adults and adolescents. Non-human studies, non-diabetic populations, and gestational diabetes were excluded. For prevalence analyses, no index or comparator was required. For association analyses, eligible studies had to report a statistical relationship between depression and/or anxiety and HbA1c, including correlation coefficients, regression coefficients (β), or effect estimates (OR/RR). The primary outcomes were the prevalence of depression and anxiety assessed using validated measurement tools (e.g., PHQ, HADS-D, DASS-Dep; GAD-7, HADS-A, DASS-Anx). Secondary outcomes included HbA1c levels (reported in % or mmol/mol) and their associations with depression or anxiety. Where multiple diagnostic thresholds were presented, we preferentially extracted the standard clinical cut-off; study-specific thresholds were retained only when necessary and marked for sensitivity analyses. Eligible study designs included observational studies (cross-sectional and cohort) and clinical trials providing relevant baseline data or appropriate analyses. Reviews, meta-analyses, editorials, commentaries, qualitative studies, case reports/series, and conference abstracts without extractable data were excluded. Duplicate records were removed at all screening stages, and in cases of multiple publications from the same dataset, the most complete report was retained. Studies were also excluded if validated measures of depression/anxiety were not used or if HbA1c data were not based on standardized laboratory assessment.

Information sources We systematically searched PubMed, Web of Science Core Collection, Embase, and APA PsycInfo from database inception to 15 March 2025, with no language or publication-status restrictions. Search strategies combined controlled vocabulary and free-text terms for diabetes, depression, anxiety, HbA1c, and prevalence/association outcomes.
We additionally searched grey literature sources, including ProQuest Dissertations & Theses Global and clinical trial registries (ClinicalTrials.gov and the WHO International Clinical Trials Registry Platform), and identified conference abstracts through Embase and Web of Science. Reference lists of all included articles and relevant systematic reviews were manually screened to capture further eligible studies.

Main outcome(s) Sixteen studies (n≈13,700) met inclusion criteria. Pooled prevalence estimates were 30% (95% CI 21–42%) for depression and 27% (15–43%) for anxiety, with high between-study heterogeneity. Depression correlated positively with HbA1c (r = 0.22, 95% CI 0.11–0.33) and anxiety with HbA1c (r = 0.27, 95% CI 0.15–0.39). Study design was the dominant source of heterogeneity in depression prevalence, while anxiety prevalence was strongly influenced by female proportion and scale type. Sensitivity analyses confirmed robustness.

Quality assessment / Risk of bias analysis In this study, risk of bias was assessed using a tiered approach based on study design type: randomized controlled trials were assessed using the Cochrane RoB 2.0 tool(9), which assesses the risk of bias based on randomization, intervention deviations, missing data, outcome measurement, and selective reporting. Cohort studies were assessed using the Newcastle–Ottawa Scale(10) (0–9 points, with 7–9 indicating low risk of bias) based on sample representativeness, comparability, and outcome assessment. Cross-sectional studies were assessed using the AHRQ/NIH Quality Assessment Scale(11) (total scores of 7–9 considered low risk of bias, 4–6 moderate risk, and 0–3 high risk) based on sample representativeness, comparability, and outcome assessment. Cross-sectional studies were assessed using the AHRQ/NIH Quality Assessment Scale(11); each of the 11 items was coded as "yes" (1 point) or "no/unclear" (0 points), the item scores were summed to yield a total of 0–11, and studies were then categorized as high quality (8–11), moderate quality (4–7), or low quality (0–3), considering study objective and sample representativeness, variable definition and measurement reliability, statistical analysis, and control of confounding. Two researchers independently assessed and cross-checked all domains, with disagreements resolved through discussion or third-party adjudication.

Strategy of data synthesis All statistical analyses were conducted in R (version 4.4.2; R Foundation

for Statistical Computing, Vienna, Austria) using the “meta” and “metafor” packages.

Primary analyses pooled study-specific proportions for depression and anxiety using random-effects (DerSimonian–Laird τ^2) with logit transformation and inverse-variance weighting; proportions and 95%CI were back-transformed for presentation. Continuity correction (0.5) was applied for zero cells; CIs were computed by normal approximation (Wilson as sensitivity where needed).

Heterogeneity: Cochran Q, τ^2, I^2 with 95% uncertainty where available, and I^2 values of approximately 25%, 50%, and 75% were interpreted as low, moderate, and high heterogeneity, respectively.

Association meta-analyses (depression/anxiety HbA1c). Because studies reported mixed metrics, we harmonized to correlation coefficients (r) for primary pooling: β→r via t statistics and df (or p-value); OR/RR→r via log(OR)→Cohen’s d→r (Chinn). Pooled using REML on Fisher’s z-transformed r; results back-transformed to r.

Subgroup analysis is pre-set to analyze from the aspects of research design, scale type, and population

Meta-regression on logit prevalence using REML with single moderators to avoid overfitting: sample size (N)、mean age、male、study design；scale type was explored via stratified analyses.

For association outcomes, we did not run meta-regression (k<10), consistent with Cochrane recommendations.

Leave-one-out analyses for all pooled outcomes; Excluding trial baseline studies from prevalence analyses; Alternative τ^2 estimator (Paule–Mandel) and transformation (Freeman–Tukey) as robustness checks.

Subgroup analysis Pre-specified subgroups were study design , scale type, and population/setting. For depression prevalence, study design was the dominant source of between-study variation （Figure S1）: trial/experimental samples—driven by high-symptom inclusion at baseline—clustered around 0.88 (95% CI 0.50–0.98), whereas observational estimates were markedly lower (cross-sectional 0.26, 0.20–0.32; cohort 0.16, 0.05–0.37). For anxiety prevalence （Figure S2）, differences were not explained by design; instead, scale type and sample structure predominated: GAD-7 yielded the lowest estimates (≈0.11), HADS-A was intermediate. Population/setting effects were smaller and inconsistent after accounting for design and scale (community/primary care vs hospital, and T1DM vs T2DM showed only minor shifts without a stable pattern).

Within-subgroup heterogeneity remained moderate-to-high, but sensitivity analyses removing trial baselines aligned the observational strata with the overall pooled values and did not change conclusions.Funnel plots for each pooled outcome; Egger’s test when k ≥ 10；otherwise visual appraisal only.

Sensitivity analysis Depression prevalence Leave-one-out pooled proportion range: 0.26–0.33 (overall random-effects 0.30, 95% CI 0.21–0.42; I^2=98.6%，Figure 6A).

Anxiety prevalence Leave-one-out pooled proportion range: 0.24–0.31 (overall random-effects 0.27, 95% CI 0.15–0.43; I^2=99.4%，Figure 6B).

Depression–HbA1c Leave-one-out pooled correlation (r) range: 0.18–0.26 (overall r=0.22, 95% CI 0.11–0.33; I^2=78.7%，Figure 6C).

Anxiety–HbA1c Leave-one-out pooled correlation (r) range: 0.23–0.34 (overall r=0.27, 95% CI 0.15–0.39; I^2=38.8%，Figure 6D).

Country(ies) involved China.

Keywords Diabetes mellitus; Depression; Anxiety; Glycaemic control; Meta-analysis.

Contributions of each author

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