The prevalence of cannabis use disorders in people who use medicinal cannabis: a systematic review and meta-analysis

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Supporting Information 1: PRISMA checklist

The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guideline checklist items for systematic review

Table S1: Shows the PRISMA checklist items for the prevalence of cannabis use disorders in people who use medicinal cannabis: a systematic review and meta-analysis

Section/topic	#	Checklist item	As reported on page number
Title			
Title	#1	Identify the report as a systematic review, meta-analysis, or both	1
Abstract			
Structured summary	#2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
Introduction			
Rationale	3	Describe the rationale for the review in the context of what is already known.	1
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	1-2
Methods			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	2
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	2
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and the date last searched.	2-3
Search	8	Present a full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	2-3
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in a systematic review, and, if applicable, included in the meta-analysis).	2-3
Data collection process	10	Describe the method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	2-3
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	2-3
Risk of bias in individual studies	12	Describe methods used for assessing the risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	2-3
Measures	13	State the principal summary measures (e.g., risk ratio, the difference in means).	2-3
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	2-3
Risk of bias across studies	15	Specify any assessment of the risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	N/A
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
Results			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	3

Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	3
Risk of bias within studies	19	Present data on the risk of bias of each study and, if available, any outcome level assessment (see item 12).	N/A
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	3-4
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	3-4
Risk of bias across studies	22	Present results of any assessment of the risk of bias across studies (see Item 15).	N/A
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A
Discussion			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policymakers).	6
Limitations	25	Discuss limitations at the study and outcome level (e.g., risk of bias), and at the review level (e.g., incomplete retrieval of identified research, reporting bias).	6
Conclusions	26	Provide a general interpretation of the results in the context of other evidence and implications for future research.	7
Funding			
Funding	27	Describe sources of funding for the systematic review and other support, and the role of funders for the systematic review.	7

Supporting Information 2: Eligibility criteria based on the Population, Exposure, Comparison, and Outcome (PECO)

Table S2: Shows the eligibility criteria based on the PECO framework for the prevalence of cannabis use disorders in people who use medicinal cannabis: a systematic review and meta-analysis

	Include	**Exclude**
Population	- Humans - The general population, community-based studies, specific populations - Age: include any age of the population	- Animals
Exposure	- Studies that reported any type of medicinal cannabis use - Studies that reported both medicinal and recreational cannabis use - Reporting type: self-report, possession of medicinal cannabis card, health records - Health condition: no restrictions	- Studies that exclusively studied participants who used cannabis for recreational purposes were excluded, as the outcomes of this motive for use may differ from medicinal use.
Comparison	N/A	N/A
Outcomes	- Prevalence of cannabis use disorders (% of sample) - CUDs includes problematic cannabis use, cannabis use disorder, cannabis dependence, cannabis abuse, unhealthy cannabis use. - Measurement: any DSM or ICD criteria, or validated assessment tool such as CUDIT-R - Time-period of the outcome including: o lifetime, o 12 months o 6 months o 3 months	- Studies using only Portenoy's criteria to measure CUDs were excluded due to lack of validity in diagnosing CUDs.
Study design	- Observational (cross-sectional, longitudinal, case-control, cohort) - Randomized Control Trials, Randomised Clinical Trails. - Articles published in peer-reviewed journals	- Reviews, case studies - Book chapters - Articles without adequate information on study designs or methods - Grey literature including conference abstracts, and dissertations with original data reported

Supporting Information 3: Search strategy

Database-specific search strategies and keywords for the prevalence of cannabis use disorders in people who use medicinal cannabis: a systematic review and meta-analysis

Table S3: PubMed search strategy

Search and concept	Search string
#1: Cannabis	(cannabis[Title/Abstract]) OR (marijuana[Title/Abstract]) OR (cannabis sativa[Title/Abstract]) OR (cannabis indica[Title/Abstract]) OR (marijuana smoking[Title/Abstract]) OR (hashish[Title/Abstract]) OR (hash[Title/Abstract]) OR (bhang[Title/Abstract]) OR (ganja[Title/Abstract]) OR (cannabis[MeSH Terms]) OR (marijuana use[MeSH Terms]) OR (cannabis sativa[MeSH Terms]) OR (cannabis indica[MeSH Terms]) OR (marijuana smoking[MeSH Terms]) AND (marijuana abuse[MeSH Terms])
#2: Medicinal	(medicinal[Title/Abstract]) OR (medical[Title/Abstract]) OR (therapeutic[Title/Abstract])
#3: Medicinal Cannabis	(medical marijuana[Title/Abstract]) OR (medical cannabis[Title/Abstract]) OR (dronabinol[Title/Abstract]) OR (nabixomols[Title/Abstract]) OR (medical marijuana[MeSH Terms]) OR (medical cannabis[MeSH Terms]) OR (marijuana treatment[MeSH Terms])
4: Cannabis Use Disorders	(cannabis use disorder[Title/Abstract]) OR (CUD[Title/Abstract]) OR (problematic cannabis use[Title/Abstract]) OR (cannabis addiction[Title/Abstract]) OR marijuana abuse[MeSH Terms]
Final Search	((#1 AND #2) OR #3) AND 4
Filter	Filters applied: Humans, from 2010/1/1 - 2024/12/12

Table S4: Embase search strategy

Search and concept	Search string
#1: Cannabis	'cannabis':ta,ab OR ‘marijuana’:ta,ab OR ‘cannabis sativa’:ta,ab ‘cannabis indica’:ta,ab OR ‘marijuana smoking:ta,ab OR ‘hashish’:ta,ab OR OR 'hash':ta,ab OR 'bhang':ta,ab OR 'ganja':ta,ab
#2: Medicinal	'medicinal':ta,ab OR 'medical':ta,ab OR 'therapeutic':ta,ab
3# Medicinal Cannabis	'medical marijuana':ti,ab OR 'dronabinol':ti,ab OR 'marinol':ti,ab OR 'dronabinolum':ti,ab OR 'tetranabinex':ti,ab OR 'qcd-84924':ti,ab OR 'cannabichromene':ti,ab OR 'dexanabinol':ti,ab OR 'nabidolex':ti,ab OR 'nabiximols':ti,ab OR 'sativex':ti,ab OR 'anandamide':ti,ab OR 'cannabidiol':ti,ab OR 'cannabinol':ti,ab 'Medicinal Treatment':ti,ab OR 'Medicinal Cannabis':ti,ab
#4: Cannabis Use Disorders	'cannabis abuse':ta,ab OR 'cannabis dependence':ta,ab OR 'cannabis use disorder':ta,ab OR 'cannabis misuse':ta,ab, ‘marijuana abuse':ta,ab,
Final Search	((#1 AND #2) OR #3) AND 4
Filter	Filter: AND [2010-2023]/py AND 'human'/de

Table S5: PsycINFO search strategy

Search and concept	Search string
#1: Cannabis	Abstract: 'cannabis' OR Abstract: 'marijuana' OR Abstract: 'Cannabis sativa' OR Abstract: 'Cannabis indica' OR Abstract: 'Marijuana Smoking' OR Abstract: 'Hashish' OR Abstract: 'Hash' OR Abstract: 'Bhang' OR Abstract: 'Ganja'
#2: Medicinal	Abstract: 'medicinal' OR Abstract: 'medical' OR Abstract: 'therapeutic'
#3: Medicinal Cannabis	Abstract: 'Medical Marijuana' OR Abstract: 'Dronabinol' OR Abstract: 'Marinol' OR Abstract: 'cannabichromene' OR Abstract: 'dexanabinol' OR Abstract: 'Nabiximols' OR Abstract: 'Sativex' OR Abstract: 'Anandamide'

	OR Abstract: 'cannabidiol' OR Abstract: 'cannabinol' OR Abstract: 'Medicinal Cannabis' OR Abstract: 'Marijuana Treatment'
#4: Cannabis Use Disorders	Abstract: 'CUD' OR Abstract: 'marijuana abuse' OR Abstract: 'cannabis use disorder'
Final Search	((#1 AND #2) OR #3) AND 4
Filter	Filter: AND Population Group: Human AND Year: 2010 To 9999

Supporting Information 4: Risk of bias assessment tools and assessment

Table S6: The JBI (Joanna Briggs Institute) Critical Appraisal Checklist for Cross-Sectional Studies included studies in the prevalence of cannabis use disorders in people who use medicinal cannabis: a systematic review and meta-analysis

The JBI (Joanna Briggs Institute) Critical Appraisal Checklist for Cross-Sectional Studies		
No	**Item**	***Rating***
1	Were the criteria for inclusion in the sample clearly defined?	1 - Yes 0 - No/Unclear
2	Were the study subjects and the setting described in detail?	1- Yes 0 - No/Unclear
3	Was the exposure measured in a valid and reliable way?	1 - Yes 0 - No/Unclear
4	Were objective, standard criteria used for measurement of the condition?	1 - Yes 0 - No/Unclear
5	Were confounding factors identified?	1 - Yes 0 - No/Unclear
6	Were strategies to deal with confounding factors stated?	1 - Yes 0 - No/Unclear
7	Were the outcomes measured in a valid and reliable way?	1 - Yes 0 - No/Unclear
8	Was appropriate statistical analysis used?	1 - Yes 0 - No/Unclear
Score		0-8

Table S7: Score for each item of the JBI risk-of-bias tool for cross sectional in the prevalence of cannabis use disorders in people who use medicinal cannabis: a systematic review and meta-analysis

Author, publication year	Item-1	Item-2	Item-3	Item-4	Item-5	Item-6	Item-7	Item-8	Score
Bialas (2023)	1	1	1	0	1	1	1	1	7
Bonn-Miller (2014)	1	1	1	0	1	0	1	1	6
Feingold (2016)	1	1	0	1	1	1	1	1	7
Gendy (2023)	1	1	1	0	1	1	0	1	6
Haug (2017)	1	1	1	0	1	1	1	1	7
Lin (2016)	1	1	0	0	1	1	1	1	6
Mills (2022)	1	1	0	0	1	1	1	1	6
Myers (2023)	1	1	1	1	1	1	1	1	8
Rubin-Kahana (2022)	1	1	1	1	1	1	1	1	8
Smith (2019)	1	1	0	0	1	1	1	1	6

Table S8: The revised JBI critical appraisal tool for the assessment of risk of bias for RCTs in the prevalence of cannabis use disorders in people who use medicinal cannabis: a systematic review and meta-analysis

The JBI (Joanna Briggs Institute) Critical Appraisal Checklist for RCTs		
No	**Item**	***Rating***
1	Was true randomization used for assignment of participants to treatment groups?	1 - Yes 0 - No/Unclear
2	Was allocation to groups concealed?	1- Yes 0 - o/Unclear
3	Were treatment groups similar at the baseline?	1 - Yes 0 - No/Unclear
4	Were participants blind to treatment assignment?	1 - Yes 0 - No/Unclear
5	Were those delivering the treatment blind to treatment assignment?	1 - Yes 0 - No/Unclear
6	Were treatment groups treated identically other than the intervention of interest?	1 - Yes 0 - No/Unclear
7	Were outcome assessors blind to treatment assignment?	1 - Yes 0 - No/Unclear
8	Were outcomes measured in the same way for treatment groups?	1 - Yes 0 - No/Unclear
9	Were outcomes measured in a reliable way?	1 - Yes 0 - No/Unclear
10	Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	1 - Yes 0 - No/Unclear
11	Were participants analyzed in the groups to which they were randomized?	1 - Yes 0 - No/Unclear
12	Was appropriate statistical analysis used?	1 - Yes 0 - No/Unclear
13	Was the trial design appropriate and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?	1 - Yes 0 - No/Unclear
Score		0-13

Table S9: Score for each item of the JBI risk-of-bias tool for RCTs in the prevalence of cannabis use disorders in people who use medicinal cannabis: a systematic review and meta-analysis

Author, publication year	Item-1	Item-2	Item-3	Item-4	Item-5	Item-6	Item-7	Item-8	Item-9	Item-10	Item-11	Item-12	Item-13	Score
Cooke 2023	1	1	1	0	1	1	1	1	1	1	0	1	1	11
Gilman 2022	1	1	1	0	1	1	1	1	1	1	0	1	1	11

Table S10: The revised JBI critical appraisal tool for the assessment of risk of bias for cohort studies in the prevalence of cannabis use disorders in people who use medicinal cannabis: a systematic review and meta-analysis

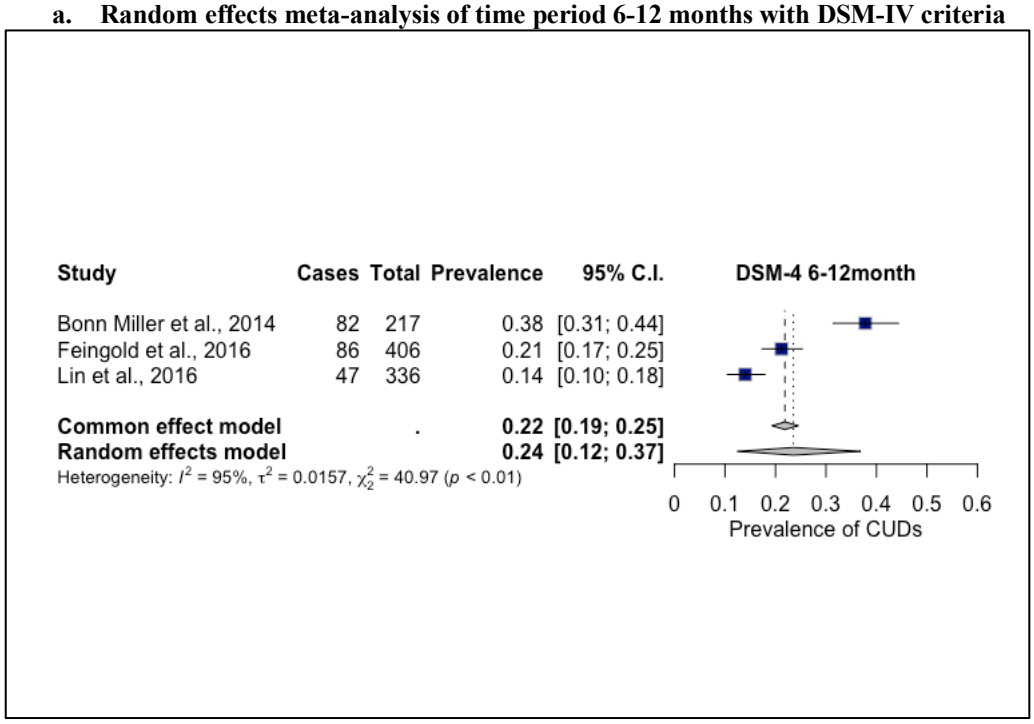
The JBI (Joanna Briggs Institute) Critical Appraisal Checklist for Cohort Studies		
No	**Item**	***Rating***
1	Were the two groups similar and recruited from the same population?	1 - Yes 0 - No/Unclear
2	Were the exposures measured similarly to assign people to both exposed and unexposed groups?	1- Yes 0 - o/Unclear
3	Was the exposure measured in a valid and reliable way?	1 - Yes 0 - No/Unclear
4	Were confounding factors identified?	1 - Yes 0 - No/Unclear
5	Were strategies to deal with confounding factors stated?	1 - Yes 0 - No/Unclear
6	Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	1 - Yes 0 - No/Unclear
7	Were the outcomes measured in a valid and reliable way?	1 - Yes 0 - No/Unclear
8	Was the follow up time reported and sufficient to be long enough for outcomes to occur?	1 - Yes 0 - No/Unclear
9	Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	1 - Yes 0 - No/Unclear
10	Were strategies to address incomplete follow up utilized?	1 - Yes 0 - No/Unclear
11	Was appropriate statistical analysis used?	1 - Yes 0 - No/Unclear
Score		0-11

Table S11: Score for each item of the JBI risk-of-bias tool for cohort studies in the prevalence of cannabis use disorders in people who use medicinal cannabis: a systematic review and meta-analysis

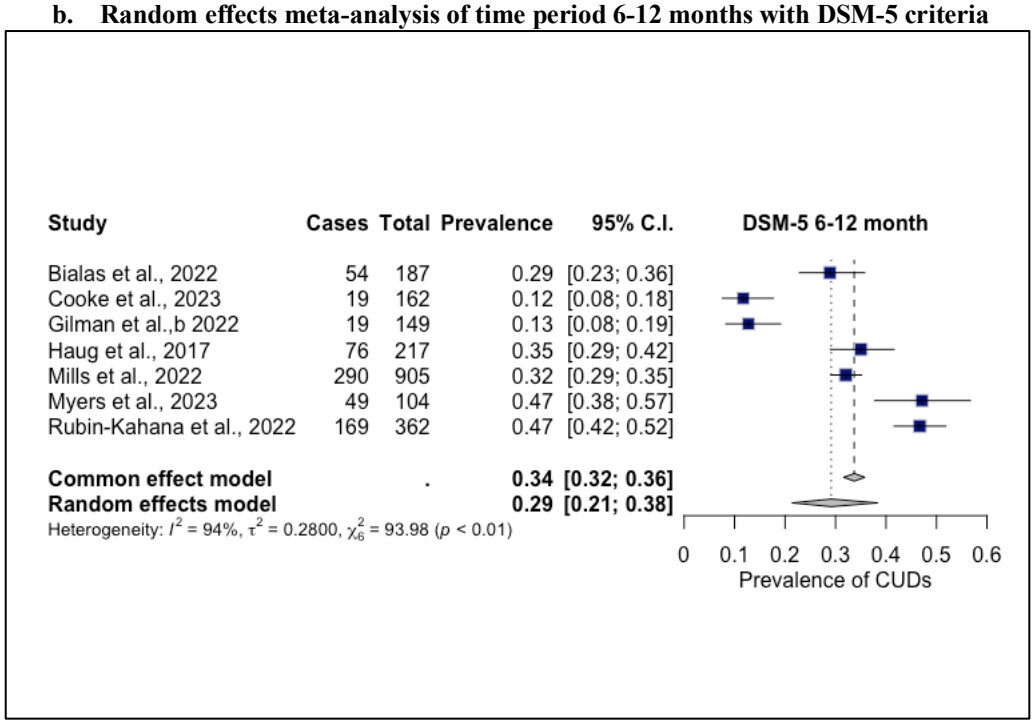
Author, publication year	Item-1	Item-2	Item-3	Item-4	Item-5	Item-6	Item-7	Item-8	Item-9	Item-10	Item-11	Score
Cooke 2023	1	1	0	1	1	1	1	1	1	1	0	10
Gilman 2022	1	1	1	0	1	1	1	0	1	1	1	10

Supporting Information 5: Forrest plots for the meta-analyses

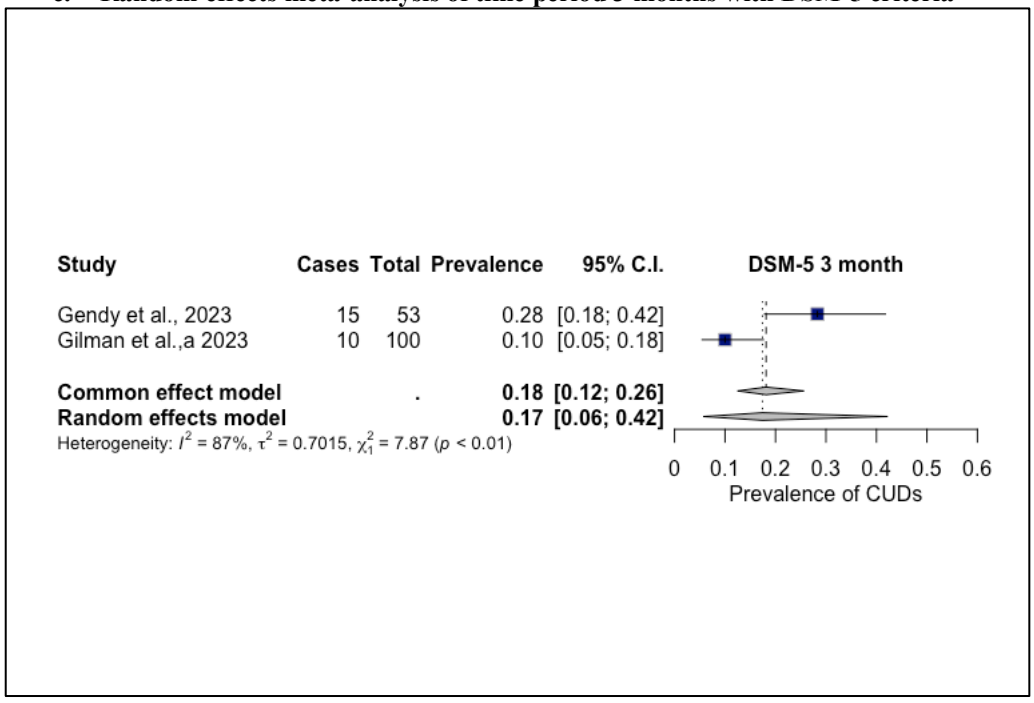
a. Random effects meta-analysis of time period 6-12 months with DSM-IV criteria



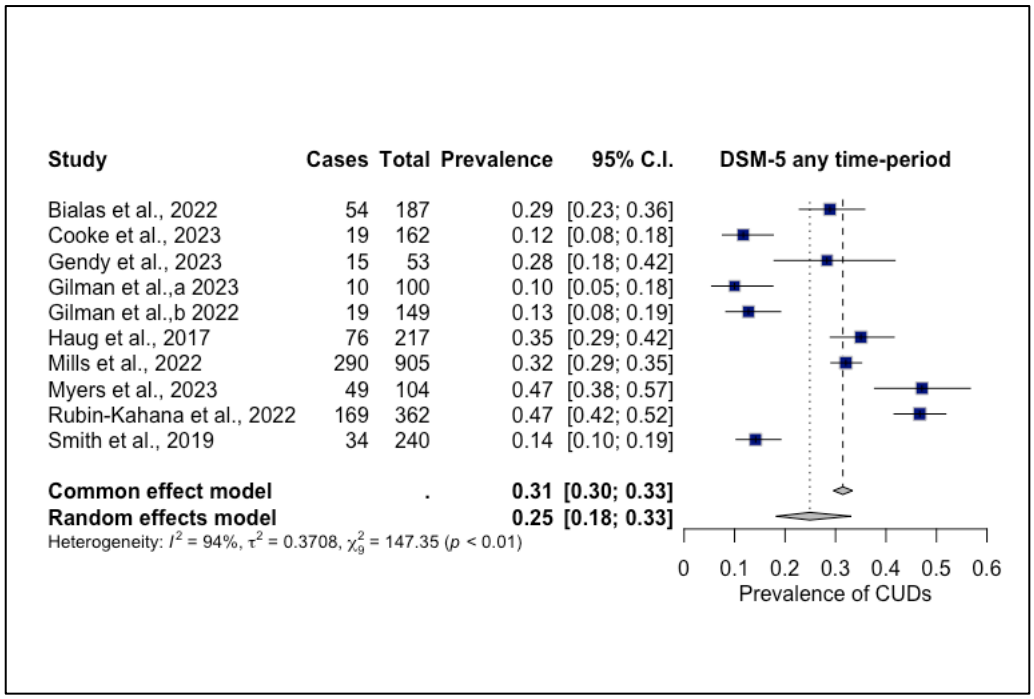
b. Random effects meta-analysis of time period 6-12 months with DSM-5 criteria



c. Random effects meta-analysis of time period 3 months with DSM-5 criteria



d. Random effects meta-analysis of time period DSM-5 combined time prevalence of 3 months and 6-12 months



Supporting Information 6: List of studies excluded at full-text screening stage

Two papers were excluded at the full text screening stage as they did not report the proportion of people who had cannabis use disorders while using medicinal cannabis. It appeared that this data may have been collected but was not reported. The corresponding authors were emailed twice with a request for additional information, however we received no response (1,2).

1. Hill ML, Loflin M, Nichter B, Norman SB, Pietrzak RH. Prevalence of cannabis use, disorder, and medical card possession in U.S. military veterans: Results from the 2019–2020 National Health and Resilience in Veterans Study. Addictive Behaviors. 2021 Sep;120:106963.

2. Camsari UM, Akturk HK, Taylor DD, Kahramangil D, Shah VN. Unhealthy Cannabis Use among Recreational and Medical Cannabis Users with Type 1 Diabetes. Canadian Journal of Addiction. 2019 Sep;10(3):38–41.