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Global temporal and regional trends in cannabis use among medical students: A systematic review and meta-analysis

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This is a preliminary, unedited version of a manuscript that has been accepted for publication in the Brazilian Journal of Psychiatry. As a service to our readers, we are providing this early version of the manuscript. The manuscript will still undergo copyediting, typesetting, and review of the resulting proof before it is published in final form. The final version may present slight differences in relation to the present version.

Global temporal and regional trends in cannabis use among medical students: A systematic review and meta-analysis

Running title: Cannabis trends among medical students

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ABSTRACT

Objective: Given the interest in the potential effects of cannabis on medical students, this study aims to establish the prevalence of recreational use within this population.

Methods: We searched MEDLINE, LILACS, PubMed, Embase, PsycINFO/PsycArticles/APA Books), and SciELO for observational studies published before June 9, 2025, that reported cannabis use prevalence among medical students. We conducted subgroup analyses based on gender, study cycle, school type, decade of publication, and world region. Data were pooled using a random-effects model.

Results: Our search identified 109 studies meeting the inclusion criteria, published between 1971 and 2025, encompassing data from 62,444 participants from 32 countries. Lifetime prevalence was 29.2%, past year 20.5%, past month 9.2%, and past week 5.1%. Global prevalence declined from 38.4% in the 1970s (95% CI 19.2-57.7) to 18.1% in the 2000s (95% CI 13.6–23.8), increased to 30.4% in the 2020s (95% CI 19.2-41.6), driven by trends in Latin America, Asia, and Africa. The lowest prevalence was in Asia (11.5%, 95% CI 07.1-15.8) and the highest in Anglo-Saxon America (59.7%, 95% CI 53.1–66.3).

Conclusions: Cannabis use is prevalent among medical students, with increasing trends and regional variations. Targeted interventions are needed to raise awareness of associated risks.

Keywords: Cannabis; Medical Students; Epidemiology; Substance Use.

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INTRODUCTION

Cannabis is one of the most widely used recreational drugs globally[1], with increasing legalization and decriminalization in many countries. Although debates continue regarding its potential therapeutic benefits, and it is sometimes used for perceived benefits like stress-relief or social connection, cannabis use has been associated with potential diverse health risks, including cardiovascular[2] and

pulmonary[3] problems, psychiatric disorders[4,5], cognitive impairments, and addiction[6].

The context of medical training, characterized by high academic pressure, long hours, and significant emotional demands, makes substance use patterns within this group a key area of public health interest. Cannabis use among medical students is particularly relevant to study in this context. Studies have associated its use during college with lower academic performance[7] and neurocognitive impairments, including memory and attention deficits[8]. Additionally, it may contribute to decreased motivation and exacerbate pre-existing psychiatric disorders[9]. Recreational use in young adulthood has also been linked to lower rates of university degree attainment[10,11]. While these associations do not imply causation, they highlight the importance of assessing the prevalence of cannabis use among medical students. Therefore, establishing a clear and updated epidemiological baseline of its prevalence is a fundamental first step before potential impacts can be further investigated.

Medical students are generally expected to have greater awareness of the risks associated with cannabis use compared to their peers in the general population. However, a 2018 meta-analysis has shown a high prevalence of cannabis use among medical students, with 17.2% reporting past-year use and 31.4% reporting lifetime use[12]. Since the publication of the aforementioned study, an additional meta-analysis[13] was published, primarily focused on data from physicians but lacked a clear definition of the medical student subgroup. With the evolving landscape of cannabis legalization and shifting cultural attitudes, understanding global trends in cannabis use among medical students requires an updated analysis. Despite this, a thorough comparison across continents over decades,

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revealing emerging or declining trends, has not been conducted. This study addresses these gaps by updating previous meta-analyses with recent studies and expanding the search to additional databases. Specifically, we aim to compare cannabis use prevalence across regions and historical periods, providing a comprehensive global profile of trends among medical students.

METHODS

We registered the protocol of this review in the International Prospective Register of Systematic Reviews (PROSPERO record number CRD42021272280).

Eligibility criteria

We included studies that met the following eligibility criteria: (1) observational design evaluating the prevalence of recreational cannabis use among medical students, reporting data for at least one of the prevalence periods of interest for this review; (2) focus exclusively on the use of the natural cannabis plant, excluding synthetic derivatives—if the type of cannabis was unspecified, it was considered natural; (3) inclusion of unpublished studies identified during the search phase; and (4) study designs including longitudinal, cross-sectional, or web-based surveys to ensure a broad perspective and maximize relevant data collection. We excluded studies that: (1) reported exclusively non-recreative cannabis use; (2) grouped medical and non-medical students without subgroup analysis; (3) were reviews, meta-analyses, interventional studies, or other publication types such as books, editorials, or chapters; (4) intervention studies that reported cannabis use at baseline, due to significant methodological

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differences from observational studies; and (5) lacked full-text availability despite attempts to contact authors.

Information sources

We searched the following databases from their inception up to June 20, 2025: BVS (MEDLINE, LILACS), PubMed, Embase, PsycINFO/PsycArticles/APA Books, and SciELO. Reference lists of included studies were also manually screened. Results from the databases were merged using EndNote to facilitate the screening for duplicates.

Search Strategy

The review team developed a common search strategy, including terms related to cannabis, medical students, prevalence, use, abuse, and other related terms. The complete search strategy is available in the Supplementary Material.. We did not apply limitations to the search.

Selection Process

Following the removal of duplicates using EndNote, two reviewers independently screened the titles and abstracts of all identified studies for eligibility. The full texts of potentially relevant articles were then retrieved and assessed independently by two reviewers to determine final inclusion. Any discrepancies at either the title/abstract or the full-text screening stage were resolved through discussion or, if necessary, by consulting a third reviewer. The selection process is depicted in the PRISMA flowchart (Figure 1).

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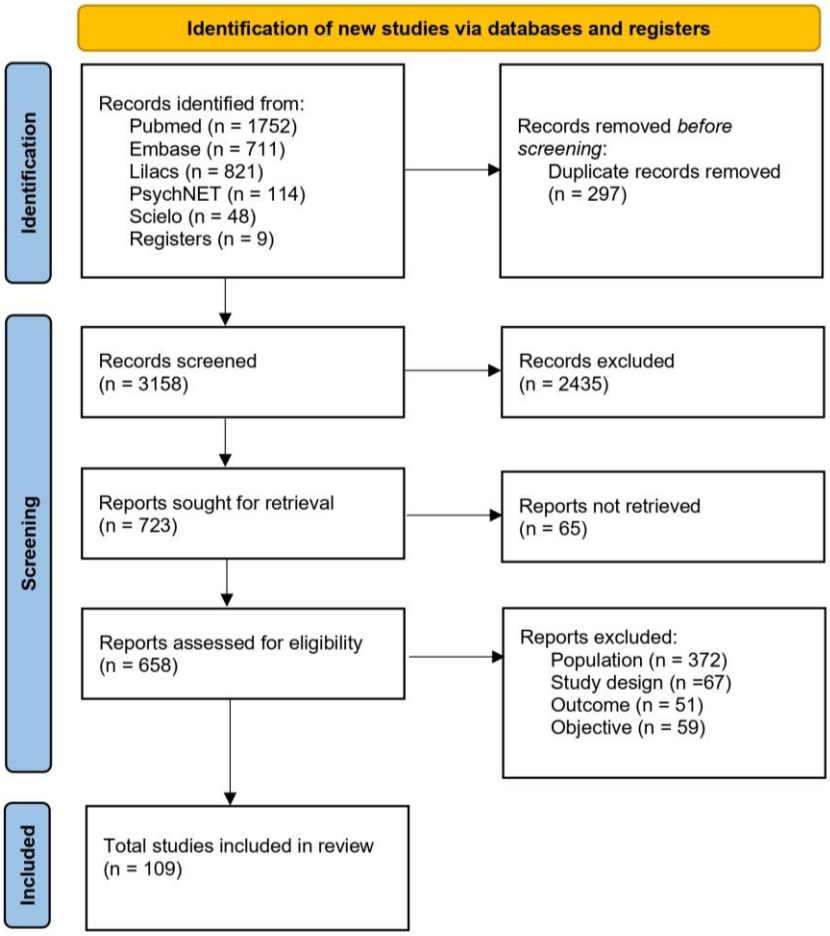

Figure 1. Flow diagram of the process of study identification, screening and selection.

Data Collection Process

Data from each included study were extracted by two reviewers working independently, using a standardized and pre-piloted form. Any discrepancies identified during the extraction process were resolved by consensus or, if necessary, through arbitration by a third reviewer. Corresponding authors were contacted via email when essential data were missing from the published reports.

Data Items

Extracted variables included: details of publication, geographical location, type of study, study population, average age, proportion of gender, prevalence or incidence of use of cannabis. Data on cannabis legalization in each country were manually assessed by the reviewers, focusing on the legal status of cannabis in the respective country (or state, for federal systems with state-level autonomy) during the specified year. The legal status of cannabis was dichotomized into two categories: 'legal' or 'illegal.' In cases where a country had a policy of decriminalization, cannabis was classified as 'legal.' For this analysis, multicentric studies were excluded if they were conducted across jurisdictions with different legal statuses or if the specific locations were not reported by the authors. Data on gender were collected in absolute numbers, either extracted directly from the text or calculated based on proportions provided. For studies that did not report the number of male and female participants, the corresponding author was contacted via email. If the author provided the data, it was included in subsequent analyses; otherwise, the study was excluded from gender-specific analyses. For the time frame, we only included data reported in the study if it aligned with the specific categories defined for our analysis (e.g., 'lifetime use,' 'past year use,' 'past month use,' and 'past week use'). For example, data were included in the 'past month use' category only if the study explicitly reported usage within the past month. The same approach was applied to other time frames. If a study reported two or more time frames within the same sample, these results were analyzed independently, with a separate meta-analysis conducted for each time frame. The primary outcome for this review was the prevalence of recreational lifetime cannabis use among medical students. Secondary outcomes included: (1) the prevalence of

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cannabis use across other recall periods (i.e., past year, past month, and past week); and (2) analyses of lifetime use within key subgroups, including decade, continent, and gender.

Risk of bias

For each search phase, two reviewers independently evaluated the included studies for reporting of ethical approval and conducted the risk-of-bias assessment using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Studies Reporting Prevalence Data[14]. This tool was selected for its ability to address both external and internal validity, as well as its demonstrated high inter-rater reliability. A detailed description of the objective criteria applied to each JBI item is provided in the Supplementary Table S2.

Effect measures

Data analysis was performed by EK and JPGP. A double arcsine transformation was applied to prevalence data before pooling and back-transformation. When studies provided appropriate data, data were pooled using a random-effects model. We assessed heterogeneity using the I^2 statistic and considered a value of 75 to 100% to represent high heterogeneity[15]. All meta-analyses were performed using R and the package Metafor[16].

Synthesis methods

To assess absolute cannabis use prevalence, we considered the following time frames: 1) lifetime use; 2) past year use; 3) past month use; and 4) past week use. For subgroup analyses, we considered the following characteristics: 1) decade of

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data collection; 2) continent; 3) legalization; 4) gender; 5) study cycle (eg. preclinical, clinical, internship); 6) public or private medical school. Regarding study cycle, the preclinical phase (comprising the initial years of medical school and not including undergraduate pre-med students) generally covers basic sciences, the clinical phase involves exposure to medical specialties, and the internship focuses on practical medical training, though curricular structures vary across countries.

When at least 4 studies were available for a given analysis, we investigated potential sources of heterogeneity. These subgroup analyses were conducted using mixed-effects meta-regression models. For these moderator analyses, we report the overall p-value, the proportion of heterogeneity explained by the model (R^2), and the amount of residual heterogeneity (I^2). The specific pooled estimate for each individual subgroup is presented with its 95% CI, the number of included studies (k), and the within-subgroup heterogeneity (I^2).

To complement the categorical analysis of decades, a univariable meta-regression was also performed to assess the linear trend of publication year as a continuous variable. Results from the analyses were presented in forest plots. We used datawrapper.de to create the world map displaying the pooled prevalence rates of lifetime cannabis use of different countries.

Reporting bias assessment

Evidence of publication bias was assessed using the Egger's test. If publication bias was detected, the trim-and-fill method was applied to estimate and adjust for the missing studies.

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RESULTS

Study characteristics

A total of 109 studies, included 62,444 participants from 32 countries. Most studies were cross-sectional in design (105 studies), with Brazil (21 studies), the United States (20 studies), and the United Kingdom (8 studies) being the most represented countries. Regarding the institutional setting, studies were predominantly conducted in public universities (59 studies), followed by a mix of public and private institutions (24 studies), and private settings (17 studies). The mean sample size was 572.9 (range: 61–4942), and the average of reported mean ages was 22.7 years (range of means: 18.8–27.7). Male students comprised 46.7% of participants (range: 22.3–100%). Study characteristics are detailed in Table 1.

Table 1 Selected characteristics of the studies of cannabis use among medical students. [a]

Study (Author, Year)	Country	Gender proportion (Male / Overall) (%)	Age mean, y (SD)	Year of training	JBI score
Adhikari, 2017[1]	Nepal	51.0	NA	1-6	Low
Aguilar, 2016[2]	Mexico	37.0	NA	6	Medium
Ali, 1994[3]	India	58.1	19.6 (1.8)	1, 2 and 6	Low
Araújo-Filho, 2021[4]	Brazil	58.1	22.6 (NA)	1-6	Medium
Ashton, 1995[5]	UK	41.4	20.4 (1.8)	2	Low
Ayala, 2017[6]	USA	35.6	25.6 (3.3)	3, 4	Medium
Ayinde, 2022[7]	Nigeria	56.4	NA	1-6	Medium
Bahji, 2021[8]	Canada	35.7	24.2 (3.5)	1-6	Low
Baldwin, 1991[9]	USA	62.7	27.7 (0.8)	4	Low
Baldwin, 2006[10]	USA	57.7	NA	NA	Low
Barahona-Correa, 2018[11]	Colombia	36.0	NA	1-5	Medium
Baptista, 1993[12]	Venezuela	29.6	23.0 (3.7)	NA	Low
Batista, 2022[13]	Brazil	52.5	NA	NA	Low

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Bíró, 2008[14]	Hungary	43.0	22.0 (NA)	NA	Medium
Bogowicz, 2017[15]	UK	46.9	NA	1, 2 and final year	Low
Boniatti, 2007[16]	Brazil	45.9	22.5 (2.4)	1-6	Low
Buchanan, 2008[17]	Honduras	44.2	NA	3, 4	Medium
Budhathoki, 2010[18]	Nepal	63.5	NA	3	Low
Carvalho, 2008[19]	Brazil	57.0	21.5 (NA)	1-6	Low
Castaldelli-Maia, 2019[20]	Brazil	23.3	NA	1-6	High
Cerame, 2008[21]	Italy	47.6	18.8 (1.0)	1	Low
Chakraborty, 1979[22]	India	87.1	NA	NA	Medium
Chan, 2017[23]	USA	48.3	NA	1-4	Low
Chau, 2019[24]	China	46.3	NA	1-6	High
Choi, 2013[25]	USA	36.0	NA	1-4	Low
Chung, 2022[26]	China	56.5	NA	1-6	Low
Conard, 1988[27]	USA	65.0	27.6 (NA)	4	Medium
Croen, 1997[28]	USA	54.1	NA	1 and 3	Low
Da Silveira, 2008[29]	Brazil	54.2	21.0 (NA)	1-6	Medium
Di Pietro, 2007[30]	Brazil	54.2	21.1 (2.4)	1-6	Low
Eiselen, 2023[31]	South Africa	36.8	NA	18 months plus	Medium
Engs, 1980[32]	Australia	NA	NA	1 and 4	High
Epstein, 1984[33]	USA	NA	NA	NA	Medium
Esteche, 2018[34]	Uruguay	29.9	23.9 (NA)	5	Medium
Farías, 2009[35]	Venezuela	NA	NA	NA	High
Farrell, 2019[36]	New Zealand	29.5	NA	1-6	Medium
Ferreira, 2022[37]	Brazil	49.9	22.8 (3.1)	1-6	Low
Gaume, 2024[38]	Switzerland	31.0	22.4 (3.3)	1-6	Low
Gignon, 2015[39]	France	43.8	22.1 (1.7)	2-6	Medium
Infortuna, 2020[40]	USA	48.3	26.9 (2.3)	1-4	Medium
Jain, 2018[41]	South Africa	45.7	NA	1-5	Low
James, 2013[42]	Nigeria	54.5	24.1 (2.4)	5	Low
Jankie, 2023[43]	Trinidad and Tobago	30.5	22.9 (3.2)	1-5	Medium
Jepsen, 2024[44]	Germany	29.8	23.6 (3.4)	1-6	Medium
Jodati, 2007[45]	Iran	100.0	21.3 (NA)	NA	Medium
Jovin, 2022[46]	Serbia	NA	NA	1-6	High
Kadhum, 2022[47]	Multiple	44.0	NA	NA	High
Keller, 2007[48]	Germany	38.0	20.6 (1.7)	1	Low

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Kerr-Corrêa, 1999[49]	Brazil	53.0	21.7 (NA)	1-6	Low
Khanal, 2010[50]	Nepal	57.2	21.2 (2.3)	1 and 6	Low
Konstantinov, 2021[51]	Multiple	43.2	21.2 (2.8)	NA	Low
Kory, 1984[52]	USA	71.4	NA	1-4	Medium
Laporte, 1977[53]	Spain	63.7	NA	1-6	Low
Lemos-Santos, 2024[54]	Brazil	57.8	23.0 (NA)	1-6	Medium
Levin, 1983[55]	South Africa	NA	NA	1-5	Low
Lipp, 1972[56]	USA	NA	NA	NA	High
Lokesh, 2023[57]	India	56.2	20.0 (1.3)	1-5	Medium
Lucas, 2006[58]	Brazil	44.7	22.7 (NA)	1-6	Low
Maddux, 1986[59]	USA	NA	NA	3-4	Low
Maier, 2013[60]	Swiss	NA	NA	NA	High
Makanjuola, 2007[61]	Nigeria	69.0	22.4 (3.2)	NA	Medium
Marcon, 2021[62]	Brazil	22.3	21.8 (3.2)	1-6	Medium
McAuliffe, 1984[63]	USA	69.0	25.0 (NA)	NA	Medium
McAuliffe, 1986[64]	USA	59.0	25.0 (NA)	NA	Low
McKay, 1973[65]	Scotland	68.7	NA	1-6	Medium
Mechanick, 1973[66]	USA	91.6	23.6 (NA)	NA	Medium
Mehmood, 2022[67]	Pakistan	60.7	21.3 (1.7)	4	Low
Merlo, 2017[68]	USA	42.9	NA	1-4	Low
Mesquita, 1998[69]	Brazil	58.1	NA	NA	Medium
Moaouad, 2012[70]	Lebanon	49.3	NA	1-7	Low
Moutinho, 2019[71]	Brazil	35.8	21.0 (2.6)	NA	High
Nawaz, 2017[72]	Pakistan	55.2	NA	1-6	Low
Newbury-Birch, 2000[73]	UK	33.0	18.8 (2.1)	1	Low
Newbury-Birch, 2001[74]	UK	33.3	NA	2 and 5	Low
Oliveira, 2009[75]	Brazil	52.0	21.0 (NA)	1, 2, 5 and 6	Low
Palin, 2021[76]	UK	24.4	NA	1-6	Medium
Papazisis, 2017[77]	Greece	43.7	21.7 (1.8)	NA	Low
Parfrey, 1977[78]	Ireland	59.7	NA	NA	Low
Passos, 2006[79]	Brazil	47.0	21.1 (3.9)	1-6	Low
Pereira, 2007[80]	Brazil	44.0	NA	1 and 6	Low
Petroianu, 2010[81]	Brazil	48.2	23.0 (NA)	1-6	Low
Pickard, 2000[82]	UK	33.8	NA	2	Low
Rai, 2008[83]	India	71.0	20.5 (NA)	NA	Medium
Rochford, 1977[84]	USA	NA	22.0 (NA)	NA	Low
Rodriguez, 1986[85]	Spain	48.2	NA	NA	High

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Rodriguez, 2012[86]	Nicaragua	42.6	19.2 (NA)	1 and 2	Medium
Romero, 2009[87]	Chile	55.0	21.5 (NA)	1-7	Medium
Rossi, 2020[88]	Paraguay	45.5	22.7 (2.3)	1-5	Low
Safiri, 2019[89]	Iran	40.7	NA	NA	Low
Sapkota, 2021[90]	Nepal	52.2	22.0 (NA)	2-3	Low
Schwartz, 1990[91]	USA	65.0	NA	2 and 3	Low
Schwarzbold, 2020[92]	Brazil	41.5	23.0 (NA)	1-4	Low
Serrano, 2023[93]	Colombia	48.6	NA	1-6	Low
Shrestha, 2020[94]	Nepal	58.0	20.0 (1.5)	1-4	Medium
Siebra, 2021[95]	Brazil	60.3	NA	1, 5, 6	Low
Singh, 2025[96]	India	62.0	NA	NA	Medium
Slaby, 1972[97]	USA	94.1	23.3 (NA)	1-4	Low
Smit, 2009[98]	South Africa	48.8	NA	1, 4 and 5	Low
Solursh, 1971[99]	USA	NA	NA	NA	Medium
Talih, 2018[100]	Lebanon	51.2	NA	1-4	Low
Tavolacci, 2018[101]	France	39.0	21.6 (1.8)	2-5	Low
Tockus, 2008[102]	Brazil	42.0	NA	1-4	Medium
Trkulja, 2003[103]	Croatia	39.0	NA	1-6	Low
van Meerbeke, 2005[104]	Colombia	NA	NA	1	Medium
Vaysse, 2014[105]	France	42.0	19.7 (0.9)	2	Low
Vorster, 2019[106]	South Africa	42.1	NA	2-3	Low
Vujcic, 2017[107]	Serbia	37.3	22.5 (1.1)	4	Low
Webb, 1998[108]	UK	44.2	20.0 (NA)	2	Low
Zhou, 2015[109]	USA	50.3	25.0 (NA)	1-4	Low

Note:
a: Full references for the individual studies listed in this table are available in the Supplementary Material.
Abbreviations: NA = Not available; SD = Standard deviation; UK = United Kingdom; USA = United States of America; JBI = Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data

Table 2. Subgroup analyses of lifetime prevalence of cannabis use among medical students

Subgroup	Studies, k	Total of students, n	Pooled prevalence, % (95% CI)	I^2
1. Private of public medical school				
Private	11	2,733	30.2 (20.7-39.6)	96.99
Public	46	23,187	23.5 (18.7-28.4)	99.48

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2. Gender				
Males	38	11,141	31.2 (24.8-37.6)	99.05
Females	38	12,584	22.9 (16.5-29.3)	99.70
3. Medical school cycle				
Preclinical	17	4,212	27.1 (19.3-34.9)	97.39
Clinical	10	2,239	23.6 (12.3-34.8)	98.29
Internship	10	1,259	35.7 (22.9-48.5)	96.37
4. Legality				
Legal	9	6,733	39.7 (27.6-51.8)	98.76
Illegal	77	37,563	27.7 (23.1-32.4)	99.62
5. Continent				
Asia	15	8,340	11.5 (7.1-15.8)	98.90
Africa	7	3,232	22.0 (9.0-34.9)	99.33
Oceania	2	651	26.2 (10.3-42.1)	94.77
Europe	23	17,585	26.1 (20.4-31.7)	98.91
Latin America	25	7,903	25.2 (18.3-32.2)	98.90
Anglo-Saxon America	16	12,003	59.7 (53.1-66.3)	98.03
6. Decade				
1970’s	8	4,183	38.4 (19.2-57.7)	99.63
1980’s	9	5,695	53.8 (38.4-69.2)	99.38
1990’s	8	5,636	30.4 (13.9-47.0)	99.79
2000’s	19	8,334	18.7 (13.6-23.8)	98.37
2010’s	30	15,886	25.0 (19.3-30.7)	99.31
2020’s	14	9,980	30.4 (19.2-41.6)	99.51

Note: Some subgroup totals do not add up to the 109 articles included in the overall analysis. This discrepancy is due to missing information in certain articles and the multicentric design of some studies, where specific subgroup data (e.g., cannabis legality) may not be applicable.

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Risk of bias assessment

Among the 109 studies, 62 (56.9%) had low risk of bias (JBI score 7–9), 37 (33.9%) had medium risk (score 4–6), and 10(9.2%) had high risk (score <4). For more details on the critical appraisal of individual studies, please refer to Table S2. The regression test for funnel plot asymmetry indicated the presence of asymmetry in all main and subgroup analyses except for the analyses of use in preclinical, clinical and internship cycles, Anglo-Saxon America, use during the 1980s and 1990s, use where it is legal and in private universities. Detailed results for each asymmetry analysis are provided in Table S3 and Figure S1. However, the trim-and-fill method did not suggest any modifications, and the adjusted prevalence remained unchanged. This is likely because the identified asymmetry was not due to missing studies, but rather to other factors, such as the high heterogeneity observed across all analyses.

Prevalence of cannabis use

A meta-analysis of 88 studies estimated lifetime cannabis use at 29.2% (95% CI, 22.9–33.6, I^2 = 99.64) (Figure 2). Based on 38 studies, past-year use was 20.5% (95% CI, 16.0–25.1, I^2 = 98.68). Analysis of 45 studies showed past-month use at 9.2% (95% CI, 7.2–11.2, I^2 = 98.89), and data from 24 studies indicated a past-week use of 5.1% (95% CI, 3.4–6.9%, I^2 = 97.99). Supplementary figure S2 to S4 illustrates the prevalence for past year, past month and past week cannabis use.

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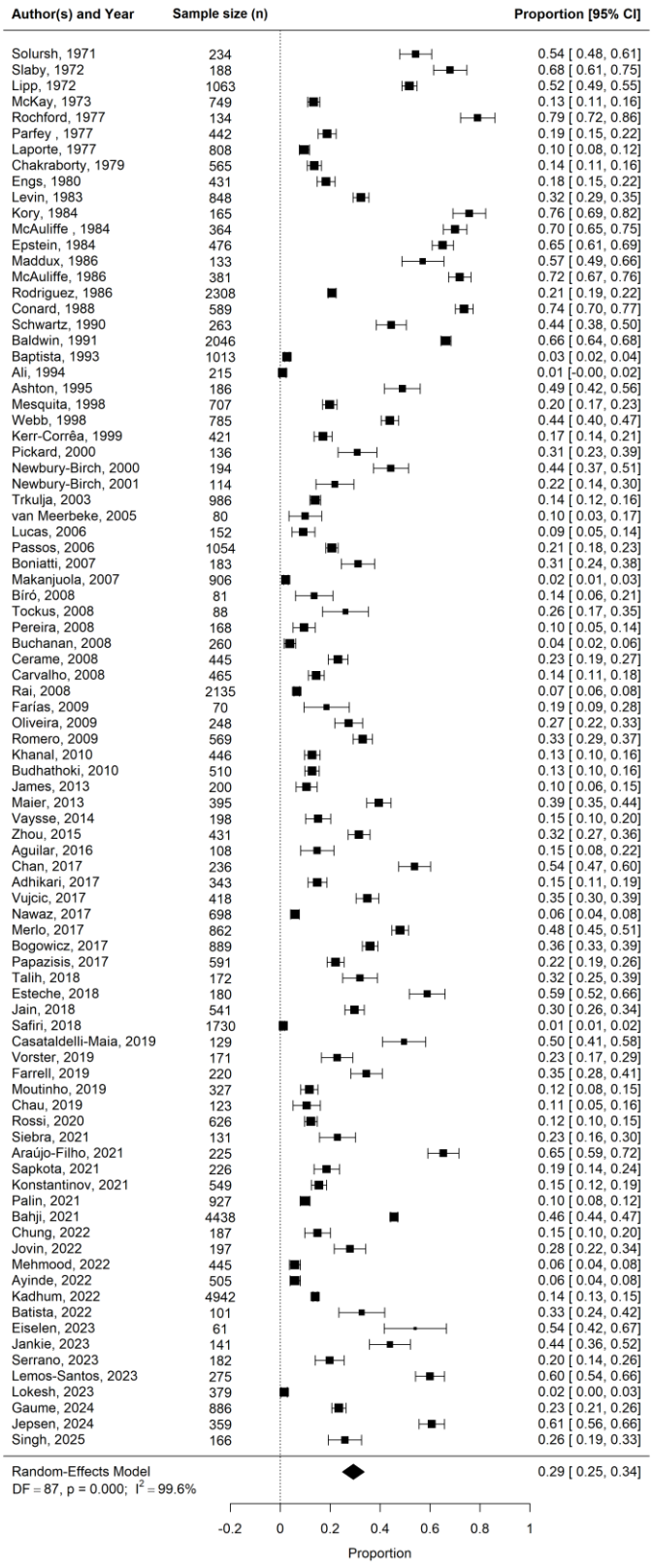

Figure 2. Prevalence of lifetime recreational cannabis use among medical students.

Temporal trends

Lifetime cannabis use varied significantly across decades ($p < 0.01$, $R^2 = 18.16$, $I^2 = 99.46\%$). A decreasing trend was observed from 38.4% in the 1970s (from 8 studies, 95% CI, 19.2–57.7, $I^2 = 99.63$) to 18.7% in the 2000s (from 19 studies, 95% CI, 13.6–23.8, $I^2 = 98.37$), followed by an increasing trend, reaching 30.4% in the 2020s (from 14 studies, 95% CI, 19.2–41.6, $I^2 = 99.51$). In contrast, a simple linear meta-regression using publication year as a continuous variable, while also statistically significant, showed only a slight negative association and explained a smaller portion of the variance (coefficient = -0.004; 95% CI, -0.006 - -0.001; $p < 0.01$; $R^2 = 8.11$; $I^2 = 99.59$). The forest plots for the temporal trends are shown in Supplementary figures S5-S10.

Regional trends

The subgroup analysis revealed differences in the prevalence of lifetime cannabis use across continents (p-val < 0.01, $R^2 = 52.48$, $I^2 = 99.09$). Asia had a prevalence of 11.5% (15 studies, 95% CI, 7.1-15.8, $I^2 = 98.90$), Africa 22.0% (7 studies, 95% CI, 9.0-34,9, $I^2 = 99.33$), Oceania 26.2% (2 studies, 95% CI, 10.3-42.1, $I^2 = 94.77$), Europe 26.1% (23 studies, 95% CI, 20.4-31.7, $I^2 = 98.91$), Latin America 25.2% (25 studies, 95% CI, 18.3-32.2, $I^2 = 98.90$), and Anglo-Saxon America (i.e., the United States and Canada) 59.7% (16 studies, 95% CI, 53.1-66.3, $I^2 = 98.03$). Figure 3 illustrates the global and regional trends across decades while figure 4 presents the pooled prevalence rates of different countries. The corresponding forest plots showing the prevalence for each continent are presented in Supplementary figures S11-S16.

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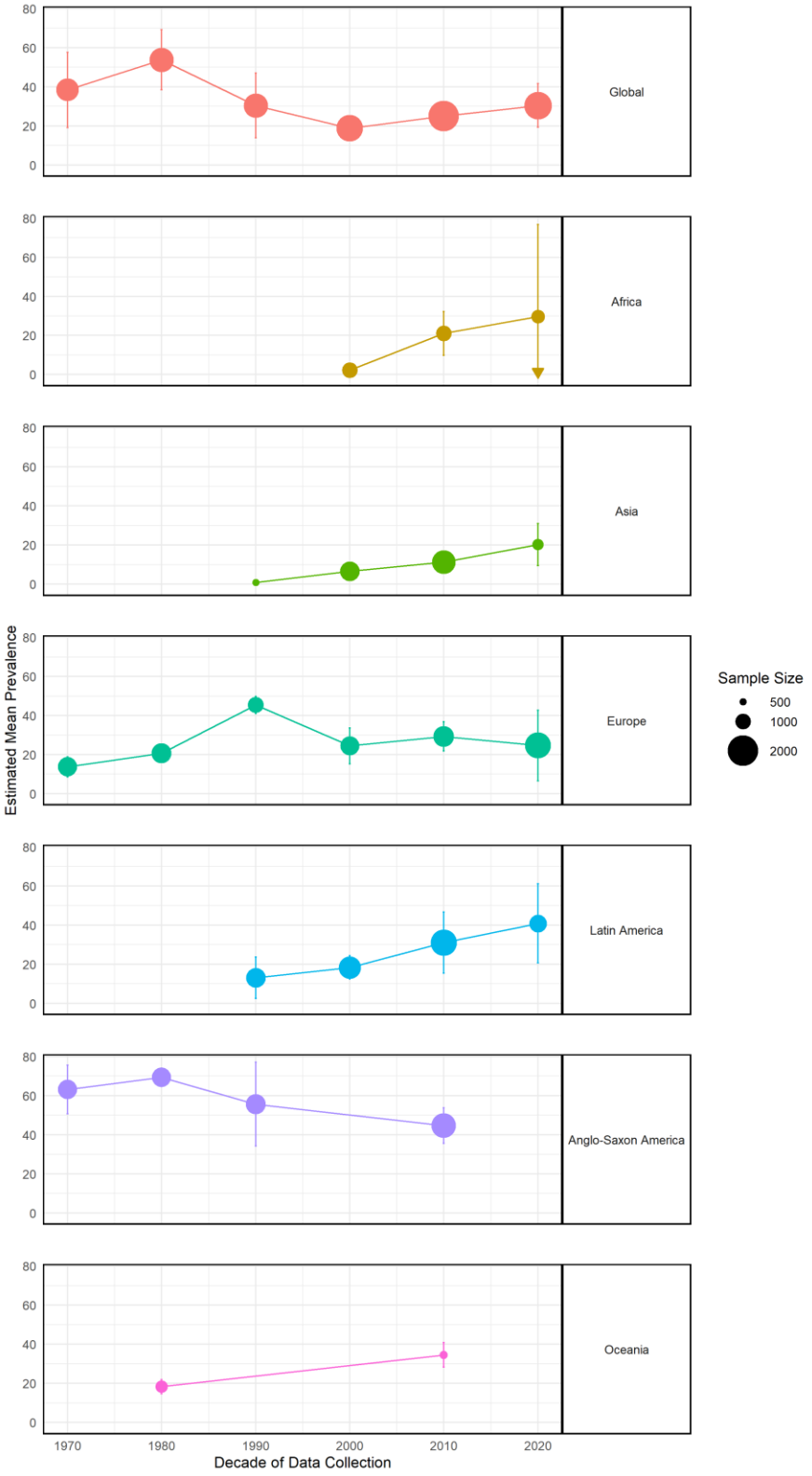

Figure 3. Global trends in lifetime prevalence of cannabis use across continents.

Legend: The size of the circles represents the sample size for each continent in the corresponding decade. Missing circles indicate the absence of studies on the subject for that continent in that

decade. Each chart corresponds to a different continent. The vertical lines represent 95% confidence intervals.

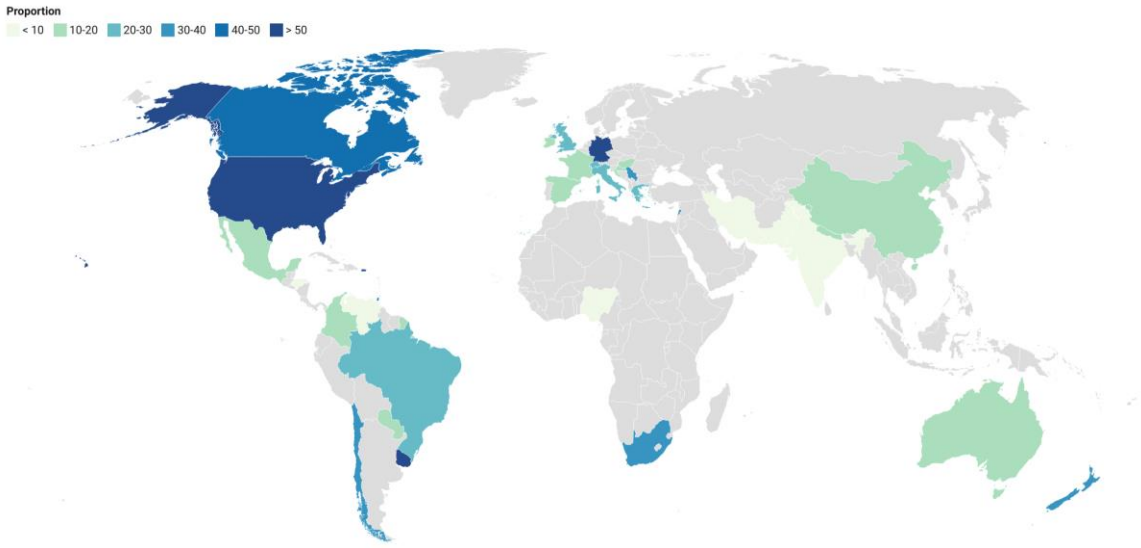

Figure 4. World map of lifetime prevalence of cannabis use among medical students by country.

Legality and sociodemographic associations

Based on an analysis of 9 studies, the prevalence of lifetime use in countries with liberal cannabis laws was 39.7% (95% CI, 27.6-51.8. I^2 = 98.76), compared to 27.7% from 77 studies in countries with strict laws (95% CI, 23.1-32.4, I^2 = 99.62). The difference between these groups was not statistically significant (p = 0.06, R^2 = 2.75, I^2 = 99.57).

The prevalence of lifetime cannabis use was 31.2% among male (95% CI, 24.8-37.6, I^2 = 99.05) and 22.9% among female students (95% CI, 16.5-29.3, I^2 = 99.70), without significant differences between these groups (p = 0.07, R^2 = 2.92, I^2 = 99.55) across the 38 included studies.

Although there is no clear linear trend across study cycles (preclinical, clinical, internship) (p = 0.30, R^2 = 1.05, I^2 = 97.56), the highest point-estimate prevalence of use is observed during the internship cycle, with the following rates: preclinical,

27.1% (from 17 studies; 95% CI, 19.3 - 34.3, I^2 = 97.39); clinical, 23.6% (from 10 studies; 95% CI, 12.3-34.8, I^2 = 98.29); and internship, 35.7% (from 10 studies; 95% CI, 22.9-48.5, I^2 = 96.37).

The subgroup analysis by university type, based on 46 studies in public universities, showed a prevalence of 23.5% (95% CI, 18.7-28.4%, I^2 = 99.48), compared to 30.2% from 11 studies in private universities (95% CI, 20.7-39.6%, I^2 = 96.99). No statistically significant difference was found between them (p = 0.2, R^2 = 0.88, I^2 = 99.38).

DISCUSSION

In this systematic review and meta-analysis of 109 studies involving 62,444 medical students from 32 countries across five continents, we examined the global prevalence of cannabis use and explored temporal, regional, and sociodemographic trends. Six key findings emerged: 1) Cannabis use appears to be considerable prevalent among medical students, with rates varying depending on the timeframe considered; 2) a U-shaped trend in cannabis use, with a decline from the 1980s to the 2000s, followed by an increase in the 2010s and 2020s; 3) the highest prevalence in Anglo-Saxon America and the lowest in Asia; 4) No statistically significant difference on prevalence estimates by gender, study cycles and country-level legal status.

This study is not without limitations. Considering the evidence included in the review, the data were derived from studies that employed varying screening tools, many of which were not validated and relied on self-reporting. To address this, future studies should utilize standardized, validated tools. Second, many studies lacked details on medical school curricula and population characteristics, complicating cross-country comparisons. Uniform reporting on these variables

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would enhance comparability. Additionally, some crucial information was missing, such as the presence of other clinical conditions and substance use disorders. Future studies should aim to collect comprehensive data on these factors. Lastly, although the review included global data, much of the recent evidence originated from North America. Only two African countries—South Africa and Nigeria—were represented, which limits the generalizability of findings, particularly across the African continent. Similarly, only two studies from Oceania were included. Future research should prioritize diverse and underrepresented samples. Furthermore, the mean age of our sample (22.7 years) is lower than the average matriculation age for medical students in the United States (24 years)[17]. This discrepancy may reflect the inclusion of studies from countries with direct-entry medical programs, unlike the graduate-entry model in the U.S., which should be considered when generalizing these demographic findings to a North American context. Limitations inherent to the review process should also be considered: the substantial statistical heterogeneity observed in most analyses requires that pooled prevalence estimates be interpreted with caution.

Our estimated lifetime prevalence of 29.2% aligns with Papazisis et al[12] but is lower than Naillon et al. (38.0%)[13] and higher than the 11.5% among nursing students[18], highlighting distinct use patterns among medical students. Importantly, medical students represent a uniquely vulnerable group, facing high rates of depression, anxiety, burnout, suicidal ideation, and sleep disorders[19–22]. These challenges may increase cannabis misuse, heightening their risk for psychiatric comorbidities and functional impairments[23], underscoring the need for targeted interventions and robust studies on the impact of this high prevalence.

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To our knowledge, this is the most comprehensive meta-analysis examining temporal trends in cannabis use among medical students. The temporal shifts in cannabis use, marked by a decline from 38.4% in the 1970 to 18.7% in the 2000s and a rise to 30.4% by the 2020s, reflect a complex pattern. The earlier decline may reflect strict anti-drug policies and limited acceptance at the time. For instance, during the Reagan-Bush era "War on Drugs" in the 1980s and 1990s, North America saw a significant decline in self-reported marijuana use, as noted by Caulkins[24]. Similar to our findings, Caulkins observed a partial recovery in self-reported cannabis use between 1992 and 2008, followed by substantial increases after 2008, likely driven by policy liberalization. Additionally, the COVID-19 pandemic may have contributed to the recent short-term uptick in cannabis use by increasing substance use, including alcohol and cannabis, as a coping mechanism for stress and emotional challenges during this period[25]. While this trend may be temporary, the pandemic's negative impact on mental health, particularly among young adults and adolescents[26], could lead to lasting changes in substance use patterns. Despite the recent rise in prevalence, our meta-regression analysis, using publication year as a predictor, indicates a long-term decline in cannabis use. However, this trend may plateau or reverse, highlighting the need for continued monitoring and identification of underlying drivers. This observed long-term decline followed by signs of recent stabilization or modest increases parallels trends in adolescent cannabis use in the United States[27], yet contrasts with the ongoing decline in cigarette consumption[28]. The legalization of recreational cannabis may influence usage among medical students by reducing perceived risk, increasing social acceptance, and enhancing availability, potentially leading to higher consumption among young adults[29–31]. Our meta-analysis does not support

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this, showing a prevalence of 39.7% in countries where recreational cannabis is legalized, compared to 27.7% in those where it is not, with no statistically significant difference (p=0.06). While legalization may increase use, it can also promote access to regulated sources and encourage better-informed consumption[28]. Further studies are needed to assess the balance between the benefits and the risks of legalization.

Cultural and legal factors may shape medical students' attitudes toward cannabis use and perception of its clinical applications, influencing their knowledge of its benefits and risks[32,33]. Lifetime cannabis use among young adults is significantly higher in liberal, high-income countries than in restrictive regions, ranging from 27.3% to 43.2% in Sweden (depending on survey methods) versus 12.6% in sub-Saharan Africa.[34,35]. Recent shifts in legalization and cultural attitudes, along with medical students' greater awareness of its therapeutic potential, despite limited official approval, may partly explain the higher prevalence in this population.

Geographically, this study revealed significant disparities in cannabis use across continents. Prevalence in Anglo-Saxon America reached 59.7%, five times higher than in Asia (11.5%) and more than double that of other regions. These findings align with the UNODC[1] report, which also highlights global disparities in cannabis use, with North America reporting the highest annual prevalence. These differences may stem from cultural norms, cannabis availability, and legal frameworks. In many countries, such as Nigeria, Singapore, Egypt, and Malaysia, cannabis use remains a criminal offense. Additionally, the smaller sample sizes from Oceania, Africa, and Asia may contribute to the observed regional disparities, highlighting the need for more comprehensive data from underrepresented regions.

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Contrasting with previous studies, male gender was not associated with higher recreational cannabis use. This gender disparity usually reported in recreational cannabis studies is hypothesized to be related with higher impulsivity, greater sensation-seeking behavior, and lower risk perception among males[36–39]. Globally, men account for two-thirds of cannabis users, but the gender gap is narrowing in high-income countries, likely due to sociocultural shifts, including evolving gender norms and increasing social acceptance, which align with our results[1,40].

Finally, cannabis use across different stages of medical education was examined, with the highest rates observed during the internship cycle (35.7%), likely due to increased stress and academic pressures. No significant differences were found between public and private universities ($p = 0.27$), highlighting the need for universal educational and support programs. Additionally, the medical school environment may influence cannabis use behaviors, warranting further investigation.

Conclusion

This systematic review and meta-analysis identified a high prevalence of cannabis use among medical students, with over one-third reporting lifetime use. Notably, a historical trend reversal was observed, with a decline from the 1970s to the 2000s, followed by an increase in the 2010s and 2020s. Regional variability was significant, with the highest prevalence in Anglo-Saxon America and greater use in legalized countries. These findings highlight the need for continued research using standardized methods to track trends and assess public health implications. Furthermore, they call for a proactive institutional response, emphasizing robust mental health support, objective strategies for preventing substance abuse, and

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the integration of a formal curriculum on the health implications and regulatory aspects of cannabis.

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Disclosure

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Conceptualization, Data curation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Edited by: Prof. João Castaldelli-Maia

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Supplementary material

Methods S1. Detailed search strategy for Pubmed
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Figure S1. Funnel plot for lifetime cannabis use.
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eFigure S14. Prevalence of recreational cannabis use among medical students in European countries.
Figure S15. Prevalence of recreational cannabis use among medical students in Latin American countries.
Figure S16. Prevalence of recreational cannabis use among medical students in Anglo-Saxon American countries.
Supplementary References. References for the meta-analysis.

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Methods S1. Detailed search strategy for Pubmed

((abuse) OR (depend*) OR (use) OR ("Substance-Related Disorders"[MeSH Terms]) OR (disord*)) AND ((marijuana) OR (cannabis) OR (hashish)) AND ((Clinical student*) OR (Education, medical [MeSH]) OR (Education, medical, undergraduate [MeSH]) OR (Med student*) OR (Medical student*) OR (Medical trainee*) OR (Preclinical student*) OR (Student doctor*) OR (Student physician*) OR (Undergraduate medic*)) AND ((prevalence) OR (risk) OR (frequency) OR (Cohort design) OR (Cohort studies [MeSH]) OR (Cross-sectional stud*) OR (Cross-sectional studies [MeSH]) OR (Epidemiologic studies [MeSH]) OR (Incidence) OR (Longitudinal design) OR (Longitudinal stud*) OR (Observational stud*) OR (Population stud*) OR (Prevalence) OR (Prospective stud*) OR (Prospective studies [MeSH]) OR (Retrospective stud*) OR (Retrospective studies [MeSH]))

SMethods S2. Detailed search strategy for LILACS and PsycNET

((abuse) OR (depend*) OR (use) OR ("Substance-Related Disorders") OR (disord*)) AND ((marijuana) OR (cannabis) OR (hashish)) AND ((Clinical student*) OR (Education, medical) OR (Education, medical, undergraduate) OR (Med student*) OR (Medical student*) OR (Medical trainee*) OR (Preclinical student*) OR (Student doctor*) OR (Student physician*) OR (Undergraduate medic*)) AND ((prevalence) OR (risk) OR (frequency) OR (Cohort design) OR (Cohort studies) OR (Cross-sectional stud*) OR (Cross-sectional studies) OR (Epidemiologic studies) OR (Incidence) OR (Longitudinal design) OR (Longitudinal stud*) OR (Observational stud*) OR (Population stud*) OR (Prevalence) OR (Prospective stud*) OR (Prospective studies) OR (Retrospective stud*) OR (Retrospective studies))

Methods S3. Detailed search strategy for Embase

(abuse OR depend* OR use OR "Substance-Related Disorders" OR disord*) AND (marijuana OR cannabis OR hashish) AND ("Clinical student*" OR "Education, medical" OR "Education, medical, undergraduate" OR "Med student*" OR "Medical student*" OR "Medical trainee*" OR "Preclinical student*" OR "Student doctor*" OR "Student physician*" OR "Undergraduate medic*")

Methods S4. Detailed search strategy for SciELO

((abuse) OR (depend*) OR (use) OR (Substance-Related Disorders) OR (disord*)) AND ((marijuana) OR (cannabis) OR (hashish)) AND ((Clinical student*) OR (Education, medical) OR (Education, medical, undergraduate) OR (Med student*) OR (Medical student*) OR (Medical trainee*) OR (Preclinical student*) OR (Student doctor*) OR (Student physician*) OR (Undergraduate medic*)) AND ((prevalence) OR (risk) OR (frequency) OR (Cohort design) OR (Cohort studies) OR (Cross-sectional stud*) OR (Cross-sectional studies) OR (Epidemiologic studies) OR (Incidence) OR (Longitudinal design) OR (Longitudinal stud*) OR (Observational stud*) OR (Population stud*) OR (Prevalence) OR (Prospective stud*) OR (Prospective studies) OR (Retrospective stud*) OR (Retrospective studies))

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Table S1 . PRISMA 2020 Main Checklist

Topic	No.	Item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	page 5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	page 5 and 6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	page 6 and 7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	page 6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	page 6
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	page 7 and 8
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	page 8
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	page 9

Topic	No.	Item	Location where item is reported
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	page 9
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	page 7 and 8
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	page 9
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item 5)).	page 6 and 7
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	page 9
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	page 9
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	page 9
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	page 9
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	page 9
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	page 9
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	page 9
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	page 10 and efigure 1

Topic	No.	Item	Location where item is reported
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	efigure 1
Study characteristics	17	Cite each included study and present its characteristics.	etable 3
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	etable 2
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	? (plots or page 10 and 11)
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	page 11
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	page 10 and 11
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	page 10 and 11
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	page 10 and 11
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	? (page 11)
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	page 11 and etable 2
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	page 12,13 and 14
	23b	Discuss any limitations of the evidence included in the review.	page 14
	23c	Discuss any limitations of the review processes used.	page 14
	23d	Discuss implications of the results for practice, policy, and future research.	page 15
OTHER INFORMATION			

Topic	No.	Item	Location where item is reported
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	page 6
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	page 6
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	page 6
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	page 1,2 and 15
Competing interests	26	Declare any competing interests of review authors.	page 15
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	supplementary material

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. MetaArXiv. 2020, September 14. DOI: 10.31222/osf.io/v7gm2. For more information, visit: www.prisma-statement.org

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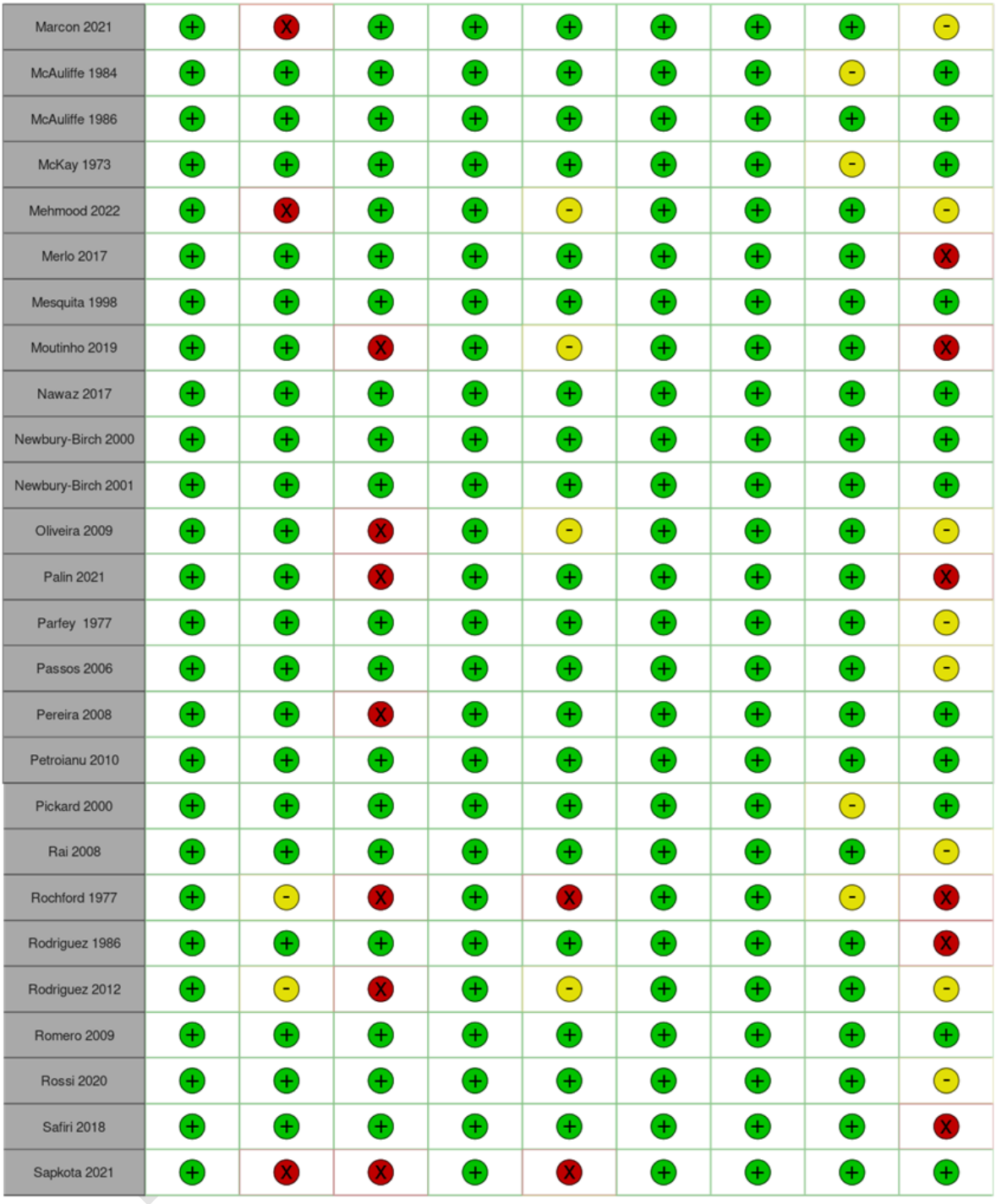
Table S2. Critical appraisal of individual studies according to the JBI Critical Appraisal Checklist for Studies Reporting Prevalence Data.

	D1	D2	D3	D4	D5	D6	D7	D8	D9
Adhikari 2017	+	+	+	+	+	+	+	+	+
Aguilar 2016	+	+	X	+	+	-	+	+	+
Ali 1994	+	+	X	+	+	+	+	+	+
Araújo-Filho 2021	+	-	X	+	+	+	+	+	-
Ashton 1995	+	+	X	+	+	+	+	+	+
Ayala 2017	+	+	+	+	+	+	+	+	-
Ayinde 2022	-	+	+	+	+	X	+	+	-
Bahji 2021	-	+	+	+	+	+	+	+	X
Baldwin 1991	+	+	+	+	+	+	+	+	+
Baldwin 2006	+	+	+	+	-	+	+	+	X
Bíró 2008	+	-	X	+	-	+	+	+	+
Boniatti 2007	+	+	+	+	-	+	+	+	X
Buchanan 2008	+	-	X	+	-	+	+	+	+
Budhathoki 2010	+	-	+	+	+	+	+	+	+
Carvalho 2008	+	+	+	+	+	+	+	+	+
Casataldelli-Maia 2019	-	-	X	+	-	+	+	+	-
Cerame 2008	+	+	+	+	+	+	+	+	+
Chan 2017	+	+	X	+	-	+	+	+	X
Choi 2013	+	+	X	+	-	+	+	+	X
Chung 2022	+	+	X	+	+	+	+	+	X
Conard 1988	+	X	+	+	-	+	+	-	X
Croen 1997	+	+	X	+	+	+	+	+	+
Da Silveira 2008	+	+	+	+	+	+	+	-	-
Eiselen 2023	X	X	X	X	X	X	+	+	+
Engs 1980	-	-	+	X	-	+	+	+	-

Esteche 2018	+	+	X	+	-	+	+	+	X
Farías 2009	-	-	X	X	X	-	+	+	-
Farrell 2019	+	+	X	+	-	+	+	+	-
Ferreira 2022	+	+	X	+	+	+	+	+	+
Gaume 2024	+	+	+	+	+	+	+	+	X
Gignon 2016	+	+	X	+	+	+	+	+	+
Jain 2018	+	+	+	+	+	+	+	+	+
James 2013	+	+	X	+	+	+	+	+	+
Jankie 2023	-	+	X	+	X	+	+	+	X
Jodati 2007	+	-	+	+	-	+	+	-	+
Jovin 2022	-	-	X	+	-	X	+	-	-
Kadhun 2022	-	-	+	+	-	-	+	-	X
Keller 2007	+	+	X	+	+	+	+	+	+
Kerr-Corrêa 1999	+	+	+	+	+	+	+	+	+
Khanal 2010	+	+	+	+	+	+	+	+	+
Konstantinov 2021	+	+	+	+	+	+	?	+	-
Kory 1984	+	+	X	+	X	+	+	-	X
Kushwaha 2019	+	+	X	+	+	+	+	+	-
Laporte 1977	+	+	+	+	+	+	+	-	+
Lemos-Santos 2023	+	+	+	+	+	+	+	+	X
Lipp 1972	-	+	+	X	+	+	+	-	+
Lokesh 2023	+	+	+	+	+	+	+	+	X
Lucas 2006	+	+	X	+	-	+	+	+	-
Maddux 1986	-	+	X	X	-	+	+	+	+
Maier 2013	+	+	+	X	+	+	+	+	-
Makanjuola 2007	+	-	+	+	+	+	+	+	+


Marcon 2021
McAuliffe 1984
McAuliffe 1986
McKay 1973
Mehmood 2022
Merlo 2017
Mesquita 1998
Moutinho 2019
Nawaz 2017
Newbury-Birch 2000
Newbury-Birch 2001
Oliveira 2009
Palin 2021
Parfey 1977
Passos 2006
Pereira 2008
Petroianu 2010
Pickard 2000
Rai 2008
Rochford 1977
Rodriguez 1986
Rodriguez 2012
Romero 2009
Rossi 2020
Safiri 2018
Sapkota 2021

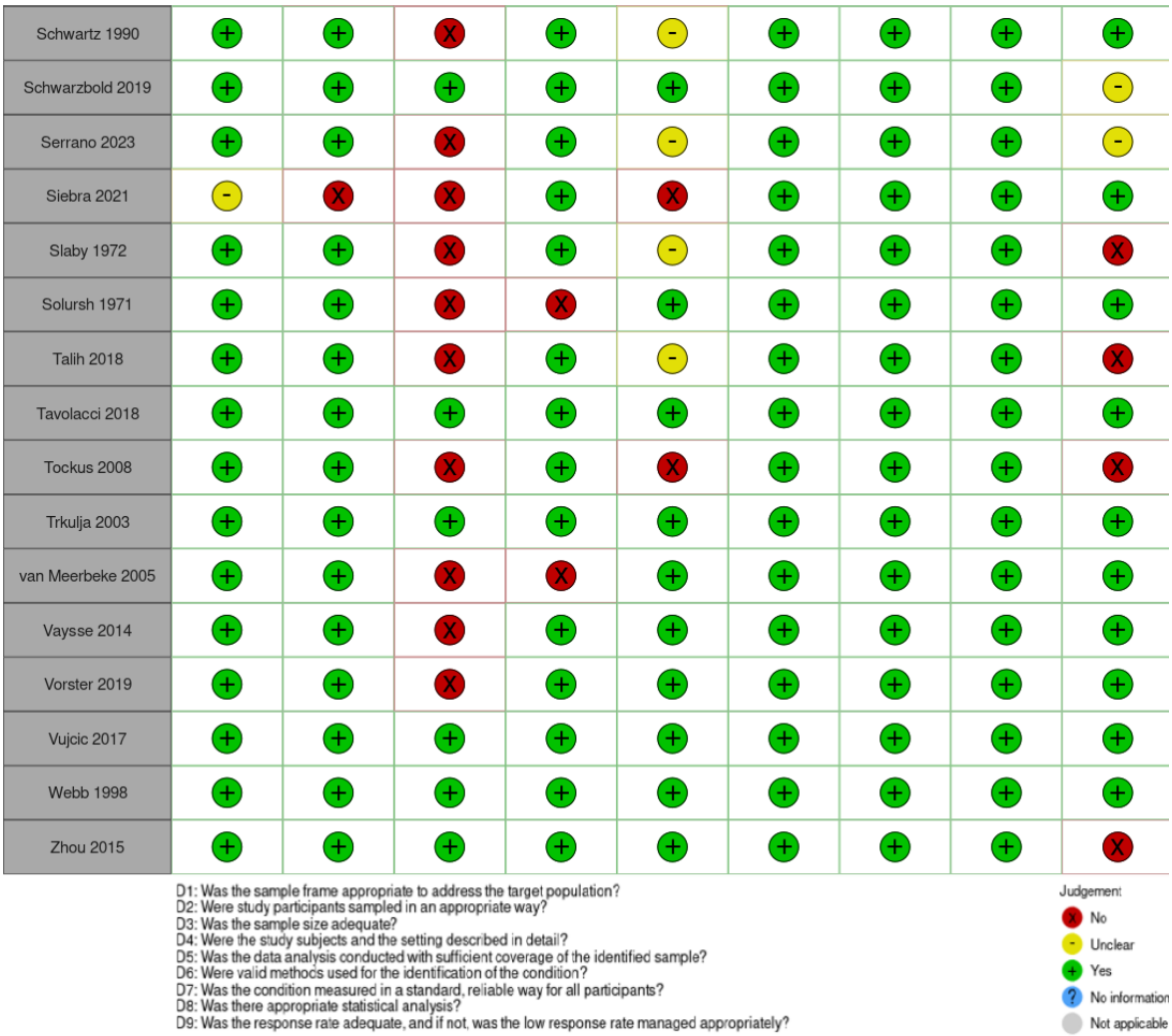

Schwartz 1990
Schwarzbold 2019
Serrano 2023
Siebra 2021
Slaby 1972
Solursh 1971
Talih 2018
Tavolacci 2018
Tockus 2008
Trkulja 2003
van Meerbeke 2005
Vaysse 2014
Vorster 2019
Vujcic 2017
Webb 1998
Zhou 2015
D1: Was the sample frame appropriate to address the target population?
D2: Were study participants sampled in an appropriate way?
D3: Was the sample size adequate?
D4: Were the study subjects and the setting described in detail?
D5: Was the data analysis conducted with sufficient coverage of the identified sample?
D6: Were valid methods used for the identification of the condition?
D7: Was the condition measured in a standard, reliable way for all participants?
D8: Was there appropriate statistical analysis?
D9: Was the response rate adequate, and if not, was the low response rate managed appropriately?
Judgement
No
Unclear
Yes
No information
Not applicable

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Table S3. Results of regression tests for funnel plot asymmetry and number of studies suggested by the trim-and-fill method.

Meta-analysis	z	p	b	95% CI	Number of suggest studies by trim-and-fill method
Time-frame					
Lifetime use	4.61	**< 0.01**	0.11	0.03 - 0.20	0
Year use	3.21	**< 0.01**	0.07	-0.02 - 0.16	0
Month use	5.73	**< 0.01**	0.02	-0.01 - 0.05	0
Week use	7.94	**< 0.01**	-0.01	-0.02 - 0.01	0
Sex*					
Male	2.55	**<0.05**	0.16	0.04 - 0.29	0
Female	3.47	**< 0.01**	0.06	-0.06 - 0.17	0
World region*					
Latin America	2.90	**<0.01**	0.05	-0.10 - 0.20	0
Anglo-Saxon America	0.84	0.40	0.52	0.34 - 0.71	-
Africa	3.16	**< 0.01**	0.04	-0.01 - 0.17	0
Asia	8.25	**< 0.01**	-0.01	-0.04 - 0.02	0
Europe	2.37	**<0.05**	0.13	0.02 - 0.25	0
Decade*					
1970's	4.52	**< 0.01**	-0.12	-0.36 - 0.12	0
1980's	1.63	0.10	0.26	-0.11 - 0.62	-
1990's	1.50	0.13	0.11	-0.19 - 0.41	-
2000's	2.64	**<0.01**	0.07	-0.02 - 0.17	0
2010's	3.04	**<0.01**	0.08	-0.04 - 0.20	0
2020's	2.89	**<0.01**	0.08	-0.09 - 0.26	0
Medical school cycle*					
Preclinical	1.30	0.19	0.12	-0.13 - 0.36	-
Clinical	1.14	0.25	0.10	-0.16 - 0.36	-
Internship	0.91	0.36	0.11	-0.44 - 0.66	-
Legality*					
Legal	1.07	0.28	0.27	0.01 - 0.52	-
Illegal	4.34	**<0.01**	0.09	-0.01 - 0.19	0
Private or public*					
Private	0.36	0.72	0.24	-.014 - 0.61	-
Public	5.51	**<0.01**	0.04	-0.04 - 0.1’2	0

*Lifetime use.

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Figure S1. Funnel plot for lifetime cannabis use among medical students.

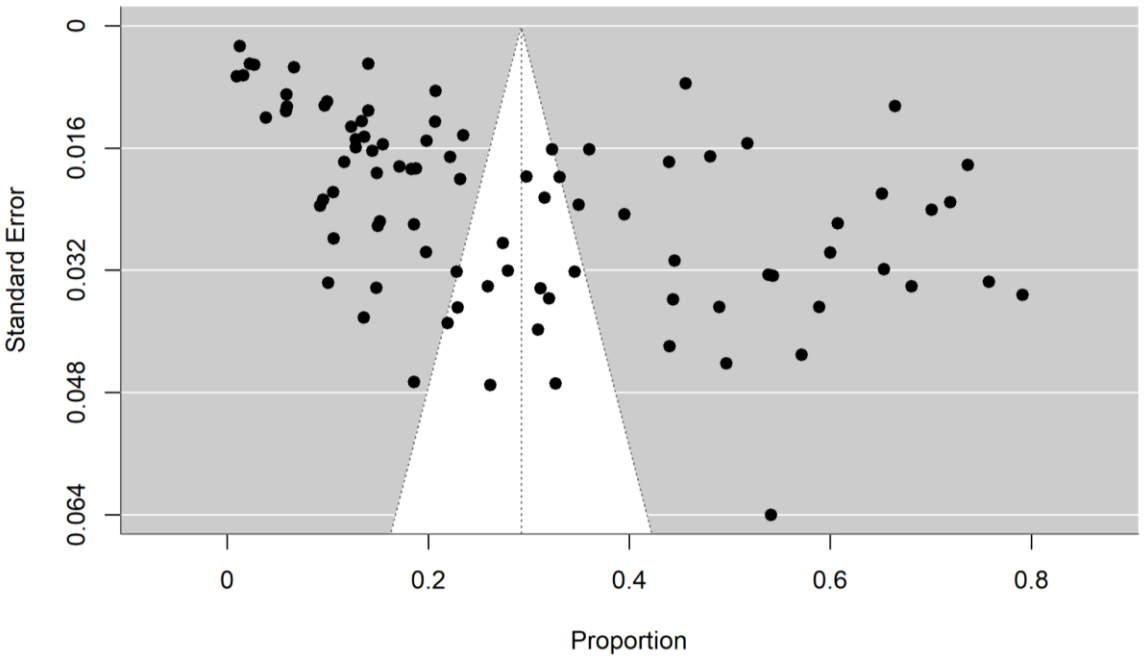

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Figure S2. Prevalence of recreational cannabis use among medical students in the past year.

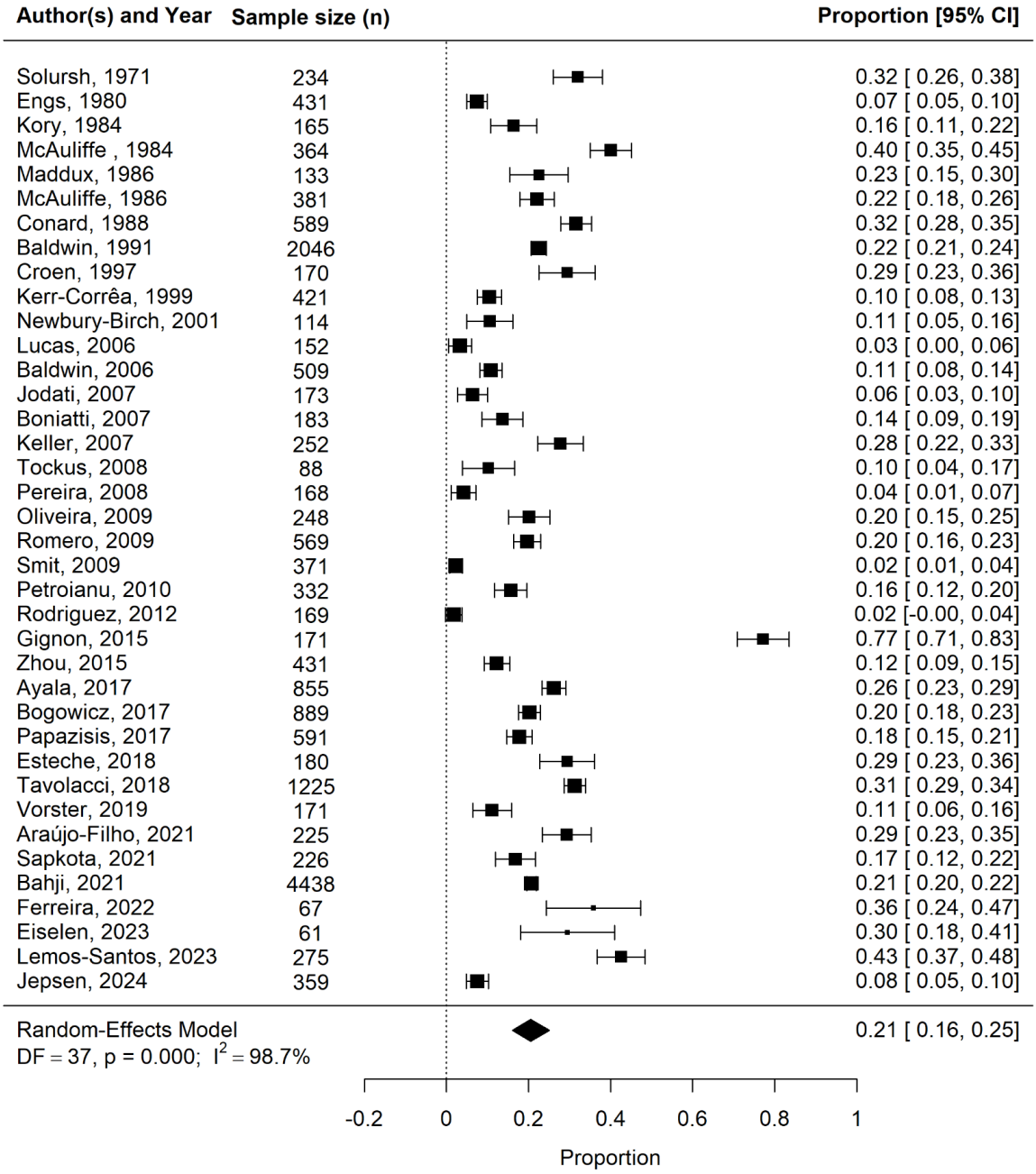

Figure S3. Prevalence of recreational cannabis use among medical students in the past month.

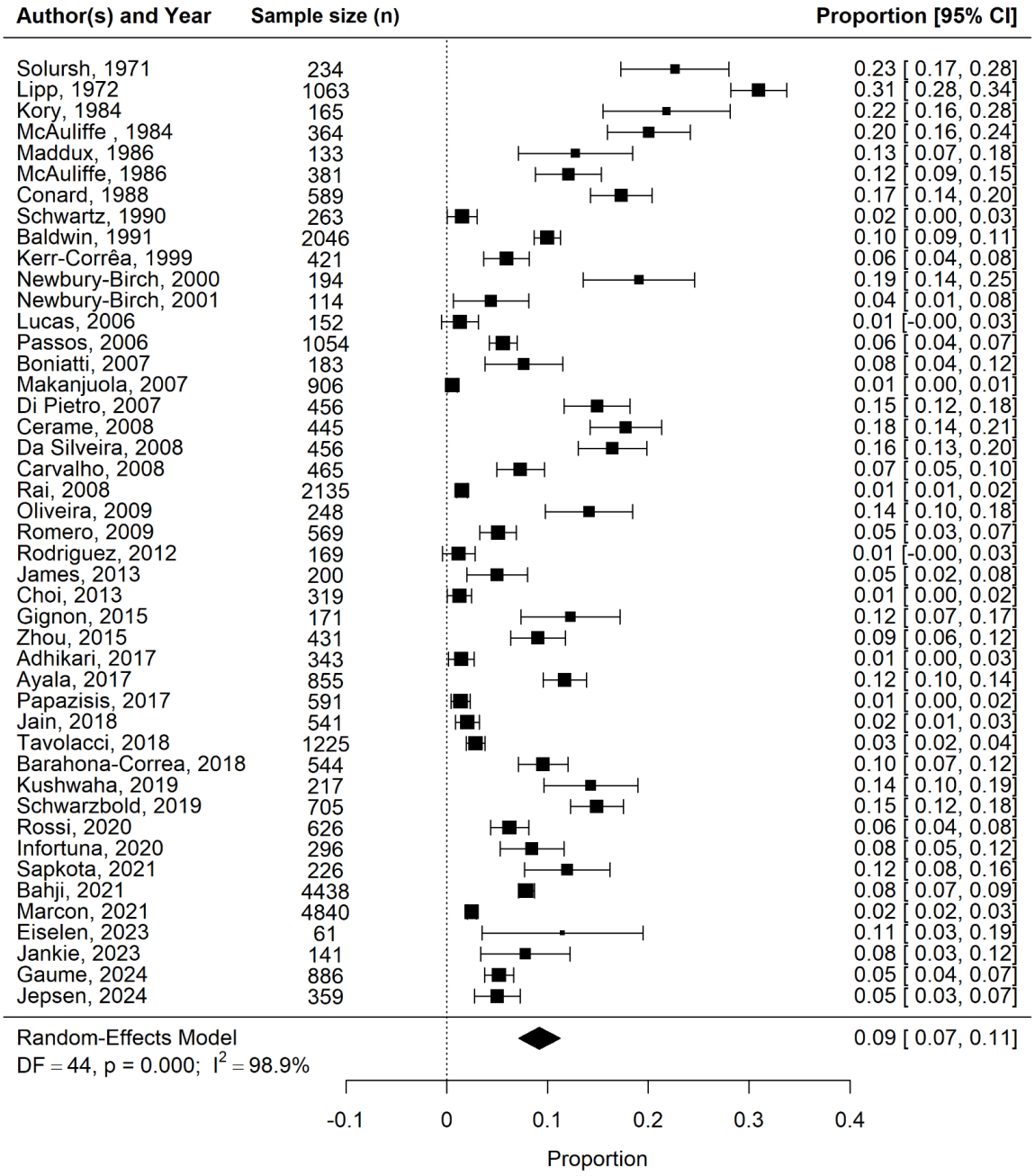

Figure S4. Prevalence of recreational cannabis use among medical students in the past week.

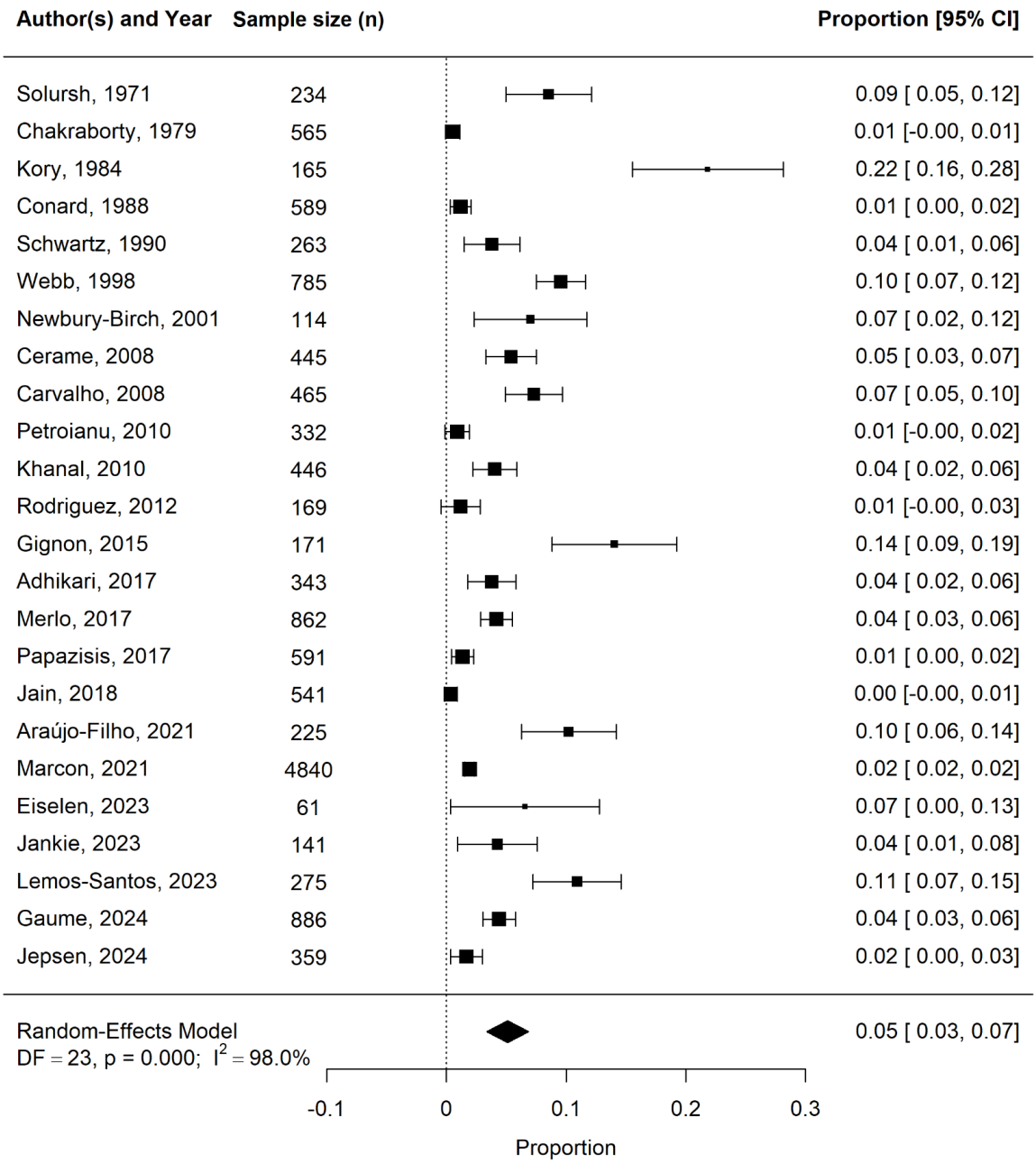

Figure S5. Prevalence of recreational cannabis use among medical students in the 1970s.

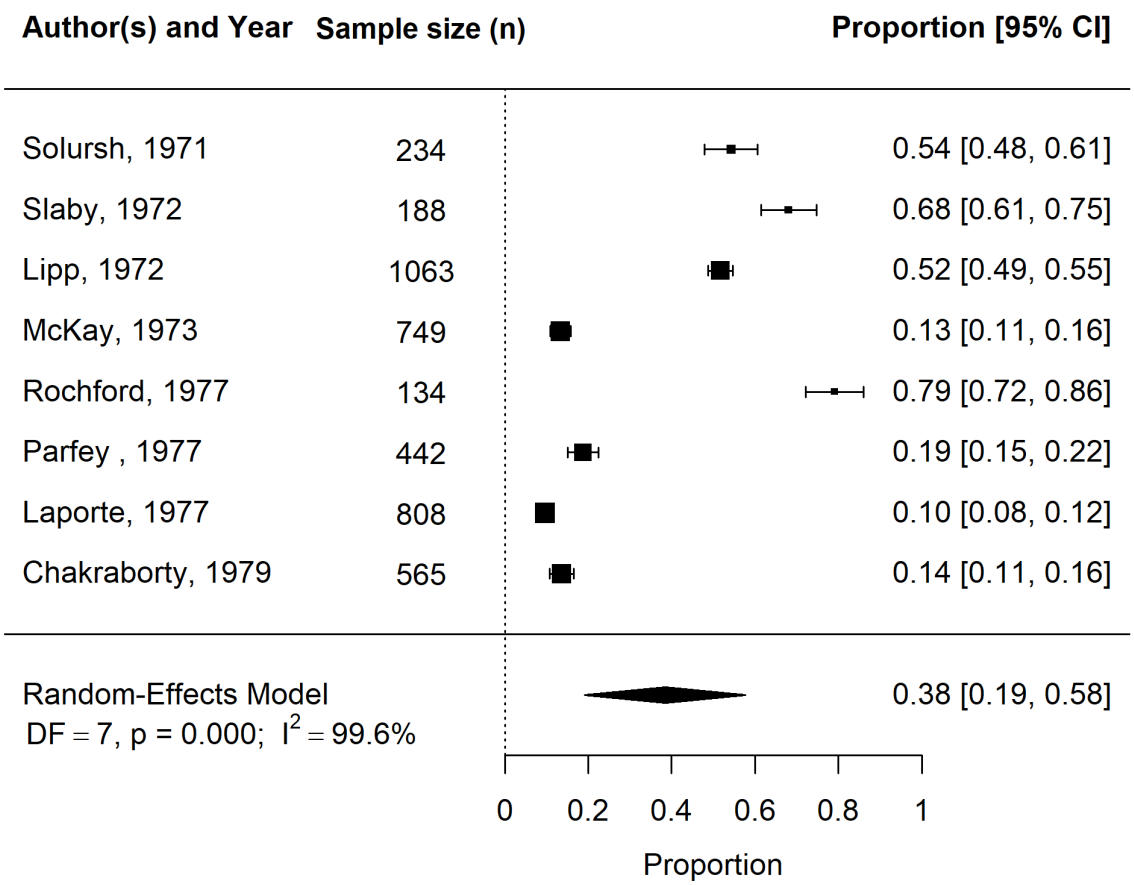

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Figure S6. Prevalence of recreational cannabis use among medical students in the 1980s.

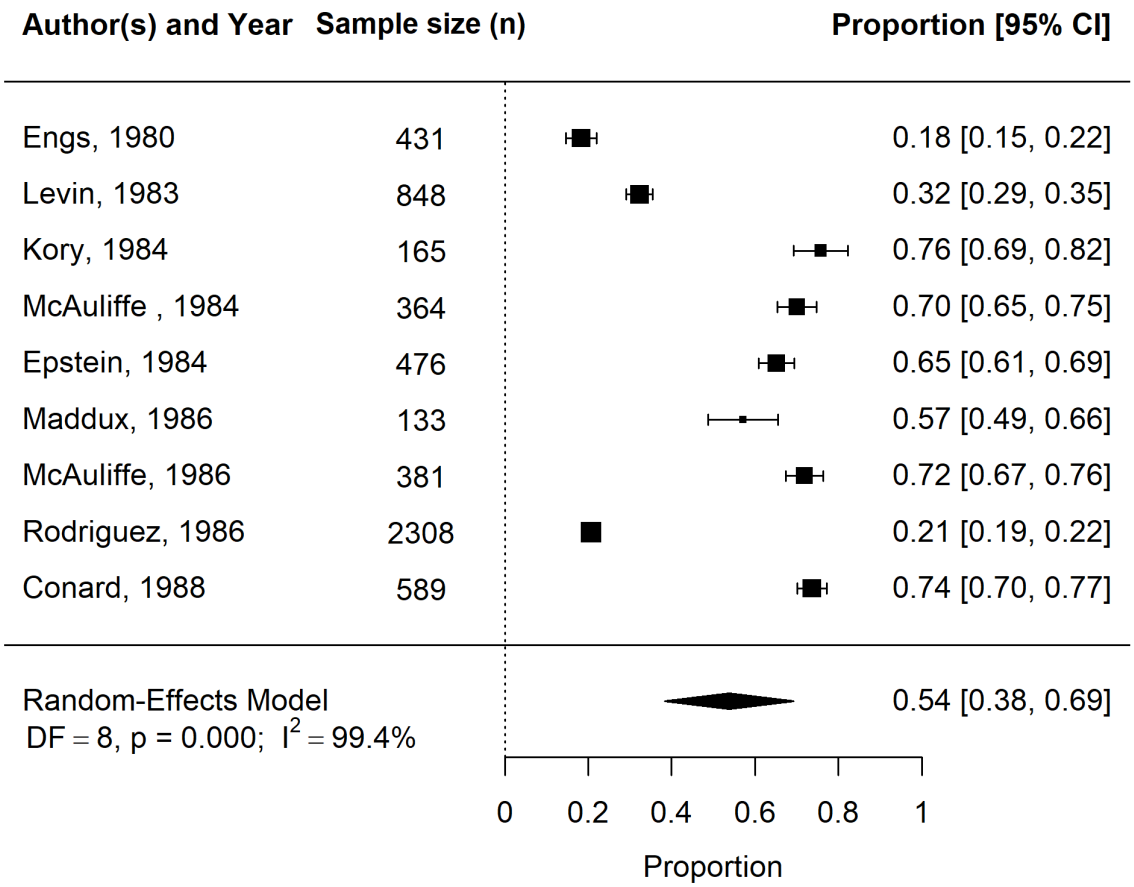

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Figure S7. Prevalence of recreational cannabis use among medical students in the 1990s.

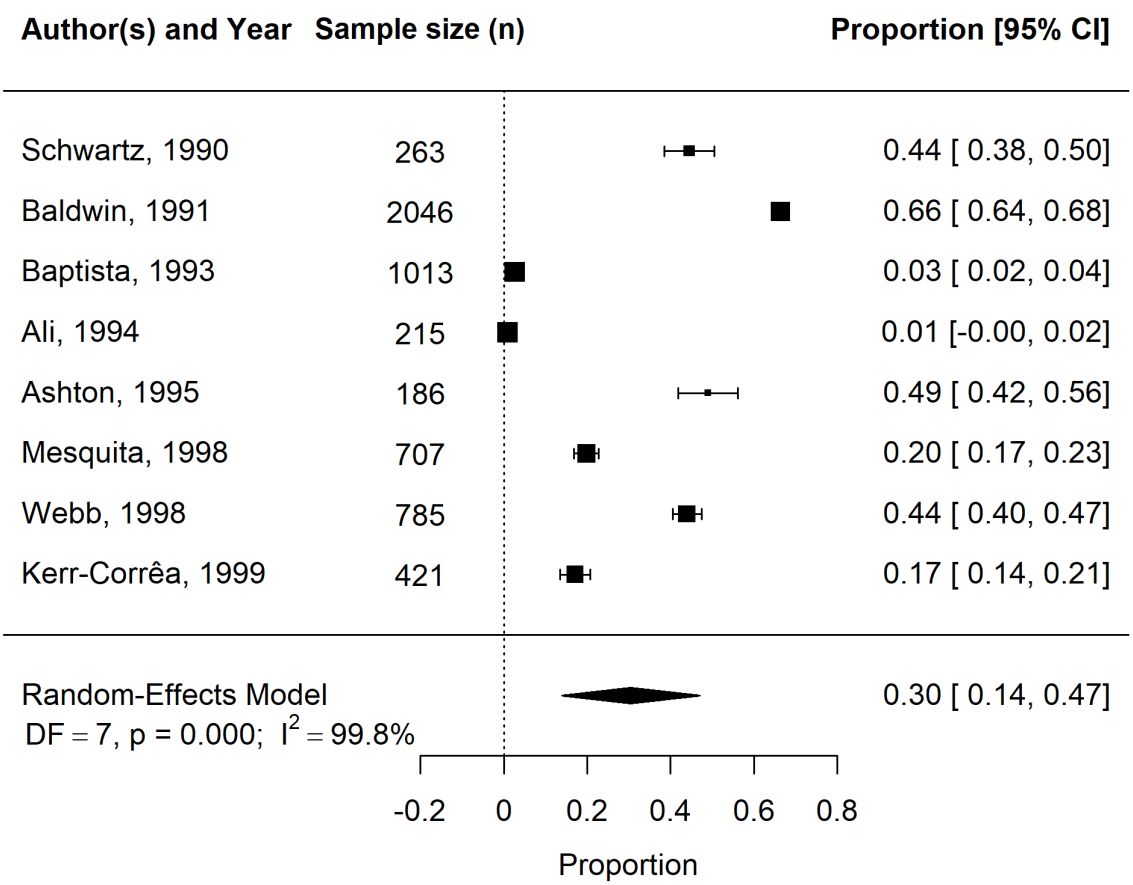

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Figure S8. Prevalence of recreational cannabis use among medical students in the 2000s.

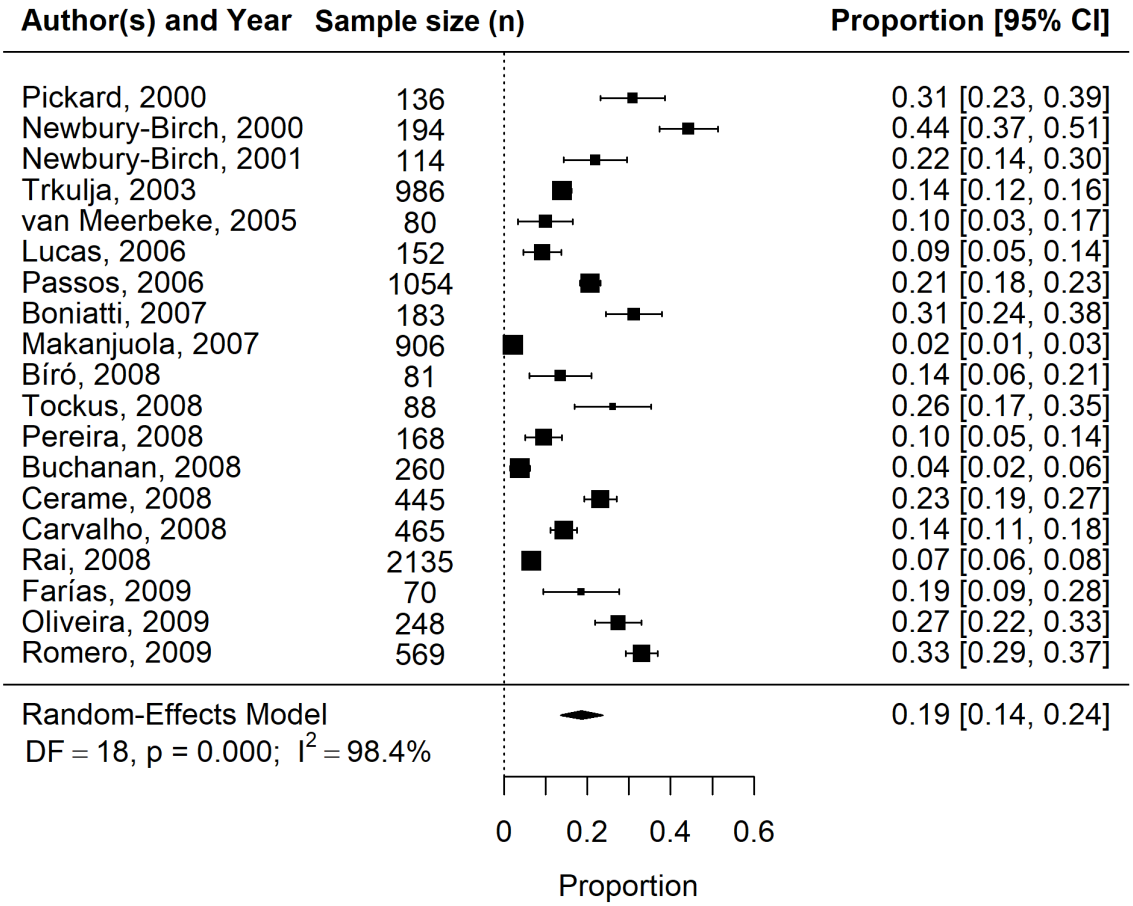

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Figure S9. Prevalence of recreational cannabis use among medical students in the 2010s.

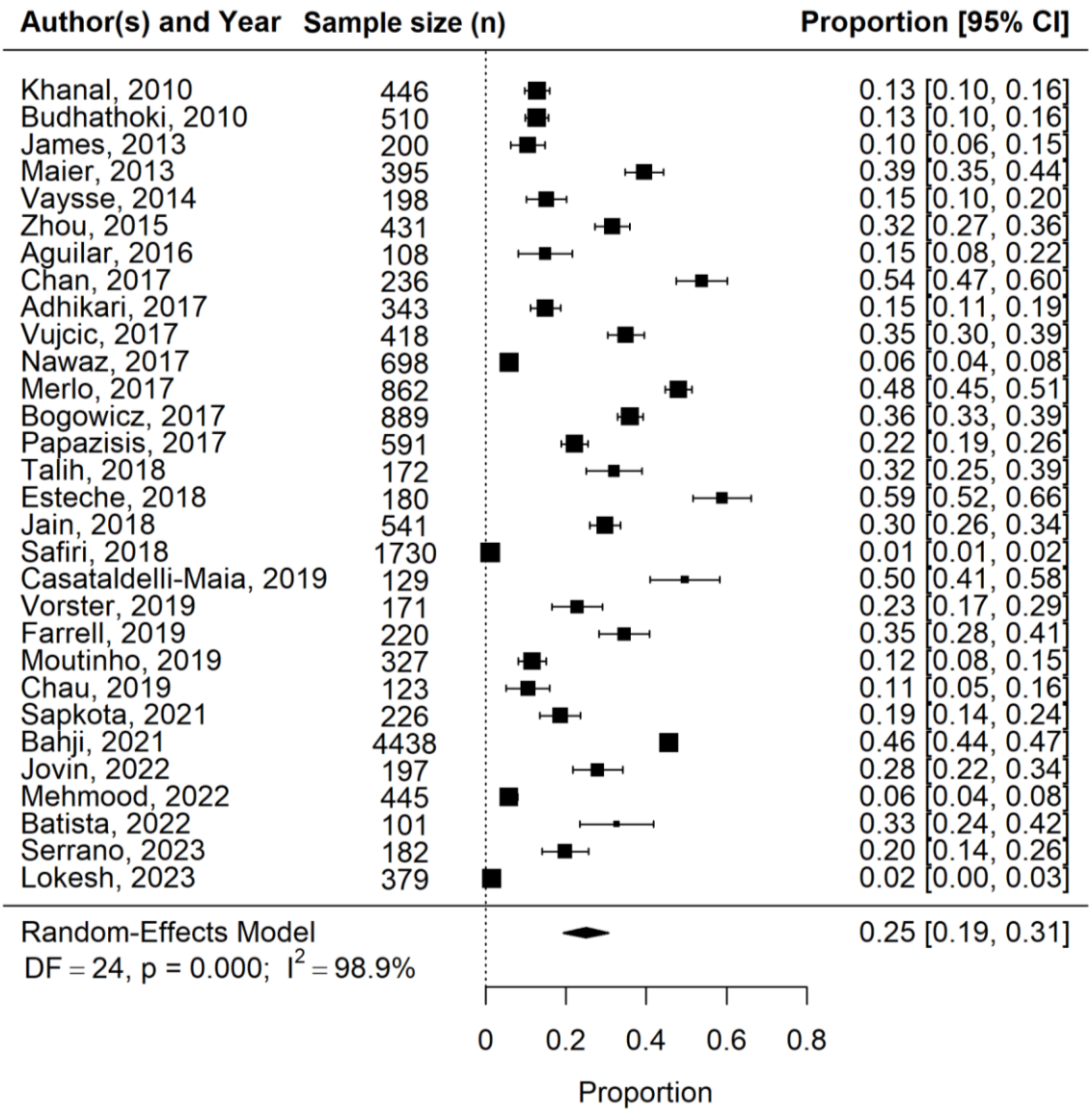

Figure S10. Prevalence of recreational cannabis use among medical students in the 2020s.

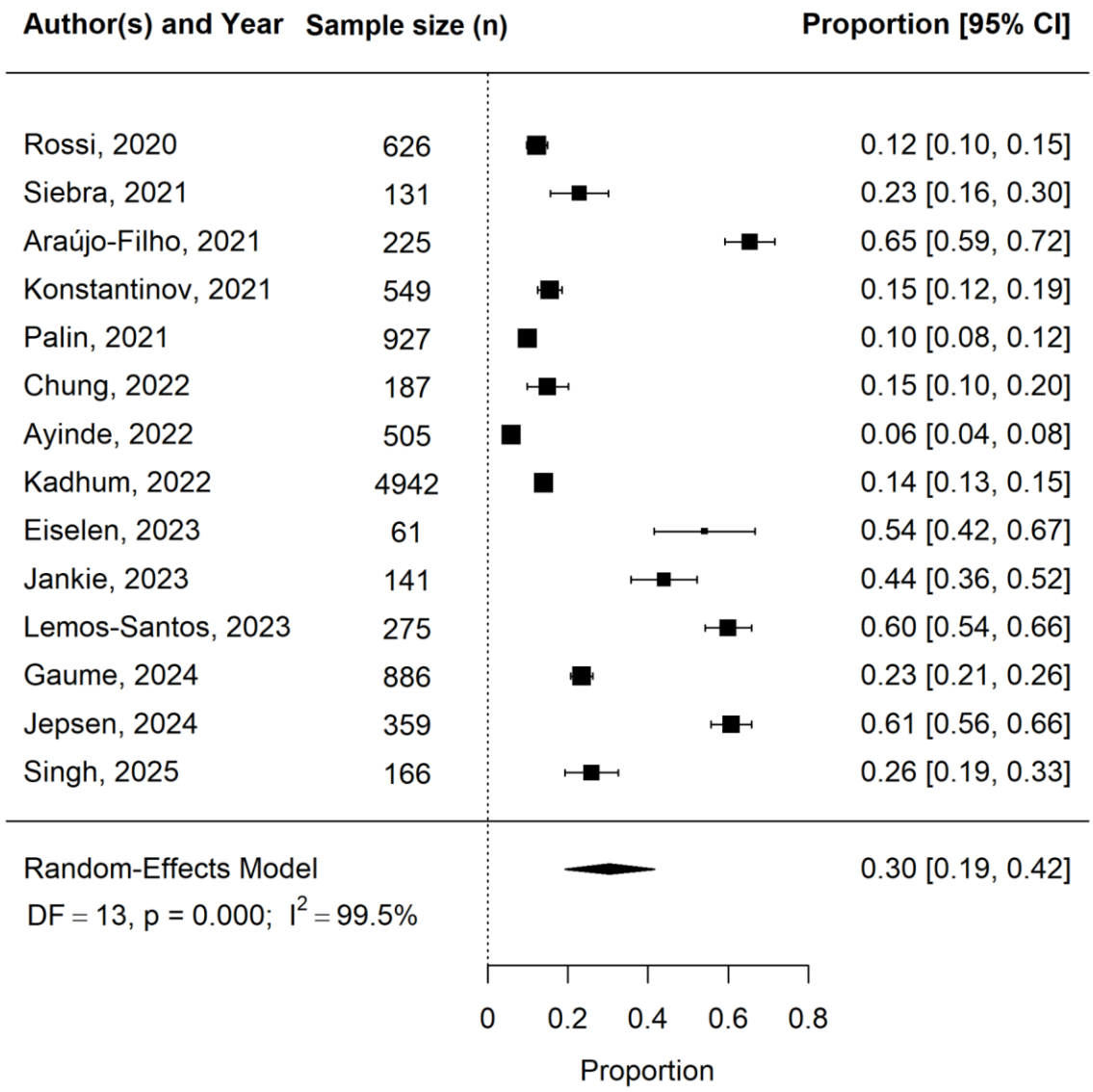

Figure S11. Prevalence of recreational cannabis use among medical students in Asian countries.

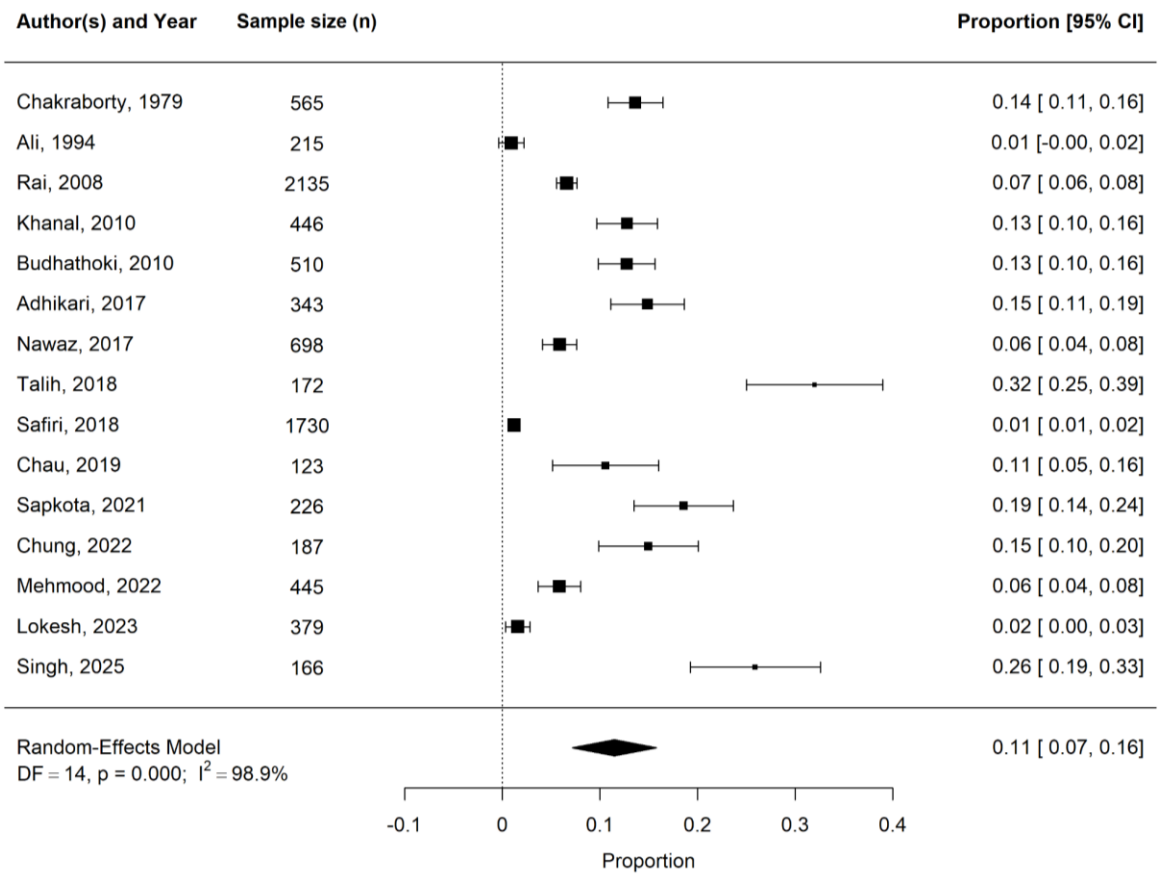

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Figure S12. Prevalence of recreational cannabis use among medical students in African countries.

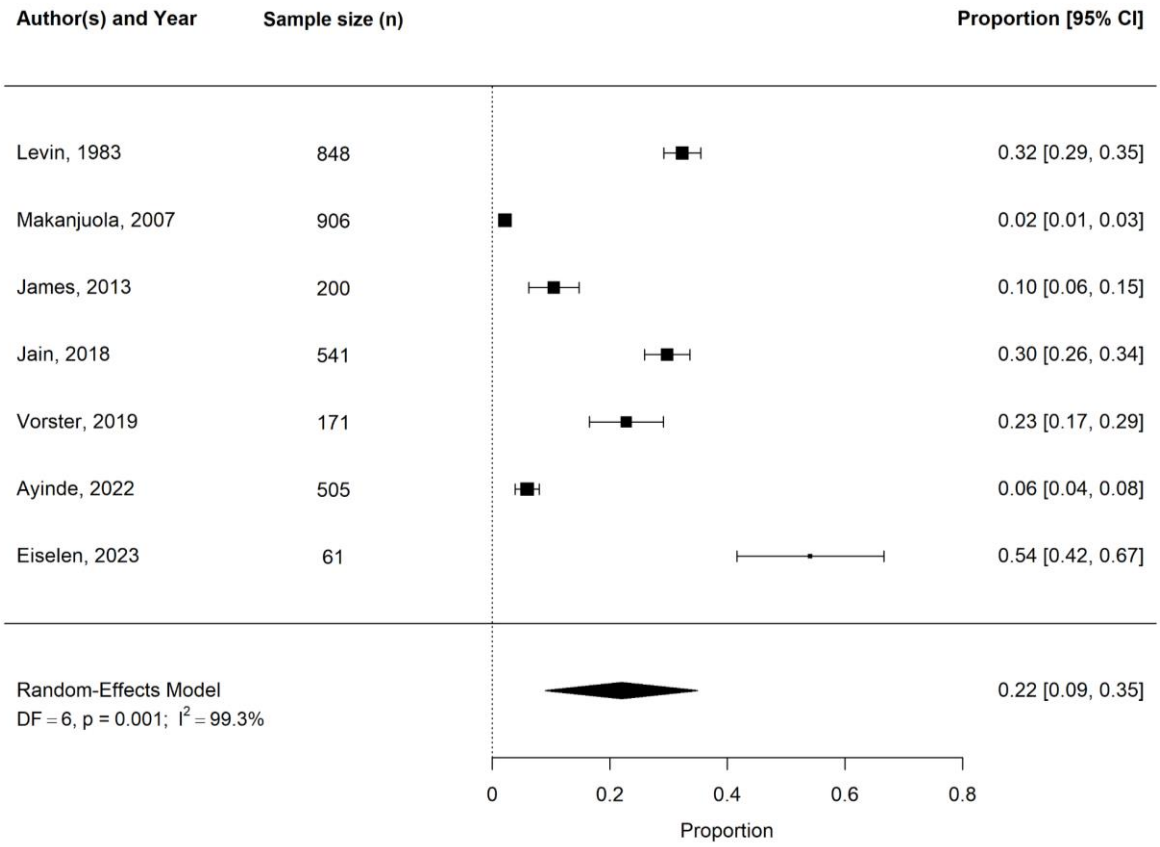

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Figure S13. Prevalence of recreational cannabis use among medical students in Oceanian countries.

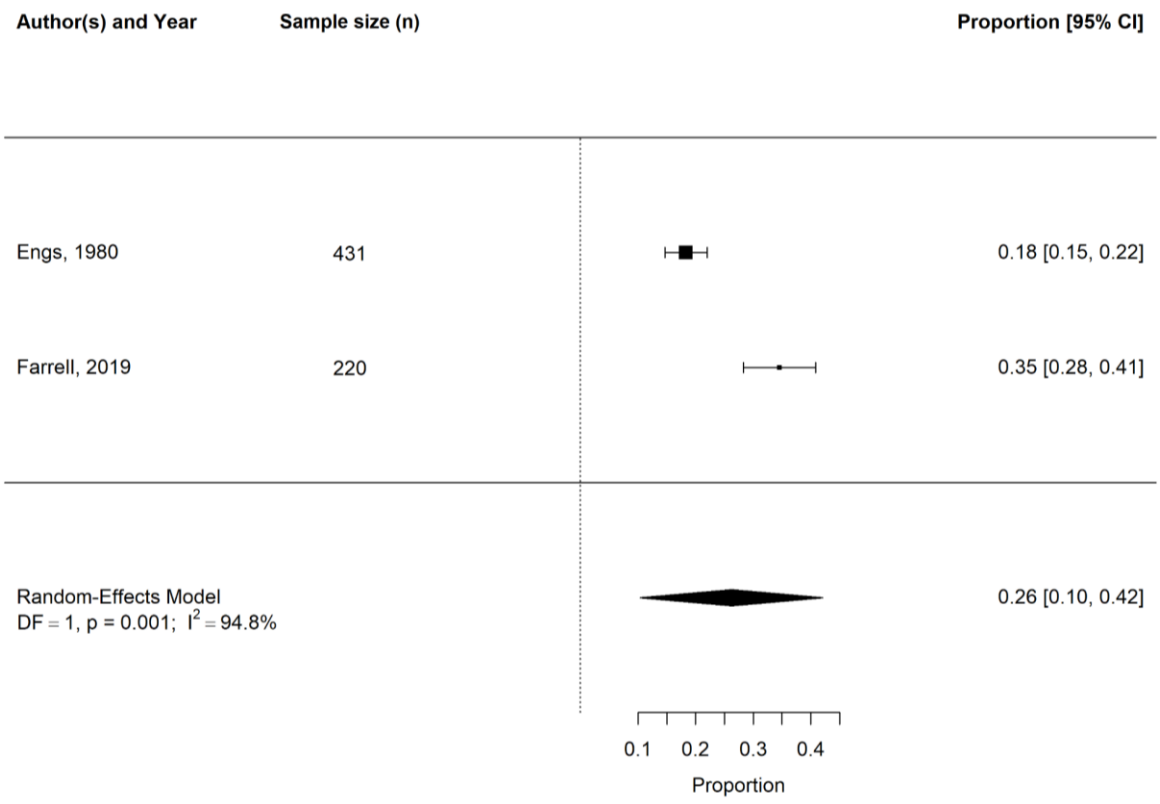

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Figure S14. Prevalence of recreational cannabis use among medical students in European countries.

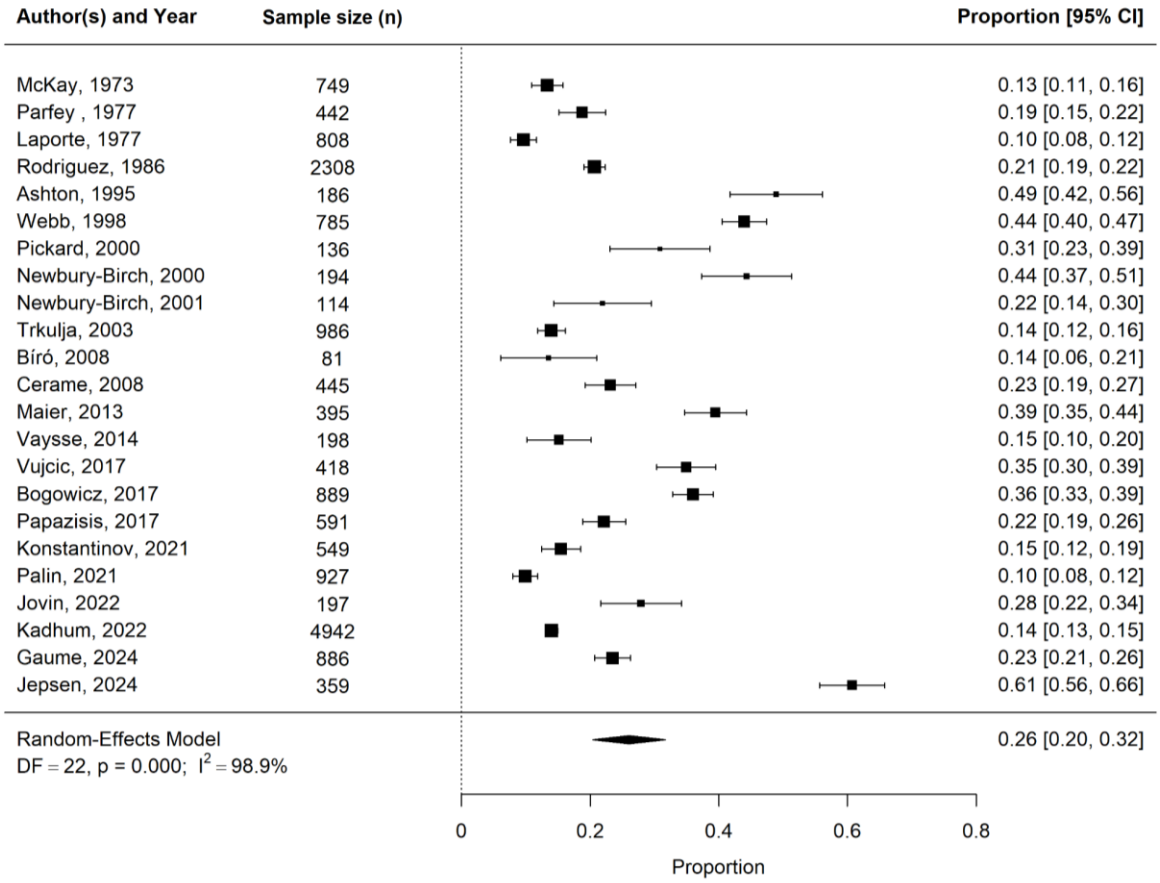

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Figure S15. Prevalence of recreational cannabis use among medical students in Latin American countries.

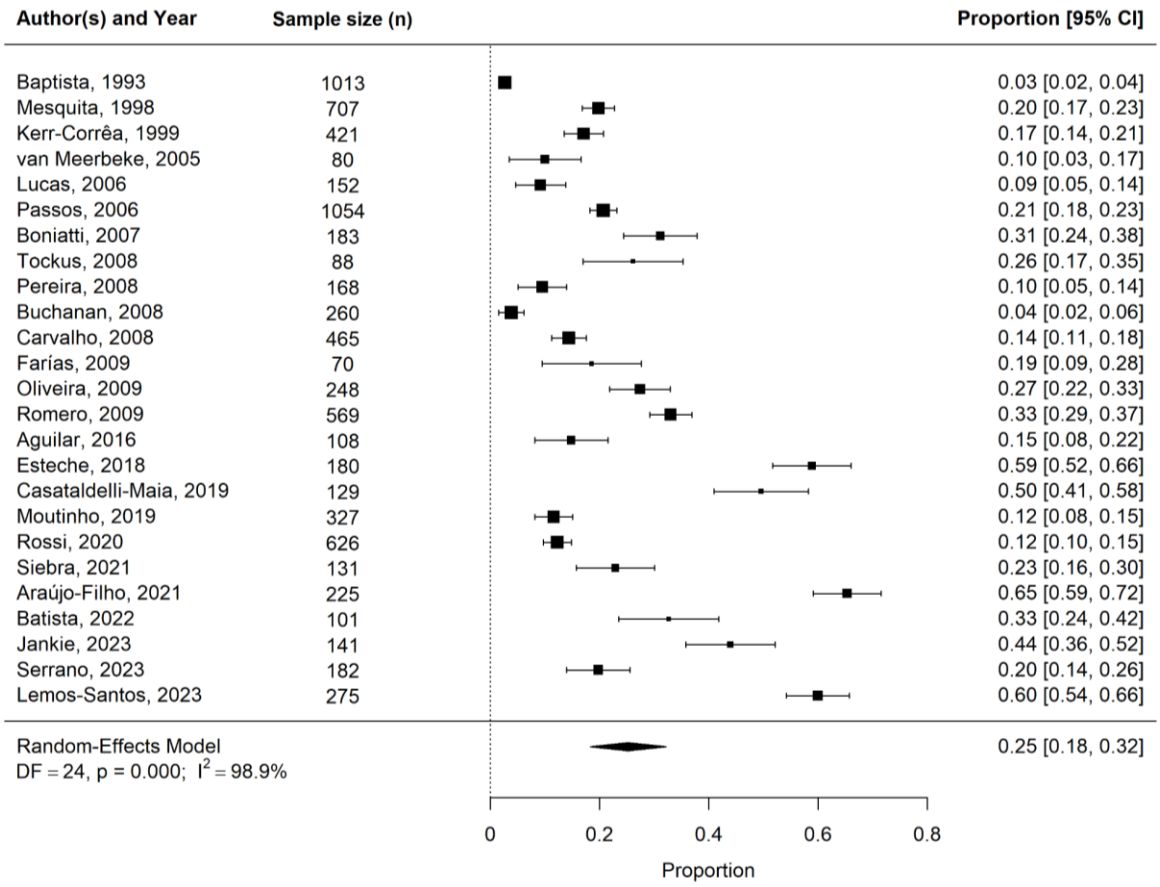

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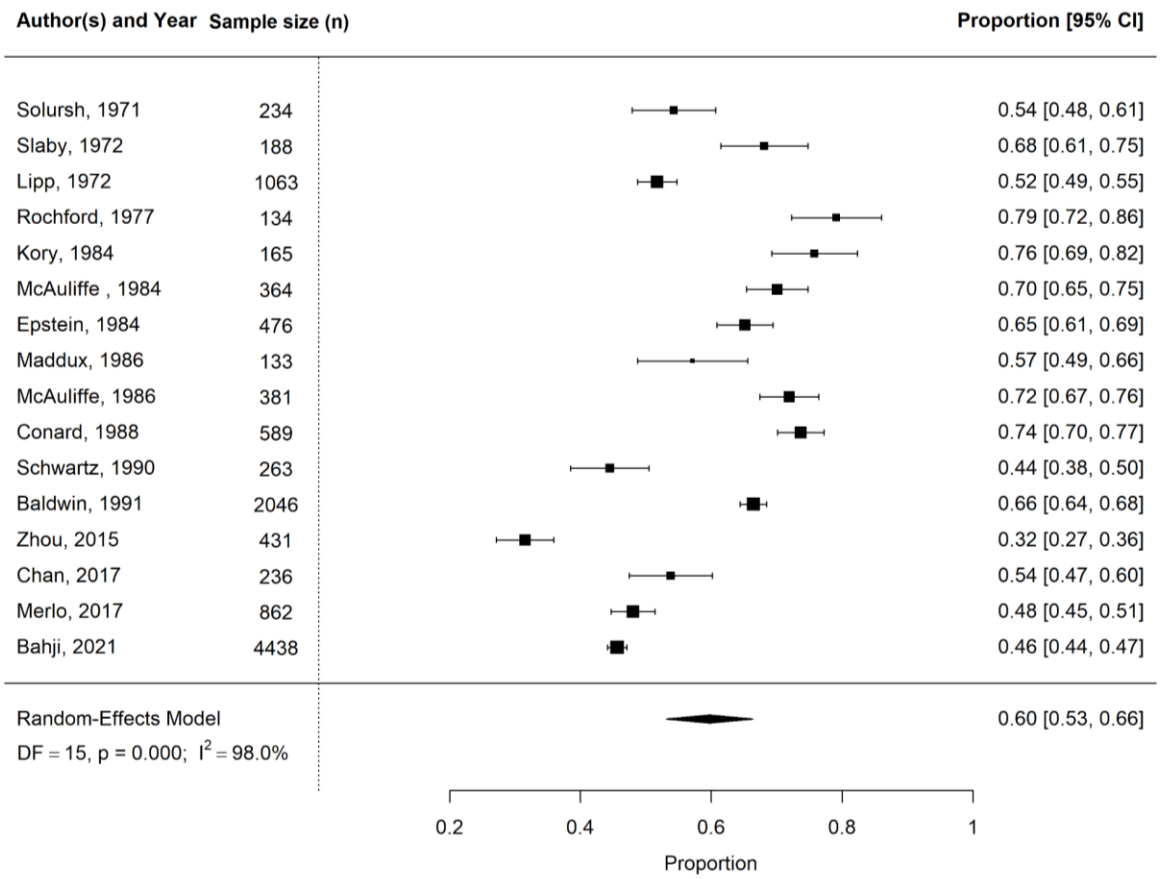
Figure S16. Prevalence of recreational cannabis use among medical students in Anglo-Saxon American countries.



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