Supplementary Online Content

Bahji A, Stephenson C, Tyo R, Hawken ER, Seitz DP. Prevalence of cannabis withdrawal symptoms among people with regular or dependent use of cannabinoids: a systematic review and meta-analysis. *JAMA Netw Open*. 2020;3(4):e202370. doi:10.1001/jamanetworkopen.2020.2370

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This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Full Systematic Review Search Strategy

EMBASE: inception to June 15, 2019

Order	Search	Hits
1.	exp "Cannabis (genus)"/ or cannabis.mp. or exp "cannabis use"/ or exp cannabis smoking/ or exp Cannabis sativa/ or exp "Cannabis sativa subsp. indica"/ or exp medical cannabis/ or exp cannabis addiction/ or exp cannabis/ or exp "Cannabis sativa subsp. sativa"/ or exp cannabis derivative/	47677
2.	marijuana.mp.	16748
3.	1 or 2	50463
4.	exp withdrawal syndrome/ or cannabis withdrawal.mp.	34063
5.	exp drug withdrawal/ or exp withdrawal syndrome/ or withdrawal.mp.	313158
6.	4 or 5	313158
7.	prevalence.mp. or exp prevalence/	988826
8.	3 and 6 and 7	239

MEDLINE: inception to June 15, 2019

Order	Search	Hits
1.	cannabis.mp. or exp Cannabis/	19938
2.	marijuana.mp.	18422
3.	cannabinoid.mp. or exp Cannabinoids/ or exp Endocannabinoids/	24887
4.	hashish.mp.	576
5.	exp "Marijuana Use"/ or exp Marijuana Abuse/	9816
6.	1 or 2 or 3 or 4 or 5	47925
7.	withdrawal.mp. or exp Substance Withdrawal Syndrome/	94691
8.	cannabis withdrawal syndrome.mp.	42
9.	7 or 8	94691

10	exp Prevalence/ or prevalence.mp.	654209
11	6 and 9 and 10	78

PsycINFO: inception to June 15, 2019

Order	Search	Hits
1.	exp "Cannabis Use Disorder"/ or exp Cannabis/ or cannabis.mp.	13157
2.	marijuana.mp. or exp Marijuana/ or exp Marijuana Usage/	11014
3.	cannabinoid.mp. or exp Cannabinoids/	5971
4.	exp Hashish/ or hashish.mp.	397
5.	nabilone.mp.	76
6.	exp Tetrahydrocannabinol/ or synthetic cannabinoids.mp.	1659
7.	weed.mp.	232
8.	1 or 2 or 3 or 4 or 5 or 6 or 7	23957
9.	exp Drug Withdrawal/ or cannabis withdrawal.mp.	7911
10	withdrawal syndrome.mp.	1637
11	marijuana withdrawal.mp.	93
12	9 or 10 or 11	8457
13	8 and 12	461

Web of Science: inception to June 15, 2019

Order	Search	Hits
1.	TOPIC: (cannabis)	21,176
2.	TOPIC: (withdrawal)	103,958
3.	TOPIC: (prevalence)	785,316
4.	1 and 2 and 3	93

Allied and Complementary Medicine: inception to June 15, 2019

Order	Search	Hits
1.	Cannabis/ or cannabis.mp.	260
2.	marijuana.mp.	92
3.	Cannabinoids/ or cannabinoids.mp.	89
4.	1 or 2 or 3	319
5.	withdrawal.mp.	721
6.	cannabis withdrawal.mp.	1
7.	5 or 6	721
8.	4 and 7	4

CINAHL and Pre-CINAHL: inception to June 15, 2019

Order	Search	Hits
1.	(MH "Cannabis") OR "cannabis" OR (MH "Medical Marijuana")	11,360
2.	(MH "Substance Withdrawal Syndrome") OR "withdrawal"	16,343
3.	S1 AND S2	293

ProQuest Dissertations & Theses: inception to June 15, 2019

Order	Search	Hits
1.	(cannabis withdrawal syndrome) AND prevalence	3,094

Psychiatry Online: inception to June 15, 2019

Order	Search	Hits
1.	cannabis withdrawal syndrome	209

eTable 2. Study Characteristics

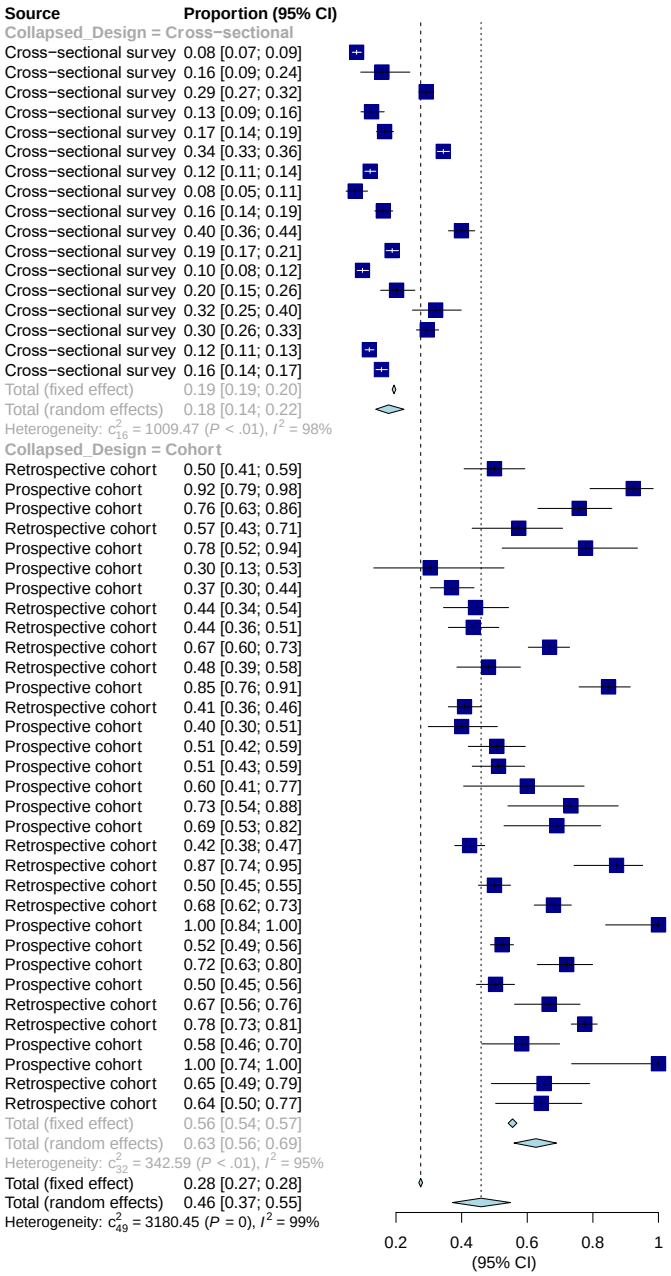
Psych	TS	Demographic	CUD_%	Male_%	Age	White_%	Black_%	Hispanic_%	Asian_%	Daily_MJ_%	Timeline	N	CWS_n	CWS_%	Threshold_Sx	Quality
No	No	Adults	12.2	62	30.8	76	0	19	7	100	Past Year	1603	**128**	8.0	2	Fair
Yes	Yes	Adults	81.7	77	41.5	31	69	0	0	53	Past Year	120	**60**	50.0	6	Poor
Yes	Yes	Adults	100	80	28.6	97	0			62	Lifetime	39	**36**	92.3	4	Fair
No	Yes	Adults	100	87	31.2	98	0	0	0	100	Lifetime	62	**47**	75.8	1	Fair
No	Yes	Adults	54	85	33.8	100	0	0	0	81	Lifetime	54	**31**	57.4	3	Poor
No	Yes	Adults	100	61	30.9	94	6	0	0	100	Lifetime	18	**14**	77.8	4	Fair
Yes	No	Adults	100	82.6	27.4	100	0	0	0	100	Past Year	23	**7**	30.4	3	Poor
Yes	No	C&A	60.7	67	16.8	90	5	2.5	2.5	45.3	Past Year	214	**79**	36.9	2	Fair
No	No	Adults	54	78	35	52	0	0	0	80	Past Year	104	**46**	44.2	4	Poor
Yes	Yes	Mixed	100	54	20.3	71	23		1	49	Past Year	170	**74**	43.5	4	Fair
No	No	Adults	8	57	37	53	36	6	6	64	Past Year	102	**16**	15.7	3	Fair
Yes	Yes	C&A	78.6	72	15.8	48	12	41	0	71	Lifetime	229	**153**	66.8	1	Fair
Yes	No	Mixed	53.4	93	19.2	22	26	35	0	78	Past Year	110	**53**	48.2	1	Fair
No	No	Adults	11.7	50	24.8	100	0	0	0		Past Year	1568	**458**	29.2	1	Fair
No	No	Adults	16.4	65	23.9	100	0	0	0	100	Past Year	359	**45**	12.5	1	Fair
Yes	Yes	Adults	100	75	28.7	100	0	0	0	100	Lifetime	92	**78**	84.8	1	Fair
No	No	Adults	13.9	38	48.4	29	71	0	0	100	Past Year	818	**135**	16.5	3	Good
No	No	Adults	92.4	58.3	29.2	0	82	6	0	66	Past Year	384	**157**	40.9	3	Fair
Yes	No	C&A	84.4	82	16.6	86	0	0	0	100	Past Year	90	**36**	40.0	1	Fair
No	No	Adults	57.2	67	58.5	75	11	7	2	57	Past Year	2613	**899**	34.4	3	Fair
No	Yes	Adults	77.9	73	33.3	10	85	5	0	100	Past Year	136	**69**	50.7	6	Fair
No	Yes	Adults	100	80	32.3	89	11	0	0	84	Past Year	160	**82**	51.3	4	Fair
No	Yes	Adults	100	87	42.5	85	15	0	0	100	Lifetime	30	**18**	60.0	3	Good
No	Yes	Adults	79.3	100	28.5	14	86	0	0	100	Lifetime	30	**22**	73.3	1	Poor
Yes	Yes	Mixed	100	74	34.3	42	24	29	2	42	Lifetime	42	**29**	69.0	1	Fair
No	No	Adults	91	58	31.2	20	80	0	0	100	Past Year	469	**199**	42.4	6	Poor

Yes	No	Adults	24.6	66		59					Past Year	1527	**185**	12.1	3	Fair
Yes	No	Adults	26.7	90.1	39					30.1	Past Year	278	**21**	7.6	3	Fair
Yes	Yes	Adults	100	63	31	66	0	0	34	98	Lifetime	47	**41**	87.2	1	Poor
No	No	Adults	48	49	22	100	0	0	0	100	Past Year	416	**208**	50.0	1	Fair
No	Yes	Adults	63	49	22	100	0	0	0	100	Lifetime	278	**189**	68.0	1	Fair
Yes	Yes	C&A	100	67	17	100	0	0	0	100	Lifetime	21	**21**	100.0	1	Fair
No	No	Mixed	3.5		19	100	0	0	0	2.9	Past Year	732	**118**	16.1	4	Fair
No	Yes	Adults	1.8	53.6	45.1	86.7	10.7	8	8	87.2	Past Year	801	**419**	52.3	1	Poor
No	Yes	Mixed	100	85	19.6	100	0	0	0	100	Lifetime	118	**85**	72.0	3	Fair
Yes	No	Adults	30	66.1	32	76					Past Year	596	**238**	39.9	2	Poor
No	Yes	Adults	100	72	30.3	64	28	0	0	100	Past Year	302	**152**	50.3	1	Fair
No	No	Adults		68	34.3					19	Past Year	1712	**322**	18.8	2	Fair
No	No	Adults		68	34.3					19	Past Year	1187	**116**	9.8	2	Fair
No	Yes	C&A	76.9	100	16.4	45	22	27	5	51	Lifetime	93	**62**	66.7	1	Fair
No	Yes	Adults	100	68.4	36.1	69.3	12.2	17.3	1.1	100	Lifetime	450	**349**	77.6	1	Fair
No	No	Adults	57	58	36					65	Past Year	243	**49**	20.2	1	Poor
No	No	Adults	92	53.7	30					51.2	Past Year	162	**52**	32.1	1	Fair
No	No	Adults	20.8							100	Past Year	722	**213**	29.5	1	Fair
No	Yes	C&A	56.9	90	16.2	89	11	0	0	100	Past Year	72	**42**	58.3	4	Fair
No	Yes	Adults	100	50	28.2	100	0	0	0	100	Lifetime	12	**12**	100.0	1	Fair
No	No	Adults	23.6	39	31.9	100	0	0	0	14	Past Year	2276	**270**	11.9	3	Fair
No	Yes	Adults	79.1	69.8	37					100	Lifetime	43	**28**	65.1	2	Poor
No	Yes	Adults	100	71.4	27					100	Lifetime	56	**36**	64.3	2	Poor
Yes	No	Adults	50.4	63	32.3	72	19	6	0	16	Past Year	1735	**270**	15.6	2	Fair

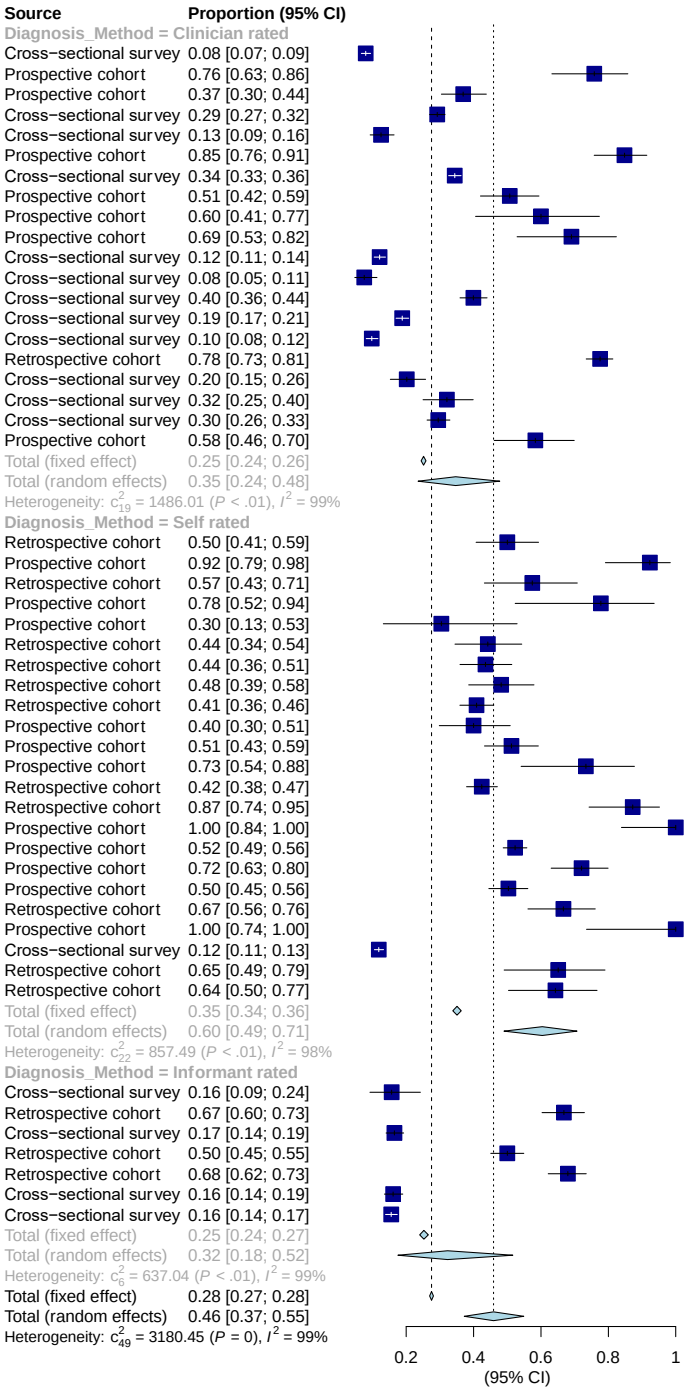
eTable 3. List of Validated Cannabis Withdrawal Instruments and Scales

Instrument	**Type**
Addiction Severity Index[1]	Clinician Administered
Cannabis Use Disorder and Associated Disabilities Schedule[2]	Clinician Administered
Customary Drinking and Drug Use Record[3]	Clinician Administered
Composite International Diagnostic Interview[4]	Clinician Administered
Circumstances, Motivation, Readiness for Treatment Scale[4]	Clinician Administered
Cannabis Use Disorders Identification Test[5]	Clinician Administered
Cannabis Withdrawal Scale[6]	Clinician Administered
Marijuana Problem Inventory[7]	Clinician Administered
Structured Clinical Interview for DSM[8]	Clinician Administered
Daily Marijuana Questionnaire[9,10]	Self-reported
Inventory of Drug Use Consequences[11]	Self-reported
Marijuana Craving Questionnaire[12]	Self-reported
Marijuana Quit Questionnaire[13]	Self-reported
Marijuana Motives Measure[14]	Self-reported
Marijuana Problem Scale[15]	Self-reported
Marijuana Withdrawal Symptom Checklist[16]	Self-reported
Symptom Checklist-90 revised[17]	Self-reported
Time-Line-Follow-Back[18]	Self-reported

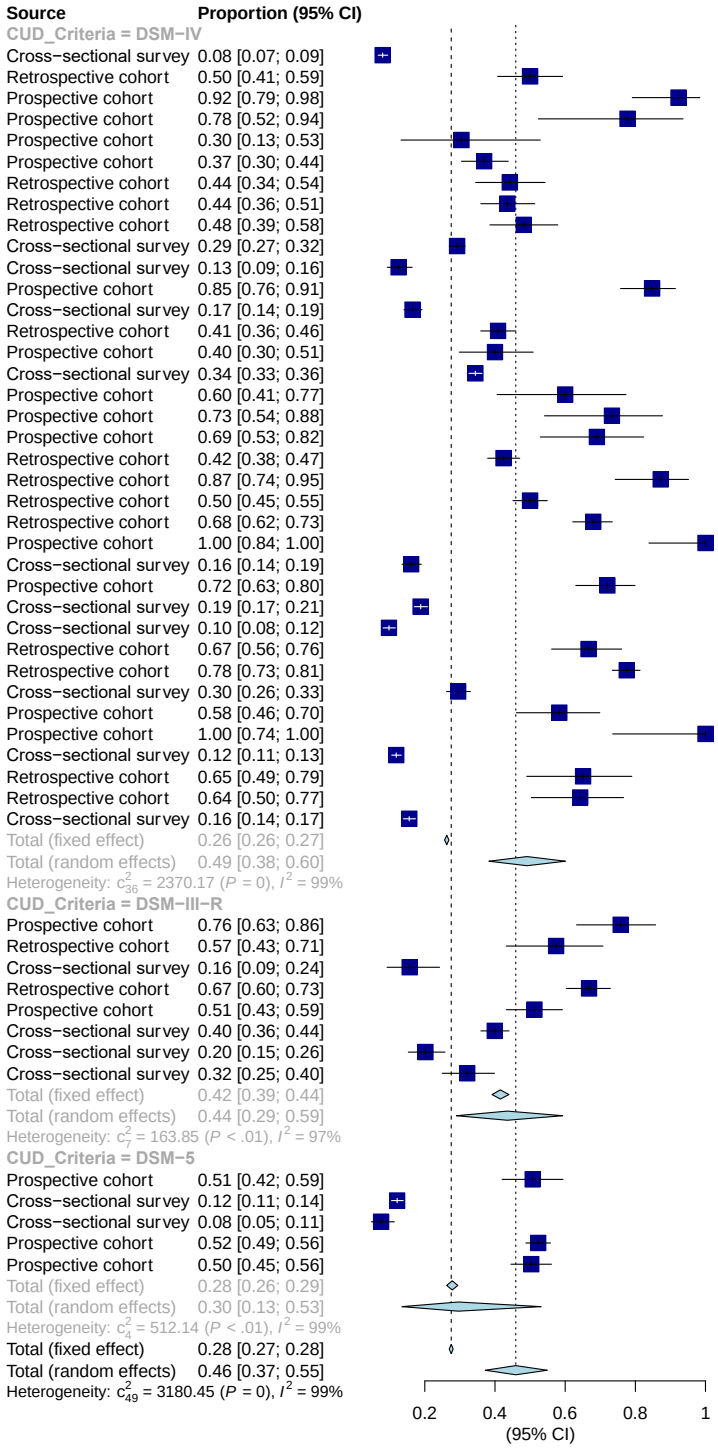
eFigure 1. Subgroup analyses and meta-regressions



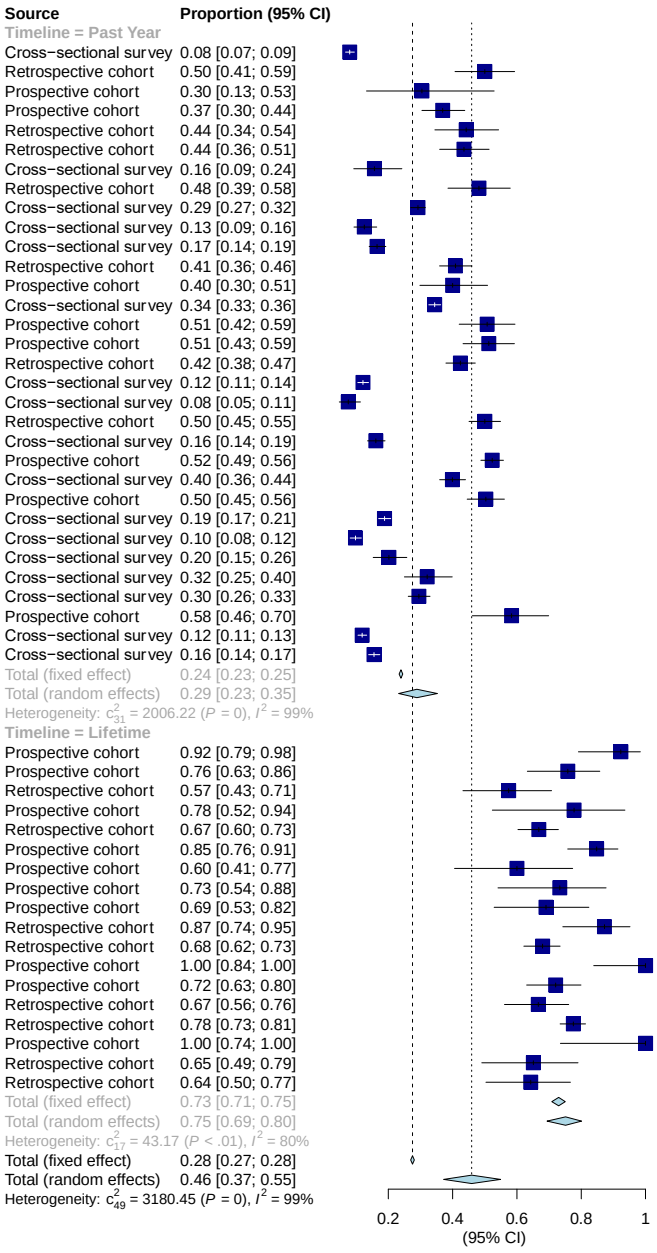
Forest Plot for Prevalence of Cannabis Withdrawal in People With Cannabis Use Disorder Stratified by Study Design



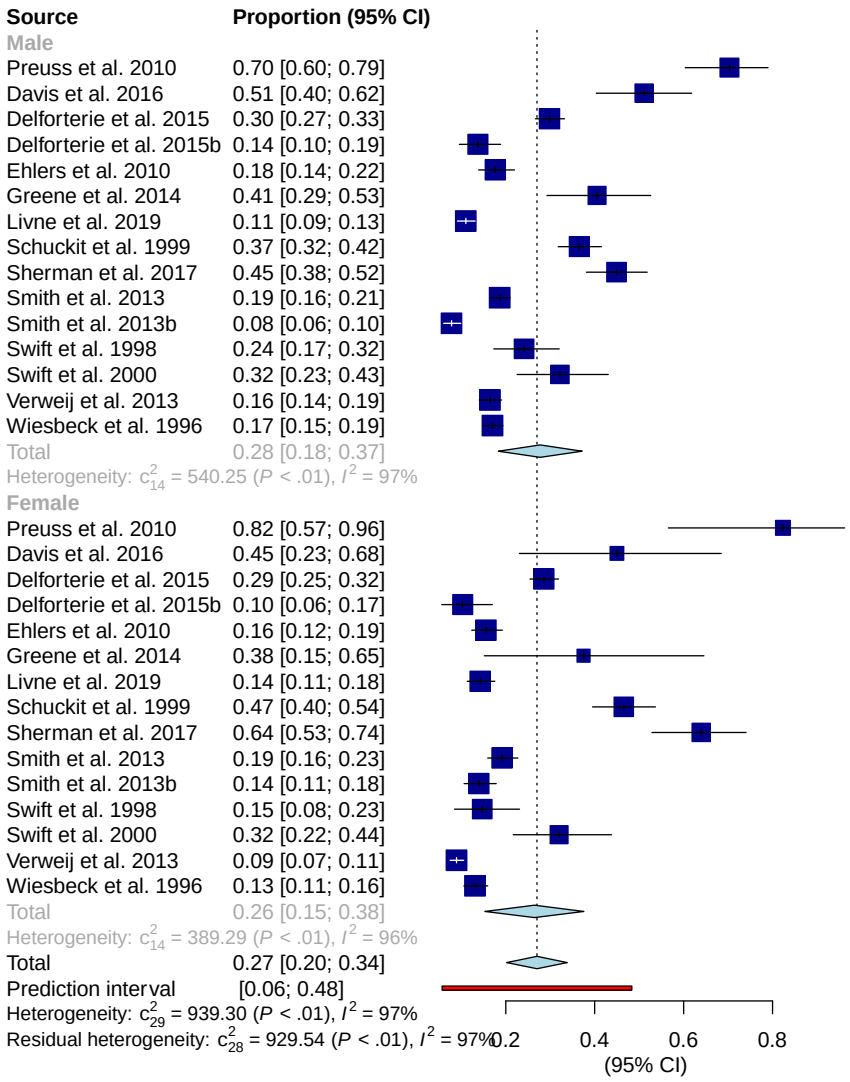
Forest Plot for Prevalence of Cannabis Withdrawal in People With Cannabis Use Disorder Stratified by Method of Cannabis Withdrawal Diagnosis



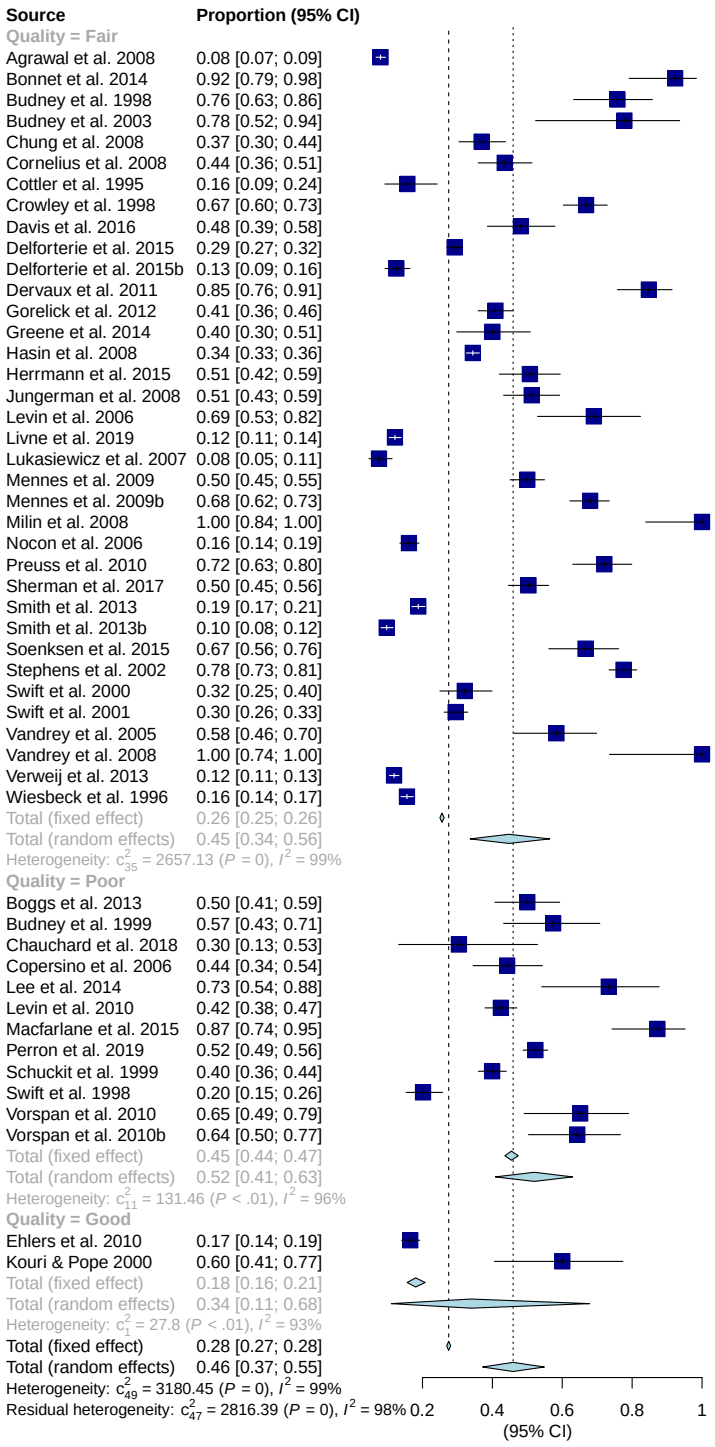
Forest Plot for Prevalence of Cannabis Withdrawal in People With Cannabis Use Disorder Stratified by Method of Cannabis Use Disorder Diagnosis



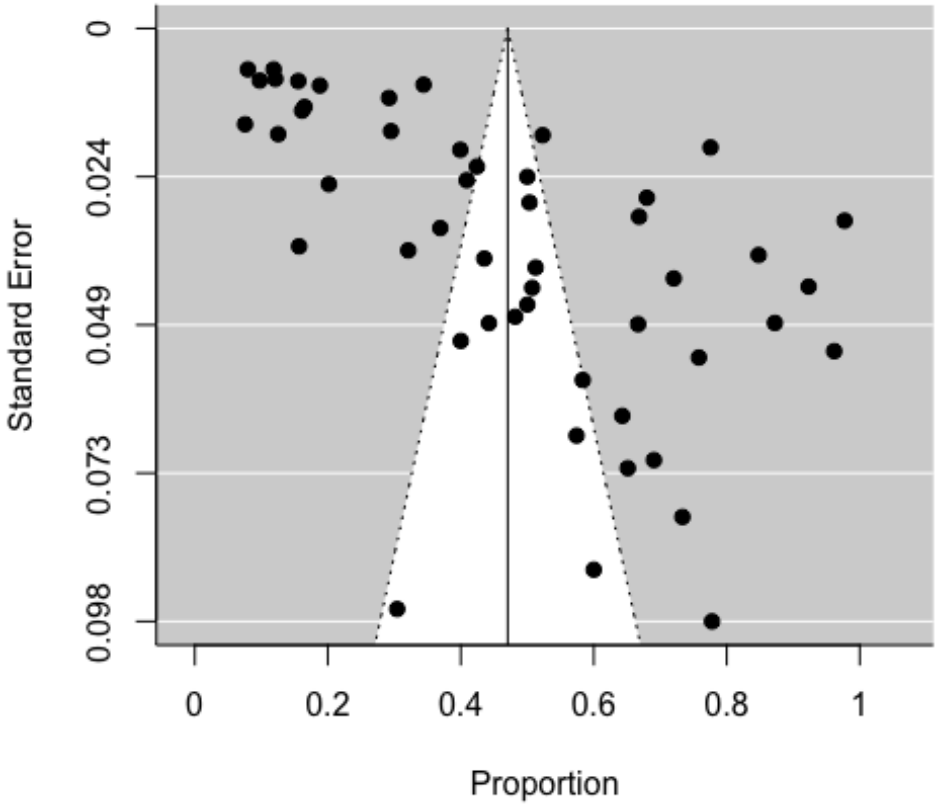
Forest Plot for Prevalence of Cannabis Withdrawal in People With Cannabis Use Disorder Stratified by Timeline of Cannabis Withdrawal



Forest Plot for Prevalence of Cannabis Withdrawal reported by studies with male and female subgroups



Forest Plot for Prevalence of Cannabis Withdrawal reported by studies by subgroups for quality of study (as per Newcastle Ottawa Scale): no subgroup differences detected.



eFigure 2. Publication bias analysis using funnel plot for prevalence of cannabis withdrawal syndrome against standard error

eTable 3. Quality Assessment Using Newcastle Ottawa Scale

Article	Representation	Selection	Exposure	Outcome	Comparability	Assessment	Follow-up	Attrition	Overall
Agrawal et al. 2008[19]	*	*	*		*				Fair
Boggs et al. 2013[20]									Poor
Bonnet et al. 2014[21]			*			*		*	Fair
Budney et al. 1998[22]			*		*				Fair
Budney et al. 1999[16]									Poor
Budney et al. 2003[23]		*			*		*		Fair
Chauchard et al. 2018[24]			*						Poor
Chung et al. 2008[25]			*				*	*	Fair
Copersino et al. 2006[26]			*						Poor
Cornelius et al. 2008[27]	*		*		*	*			Fair
Cottler et al. 1995[28]	*		*						Fair
Crowley et al. 1998[29]			*		*				Fair
Davis et al. 2016[30]	*		*		*		*		Fair
Delforterie et al. 2015[31]	*		*						Fair
Delforterie et al. 2015b[31]	*		*						Fair
Dervaux et al. 2011[32]			*		*				Fair
Ehlers et al. 2010[33]	*	*	*		*	*		*	Good
Gorelick et al. 2012[34]			*		*		*		Fair
Greene et al. 2014[35]					*	*			Fair
Hasin et al. 2008[36]	*		*		*	*			Fair
Herrmann et al. 2015[37]			*		*				Fair
Jungerman et al. 2008[38]			*		*				Fair
Kouri & Pope 2000[39]	*	*		*	*		*	*	Good
Lee et al. 2014[40]					*				Poor
Levin et al. 2006[41]			*		*				Fair
Levin et al. 2010[13]					*				Poor
Livne et al. 2019[42]	*		*						Fair

Lukasiewicz et al. 2007[43]			*			*			*Fair*
Macfarlane et al. 2015[44]			*						*Poor*
Mennes et al. 2009[45]	*		*		*	*			*Fair*
Mennes et al. 2009b[45]	*				*	*			*Fair*
Milin et al. 2008[46]			*		*		*		*Fair*
Nocon et al. 2006[47]	*		*				*	*	*Fair*
Perron et al. 2019[48]									*Poor*
Preuss et al. 2010[49]					*			*	*Fair*
Schuckit et al. 1999[50]					*				*Poor*
Sherman et al. 2017[51]			*		*				*Fair*
Smith et al. 2013[52]	*		*			*			*Fair*
Smith et al. 2013b[52]	*		*			*			*Fair*
Soenksen et al. 2015[53]		*		*	*				*Fair*
Stephens et al. 2002[54]		*	*			*	*		*Fair*
Swift et al. 1998[55]			*						*Poor*
Swift et al. 2000[56]			*				*	*	*Fair*
Swift et al. 2001[57]	*		*						*Fair*
Vandrey et al. 2005[9]			*		*				*Fair*
Vandrey et al. 2008[58]			*	*	*		*		*Fair*
Verweij et al. 2013[59]	*		*			*			*Fair*
Vorspan et al. 2010[60]									*Poor*
Vorspan et al. 2010b[60]									*Poor*
Wiesbeck et al. 1996[61]	*	*	*			*			*Fair*

Studies that achieved a total rating of 6 points or higher were considered to be of the highest quality ("good"); studies that achieved a total rating of fewer than 2 points were considered to be of lowest quality ("poor"); and those between 2 and 5 points were rated as fair quality.

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