SUPPLEMENT 1

Method

Description of Risk Factors

Psychiatric disorders included anxiety disorders (separation anxiety, generalized anxiety, social phobia, specific phobia, agoraphobia, panic disorder, obsessive-compulsive disorder, and posttraumatic stress disorder), depressive disorders (major depression, dysthymia, depressive disorder, not otherwise specified [NOS]), and suicidality defined as having thought about, planned, or attempted suicide. During childhood only (ages 9-16), we also assessed attention-deficit/hyperactive disorder (ADHD), oppositional defiant disorder (ODD), and conduct disorder (CD).

Other substance use in childhood (ages 9-16) was defined as any tobacco use, alcohol use, and other illicit drug use such as opioids, cocaine, mushrooms, and sedatives. To capture atypical tobacco and alcohol use in late adolescence (ages 19-21)—when substance use is at its highest[1, 2]—we measured nicotine dependence/abuse or daily use and alcohol use disorder, respectively.

Measures of economic and social challenges during childhood addressed family, peer, and individual risk factors. In childhood (ages 9-16), low socioeconomic status was defined by at least one parent not graduating from high school, at least one parent having low occupational status, or family income falling below the federal poverty level. Family dysfunction was coded as one or more disagreements between the participant and at least one parent in the past three months that lasted a minimum of five minutes, and involved raised voices, verbal abuse, or physical aggression. Family instability was determined if two or more of the following conditions were met: single parent structure, step-parent in household, biological parents ever divorced, parental separation, or a parent moved out in the past three months. Child maltreatment

was endorsed if there was ever a family history of physical abuse or sexual abuse, or if the interviewer observed neglect at the time of the interview. For peer risk factors, delinquent and age-inappropriate friends were combined into one measure for 1) having friends who get into a lot of trouble, are disruptive to others a lot, are disrespectful to adults a lot, or do things like drink or steal in the past three months; or 2) most friends being two or more years older in the past three months. Additional risk factors included being a bully victim at home, school, or elsewhere in past three months and having a history of ever being expelled from school.

Economic and social risk factors during late-adolescence (ages 19-21) consisted of material hardship coded as an inability to meet basic needs, not having health insurance, poor financial coverage, or residential instability within the past three months; being the parent of at least two children by age 21; majority of the friends are substance users; not graduating from high school with a diploma; and criminal charges for a moderate to violent crime based on official charges obtained from the North Carolina Administrative Offices of the Court Database and, or self-reports of police contact.

References

1. Nelson SE, Van Ryzin MJ, Dishion TJ. Alcohol, marijuana, and tobacco use trajectories from age 12 to 24 years: demographic correlates and young adult substance use problems. *Dev Psychopathol.* 2015;27:253-277.
2. Copeland WE, Angold A, Shanahan L, Dreyfuss J, Dlamini I, Costello EJ. Predicting persistent alcohol problems: a prospective analysis from the Great Smoky Mountain Study. *Psychol Med.* 2012;42:1925-1935.

Table S1. Pairwise Comparison of Childhood Risk Factors (9-16 Years) Across Problematic Cannabis Use Patterns (n=1,229)

Psychiatric Risk Factors (≤16 years)	Limited vs. Non-Problematic		Persistent vs. Non-Problematic		Delayed vs. Non-Problematic		Persistent vs. Limited Problematic		Limited vs. Delayed Problematic		Persistent vs. Delayed Problematic	
	RRR	95% CI	RRR	95% CI	RRR	95% CI	RRR	95% CI	RRR	95% CI	RRR	95% CI
Anxiety disorders	1.14	[0.52, 2.51]	3.94**	[1.57, 9.88]	0.93	[0.37, 2.35]	3.45*	[1.18, 10.11]	1.23	[0.42, 3.63]	4.25*	[1.28, 14.07]
Depressive disorders	1.71	[0.74, 3.92]	4.33**	[1.57, 11.95]	2.31	[0.93, 5.74]	2.54	[0.84, 7.67]	0.74	[0.26, 2.07]	1.88	[0.58, 6.05]
ODD	1.64	[0.87, 3.10]	2.84*	[1.22, 6.64]	3.42**	[1.37, 8.53]	1.73	[0.68, 4.39]	0.48	[0.18, 1.30]	0.83	[0.26, 2.64]
CD	4.52***	[2.15, 9.52]	3.99**	[1.58,10.04]	4.67**	[1.72, 12.64]	0.88	[0.33, 2.38]	0.97	[0.33, 2.82]	0.85	[0.25, 2.87]
ADHD	1.59	[0.52, 4.86]	0.75	[0.25, 2.25]	2.01	[0.66, 6.15]	0.47	[0.12, 1.81]	0.79	[0.20, 3.06]	0.37	[0.10, 1.41]
Suicidality	0.75	[0.39, 1.44]	0.81	[0.29, 2.26]	1.05	[0.46, 2.40]	1.09	[0.36, 3.24]	0.71	[0.28, 1.79]	0.77	[0.23, 2.53]
Comorbidity: 2 or more	2.22*	[1.15, 4.26]	3.20**	[1.37, 7.46]	3.15*	[1.21, 8.25]	1.44	[0.58, 3.59]	0.70	[0.25, 1.97]	1.01	[0.31, 3.29]
Other Substance Use Risk Factors (≤16 years)												
Early tobacco use	4.58***	[2.51, 8.38]	5.38***	[2.38, 12.17]	3.24*	[1.13, 9.30]	1.17	[0.47, 2.91]	1.41	[0.46, 4.35]	1.66	[0.48,5.73]
Early alcohol use	4.98***	[2.79, 8.90]	4.24***	[1.95, 9.21]	0.80	[0.25, 2.60]	0.85	[0.35, 2.04]	6.19**	[1.79, 21.48]	5.27*	[1.37,20.20]
Early illicit drug use	6.99**	[1.97, 24.84]	11.06***	[2.88, 42.48]	1.44	[0.23, 9.12]	1.58	[0.44, 5.67]	4.85	[0.83, 28.46]	7.67*	[1.10, 53.48]
Economic and Social Risk Factors (≤16 years)												
Family low-SES	1.35	[0.75, 2.43]	1.18	[0.50, 2.76]	0.95	[0.45, 2.05]	0.87	[0.33, 2.28]	1.42	[0.58, 3.44]	1.23	[0.42, 3.66]
School expulsion	2.86**	[1.31, 6.22]	5.22**	[1.74, 15.62]	3.95	[0.87, 17.85]	1.83	[0.66, 5.08]	0.72	[0.16, 3.21]	1.32	[0.25, 6.97]

Family instability	2.63**	[1.47, 4.68]	0.81	[0.39, 1.67]	2.14	[0.89, 5.13]	0.31**	[0.13, 0.72]	1.23	[0.46, 3.28]	0.38	[0.13, 1.10]
Family dysfunction	2.79***	[1.60, 4.86]	0.96	[0.43, 2.12]	1.86	[0.70, 4.96]	0.34*	[0.14, 0.85]	1.50	[0.52, 4.30]	0.51	[0.15, 1.71]
Caregiver maltreatment	1.72	[0.99, 2.97]	2.17	[1.00, 4.71]	3.00*	[1.17, 7.64]	1.26	[0.52, 3.05]	0.57	[0.21, 1.59]	0.72	[0.23, 2.30]
Bully victimization	1.56	[0.86, 2.83]	1.69	[0.76, 3.78]	3.30*	[1.33, 8.19]	1.09	[0.43, 2.74]	0.47	[0.17, 1.30]	0.51	[0.16, 1.62]
Delinquent/older friends	3.09***	[1.75, 5.46]	3.19**	[1.47, 6.92]	1.67	[0.62, 4.52]	1.03	[0.43, 2.50]	1.84	[0.63, 5.39]	1.90	[0.58, 6.24]

Note: Adjusted models with sampling weights controlled for sex and race. ADHD = attention-deficit/hyperactivity disorder; CD = conduct disorder; ODD = oppositional defiant disorder; RRR = relative risk ratios [95% CI]; SES = socioeconomic status.

*p<.05; **p<.01; ***p<.001

Table S2. Late-Adolescent Risk Factors (19-21 Years) Across Problematic Cannabis Use Patterns (n = 1,095)

Psychiatric Risk Factors	Limited vs. Non-Problematic		Persistent vs. Non-Problematic		Delayed vs. Non-Problematic		Persistent vs. Limited Problematic		Limited vs. Delayed Problematic		Persistent vs. Delayed Problematic	
	RRR	95% CI	RRR	95% CI	RRR	95% CI	RRR	95% CI	RRR	95% CI	RRR	95% CI
Anxiety disorders	0.43*	[0.20, 0.91]	3.83*	[1.33, 11.05]	0.39	[0.09, 1.74]	8.88***	[2.89, 27.27]	1.09	[0.24, 4.88]	9.71**	[1.86, 50.60]
Depressive disorders	2.88*	[1.11, 7.44]	4.45*	[1.18, 16.71]	0.36	[0.04, 3.10]	1.55	[0.35, 6.74]	7.95	[0.89, 71.13]	12.29*	[1.09, 139.06]
Suicidality	1.51	[0.47, 4.86]	5.19*	[1.48, 18.18]	2.99	[0.58, 15.56]	3.44	[0.74, 15.99]	0.50	[0.07, 3.67]	1.73	[0.26, 11.76]
Comorbidity: 2 or more conditions	2.40*	[1.06, 5.47]	7.38***	[2.66, 20.46]	2.44	[0.44, 13.48]	3.07*	[1.04, 9.11]	0.98	[0.17, 5.77]	3.02	[0.46, 20.03]
Other Substance Use Risk Factors												
Tobacco smoking-daily	11.85***	[5.19, 27.03]	13.93***	[4.49, 43.20]	3.97*	[1.25, 12.65]	1.18	[0.31, 4.51]	2.98	[0.76, 11.66]	3.51	[0.74, 16.54]
Alcohol use disorder	7.69***	[4.28, 13.82]	7.58***	[3.22, 17.85]	1.34	[0.42, 4.25]	0.99	[0.38, 2.52]	5.74**	[1.69, 19.43]	5.65*	[1.45, 22.10]
Illicit drug use	18.57***	[9.03, 38.20]	22.57***	[8.78, 58.02]	2.59	[0.56, 11.96]	1.22	[0.47, 3.14]	7.16*	[1.57, 32.56]	8.70**	[1.72, 44.05]
Social Risk Factors												
Material hardships	2.10*	[1.17, 3.76]	1.10	[0.50, 2.40]	1.73	[0.57, 5.21]	0.52	[0.21, 1.30]	1.21	[0.37, 4.02]	0.63	[0.17, 2.31]
Low educational attainment	1.92*	[1.06, 3.49]	2.33*	[1.04, 5.24]	2.93	[0.80, 10.69]	1.21	[0.49, 3.01]	0.66	[0.17, 2.54]	0.80	[0.19, 3.42]
Young parenthood - 2 or more kids	0.33**	[0.14, 0.74]	1.91	[0.55, 6.63]	0.34	[0.08, 1.50]	5.82**	[1.54, 21.91]	0.96	[0.20, 4.53]	5.58	[0.93, 33.26]
Most friends use drugs	6.66***	[3.59, 12.35]	21.86***	[8.41, 56.83]	2.07	[0.87, 4.92]	3.28*	[1.18, 9.16]	3.22*	[1.26, 8.25]	10.57***	[3.20, 34.95]
Moderate-violent crime	4.53***	[2.26, 9.07]	5.73***	[2.21, 14.85]	3.64	[0.76, 17.47]	1.27	[0.45, 3.55]	1.24	[0.25, 6.12]	1.57	[0.29, 8.62]

Table S3. Risks of Cannabis Use, Disorder, and Symptomology Between Limited and Persistent Problematic Use Patterns

	Significance of Pairwise Comparison Persistent versus limited problematic use	
	RRR	**[95% CI]**
Frequency of cannabis use (≤16years)	**n = 200**	**n = 84**
Ever use	1.44	[0.59,3.48]
Weekly use	0.90	[0.34,2.38]
Daily use	2.32	[0.67,8.01]
CUD	1.39	[0.50,3.86]
CUD Symptomology (19-21 years)	**n = 195**	**n = 83**
Overconsumption	3.06*	[1.05,8.97]
Attempts to cut back	1.82	[0.75,4.42]
Excessive time spent	4.73**	[1.66,13.50]
Craving	2.99*	[1.19,7.56]
Failure to fulfill major roles	2.75	[0.72,10.51]
Causes interpersonal problems	0.73	[0.09,5.63]
Reduced activities	2.00	[0.18,22.18]
Physically hazardous	2.78	[0.74,10.52]
Physical or psychological problems	3.24	[0.62,17.02]
Tolerance	2.65*	[1.00,7.00]
Withdrawal[a]	----	-------
Total CUD symptoms	1.63***	[1.28,2.09]

Note: Adjusted regression models controlled for sex and race. CUD = cannabis use disorder; RRR = relative risk ratio.

[a] No observations across groups
*p<.05; **p<.01; ***p<.001