Parental Cannabis Use Is Associated with Cannabis Initiation and Use in Offspring

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Objectives To assess, before legalization in Canada, whether parental cannabis use is associated with initiation of use in adolescent offspring or with use in young-adult offspring.

Study design Data were available in 2 longitudinal studies in Montréal, Canada. In AdoQuest, 1048 parents with children in grade 6 reported past-year cannabis use. Cannabis initiation among offspring was measured in grade 7, 9, and/or 11. In the Nicotine Dependence in Teens study, cannabis use data were available for 584 participants (mean age 24 years) and their parents (ie, 542 offspring–mother pairs, 438 offspring–father pairs). The association between parental and offspring cannabis use was estimated using multivariable logistic regression in both studies.

Results In AdoQuest, grade 6 never-users were 1.8 times more likely to initiate cannabis during high school if their parents reported past-year use. In the Nicotine Dependence in Teens study, the aORs (95% CI) for past-year cannabis use among adult offspring were not different for "mother uses cannabis" (2.8 [1.4-5.8]) or "father uses cannabis" (2.1 [1.2-3.8]). Participants with 1 or 2 cannabis-using parents were 1.7 and 7.1 times more likely to use cannabis, respectively, than participants with non-using parents.

Conclusions To enable informed decision-making about their own cannabis use, parents need to be aware that children of cannabis users are more likely to use cannabis in adolescence and young adulthood. *(J Pediatr 2019;206:142-7).*

Nearly all cannabis use begins in adolescence or young adulthood,[1] when the maturing brain is undergoing extensive changes in structure and function[2] and may be more vulnerable to the adverse effects of cannabis.[3] Earlier initiation and daily or near-daily use increase the risk of behavioral,[4] cognitive,[5] and mental health problems[4,6]; adult dependence on cannabis[7]; poorer educational and employment outcomes[7,8]; and progression to other illicit drugs.[7] The increasing potency of today's cannabis[9] and the popularity of designer drugs containing synthetic cannabinoids that are functionally similar to tetrahydrocannabinol but have greater potency and longer half-lives[10] could magnify any impact on the adolescent brain.

Many jurisdictions worldwide are considering legalizing adult recreational cannabis use despite numerous concerns, including that legalization may increase adolescent use. Although parental use increases the risk of offspring use,[11-15] most previous intergenerational studies measured prevalent rather than incident adolescent use, so that whether parental use is a risk factor for onset or sustained use cannot be distinguished. Also, few studies assessed maternal and paternal cannabis use separately.[11,12] A father's cannabis use is associated with early cannabis use in offspring, but evidence of continuity between mothers and offspring is limited.[12,16] Unlike use of illegal drugs, which may be concealed, legal substances may be more salient to mother–child transmission,[12] reflecting their heavier caretaking role, which could render their substance use more evident.[17]

Methods

We used data from 2 studies of young persons and their parents to address these 2 gaps in the literature. First, using AdoQuest data,[18] we examined whether parental cannabis use is associated with incident cannabis use among adolescent offspring in high school. Second, using data from the Nicotine Dependence in Teens (NDIT) study,[19] we investigated whether cannabis use by mothers or fathers is

NDIT Nicotine Dependence in Teens

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associated with cannabis use in young-adult offspring. We use the term "adolescent" to refer to persons ages 12-17 years, and "young adult" to refer to persons ages 18-26.[20,21]

AdoQuest is a longitudinal study of fifth-grade students age 10-11 years at inception, recruited in 29 French-language elementary schools (72.5% of 40 schools approached) in greater Montréal. Of 2946 eligible students, 1801 (61%) provided baseline data. Characteristics of the sample were comparable with those of 2 provincially representative samples of similarly aged Québec youth.[22] Baseline data were collected in spring 2005 in classroom-administered, self-report questionnaires. Follow-up in fall (2006) and spring (2007) of grade 6 used the same data collection method. In seventh, ninth, and eleventh grade (2007-2011), self-report questionnaires were mailed to participants' homes with stamped, addressed return envelopes. Response proportions in grade 6 (fall), 6 (spring), 7, 9, and 11 were 83%, 87%, 56%, 68%, and 69%, respectively. The lower response in grades 7-11 relates to challenges tracing students from elementary to high school. Mean (SD) age in grade 6, 7, 9, and 11 was 11.7 (0.4), 12.9 (0.4), 15.2 (0.5), and 16.8 (0.5), respectively; 46% of participants were boys; 88% were Francophone and 93% were Caucasian. Among participants with parental data, 30% had university-educated mothers; 7%, 44%, and 19% of participants had annual household incomes <30 000 CAD, 30 000 to <100 000 CAD, and ≥100 000 CAD, respectively (30% were missing income data). Active parental consent was obtained before baseline data collection, and participants provided assent.

Parents completed mailed self-report questionnaires in 2006-2007, when their offspring were in grades 6-7. The sample for the current analysis included grade 6 students who had never used cannabis. Parental data on past-year cannabis use were drawn from parental questionnaires, and data on initiation of cannabis use among offspring were drawn from offspring questionnaires completed in grades 7, 9, and 11.

NDIT is an ongoing investigation of grade 7 students recruited in 10 Montreal high schools in 1999-2000.[19] Of 2325 eligible students, 56% participated at baseline. The low response related to the need for blood samples for genotyping and to a labor dispute in Quebec that resulted in numerous teachers refusing to collect consent forms. No data were collected from nonrespondents.[19] Self-report questionnaires were administered at school every 3 months in grades 7-11, for a total of 20 cycles during the 5 years of high school. Post-high school data were collected in self-report questionnaires in 2007-2008 (cycle 21) and 2011-2012 (cycle 22), when participants were age 20 and 24 years on average, respectively.

In 2009-2010, when participants were age 22 years on average, self-report questionnaires were mailed to the parents of 1009 participants (78% of 1294 participants). Of the 285 participants whose parents did not receive questionnaires, 221 refused to continue participating in NDIT, 34 were lost-to-follow-up, and 29 did not want their parents contacted. Parental data were collected in 2 questionnaires, one completed by the mother, and one completed by the father. All participants provided assent, and their parents provided informed consent. The current analysis uses data on current cannabis use by mothers and fathers and data on past-year cannabis use by offspring in cycle 22. Although parental data were collected before offspring data, we viewed data collection as contemporaneous because parents reported current use in 2009-2010 and offspring reported past-year use in 2011-2012. Both AdoQuest and NDIT received ethics approval from the Centre de Recherche du Centre Hospitalier de l'Université de Montréal. There was no overlap in schools across the 2 datasets.

Study Variables

AdoQuest—In the parent questionnaire, parents were asked: "In the past 12 months, did you smoke marijuana?" (n = 1173), and "In the past 12 months did the other parent (stepparent, caretaker) smoke marijuana?" (n = 1161; n = 69 participants reported "no other parent"). Response options for parental cannabis use (never, less than once a month, once a month, 2-3 times a month, once a week, 2-3 times a week, 4-6 times a week, every day, I don't know) were re-coded for multivariable analysis as no (neither parent used cannabis; I don't know) or yes (at least 1 parent used cannabis). In offspring, cannabis use was measured in grade 7 by: In the past 6 months, how many times did you consume cannabis? Use in grades 9 and 11 were measured by: In the past 6 (grade 9)/12 (grade 11) months, how often did you consume cannabis? Response options were re-coded no (including don't know) or yes. Offspring cannabis initiation was determined to have occurred in the first cycle in which cannabis use was reported. Potential confounders were identified in the literature or in team discussions as potentially causally associated with adult/parental cannabis use and with use in adolescents and included mother university-educated (yes, no, missing) and parent(s) smoke cigarettes (yes, no).[13,23,24] We also included age and sex as covariates.

NDIT—Father/mother uses cannabis was measured in mothers and fathers separately by: How often do you use marijuana, cannabis, or hashish? Response options (never, rarely, sometimes, often, very often) were re-coded for analyses no (does not use cannabis) or yes (uses cannabis).

Frequency of past-year cannabis use in offspring was measured by: In the past 12 months, how often did you use marijuana, cannabis, or hashish? Response choices (never, less than once a month, 1-3 times per month, 1-6 times per week, every day) were re-coded for multivariable analysis as no (do not use) or yes (use). Age at first cannabis use in offspring was assessed in cycle 21 by: Have you ever used marijuana, cannabis, or hashish? If yes, how old were you the first time? We computed duration of cannabis use as current age in cycle 22 minus age at first use. Potential confounders included French-speaking (selected after discussion among co-authors about possible cultural differences in Quebec in cannabis-related attitudes and beliefs), born in Canada, mother university-educated,[13,23] and parent(s) smoke cigarettes[13,24] (which were literature-driven). We also included age and sex as covariates.

Statistical Analyses

We used logistic regression in both studies to assess whether parental cannabis use was associated with initiation or use of cannabis among offspring, controlling for potential

Table I. Frequency of cannabis use among offspring by grade and among parents, AdoQuest 2005-2011

Offspring*						Parents†		
Frequency of cannabis use in past 6 or 12 mo	Grade 6 Fall (n = 1486)* %	Grade 6 Spring (n = 1573) %	Grade 7 (n = 1003) %	Grade 9 (n = 1227) %	Grade 11 (n = 1238) %	Frequency of cannabis use in past 12 mo	Parent 1 (n = 1140) %	Parent 2 (n = 1128) %
Never	96.8	96.2	95.8	82.5	74.3	Never	95.5	84.3
~1-2 times	1.7	2.8	2.4	8.2	11.2	Less than once/ month	3.1	3.2
More often	1.4	1.0	1.8	9.2	14.5	More often	1.5	3.2

*Uses all data available in grades 6-11. Percents exclude participants with missing data from the denominator (ie, n = 59, 84, 27, 17, and 11 participants in grade 6 fall, 6 spring, 7, 9, and 11, respectively).
†A total of 5.9% of parents who completed the questionnaire indicated that there was no other parent.

confounders. Because missing data were minimal, analyses were undertaken with complete data only using SPSS, Version 25.0 (IBM Corp, Armonk, New York).

Results

In AdoQuest, 1801 grade 5 students provided baseline data and 1238 (69%) provided data in grade 11. The 563 participants lost-to-follow-up were marginally older than those retained (10.8 vs 10.7 years, $P < .001$), more were male (50% vs 43.5%, $P = .01$), and relatively fewer had university-educated mothers (25.8% vs 33.1%, $P = .04$), smoked cigarettes (10.8% vs 17.3%, $P < .001$), and reported above-average academic performance (33.4% vs 44.2%, $P < .001$). Greater proportions of those lost-to-follow-up had fathers (31.2% vs 22.8%, $P < .001$), mothers (27.1% vs 20.9%, $P = .002$), and friends who smoked cigarettes (19.2% vs 12.9%, $P < .000$). Finally mean school connectedness scores were greater among those lost-to-follow-up (1.8 vs 1.7, $P = .003$). The proportions reporting full home smoking bans, mean self-esteem, and mean depression symptoms scores were not statistically different across the 2 groups.

A total of 103 participants (5.7% of 1801) reported cannabis use in grade 6 (ie, prevalent users) and were therefore excluded. Parental questionnaires were completed by the mother or father of 1145 children. A total of 1048 children (58.2% of 1801) had parental data, were never-cannabis users in grade 6, and had follow-up data in grade 7, 9, and/or 11. Ever-cannabis use increased from 3.1% in grade 6 to 25.7% in grade 11 (**Table I**). Less than 2% of grade 6-7 students had used cannabis ≥3 times, compared with 9.2% and 14.5% in grades 9 and 11, respectively.

In unadjusted analyses (**Table II**), children whose parents reported past-year cannabis use were 1.8 times more likely to initiate cannabis use than children whose parents did not use cannabis. Controlling for age, sex, and potential confounders did not alter the magnitude of the association.

The **Figure** (available at www.jpeds.com) describes the derivation of the NDIT samples. Among 1294 baseline participants, 584 provided data on cannabis use at age 24 years and had parental cannabis use data, leaving 542 offspring-mother pairs (41.8% of 1294) and 438 offspring-father pairs (33.8% of 1294) available for analyses. In total, 396 participants had cannabis data for both mothers and fathers; 146 had data on mother's cannabis use only; and 42 had data on father's cannabis use only.

Participants of the NDIT study not retained for analysis were older at baseline than those retained (mean age 12.8 vs 12.6, $P < .001$), fewer were born in Canada (90.3% vs 95.7%, $P = .001$), and fewer had university-educated mothers (40.7% vs 49.3%, $P = .007$). Relatively more had smoked cigarettes (37.7% vs 20.7%), used other tobacco products (12.4% vs 5.4%, $P < .001$), and had parents (45.4% vs 26.9%, $P < .001$), siblings (17.2% v. 12.4%, $P = .03$), and friends who smoked cigarettes (40.8% vs 28.2%, $P < .001$). Finally, mean scores for family-related stress (1.4 vs 1.3, $P < .001$) and other stress (1.5 vs 1.4, $P < .001$) were greater. There was little difference between groups in sex, the proportion who drink alcohol, or mean depressive symptoms scores.

The prevalence of cannabis use among mothers, fathers, and young adult offspring was 8%, 14%, and 45%, respectively. Mean (SD) age at first use among offspring was 15.1 (2.0) (range 9-23). Offspring with cannabis-using parents were younger at first cannabis use compared with participants with non-using parents (**Table III**). In cycle 22, the mean (SD) years of use among offspring with at least one cannabis-using parent (n = 35) and without (n = 108) cannabis-using parents was 9.1 (2.0) and 8.5 (1.9), respectively ($P = .099$). A greater proportion of offspring with cannabis-using parents reported cannabis use once a month or more (**Table III**).

In multivariable analyses (**Table IV**), young-adult offspring with cannabis-using parents were 2-3 times more likely

Table II. Initiation of cannabis use from grade 7 to 11 among grade 6 never users by past-year parental cannabis use, AdoQuest 2005-2011

Past-year parental cannabis use	Initiation of cannabis use among grade 6 never users		Model 1 (n = 1048) OR_{crude} (95% CI)	Model 2 (n = 1010)* OR_{adj}† (95% CI)
	Total n	%		
No	962	23.6	Ref	Ref
Yes	86	36.0	1.8 (1.2, 2.9)	1.8 (1.1, 2.9)

*n differs from Model 1 because of missing data on covariates and potential confounders.
†Adjusted for age, sex, mother university-educated, and parent(s) smoke cigarettes (data were drawn from grade 5 questionnaires).

Table III. Frequency of cannabis use in the past year and age first used cannabis among young-adult offspring according to parental cannabis use, NDIT 2009-2012

	Frequency of cannabis use in past year					Age first used cannabis§			
Parental cannabis use	n*	Never %	Less than once a month %	Once a month or more %	*P* value†	n‡	<15 y %	≥15 y %	*P* value†
Father uses cannabis					.018				.026
No	377	59.2	18.0	22.8		234	35.9	64.1	
Yes	61	41.0	21.3	37.7		47	53.2	46.8	
Mother uses cannabis					≤.001				.066
No	501	59.3	18.8	22.0		318	36.8	63.2	
Yes	41	31.7	12.2	56.1		34	52.9	47.1	

*Young adult offspring can be included in both the father–offspring and the mother–offspring cannabis use analyses.
†Pearson χ^2 test.
‡Includes 352 of 542 offspring in the mother–offspring database and 281 of 438 offspring in the father–offspring database with data on age first used cannabis in cycle 21.
§Age 15 years was selected as the cut point because it corresponds to the mean age at first cannabis use among youth in Canada[36,37] as well as in offspring in the NDIT study.

to report past-year cannabis use. In secondary analyses, we ran a model including terms for both mother and father cannabis use. A contrast analysis with the hypothesis of equality was not rejected ($P = .85$), indicating no statistically significant difference between the effect of mother and father use on cannabis use in offspring.

Of 396 participants with parental data for both mothers and fathers, the parents of 322 participants (81.3%) reported no cannabis use, one parent (either the mother or father) of 61 participants (15.4%) used cannabis, and both parents of 13 participants (3.3%) used cannabis (**Table IV**); 40.1%, 52.5%, and 84.6% of offspring reported cannabis use if 0, 1, or both parents used cannabis ($P < .002$). Relative to participants with non-using parents, those with one cannabis-using parent were 1.7 times more likely to use cannabis. If both parents used, young adult offspring were 7.1 times more likely to use cannabis.

Because frequent (ie, daily or near-daily) cannabis use may be more harmful than "any" use,[6] we examined whether parental cannabis use was associated with each of daily cannabis use (yes, no) or with weekly or daily cannabis use (yes, no) among young adult offspring (**Table IV**). The results mirror those for past-year use and suggest that cannabis use by either parent is associated with both daily and weekly or daily cannabis use in young-adult offspring, and that the risk increases when both parents use cannabis.

Discussion

In October 2018, after almost 2 decades of legal access to medical cannabis, the Canadian Government legalized and now regulates recreational cannabis use among adults.[25,26] In the US, 9 states and the District of Columbia have legalized cannabis for adult recreational use, and in 2017, 20 other states had bills pending that would legalize recreational use.[27,28] In Europe, no country has legalized cannabis, although the trend has been toward decriminalization and depenalization.[29] Legalization of recreational cannabis is controversial from a public health

Table IV. Crude and aORs and 95% CIs for past-year, daily, and weekly or daily cannabis use in young-adult offspring according to parental cannabis use, NDIT study, 1999-2012

	Young-adult offspring									
		Past-year cannabis use			Daily cannabis use			Weekly or daily cannabis use		
Parental cannabis use	Total n	%	OR crude (95% CI)	OR adj* (95% CI)	%	OR crude (95% CI)	OR adj* (95% CI)	%	OR crude (95% CI)	OR adj* (95% CI)
Model 1: Father uses cannabis										
No	377	40.8	Ref	Ref	4.5	Ref	Ref	14.9	Ref	Ref
Yes	61	59.0	2.1 (1.2-3.6)	2.1 (1.2-3.8)	18.0	4.7 (2.1-10.5)	4.5 (1.9-10.5)	27.9	2.2 (1.2-4.2)	1.9 (1.0-3.7)
Model 2: Mother uses cannabis										
No	501	40.7	Ref	Ref	6.2	Ref	Ref	14.6	Ref	Ref
Yes	41	68.3	3.1 (1.6-6.2)	2.8 (1.4-5.8)	14.6	2.6 (1.0-6.7)	3.2 (1.2-8.6)	36.3	3.4 (1.7-6.7)	3.4 (1.7-7.0)
Model 3: No. parents using cannabis†										
0	322	40.1	Ref	Ref	4.7	Ref	Ref	13.4	Ref	Ref
1	61	52.5	1.7 (1.0-2.9)	1.7 (0.9-3.0)	11.5	2.7 (1.0-6.8)	2.6 (0.9-7.0)	24.6	2.1 (1.1-4.1)	2.1 (1.0-4.2)
2	13	84.6	8.2 (1.8-37.7)	7.1 (1.5-34.2)	23.1	6.1 (1.5-24.7)	6.1 (1.5-24.7)	38.5	4.1 (1.3-13.0)	3.3 (0.9-12.1)

*Models controlled for age (continuous), sex, French-speaking, born in Canada, mother university-educated, and parent(s) smoke cigarettes.
†Includes participants with data on both mother's and father's cannabis use (n = 396).

stance, and greater understanding of the parent–offspring cannabis association will inform the debate on its pros and cons.

Parental influences likely differ by offspring stage of development. Although some research suggests that the influence of parental cannabis use may be stronger in adolescence than in adulthood,[30] others suggest that with increasing independence and the reduced conflict with parents that comes with increasing age, older offspring are more likely to model their parents' substance use behaviors.[17] Further, parents may be more open with their cannabis use and/or share substances with older offspring.

AdoQuest data provide evidence that children whose parents use cannabis are 1.8 times more likely to initiate cannabis use, and NDIT data suggest that young-adult offspring whose mothers or fathers use cannabis are more likely to report past-year cannabis use. Our results are consistent with cross-sectional findings[30] and findings from recent longitudinal studies on prevalent cannabis use in adolescents.[13,15] In addition, they add to the limited evidence on young-adult offspring use,[31] suggesting that cannabis use by both mothers and fathers is associated with offspring use. Although Kosty et al reported that the risk of cannabis use disorder was not increased among offspring when both (relative to one) parents had a history of cannabis use disorder, our data suggest that the risk of offspring use is increased substantially if both parents use cannabis (ie, 85% of offspring used cannabis if both parents reported use).[11] Finally, there was no indication in the NDIT study data that cannabis use by mothers or fathers had a differential effect on offspring cannabis use.

Several mechanisms may underpin the association. Parental use could influence offspring use directly through ease of access, increased visibility of cannabis use, role modeling, or transmission of pro-cannabis norms.[15] Some parents may involve their children in their own use (eg, having them pass or handle cannabis or paraphernalia).[32] In addition, although the impact of exposure to second-hand cannabis smoke on noncannabis users is not known, evidence suggests that under unventilated conditions, exposure results in measurable tetrahydrocannabinol concentrations in nonusers' blood, urine, and oral fluids.[33,34] In addition to psychosocial priming, biological exposure may sensitize non-users to cannabis. Bailey et al suggested that the association could be mediated by youth norms about cannabis.[13] Hill et al reported that positive parenting (ie, parental support, monitoring, and consistency of discipline) may mediate the association, although this finding was limited to parents who met cannabis use disorder criteria.[14] Kerr et al found an indirect effect of parental cannabis use on offspring initiation through deviant peer affiliations among offspring, and through "context" (ie, parental approval of child cannabis use, child exposure to cannabis, and child–peer cannabis use).[15] If prevalence or frequency of use does increase among parents, our data strongly suggest that without educational or other intervention, offspring use also may increase.

Our findings highlight a major intervention opportunity in family healthcare settings. After legalization, screening for parental cannabis use will become even more important, although a distinction will need to be made between medicinal and recreational use. For medicinal use, counseling parents about product storage, location of use, and emphasizing that cannabis should be treated like any other prescription drug, may mitigate the influence of parental use on offspring. For recreational use, counseling parents that adolescent cannabis use is not safe while the brain develops and linking this to clear parental expectations of non-use may help lower offspring risk. The heightened potency of today's cannabis should be a component of teaching because parental experiences with cannabis may not translate to today's cannabis. Finally, although parental abstinence may be a desired goal in terms of preventing offspring uptake, a harm reduction approach also may be relevant. Clear messaging on how parental use increases the risk for early use and addiction in offspring may help, as may suggestions about using cannabis recreationally in moderation and away from offspring.

Limitations of these analyses include loss to follow-up, which could have attenuated the estimates of the association of interest. However, 25.4% of grade 11 students aged 16-17 years in AdoQuest had ever used cannabis in 2011, which mirrored the national prevalence (25.0% in 15-17-year-olds in 2012[35]; 20.6% in 15-19-year-olds in 2015).[36] Further, mean age of onset (15.1 years) in NDIT is the same nationally.[36,37] Past-year prevalence at age 24 years in 2011 (45%), mirrored the 2012 national lifetime (43.8%) and past-year prevalence (30.8%), respectively for 18-24 year-olds.[35] These similarities lessen concerns that data are affected by selection bias or that external generalizability is limited. Cannabis use may be underreported (eg, participants were not asked about edibles, vaporization, oil, or pills). We did not differentiate medical and recreational cannabis use, and we did not investigate whether parents altered cannabis use in the presence of children or if living in a single-parent family had a differential effect on offspring cannabis use than living in 2-parent families. Children in the AdoQuest study who initiated cannabis use in grade 7 may have done so before their parents initiated. Finally, residual confounding may limit the strength of our conclusions.

In conclusion, parental cannabis use is associated with cannabis initiation in adolescents and with weekly and daily use in young adult offspring. To enable informed decision-making about using cannabis, practitioners and parents need to be aware that children of cannabis-using parents are more likely to use cannabis during the vulnerable adolescent period into young adulthood. ■

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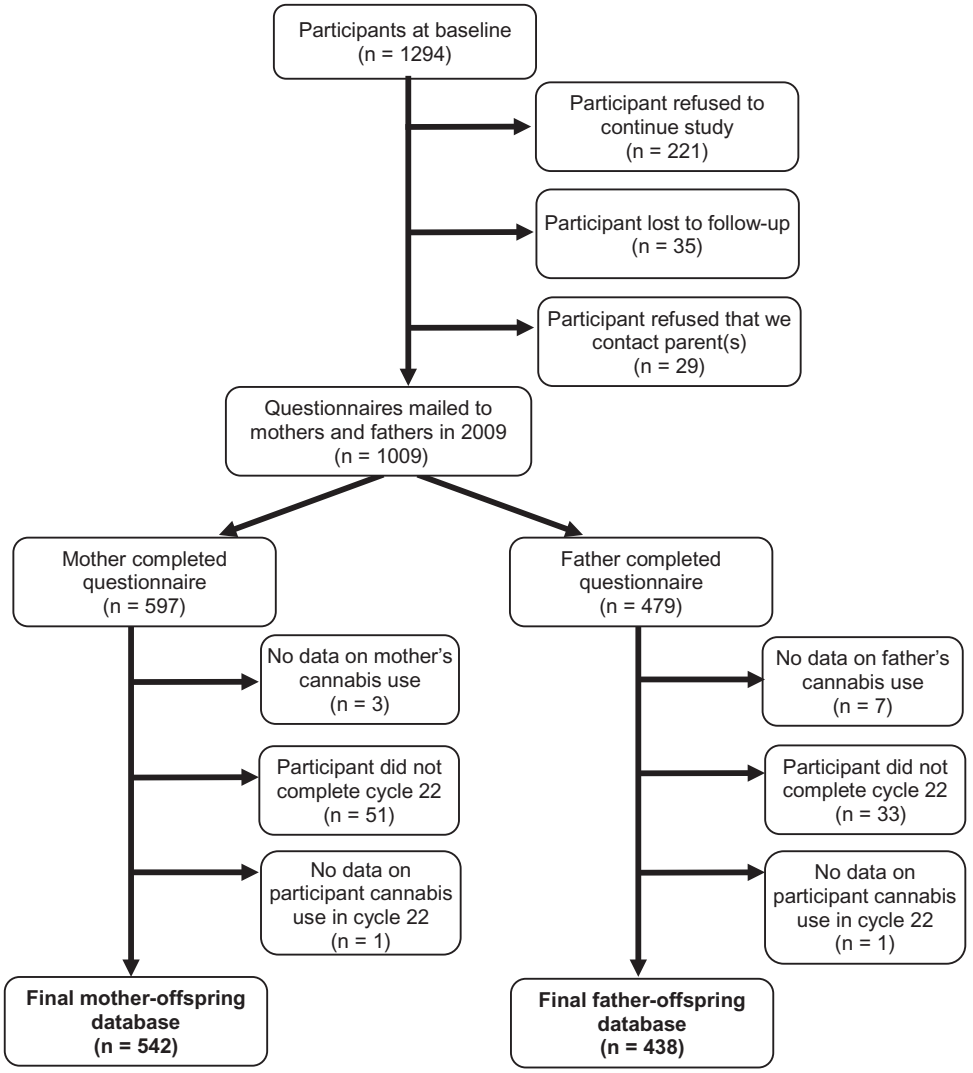

Figure. Derivation of the NDIT study analytic sample.