



Original article

## Cannabis Use, Polysubstance Use, and Psychosis Spectrum Symptoms in a Community-Based Sample of U.S. Youth


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### A B S T R A C T

**Purpose:** To examine how cannabis use and polysubstance use among cannabis users relate to psychosis spectrum (PS) symptoms in a large community-based sample of U.S. youth.

**Methods:** Four thousand one hundred seventy-one youths (aged 14–21 years; mean = 16.90 years, SD = 1.85; 55% female) from the Philadelphia Neurodevelopmental Cohort completed assessments of substance use, PS symptoms, and confounding variables (e.g., demographics, comorbid psychopathology, and trauma exposure).

**Results:** After adjusting for confounds, cannabis use by itself was not associated with increased odds of being classified as “psychosis spectrum.” However, cannabis use in combination with tobacco or other substance use was associated with increased odds of PS classification (adjusted odds ratios [ORs] = 1.37–1.76). Follow-up symptom-level analyses revealed that cannabis use in combination with other substances was associated with subclinical positive symptoms (ORs = 1.95 and 2.24) and frequent cannabis use was associated with subclinical negative/disorganized symptoms (OR = 2.14). However, these symptom-level findings were reduced to trends after correction for multiple comparisons. Neither cannabis use nor polysubstance use was associated with threshold delusions or hallucinations.

**Conclusions:** After adjusting for important confounds, there was minimal evidence for associations between cannabis use by itself and PS symptoms. More compelling evidence emerged for associations between polysubstance use among cannabis users and PS symptoms. This study highlights the importance of considering polysubstance use and confounds when examining associations between cannabis use and PS symptoms. Further longitudinal research is necessary to determine whether these findings represent causal associations or shared genetic and/or environmental vulnerability for substance use and PS symptoms.

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### IMPLICATIONS AND CONTRIBUTION

This study found minimal evidence for associations between cannabis use alone and psychosis spectrum (PS) symptoms in U.S. youth. However, cannabis use in combination with other substance use was associated with PS symptoms, highlighting the importance of considering polysubstance use and potential confounds in understanding associations between cannabis use and PS symptoms.

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Cannabis is the most commonly used illicit substance among young people in the United States [1]. An estimated 1.8 million adolescents and 6.8 million young adults in the United States are current cannabis users, and the prevalence of cannabis use in the United States is increasing [1,2]. In addition, relative to prior years, U.S. adolescents now report more permissive attitudes toward cannabis use and perceive regular cannabis use as less of a health risk [3,4]. Given the ongoing societal-level changes in the use and legalization of cannabis in the United States, a critical task for researchers is to advance knowledge about potential associations between cannabis use and adolescent health and adjustment.

### *Cannabis use and psychosis*

Researchers and clinicians have long been interested in associations between cannabis use and mental health. Most of the research in this area has focused on possible links between cannabis use and the psychosis spectrum (PS)—a continuum ranging from subclinical psychotic-like experiences which may or may not persist, to threshold delusions and hallucinations that cause significant distress and impairment [5,6]. Examples of subclinical psychotic-like experiences include attenuated positive symptoms, such as odd or unusual thoughts and perceptual illusions, and attenuated negative or disorganized symptoms, such as blunted affect and diminished volition or social interest. Such symptoms are relatively common in the general population [6], particularly among young people. An estimated 17% of children and 7.5% of adolescents report subclinical psychotic-like experiences [7]. Young people who experience these subclinical psychotic symptoms are at increased risk of developing a psychotic disorder [8], and these symptoms are associated with poorer global functioning, comorbid psychological difficulties, and increased suicidality [5,9].

Mounting empirical evidence supports an association between cannabis use and the PS [10,11]. Studies have shown that cannabis use during adolescence is associated with subclinical positive and negative symptoms [12] and predicts the onset of psychotic disorders in adulthood [13]. In general, studies have shown a dose-response relation between cannabis and psychosis outcomes, with frequent use more strongly associated with psychotic experiences and disorders than less frequent use [11]. Some studies have found that early onset cannabis use (e.g., before 16 years) is more strongly associated with subclinical positive and negative symptoms and subsequent psychotic disorders than later onset use [12,14].

It is noteworthy that nearly all the community research on adolescent cannabis use and PS symptoms has been conducted outside of the United States. In other parts of the world, the type of cannabis used (e.g., hash or skunk) and its cannabinoid concentrations may vary from the types used in the United States [15], making generalizations to U.S. samples challenging. To the best of our knowledge, associations between cannabis use and PS symptoms have only been examined in one other large cohort of non-help-seeking U.S. adolescents [16,17]. In this sample of male adolescents, cannabis use did not predict the subsequent development of a psychotic disorder [17]; however, sustained cannabis use across adolescence predicted an increased risk of subclinical positive psychotic symptoms [16]. Additional research with nonclinical samples of U.S. youth is warranted to address the limitations of prior work and expand upon these initial findings.

### *Polysubstance use and psychosis*

Many cannabis users also use other substances [18]. A recent review reported that up to 29% of adolescents who use cannabis also use other drugs [19]. This raises the possibility that associations between cannabis use and PS symptoms could be due to the confounding effects of other substances or the combined effects of polysubstance use. Controlling for other substance use has been found to attenuate the associations between cannabis use and psychotic-like experiences and, in some cases, reduce the associations to nonsignificance [20,21]. Moreover, the few studies examining polysubstance use have reported that cannabis use combined with other substance use is more strongly associated with psychotic-like experiences than cannabis use alone [20,21]. Thus, it is important to account for polysubstance use when examining the associations between cannabis use and PS symptoms.

### *The present study*

We utilized data from the Philadelphia Neurodevelopmental Cohort (PNC) to examine how cannabis use and polysubstance use relate to PS symptoms in a large, non-help-seeking sample of U.S. youth. Our previous broad analysis of predictors of PS classification in the PNC suggested that lifetime “ever use” of cannabis was not predictive of psychosis risk [5]. Here, we more comprehensively evaluate the associations between cannabis use and PS symptoms. Based on previous work [11,12,20,21] we hypothesized that frequent cannabis use, early cannabis use, and polysubstance use would be associated with increased odds of being classified as PS and with greater subclinical positive and negative/disorganized symptoms. Given the previously reported null findings from another U.S. cohort [17], we did not make specific predictions about the links between cannabis use and threshold delusions/hallucinations.

This study adds to the literature in a number of ways. As noted previously, there has been minimal investigation into the links between cannabis use and PS symptoms in non-help-seeking U.S. youth. The previous smaller scale U.S. cohort study [16,17] only included male adolescents, did not examine the effects of polysubstance use on PS symptoms, did not examine subclinical negative/disorganized symptoms, and did not control for trauma exposure. We address these limitations in the present study. Recent research has underscored the importance of investigating risk indicators associated with a wide range of symptoms in the psychosis continuum as young people develop [6]. Thus, our inclusion of a broad spectrum of psychosis-relevant symptoms—from subclinical symptoms to threshold delusions/hallucinations—is a notable strength. In addition, extensive, structured, in-person assessments in the PNC enabled us to model many variables that could confound the relation between cannabis use and PS symptoms, including demographics, intellectual function, comorbid psychopathology, use of other substances, trauma exposure, and family history of substance abuse [5,10,20].

## **Methods**

### *Participants*

The PNC includes 9,498 youths between the age of 8 and 21 years from the Philadelphia area. Importantly, the PNC is a

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