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## Attitudes towards cannabis use and genetic testing for schizophrenia

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### Abstract

**Aim**—Within schizophrenia, genetic factors contribute greatly to risk, yet genetic testing for the disorder is not available. For some individuals with specific genotypes, cannabis use may increase risk of schizophrenia. It is possible that genetic tests could be offered in the future to inform individuals of the risk of schizophrenia if they use cannabis. Previous research, however, provides little guidance on how young adults might respond to such tests.

**Methods**—We assessed a group of young adults ( $n = 83$ ) to determine how the perceived magnitude of increased risk for schizophrenia in the presence of cannabis use influences decisions to undergo genetic testing, as well as subsequent attitudes and intentions towards cannabis use.

**Results**—Participants were significantly more likely to indicate willingness to get tested if the results identified a 10% risk versus a 2% risk of schizophrenia. Participants also indicated that if the results of their test reflected increased risk due to cannabis use, it would be more important to avoid cannabis in the 10% risk scenario as compared to the 2% risk scenario. These findings remained consistent among a subset of participants who indicated cannabis use.

**Conclusions**—Results suggest that cannabis users and non-users were positively influenced in terms of intentions to change behavior based on the magnitude of risk conveyed by genetic testing. These findings provide an initial step towards understanding young people's attitudes towards genetic testing and may help prepare interventions specifically tailored around cannabis use reduction for people at risk for schizophrenia.

### Keywords

attitudes; cannabis; genetic testing; schizophrenia

### Introduction

Schizophrenia is a potentially debilitating mental disorder affecting approximately 1% of the population.<sup>1</sup> Current research suggests that genetic variation accounts for 70-85% of risk for the disorder.<sup>2-4</sup> Although many common genes are linked to schizophrenia, each has a very

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small impact (e.g., increasing risk from 1.0% to 1.3%), and thus, despite some private industry attempts<sup>5</sup>, genetic testing for schizophrenia is not generally used in clinical practice. Yet even with only modest information offered by genetic testing<sup>6</sup>, surveys of patients and families suggest a strong propensity to endorse the value of such tests. Further, patients often express intent to seek testing when possible despite concerns of stigma and possible subsequent mistreatment.<sup>3,7-9</sup> These findings suggest a need to further understand factors that could influence whether an individual would choose to be tested, and how he/she would respond to the results.

Despite the considerable role genetics plays in the development of schizophrenia, it is widely held that genetic predisposition by itself is not sufficient to cause the disorder.<sup>10</sup> Rather, the disorder is thought to arise from an interaction between genetic and environmental factors. Perhaps tests designed to identify gene by environment risk will increase the predictive ability of testing. Attitudes toward testing might differ when tests provide stronger predictions of schizophrenia risk, and if environmental risk factors are modifiable.<sup>11</sup>

One frequently studied environmental risk factor related to schizophrenia is premorbid cannabis use.<sup>12,13</sup> Identifying who may be vulnerable to schizophrenia in the presence of cannabis has become a growing research priority<sup>14</sup>, with various groups uncovering promising leads (e.g., particular genotype variation<sup>15</sup>; specific cannabinoid receptor polymorphisms<sup>16</sup>). It is likely that for some individuals with specific genotypes, cannabis use would increase the risk of schizophrenia, while for others, cannabis use would not alter risk. It is possible that genetic tests could be offered in the future to inform individuals of the risk of schizophrenia if they use cannabis (or some other risk factor).

The results of such a genetic test could influence individuals' cannabis use. A favorable outcome could ensue, for instance, if a genetic test indicating the presence of the cannabis-risk allele led to increased recognition of the importance of and commitment to stopping cannabis use. A less favorable outcome could result if the same test led to a sense of helplessness and defeatism that increased cannabis use and other high risk behavior.

As the accuracy of genetic testing and identification of risk for schizophrenia increases, it will become increasingly important to understand attitudes related to genetic testing and, for some, cannabis use.<sup>17</sup> Salient questions include whether to undergo genetic testing, how varying levels of risk will influence that decision, and the potential response to the results. Given that the peak age for cannabis use and the modal age of risk for schizophrenia are between 18-25 years of age, asking these questions among young adults (many of whom likely use cannabis), is particularly relevant.<sup>18</sup>

This study uses a specifically developed survey to assess a group of young adults to determine how the perceived magnitude of increased risk for schizophrenia in the presence of cannabis use influences: 1) decisions to undergo genetic testing, and 2) subsequent attitudes and intentions towards cannabis use. We hypothesized that a test that conveys higher risk for schizophrenia will be associated with an increased likelihood of getting tested. Further, we hypothesized that a test showing that cannabis use increases

schizophrenia risk would increase participants' likelihood of saying that it is important to avoid cannabis, and that they would be less likely to use cannabis. Additionally, as a potentially relevant sub-group, we were particularly interested in the attitudes and intentions of participants who reported a history of cannabis use.

## Methods

### Sample

The sample consisted of 83 college students (43 males), who were 20.83 (SD=5.98) years old on average who completed a one-time questionnaire packet that included a survey related to genetic testing and cannabis use. All participants were enrolled in an Introductory Psychology course at the University of Maryland, Baltimore County (UMBC) at the time of the study. This study was approved by the UMBC Institutional Review Board.

### Measures

Participants were presented with a survey asking various questions related to genetic testing, cannabis use, attitudes towards cannabis use, and behavioral intention around cannabis use. Two genetic testing scenarios were presented: 1) testing reveals if cannabis use increases the risk of schizophrenia to 2%; 2) testing reveals if cannabis use increases the risk of schizophrenia to 10%. These percentages were chosen a priori to represent approximately a two-fold and tenfold elevation of risk over the risk in the general population. Questions for the two scenarios are listed in Table 2. For the purposes of analyses, responses were coded as numeric values from 1 to 4, with a "1" representing "Not at all" and a "4" representing "Very."

## Results

### Total Sample

**Willingness to get tested**—Among the entire sample, participants were significantly more willing to get tested if the results could identify a 10% versus 2% risk of schizophrenia [ $t(78) = 5.39, p < .001$ ]. Specifically, when testing indicated an increased risk for schizophrenia from 1% to 2%, 80% of respondents reported that they were not at all or not very likely to get tested, whereas 20% reported being somewhat or very likely to get tested. In contrast, when testing indicated an increased risk for schizophrenia from 1% to 10%, 57% of participants reported they were not at all or not very likely to get tested, whereas 43% were somewhat or very likely to get tested.

**Impact of Testing Results**—As a whole, the majority of the sample, regardless of the risk reported by the test, indicated that it is important to avoid cannabis use and that they would likely try to avoid use. Participants responded that if the results showed cannabis increased their schizophrenia risk, it would be more *important* to stay away from cannabis in the 10% risk scenario as compared to the 2% risk scenario [ $t(80) = 4.05, p < .001$ ]. Additionally, if the test were positive, participants said they would be more *likely* to stay away from cannabis when responding to the 10% risk scenario relative to the 2% risk scenario [ $t(79) = 3.60, p = .001$ ] (Table 2). Regardless of the increment in risk indicated by

the test (2% vs 10%), if testing did not reveal any additional risk of schizophrenia due to cannabis, close to two-thirds of participants said that it would be important or very important to avoid cannabis and that they were likely or very likely to do so. There were no significant differences in response to this question across risk levels.

### Cannabis-using Subsample

**Willingness to test**—Of the total sample, 29 participants reported a history of cannabis use. Given that the genetic testing scenario may be particularly applicable to this group, analyses were repeated including only participants who reported any lifetime cannabis use. People with a history of cannabis use were significantly more likely to endorse willingness for genetic testing when responding to the 10% risk scenario compared to the 2% risk scenario [ $t(28) = 4.17, p < .001$ ]. In the 2% condition, 79% reported that they were not at all or not very likely to get tested, whereas 21% were somewhat or very likely. When risk increased to 10%, 48% were not at all or not very likely to get tested, whereas 52% were somewhat or very likely. With respect to importance and likelihood of avoiding cannabis, in the 2% condition just over 50% reported that they were not at all or not very likely to avoid cannabis or find avoiding it important. In the 10% condition slightly more than two-thirds of respondents reported that they were likely or very likely to avoid cannabis or find avoiding cannabis somewhat or very important. Regardless of risk level, if testing did not reveal an increased risk, over 70% of cannabis users reported that they were not at all or not very likely to avoid cannabis or find avoiding it somewhat or very important. Overall, participants with reported cannabis use indicated that it would be more important [ $t(28) = 3.59, p = .001$ ] and they would be more likely [ $t(28) = 3.36, p = .002$ ] to stay away from cannabis in the 10% risk scenario relative to the 2% risk scenario if the genetic test was positive.

### Discussion

There is a possibility that genetic tests could be offered in the future to predict schizophrenia risk. Private companies have offered genetic testing for psychiatric risk of suicide from antidepressant treatment, bipolar disorder, and potential treatment response to psychopharmacological treatments.<sup>5</sup> Despite their availability, the clinical accuracy of these tests, in particular as related to schizophrenia, is unclear, and as such their use is currently controversial. There is hope that accounting for environmental factors may improve the predictive power of such tests. Previous research provides little guidance on how young adults - who are in the age of highest risk - might respond to genetic tests that predict schizophrenia risk or guide interventions. Information is lacking with regard to whether to test, as well as to the impact of test results on subsequent behavior. With cannabis use emerging as a potentially modifiable environmental stressor that might interact with a genetic predisposition, understanding people's attitudes towards genetic testing may help guide interventions specifically tailored around cannabis use reduction for people at risk for schizophrenia.

The percentage of the young adults in our sample likely to get tested increased as risk for schizophrenia increased from 2% to 10%, although most reported that they were unlikely to get tested regardless of the test's predictive power. This is not entirely surprising as many of

the participants in our study reported never using cannabis. Among people who use cannabis, however, when presented with the 10% risk scenario, 52% reported that they would be “somewhat” or “very” likely to get tested, in contrast to the 2% risk scenario where only 21% of cannabis users reported a likelihood of testing. These findings suggest that among cannabis users, a relevant subgroup within this study, as predictive power increases so does interest in genetic testing.

Findings also suggest an increase in recognition of the importance of staying away from cannabis as risk increases. Similarly, findings suggest the increased likelihood of avoiding cannabis with increased risk. The importance/likelihood findings were true in the entire sample, as well as among cannabis users only. Thus, in contrast to a potential backlash whereby risk might cause a sense of helplessness and result in increased use, our findings suggest that risk reported by genetic testing in this hypothetical scenario positively influenced intentions to change behaviors in a potentially vulnerable group of users. Future research could aim to explore whether any risk condition might increase the likelihood of cannabis use or lead to other less favorable outcomes. Results for the “importance” and “likelihood” questions were very similar. It is possible that respondents did not distinguish these two potentially distinct constructs; importance to avoid and intention to avoid may have very similar meanings for people whereby the distinction is not clinically useful.

Interestingly, among cannabis users, in the situation where the test result indicated no increased risk, the importance and likelihood of avoiding cannabis decreased relative to scenarios where risk increased. These findings suggest that if the test shows that cannabis use does not increase schizophrenia risk, those who already use cannabis are likely to continue use.

Limitations of the study include a reliance on responses to hypothetical scenarios, and that the data reflect reports of behavioral intention, and not direct behavior. These limitations, however, are not unique to this study, and an abundance of research has shown a link between behavioral intention, as measured in studies relying on responses to hypothetical situations in questionnaires, and subsequent behavior in the real world.<sup>19,20</sup> Additionally, there are inherent limitations with using college samples. Although rates of substance use are comparable in college students and non-students of similar age in the general population<sup>18</sup>, it is possible that our sample of college students enrolled in an Introductory Psychology course had more exposure to and knowledge of mental illnesses such as schizophrenia than the general population. Although overall exposure to schizophrenia is limited in Introduction to Psychology, factors shared by psychology students such as increased awareness of mental illness may influence responses to inquiries aimed at assessing genetic risk for schizophrenia in a way that might impact generalizability. As an additional consideration, data on several potentially relevant independent variables such as frequency and amount of cannabis use, as well as prior history and attitude, were not available. Future research may shed light on the potential impact of these variables.

Despite these limitations, this study has the potential to increase awareness of what potential consumers think about genetic testing, which might inform the development of targeted interventions. Our findings suggest that many young adults, including those who use

cannabis, may be positively inclined towards testing in the presence of a 10% risk threshold. Furthermore, among cannabis users and non-users, when the genetic test showed a greater level of risk, people were more inclined to avoid or reduce cannabis.

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**Table 1**

## Demographics

Males (females)	43 (37) 3 missing
Mean age (SD)	20.83 (5.98)
<i>Race</i>	
Asian	34 (41.0%)
White/Caucasian	28 (33.7%)
Black/African-American	12 (14.5%)
Other	6 (7.2%)
Hispanic/Latino	2 (2.4%)
History of cannabis use	29 (34.9%)
Mean age onset (SD)	16.73 (1.96)

Table 2

## Attitudes towards genetic testing

	Not at all	Not Very	Some-what	Very		Not at all	Not Very	Some-what	Very
If a genetic test could show that marijuana use increases your schizophrenia risk from <b>1%</b> to <b>2%</b> , how <i>likely</i> would you be to get tested? (n=80)	49 (61.3%)	15 (18.8%)	11 (13.8%)	5 (6.3%)	If a genetic test could show that marijuana use increases your schizophrenia risk from <b>1%</b> to <b>10%</b> , how <i>likely</i> would you be to get tested? (n=79)	33 (41.8%)	12 (15.2%)	15 (19.0%)	19 (24.1%)
If you took this test and it showed that marijuana use increases your risk of schizophrenia from <b>1%</b> to <b>2%</b> :					If you took this test and it showed that marijuana use <b>does not</b> increase your risk of schizophrenia from <b>1%</b> to <b>2%</b> :				
<i>How important</i> would it be for you to stay away from marijuana? (n=82)	18 (22.0%)	10 (12.2%)	16 (19.5%)	38 (46.3%)	<i>How important</i> would it be for you to stay away from marijuana? (n=82)	25 (30.5%)	12 (14.6%)	10 (12.2%)	35 (42.7%)
<i>How likely</i> would you be to stay away from marijuana? (n=81)	14 (17.3%)	10 (12.3%)	10 (12.3%)	47 (58.0%)	<i>How likely</i> would you be to stay away from marijuana? (n=81)	18 (22.2%)	13 (16.0%)	9 (11.1%)	41 (50.6%)
If you took this test and it showed that marijuana use increases your risk of schizophrenia from <b>1%</b> to <b>10%</b> :					If you took this test and it showed that marijuana use <b>does not</b> increase your risk of schizophrenia from <b>1%</b> to <b>10%</b> :				
<i>How important</i> would it be for you to stay away from marijuana? (n=81)	10 (12.3%)	8 (9.9%)	15 (18.5%)	48 (59.3%)	<i>How important</i> would it be for you to stay away from marijuana? (n=80)	20 (25.0%)	15 (18.8%)	9 (11.3%)	36 (45.0%)
<i>How likely</i> would you be to stay away from marijuana? (n=80)	7 (8.8%)	6 (7.5%)	16 (20.0%)	51 (63.8%)	<i>How likely</i> would you be to stay away from marijuana? (n=79)	14 (17.7%)	16 (20.3%)	10 (12.7%)	39 (49.4%)

Table 3

Attitudes towards genetic testing among cannabis users

	Not at all	Not Very	Some-what	Very		Not at all	Not Very	Some-what	Very
If a genetic test could show that marijuana use increases your schizophrenia risk from <b>1%</b> to <b>2%</b> , how likely would you be to get tested? (n=29)	13 (44.8%)	10 (34.5%)	5 (17.2%)	1 (3.4%)	If a genetic test could show that marijuana use increases your schizophrenia risk from <b>1%</b> to <b>10%</b> , how likely would you be to get tested? (n=29)	6 (20.7%)	8 (27.6%)	10 (34.5%)	5 (17.2%)
If you took this test and it showed that marijuana use increases your risk of schizophrenia from <b>1%</b> to <b>2%</b> :					If you took this test and it showed that marijuana use <b>does not</b> increase your risk of schizophrenia from <b>1%</b> to <b>2%</b> :				
<i>How important</i> would it be for you to stay away from marijuana? (n=29)	8 (27.6%)	7 (24.1%)	9 (31.0%)	5 (17.2%)	<i>How important</i> would it be for you to stay away from marijuana? (n=29)	15 (51.7%)	6 (20.7%)	5 (17.2%)	3 (10.3%)
<i>How likely</i> would you be to stay away from marijuana? (n=29)	8 (27.6%)	8 (27.6%)	5 (17.2%)	8 (27.6%)	<i>How likely</i> would you be to stay away from marijuana? (n=29)	12 (41.4%)	9 (31.0%)	5 (17.2%)	3 (10.3%)
If you took this test and it showed that marijuana use increases your risk of schizophrenia from <b>1%</b> to <b>10%</b> :					If you took this test and it showed that marijuana use <b>does not</b> increase your risk of schizophrenia from <b>1%</b> to <b>10%</b> :				
<i>How important</i> would it be for you to stay away from marijuana? (n=29)	3 (10.3%)	6 (20.7%)	10 (34.5%)	10 (34.5%)	<i>How important</i> would it be for you to stay away from marijuana? (n=28)	10 (35.7%)	10 (35.7%)	4 (14.3%)	4 (14.3%)
<i>How likely</i> would you be to stay away from marijuana? (n=29)	3 (10.3%)	5 (17.2%)	11 (37.9%)	10 (34.5%)	<i>How likely</i> would you be to stay away from marijuana? (n=28)	8 (28.6%)	12 (42.9%)	4 (14.3%)	4 (14.3%)