BMJ Open

Cannabis and cannabidiol use among autistic and non-autistic adults in the UK: a propensity score-matched analysis

Daniel Ying-Heng Hua ,[1] Rachel Lees,[1] Mark Brosnan,[2] Tom P Freeman[1]

To cite: Hua DY-H, Lees R, Brosnan M, *et al*. Cannabis and cannabidiol use among autistic and non-autistic adults in the UK: a propensity score-matched analysis. *BMJ Open* 2021;**11**:e053814. doi:10.1136/bmjopen-2021-053814

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2021-053814).

Received 24 May 2021
Accepted 30 November 2021

Check for updates

© Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

[1]Addiction and Mental Health Group (AIM), Department of Psychology, University of Bath, Bath, UK
[2]Centre for Applied Autism Research, Department of Psychology, University of Bath, Bath, UK

Correspondence to
Dr Tom P Freeman;
t.p.freeman@bath.ac.uk

ABSTRACT

Objectives To assess whether autistic and non-autistic adults differ in their cannabis and cannabidiol (CBD) use, their perceptions of cannabinoid products and their cannabinoid-related support-seeking behaviours.

Design Cross-sectional survey.

Participants Respondents to an online survey, who self-reported an autism-spectrum disorder diagnosis (autistic participants) or no issues relating to autism (controls). Exclusion criteria were: related/subclinical issues relating to autism, non-UK residence, under 16 years old. Propensity score matching was used to match autistic participants and controls on age, gender and ethnicity. The full-sample analysis included 269 participants and the propensity-matched sample analysis included 166 participants. Propensity-matched analysis was used for primary analysis and was considered robust if supported by triangulation with full-sample analysis.

Results Autistic participants were more likely to have used CBD in the past 12 months compared with controls (OR=3.52, 95% CI 1.57 to 7.87, p=0.002). They used CBD on more days in the past 12 months (M=34, SD=93) compared with controls (M=17, SD=69, p=0.002). Autistic participants reported trusting the news and doctors less as sources of cannabinoid-related information than controls (p=0.024 and p=0.003, respectively). Autistic participants endorsed the following barriers to cannabinoid-related support seeking more than controls: 'worrying they won't understand me' (OR=3.25, 95% CI 1.67 to 6.33, p<0.001), 'going somewhere unfamiliar' (OR=5.29, 95% CI 2.62 to 10.67, p<0.001) and 'being in a crowded or chaotic place' (OR=9.79, 95% CI 4.18 to 22.89, p<0.001).

Conclusion Results indicate a higher prevalence and frequency of CBD use, but not cannabis use, among autistic individuals compared with controls. Findings also suggest appropriate methods to disseminate cannabinoid-related support to autistic individuals, and indicate differences in the potential barriers autistic and non-autistic individuals may face when seeking cannabinoid-related support.

Strengths and limitations of this study

- ► Propensity score matching allows differences between autistic and non-autistic participants to be likelier attributable to autism-spectrum disorder.
- ► Triangulation of the matched sample analysis to a full-sample analysis increases the robustness of findings when considering exclusion bias introduced through matching.
- ► Autistic and non-autistic participants were matched on age, gender and ethnicity. It is possible that non-included or unmeasured variables still represent confounding factors.
- ► Given the exploratory nature of this research, correction for multiple testing was not applied for the majority of analysis. Results should, therefore, be interpreted cautiously.
- ► Autistic participants were predominantly White, university-educated, and their self-reported diagnoses were not verified by a clinician. Results may not generalise across ethnicities or to individuals who are unable to access online research studies.

INTRODUCTION

Autism-spectrum disorder (ASD) is a neurodevelopmental condition defined by social communication difficulties and restricted, repetitive behaviours.[1] ASD may be additionally associated with anxiety and low mood among other challenges.[2 3]

To manage these challenges, autistic individuals may self-medicate using substances.[4] Studies have shown autistic individuals to be two to four times more likely to endorse tobacco, alcohol or other drug-related problems compared with their non-autistic relatives.[5] Even in those without an ASD diagnosis, autism-related difficulties including social communication difficulties and repetitive behaviours may be associated with greater tobacco, alcohol and cannabis use, as evidenced by a large survey of the general adult population.[6] These findings may indicate that substances are used to alleviate difficulties associated with ASD, which is noted in qualitative interviews with substance-using autistic individuals.[7] In line with this notion of self-medication, expectancy theory proposes that substance use is motivated by expectancies that this behaviour will produce a positive effect.[8] A previous study found that the expectancy that alcohol would benefit autism-related difficulties was associated

BMJ Open: first published as 10.1136/bmjopen-2021-053814 on 16 December 2021. Downloaded from http://bmjopen.bmj.com/ on November 11, 2024 by guest. Protected by copyright.

with higher frequency of alcohol use in autistic individuals.[9] However, expectancies among autistic individuals for other substances have been understudied. One such group of substances is compounds derived from the cannabis plant, called cannabinoids. The two most abundant of these are cannabidiol (CBD), a non-intoxicating cannabinoid, and delta-9-tetrahydrocannabinol (THC), which is intoxicating.

Cannabinoids may help mitigate several difficulties that can be associated with ASD. Epilepsy has been regarded as a frequent comorbidity and exacerbator of behavioural difficulties in autistic individuals.[10] Recently, CBD was approved as an effective treatment for certain forms of epilepsy. Additionally, some evidence suggests that there may be a more substantial effect when CBD is combined with THC.[11] Autistic individuals may also face difficulties with recognising emotions.[12] A randomised placebo-controlled trial found that a single dose of CBD improved emotional face recognition, whereas THC impaired performance on the same task.[13] Animal studies have further shown CBD to exert agonist effects on 5-HT1a serotonin receptors similarly to antidepressants, and so CBD may produce benefits to mood and anxiety.[14] THC may also have benefits for autistic individuals by reducing locomotor activity[15] and in tandem with CBD, improve on hyperactivity and impulsivity.[16] Most recently, a double-blinded randomised controlled trial of CBD and THC in a 20:1 ratio found significant improvements to social responsiveness and disruptive behaviours compared with placebo, among 150 autistic children and adolescents.[17]

While some research indicates potential medicinal uses of cannabinoids for autistic individuals, current research on efficacy and safety is limited[18]. Therefore, cannabinoids are currently not approved as pharmacological interventions for ASD. In the absence of prescribed cannabinoids, or any pharmacological intervention for autistic individuals,[19] some may turn to non-prescribed cannabinoid use. A growing public interest in the use of cannabinoids for medicinal or wellness purposes may facilitate such behaviours.[20] Within the UK, non-prescribed use of cannabinoids largely takes the form of CBD products, which are legally available in health food shops and online, and of non-prescribed cannabis, which is currently illegal.[21]

Overall, CBD has been regarded as a well-tolerated drug with few side effects.[22 23] However, levels of CBD in available CBD products are typically far lower than those administered in clinical trials;[24] hence, the effectiveness of these products remains unknown. Moreover, THC levels in these products are often variable and have been found at times to exceed legal limits in some jurisdictions.[25] Thus, CBD products may currently lack quality assurance and data on their safety or efficacy. It is notable that the recent classification of CBD as a novel food by the European Food Standards Agency has facilitated tightened safety regulations within the UK since March 2021, which may influence these issues with CBD products in the future.[26] Conversely, cannabis use has been associated with increased risk of developing cannabis use disorder and psychosis.[27 28] These effects are attributable to THC, which has been shown during acute administration to produce transient psychotic symptoms and impaired memory in a dose-dependent manner.[29]

Despite the potential risks of cannabis and the lack of quality assurance for CBD products as well as the potential benefits of cannabinoids for ASD, there is a current lack of data on the prevalence and characteristics of their use, across autistic and non-autistic individuals. Current data are limited to diagnosis rates of substance use disorders among autistic adults,[30 31] which fails to capture subclinical cannabinoid use, and how and why autistic individuals use these products. Without this information, the extent of potential benefits or harms caused by unregulated cannabis use among autistic people remains unknown. Moreover, this precludes understanding the aetiological factors of cannabinoid use for autistic individuals, which impedes the development of evidence-based support programmes.[32] To address this gap in the literature, we sought to provide a comprehensive survey of cannabinoid-related behaviours in autistic versus non-autistic individuals, including prevalence and frequency of use, expectancies regarding cannabis and CBD, cannabinoid-use support-seeking behaviours and whether cannabis/CBD use is associated with use of other drugs.

METHOD

Participants and design

A cross-sectional, observational online survey design was used. The survey was open from 4 February to 7 April 2020. Participants were contacted to participate from the Centre for Applied Autism Research, the University of Bath Research Participation Scheme, the Cambridge Autism Research Database and via direct recruitment of friends and family by university students. Participants recruited via the Research Participation Scheme were given course-relevant credits and no other reimbursements were given. Inclusion criteria were as follows: fluency in written English and residing within the UK. Exclusion criteria were as follows: non-UK residence, not providing consent to analyse data, related/subclinical issues relating to ASD and under 16 years old.

Procedure and measures

Respondents accessed the online survey on their personal devices. Respondents were asked for demographic and clinical information. Two questions were then asked regarding autism-related difficulties: ‘How often do you have difficulties with social communication and social interaction with other people? (eg, difficulties with normal back-and-forth social conversation or making normal eye contact or making friends)’ and ‘How often do you have difficulties with restricted and repetitive patterns of behaviours, activities or interests? (eg, difficulties with repetitive movements, or insisting on sameness (or routines), or fixated and intense interests, or very high

BMJ Open: first published as 10.1136/bmjopen-2021-053814 on 16 December 2021. Downloaded from http://bmjopen.bmj.com/ on November 11, 2024 by guest. Protected by copyright.

(or very low) sensitivity to the environment, such as light, sound or texture'. Both questions used a 5-point rating scale: 0 (almost never/in almost no situations), 1 (rare/in rare situations), 2 (sometimes/in some situations), 3 (mostly/in most situations) and 4 (almost always/in almost all situations). These questions have been demonstrated to distinguish autistic and non-autistic individuals and correlate with established measures of autistic-like traits.[33] These questions functioned to confirm that individuals who self-reported an ASD diagnosis did endorse autism-related difficulties to levels seen in previous published samples of autistic individuals.[9 33]

Respondents were then asked whether they had used alcohol, tobacco, cannabis or CBD products within the past 12 months. Subsequently, respondents were asked to rate how frequently they used cannabis and/or CBD products in the past 12 months, using the following scale: (1) not in the last year, (2) once or two times a year, (3) once every couple of months, (4) once or two times a month, (5) once or two times a week, (6) 3 or 4 days a week, (7) 5 or 6 days a week and (8) almost every day.

Alongside this, respondents completed the Severity of Dependence scale (SDS)[34] for cannabis and then CBD. Five items are scored on a 4-point scale with higher scores indicating greater dependence. A diagnostic cut-off for cannabis dependence has been suggested at a total score of at least 3.[35] The SDS has demonstrated strong internal and test–retest reliabilities, and good discriminant and construct validities in assessing dependence among several substances, including cannabis.[36] Within this study, internal reliability was good for cannabis (α=0.838) and CBD (α=0.845).

Respondents were then given a 15-item questionnaire adapted from a previous study on alcohol[9] to assess cannabis and CBD expectancies. The first six items relate to commonly endorsed expectancies for substance use identified in the general population[37] (1) global positive changes, (2) changes in social behaviour, (3) improved cognitive and motor abilities, (4) sexual enhancement, (5) cognitive and motor impairment and (6) relaxation and tension reduction. The next seven items are autism-specific expectancies related to diagnostic criteria for autism-spectrum disorder[1] (1) verbal communication; (2) non-verbal communication; (3) developing, maintaining and understanding relationships; (4) stereotyped or repetitive motor movements; (5) insistence on sameness; (6) highly restricted, fixated interests and (7) hyperreactivity or hyporeactivity to sensory stimuli. Finally, two medical expectancies were included: (1) medicinal properties and (2) safety. A 5-point scale was used for this questionnaire, from (1) almost never/never to (5) almost always/always.

Following this, respondents were asked to rate the extent they agreed that accurate information and labelling of cannabis and CBD products were available to them on visual analogue scales from 0 (least agree) to 100 (most agree). Respondents were then asked to rate how much they trusted certain sources when finding out information about cannabis and/or CBD products from 0 (least trust) to 100 (most trust).

Finally, respondents were asked if they were to experience excessive cannabis/CBD use, where they would go for help, and what they would perceive as barriers to support-seeking. A full view of the survey, including all measures, may be seen in online supplemental materials.

Public involvement statement

No members of the public were involved in the design or analysis of this study. A draft of the manuscript was reviewed by an autistic individual, to ensure that the commentary of the study was appropriate and not out of line with the lived experiences of an autistic person. Specifically, they commented that the available support after their autism diagnosis was very limited, and this study's findings were concordant with their own use of CBD oil as a form of self-medication. Additionally, they reported that the identity-first language used in this paper (ie, 'autistic person' rather than 'person with autism') was preferred, as was the focus on the perspective of autistic individuals rather than the perspective of carers.

Analysis

The focus of our analysis was to compare autistic and non-autistic individuals on cannabinoid use behaviours and related factors. In order to account for the likelihood that autistic participants differed on key demographic variables to control participants, propensity score matching on age, gender and ethnicity was conducted to obtain groups with similar demographics. This allows differences between groups to be likelier attributable to ASD. Following recommendations, 1:1 nearest neighbour logistic regression matching with replacement, with a tolerance level of 0.03, was chosen.[38 39] Several authors have noted matching with or without replacement is generally comparable, and, indeed, this produced the same sample size in the current study.[40 41] Given the reduction in confounding by demographic factors in the matched sample, this method is more conservative than the full-sample analysis and was chosen as the primary method for analysis. Elimination of data to obtain matched samples may, however, introduce exclusion bias. Therefore, to ensure that any case–control differences were robust to different analytical methods, propensity score matching results were triangulated with full-sample analysis results. Group differences were only considered robust if supported by triangulation between propensity score matching and full sample analysis results.[42]

Differences between autistic and control groups were assessed using χ^2 independence tests, Fisher's exact tests, independent-sample t tests, and Mann-Whitney U tests as appropriate with an alpha level of 0.05. Effect sizes were computed as ORs or r ($Z/(\sqrt{N})$ for χ^2 independence tests and Mann-Whitney U tests, respectively. Post-hoc Spearman's Rho correlations were used to assess within-group associations between autism-related difficulties (social communication difficulties and restricted, repetitive

BMJ Open: first published as 10.1136/bmjopen-2021-053814 on 16 December 2021. Downloaded from http://bmjopen.bmj.com/ on November 11, 2024 by guest. Protected by copyright.

behaviours) and frequency of cannabis/CBD use, using Bonferroni-adjusted alpha levels of 0.025 (0.05/2). Post-hoc Spearman's Rho correlations were also used to assess within-group associations between expectancies of cannabis/CBD use and frequency of cannabis/CBD use, using Bonferroni-adjusted alpha levels of 0.0125 (0.05/4). No adjustment was made for other analyses. Missing data were handled through pairwise deletion.

RESULTS

A total of 378 respondents accessed the survey. Thirty-two respondents were excluded due to non-UK residence, and 62 respondents did not provide consent to take part. Fifteen respondents indicated they did not have a formal ASD diagnosis but had related, subclinical issues. To ensure the group of autistic individuals was consistent, and to obtain a comparison between ASD diagnosed and non-ASD diagnosed groups, we excluded these respondents from analysis. Finally, propensity score matching to obtain a matched sample resulted in the exclusion of 103 participants. The final sample size was 166. Matched sample characteristics are seen in table 1, while full sample characteristics can be viewed in online supplemental table S1.

As shown in table 2, autistic participants were significantly less likely to have drank alcohol in the past 12 months compared with control participants, and this finding was supported by the full-sample analysis (online supplemental table S2). Groups were comparable in their use of tobacco in the past 12 months.

Autistic participants were significantly more likely to have used CBD in the past 12 months compared with control participants, and this finding was supported by the full-sample analysis (online supplemental table S2). Groups were similar in their use of cannabis in the past 12 months.

Autistic participants used CBD significantly more frequently compared with control participants, with a small-to-medium effect. This was supported by the full-sample analysis (online supplemental table S2). No differences in frequency of cannabis use between groups were found. Autism-related difficulties (social communication difficulties and restricted, repetitive behaviours) were not significantly correlated with frequency of cannabis or CBD use in the past 12 months, within either the autistic or control groups (all p values >0.05).

Both groups had comparable severity of dependence scores, for cannabis and for CBD.

In autistic participants, alcohol use was significantly associated with CBD use, while tobacco use was significantly associated with cannabis use in both autistic and control participants (online supplemental materials).

Table 3 shows between-group differences in cannabis use and CBD use expectancies. Groups were comparable on recreational drug use and autism-specific expectancies for cannabis use and whether they thought cannabis was safe and had medicinal properties. In the

Table 1 Demographic and clinical information for propensity score matched autistic and control participants

	ASD diagnosis n (%)	Control n (%)	Comparison test
Sample size	83	83	
Age			t(158)=0.01, p=0.993
N	83	83	
M	37.39	37.41	
SD	15.46	18.72	
Range	18–71	18–91	
Gender			p = 1.000†
Female	51 (61.4)	51 (61.4)	
Male	30 (36.1)	31 (37.3)	
Non-binary	2 (2.4)	1 (1.2)	
Ethnicity			*p* = 1.000†
White	78 (94.0)	79 (95.2)	
Asian or Asian British	1 (1.2)	1 (1.2)	
Mixed or Multiple Ethnic Groups	1 (1.2)	1 (1.2)	
Black, African, Caribbean or Black British	1 (1.2)	0 (0.0)	
Other Ethnic Group	1 (1.2)	0 (1.2)	
Omitted	1 (1.2)	2 (2.4)	
Highest education level			*p* = .294†
University degree	64 (77.1)	69 (83.1)	
A levels	14 (16.9)	7 (8.4)	
GCSEs	5 (6.0)	6 (7.2)	
Below GCSE	0 (0.0)	1 (1.2)	
Employment			$\chi^2(2)=0.86$, p=0.651
Full time	26 (31.3)	30 (36.1)	
Part time	16 (19.3)	12 (14.5)	
Unemployed	41 (49.4)	41 (49.5)	
Age of diagnosis			t(8.31)=−0.79, p=0.449
N	58	5	
M	30.47	27.40	
SD	16.40	7.16	
Range	3–63	19–36	
ASD			N/A
Diagnosis	83 (100.0)	0 (0.0)	
No diagnosis	0 (0.0)	83 (100.0)	
ADHD			*p* = .059†

Continued

BMJ Open: first published as 10.1136/bmjopen-2021-053814 on 16 December 2021. Downloaded from http://bmjopen.bmj.com/ on November 11, 2024 by guest. Protected by copyright.

Table 1 Continued

	ASD diagnosis n (%)	Control n (%)	Comparison test
Diagnosis	5 (6.0)	0 (0.0)	
No diagnosis	78 (94.0)	83 (100.0)	
OCD			$\chi^2(1)=6.81$, p=0.009*
Diagnosis	9 (10.8)	1 (1.2)	
No diagnosis	74 (89.2)	82 (98.8)	
Anxiety			$\chi^2(1)=40.44$, p<0.001*
Diagnosis	45 (54.2)	7 (8.4)	
No diagnosis	38 (45.8)	76 (91.6)	
Depression			$\chi^2(1)=27.14$, p<0.001*
Diagnosis	45 (54.2)	13 (15.7)	
No diagnosis	38 (45.8)	70 (84.3)	
Panic			$\chi^2(1)=7.80$, p=0.005*
Diagnosis	12 (14.5)	2 (2.4)	
No diagnosis	71 (85.5)	81 (97.6)	
PTSD			$\chi^2(1)=7.89$, p=0.005*
Diagnosis	10 (12.0)	1 (0.6)	
No diagnosis	73 (88.0)	82 (99.4)	
Intellectual disability			*p* = .682†
Diagnosis	5 (6.0)	2 (2.4)	
No diagnosis	78 (94.0)	81 (97.6)	
Psychosis			N/A
Diagnosis	0 (0.0)	0 (0.0)	
No diagnosis	83 (100)	83 (100.0)	
Other			$\chi^2(1)=14.55$, p<0.001*
Diagnosis	18 (21.7)	2 (2.4)	
No diagnosis	65 (78.3)	81 (97.6)	

*p < 0.05.
†Fisher's exact test used due to low expected cell count.
ADHD, attention deficit hyperactivity disorder; A levels, advanced levels (further education qualification); ASD, autism spectrum disorder; GCSE, general certificate of secondary education (further education qualification); N/A, not applicable; OCD, obsessive compulsive disorder; PTSD, post-traumatic stress disorder.

control group, frequency of cannabis use in the past 12 months was significantly positively correlated with recreational drug use expectancies, $r_s=0.356$, p=0.001, N=80, the expectancy that cannabis is safe, $r_s=0.563$, p<0.001, N=81 and the expectancy that cannabis has medicinal properties, $r_s=0.284$, p=0.010, N=81. In the autistic group, frequency of cannabis use in the past 12 months was significantly positively correlated with recreational drug use expectancies, $r_s=0.348$, p=0.001, N=82, and the expectancy that cannabis is safe, $r_s=0.424$, p<0.001, N=83. All other correlations were non-significant. Differences in non-grouped cannabis expectancies between autistic and non-autistic individuals are shown in online supplemental table S3.

Control participants endorsed recreational drug use expectancies of CBD use to a significantly greater extent compared with autistic participants, with a small-to-medium effect that was also supported by the full-sample analysis (online supplemental table S4). Groups were comparable on the extent they endorsed autism-specific expectancies of CBD use, whether CBD was safe and whether it had medicinal properties. In the control group, frequency of CBD use in the past 12 months was significantly positively correlated with the expectancy that CBD has medicinal properties, $r_s=0.345$, p=0.002, N=77, and the expectancy that CBD is safe, $r_s=0.343$, p=0.002, N=77. In the autistic group, frequency of CBD use in the past 12 months was significantly positively correlated with the expectancy that CBD is safe, $r_s=0.321$, p=0.003, N=82. Differences in non-grouped CBD expectancies between groups are shown in online supplemental table S5.

Autistic and non-autistic participants were comparable in how they perceived the accuracy of information conveyed to them about cannabis and CBD (online supplemental table S6).

Table 4 displays autistic and non-autistic participants' ratings of trust for various sources of information regarding cannabinoids. Autistic participants trusted 'News' less than controls, with a small-to-medium effect size. Similarly, the autistic group reported less trust for doctors compared with controls, with a small-to-medium effect. Both of these group differences were replicated within the full-sample analysis (online supplemental table S7). All other sources of information were perceived to be equally trustworthy by autistic and non-autistic participants.

No significant differences were found between autistic and non-autistic participants for who they stated they would seek support for reducing cannabis/CBD use from. Searching online for information and going to the doctor/GP were the two most popular sources of support for autistic participants, both endorsed by 56.6% of autistic participants. See online supplemental table S8 for full details.

Barriers to seeking support for cannabis/CBD use are shown in table 5. Autistic participants, compared with control participants, were significantly more likely to endorse the following as barriers: worrying they would not be understood, going somewhere unfamiliar and being in a crowded or chaotic place. All of these group differences were supported by the full-sample analysis (online supplemental table S9).

BMJ Open: first published as 10.1136/bmjopen-2021-053814 on 16 December 2021. Downloaded from http://bmjopen.bmj.com/ on November 11, 2024 by guest. Protected by copyright.

Table 2 Prevalence and frequency of substance use and severity of dependence, among autistic and control participants

	ASD diagnosis	Control	Comparison test
	Number of participants endorsing substance use in past 12 months (%)		
Alcohol	63 (75.9)	77 (92.8)	$\chi^2(1)=8.94$, p=0.003* $n_1=83$, $n_2=83$ OR=0.25 (0.09 to 0.65)
Tobacco	26 (31.3)	25 (30.1)	$\chi^2(1)=0.03$, p=0.866 $n_1=83$, $n_2=83$ OR=1.06 (0.55 to 2.05)
Cannabis	21 (25.3)	30 (36.1)	$\chi^2(1)=2.29$, p=0.130 $n_1=83$, $n_2=83$ OR=0.60 (0.31 to 1.17)
CBD	27 (32.5)	10 (12.0)	$\chi^2(1)=10.05$, p=0.002* $n_1=83$, $n_2=83$ OR=3.52 (1.57 to 7.87)
	Mean number of days used in last 12 months (*SD*)		
Cannabis	43.48 (105.86)	31.31 (88.26)	U=3149.50, p=0.313 $n_1=83$, $n_2=82$ r=−0.08
CBD	34.30 (93.16)	17.01 (68.97)	U=2716.00, p=0.002* $n_1=83$, $n_2=82$ r=−0.24
	Mean score (*SD*)		
Severity of cannabis dependence	3.00 (3.30)	1.57 (2.50)	U=217.50, p=0.147 $n_1=19$, $n_2=30$ r=−0.21
Severity of CBD dependence	0.92 (2.50)	0.40 (0.70)	U=123.50, p=0.943 $n_1=25$, $n_2=10$ r=−0.01

Only those using cannabis/CBD in the past 12 months were given Severity of Dependence scales for cannabis/CBD, respectively. ORs are presented followed by 95% CIs in parentheses.
*p < 0.05.
ASD, autism-spectrum disorder; CBD, cannabidiol; n_1, sample size of autistic participants; n_2, sample size of control participants.

DISCUSSION

Principal findings

To our knowledge, this is the first study to compare autistic and non-autistic individuals on their use of cannabis and CBD. Autistic participants were found to use CBD more and cannabis to a similar extent compared with non-autistic participants. However, autism-related difficulties (social communication difficulties and restricted, repetitive behaviours) were not correlated with frequency of cannabis or CBD use in the past 12 months, for both autistic and non-autistic participants. Cannabis and CBD use expectancies were similar between autistic and non-autistic participants, except recreational drug use expectancies for CBD which were lower for autistic participants. Recreational drug use expectancies for cannabis were positively correlated with frequency of cannabis use in the past 12 months, for both autistic and non-autistic groups. Medical expectancies regarding safety and medicinal properties were also positively correlated with frequency of cannabis and CBD use in both groups. Perceptions of accuracy for cannabinoid-related information were similar for autistic and non-autistic participants, though autistic participants were found to trust the news and doctors less as sources of information regarding cannabinoids. Potential barriers to cannabinoid-related support seeking that autistic participants endorsed more than non-autistic participants included not being understood, and going somewhere unfamiliar, crowded and chaotic.

Strengths and limitations

Strengths of this study include the use of propensity score matching and triangulation with full-sample analysis, to ensure that findings were robust to different analytical approaches. Thus, by limiting our interpretation of group differences to those where both matched and full samples produced corroborating results, our findings can be considered more robust.[42] Limitations of this study include a lack of correction for multiple comparisons in the majority of analysis. This was chosen given the novel and exploratory nature of this research, though findings

BMJ Open: first published as 10.1136/bmjopen-2021-053814 on 16 December 2021. Downloaded from http://bmjopen.bmj.com/ on November 11, 2024 by guest. Protected by copyright.

Table 3 Expectancies of cannabis and CBD use among autistic and control participants

	Mean score (SD)		
	ASD diagnosis	Control	Comparison test
Recreational drug use expectancies for cannabis	2.75 (0.85)	2.54 (0.70)	U=2788.00, p=0.098 n_1=82, n_2=80 r=−0.13
Autism-specific expectancies for cannabis	2.41 (0.95)	2.10 (0.77)	U=2704.00, p=0.053 n_1=82, n_2=80 r=−0.15
Cannabis is safe	2.92 (1.31)	2.93 (1.25)	U=3343.00, p=0.950 n_1=83, n_2=81 r=−0.00
Cannabis has medicinal properties	3.36 (1.16)	3.23 (1.18)	U=3157.00, p=0.489 n_1=83, n_2=81 r=−0.05
Recreational drug use expectancies for CBD	2.28 (1.00)	2.59 (0.90)	U=2495.00, p=0.030* n_1=82, n_2=76 r=−0.17
Autism-specific expectancies for CBD	2.09 (1.00)	2.36 (0.98)	U=2577.00, p=0.060 n_1=82, n_2=76 r=−0.15
CBD is safe	3.73 (1.27)	3.49 (1.30)	U=2832.00, p=0.245 n_1=82, n_2=77 r=−0.09
CBD has medicinal properties	3.30 (1.33)	3.57 (1.25)	*U*=2757.50, p=0.197 n_1=81, n_2=77 *r*=−0.10

Recreational drug use expectancies (eg, 'cannabis/CBD generally has positive effects on people') were grouped and the average score for each participant was calculated. Autism-specific expectancies (eg, 'cannabis/CBD makes social relationships easier') were also grouped and the average score per participant was calculated. Scores represent the following: 1=almost never/never, 2=some of the time, 3=about half of the time, 4=most of the time, 5=almost always/always.
*p < 0.05.
ASD, autism spectrum disorder; n_1, sample size of ASD diagnosis group; n_2, sample size of control group.

should, therefore, be interpreted cautiously and require further replication. Additionally, this study was restricted to UK residents and failed to capture cross-national differences in cannabinoid usage rates as well as cultural and policy views regarding cannabinoids.[43] This study's sampling methods may also limit the generalisability of findings. Given the technological abilities required to access the online survey and the high proportion of university-educated participants, findings may not be representative of autistic individuals with co-occurring learning disability. Generalisation across ethnicities may also be limited given the high proportion of the sample

Table 4 Perceived trustworthiness of sources for cannabis/CBD information, among autistic and control participants

	Median score		Comparison test
	ASD diagnosis	Control	
Parents	20.0	25.5	U=2289.50, p=0.346 n_1=72, n_2=70 r=−0.08
Friends	30.0	42.0	U=2522.00, p=0.141 n_1=78, n_2=75 r=−0.12
News	24.0	35.0	U=2277.50, p=0.024* n_1=77, n_2=75 r=−0.18
Doctor	70.0	80.0	U=2242.00, p=0.003* n_1=79, n_2=78 r=−0.24
Scientific journals	80.0	83.5	U=3020.50, p=0.384 n_1=82, n_2=80 r=−0.07
Police	40.0	45.5	U=2354.50, p=0.279 n_1=73, n_2=72 r=−0.09
National Institute of Health and Care Excellence	72.0	79.0	U=2562.00, p=0.070 n_1=81, n_2=76 r=−0.14

Scores range from 0 being 'least trust' to 100 being 'most trust'.
*p < 0.05.
ASD, autism spectrum disorder; CBD, cannabidiol; n_1, sample size of ASD diagnosis group; n_2, sample size of control group.

BMJ Open: first published as 10.1136/bmjopen-2021-053814 on 16 December 2021. Downloaded from http://bmjopen.bmj.com/ on November 11, 2024 by guest. Protected by copyright.

Table 5 Barriers to seeking support for cannabis/CBD use among autistic and control participants

	ASD diagnosis	Control	
	n (%)	*n* (%)	Comparison test
Fear of being judged for taking cannabis/CBD	44 (53.7)	51 (64.6)	$\chi^2(1)=1.98$, p=0.160 $n_1=82$, $n_2=79$ OR=0.64 (0.34 to 1.20)
Fear of legal consequences	50 (61.0)	57 (72.2)	$\chi^2(1)=2.26$, p=0.133 $n_1=82$, $n_2=79$ OR=0.60 (0.31 to 1.17)
Worrying they would not understand me	43 (52.4)	20 (25.3)	$\chi^2(1)=12.43$, p<0.001* $n_1 = 82$, $n_2=79$ OR=3.25 (1.67 to 6.33)
Going somewhere unfamiliar	47 (57.3)	16 (20.3)	$\chi^2(1)=23.21$, p<0.001* $n_1 = 82$, $n_2=79$ OR=5.29 (2.62 to 10.67)
Being in a crowded or chaotic place	43 (52.4)	8 (10.1)	$\chi^2(1)=33.28$, p<0.001* $n_1 = 82$, $n_2=79$ OR=9.79 (4.18 to 22.89)
Other	10 (12.2)	8 (10.1)	$\chi^2(1)=0.17$, p=0.677 $n_1=82$, $n_2=79$ OR=1.23 (0.46 to 3.30)

ORs are presented followed by 95% CIs in parentheses.
*p < 0.05.
ASD, autism spectrum disorder.; CBD, cannabidiol; n_1, sample size of ASD diagnosis group; n_2, sample size of control group.

that were White. Sampling limitations, such as these have been previously discussed within cannabis and autism-related research,[44 45] and future studies may wish to consider targeted recruitment towards hard-to-reach autistic populations. It is also important to note that a proportion of autistic and non-autistic participants had psychiatric comorbidities, which have been demonstrated to affect substance use and self-medication attitudes.[46–48] Finally, ASD diagnoses were self-reported and not verified by a trained clinician.

Relationship to previous literature

In this study, autistic participants were more likely to have tried CBD in the past 12 months and used it more frequently, compared with non-autistic participants. However, frequency of CBD use in the past 12 months was not correlated with autism-related difficulties, which does not support the notion that autistic individuals self-medicate using CBD in response to particular aspects of ASD. In understanding the reasons why autistic individuals may use CBD, it is notable that diagnosis rates for anxiety and depression were higher in the autistic versus control group, which is in line with previous findings.[49] Anxiety and depression have been previously found to be common reasons for CBD use,[50] and it may be that autistic individuals are choosing to use CBD to self-medicate anxiety or depression rather than autism per se. However, current findings are unable to confirm the reasons autistic participants used CBD, and this may represent an area for further inquiry.

Previous studies have found ASD diagnoses and autistic traits to be associated with cannabis use and increased risk of drug use disorder, supporting the notion of self-medication.[5 6] In contrast, this study did not find cannabis use nor severity of cannabis dependence to be elevated in autistic participants. Given contradictory findings, further research may be warranted.

Expectancy theory proposes that expectancies motivate substance-using behaviours,[8] and our results provide partial support for this proposition. Recreational drug use expectancies were associated with frequency of cannabis use for both autistic and non-autistic participants. Medical expectancies were also associated with frequency of cannabis and CBD use in both groups. However, autism-specific expectancies were not associated with frequency of cannabis or CBD use, and recreational drug use expectancies were not associated with frequency of CBD use. This contrasts a previous study, which found autism-specific expectancies to be associated with more frequent alcohol use among autistic individuals.[9] Since alcohol is readily available for purchase by adults, expectancies may be the dominant factor determining alcohol use, while cannabis and CBD use may be determined by additional factors such as illegality and high prices.[21 51]

Implications

These findings indicate appropriate avenues to disseminate cannabinoid-related information and support to autistic individuals. Compared with non-autistic participants, autistic participants trusted the news and doctors less as sources of information regarding cannabinoids. Scientific journals and National Institute of Health and Care Excellence (NICE) were rated as the most trusted sources by autistic individuals. Current NICE guidelines on medicinal cannabinoids do not mention its relevance to ASD,[52] although these findings indicate this information could positively inform cannabinoid use for autistic individuals. Additionally, our findings corroborate previous work[9] that the internet is among the most popular sources for substance-related support, reiterating

BMJ Open: first published as 10.1136/bmjopen-2021-053814 on 16 December 2021. Downloaded from http://bmjopen.bmj.com/ on November 11, 2024 by guest. Protected by copyright.

the importance of high-quality, accessible guidance online.

Finally, this study highlights the benefits of autism-relevant adjustments within substance use services. Autistic participants endorsed that not being understood, being somewhere unfamiliar and going to a crowded, chaotic place were potential barriers to cannabinoid-related support seeking, more so than non-autistic participants. These potential barriers were also identified by previous work[9] as highly prevalent for autistic individuals in relation to alcohol-related support seeking and together suggests targets to improve accessibility of care. Notably, a transition to remote services due to the SARS-CoV-19 pandemic may lessen these barriers, and it will be pertinent to investigate how these changing services are experienced by autistic individuals.[53] Furthermore, future research may wish to assess how autistic individuals access cannabis, as these barriers may potentially suggest a preference away from approaching cannabis dealers in-person if this involves unfamiliar or chaotic environments.

CONCLUSION

This study used propensity score matching and triangulation to examine differences between autistic and non-autistic participants in their cannabinoid use and related beliefs. Our findings indicate a higher prevalence and frequency of CBD use, but not cannabis use, among autistic individuals compared with non-autistic individuals. Findings also suggest appropriate methods to disseminate cannabinoid-related support and guidance to autistic people and highlight potential barriers to target in improving access to cannabinoid-related support.

Acknowledgements We would like to thank Will Reid, Kristi Mandova, Prarthana Sabharwal, Scarlet Jenne, Noor-Alhuda El-Amin and Wenjing Yu who assisted with data collection, and the autistic individual who kindly reviewed our manuscript. We are grateful to the Autism Research Centre at the University of Cambridge for access to the Cambridge Autism Research Database as a source of recruitment.

Contributors The ICMJE recommends that authorship be based on the following four criteria. Underneath each criterion, it is detailed how all authors meet this. 1. Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work. TF and MB were involved in the conception and design of the study. RL was involved in data collection. DY-HH and RL conducted the analysis with supervision from TF. DY-HH wrote all drafts of the manuscript with comments from TF, MB and RL. 2. Drafting the work or revising it critically for important intellectual content. All authors contributed important intellectual content that was incorporated into drafts of the manuscript. 3. Final approval of the version to be published. All authors have given final approval for this version to be published. 4. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors agree to be accountable for all aspects of the work.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by the University of Bath Psychology Research Ethics Committee (Code: 19-317). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. Data from this study is unable to be shared as participants did not consent to data sharing.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/.

ORCID iD

Daniel Ying-Heng Hua http://orcid.org/0000-0003-1942-4957

REFERENCES

1 American Psychiatric Association. *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Publishing, 2013.
2 Simonoff E, Jones CRG, Pickles A, *et al*. Severe mood problems in adolescents with autism spectrum disorder. *J Child Psychol Psychiatry* 2012;53:1157–66.
3 Wood JJ, Gadow KD. Exploring the nature and function of anxiety in youth with autism spectrum disorders. *Clin Psychol Sci Pract* 2010;17:281–92.
4 Khantzian EJ. The self-medication hypothesis of substance use disorders: a reconsideration and recent applications. *Harv Rev Psychiatry* 1997;4:231–44.
5 Butwicka A, Långström N, Larsson H, *et al*. Increased risk for substance use-related problems in autism spectrum disorders: a population-based cohort study. *J Autism Dev Disord* 2017;47:80–9.
6 De Alwis D, Agrawal A, Reiersen AM, *et al*. ADHD symptoms, autistic traits, and substance use and misuse in adult Australian twins. *J Stud Alcohol Drugs* 2014;75:211–21.
7 Clarke T, Tickle A, Gillott A. Substance use disorder in Asperger syndrome: an investigation into the development and maintenance of substance use disorder by individuals with a diagnosis of Asperger syndrome. *Int J Drug Policy* 2016;27:154–63.
8 Oei TP, Baldwin AR. Expectancy theory: a two-process model of alcohol use and abuse. *J Stud Alcohol* 1994;55:525–34.
9 Brosnan M, Adams S. The expectancies and motivations for heavy episodic drinking of alcohol in autistic adults. *Autism in Adulthood* 2020;2:317–24.
10 Besag FM. Epilepsy in patients with autism: links, risks and treatment challenges. *Neuropsychiatr Dis Treat* 2018;14:1–10.
11 Zafar RR, Schlag AK, Nutt DJ. Ending the pain of children with severe epilepsy? an audit of the impact of medical cannabis in 10 patients. *Drug Sci Policy Law* 2020;6:2050324520974487
12 Golan O, Baron-Cohen S, Hill JJ, *et al*. The "reading the mind in films" task: complex emotion recognition in adults with and without autism spectrum conditions. *Soc Neurosci* 2006;1:111–23.
13 Hindocha C, Freeman TP, Schafer G, *et al*. Acute effects of delta-9-tetrahydrocannabinol, cannabidiol and their combination on facial emotion recognition: a randomised, double-blind, placebo-controlled study in cannabis users. *Eur Neuropsychopharmacol* 2015;25:325–34.
14 Linge R, Jiménez-Sánchez L, Campa L, *et al*. Cannabidiol induces rapid-acting antidepressant-like effects and enhances cortical 5-HT/glutamate neurotransmission: role of 5-HT1A receptors. *Neuropharmacology* 2016;103:16–26.
15 Bruijnzeel AW, Qi X, Guzhva LV, *et al*. Behavioral characterization of the effects of cannabis smoke and anandamide in rats. *PLoS One* 2016;11:e0153327.
16 Cooper RE, Williams E, Seegobin S, *et al*. Cannabinoids in attention-deficit/hyperactivity disorder: a randomised-controlled trial. *Eur Neuropsychopharmacol* 2017;27:795–808.
17 Aran A, Harel M, Cassuto H, *et al*. Cannabinoid treatment for autism: a proof-of-concept randomized trial. *Mol Autism* 2021;12:1–11.

BMJ Open: first published as 10.1136/bmjopen-2021-053814 on 16 December 2021. Downloaded from http://bmjopen.bmj.com/ on November 11, 2024 by guest. Protected by copyright.

18 Fusar-Poli L, Cavone V, Tinacci S, *et al*. Cannabinoids for people with ASD: a systematic review of published and ongoing studies. *Brain Sci* 2020;10:572.
19 Eissa N, Al-Houqani M, Sadeq A, *et al*. Current enlightenment about etiology and pharmacological treatment of autism spectrum disorder. *Front Neurosci* 2018;12:304.
20 Narayanan S, Lazar Neto F, Tanco K, *et al*. Cannabidiol (CBD) oil, cancer, and symptom management: a Google trends analysis of public interest. *J Altern Complement Med* 2020;26:346–8.
21 Freeman TP, Hindocha C, Green SF, *et al*. Medicinal use of cannabis based products and cannabinoids. *BMJ* 2019;365:l1141.
22 Chesney E, Oliver D, Green A, *et al*. Adverse effects of cannabidiol: a systematic review and meta-analysis of randomized clinical trials. *Neuropsychopharmacology* 2020;45:1799–806.
23 CBD. *Expert Committee on drug dependence fortieth meeting. cannabidiol (CBD) critical review report*. Geneva, 2018.
24 Devinsky O, Patel AD, Thiele EA, *et al*. Randomized, dose-ranging safety trial of cannabidiol in Dravet syndrome. *Neurology* 2018;90:e1204–11.
25 Hazekamp A. The trouble with CBD oil. *Med Cannabis Cannabinoids* 2018;1:65–72.
26 Tallon MJ. *Cannabis sativa* L. and Its Extracts: Regulation of Cannabidiol in the European Union and United Kingdom. *J Diet Suppl* 2020;17:503–16.
27 Blanco C, Hasin DS, Wall MM, *et al*. Cannabis use and risk of psychiatric disorders: prospective evidence from a US national longitudinal study. *JAMA Psychiatry* 2016;73:388–95.
28 Gage SH, Hickman M, Zammit S. Association between cannabis and psychosis: epidemiologic evidence. *Biol Psychiatry* 2016;79:549–56.
29 D'Souza DC, Perry E, MacDougall L, *et al*. The psychotomimetic effects of intravenous delta-9-tetrahydrocannabinol in healthy individuals: implications for psychosis. *Neuropsychopharmacology* 2004;29:1558–72.
30 Sizoo B, van den Brink W, Koeter M, *et al*. Treatment seeking adults with autism or ADHD and co-morbid substance use disorder: prevalence, risk factors and functional disability. *Drug Alcohol Depend* 2010;107:44–50.
31 Sunwoo M, O'Connell J, Brown E, *et al*. Prevalence and outcomes of young people with concurrent autism spectrum disorder and first episode of psychosis. *Schizophr Res* 2020;216:310–5.
32 Adhia A, Bair-Merritt M, Broder-Fingert S, *et al*. The critical lack of data on alcohol and marijuana use by adolescents on the autism spectrum. *Autism in Adulthood* 2020;2:282–8.
33 Brosnan M. An exploratory study of a dimensional assessment of the diagnostic criteria for autism. *J Autism Dev Disord* 2020;50:4158–64.
34 Gossop M, Best D, Marsden J, *et al*. Test-retest reliability of the severity of dependence scale. *Addiction* 1997;92:353.
35 Swift W, Copeland J, Hall W. Choosing a diagnostic cut-off for cannabis dependence. *Addiction* 1998;93:1681–92.
36 Cuenca-Royo AM, Sánchez-Niubó A, Forero CG, *et al*. Psychometric properties of the CAST and SDS scales in young adult cannabis users. *Addict Behav* 2012;37:709–15.
37 Brown SA, Goldman MS, Inn A, *et al*. Expectations of reinforcement from alcohol: their domain and relation to drinking patterns. *J Consult Clin Psychol* 1980;48:419–26.
38 Austin PC. Some methods of propensity-score matching had superior performance to others: results of an empirical investigation and Monte Carlo simulations. *Biom J* 2009;51:171–84.
39 Baser O. Too much ado about propensity score models? comparing methods of propensity score matching. *Value Health* 2006;9:377–85.
40 Austin PC. A comparison of 12 algorithms for matching on the propensity score. *Stat Med* 2014;33:1057–69.
41 Caliendo M, Kopeinig S. Some practical guidance for the implementation of propensity score matching. *J Econ Surv* 2008;22:31–72.
42 Munafò MR, Davey Smith G, Smith GD. Robust research needs many lines of evidence. *Nature* 2018;553:399–401.
43 Wadsworth E, Hammond D. International differences in patterns of cannabis use among youth: prevalence, perceptions of harm, and driving under the influence in Canada, England & United States. *Addict Behav* 2019;90:171–5.
44 West EA, Travers JC, Kemper TD, *et al*. Racial and ethnic diversity of participants in research supporting evidence-based practices for learners with autism spectrum disorder. *J Spec Educ* 2016;50:151–63.
45 Martin-Willett R, Bidwell LC. Call to action for enhanced equity and inclusion in cannabis research. *Cannabis Cannabinoid Res* 2021;6:77–81.
46 Thornton LK, Baker AL, Lewin TJ, *et al*. Reasons for substance use among people with mental disorders. *Addict Behav* 2012;37:427–34.
47 Hides L, Lubman DI, Cosgrave EM, *et al*. Motives for substance use among young people seeking mental health treatment. *Early Interv Psychiatry* 2008;2:188–94.
48 Garey L, Olofsson H, Garza T. Directional effects of anxiety and depressive disorders with substance use: a review of recent prospective research. *Curr Addict Rep* 2020:1–12.
49 Hollocks MJ, Lerh JW, Magiati I, *et al*. Anxiety and depression in adults with autism spectrum disorder: a systematic review and meta-analysis. *Psychol Med* 2019;49:559–72.
50 Corroon J, Phillips JA. A cross-sectional study of cannabidiol users. *Cannabis Cannabinoid Res* 2018;3:152–61.
51 Shea LA, Leeds M, Bui D, *et al*. "Over-the-counter" cannabidiol (CBD) sold in the community pharmacy setting in Colorado. *Drugs Ther Perspect* 2020;36:573–82.
52 National Institute of Health and Care Excellence. Cannabis-based medicinal products, 2019. Available: https://www.nice.org.uk/guidance/ng144/resources/cannabisbased-medicinal-products-pdf-66141779817157 [Accessed 19 Mar 2021].
53 Autistica. The world after coronavirus, 2020. Available: https://www.autistica.org.uk/news/world-after-coronavirus [Accessed 19 Mar 2021].

BMJ Open: first published as 10.1136/bmjopen-2021-053814 on 16 December 2021. Downloaded from http://bmjopen.bmj.com/ on November 11, 2024 by guest. Protected by copyright.

SUPPLEMENTAL MATERIALS

Chi-square independence tests were used to assess associations between cannabinoid use and alcohol/tobacco use, within groups. Within control participants, tobacco use in the past 12 months was significantly associated with cannabis use in the past 12 months, $\chi_2(1) = 39.22$, $p < .001$, where 22 out of 31 cannabis users had also used tobacco. A Fisher's exact test due to low expected cell count also revealed tobacco use in the past 12 months to be associated with CBD use in the past 12 months, $p = .008$, where 6 out of 8 CBD users had not used tobacco. Within autistic participants, alcohol use in the past 12 months was significantly associated with CBD use in the past 12 months, $\chi_2(1) = 5.07$, $p = .024$, where 23 out of 25 CBD users had also used alcohol. Tobacco use in the past 12 months was also associated with cannabis use in the past 12 months in this group, $\chi_2(1) = 38.73$, $p < .001$, where 17 out of 19 cannabis users had also smoked tobacco. No other significant associations were found in either groups.

Table S1

Demographic and Clinical Information for Non-Propensity Score Matched Autistic and Control Participants

	ASD Diagnosis *n* (%)	Control *n* (%)	Comparison Test
Sample size	100	169	
Age			t(261) = -3.42, *p* = .001*
N	99	164	
M	37.58	30.37	
SD	14.79	17.52	
Range	18-71	16-91	
Gender			$\chi^2(2) = 21.78$, $p < .001$*
Female	52 (52.0)	130 (76.9)	
Male	41 (41.0)	38 (22.5)	
Non-binary	7 (7.0)	1 (0.6)	
Ethnicity			*p* < .001*[a]
White	94 (94.0)	129 (76.3)	
Asian or Asian British	1 (1.0)	24 (14.2)	
Mixed or Multiple Ethnic Groups	2 (2.0)	6 (3.5)	
Black, African, Caribbean or Black British	1 (1.0)	2 (1.2)	
Other Ethnic Group	1 (1.0)	4 (2.4)	
Omitted	1 (1.0)	4 (2.4)	
Highest education level			*p* = .085[a]
University degree	76 (76.0)	146 (86.4)	
A Levels	15 (15.0)	13 (7.7)	
GCSEs	7 (7.0)	7 (4.1)	
Below GCSE	2 (2.0)	1 (0.6)	
Omitted	0 (0.0)	2 (1.2)	
Employment			$\chi^2(2) = 6.90$, $p = .032$*
Full time	34 (34.0)	33 (19.5)	
Part time	18 (18.0)	33 (19.5)	
Unemployed	48 (48.0)	101 (60.0)	
Omitted	2 (2.0)	0 (0.0)	
Age of diagnosis			t(27.72) = -2.95, *p* = .006*
N	67	10	

M	31.42	22.80	
SD	16.16	6.828	
Range	3-63	17-36	
ASD			
Diagnosis	100 (100.0)	(100.0)	
No diagnosis	0 (0.0)	169 (0.0)	
ADHD			$p = .007$*[a]
Diagnosis	5 (5.0)	0 (0)	
No diagnosis	95 (95.0)	169 (100.0)	
OCD			$p = .001$*[a]
Diagnosis	10 (10.0)	2 (1.2)	
No diagnosis	90 (90.0)	167 (98.8)	
Anxiety			$\chi^2(1) = 77.07, p < .001$*
Diagnosis	55 (55.0)	12 (7.1)	
No diagnosis	45 (45.0)	157 (92.9)	
Depression			$\chi^2(1) = 71.88, p < .001$*
Diagnosis	59 (59.0)	18 (10.7)	
No diagnosis	41 (41.0)	151 (89.3)	
Panic			$\chi^2(1) = 20.26, p < .001$*
Diagnosis	15 (15.0)	2 (1.2)	
No diagnosis	85 (85.0)	167 (98.8)	
PTSD			$p < .001$*[a]
Diagnosis	10 (10.0)	1 (0.6)	
No diagnosis	90 (90.0)	168 (99.4)	
Intellectual Disability			$p = .430$[a]
Diagnosis	4 (4.0)	3 (1.8)	
No diagnosis	96 (96.0)	166 (98.2)	
Psychosis			N/A
Diagnosis	0 (0.0)	0 (0.0)	
No diagnosis	100 (100.0)	169 (100.0)	
Other			$\chi^2(1) = 18.18, p < .001$*
Diagnosis	18 (18.0)	5 (3.0)	
No diagnosis	82 (82.0)	164 (97.0)	

Note. ASD = Autism spectrum disorder. A Levels = Advanced levels (further education qualification). GCSE = General certificate of secondary education (further education qualification). ADHD = Attention deficit hyperactivity disorder. OCD = Obsessive compulsive disorder. PTSD = Post-traumatic stress disorder. N/A = Not applicable.

[a]Fisher's exact test used due to low expected cell count.

*$p < .05$

Table S2

Prevalence and Frequency of Substance Use and Severity of Dependence, among Non-Matched Autistic and Control Participants

	ASD Diagnosis	Control	Comparison Test
	Number of participants endorsing substance use in past 12 months (%)		
Alcohol	75 (75.0)	146 (86.4)	$\chi^2(1) = 5.56$, $p = .018$* $n_1 = 100$, $n_2 = 169$ OR = 0.47 (0.25-0.89)
Tobacco	30 (30.0)	36 (21.3)	$\chi^2(1) = 2.57$, $p = .109$ $n_1 = 100$, $n_2 = 169$ OR = 1.58 (0.90-2.78)
Cannabis	27 (27.0)	43 (25.4)	$\chi^2(1) = 0.08$, $p = .779$ $n_1 = 100$, $n_2 = 169$ OR = 1.08 (0.62-1.90)
CBD	30 (30.0)	20 (11.8)	$\chi^2(1) = 13.70$, $p < .001$* $n_1 = 100$, $n_2 = 169$ OR = 3.19 (1.70-6.01)
	Mean number of days used in last 12 months (*SD*)		
Cannabis	38.89 (98.68)	19.24 (66.53)	$U = 8008.50$, $p = .467$ $n_1 = 100$, $n_2 = 167$ $r = -0.04$
CBD	37.05 (97.11)	11.65 (56.72)	$U = 6743.50$, $p < .001$* $n_1 = 100$, $n_2 = 167$ $r = -0.24$
	Mean score (*SD*)		
Severity of cannabis dependence	2.42 (3.15)	1.32 (2.21)	$U = 420.50$, $p = .301$ $n_1 = 24$, $n_2 = 41$ $r = -0.13$
Severity of CBD dependence	0.86 (2.37)	0.37 (0.83)	$U = 251.50$, $p = .672$ $n_1 = 28$, $n_2 = 19$ $r = -0.06$

Note. Participants were only provided the Severity of Dependence Scale for cannabis/CBD if they had indicated cannabis/CBD use in the past 12 months, respectively. Odds ratios (OR) are presented followed by 95% confidence intervals in parentheses. ASD = Autism spectrum disorder. CBD = Cannabidiol. n_1 = Sample size of autistic participants. n_2 = Sample size of control participants.

*$p < .05$

Table S3

Non-Grouped Expectancies of Cannabis Use among Matched Autistic and Control Participants

	Mean *S*core (*SD*)		Comparison Test
	ASD Diagnosis	Control	
Cannabis generally has positive effects on people (for example, makes a person feel good or happy; future seems brighter)	3.20 (1.12)	2.99 (1.06)	U = 2961.50, p = .171 n_1 = 83 , n_2 = 81 r = -0.11
Cannabis can help how well a person gets along with others (for example, makes people want to have fun together; makes people mean to others)	2.98 (1.20)	2.65 (1.09)	U = 2835.00, p = .071 n_1 = 83, n_2 = 81 r = -0.14
Cannabis helps people think better and helps coordination (for example, people understand thins better; can do things better)	1.94 (1.20)	1.54 (0.87)	U = 2623.50, p = .010* n_1 = 83 , n_2 = 80 r = -0.20
Cannabis improves sex (for example, more enjoyable; feel more romantic or sexual; makes it easier to have sex)	2.32 (1.28)	2.22 (1.17)	U = 3212.50, p = .708 n_1 = 82 , n_2 = 81 r = -0.03
Cannabis makes a person feel stronger and more powerful (for example, easier to fight, speak in front of others, stand up to others)	2.29 (1.10)	1.95 (1.11)	U = 2686.00, p = .019* n_1 = 83, n_2 = 81 r = -0.18
Cannabis helps a person relax, feel less tense, and can keep a person's mind off of mistakes (for example at school or work)	3.78 (1.15)	3.81 (1.15)	U = 3311.50, p = .863 n_1 = 83 , n_2 = 81 r = -0.01
Cannabis makes verbal communication easier (for example, starting conversations, responding to what other people say, or maintaining a normal back-and-forth conversation)	2.67 (1.21)	2.06 (1.05)	U = 2395.00, p = .001* n_1 = 83 , n_2 = 81 r = -0.26
Cannabis makes non-verbal communication easier (for example understanding gestures or facial expressions or making normal eye contact)	2.07 (1.13)	1.84 (1.07)	U = 2907.50, p = .143 n_1 = 82 , n_2 = 81 r = -0.11
Cannabis makes social relationships easier (for example, making or keeping friends)	2.52 (1.16)	2.27 (1.05)	U = 2936.50, p = .147 n_1 = 83 , n_2 = 81 r = -0.11

	Mean Score (*SD*)		Comparison Test
	ASD Diagnosis	Control	
Cannabis decreases people doing the same thing over and over again (for example, repeating the same words or repeating the same behaviour)	2.13 (1.16)	1.69 (0.93)	$U = 2606.00$, $p = .011$* $n_1 = 82$, $n_2 = 81$ $r = -0.20$
Cannabis makes it easier for people to be flexible (for example, coping better with unexpected changes)	2.83 (1.24)	2.40 (1.25)	$U = 2691.50$, $p = .023$* $n_1 = 83$, $n_2 = 81$ $r = -0.18$
Cannabis makes people less focussed on their own interests (for example, people are less likely to talk about something if other people do not share their interest)	2.18 (1.18)	2.21 (1.17)	$U = 3269.50$, $p = 858$ $n_1 = 82$, $n_2 = 81$ $r = -0.01$
Cannabis makes people less over-sensitive (for example, to sounds, lights, tastes, smells or textures)	2.53 (1.29)	2.21 (1.22)	$U = 2853.50$, $p = .109$ $n_1 = 83$, $n_2 = 80$ $r = -0.13$

Note. Scores represent the following: 1 = almost never/never, 2 = some of the time, 3 = about half of the time, 4 = most of the time, 5 = almost always/always. ASD = Autism spectrum disorder. *SD* = Standard deviation. n_1 = Sample size of autistic participants. n_2 = Sample size of control participants.

*$p < .05$

Table S4

Expectancies of Cannabis and CBD Use among Non-Matched Autistic and Control Participants

	Mean Score (*SD*)		Comparison Test
	ASD Diagnosis	Control	
Recreational drug use expectancies for cannabis	2.76 (0.81)	2.52 (0.70)	U = 6608.00, p = .014* n_1 = 99, n_2 = 163 r = -0.15
Autism-specific expectancies for cannabis	2.41 (0.94)	2.14 (0.71)	U = 6885.00, p = .046* n_1 = 99, n_2 = 163 r = -0.06
Cannabis is safe	3.00 (1.33)	2.84 (1.17)	U = 7637.50, p = 335 n_1 = 100, n_2 = 164 r = -0.06
Cannabis has medicinal properties	3.38 (1.17)	3.25 (1.14)	U = 7664.00, p = .403 n_1 = 100, n_2 = 163 r = -0.05
Recreational drug use expectancies for CBD	2.30 (1.00)	2.61 (0.88)	U = 6216.00, p = .007* n_1 = 99, n_2 = 157 r = -0.17
Autism-related expectancies for CBD	2.09 (1.00)	2.34 (0.92)	U = 6394.00, p = .017* n_1 = 99, n_2 = 157 r = -0.12
CBD is safe	3.76 (1.29)	3.62 (1.15)	U = 7110.50, p = .204 n_1 = 99, n_2 = 158 r = -0.08
CBD has medicinal properties	3.34 (1.33)	3.68 (1.21)	U = 6617.00, p = .044* n_1 = 98, n_2 = 158 r = -0.13

Note. Recreational drug use expectancies (e.g., 'Cannabis/CBD generally has positive effects on people') were grouped and the average score for each participant calculated. Autism-specific expectancies (e.g., 'Cannabis/CBD makes social relationships easier') were also grouped and the average score per participant calculated. Scores represent the following: 1 = almost never/never, 2 = some of the time, 3 = about half of the time, 4 = most of the time, 5 = almost always/always. ASD = Autism spectrum disorder. *SD* = Standard deviation. n_1 = Sample size of ASD diagnosis group. n_2 = Sample size of control group.

*$p < .05$

Table S5

Non-Grouped Expectancies of CBD Use among Matched Autistic and Control Participants

	Mean Score (*SD*)		Comparison Test
	ASD Diagnosis	Control	
CBD generally has positive effects on people (for example, makes a person feel good or happy; future seems brighter)	2.73 (1.41)	2.99 (1.12)	$U = 2773.00$, $p = .175$ $n_1 = 82$, $n_2 = 77$ $r = -0.11$
CBD can help how well a person gets along with others (for example, makes people want to have fun together; makes people mean to others)	2.24 (1.18)	2.52 (1.13)	$U = 2701.50$, $p = .105$ $n_1 = 82$, $n_2 = 77$ $r = -0.13$
CBD helps people think better and helps coordination (for example, people understand thins better; can do things better)	2.16 (1.17)	2.38 (1.12)	$U = 2758.00$, $p = .153$ $n_1 = 82$, $n_2 = 77$ $r = -0.11$
CBD improves sex (for example, more enjoyable; feel more romantic or sexual; makes it easier to have sex)	1.80 (1.07)	2.08 (1.04)	$U = 2632.50$, $p = .053$ $n_1 = 82$, $n_2 = 77$ $r = -0.15$
CBD makes a person feel stronger and more powerful (for example, easier to fight, speak in front of others, stand up to others)	1.88 (1.12)	2.32 (1.16)	$U = 2417.50$, $p = .007$* $n_1 = 82$, $n_2 = 77$ $r = -0.21$
CBD helps a person relax, feel less tense, and can keep a person's mind off of mistakes (for example at school or work)	2.87 (1.38)	3.23 (1.27)	$U = 2667.50$, $p = .084$ $n_1 = 82$, $n_2 = 77$ $r = -0.14$
CBD makes verbal communication easier (for example, starting conversations, responding to what other people say, or maintaining a normal back-and-forth conversation)	2.17 (1.21)	2.43 (1.14)	$U = 2719.50$, $p = .118$ $n_1 = 82$, $n_2 = 77$ $r = -0.12$
CBD makes non-verbal communication easier (for example understanding gestures or facial expressions or making normal eye contact)	1.93 (1.15)	2.18 (1.03)	$U = 2598.50$, $p = .057$ $n_1 = 82$, $n_2 = 76$ $r = -0.15$
CBD makes social relationships easier (for example, making or keeping friends)	2.13 (1.23)	2.38 (1.15)	$U = 2727.50$, $p = .124$ $n_1 = 82$, $n_2 = 77$ $r = -0.12$

	Mean Score (*SD*)		Comparison Test
	ASD Diagnosis	Control	
CBD decreases people doing the same thing over and over again (for example, repeating the same words or repeating the same behaviour)	2.05 (1.07)	2.30 (1.18)	$U = 2797.50$, $p = .196$ $n_1 = 82$, $n_2 = 77$ $r = -0.10$
CBD makes it easier for people to be flexible (for example, coping better with unexpected changes)	2.23 (1.15)	2.57 (1.25)	$U = 2677.50$, $p = .088$ $n_1 = 82$, $n_2 = 77$ $r = -0.14$
CBD makes people less focussed on their own interests (for example, people are less likely to talk about something if other people do not share their interest)	1.93 (1.00)	2.22 (1.10)	$U = 2690.50$, $p = .090$ $n_1 = 82$, $n_2 = 77$ $r = -0.13$
CBD makes people less over-sensitive (for example, to sounds, lights, tastes, smells or textures)	2.16 (1.13)	2.40 (1.24)	$U = 2829.00$, $p = .240$ $n_1 = 82$, $n_2 = 77$ $r = -0.09$

Note. Scores represent the following: 1 = almost never/never, 2 = some of the time, 3 = about half of the time, 4 = most of the time, 5 = almost always/always. CBD = Cannabidiol. ASD = Autism spectrum disorder. *SD* = Standard deviation. n_1 = Sample size of autistic participants. n_2 = Sample size of control participants.

*$p < .05$

Table S6

Perceptions of Accuracy Regarding Information about Cannabis and CBD, among Autistic and Control Participants

	Median Score		Comparison Test
	ASD Diagnosis	Control	
There is accurate information available to me about cannabis products	48.0	51.0	U = 2786.00, p = .159 n_1 = 82, n_2 = 78 r = -0.11
The constituents of cannabis products are accurately conveyed to the consumer	29.0	29.0	U = 2862.00, p = .732 n_1 = 81, n_2 = *73* r = -0.03
There is accurate information available to me about CBD products	40.0	49.0	U = 2637.00, p = .120 n_1 = 80, n_2 = 77 r = -0.12
There is accurate labelling of the constituents of CBD products	47.5	50.0	U = 2797.00, p = .328 n_1 = 82, n_2 = 75 r = -0.08

Note. Scores range from 0 being 'least agree' to 100 being 'most agree'. CBD = Cannabidiol. ASD = Autism spectrum disorder. n_1 = Sample size of ASD diagnosis group. n_2 = Sample size of control group.

Table S7

Perceived Trustworthiness of Sources for Cannabis and CBD Information, among Non-Matched Autistic and Control Participants

	Median Score		Comparison test
	ASD Diagnosis	Control	
Parents	19.0	33.0	$U = 5393.50$, $p = .016$* $n_1 = 89$, $n_2 = 149$ $r = -0.16$
Friends	37.50	42.0	$U = 6544.00$, $p = .216$ $n_1 = 92$, $n_2 = 157$ $r = -0.08$
News	25.0	41.0	$U = 5121.00$, $p < .001$* $n_1 = 93$, $n_2 = 157$ $r = -0.25$
Doctor	70.0	80.0	$U = 5393.50$, $p < .001$* $n_1 = 96$, $n_2 = 161$ $r = -0.25$
Scientific journals	80.0	86.0	$U = 7444.50$, $p = .293$ $n_1 = 99$, $n_2 = 163$ $r = -0.06$
Police	38.5	50.0	$U = 5348.50$, $p = .008$* $n_1 = 88$, $n_2 = 153$ $r = -0.17$
National Institute of Health and Care Excellence (NICE)	71.5	80.0	$U = 6037.50$, $p = .002$* $n_1 = 98$, $n_2 = 159$ $r = -0.19$

Note. Scores range from 0 being 'least trust' to 100 being 'most trust'. CBD = Cannabidiol. ASD = Autism spectrum disorder. n_1 = Sample size of ASD diagnosis group , n_2 = Sample size of control group

*$p < .05$

Table S8

Sources of Support for Cannabis/CBD Use among Autistic and Control Participants

	ASD Diagnosis *n* (%)	Control *n* (%)	Comparison Test
A family member	24 (28.9)	25 (30.9)	$\chi^2(1) = 0.74$, $p = .785$ $n_1 = 83$, $n_2 = 81$ OR = 0.91 (0.47-1.78)
A friend	28 (33.7)	37 (45.7)	$\chi^2(1) = 2.44$, $p = .118$ $n_1 = 83$, $n_2 = 81$ OR = 0.61 (0.32-1.14)
My doctor (GP)	47 (56.6)	46 (56.7)	$\chi^2(1) = 0.00$, $p = .983$ $n_1 = 83$, $n_2 = 81$ OR = 0.99 (0.54-1.84)
A local drugs service	29 (34.9)	25 (30.9)	$\chi^2(1) = 0.31$, $p = .579$ $n_1 = 83$, $n_2 = 81$ OR = 1.20 (0.63-2.31)
A self-help group	15 (18.1)	7 (8.6)	$\chi^2(1) = 3.14$, $p = .076$ $n_1 = 83$, $n_2 = 81$ OR = 2.33 (0.90-6.06)
Search online for information	47 (56.6)	45 (55.6)	$\chi^2(1) = 0.02$, $p = .890$ $n_1 = 83$, $n_2 = 81$ OR = 1.04 (0.56-1.94)
Other	2 (2.4)	2 (2.5)	$\chi^2(1) = 0.00$, $p = .980$ $n_1 = 83$, $n_2 = 81$ OR = 0.98 (0.13-7.09)
I wouldn't seek help	11 (13.3)	4 (4.9)	$\chi^2(1) = 3.41$, $p = .065$ $n_1 = 83$, $n_2 = 81$ OR = 2.94 (0.90-9.65)

Note. Odds ratios (OR) are presented followed by 95% confidence intervals in parentheses. CBD = Cannabidiol. ASD = Autism spectrum disorder. GP = General practitioner. n_1 = Sample size of ASD diagnosis group , n_2 = Sample size of control group.

*$p < .05$

Table S9

Barriers to Seeking Support for Cannabis/CBD Use among Non-Matched Autistic and Control Participants

	ASD Diagnosis *n* (%)	Control *n* (%)	Comparison test
Fear of being judged for taking cannabis/CBD	52 (52.5)	118 (72.8)	χ^2 (1) = 11.17, p = .001* n_1 = 99, n_2 = 162 OR = 0.41 (0.24-0.70)
Fear of legal consequences	64 (64.6)	128 (79.0)	χ^2 (1) = 6.52, p = .011* n_1 = 99, n_2 = 162 OR = 0.49 (0.28-0.85)
Worrying they won't understand me	47 (47.5)	50 (30.9)	χ^2 (1) = 7.26, p = .007* n_1 = 99, n_2 = 162 OR = 2.03 (1.21-3.39)
Going somewhere unfamiliar	56 (56.6)	47 (29.0)	χ^2 (1) = 19.53, p < .001* n_1 = 99, n_2 = 162 OR = 3.19 (1.89-5.37)
Being in a crowded or chaotic place	51 (51.5)	21 (13.0)	χ^2 (1) = 45.72, p < .001* n_1 = 99, n_2 = 162 OR = 7.13 (3.90-13.06)
Other	10 (10.1)	11 (6.8)	χ^2 (1) = 0.91, p = .340 n_1 = 99, n_2 = 162 OR = 1.54 (0.63-3.78)

Note. Odds ratios (OR) are presented followed by 95% confidence intervals in parentheses. CBD = Cannabidiol. ASD = Autism spectrum disorder. n_1 = Sample size of autistic participants. n_2 = Sample size of control participants.

*p < .05

The online survey is as follows (output taken from Qualtrics):

cbd survey - RL

Start of Block: 1.2

Page Break

Q174 **Survey for people aged 16+ who do and do not consume cannabis and/or CBD products.** *Please scroll down the page to read the following information and click the red arrow at the bottom of the page to continue.* **Participant Information:** This is a survey for young people and adults to identify motivations for, and expectations of, taking cannabis and/or cannabidiol (CBD) products.

This survey will inform our understanding of why people do and do not choose to use cannabis and/or CBD products - both for people who are autistic and those who are not.

You are invited to complete this online questionnaire which may take about 15 minutes to finish.

The questionnaire concerns expectations about and motivations for using cannabis and/or CBD products. There are 14 questions which are answered on a 5-point rating scale. There are also questions about you (e.g. your age and sex) and whether or not you use cannabis and/or CBD products. It is designed to be completed by both people who do, and people who do not, use these products.

To take part you must be 16 years of age or older.

You do not have to take part and you can withdraw at any time before completion of the survey without having to give a reason for doing so.

If you do take part, all your data will be anonymous and cannot be linked to you in any way. Therefore, if you do submit your answers to the survey, you will not be able to withdraw your responses after that point. Your data will be confidential and securely stored. If you have any questions before taking part, please email: rhl32@bath.ac.uk. The Psychology Research Ethics Committee can be contacted via: psychology-ethics@bath.ac.uk.

When you are happy to proceed, please read and click the red arrow below.

Page Break

Q175 **Consent**

I confirm I am 16 years of age or older, and I have received enough information about this study to make an informed decision to take part. I am aware that I can withdraw at any time from the study without having to give a reason for doing so. I understand the data I provide will be anonymous and the University of Bath will use the data for research purposes.
PLEASE CLICK ONE OPTION BELOW:

- ○ I consent to take part in the survey (1)
- ○ I do not want to take part in this survey (2)

Skip To: End of Survey If Consent I confirm I am 16 years of age or older, and I have received enough information about thi... = I do not want to take part in this survey

Skip To: Q176 If Consent I confirm I am 16 years of age or older, and I have received enough information about thi... = I consent to take part in the survey

Page Break

Q176 **About you:** 1.1 Do you identify as:

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary (3)

Q177 1.2 How old are you?

_____

Q178 1.3 What is your ethnicity?

_____

Q179 1.4 Which City, Town or village do you live in?

_____

Q180 1.5 Did you take (or are you taking) GCSEs (or equivalent)?

- ○ Yes (1)
- ○ No (2)

Q181 1.6 Did you take (or are you taking) A-levels (or equivalent)?

- ○ Yes (1)
- ○ No (2)

Q182 1.7 Did you study (or are studying) for a university degree?

- ○ Yes (1)
- ○ No (2)

Q183 1.8 Do you currently have a job?

- ○ Yes (1)
- ○ No (2)

Skip To: Q184 If 1.8 Do you currently have a job? = Yes
Skip To: Q185 If 1.8 Do you currently have a job? = No

Page Break

Q184 1.8a Is your job:

- ○ Full time paid (1)
- ○ Full time voluntary (2)
- ○ Part-time paid (3)
- ○ Part time voluntary (4)

Q185 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any issues related to any clinical conditions (but do **NOT** have a formal clinical diagnosis from a qualified health professional).

Click all that apply: (Please note there is a 'none of the above' option at the bottom)

	Formal Diagnosis (from a qualified health professional) (1)	Related issues (but NOT a formal diagnosis) (2)
Autism (1)	☐	☐
ADHD (2)	☐	☐
OCD (3)	☐	☐
Anxiety (4)	☐	☐
Depression (5)	☐	☐
Panic Attacks (6)	☐	☐
Post Traumatic Stress (7)	☐	☐
Intellectual Disability (learning difficulties) (8)	☐	☐
Psychosis (11)	☐	☐
Other (please specify): (9)	☐	☐
None of the above (10)	☐	☐

Skip To: Q186 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = Autism [Formal Diagnosis (from a qualified health professional)]

Skip To: Q187 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = Autism [Related issues (but NOT a formal diagnosis)]

Skip To: Q187 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = ADHD [Related issues (but NOT a formal diagnosis)]

Skip To: Q187 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = OCD [Related issues (but NOT a formal diagnosis)]

Skip To: Q187 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = Anxiety [Related issues (but NOT a formal diagnosis)]

Skip To: Q187 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = Depression [Related issues (but NOT a formal diagnosis)]

Skip To: Q187 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = Post Traumatic Stress [Related issues (but NOT a formal diagnosis)]

Skip To: Q187 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = Panic Attacks [Related issues (but NOT a formal diagnosis)]

Skip To: Q187 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = Intellectual Disability (learning difficulties) [Related issues (but NOT a formal diagnosis)]

Skip To: Q187 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = Other (please specify): [Related issues (but NOT a formal diagnosis)]

Skip To: Q214 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = None of the above [Formal Diagnosis (from a qualified health professional)]

Skip To: Q214 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = None of the above [Related issues (but NOT a formal diagnosis)]

Skip To: Q186 If 1.9 Do you have a formal clinical diagnosis (i.e. from a qualified health professional) or any is... = Psychosis [Formal Diagnosis (from a qualified health professional)]

Page Break

Q186 1.9a At what age did you get your diagnosis (or diagnoses)?

_____

Q187 1.10 How often do you have difficulties with social communication and social interaction with other people? (For example, difficulties with normal back-and-forth social conversation, or making normal eye contact or making friends).

- Almost always/ in almost all situations (1)
- Mostly/ in most situations (2)
- Sometimes/ in some situations (3)
- Rarely/ in rare situations (4)
- Almost never/ in almost no situations (5)

Q188 1.11 How often do you have difficulties with restricted and repetitive patterns of behaviours, activities or interests? (For example, difficulties with repetitive movements, or insisting on sameness (or routines), or fixated and intense interests, or very high (or very low) sensitivity to the environment - such as light, sound or texture).

- Almost always/ in almost all situations (1)
- Mostly/ in most situations (2)
- Sometimes/ in some situations (3)
- Rarely/ in rare situations (4)
- Almost never/ in almost no situations (5)

Page Break

Q214 **2. EXPERIENCE WITH ALCOHOL AND TOBACCO**

Have you used either of these drugs in the last 12 months?

- ☐ Alcohol (1)
- ☐ Tobacco (2)
- ☐ Neither Alcohol or Tobacco (4)

Q189 **2.1 EXPERIENCE WITH CANNABIS AND/OR CBD PRODUCTS** By **cannabis products**, we mean dried herbal preparations from the cannabis plant *such as sinsemilla or 'skunk', compressed blocks of cannabis resin or hashish, or any other products containing the main intoxicating constituent of cannabis: delta-9-tetrahydrocannabinol (THC). For example, edible products containing THC, or vaporisers containing THC.*

*By **CBD products**, we mean products containing cannabidiol (CBD) rather than THC. CBD comes from the cannabis plant but it unlike THC, CBD is not intoxicating and people often use it for different reasons. CBD products are widely available in health food shops and online. These include* oils, tinctures, tablets, foods or drinks.

2.1 Which of the following products have you taken in the past 12 months? (please select all that apply):

- ☐ Cannabis products (1)
- ☐ CBD products (17)
- ☐ Neither (26)

Skip To: End of Block If 2.1 EXPERIENCE WITH CANNABIS AND/OR CBD PRODUCTS By cannabis products, we mean dried herbal pre... = Neither

Page Break

Q200 2.2 How often have you taken *cannabis products* in the last 12 months?
Remember, b*y cannabis products, we mean dried herbal preparations from the cannabis plant* such as sinsemilla or 'skunk', compressed blocks of cannabis resin or hashish, or any other products containing the main intoxicating constituent of cannabis: delta-9-tetrahydrocannabinol (THC). For example, edible products containing THC, or vaporisers containing THC. Tick the most accurate one only

- ○ Almost every day (1)
- ○ Five or six days a week (2)
- ○ Three or four days a week (3)
- ○ Once or twice a week (4)
- ○ Once or twice a month (5)
- ○ Once every couple of months (6)
- ○ Once or twice a year (7)
- ○ Not in the last year (8)

Skip To: Q201 If 2.2 How often have you taken cannabis products in the last 12 months? Remember, by cannabis produ... = Not in the last year

Q209 2.3 Please answer the following questions in relation to your use of cannabis products during the past year:

Remember, by cannabis products, we mean dried herbal preparations from the cannabis plant such as sinsemilla or 'skunk', compressed blocks of cannabis resin or hashish, or any other products containing the main intoxicating constituent of cannabis: delta-9-

tetrahydrocannabinol (THC). For example, edible products containing THC, or vaporisers containing THC.

	Never/almost never (1)	Sometimes (2)	Often (3)	Always/nearly always (4)
Did you think your use of cannabis was out of control? (1)	○	○	○	○
Did the prospect of missing a dose make you anxious or worried? (2)	○	○	○	○
Did you worry about your use of cannabis? (3)	○	○	○	○
Did you wish that you could stop? (4)	○	○	○	○

Q211 2.4 Please answer the following questions in relation to your use of cannabis products during the past year:

Remember, by cannabis products, we mean dried herbal preparations from the cannabis plant such as sinsemilla or 'skunk', compressed blocks of cannabis resin or hashish, or any other products containing the main intoxicating constituent of cannabis: delta-9-tetrahydrocannabinol (THC). For example, edible products containing THC, or vaporisers containing THC.

	Not difficult (1)	Quite difficult (2)	Very difficult (3)	Impossible (4)
How difficult would you find it to stop, or go without cannabis? (1)	○	○	○	○

Q201 2.5 How often have you taken *CBD products* in the the last 12 months?

Tick the most accurate one only

- ○ Almost every day (1)
- ○ Five or six days a week (2)
- ○ Three or four days a week (3)
- ○ Once or twice a week (4)
- ○ Once or twice a month (5)
- ○ Once every couple of months (6)
- ○ Once or twice a year (7)
- ○ Not in the last year (8)

Skip To: End of Block If 2.5 How often have you taken CBD products in the the last 12 months? Tick the most accurate one... = Not in the last year

Q212 2.6 Please answer the following questions in relation to your use of CBD products during the past year:

Remember, by CBD products*, we mean products containing cannabidiol (CBD) rather than THC. CBD comes from the cannabis plant but it unlike THC, CBD is not intoxicating and people often use it for different reasons. CBD products are widely* available in health food shops and online. These include *oils, tinctures, tablets, foods or drinks.*

	Never/almost never (1)	Sometimes (2)	Often (3)	Always/nearly always (4)
Did you think your use of CBD was out of control? (1)	○	○	○	○
Did the prospect of missing a dose make you anxious or worried? (2)	○	○	○	○
Did you worry about your use of CBD? (3)	○	○	○	○
Did you wish that you could stop? (4)	○	○	○	○

Q213 2.7 Please answer the following questions in relation to your use of CBD products during the past year:

Remember, b*y* CBD products*, we mean products containing cannabidiol (CBD) rather than THC. CBD comes from the cannabis plant but it unlike THC, CBD is not intoxicating and people often use it for different reasons. CBD products are widely* available in health food shops and online. These include oils, tinctures, tablets, foods or drinks.

	Not difficult (1)	Quite difficult (2)	Very difficult (3)	Impossible (4)
How difficult would you find it to stop, or go without CBD? (1)	○	○	○	○

End of Block: 1.2

Start of Block: 2

Page Break

Page Break

Q80 **3. YOUR EXPECTATIONS ABOUT CANNABIS PRODUCTS** 3.1 The following contains statements about the effects of cannabis products. Answer each statement according to your own personal thoughts, feelings, and beliefs. We're interested in what you think about cannabis, not what others might think. **You should answer these questions whether you have used cannabis products or not.**

Remember, by cannabis products, we mean dried herbal preparations from the cannabis plant such as sinsemilla or 'skunk', compressed blocks of cannabis resin or hashish, or any other products containing the main intoxicating constituent of cannabis: delta-9-

tetrahydrocannabinol (THC). For example, edible products containing THC, or vaporisers containing THC.

	1 almost never/never (1)	2 some of the time (2)	3 about half of the time (3)	4 most of the time (4)	5 almost always/always (5)
Cannabis generally has positive effects on people (for example, makes a person feel good or happy; future seems brighter). (4)	○	○	○	○	○
Cannabis can help how well a person gets along with others (for example, makes people want to have fun together; makes people mean to others). (5)	○	○	○	○	○
Cannabis helps people think better and helps coordination (for example, people understand things better; can do things better). (6)	○	○	○	○	○
Cannabis improves sex (for example, more enjoyable; feel more romantic or sexual; makes it easier to have sex). (7)	○	○	○	○	○

Cannabis makes a person feel stronger and more powerful (for example, easier to fight, speak in front of others, stand up to others). (9)	○	○	○	○	○
Cannabis helps a person relax, feel less tense, and can keep a person's mind off of mistakes (for example at school or work). (10)	○	○	○	○	○
Cannabis makes verbal communication easier (for example, starting conversations, responding to what other people say, or maintaining a normal back-and-forth conversation). (11)	○	○	○	○	○
Cannabis makes non-verbal communication easier (for example understanding gestures or facial expressions or making normal eye contact). (12)	○	○	○	○	○
Cannabis makes social relationships easier (for example, making or keeping friends). (13)	○	○	○	○	○

Cannabis decreases people doing the same thing over and over again (for example, repeating the same words or repeating the same behaviour). (14)	○	○	○	○	○
Cannabis makes it easier for people to be flexible (for example, coping better with unexpected changes). (15)	○	○	○	○	○
Cannabis makes people less focussed on their own interests (for example, people are less likely to talk about something if other people do not share their interest). (16)	○	○	○	○	○
Cannabis makes people less over-sensitive (for example, to sounds, lights, tastes, smells or textures). (17)	○	○	○	○	○
Cannabis has medicinal properties (19)	○	○	○	○	○
Cannabis is safe (20)	○	○	○	○	○

Q202 **3. YOUR EXPECTATIONS ABOUT CBD PRODUCTS** 3.1 The following contains statements about the effects of cannabis products. Answer each statement according to your own personal thoughts, feelings, and beliefs. We're interested in what you think about cannabis, not what others might think. **You should answer these questions whether you have used CBD products or not.**

Remember, by CBD products, we mean products containing cannabidiol (CBD) rather than THC. CBD comes from the cannabis plant but it unlike THC, CBD is not intoxicating and

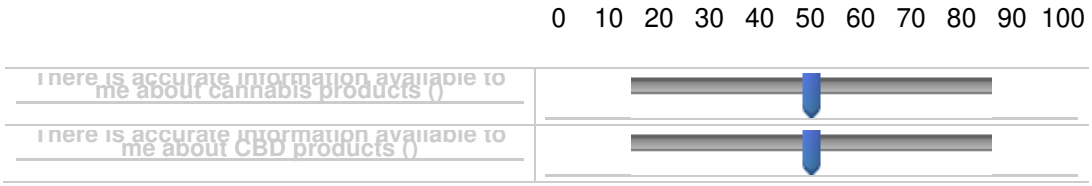
people often use it for different reasons. CBD products are widely available in health food shops and online. These include *oils, tinctures, tablets, foods or drinks.*

	1 almost never/never (1)	2 some of the time (2)	3 about half of the time (3)	4 most of the time (4)	5 almost always/always (5)
CBD generally has positive effects on people (for example, makes a person feel good or happy; future seems brighter). (4)	○	○	○	○	○
CBD can help how well a person gets along with others (for example, makes people want to have fun together; makes people mean to others). (5)	○	○	○	○	○
CBD helps people think better and helps coordination (for example, people understand things better; can do things better). (6)	○	○	○	○	○
CBD improves sex (for example, more enjoyable; feel more romantic or sexual; makes it easier to have sex). (7)	○	○	○	○	○
CBD makes a person feel stronger and more powerful (for example, easier to fight, speak in front of others, stand up to others). (9)	○	○	○	○	○

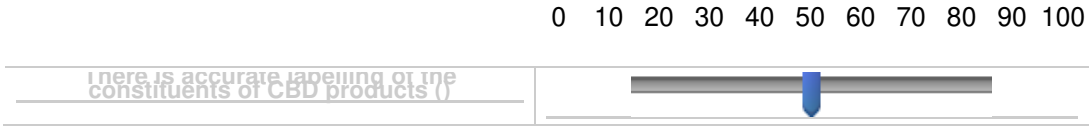
CBD helps a person relax, feel less tense, and can keep a person's mind off of mistakes (for example at school or work). (10)	○	○	○	○	○
CBD makes verbal communication easier (for example, starting conversations, responding to what other people say, or maintaining a normal back-and-forth conversation). (11)	○	○	○	○	○
CBD makes non-verbal communication easier (for example understanding gestures or facial expressions or making normal eye contact). (12)	○	○	○	○	○
CBD makes social relationships easier (for example, making or keeping friends). (13)	○	○	○	○	○

CBD decreases people doing the same thing over and over again (for example, repeating the same words or repeating the same behaviour). (14)	○	○	○	○	○
CBD makes it easier for people to be flexible (for example, coping better with unexpected changes). (15)	○	○	○	○	○
CBD makes people less focussed on their own interests (for example, people are less likely to talk about something if other people do not share their interest). (16)	○	○	○	○	○
CBD makes people less over-sensitive (for example, to sounds, lights, tastes, smells or textures). (17)	○	○	○	○	○
CBD has medicinal properties (19)	○	○	○	○	○
CBD is safe (20)	○	○	○	○	○

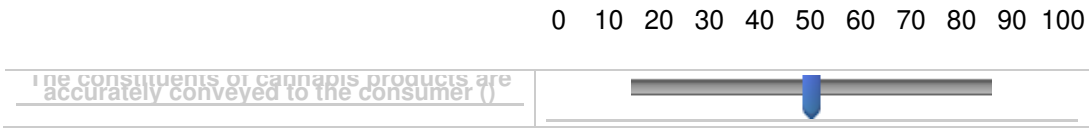
Q206 To what extent do you think that there is accurate information available to you about cannabis and/or CBD products? Please rate your agreement with each one from 0-100



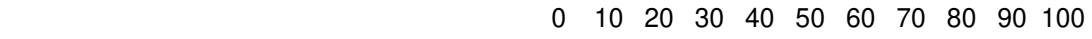
Q215 To what extent do you think the constituents of CBD products are accurately labelled? Please rate your agreement from 0-100

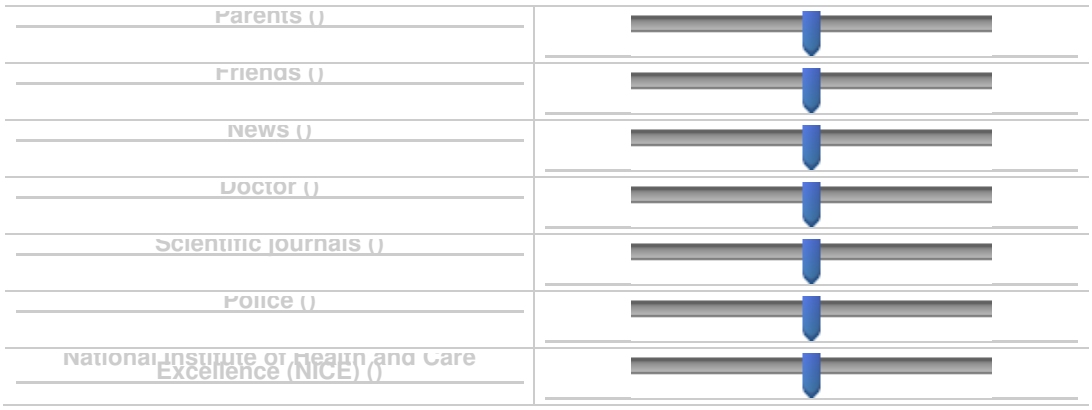


Q216 To what extent do you think the constituents of cannabis products are accurately conveyed to the consumer? Please rate your agreement
from 0 to 100



Q203 To what extent would you trust the following sources when finding out information about cannabis and/or CBD products? Please rate each one from 0-100





End of Block: 2

Start of Block: 5

Q226 **5 SUPPORT** 5.1 If you were worried you were taking too much cannabis or CBD, where would you go for help or advice? (Please click all that are true):

- ☐ A family member (1)
- ☐ A friend (8)
- ☐ My doctor (GP) (2)
- ☐ A local drugs service (3)
- ☐ A self-help group (4)
- ☐ Search online for information (5)
- ☐ Other…please say where (6) _____
- ☐ I wouldn't seek help (7)

Q227 5.2 If you were seeking help or advice about cannabis or CBD, which of the following do you think could put be a barrier to you: (Please click all that are true):

- ☐ Fear of being judged for taking cannabis / CBD (1)
- ☐ Fear of legal consequences (7)
- ☐ Worrying they won't understand me (2)
- ☐ Going somewhere unfamiliar (3)
- ☐ Being in a crowded or chaotic place (4)
- ☐ Other…please say what (6) _____

Page Break

Q229 Thank you for taking the time to complete the questionnaire. The questionnaire asked about expectations and motivations concerning taking cannabis and/or CBD products. We are interested in the views of both people who do, and people who do not, use these products. We will explore whether there are any autism-specific expectations or motivations for using these products through the questionnaire. This will help inform services, such as those dealing with cannabis related disorders, as well as cannabis-related medicines in the NHS, become more 'autism friendly'. If you think that you or a friend may have a problem with cannabis or CBD, further information is available from the following website: https://www.talktofrank.com/drug/cannabis Rachel Lees can be contacted via email: rhl32@bath.ac.uk and CAAR can be contacted via email: CAAR@bath.ac.uk. The Psychology Research Ethics Committee can be contacted via: psychology-ethics@bath.ac.uk **Thank you again for completing this questionnaire. Please click the red arrow below to finish.**

Page Break

End of Block: 5