

**Illicit Cannabis Use to Self-Treat Chronic Health Conditions:
A Cross-Sectional Study from the United Kingdom**

Original Paper

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Abstract

Background: In 2019, it was estimated that approximately 1.4 million adults in the United Kingdom (UK) purchase illicit cannabis to self-treat chronic physical and mental health conditions. This analysis was conducted following the rescheduling of cannabis-based medicinal products (CBMPs) in the UK, but before the first specialist clinics had started treating patients.

Objective: The aim of this study was to assess the prevalence of illicit cannabis consumption to treat a medically diagnosed condition, following the introduction of specialist clinics who could prescribe legal CBMPs in the UK.

Methods: Adults over the age of 18 in the UK were invited to participate in a cross-sectional survey through YouGov® between 22nd and 29th September 2022. A series of questions were asked about respondents' medical diagnoses, illicit cannabis use, cost of purchasing illicit cannabis per month, and basic demographics. The responding sample was weighted to generate a sample representative of the adult population of the UK. Modelling of population size was conducted based on an adult (≥ 18 years) population of 53,369,083 according to 2021 national census data.

Results: There were 10,965 respondents to the questionnaire, to which weighting was applied. 5,700 (51.98%) respondents indicated that they were affected by a chronic health condition. The most reported condition was anxiety ($n = 1588$; 14.48%). Of those suffering with health conditions, 364 (6.38%) purchased illicit cannabis to self-treat health conditions. Based on survey responses, it was modelled that 1,770,627 (95% confidence interval: 1,073,791–2,467,001) individuals consume illicit cannabis for health conditions across the United Kingdom. On multivariable logistic regression, the following were associated with increased likelihood of reporting illicit cannabis use for health reasons: chronic pain, fibromyalgia, post-traumatic stress disorder, multiple sclerosis, other mental health disorders, male gender, younger age, living in London, being unemployed or not working for other reasons, and working part-time ($p < 0.050$).

Conclusions: This study highlights the scale of illicit cannabis use for health reasons in the UK and the potential barriers to accessing legally prescribed CBMPs. This is an important step in developing harm reduction policies to transition these individuals, where appropriate, to CBMPs. Such policies are particularly important considering the potential risks from harmful contaminants of illicit cannabis and self-treating a medical condition without clinical oversight. Moreover, it emphasises the need for further funding of randomised controlled trials and the use of novel methodologies to determine the efficacy of CBMPs and their utility in common chronic conditions.

Trial Registration: N/A

Keywords: Cannabis; Chronic pain; Anxiety; Multiple Sclerosis; Post-traumatic stress disorder; Fibromyalgia

Introduction

In November 2018, the United Kingdom (UK) Home Office rescheduled cannabis-based medicinal products (CBMPs), allowing them to be initiated by consultant physicians on the General Medical Council's specialist register for individuals who failed to achieve sufficient benefit from licensed therapies [1]. This was in response to commentary provided by the then Chief Medical Officer to suggest that there was conclusive evidence of the medicinal value of CBMPs [1]. At the end of 2022 it was estimated that 32,000 patients were now being prescribed CBMPs [2]. The most common conditions for which they are now prescribed include chronic pain, anxiety, and fibromyalgia [3]. However, there are still several barriers to eligible patients accessing CBMPs, including cost, perceived stigmatisation, and a lack of high-quality randomised controlled trials [4-7]. Therefore, whilst there has been significant growth in the number of patients being prescribed CBMPs, this is surpassed by the most recent estimates of illicit cannabis use, including those who are using cannabis to self-treat diagnosed health conditions [8,9].

Cannabis is one of the most used drugs globally and the UK is among the top 10 highest consumers of cannabis in Europe [8,10-13]. The incidence of cannabis use in the UK is continuing to rise in line with other countries [8,10-14]. In March 2013, the past-year prevalence of illicit cannabis use was 6.3% [8]. It has since risen to 7.6% [8]. Whilst the perception of risk associated with cannabis is low and assessment of longitudinal registry data suggests CBMPs are largely well-tolerated [3,15-17], there are inherent personal and societal harms that may be associated with illicit cannabis use, even when intended for symptom management or control.

Illegal cannabis does not have to meet any regulatory standards to ensure consistency or absence of harmful contaminants. Several potentially pathogenic bacterial species have been identified on cannabis, including *Acinetobacter baumannii*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Clostridium botulinum* [18]. Moreover, several fungal species identified from dried cannabis flower, including *Penicillium spp.*, *Aspergillus spp.*, and *Fusarium spp.* commonly cause invasive infections in the immunocompromised [18]. The true incidence of adverse effects due to exposure to potential pathogens in illicit cannabis is not well

characterised. Case reports indicate that the greatest risk is risk to immunocompromised individuals or those with underlying lung disease [18]. Yet, there are reports of invasive infections secondary to contaminated illicit cannabis in otherwise healthy individuals [19,20]. Moreover, the use of tainted fertilisers or phosphate-heavy fertilisers can lead to heavy metal contamination, specifically cadmium and arsenic, at levels exceeding those which are considered safe [18]. Inappropriate use of pesticides may also expose individuals to harmful compounds, including carcinogens [21].

There are other risks associated with illicit cannabis use. Between 2010 and 2020 there were 162,000 convictions in English and Welsh courts where drug possession was the most significant offence [22]. Over-policing of drug possession disproportionately affects Black communities [22]. Beyond harms to the individual, illicit drug markets, including cannabis, actively contribute to the sustenance of organised crime groups and their exploitation of vulnerable individuals, including women, children, and refugees [23-26].

There is a paucity of high-quality randomised controlled trials to inform the evidence base on CBMPs [27,28]. Consequently, whilst there is promising evidence of its medicinal effects, this is currently insufficient to recommend their use on a population basis, except for a few specific indications for which there are licensed CBMPs [28,29]. There is therefore limited access to CBMPs in the UK. A cross-sectional, nationally representative survey on the prevalence of self-treating health conditions with illicit cannabis was conducted in October 2019 [9]. It estimated that 1.4 million individuals were consuming illicit cannabis for health reasons [9]. Whilst that analysis was conducted following the rescheduling of CBMPs, it was completed before the first clinic meeting regulatory standards, Curaleaf Clinic (formerly known as Sapphire Medical Clinics), began seeing patients [30]. Consequently, the impact of rescheduling of CBMPs will not be incorporated in that study's findings. Moreover, the report by Couch and colleagues has not undergone peer review [9]. This study therefore primarily aimed to assess the prevalence of cannabis use for health conditions, as the effect of access to CBMPs on illicit cannabis consumption is unknown. This study also aimed to assess which demographic factors are associated with an increased likelihood of consuming illicit cannabis for health reasons.

Methods

Study Design

A cross-sectional survey was administered to adults (aged ≥ 18 years old) residing in the UK between 22nd and 29th September 2022. The survey was distributed to a nationally representative sample by YouGov® (YouGov PLC, London, United Kingdom).

Participants were recruited utilising active sampling by YouGov® from a panel of more than 800,000 individuals [31]. This method was utilised to generate a nationally representative sample of UK adults

Ethical considerations

Participants provide YouGov® with consent to be contacted via email and participate in questionnaires. YouGov® is a member of the British Polling Council and the European Society for Opinion and Marketing Research. It is also registered with the Information Commissioner. Participants are rewarded for taking part in surveys by receiving points, which can be converted to financial compensation. As all data was anonymised, there was no need for participants to provide further consent, beyond the implicit consent by completing the survey. The survey was developed by the study authors and reviewed by YouGov® to ensure compliance with their Global Code of Ethics. The questionnaire was distributed on behalf of the authors by YouGov®. They were subsequently provided access to anonymised data following completion of the study period. Ethical approval was obtained from the University of the West of Scotland School of Education and Social Sciences Ethics Committee (reference: # 2024-21236-17820).

Study Overview

The survey was developed utilising the questionnaire developed previously in a report by Couch and colleagues [9]. This was to allow for direct comparison of prevalence between each analysis. Changes were made to the questionnaire, to account for the differences between October 2019 and September 2022 in access to specialist medical cannabis clinics who could prescribe CBMPs. Questions were delivered in series with branching logic applied between questions one and two, removing respondents who reported they did not

have any diagnosed health conditions. Branching logic was also applied between question two and the rest of the survey, removing participants who did not use illicit cannabis for their health condition or were not prepared to disclose their use. The questions are detailed in full in Table 1.

Table 1. Questionnaire and available responses administered to a nationally representative sample via YouGov® to adults (aged ≥ 18 years old) residing in the UK between 22nd and 29th September 2022.

Question	Answers
<p>For the following questions, please remember your answers will always be treated anonymously and will never be analysed individually...Which, if any, of the following health conditions have you been diagnosed with officially by a medical professional (e.g. a doctor, nurse etc.) as currently having? (Please select all that apply)</p>	Chronic pain
	Anxiety disorder
	Fibromyalgia
	Post-Traumatic Stress Disorder (PTSD)
	Multiple sclerosis (MS)
	Other mental health condition
	Other physical condition
	Other, not described
	Not applicable - I have not been diagnosed with any health condition
<p>For the following questions, when answering the question, please think only about the plant product cannabis (also known as marijuana) that you are not able to obtain from a specialist doctor.</p> <p>Please do not include cannabis derived products (like Cannabidiol or CBD) that you can legally obtain on the high street or internet, or those available on prescription from a specialist doctor...</p>	N/A

<p>As a reminder, please remember your answers will always be treated anonymously and will never be analysed individually.</p> <p>Thinking only about any use of cannabis to specifically manage your condition(s) mentioned in the previous question, or to treat any symptoms or side effects brought on by your prescribed treatment, please do not include using cannabis recreationally or for any other purpose...Do you currently use cannabis to help manage or treat any symptoms of your condition(s) or side effects of its treatment?</p>	Yes, I currently use cannabis to help manage or treat symptoms of my condition(s) or side effects brought on by treatment
	No, I do not currently use
	Don't know
	Prefer not to say
	£1 to £99
<p>Approximately, how much money would you say you personally spend on cannabis to manage or treat some symptoms or side effects brought on by the treatment of your condition(s), in an average month?</p>	£100 to £199
	£200 to £299
	£300 to £399
	£400 or above
	Don't know
	Not applicable - I do not spend any money
	Prefer not to say
<p>As a reminder, your answers will always be treated anonymously and will never be analysed individually.</p> <p>Which, if any, of the following are reasons why you obtain cannabis for your condition(s) in the way you currently do? (Please select all that apply. If any of your answers don't appear in the list below, please type them in the 'Other' box)</p>	I was not aware that it is available legally to manage/ treat some physical/ mental health conditions
	I presume obtaining it legally would be very difficult
	I presume obtaining it legally would be very expensive
	I want to manage/ treat my condition quickly

<p>For the following question, by 'medical cannabis', we mean any cannabis-based medicine prescribed by a GP/ specialist. Thinking about speaking to a GP or specialist about medical cannabis being used to manage/ treat your current physical/ mental health condition(s)...Which ONE, if any of the following statements BEST applies to you? (If you have spoken to a GP or specialist about medical cannabis more than once, please think about the most recent time)</p>	Other
	Don't know
	Prefer not to say
	We have discussed it in detail and explored it/ are exploring it further
	We have discussed it in detail and decided against it
	My GP/ specialist mentioned it in passing
	I mentioned it but my GP/ specialist advised against it
	I mentioned it to my GP/specialist but they knew nothing about it
	We have never discussed it
	None of these
Don't know/can't recall	
Prefer not to say	

GP – general practitioner; N/A – not applicable

In addition, the following demographic data was recorded: age, gender, geographical region, government region, working status, marital status, number of children in the household, parent or guardian status, and use of social media or messaging services in the last month. The social grade was also recorded as either ABC1 (middle class) or C2DE (working class or non-working individuals) as defined by National Readership Survey (NRS) social grade classifications [32].

Data Collection

In accordance with YouGov® active sampling methodology, participants were selected at random from the base sample of over 800,000 individuals. These emails are generic and do not alert the participant to the subject matter prior to engaging with the questions. The invitation link was active for this survey throughout the data collection period. This methodology, when used in conjunction with proportional weighting to a population matched sample has been shown to create a sample which is representative of the UK adult population [31]. This has been demonstrated in predicting public opinion on political and social issues [31].

Statistical Analysis

The responses to the questionnaire underwent proportional weighting to ensure they were representative of the target population, adult residents of the UK. Respondent number was subsequently rounded to the nearest integer. All other data is presented to two decimal places. The prevalence of each condition and reported illicit cannabis use was calculated and presented with 95% confidence intervals (CIs). All other responses are reported as frequencies. Modelling of population size was conducted based on an adult (≥ 18 years) population of 53,369,083 according to 2021 national census data. A univariable logistic regression was conducted to assess the association between condition and demographic variables and likelihood of reporting illicit cannabis use for health reasons. All variables with a statistically significant outcome were taken forward into a multivariable logistic regression analysis. There were reported as odds ratios (ORs) and 95% CIs. P-values < 0.050 were considered statistically significant. All statistical analysis was conducted using R version 4.3.1. Figures were created using the *ggplot2* package.

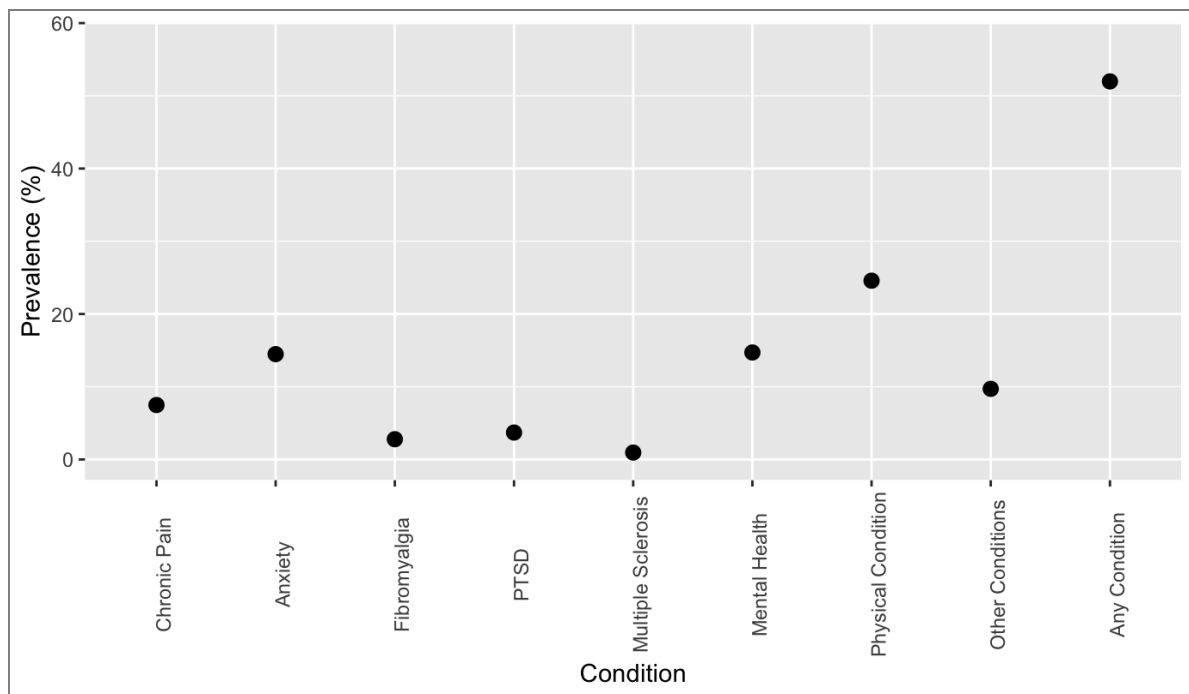
Results

There were 10,965 respondents to the questionnaire. After weighting was applied, 5,700 (51.98%) participants reported experiencing any diagnosed health conditions (Figure 1). The number of UK adults estimated to be affected by a diagnosed health condition was subsequently modelled as 27,741,361 (95% CI: 27,242,290-28,240,433) (Supplementary Table 1). The most reported diagnoses were the groups *Other physical condition* (24.58%; 95% CI:

23.77-25.39%) and *Other mental health condition* (14.71%; 95% CI: 14.05-15.37%). The most common specifically identified conditions were anxiety (14.48%; 95% CI: 13.82-15.14%) and chronic pain (7.48%; 95% CI: 6.99-7.98%).

3,072 (53.90%) participants with health conditions were female. The most common age category was 55+ (n = 2,656; 46.59%). The full demographics of the population with health conditions, with additional stratification according to individual condition is detailed in Supplementary Table 2.

Figure 1. Prevalence (%) of medical conditions diagnosed by a healthcare professional reported by respondents to a nationally representative survey.



Mental Health – Other mental health condition; Other Conditions – Other, not described; Physical Condition – Other physical condition; PTSD – post-traumatic stress disorder

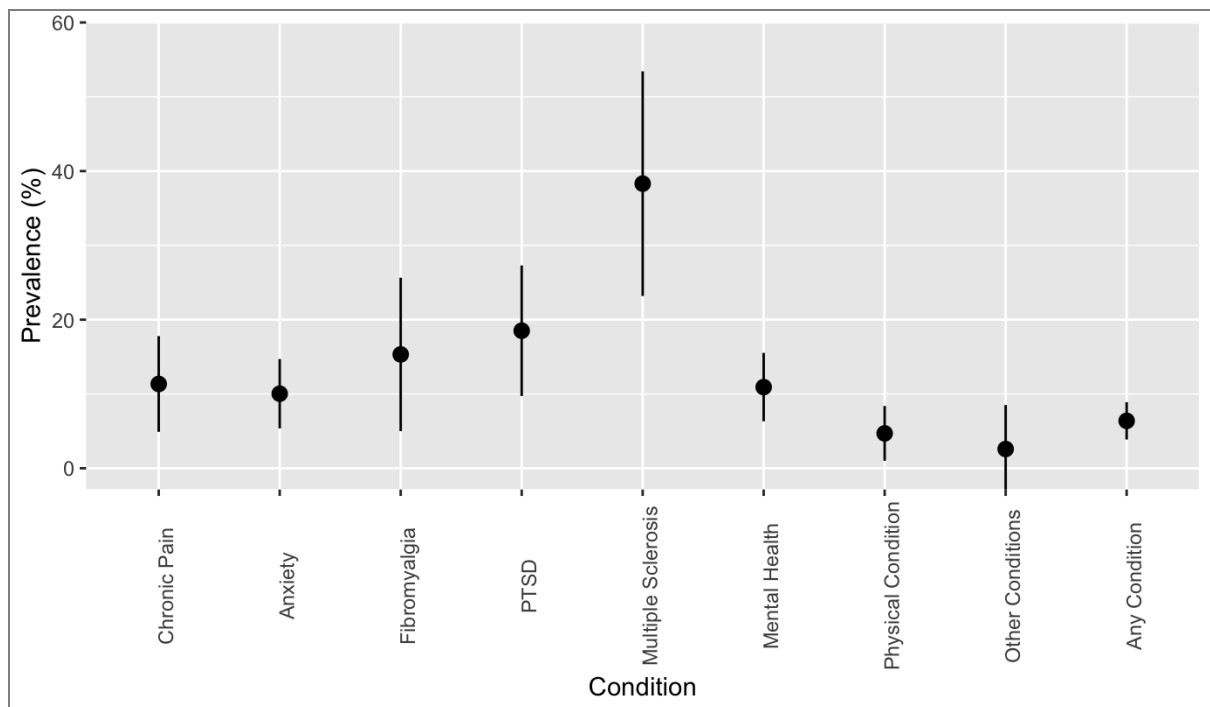
Reported Use of Illicit Cannabis for Health Conditions

Of the 5,700 participants who declared having one or more health conditions captured by this survey 364 (6.38%) reported using illicit cannabis specifically to manage the declared condition (Figure 2). The total population of UK adults who use illicit cannabis to manage health conditions was estimated as 1,770,627 (95% CI: 1,073,791-2,467,001) (Table 2). The

condition with the highest proportional prevalence of illicit cannabis use was multiple sclerosis (38.31%; 95% CI: 23.19-53.43%). The specific condition with the largest estimated population self-treating with illicit cannabis in the UK was anxiety (n = 775,782; 95% CI: 415,243-1,136,107).

201 (55.20%) participants who consumed illicit cannabis for this reason were male. The most common age category was 18-24 (n = 106; 29.15%). 175 (44.07%) participants were in full time or part employment. The full demographics of individuals who consume illicit cannabis for health reasons is contained within Supplementary Table 3.

Figure 2. Prevalence (%) of illicit cannabis consumption reported by respondents to a nationally representative survey for medical conditions diagnosed by a healthcare professional.



Mental Health – Other mental health condition; Other Conditions – Other, not described; Physical Condition – Other physical condition; PTSD – post-traumatic stress disorder

Table 2. Illicit cannabis consumption reported by survey respondents to self-treat medical conditions diagnosed by a healthcare professional.

Condition	Respondents (n)	Prevalence (95% CI)	UK Population Estimate (95% CI)
Chronic Pain	93	11.35% (4.91-17.79%)	453,255 (195,947-710,430)
Anxiety	159	10.04% (5.37-14.70%)	775,782 (415,243-1,136,107)
Fibromyalgia	47	15.32% (5.00-25.64%)	227,752 (74,355-381,077)
PTSD	75	18.51% (9.73-27.30%)	365,421 (191,994-538,747)
Multiple Sclerosis	40	38.31% (23.19-53.43%)	193,336 (117,038-269,583)
Other mental health condition	176	10.93% (6.32-15.53%)	857,760 (496,165-1,219,127)
Other physical condition	127	4.70% (1.01-8.38%)	616,088 (132,613-1,099,357)
Other, not described	28	2.59% (-3.34-8.52%)	134,184 (-173,035-441,321)
Any Condition	364	6.38% (3.87-8.89%)	1,770,627 (1,073,791-2,467,001)

CI – confidence interval; PTSD – post-traumatic stress disorder

Univariable logistic regression analysis identified that the presence of each condition, gender, age category, social grade, geographic region, reemployment status, marital status, and the number of children in the household were associated with the likelihood of consuming illicit cannabis for a diagnosed health condition ($p < 0.050$) (Table 3).

Table 3. Univariable logistic regression analysis of the relationship between independent variables and the likelihood of consuming illicit cannabis to self-manage a diagnosed health condition.

	n	Odds Ratio (95% Confidence Interval)	P-Value
Chronic Pain			
No	4921	Ref.	
Yes	839	2.17 (1.67-2.78)	<0.001
Anxiety			
No	4239	Ref.	
Yes	1521	2.12 (1.71-2.63)	<0.001
Fibromyalgia			
No	5461	Ref.	
Yes	299	2.88 (2.07-4.01)	<0.001
PTSD			
No	5372	Ref.	
Yes	388	3.92 (2.97-5.17)	<0.001
Multiple Sclerosis			
No	5666	Ref.	
Yes	94	10.04 (6.56-15.16)	<0.001
Other Mental Health Condition			
No	4205	Ref.	
Yes	1555	2.53 (2.04-3.14)	<0.001
Other Physical Condition			
No	2928	Ref.	
Yes	2832	0.57 (0.46-0.72)	<0.001
Other Condition, Not Described			
No	4642	Ref.	
Yes	1118	0.34 (0.23-0.50)	<0.001
Gender			
Female	3164	Ref.	
Male	2596	1.50 (1.21-1.85)	<0.001
Age			
18-24	405	Ref.	
25-34	701	0.60 (0.44-0.81)	<0.001
35-44	883	0.46 (0.33-0.62)	<0.001
45-54	850	0.25 (0.17-0.36)	<0.001
55+	2921	0.07 (0.05-0.10)	<0.001
Social Grade			
ABC1	3336	Ref.	
C2DE	2424	1.32 (1.07-1.63)	0.010

Region			
London	651	Ref.	
East Midlands	416	0.42 (0.25-0.70)	<0.001
East of England	498	0.42 (0.26-0.68)	<0.001
North East	237	0.57 (0.32-1.01)	0.054
North West	629	0.63 (0.43-0.93)	0.021
Northern Ireland	157	1.04 (0.60-1.81)	0.891
Scotland	513	0.52 (0.33-0.81)	0.004
South East	777	0.44 (0.29-0.66)	<0.001
South West	574	0.43 (0.28-0.68)	<0.001
Wales	297	0.70 (0.43-1.14)	0.152
West Midlands	494	0.43 (0.27-0.70)	<0.001
Yorkshire and the Humber	517	0.53 (0.35-0.83)	0.005
Employment Status			
Working full time	1963	Ref.	
Full time student	189	2.963 (1.992-4.408)	<0.001
Not working Other	681	2.089 (1.542-2.828)	<0.001
Retired	1887	0.248 (0.159-0.386)	<0.001
Unemployed	249	3.440 (2.394-4.943)	<0.001
Working part time	791	1.454 (1.056-2.000)	0.022
Marital Status			
Never Married	1477	Ref.	
Living as married	710	0.54 (0.39-0.76)	<0.001
Married/ Civil Partnership	2680	0.29 (0.23-0.38)	<0.001
Separated/ Divorced	598	0.43 (0.29-0.64)	<0.001
Widowed	295	0.19 (0.09-0.43)	<0.001
Children in Household			
No Children	4541	Ref.	
1 Child	572	1.53 (1.11-2.11)	0.01
2 Children	459	1.57 (1.10-2.23)	0.013
3+ Children	188	4.11 (2.84-5.93)	<0.001

ABC1 – middle class; C2DE – working class or not working; PTSD – post-traumatic stress disorder

Multivariable logistic regression analysis was conducted including variables that were statistically significant on univariable analysis. The following were identified as having an association with consuming illicit cannabis for a diagnosed health condition: chronic pain, fibromyalgia, post-traumatic stress disorder (PTSD), multiple sclerosis, other mental health conditions, gender, age category, geographic region, employment status, and number of children in household ($p < 0.050$) (Table 4).

Table 4. Multivariable logistic regression analysis of the relationship between independent variables and the likelihood of consuming illicit cannabis to self-manage a diagnosed health condition.

	n	Odds Ratio (95% Confidence Interval)	P-Value
Chronic Pain			
No	4921	Ref.	
Yes	839	2.01 (1.49-2.71)	<0.001
Anxiety			
No	4239	Ref.	
Yes	1521	1.00 (0.77-1.29)	0.99
Fibromyalgia			
No	5461	Ref.	
Yes	299	1.77 (1.19-2.65)	0.005
PTSD			
No	5372	Ref.	
Yes	388	2.43 (1.78-3.32)	<0.001
Multiple Sclerosis			
No	5666	Ref.	
Yes	94	7.47 (4.58-12.20)	<0.001
Other Mental Health Condition			
No	4205	Ref.	
Yes	1555	1.41 (1.10-1.81)	0.008
Other Physical Condition			
No	2928	Ref.	
Yes	2832	0.92 (0.71-1.20)	0.534
Other Condition, Not Described			
No	4642	Ref.	
Yes	1118	0.68 (0.44-1.05)	0.081
Gender			
Female	3164	Ref.	
Male	2596	1.86 (1.46-2.37)	<0.001
Age			
18-24	405	Ref.	
25-34	701	0.72 (0.50-1.03)	0.073
35-44	883	0.52 (0.36-0.76)	<0.001
45-54	850	0.27 (0.17-0.42)	<0.001
55+	2921	0.10 (0.06-0.17)	<0.001
Social Grade			
ABC1	3336	Ref.	
C2DE	2424	1.16 (0.90-1.50)	0.252
Region			
London	651	Ref.	

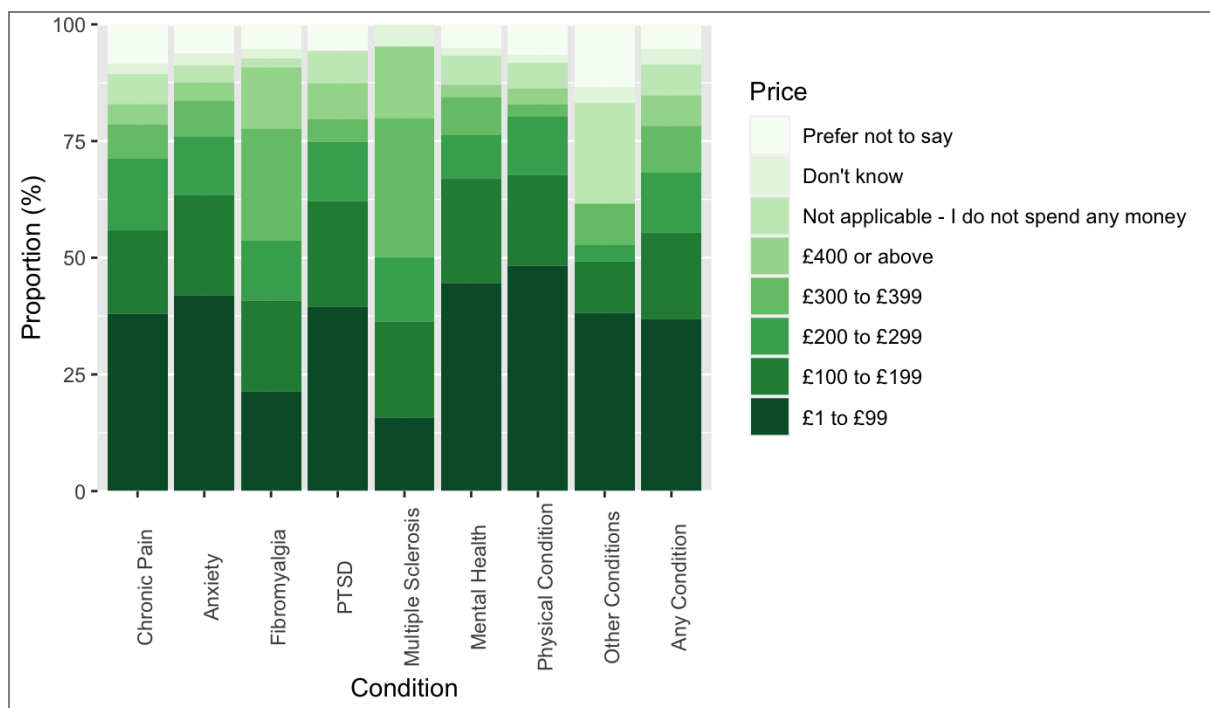
East Midlands	416	0.48 (0.28-0.85)	0.011
East of England	498	0.48 (0.29-0.80)	0.005
North East	237	0.57 (0.30-1.06)	0.076
North West	629	0.75 (0.48-1.15)	0.187
Northern Ireland	157	1.14 (0.62-2.10)	0.668
Scotland	513	0.51 (0.31-0.84)	0.008
South East	777	0.50 (0.29-0.70)	<0.001
South West	574	0.50 (0.31-0.83)	0.007
Wales	297	0.72 (0.42-1.25)	0.247
West Midlands	494	0.43 (0.26-0.72)	0.001
Yorkshire and the Humber	517	0.53 (0.33-0.87)	0.011
Employment Status			
Working full time	1963	Ref.	
Full time student	189	1.18 (0.74-1.91)	0.487
Not working Other	681	1.71 (1.19-2.45)	0.003
Retired	1887	1.08 (0.61-1.93)	0.787
Unemployed	249	2.26 (1.49-3.43)	<0.001
Working part time	791	1.82 (1.27-2.61)	0.001
Marital Status			
Never Married	1477	Ref.	
Living as married	710	0.80 (0.56-1.16)	0.244
Married/ Civil Partnership	2680	0.84 (0.60-1.16)	0.285
Separated/ Divorced	598	1.32 (0.83-2.10)	0.250
Widowed	295	0.97 (0.38-2.47)	0.945
Children in Household			
No Children	4541	Ref.	
1 Child	572	0.89 (0.62-1.27)	0.516
2 Children	459	0.88 (0.58-1.34)	0.565
3+ Children	188	1.61 (1.04-2.48)	0.031

ABC1 – middle class; C2DE – working class or not working; PTSD – post-traumatic stress disorder

Monthly Cost of Illicit Cannabis

The most common monthly cost category was £1 to £99 (n=134; 36.85%). However, 68 (18.69%), 47 (12.85%), 36 (9.88%), and 24 (6.59%) respondents spent reported costs of £100 to £199, £200 to £299, £300 to £399, or £400 or above respectively (Figure 3; Supplementary Table 4).

Figure 3. Proportional spend on illicit cannabis for a diagnosed health condition by respondents reported as a proportion of patients declaring illicit cannabis use to self-treat health conditions.

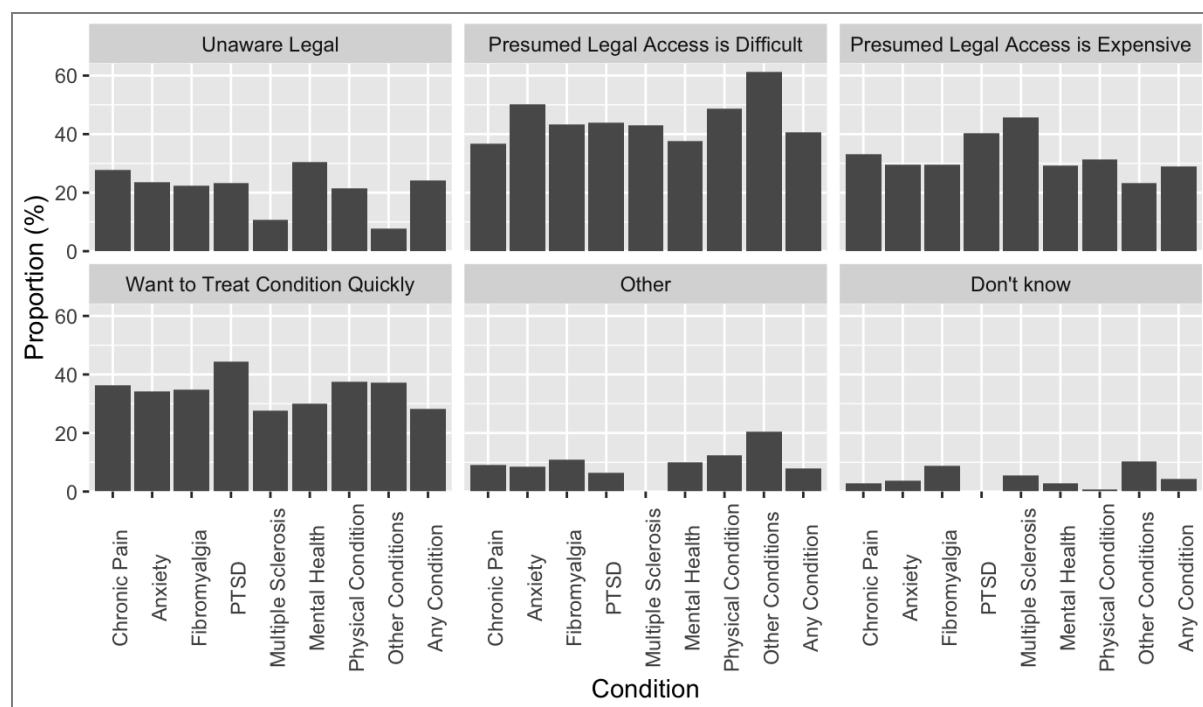


Mental Health – Other mental health condition; Other Conditions – Other, not described; Physical Condition – Other physical condition; PTSD – post-traumatic stress disorder

Reasons for Consuming Cannabis Illicitly

On questioning as to why the participants chose to consume cannabis illicitly, the most common response was that they presumed legal access was very difficult (n=148; 40.75%) (Figure 4; Supplementary Table 5). Participants could select more than one answer and other responses included that they presumed legal access was expensive (n=105; 28.87%), they wanted to treat their condition quickly (n=103; 28.35%), or that they were unaware it was legal (n=88; 24.15%).

Figure 4. Reasons why respondents consumed illicit cannabis to self-treat their health conditions reported as a proportion of patients declaring illicit cannabis use to self-treat health conditions.



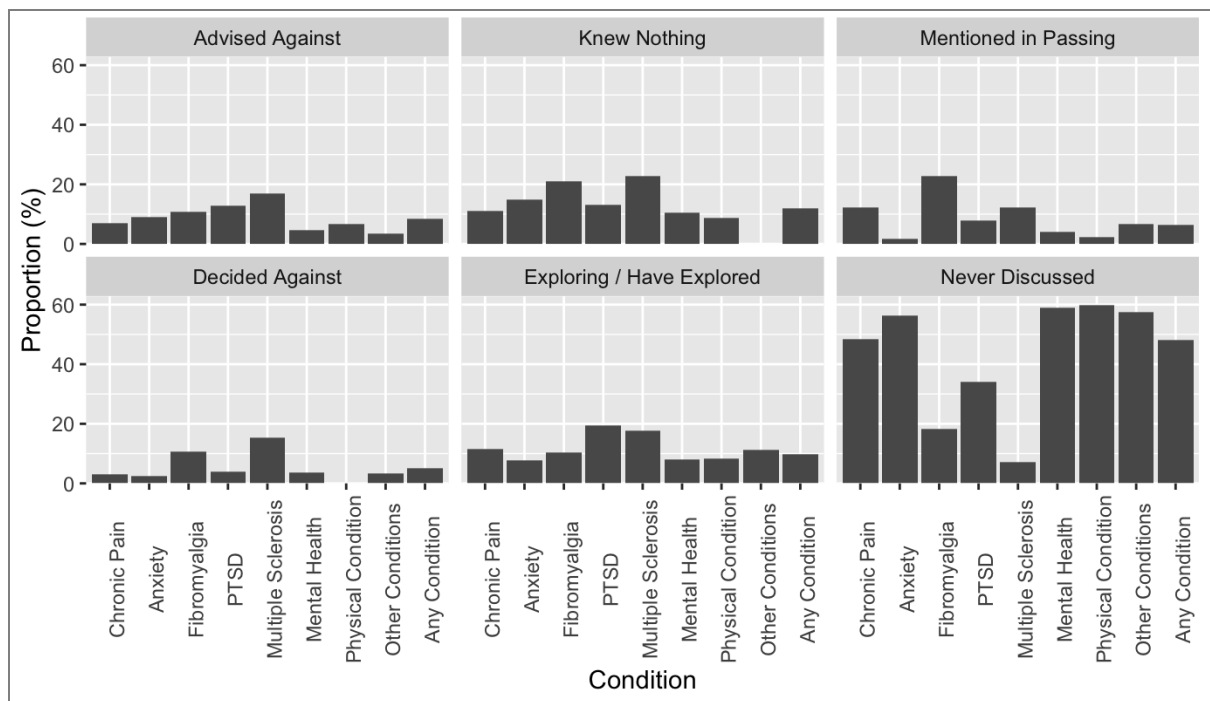
Mental Health – Other mental health condition; Other Conditions – Other, not described; Physical Condition – Other physical condition; PTSD – post-traumatic stress disorder

Discussion with Doctors

When asked to consider their discussions with either a general practitioner (GP) or specialist doctor, 48.11% (n=175) said they had never discussed it (Figure 5; Supplementary Table 6). 11.86% (n=43) of respondents said they had discussed CBMPs with either a GP or specialist doctor, but they knew nothing about them. Considering those participants who had

discussed it with their physician, 11.86% (n=43) said their doctor knew nothing about them, 9.71% (n=35) are exploring the option further or have explored it, 5.18% (n=19) decided against it in collaboration with their doctor, and 8.40% (n=31) were advised against CBMPs by their doctor.

Figure 5. Outcome of discussions with general practitioner or specialist regarding cannabis-based medicinal products reported as a proportion of patients declaring illicit cannabis use to self-treat health conditions.



Mental Health – Other mental health condition; Other Conditions – Other, not described; Physical Condition – Other physical condition; PTSD – post-traumatic stress disorder

Discussion

This nationally representative survey study estimates that 6.38% of individuals with a diagnosed health condition consume cannabis illicitly as a component of self-treating that health condition. Utilising census data this estimates that 1.77 million UK adults are using illicit cannabis for this reason. The health conditions with the strongest association for cannabis use on multivariate analysis were multiple sclerosis, chronic pain, and PTSD. The demographic factors with the strongest association with illicit cannabis use for health reasons included male gender, younger age categories, living in London, and being unemployed. The most common reported reason for using cannabis illicitly, rather than opting for legally prescribed CBMPs was due to presumed difficulties in accessing CBMPs. One in four illicit cannabis users were unaware that CBMPs had been rescheduled and could be legally prescribed in the UK. Moreover, almost half of respondents who used illicit cannabis in this way had never discussed whether CBMPs may be an option for them.

The most striking finding from this study is that a 1.77 million people were estimated to use illicit cannabis to treat their diagnosed health conditions based upon best available survey data. This is an increase from the only previous nationally representative study which has sought to quantify the population of UK adults who use illicit cannabis for this reason [9]. That report, which was conducted in 2019 but has not undergone peer review, before the introduction of specialist medical cannabis clinics, but after the rescheduling of CBMPs in the UK, estimated the figure to be 1.4 million [9]. Whilst this previous study did not present the 95% CIs for this estimate it is important to note that the lower bound of the figure derived in the present study is 1.07 million, which may therefore reflect that there has been no change. The difference could therefore simply represent natural variance in repeated surveying of similar populations. Whilst the present study utilised very similar methodology to the study conducted in 2019, there are some key differences, which may also be reflected in the modelled population estimate. The present study utilised terminology to capture individuals with any diagnosed health condition incorporating variables, such as *Other mental health condition*, *Other physical condition*, and *Other, not described*. The 2019 study, in comparison utilised a longer list of specific diagnoses, but could not be exhaustive due to limitations of a survey study, and did not utilise a catch-all term

[9]. Consequently, the prevalence of any diagnosed health condition was 51.98% in the present study, compared to 46.37% in the 2019 report [9]. Both figures are similar to the estimated prevalence derived from the UK sample of the European Health Interview Survey for 2019-2020 (48.06%) [33]. The 95% CIs of estimated illicit cannabis use for health reasons overlap between 2019 and 2022, suggesting there was no change to the overall proportion of people who consume cannabis. This is supported by a study by Waldron and colleagues which found perception of risk towards both CBMPs, and recreational cannabis is unchanged despite the rescheduling of CBMPs [34].

Considering the potential health and societal harms that may be associated with illicit cannabis [18-21,23-26], irrespective of potential medicinal value, it is important to consider policy interventions which may facilitate the transition of patients from illicit cannabis to legal CBMPs with clinical oversight. Despite rescheduling there may be many factors which mean participants continue to consume illicit cannabis. The study highlights a general lack of awareness of the rescheduling of CBMPs, with one in four participants being unaware of their legal status. Many participants also highlighted that they thought access to CBMPs may be difficult, expensive, or not appropriate to get timely treatment of their condition. Almost half of all individuals using illicit cannabis for self-treating their health condition had not talked about CBMPs with their GP or specialist. This may be reflective of the high levels of perceived stigma among medical cannabis patients [4]. One in five individuals reported that their doctor had either advised against CBMPs or did not know enough about these medications. This is supported by data from the Primary Care Cannabis Network which suggests 72% and 68% of GPs are concerned about the unlicensed nature of most CBMPs and lack of efficacy respectively [35]. There may be supplementary barriers to accessing CBMPs which are not assessed in the present study. Most care for individuals prescribed CBMPs is provided in the private sector [36,37]. The associated costs of this care may mean that it is not accessible to all. In addition, patients must meet national criteria for eligibility for CBMPs [38]. Therefore, patients who have not had a sufficient trial of licensed therapies will not be able to access CBMPs. Policy interventions, specifically targeted at overcoming these barriers to access may have positive implications with respect to harm reduction. Implementation of National Health Service (NHS) provisions to access CBMPs

and care for individuals who report positive impacts on their diagnosed health conditions from illicit cannabis, and otherwise meet relevant eligibility criteria [38], may have positive effects at an individual and population basis. Ultimately improved quality and quantity of clinical research will be required to truly address barriers to accessing CBMPs. At present there is insufficient evidence to support national prescribing via the NHS [29]. Research with CBMPs that demonstrates cost-effectiveness in appropriate conditions will help reduce financial barriers, increase healthcare practitioner education, and help reduce stigma.

This study highlights differences between groups which may influence their likelihood of self-treating their health conditions with illicit cannabis. Multiple sclerosis had the strongest association with illicit cannabis on multivariate logistic regression. Patients with multiple sclerosis were also more likely to report higher levels of expenditure on illicit cannabis. Multiple sclerosis was also the single condition that was most likely to be aware that CBMPs were available legally on prescription and to have discussed its use with a doctor. These findings may be secondary to awareness of nabiximols, a licensed CBMP for spasticity in adults with multiple sclerosis [29]. Whilst this may serve to increase awareness of CBMPs as a treatment class, nabiximols is only available in restricted settings [29]. Chronic pain is the most common reason why CBMPs are prescribed in the UK and is the most common indication for symptomatic treatment in multiple sclerosis, but nabiximols is not available in this setting [39].

Observational or real-world evidence has played a crucial role in advancing the field of cannabis science in the absence of a sufficient number of high-quality randomised controlled trials. In the UK, for example, the efficacy of CBMPs in treating rare, treatment-resistant forms of epilepsy in select individuals was an important factor in the rescheduling of CBMPs [1]. As this study uncovers, 1.77 million people in the UK are estimated to consume illicit cannabis for health reasons. This is observational evidence of the potential therapeutic value of CBMPs, but insufficient to support wider access to CBMPs for individuals who are cannabis naïve. It does, however, support the need for further funding for randomised controlled trials of CBMPs in conditions such as chronic pain and anxiety which are estimated in the present study to affect 3.99 and 7.73 million UK adults respectively.

Considering the inherent challenges in conducting randomised controlled trials with CBMPs [40], novel approaches to incorporating and analysing real-world evidence should also be considered. Large patient registries, such as the UK Medical Cannabis Registry, may be utilised in increasingly novel and innovative ways to further understand the clinical efficacy of CBMPs, beyond the preliminary data which has been published on chronic pain, anxiety, fibromyalgia, and PTSD so far [41-47].

Despite the utilisation of a sampling and weighting methodology to derive a nationally representative population, this study is subject to inherent limitations. Responses to the survey may be affected by a social desirability bias [48]. Whilst all responses were anonymous, it is still well-known that participants in research are more likely to provide responses which are deemed acceptable. This may therefore lead to a reduction in declared illicit cannabis use for health reasons. YouGov® utilises an online sampling methodology, which may inappropriately exclude individuals who cannot engage with digital technology. This may disproportionately affect certain members of society and therefore the representativeness of the survey [49]. Whilst the weighting of the survey is adjusted to account for this sampling bias, there may still be characteristics of those who lack digital inclusivity which are unable to be accounted for by statistical weighting. The weighting of YouGov data, also does not account for ethnicity or race and therefore information about this variable is not included in this analysis. Considering how over-policing of cannabis possession disproportionately affects Black communities [22], further information on ethnicity would have been beneficial. Another limitation is the self-reporting of conditions. Whilst efforts were made to word the first question appropriately to specifically ask about conditions diagnosed by an appropriately trained healthcare professional, without confirmation from a healthcare professional of the diagnostic accuracy it may lead to inappropriate recording of conditions. In addition, the study was limited to asking about five specific conditions, rather than having a more discrete list of other conditions which people may self-treat with illicit cannabis. Further conditions were not added due to cost-constraints. This limits the additional analysis that can be assessed, such as the more comprehensive list published by Ware and colleagues [50]. Whilst this reduces the granularity of available data, by including terms to capture any other medical conditions

this is likely to improve the accuracy of the estimated total population of UK adults who use illicit cannabis for health reasons.

In conclusion, this study estimates that 1.77 million UK adults are consuming illicit cannabis for the purpose of managing their health conditions based upon nationally representative survey data. This number has not materially changed since 2019, when it was estimated to be 1.4 million [9]. This is despite the introduction of specialist medical cannabis clinics, who provide clinical care to an estimated 32,000 individuals in the UK [2]. To address the potential public health and societal problems this creates, despite any therapeutic value derived from the illicit cannabis, it is important to prioritise policies which help reduce the barriers to accessing CBMPs. This is particularly important for the estimated 1.77 million UK adults who are consuming illicit cannabis for health reasons. Beyond this, it is important to prioritise funding and the adoption of novel research methodologies to establish the efficacy of CBMPs and the role they should play in the treatment of chronic health conditions for all individuals.

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Data Availability Statement

Raw data is available from the corresponding author (m.sodergren@imperial.ac.uk) upon reasonable request

Conflicts of Interest

Dr Simon Erridge is the Director of Research at Curaleaf Clinic. Dr Mikael Hans Sodergren is the Chief Medical Officer of Curaleaf International. There are no further conflicts of interest to declare.

References

- (1) Case P. The NICE guideline on medicinal Cannabis: keeping Pandora's box shut tight? *Medical law review*. 2020; 28 (2): 401-411.
- (2) Sinclair S. Number of legal cannabis patients in Europe grew by approximately 100,000 in 2022. <https://cannabishealthnews.co.uk/2022/12/12/number-of-legal-cannabis-patients-in-europe-grew-by-approximately-100000-in-2022/> [Accessed Feb 16, 2024].
- (3) Olsson F, Erridge S, Tait J, Holvey C, Coomber R, Beri S, et al. An observational study of safety and clinical outcome measures across patient groups in the United Kingdom Medical Cannabis Registry. *Expert Review of Clinical Pharmacology*. 2023; 16 (3): 257-266.
- (4) Troup LJ, Erridge S, Ciesluk B, Sodergren MH. Perceived stigma of patients undergoing treatment with cannabis-based medicinal products. *International Journal of Environmental Research and Public Health*. 2022; 19 (12): 7499.
- (5) Wilson HB, McGrath LM. "It's a big added stress on top of being so ill": The challenges facing people prescribed cannabis in the UK. *International Journal of Drug Policy*. 2023; 122 104220.
- (6) Nutt D, Bazire S, Phillips LD, Schlag AK. Communication: So near yet so far: why won't the UK prescribe medical cannabis? *BMJ open*. 2020; 10 (9): .
- (7) Schlag AK, Baldwin DS, Barnes M, Bazire S, Coathup R, Curran HV, et al. Medical cannabis in the UK: From principle to practice. *Journal of Psychopharmacology*. 2020; 34 (9): 931-937.
- (8) Office for National Statistics. *Drug misuse in England and Wales: year ending March 2023*. 2023.
- (9) Couch D. *Left behind: the scale of illegal cannabis use for medicinal intent in the UK*. <https://thecmcuk.org/wp-content/uploads/2022/02/Left-Behind012020.pdf> [Accessed Feb 16, 2024].
- (10) Azofeifa A, Mattson ME, Schauer G, McAfee T, Grant A, Lyerla R. National estimates of marijuana use and related indicators—National Survey on Drug Use and Health, United States, 2002–2014. *Morbidity and Mortality Weekly Report: Surveillance Summaries*. 2016; 65 (11): 1-25.
- (11) Kalayasiri R, Boonthae S. Trends of cannabis use and related harms before and after legalization for recreational purpose in a developing country in Asia. *BMC public health*. 2023; 23 (1): 1-11.

- (12) Manthey J, Freeman TP, Kilian C, López-Pelayo H, Rehm J. Public health monitoring of cannabis use in Europe: prevalence of use, cannabis potency, and treatment rates. *The Lancet Regional Health–Europe*. 2021; 10 .
- (13) Hasin D, Walsh C. Trends over time in adult cannabis use: a review of recent findings. *Current opinion in psychology*. 2021; 38 80-85.
- (14) Mills L, Arnold JC, Suraev A, Abelev SV, Zhou C, Arkell TR, et al. Medical cannabis use in Australia seven years after legalisation: findings from the online Cannabis as Medicine Survey 2022 (CAMS-22). *PLOS One*. 2024; <https://doi.org/10.1371/journal.pone.0297092>.
- (15) Parker MA, Anthony JC. A prospective study of newly incident cannabis use and cannabis risk perceptions: results from the United States Monitoring the Future study, 1976–2013. *Drug and alcohol dependence*. 2018; 187 351-357.
- (16) Pedersen W, Fjær EG, Gray P, Soest Tv. Perceptions of harms associated with tobacco, alcohol, and cannabis among students from the UK and Norway. *Contemporary Drug Problems*. 2016; 43 (1): 47-61.
- (17) Kvillemo P, Strandberg AK, Gripenberg J. Attitudes to cannabis use and public prevention information among young adults: a qualitative interview study with implications for prevention practice. *Frontiers in Public Health*. 2022; 10 830201.
- (18) McPartland JM, McKernan KJ. Contaminants of concern in cannabis: microbes, heavy metals and pesticides. *Cannabis sativa L.-Botany and Biotechnology*. 2017; 457-474.
- (19) Shapiro BB, Hedrick R, Vanle BC, Becker CA, Nguyen C, Underhill DM, et al. Cryptococcal meningitis in a daily cannabis smoker without evidence of immunodeficiency. *Case Reports*. 2018; 2018 bcr-221435.
- (20) Yataco AOC, Aragaki A. Invasive Neuroaspergillosis in an Immunocompetent Host. *Chest*. 2010; 138 (4): 108A.
- (21) Mikuriya TH, North W, Lucido F, Jaffee R, Weirick J. Cerebrospinal delayed allergic reaction to pesticide residue. *Conference proceedings, international association for Cannabis as medicine*. p. ; 2005.
- (22) Stevens A, Eastwood N, Douse K. In defence of the decriminalisation of drug possession in the UK. *Drug Science, Policy and Law*. 2024; 10 20503245241239200.
- (23) Robinson G, McLean R, Densley J. Working county lines: Child criminal exploitation and illicit drug dealing in Glasgow and Merseyside. *International Journal of Offender Therapy and Comparative Criminology*. 2019; 63 (5): 694-711.
- (24) O'Hagan A, Long A. The socioeconomic effects of organised crimes county lines on the United Kingdom community. *Forensic Research and Criminology International Journal*. 2019; 7 (5): 274-280.

- (25) Hopkins M, Keighley R, Sanders T. Organised Crime and the ecosystems of sexual exploitation in the United Kingdom: How supply and demand generate sexual exploitation and protection from prosecution. *Trends in Organized Crime*. 2023; 1-21.
- (26) Roman-Urrestarazu A, Yang J, Robertson R, McCallum A, Gray C, McKee M, et al. Brexit threatens the UK's ability to tackle illicit drugs and organised crime: What needs to happen now? *Health policy*. 2019; 123 (6): 521-525.
- (27) Fisher E, Moore RA, Fogarty AE, Finn DP, Finnerup NB, Gilron I, et al. Cannabinoids, cannabis, and cannabis-based medicine for pain management: a systematic review of randomised controlled trials. *Pain*. 2021; 162 S45-S66.
- (28) Solmi M, De Toffol M, Kim JY, Choi MJ, Stubbs B, Thompson T, et al. Balancing risks and benefits of cannabis use: umbrella review of meta-analyses of randomised controlled trials and observational studies. *bmj*. 2023; 382 e072348.
- (29) National Institute for Health and Care Excellence. *Cannabis-based medicinal products NICE guideline [NG144]*. <https://www.nice.org.uk/guidance/ng144> [Accessed Feb 16, 2024].
- (30) Boyd C. Hope for hundreds of families seeking medicinal cannabis in the UK as first private clinic in London is approved to dish out prescriptions. *Daily Mail*. Oct 4, 2019. <https://www.dailymail.co.uk/health/article-7537597/Medical-cannabis-available-prescription-private-clinic-London.html>. [Accessed Feb 16, 2024].
- (31) Twyman J. Getting it right: YouGov and online survey research in Britain. *Journal of Elections, Public Opinion and Parties*. 2008; 18 (4): 343-354.
- (32) Meier E, Moy C. Social classifications-a new beginning or less of the same? *Market Research Society*. 1999; 41 (2): 135-151.
- (33) Office for National Statistics. *UK health indicators: 2019 to 2020*. 2022.
- (34) Waldron J, Grabski M, Freeman TP, van Laar M, Curran HV. Impact of the introduction of medical cannabis in the UK on risk perception and recreational use of cannabis: A longitudinal and cross-sectional analysis. *Drug Science, Policy and Law*. 2023; 9 20503245231168392.
- (35) Barron L. *UK GP Attitudes Towards Medical Cannabis Survey 2021*. <https://www.ukmccs.org/wp-content/uploads/2023/03/Uk-GP-Attitudes-towards-medical-cannabis-2021-FINAL-June.pdf> [Accessed Mar 21, 2024].
- (36) Bruns C. *No government-funded medical cannabis clinical trials ongoing, two years since legalisation*. <https://pharmaceutical-journal.com/article/news/no-government-funded-medical-cannabis-clinical-trials-ongoing-two-years-since-legalisation> [Accessed Mar 12, 2024].

(37) Janković S. *No government-funded medical cannabis clinical trials ongoing, NIHR confirms.* <https://pharmaceutical-journal.com/article/news/no-government-funded-medical-cannabis-clinical-trials-ongoing-nihr-confirms> [Accessed Mar 12, 2024].

(38) Medicines & Healthcare products Regulatory Agency. *The supply, manufacture, importation and distribution of unlicensed cannabis-based products for medicinal use in humans 'specials'.* https://assets.publishing.service.gov.uk/media/5e58eefb86650c53a363f77c/Cannabis_Guidance_unlicensed_CBPMs_updated_2020.pdf [Accessed Feb 16, 2024].

(39) Erridge S, Sodergren MH, Weatherall MW. Medical cannabis in multiple sclerosis. *British Journal of Neuroscience Nursing.* 2022; 18 (Sup3): S28-S31.

(40) Banerjee R, Erridge S, Salazar O, Mangal N, Couch D, Pacchetti B, et al. Real world evidence in medical cannabis research. *Therapeutic innovation & regulatory science.* 2022; 56 8-14.

(41) Pillai M, Erridge S, Bapir L, Nicholas M, Dalavaye N, Holvey C, et al. Assessment of clinical outcomes in patients with post-traumatic stress disorder: analysis from the UK Medical Cannabis Registry. *Expert review of neurotherapeutics.* 2022; 22 (11-12): 1009-1018.

(42) Bapir L, Erridge S, Nicholas M, Pillai M, Dalavaye N, Holvey C, et al. Comparing the effects of medical cannabis for chronic pain patients with and without co-morbid anxiety: A cohort study. *Expert Review of Neurotherapeutics.* 2023; 23 (3): 281-295.

(43) Tait J, Erridge S, Holvey C, Coomber R, Usmani A, Sajad M, et al. Clinical outcome data of chronic pain patients treated with cannabis-based oils and dried flower from the UK Medical Cannabis Registry. *Expert Review of Neurotherapeutics.* 2023; 23 (4): 413-423.

(44) Wang C, Erridge S, Holvey C, Coomber R, Usmani A, Sajad M, et al. Assessment of clinical outcomes in patients with fibromyalgia: Analysis from the UK Medical Cannabis Registry. *Brain and Behavior.* 2023; e3072.

(45) Rifkin-Zybutz R, Erridge S, Holvey C, Coomber R, Gaffney J, Lawn W, et al. Clinical outcome data of anxiety patients treated with cannabis-based medicinal products in the United Kingdom: a cohort study from the UK Medical Cannabis Registry. *Psychopharmacology.* 2023; 1-11.

(46) Murphy M, Erridge S, Holvey C, Coomber R, Rucker JJ, Sodergren MH. A cohort study comparing the effects of medical cannabis for anxiety patients with and without comorbid sleep disturbance. *Neuropsychopharmacology Reports.* 2023; .

(47) Li A, Erridge S, Holvey C, Coomber R, Barros D, Bhoskar U, et al. UK Medical Cannabis Registry: a case series analyzing clinical outcomes of medical cannabis therapy for generalized anxiety disorder patients. *International clinical psychopharmacology.* 2024; 10.1097.

(48) Krumpal I. Determinants of social desirability bias in sensitive surveys: a literature review. *Quality & quantity*. 2013; 47 (4): 2025-2047.

(49) Hall AK, Bernhardt JM, Dodd V, Vollrath MW. The digital health divide: evaluating online health information access and use among older adults. *Health Education & Behavior*. 2015; 42 (2): 202-209.

(50) Ware MA, Adams H, Guy GW. The medicinal use of cannabis in the UK: results of a nationwide survey. *International journal of clinical practice*. 2005; 59 (3): 291-295.

Abbreviations

CBMP – cannabis-based medicinal product

CI – confidence interval

GP – general practitioner

NHS – National Health Service

OR – odds ratio

PTSD – post-traumatic stress disorder

UK – United Kingdom