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Cannabis use amongst individuals with CNS neuroinflammatory diseases

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Thesis

CANNABIS USE AMONGST INDIVIDUALS WITH CNS NEUROINFLAMMATORY DISEASES

by

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ABSTRACT

Patients with rare central nervous system (CNS) inflammatory diseases often endure heightened levels of pain unique to their conditions. Despite the availability of symptomatic treatments, many individuals with neuromyelitis optica spectrum disorder (NMOSD), myelin oligodendrocyte glycoprotein antibody disease (MOGAD), acute disseminated encephalomyelitis (ADEM), and transverse myelitis (TM) experience only partial relief with these therapies. The use of medicinal cannabis is widespread amongst patients with central nervous system neuroinflammatory disorders such as multiple sclerosis (MS). While extensive research has been published on cannabis use in the MS community, this topic has not been explored in the rarer neuroinflammatory conditions. Neurologists' clinical observations coupled with insights from patient advocacy groups and a dearth of published information have led to a range of usage patterns, dosing, reported adverse events, and motivations among these patient populations. This cross-sectional study sought to begin to bridge these gaps through a comprehensive survey. By employing an electronic census design using a REDcap software, participants with rare neuroinflammatory disease belonging to social media advocacy groups were invited to participate via email-based invitation. This study aims to elucidate the frequency, mode, and dosing of cannabis use; symptom targets; perceived efficacy; and adverse effects. With this data, the roles of healthcare providers in cannabis use, reasons for non-use or

discontinuation, and the relationship between recreational and medicinal use will be explored.

In summary, our findings show that out of 117 respondents, 57.3% of the population turns to cannabis for symptom relief. Of those that use cannabis, three of the most common symptoms being targeted included: neuropathic pain, insomnia and muscle spasticity. The most common methods of cannabis consumption were through ingestion (ex.edibles), inhalation, and or vaporization. Respondents frequently reported daily consumption and that it was a very effective outlet for pain management, anxiety, depression and sleep disturbances. Symptoms with little relief from cannabis included the following: tremor, overactive bladder, sexual dysfunction, migraines/headaches, eye pain and nausea. Survey respondents also reported that while some feel comfortable discussing cannabis use with physicians, others were not comfortable due to the belief that their physician is unlikely to have helpful knowledge or experience with cannabis use. With the rising popularity of cannabis use for symptomatic relief in neuroinflammatory conditions, these findings offer guidance to physicians and patients hoping to better understand this topic.

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LIST OF ABBREVIATIONS

ADEM..... Acute Disseminated Encephalomyelitis

AQP4-IgG..... Aquaporin-4 Immunoglobulin G

CBD .....Cannabidiol

CNS..... Central Nervous System

HIV ..... Human Immunodeficiency Virus

HTLV-1.....Human T-cell Leukemia Virus Type-1

IRB..... Institutional Review Boards

IVIG .....Intravenous Immunoglobulin

MGH .....Massachusetts General Hospital

MOG .....Myelin Oligodendrocyte Glycoprotein

MOGAD ..... Myelin Oligodendrocyte Glycoprotein Antibody Disease

MS.....Multiple Sclerosis

NARCOMS.....North American Research Committee on Multiple Sclerosis

NMOSD .....Neuromyelitis Optica Spectrum Disorder

QR..... Quick Response

SCIG ..... Subcutaneous Immunoglobulin

SRNA.....Siegel Rare Neuroimmune Association

STATA.....Statistics and Data

THC.....Tetrahydrocannabinol

TM..... Transverse Myelitis

BACKGROUND

Neuromyelitis Optica Spectrum Disorder (NMOSD), Myelin Oligodendrocyte Glycoprotein Antibody Disease (MOGAD), Transverse Myelitis (TM) and Acute Disseminated Encephalomyelitis (ADEM) are rare inflammatory disorders of the central nervous system (CNS).

NMOSD, also known as Devic's disease, most commonly affects adults in their mid 30's - 40's years of age. It has two major clinical manifestations that include inflammation of the spinal cord and optic nerve leading to paralysis and blindness (Shumway et.al 2024). Multiple sclerosis (MS), is the most common cause of optic neuritis, while NMOSD is fifty times rarer (Ghasemi et al., 2017). MS specifically targets young adults whose symptomatology is triggered by the immune system attacking the myelin sheath that surrounds nerve fibers in the brain and spinal cord (Ghasemi et al., 2017). This damage can cause symptoms including the following: cognitive impairment, incoordination and motor imbalance, fatigue, bladder/ bowel dysfunction, eyesight problems and numbing/ tingling and or weakness (Ghasemi et al., 2017). Because patients with NMOSD share similar clinical manifestations with MS patients, many have been misdiagnosed with MS and given ineffective treatment. In 2004, NMOSD was recognized as distinct from MS, when clinical investigators found a pathogenic antibody called aquaporin-4 (AQP4-IgG) that distinguished NMOSD patients (Lennon et al., 2004). This antibody targets aquaporin-4 water channels located on astrocytes, which are a specific type of glial cells. Inflammation is propagated when AQP4-IgG binds to astrocytes leading to damage in certain CNS regions, especially the optic nerves and

spinal cord (Papadopoulos et al., 2012). This discovery of the AQP4-IgG biomarker has impacted the lives of many patients by leading to the development of effective therapies for NMOSD.

Just as NMOSD was initially thought to be a subtype of MS, MOGAD also mirrors these relapsing inflammatory diseases that preferentially affect the optic nerves and spinal cord. In the mid-2000s, MOG antibodies were initially found in a subset of MS patients (Lennon et al., 2004). Over time, MOGAD was recognized as a different disease from MS, albeit with a lot of clinical and pathological overlap.

Identification of these diseases as having distinct pathophysiologies can help neurologists inform patients about any clinical manifestations that are to be expected with these diseases. In comparison to MS, there are a lot higher rates of spasticity, tonic spasms, and intractable neuropathic pain seen in NMOSD, while individuals with MOGAD have these symptoms appear a lot less (Asseyer et al., 2020, Fujihara et al., 2021). NMOSD and MOGAD's common symptoms include: anxiety, depression, bowel and bladder disorders and sleep disturbances (Banwell et al., 2023). In addition, due to 'area postrema syndrome,' severe vomiting may also be seen, which does not occur with MS (Banwell et al., 2023).

Transverse myelitis (TM) is a single inflammatory attack of the spinal cord which causes the same symptoms as NMOSD, MOG or MS attack of the spinal cord, but it only occurs once. While TM is often idiopathic, it has been associated with infections such as human T-cell leukemia virus type 1 (HTLV-1), neuroborreliosis (lyme), Zika virus, West

nile virus, Treponema pallidum, herpes viruses, HIV and many more (Simone et., al 2022).

TM can also be a presenting symptom or relapse presentation of the other neuro-inflammatory conditions such as NMOSD, MS, and ADEM. It is characterized by inflammation of the spinal cord most commonly seen at the thoracic level. Due to damage of the myelin sheath and nerve fibers, this inflammatory disorder can cause both unilateral and bilateral deficiencies (Simone et., al 2022). This can lead to dysfunction in nerve and spinal cord communication causing symptoms such as autonomic impairment (loss of bladder/bowel control), paralysis and sensation changes (Simone et., al 2022). There is a wide spectrum of ages affected with TM ranging from 10 to over 40 years of age (Simone et., al 2022).

ADEM is an immune mediated neurological disorder usually seen following a viral or bacterial infection. It is characterized by inflammatory damage to myelin in both the spinal cord and the brain. Symptoms include fever, nausea, and vomiting along with both neurological and spinal cord disturbances (Tenembaum et al., 2007). Usually diagnosed in children, this condition manifests with multiple neurological impairments and acute encephalopathy (Tenembaum et al., 2007). Like TM, ADEM usually only occurs once in a lifetime.

Both TM and ADEM are rare CNS inflammatory conditions that share similarities with NMOSD, MOGAD, and MS. However, the potential impact of cannabis use within these patient populations remains largely unexplored. There are distinctive characteristics of TM and ADEM that might make cannabis use patterns different in these populations.

Individuals who have a history of ADEM attacks may have more cognitive sequelae and as a result are more vulnerable to adverse effects from cannabis (Salter et al., 2021). On the other hand, patients with idiopathic TM might experience more spasticity and pain compared to cognitive issues, and thus they may use cannabis more for symptom relief.

Immunosuppressive therapies can be used to stabalize these symptoms in NMOSD and MOGAD. While they lower the risk of relapse and prevent further progression of neurologic disability, these therapies may vary in symptomatic treatment responses and can be linked to adverse effects restricted by dosage. Due to the presence of significant residual symptoms, patients will commonly use or express interest in cannabis for symptom management in the clinical setting. However, there is a lack of literature regarding usage patterns, modes of administration, target symptoms and the effectiveness of cannabinoid products.

Cannabinoid receptor agonists have demonstrated measurable enhancement of spasticity in mouse models of neuroinflammation, whereas blocking cannabinoid receptors exacerbated symptoms (Cristino et al., 2020). Furthermore, nabiximols, a pharmaceutical-grade cannabinoid product derived from plants, has been authorized in Europe for nearly a decade to manage spasticity associated with multiple sclerosis (MS), supported by three extensive Phase III randomized clinical trials (Conte et al., 2021). However, its advancement in the United States was stopped due to more stringent federal regulations.

Surveys investigating cannabis usage among individuals with MS have revealed that a notable proportion of patients resort to cannabis for alleviating symptoms (Rice et

al., 2020; Salter et al., 2021). A nationwide survey was conducted in 2020 among over 3000 MS patients (using the NARCOMS registry) which indicated that 31% of patients had used cannabis at some point (not including CBD-only formulations) specifically to address MS symptoms. 20% of those participants reported recent use within the previous 30 days (Rice et al., 2020; Salter et al., 2021). Compared to non-users, those who had ever used cannabis were typically younger, exhibited higher levels of disability, sleep disturbances, pain and severe spasticity (Salter et al., 2021). These three symptoms were also identified as the most common targets for cannabis use. Furthermore, many patients had previously tried other therapies for symptom management before turning to cannabis, or continued these treatments simultaneously (Schabas et al., 2019). Recent surveys suggest an upward trend in reported cannabis use, likely due to reduced legal barriers to access and increasing societal acceptance of cannabis over time. Additional surveys involving MS patients, encompassing CBD products and recreational use, have found that over half of patients report cannabis usage, with 30-50% indicating current use (Rice et al., 2020; Salter et al., 2021; Schabas et al., 2019). Clinical observations at the MGH Neuroimmunology clinic with NMOSD and MOGAD patients indicate even higher rates of cannabis usage among this demographic. This heightened usage appears to be driven by factors such as inadequate response to conventional therapies, heightened severity of spasticity and pain, presence of additional symptoms responsive to cannabinoids like nausea, and lower prevalence of baseline symptoms that typically limit cannabis use, such as cognitive dysfunction, fatigue, and "brain fog," as compared to MS patients.

To date, there is no literature describing the pattern, frequency, and perceived efficacy of cannabis use in NMOSD, MOGAD, ADEM, or TM patients. Several foundations such as the Mog Project, the Sumaira Foundation, and the Siegel Rare Neuroimmune Association (SRNA) have noted that they have a significant number of inquiries from their members regarding cannabis usage. However, they find it challenging to address the questions due to the lack of research on this subject. No survey studies have targeted this specific population and therefore many providers remain hesitant to guide unsure patients in cannabis utilization.

SPECIFIC AIMS AND OBJECTIVES

The purpose of this study is to address the modes, frequency and efficacy of cannabis use among NMOSD, MOGAD, ADEM, and TM patients for symptom relief. The survey aims to determine the following:

Specific Aim #1: To determine the primary symptoms that individuals with NMOSD, MOGAD, ADEM, and TM are targeting when using cannabis for therapeutic use as well as the perceived efficacy and any adverse events. Hypothesis: Pain and spasticity will be the primary symptoms targeted by cannabis, with mild to moderate perceived efficacy.

Specific Aim #2: To determine the relationship between medicinal cannabis use and other recreational substance use.

> *Sub Aim 2.1* – To determine the relationship between recreational cannabis use and medicinal use. Hypothesis: Medicinal cannabis use will be largely independent from a past history of recreational use.
>
> *Sub Aim 2.2* – To determine the relationship between alcohol/smoking and cannabis usage. Hypothesis: Individuals that are heavy drinkers and smokers are more likely to turn to cannabis.

Specific Aim #3: To determine patients' perspectives on current and desired roles of medical providers on cannabis utilization. Hypothesis: Given that cannabis is being used as a therapeutic approach in various neurological disorders,

NMOSD/MOGAD/TM/ADEM patients are seeking more guidance from their providers about current practices, preferences and appropriate dosages of cannabis.

Specific Aim #4: To determine the reasons why certain patients do not use cannabis or have discontinued any mode of cannabis products. Hypothesis: Patients may have discontinued cannabis products due to side effects (anxiety, cognitive impairments etc.) or due to the legal status of cannabis.

METHODS

This is a cross-sectional survey study with a duration of 1 year. The study will enroll patients for approximately 9 months and have a data analysis period of approximately 3 months. This thesis represents the first wave of interim data analysis.

Subject Recruitment

Both the principal investigator and clinical research coordinator recruited patients. The recruitment process for this study involved the following:

First, research study flyers were distributed to patients in the waiting room of the Massachusetts General Hospital Neuroimmunology Clinic. Patients in the waiting room were informed about this survey and given the link via a QR code that could be scanned via their cellular device. To respect patient privacy, further discussions and/or completion of the survey took place in the clinic rooms. Participants chose to complete the survey on that date, at a later date, or not at all. It was made clear that participation was entirely voluntary and would not affect patient care in any way.

Second, respondents were emailed information and a link to the survey via the email lists of foundations such as the Sumaira Foundation, SRNA, and the MOG project. These foundations agreed to collaborate and disseminate the survey link to their members as they are representative of the patient population the study is targeting (patients with NMOSD, MOGAD, ADEM and TM). The emails were sent directly by foundation staff, and study investigators did not have access to the email addresses or contact information of the foundation members. The first wave of recruitment began via the second method so that the study could report patient response rates to ensure that only eligible

participants were invited. Foundation partners were asked for the number of members that they emailed and the distribution of diagnoses. No identifying information about the emailed members was collected.

Depending on the success of the two recruitment methods, the study will begin a third phase of open recruitment. In this phase, the link will be made available on the websites of the foundation partners listed above, on a Massachusetts General Hospital online platform known as "Rally," the Neuroimmunology clinic website, and on Facebook groups for patients. Participants in these Facebook groups comment frequently on posts in these groups, and turning off comments is not a feasible option since it would immediately discourage or decrease engagement with the study post. The following standard response was drafted in case of any personal inquiries or comments in response to the post: Standard response: We are not authorized as study investigators to comment on individual cases – please reach out via our study email studysurvey@massgeneralbrigham.org for more information.

Inclusion Criteria: 1. Adults over the age of 18 years old 2. Diagnosed with MOG Antibody Disease (MOGAD), Neuromyelitis Optica (NMOSD), Transverse Myelitis (TM), or Acute Disseminated Encephalomyelitis (ADEM) 3. Participant must be willing to complete the survey
Exclusion Criteria: 1. Not diagnosed with NMOSD or MOGAD 2. Not diagnosed with TM or ADEM

Table 1. Inclusion and Exclusion Criteria

Given that this survey is conducted on rare diseases, this study targeted all eligible participants that research investigators were able to reach. There was no mechanism to specifically target under-represented populations.

Although the study aimed to recruit approximately 160 individuals to participate in the survey, only 62 patients participated in the first round of recruitment. With a longer timeline and other forms of recruitment mentioned, the study aims to have a roughly even distribution among the different disease conditions. This study will not close participation to any particular group if the study over-enrolls in a particular subset.

Subject Enrollment

The survey was entirely anonymized. A separate consent form was waived, and a short e-consent was included at the start of the online survey. By reading the e-consent (Appendix pg. 51) participants had the opportunity to make the decision to continue and complete the survey or not participate at all.

Given the sensitive nature of the survey questions, the principal risk of this study is potential harm to patients in the event of a breach of confidentiality. Therefore, a full informed consent was waived. Completion of an anonymized online survey presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required. Information about the survey, privacy and confidentiality, and data storage and analysis was included in the survey platform before initiation of the survey. We also included a question regarding consent for completion of the survey and for data analysis preceding any survey completion or survey screening. After the consent

question, participants answered several questions aimed at ensuring the participants' eligibility for completion of the survey. There was no pre-screening in the study. Non-English speakers were not included. Translated questionnaires require validation to ensure that the questions are accurate, and this is beyond the scope of this study. To minimize the undue influence to enroll via the investigator's own patients, the research coordinator approached the patients in the waiting room.

Study Procedures

Participants were invited to participate in the study and were provided a link for an online REDCap-based survey. Willing study participants completed the survey. There was no planned return of results to study participants since contact information was not collected and maintained. There was no financial remuneration for the study.

Endpoints

This study's endpoints included perceived benefits for various symptoms, cannabis usage patterns, cannabis adverse effects, and others (Appendix pg. 51).

Study Termination

The study terminated when the first wave of recruitment goals were reached. A second and third wave of recruitment will be extended until September 2024 to expand the data analysis.

Risks and Discomforts

The primary risk of this study was loss of privacy and confidentiality. This is a particularly important risk given the varying legal statuses of cannabis-based products in the United States. However, this risk was minimized as the survey was fully anonymized with no personal identifiers collected. Although the survey targeted participants with rare diseases, the diseases were common enough (i.e. current estimates suggest that there are 4000-8000 individuals with NMOSD in the US, and the other diseases are even more common), that identifying participants based on survey responses would be virtually impossible. The survey did not include general location data (i.e. which state the participant is located in) specifically to avoid this issue.

The survey asked about participants' medical conditions and disability status. Some participants may find this distressing and not want to complete the survey. Therefore, at the beginning of the survey, it stated that participants could withdraw their responses at any time before submission of the survey.

Benefits to Individual Subjects

There is no direct benefit for participating individuals.

Benefits to the Medical Community

The data collected in this study will help clinicians and researchers better understand the modes, frequency and efficacy of cannabis use that MOGAD/NMOSD/TM/ADEM patients are reporting for symptom relief. This data will benefit the larger patient

community by informing healthcare providers and better preparing them to discuss cannabis utilization with patients.

Statistical Analysis

Participant data was recorded in a secure electronic case report form in REDCap software. All collected data was de-identified prior to analysis. The statistics, data analysis and data visualization packages within REDCap were utilized for the data analysis. Graphics were generated using REDCap.

For the interim analysis presented in this thesis, descriptive statistics were used to summarize the demographics, diagnoses, medical history, and cannabis preferences of the surveyed population. Mean, standard deviation, median, and range were presented for continuous variables (i.e age in years, duration of diagnosis, etc.), and counts and percentages were presented for binary and categorical variables which represented the majority of variables.

Once all survey data has been completed in September 2024, differences between groups (such as males and females, different diagnostic categories, or levels of disability) in regard to specific survey answers will be compared using chi-square tests (for binary or category variables). This analysis will be conducted in STATA software.

Monitoring and Quality Assurance

The principal investigator was responsible for monitoring survey responses, reviewing responses to ensure consistency and lack of rote or automatized responses.

There were no adverse events that occurred during this interim analysis. In case of an adverse event, such as loss of data confidentiality, the conflict would have been reported to the IRB to further mitigate other potential risks. The principal investigator and research coordinator would have also conducted a thorough investigation that would have involved identifying how the breach occurred and further enhance data security protocols to prevent those incidents in the future.

RESULTS

There were 162 survey respondents. Of the 162 surveys, 39 surveys were incomplete. 123 surveys were complete, which represents 75.9% of all survey entries. This thesis interim analysis only included survey respondents from amongst the email listserv members of the Sumaira Foundation, MOG project, SRNA foundation and an additional 2 patients of the Mass General neuroimmunology clinic. The MOG project has 573 members. The SRNA foundation has 4,000 members and the Sumaira Foundation has 78 members.

Variables of Interest

General Demographics:

Age: The average age in years from the participant pool was 49 years old (standard deviation: 15.8).

Sex: Out of 117 respondents, 40 (34.2%) participants reported they were male, 76 (65.0%) reported their sex was female and one reported being intersex (0.9%). Six respondents did not report their sex. No participants were non-binary or transgender.

Education: Among 117 participants sampled, a bachelor's degree emerges as the predominant level of education.

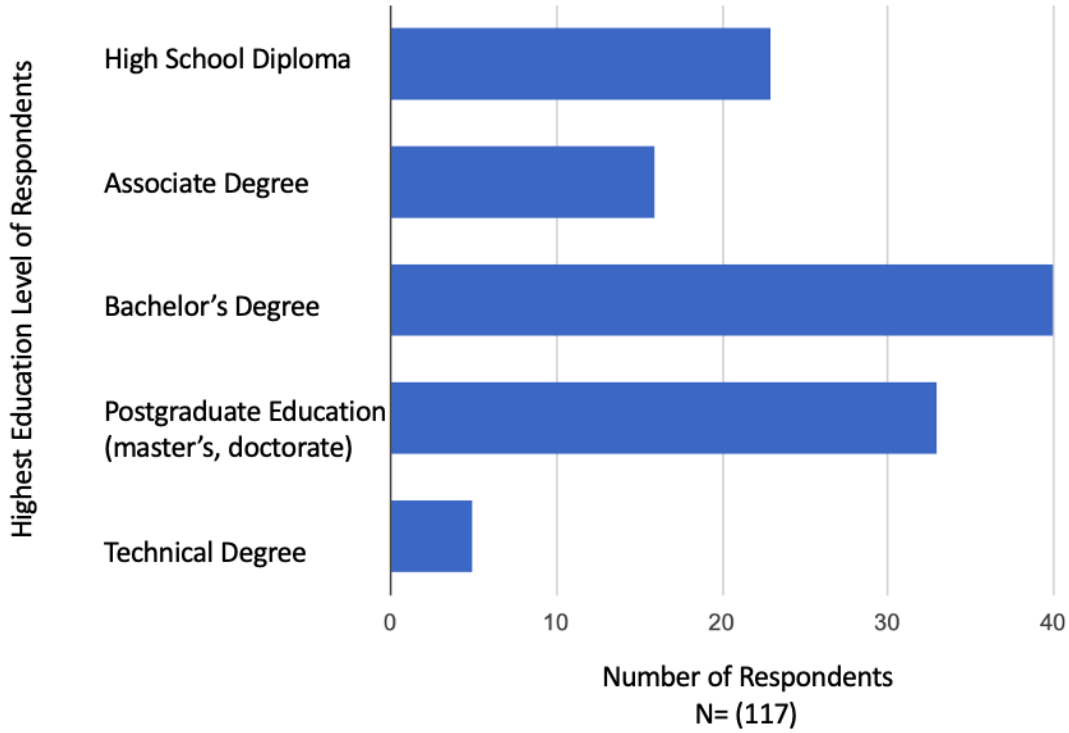

Figure 1: Participants' highest level of education of respondents reported by survey respondents, organized according to degree type.

23 (19.7%) respondents reported having received a high school diploma/GED. 16 (13.7%) reported receiving an associate's degree. 40 (34.2%) reported receiving a bachelor's degree. 33 (28.2%) reported receiving a postgraduate education and five (4.3%) reported receiving a technical degree. Six respondents did not report their education level.

Alcohol Intake:

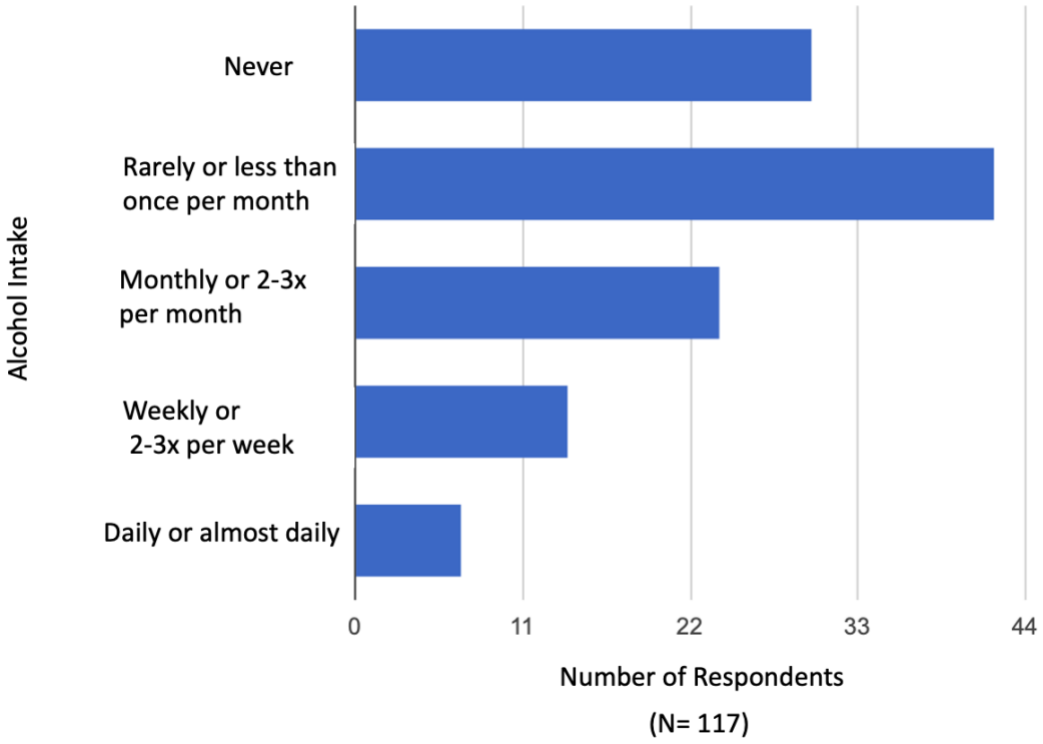

Figure 2: Participants' alcohol intake within the past year.

A "drink" was considered a can or bottle of beer, a glass of wine, a wine cooler, one cocktail, or a shot of hard liquor (like scotch, gin, or vodka). 30 (25.6%) respondents reported that they never consume alcohol. 42 (35.9%) participants reported they rarely (less than once a month) drink. 24 (20.5%) participants consume monthly or 2-3 times a month. 14 (12.0%) participants consume alcohol weekly or 2-3 times per week and seven (6.0%) people consume alcohol daily. Six individuals did not report their alcohol intake.

Frequency of Alcohol Intake:

Of 87 respondents, 53 (60.9%) respondents reported that within the past year they have never consumed five or more drinks on one occasion. 19 (21.8%) reported rarely or less than once per month, and 9 (10.3%) responded monthly or 2-3 times per month. 36 participants did not report a response (of note, participants were not prompted to answer this question if they reported never using alcohol on the prior question).

Smoking:

Of 117 respondents, 45 (38.5%) reported they smoked regularly or used e-cigarettes. 72 (61.5%) responded that they do not smoke.

45 respondents reported that in the past 30 days, 32 (71.1%) did not smoke. 6 (13.3%) said sometimes and 7 (15.6%) respondents reported that they smoked one cigarette a day.

Employment:

37 (31.6%) respondents were employed full time. 17 (14.5%) were employed part-time and 63 (53.8%) reported not working. 6 respondents did not report their employment status. Of those individuals that were not employed, the majority reported that it was due to being disabled, for medical reasons, or retirement purposes.

Race:

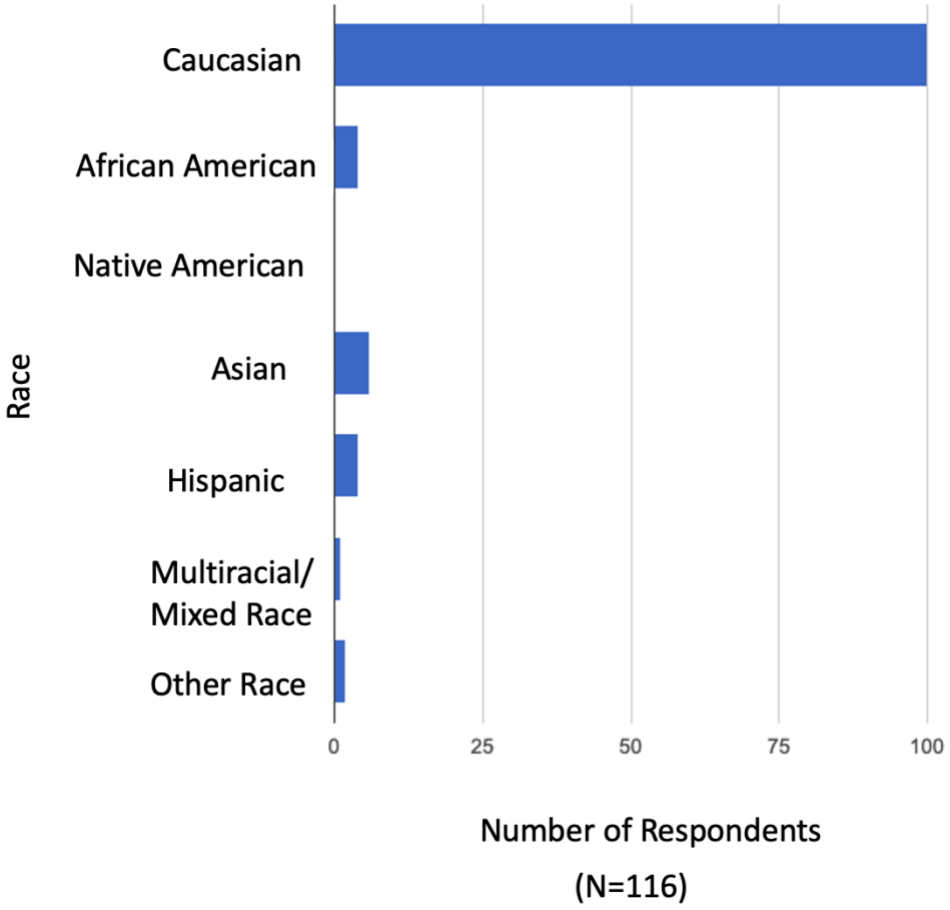

Figure 3: Participants' racial status.

The sample pool included 99 (85.3%) Caucasian, 4 (3.4%) African American , 0 Native American, 6 (5.2%) Asian, 4 (3.4%) Hispanic, and 1 (0.9%) Multiracial or mixed race. 2 (1.7%) reported as other races.

Disease Diagnosis Information

Diagnosis:

Within the sample pool of 123 completed surveys, the majority of the participants were diagnosed with MOGAD. 51 (41.5%) reported to have MOGAD. 19 (15.4%) reported to have NMOSD. 47 (38.2%) reported to have TM. 3 (2.4%) have ADEM. 1 (0.8%) have MS. There were no parents of an individual with NMOSD, MOGAD, ADEM, or TM surveyed. 2 (1.6%). Reported with 'other' diagnosis.

Disease Manifestations:

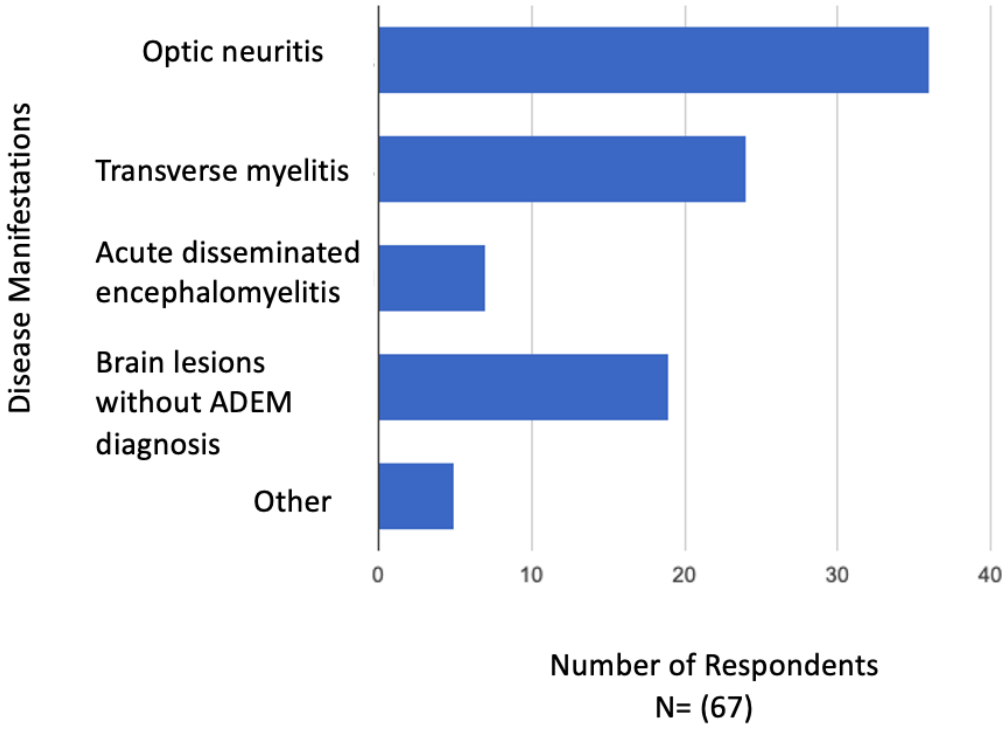

Figure 4: Participants' reported disease manifestations.

Of 67 respondents, 45 (67.2%) patients experienced Optic neuritis. 32 (47.8%) experienced TM. 7 (10.4%) experienced ADEM. 19 (28.4%) had brain lesions without an ADEM diagnosis. 6 (9.0%) respondents experienced other manifestations.

Patient Derived- Disease Steps

Disability Severity

117 respondents reported one category that best represents their disease state condition.

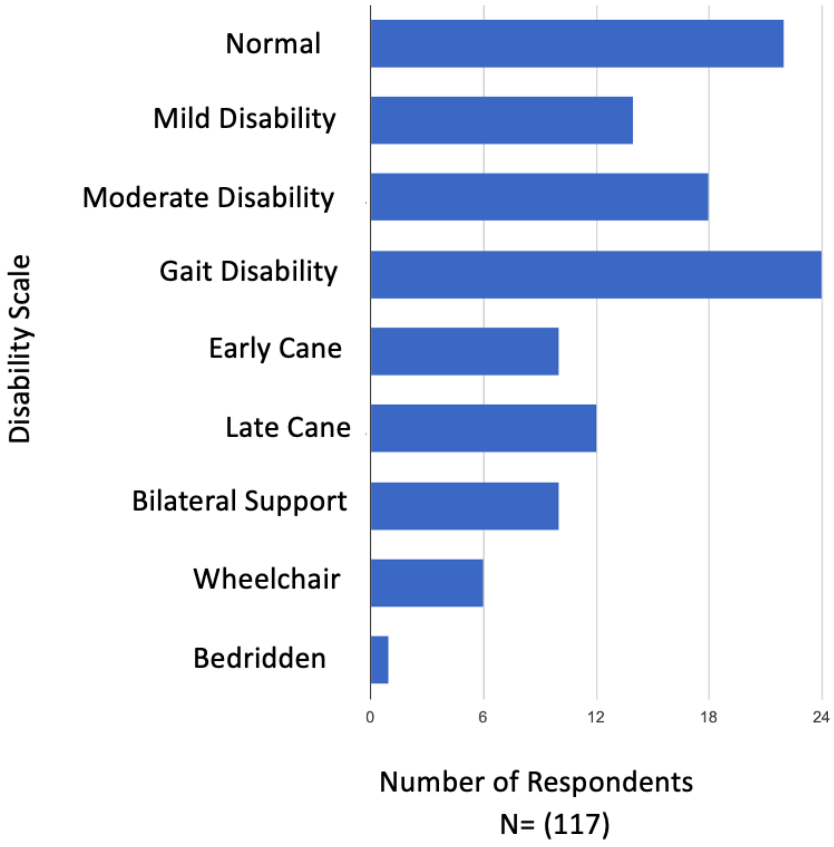

Figure 5: Participants' disability scale.

Normal was defined as patients with mild symptoms (mostly sensory) due to their diagnosis but that do not limit their activity. If they did have an attack, they returned to normal after the attack. 22 (18.8%) reported normal. Mild disability was defined as patients having some noticeable symptoms from their diagnosis, but the symptoms are minor and have only a small effect on their lifestyle. 14 (12.0%) reported mild disability. Moderate disability was defined as patients who do not have any limitations in their walking ability but do have significant problems due to their diagnosis that limits daily activities in other ways. 18 (15.4%) reported moderate disability. Gait disability was defined as a diagnosis that does interfere with activities, especially when patients are walking. They can work a full day, but athletic or physically demanding activities are more difficult than they used to be. They usually do not need a cane or other assistance to walk, but they might need some assistance during an attack. 24 (20.5%) reported to have gait disability. Early cane was defined as using a cane, a single crutch, or some other form of support (such as touching a wall or leaning on someone's arm) for walking all the time or part of the time, especially when walking outside. They report they can walk 25 feet in 20 seconds without a cane or crutch but need some assistance (cane or crutch) if they want to walk as far as 3 blocks. 10 (8.5%) reported to have early cane disability. Late cane was defined as being able to walk 25 feet using a cane, crutch or someone to hold onto. They can get around the house or other buildings by holding onto furniture or touching the walls for support. They may use a scooter or wheelchair if they want to go greater distances. There were 12 (10.3%) late cane respondents reported. Bilateral support was defined as being able to walk as far as 25 feet having two canes or crutches

or a walker. They may use a scooter or wheelchair for longer distances. 10 (8.5%) reported to have bilateral support. Wheelchair / scooter was defined as using those as their main form of mobility. They may be able to stand and/or take one or two steps, but they cannot walk 25 feet, even with crutches or a walker. 6 (5.1%) reported to use a wheelchair/scooter. Bedridden was defined as unable to sit in a wheelchair for more than one hour. 1 (0.9%) reported being bedridden.

Symptoms

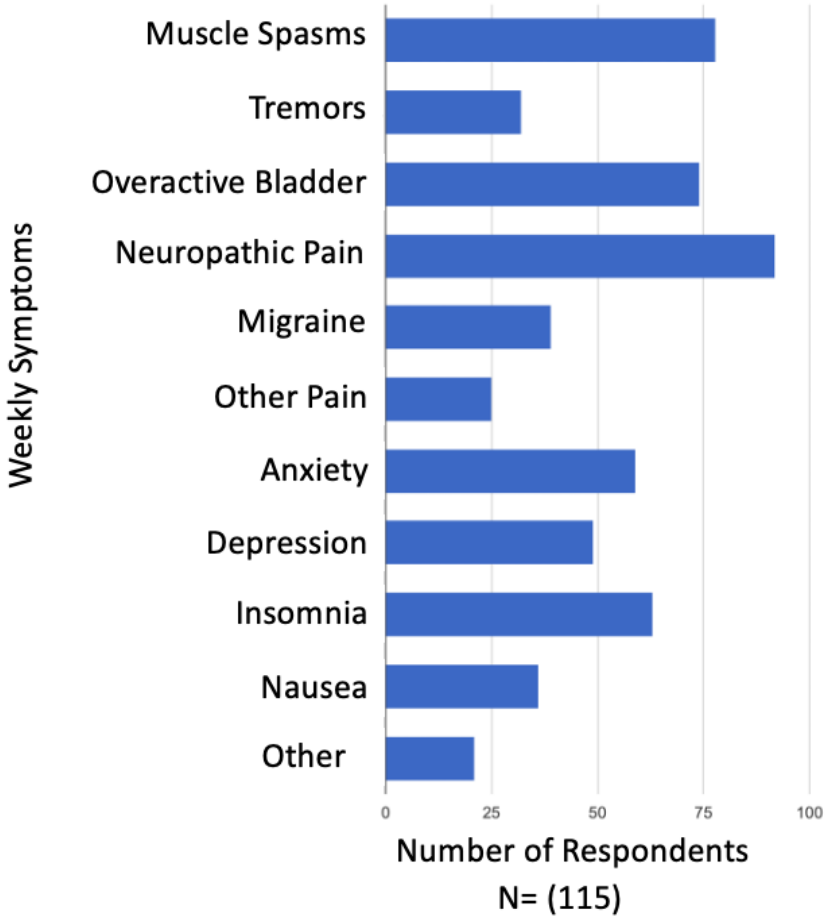

Figure 6: Participants' weekly symptoms.

78 (67.8%) reported to have muscle spasms, cramps, or spasticity. 32 (27.8%) have tremors. 74 (64.3%) have overactive bladder / bladder symptoms. 92 (80.0%) have neuropathic pain (electric, tingling, or burning pain), 39 (33.9%) migraine / headaches / eye pain. 25 (21.7%) reported other pain (excluding neuropathic pain and headaches). 59 (51.3%) reported to have anxiety. 49 (42.6%) have depression. 63 (54.8%) have insomnia / sleep problems. 36 (31.3%) have nausea / gastrointestinal problems. 21 (18.3%) report 'other.' Eight did not respond.

Muscle Spasms

77 respondents rated their level of spasticity (muscle spasms, muscle tightness or stiffness). From a scale of 0-10, with 0 being "no spasticity" and 10 being "worst possible spasticity," there was an average level of spasticity of 5.62.

To treat their muscle spasms, a total of 78 respondents reported that they use different forms of treatments. 49 (62.8%) use oral medications. Four (5.1%) use Botulinum toxin injections. One (1.3%) uses Baclofen pump, 16 (20.5%) use physical or occupational therapy. Eight (10.3%) reported 'other,' and 23 (29.5%) reported they use no treatment.

Oral Medications for Muscle Spasms

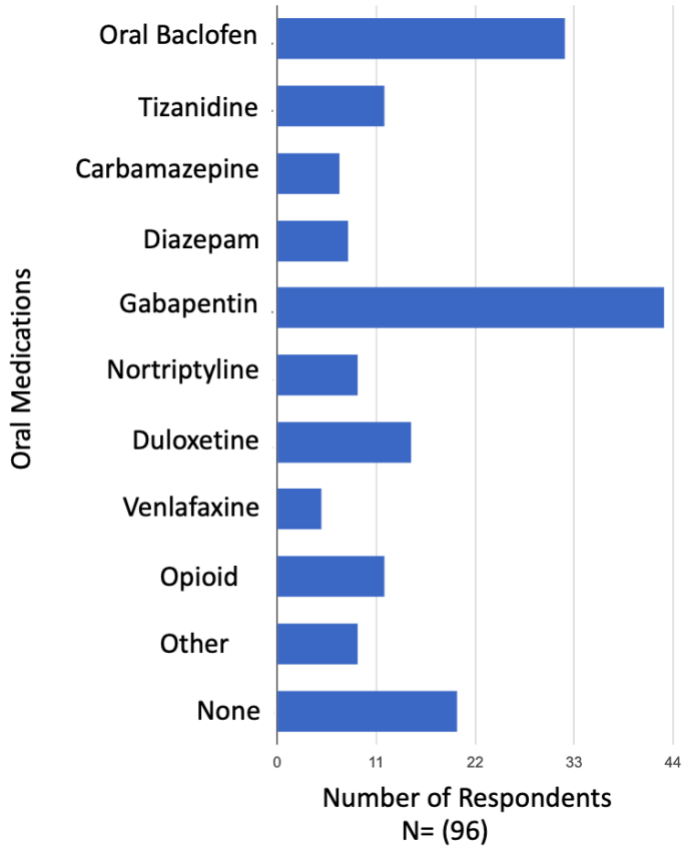

Figure 7: Participants' oral medications to treat spasticity or pain.

Participants were asked which oral medications they currently use to treat their spasticity or pain associated with their diagnosis. Out of 96 reported, 32 (33.3%) use oral Baclofen (Gablofen and Lioresal). 12 (12.5%) respondents use Tizanidine (Zanaflex) or Cyclobenzaprine (Flexeril). Seven (7.3%) respondents use Carbamazepine (Tegretol) or Oxcarbazepine (Trileptal). Eight (8.3%) respondents use Diazepam (Valium) or Clonazepam (Klonopin). 43 (44.8%) respondents use Gabapentin (Neurontin) or Pregabalin (Lyrica). Nine (9.4%) respondents use Nortriptyline (Pamelor) or Amitriptyline (Elavil). 15 (15.6%) respondents use Duloxetine (Cymbalta). Five

(5.2%) respondents use Venlafaxine (Effexor). 12 (12.5%) respondents use Opioid pain medications(Tramadol, Oxycodone, Morphine, etc.). 9 (9.4%) respondents use 'other' medications. 20 (20.8%) use no medications.

Pain Rating Scales

Symptom	Number of Respondents	Average Rating
All forms of pain (ex. Musculoskeletal, nerve pain etc.)	101	5.28
Insomnia	63	6.37

Table 2: Symptom rating scale results.

Participants were asked to rate their pain from their symptoms over the past week. On a scale of 0 to 10, with 0 being "no pain" and 10 being "worst possible pain."

Treatments

Immunotherapies

Respondents were asked which immunotherapies they are receiving for their diagnosis. Out of 66 respondents, 46 (69.7%) reported they are not receiving any immunotherapy. 14 (21.2%) use Rituximab (Rituxan). One (1.5%) uses Mycophenolate mofetil (Cellcept). Two (3.0%) use Intravenous Immunoglobulin (IVIG) or subcutaneous immunoglobulin (SCIG). One (1.5%) uses Tocilizumab. No participants report using Inebilizumab

(Uplinza), Satralizumab (Enspryng), nor Eculizumab (Soliris). Three (4.5%) report they use other immunotherapies.

Complementary VS. Alternative Medicines

Participants were asked if they utilize complementary or alternative medicine approaches for their treatment of their symptoms. Out of 117 respondents, 23 participants (19.7%) have used complementary or alternative medicine approaches in the past 3 months. 19 (16.2%) have used complementary or alternative medicine in the past but not in the past 3 months. 75 (64.1%) have not used complementary or alternative medicine approaches.

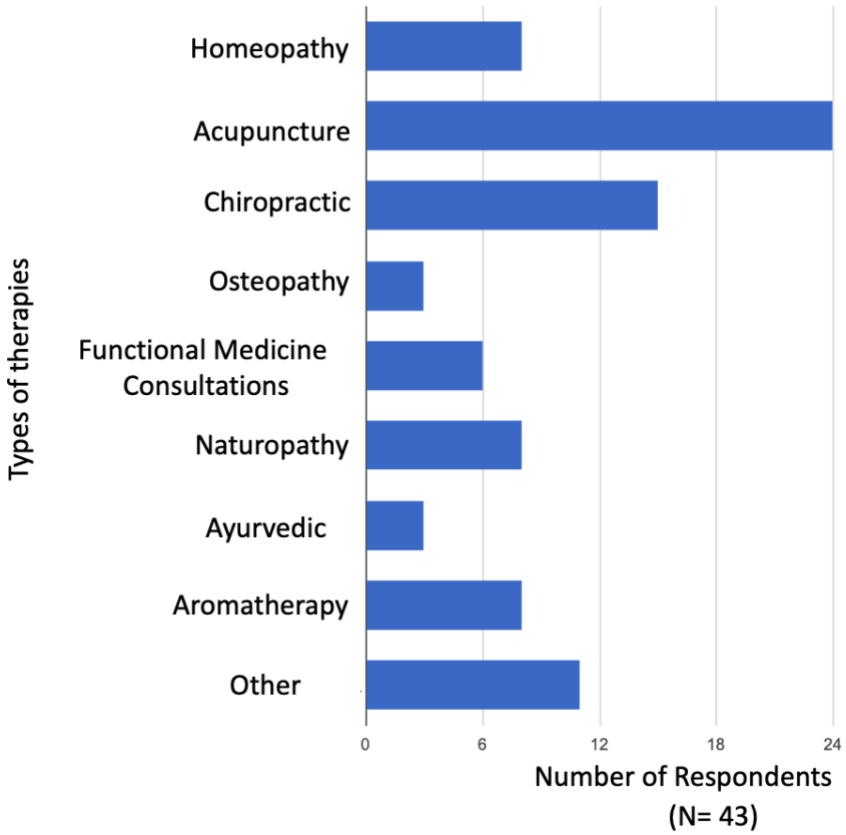

Figure 8: Participants' complementary or alternative medicines utilized.

43 participants were asked which complementary or alternative medicine therapies they have utilized. 8 (18.6%) individuals use homeopathy. 24, (55.8%) individuals use acupuncture. 15 (34.9%) individuals use Chiropractic. Three (7.0%) individuals use Osteopathy. Six (14%) individuals use functional medicine consultations. Eight (18.6%) individuals use naturopathy. Three (7.0%) individuals use ayurvedic. Eight (18.6%) individuals use aromatherapy. 11 (25.6%) individuals use 'other' therapies

Cannabis

Cannabis Use

Participants were asked if they have ever, even once, used cannabis / marijuana to treat their symptoms. Out of 117 respondents, 67 (57.3%) answered yes and 50 (42.7%) answered no.

Major Reasons for Cannabis Usage

Out of 67 respondents, 26 (38.8%) reported that one of the major reasons they started using cannabis/ marijuana was because they started using it recreationally and found that it was helpful for symptoms. 20 (29.9%) use cannabis via doctor's recommendation. 11 (16.4%) use cannabis via media reports on potential benefits. 15 (22.4%) use cannabis via word-of-mouth from other patients (in-person) 14 (20.9%) use cannabis via online patient message-boards or support groups. 19 (28.4%) use cannabis due to recommendations from family or friends. 4 (6.0%) reported that they started using cannabis for other reasons.

Cannabis Time of Day Usage

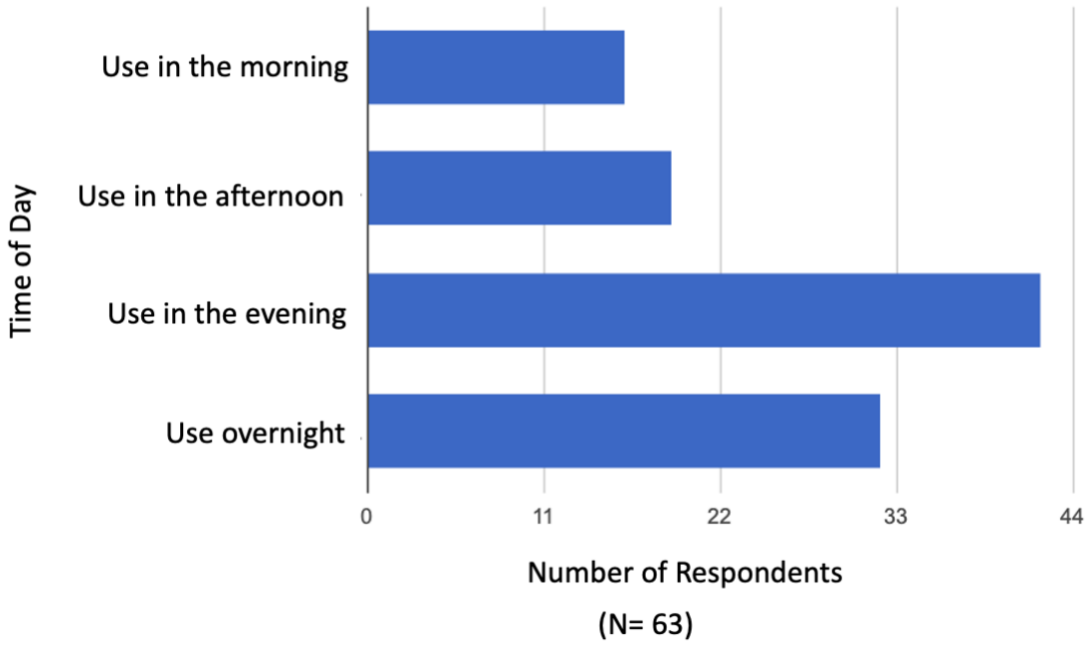

Figure 9: Participants' utilization of cannabis according to time of day to treat their symptoms.

16 (25.4%) participants use cannabis in the morning (after waking but before lunchtime). 19 (30.2%) participants use it in the afternoon (after lunchtime but before dinnertime). 42 (66.7%) participants use it in the evening (after dinner time but before bedtime). 32 (50.8%) participants use it overnight (at or after bedtime but before waking in the morning).

Out of 63 respondents, 26 (41.3%) participants report they use cannabis at a regular, consistent time most days, regardless of symptoms. 7 (11.1%) respondents use it before symptom onset to prevent symptoms. 14 (22.2%) respondents use it when they

start to feel symptoms coming on or when symptoms are mild. 16 (25.4%) respondents use it when their symptoms are persistent or severe.

Type of Cannabis Used

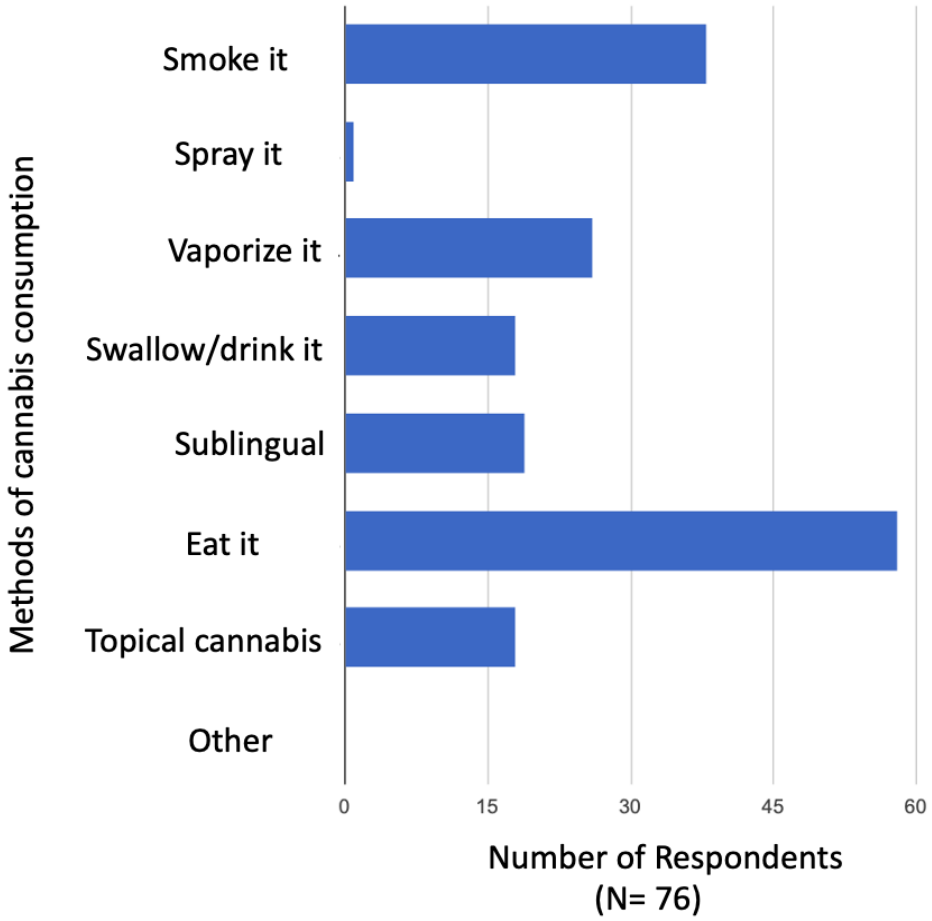

Figure 10: Participants' most common method of cannabis consumed.

Participants reported the method that they most used to consume cannabis/ marijuana the past year. Out of 76 respondents, 38 (50.0%) smoke it, for example in a joint, bong, pipe, or blunt. 1 (1.3%) spray it, using an oral spray device. 26 (34.2%) vaporize or 'vape' it, or

'dab' it. 18 (23.7%) swallow or drink it, for example as an oil, tincture, pill, or tea. 19 (25.0%) administer sublingually, such as placing oil or tincture underneath the tongue or spraying into cheek or under the tongue. 58, (76.3%) eat it, for example in brownies, cakes, cookies, or gummies. 18, (23.7%) administer topically, for example as a patch or cream. 0 individuals report other.

Type of Cannabis Composition Used

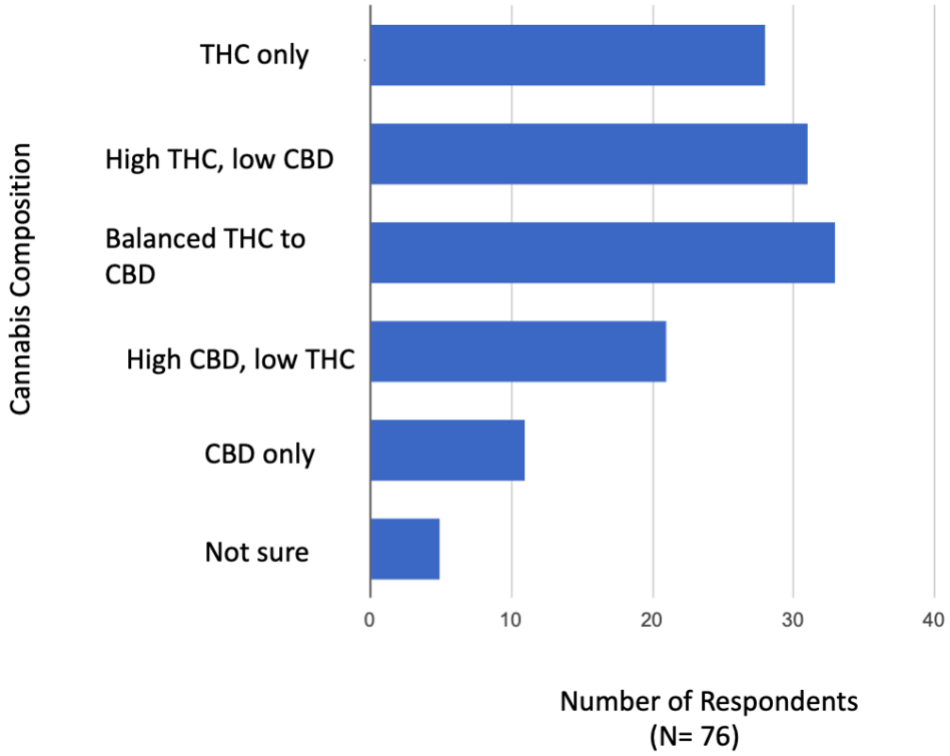

Figure 11: Participants' typical cannabis composition used.

Out of 76 respondents, 28 (36.8%) use THC (tetrahydrocannabinol) only. 31 (40.8%) use high THC content, low CBD (cannabidiol) content. 33 (43.4%) use balanced THC to

CBD ratio. 21 (27.6%) use high CBD content, low THC content. 11 (14.5%) use CBD only. 5 (6.6%) individuals are not sure what the composition is.

Adverse Effects of Cannabis Use

Feeling high: 10 (11.0%) participants reported never experiencing feeling high. 12 (13.2%) participants reported very mild. 23 (25.3%) participants reported mild effects. 36, (39.6%) participants reported moderate effect. 7 (7.7%) participants reported severe effects. 3 (3.3%) participants reported a very severe effect.

Drowsiness: 11 (12.1%) participants reported never experiencing drowsiness. 13 (14.3%) participants reported very mild effects. 23 (25.3%) participants reported mild effects. 37 (40.7%) participants reported moderate effects. 4 (4.4%) participants reported severe effects. 3 (3.3%) participants reported very severe effects.

Thinking problems, brain fog, or confusion: 36 (39.6%) participants reported never experiencing thinking problems, brain fog, or confusion. 23 (25.3%) participants reported very mild effects. 15 (16.5%) participants reported mild effects, 16 (17.6%) participants reported moderate effects. One (1.1%) participant reported severe effects. None reported very severe effects.

Decreased concentration or motivation: 37 (40.7%) participants reported never experiencing decreased concentration or motivation. 23 (25.3%) participants reported very mild effects. (15, 16.5%) participants reported mild effects. 12 (13.2%) participants reported moderate effects. 3, (3.3%) participants reported severe effects. 1 (1.1%) participants reported very severe effects.

Dizziness or lightheadedness: 45 (49.5%) participants reported never experiencing dizziness or lightheadedness, 19 (20.9%) participants reported very mild effects, 18 (19.8%) participants reported mild effects, 7 (7.7%) participants reported moderate effects, 2 (2.2%) participants reported severe effects, no participants reported very severe effects.

Balance or coordination problems: 46 (50.5%) participants reported never experiencing balance or coordination problems. (16, 17.6%) participants reported very mild effects. 19 (20.9%) participants reported mild effects. 6 (6.6%) participants reported moderate effects. Two (2.2%) participants reported severe effects. Two (2.2%) participants reported very severe effects.

Anxiety: 47 (52.2%) participants reported never experiencing anxiety, 14 (15.6%) participants reported very mild effects. 12 (13.3%) participants reported mild effects. 7 (7.8%) participants reported moderate effects. 6 (6.7%) participants reported severe effects. 4 (4.4%) participants reported very severe effects.

Paranoia: 57 (63.3%) participants reported never experiencing paranoia. 16 (17.8%) participants reported very mild effects. 10 (11.1%) participants reported mild effects. One (1.1%) participant reported moderate effects. 4 (4.4%) participants reported severe effects. Two (2.2%) participants reported very severe effects.

Hallucinations: (84, 93.3%) participants reported never experiencing hallucinations. 3 (3.3%) participants reported very mild effects. No participants reported mild effects. No participants reported moderate effects. One (1.1%) participant reported severe effects. Two (2.2%) participants reported very severe effects.

Suicidality: 88 (97.8%) participants reported never experiencing suicidality. No participants reported very mild effects. No participants reported mild effects. No participants reported moderate effects. No participants reported severe effects. Two (2.2%) participants reported very severe effects.

Depression: 71 (78.9%) participants reported never experiencing depression. 10 (11.1%) participants reported very mild effects. 7 (7.8%) participants reported mild effects. One (1.1%) participant reported moderate effects. No participant reported severe effects. One (1.1%) participant reported very severe effects.

Palpitations/ Increased Heart Rate: 67 (74.4%) participants reported never experiencing palpitations/increased heart rate. (11, 12.2%) participants reported very mild effects. (9, 10.0%) participants reported mild effects. One (1.1%) participant reported moderate effects. One (1.1%) participant reported severe effects. One (1.1%) participant reported very severe effects.

Red Eyes: 36 (40.0%) participants reported never experiencing red eyes. 25 (27.8%) participants reported very mild effects. 17 (18.9%) participants reported mild effects. 7 (7.8%) participants reported moderate effects. 3 (3.3%) participants reported severe effects, 2 (2.2%) participants reported very severe effects.

Increased Appetite: (20, 22.2%) participants reported never experiencing increased appetite. 15, (16.7%) participants reported very mild effects. 22 (24.4%) participants reported mild effects. 23 (25.6%) participants reported moderate effects. 8 (8.9%) participants reported severe effects. 2 (2.2%) participants reported very severe effects.

Nausea: 75 84.3%) participants reported never experiencing nausea. 4 (4.5%) participants reported very mild effects. 5 (5.6%) participants reported mild effects. 3 (3.4%) participants reported moderate effects. No participants reported severe effects. Two (2.2%) participants reported very severe effects.

Reasons of Cannabis Use/ No Use

Out of 116 respondents, 75 (65.7%) have used cannabis/marijuana recreationally or for reasons unrelated to their diagnosis. 41 (35.3%) reported they have not used cannabis/marijuana recreationally or for reasons unrelated to their diagnosis.

Out of 50 respondents, 11(22.0%) participants report they do not need cannabis for their symptoms because they are manageable or controlled with other medications. 16 (32.0%) have never thought about it. 5 (10.0%) said their healthcare professional did not recommend it. 7 (14.0%) due to cost or lack of insurance coverage. 18 (36.0%) reported concerns about its legality. 13 (26.0%) have concerns about drug testing (including effects on employment, losing benefits, etc.). 8 (16.0%) reported due to stigma associated with using cannabis/marijuana. 9 (18.0%) reported it is difficult to obtain. 16 (32.0%) individuals have concerns about potential side effects or adverse events. 10 (20.0%) individuals have concerns on ethical or moral grounds. 11 (22.0%) report there is not enough data about how safe it is or how well it works. 9 (18.0%) report other.

Frequency of Cannabis Use

Out of 91 respondents, 15 (16.5%) reported never. 15 (16.5%) reported rarely or less than once per month. 9 (9.9%) reported monthly or 2-3 times per month. 13 (14.3%) reported weekly or 2-3 times per week. 28, (30.8%) reported daily or almost daily. 11 (12.1%) reported multiple times per day.

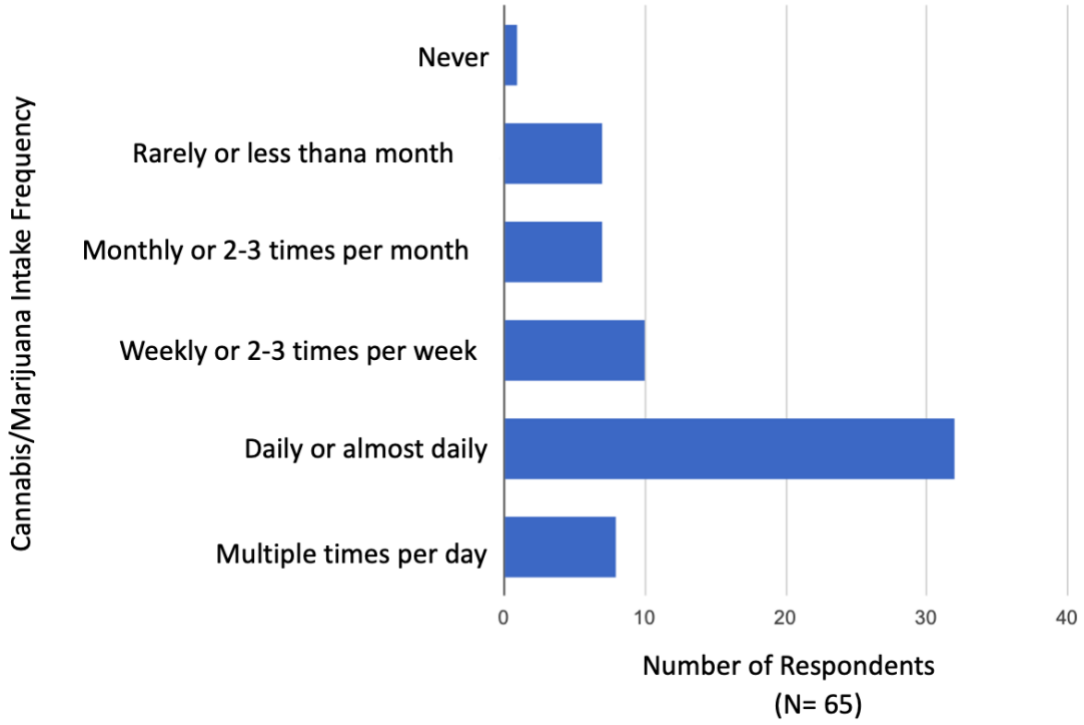

Figure 12: Participants' frequency of cannabis/marijuana usage within the past year.

Participants were asked within the past year, how often they used cannabis/marijuana for medical reasons (either to treat or decrease symptoms of a health condition). One (1.5%) reported never. Seven /(10.8%) reported rarely or less than once per month. Seven (10.8%) reported monthly or 2-3 times per month. 10 (15.4%) reported

weekly or 2-3 times per week. 32 (49.2%) reported daily or almost daily. Eight (12.3%) reported multiple times per day.

Cannabis & CNS Symptoms

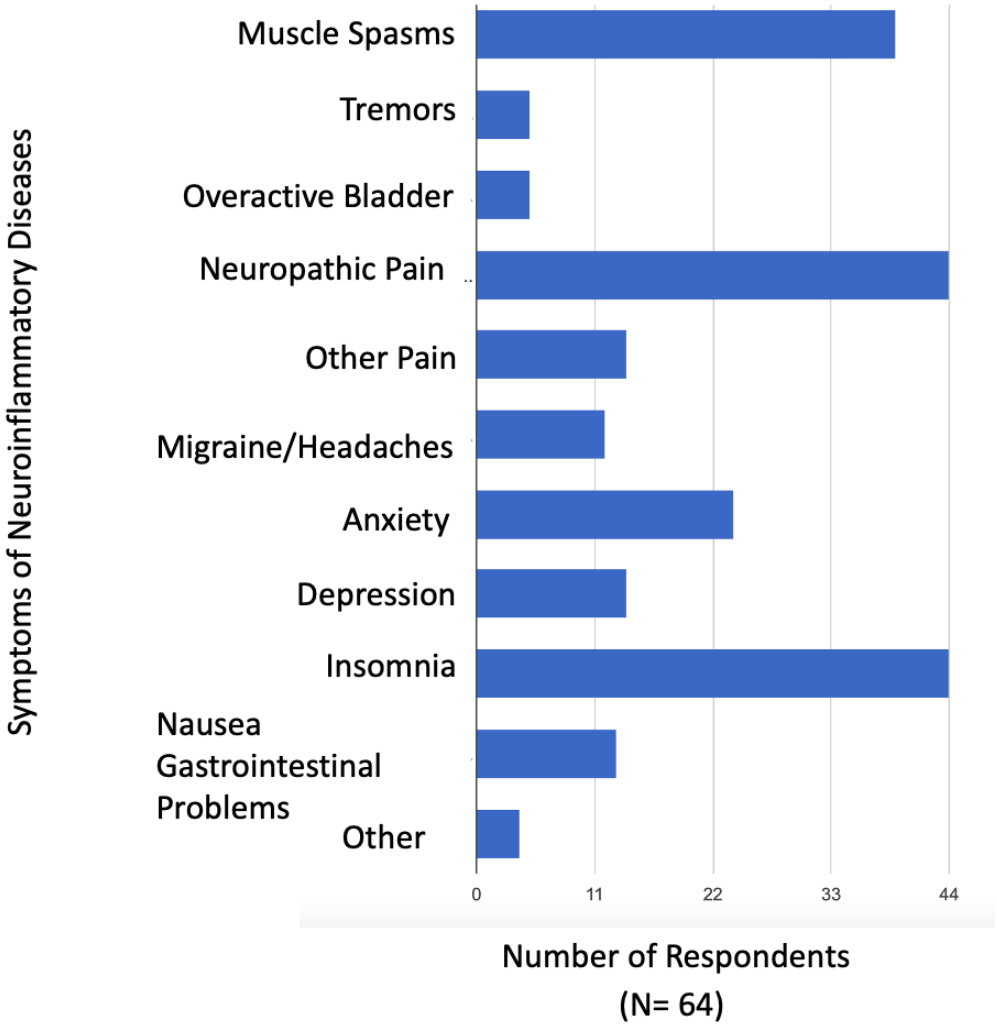

Figure 13: Participants' symptoms targeted when using cannabis/marijuana.

Participants were asked which symptoms were targeted to treat when using cannabis/marijuana. 39 (60.9%) participants targeted muscle spasms, cramps, or

spasticity. Five (7.8%) participants targeted tremors. Five (7.8%) participants targeted overactive bladder / bladder symptoms. 44 (68.8%) participants targeted neuropathic pain (numbness, tingling, or burning). 14 (21.9%) participants targeted other pain. 12, (18.8%) participants targeted migraine / headaches / eye pain. 24 (37.5%) participants targeted anxiety. 14 (21.9%) participants targeted depression. 44 (68.8%) participants targeted insomnia / sleep problems. 13 (20.3%) participants targeted nausea / gastrointestinal problems. Four (6.3%) reported 'other'.

Substituting Cannabis

Participants were asked if they ever used cannabis to decrease the dose of or replace other medications prescribed to them for pain or spasticity. Out of 57 respondents, 26 (45.6%) responded yes and 31 (54.4%) responded no.

Cannabis Efficacy for Muscle Spasticity

The survey asked about how effective participants found cannabis in reducing the need for other pain and spasticity medications. Out of 26 respondents, 12 (46.2%) found it very effective. 12 reported (46.2%) somewhat effective. 2 (7.7%) reported not very effective and no one reported that it was not effective at all.

For those that found cannabis to be effective for their muscle spasticity, out of 63 respondents, 26 (41.3%) found that cannabis helps a lot. 20 (31.7%) individuals said it helps a little and seven (11.1%) reported no change. Others reported it was not applicable 10 (15.9%).

If there was an FDA-approved prescription cannabinoid medication available to treat pain and spasticity 99 (84.6%) participants said they would be interested in taking it and 18 (15.4%) said they would not.

Cannabis Efficacy for Depression, Anxiety or Sleep

Another question asked participants whether they have ever used cannabis to decrease the dose or replace other medications prescribed to them for depression, anxiety or sleep. Out of 52 respondents, 30 (57.7%) said ‘no’ and 22 (42.3%) said ‘yes.’ As for efficacy, 9 (40.9%) individuals found that cannabis is very effective in decreasing the need for depression, anxiety and sleep medication. 11 (50.0%) found it somewhat effective and two (9.1%) found it not very effective.

Cannabis Efficacy for Tremors

As for tremors, out of 63 participants 12 (19.0%) reported that there was no change. 14 (22.2%) reported that it helped a little. 6 (9.5%) reported it helped a lot and 31 (49.2%) reported it was not applicable.

Cannabis Efficacy for Overactive Bladder

Out of 63 respondents, one (1.6%) individual reported cannabis worsens their bladder a lot. One (1.6%) reported it worsens a little. 31 (49.2%) reported no change. 4 (6.3%) reported helps a little. One (1.6%) reported it helps a lot, and 25 (39.7%) reported not applicable.

Cannabis Efficacy for Neuropathic Pain, Numbness, Tingling or Burning

Out of 64 respondents, one (1.6%) reported that pain, numbness, tingling or burning worsens a lot. Zero individuals reported it worsens a little. Five (7.8%) reported no change. 25 (39.1%) reported helps a little. 28 (43.8%) reported helps a lot. Five (7.8%) reported not applicable.

Cannabis Efficacy for Other Pain

Out of 61 respondents, one (1.6%) reported cannabis worsens "other pain" a lot. Zero reported that it worsens a little. Seven (11.5%) reported no change. 18 (29.5%) reported helps a little. 23 (37.7%) reported helping a lot and 12 (19.7%) individuals reported not applicable.

Cannabis Efficacy for Migraine, Headaches and Eye Pain

Out of 63 respondents, one (1.6%) reported it worsens a lot. Zero reported it worsens a little. 11 (17.5%) reported no change. 15 (23.8%) reported helps a little. Eight (12.7%) reported helps a lot. 28 (44.4%) reported not applicable.

Cannabis Efficacy for Anxiety

Out of 63 individuals, one (1.6%) participant reports cannabis worsens their anxiety a lot. Four (6.3%) participants report it worsens a little. Seven (11.1%) participants report no change. 16 (25.4%) participants report it helps a little. 20 (31.7%) participants report it helps a lot. 15 (23.8%) participants report not applicable.

Cannabis Efficacy for Depression

Out of 63 participants, zero report cannabis worsens their depression a lot. Three (4.8%) participants report it worsens it a little. 11 (17.5%) participants report no change. 12 (9.0%) participants report it helps a little. 19 (30.2%) participants report it helps a lot. 18 (28.6%) participants report not applicable.

Cannabis Efficacy for Insomnia/ Sleep Problems

Out of 64 respondents, zero participants report cannabis worsens their insomnia a lot. Zero participants report it worsens a little. Four (6.3%) participants report no change. 13 (20.3%) participants report helps a little. 40, (62.5%) participants report it helps a lot. Seven (10.9%) participants report not applicable.

Cannabis Efficacy for Nausea/ Gastrointestinal Problems

Out of 63 respondents, zero participants report that cannabis worsens nausea/ gastrointestinal problems a lot. Zero participants report it worsens a little. 17 (27.0%) participants report no change. 11 (17.5%) participants report it helps a little. 11 (17.5%) participants report it helps a lot. 24 (38.1%) participants report not applicable.

Cannabis Efficacy for Balance Problems

Out of 63 respondents, one (1.6%) reports cannabis worsens their balance problems a lot. Nine (14.3%) participants report it worsens a little. 25 (39.7%) participants report no

change. Nine (14.3%) participants report it helps a little. Zero participants report it helps a lot. 19 (30.2%) participants report not applicable.

Cannabis Efficacy for Thinking Problems, 'Brain Fog,' or Confusion

Out of 63 respondents, zero participants reported cannabis worsens their thinking problems, 'brain fog,' or confusion a lot. 16 (25.4%) participants reported it worsens a little. 19 (30.2%) participants reported no change. Nine (14.3%) participants reported it helps a little. Four (6.3%) participants reported it helps a lot. 15 (23.8%) participants reported not applicable.

Cannabis Efficacy for Sexual Function

Out of 63 respondents, 0 (0.0%) participants reported cannabis worsens their sexual function a lot, two (3.2%) worsens a little, 20 (31.7%) no change, nine (14.3%) helps a little, nine (14.3%) helps a lot, 23 (36.5%) not applicable.

Speaking to Physicians About Cannabis Use

Of 117 participants, 56 (47.9%) have never talked to their doctor about cannabis/marijuana use. 23 (19.7%) participants have had their doctor ask them about cannabis/marijuana use. 38 (32.5%) participants have brought up cannabis/marijuana use.

17 (14.5%) report that they would not feel comfortable discussing cannabis with their doctors. 41 (35.0%) participants say that they would feel comfortable discussing

cannabis/marijuana with ‘some’ of their doctors. 59 (50.4%) participants report that they would feel comfortable discussing cannabis/marijuana with ‘all’ of their doctors.

Patients VS. Physicians: Barriers Experienced Regarding Discussing Cannabis/Marijuana Use

Out of 57 respondents, six (10.5%) report there is not enough time during the visit. 14 (24.6%) participants are concerned about legal implications of discussing cannabis. 19 (33.3%) participants report they do not want information about cannabis use to be in my medical chart. 17 (29.8%) believe their provider would disapprove or be judgmental about my cannabis use. 22 (38.6%) believe their physician is unlikely to have helpful knowledge or experience with cannabis use. 14 (24.6%) participants do not experience any barriers to discussing cannabis / marijuana use, but it has not come up. Nine (15.8%) reported “other.”

DISCUSSION

The interim analysis of this study reveals novel insights into the patterns, frequency, and effectiveness of cannabis use reported by patients seeking relief from symptoms associated with NMOSD, MOGAD, ADEM, and TM. Interestingly, the patient population sampled exhibited a nearly equal division regarding their adoption of cannabis for managing symptoms related to CNS diseases. Slightly more than half of the participants have utilized cannabis or marijuana, while the remaining portion has refrained from its use. Legal concerns (for N= 18/50, 36%) of respondents) and apprehensions regarding potential side effects (for N= 16/50, 32% of respondents) emerged as significant factors influencing the decision of those who opted not to use cannabis.

For those that use cannabis, the survey revealed that the majority of this population consumes cannabis/marijuana by ingesting it (ex.gummies/brownies/cakes/cookies). The second and third most popular methods were inhalation(via joint, bong, pipe or blunt) and vaporization (via vape or dab). Cannabis was reportedly used daily in most of these patients (N= 32/65, 49.2%) to target their most common symptoms, and it was usually consumed in the evenings or overnight (amongst N= 42/63, 66.7%). Neuropathic pain (amongst N= 92/115, 80.0%), insomnia (amongst N=63/115, 54.8%) and muscle spasms (amongst N= 78/115, 67.8%) were reported as three of the most commonly-targeted symptoms when patients turn to cannabis.

Regarding efficacy, individuals consistently reported that cannabis was highly effective in managing muscle spasticity (N= 26/63, 41.3%) and many respondents (N= 99/117, 84.6%) expressed willingness to consider an FDA-approved prescription cannabinoid medication for pain and spasticity relief. Moreover, many respondents reported that cannabis was highly effective for alleviating symptoms of anxiety, depression, and improving sleep quality (N= 11/22, 50.0%). Further exploration through a follow-up study to validate these findings on efficacy is necessary. Conversely, the data indicated limited to no efficacy in addressing tremors, overactive bladders, sexual dysfunction, migraines/headaches/eye pain, and nausea.

The data collected will significantly shape future interactions between physicians and patients, particularly regarding discussions about cannabis. A considerable number of patients have expressed their perspectives on engaging in conversations about cannabis during follow-up visits. While over half of them (N= 59/117, 50.4%) indicated comfort in discussing their cannabis usage with their doctors, many harbor doubts about their physicians' level of knowledge or experience in this area (N=22/57, 38.6%).

As emerging research continues to underscore the efficacy of cannabis in addressing symptoms associated with conditions such as MOGAD, NMOSD, ADEM, and TM, there is a growing need for physicians to familiarize themselves with cannabis dosages. This knowledge can empower them to provide valuable guidance to patients who may benefit from medical marijuana but have reservations or lack information. Furthermore, this study lays a groundwork for increasing physician involvement in the process of issuing medical marijuana cards. By expanding their understanding and

involvement in cannabis-related healthcare, physicians can better support their patients and contribute to improved treatment outcomes.

Many individuals (N=19/57, 33.3%) who expressed discomfort in disclosing their cannabis use to their physicians cited concerns about their information being documented in their medical records. While it's crucial for physicians to stress the importance of comprehensive disclosure for effective treatment, they also play a pivotal role in dismantling the stigma associated with cannabis. This entails ensuring patients feel secure in a non-judgmental atmosphere and reaffirming the confidentiality of all medical records.

There are many strengths of this study, foremost among them being its utilization of a survey-based approach. This method offers distinct advantages, serving as a cost-effective and expeditious means of data collection. Moreover, by leveraging the survey format, researchers can effectively target a broad geographical population, thereby enhancing the reliability and adaptability of the gathered data compared to alternative collection methods in research studies.

Furthermore, the study benefited significantly from extensive collaboration networks. Partnering with foundations and the neuroimmunology clinic facilitated the acquisition of a substantial volume of survey responses within a condensed time frame. This collaborative effort not only bolstered the study's comprehensiveness but also expedited the accumulation of invaluable insights.

This interim analysis was heavily skewed toward MOGAD, as the MOG project was the first foundation that distributed the survey to its subscribers. While the majority of the patient population that completed this survey were MOGAD patients, this was not viewed as problematic as those with MOGAD also have co-existing conditions such as ADEM and TM. ADEM and TM are presenting features of MOGAD and therefore could offer insights into idiopathic TM and ADEM as well.

MOGAD is also commonly diagnosed during childhood, so the average age of participants that completed this survey was skewed lower. While this may be seen as a limitation, it mirrors the characteristics of the disease. To diminish this skew and obtain a more normal data distribution, the study will await further data analysis when other foundations including SRNA and the Sumaira foundation continue distribution of the survey to their subscribers. The SRNA foundation reports they have 4,000 members and the Sumaira Foundation has 78 members. Expanding the study population will allow investigators to gain a greater understanding of cannabis use within the NMOSD, MOGAD, ADEM and TM populations.

Another limitation of this study includes lack of generalizability due to the cross-sectional design. The results of this study are also skewed toward MOGAD and therefore may not be as generalizable to the other CNS disorders that were targeted to be studied. The survey also lacked racial generalizability within patient populations. There was a higher number of caucasians (N= 99/116, 85.3%) compared to other ethnic groups: African American (N= 4/116,3.4%) Asian (N=6/116, 5.2%) and Hispanic (N=4/116,

3.4%), which could be explained by the fact that the MOG project does not have a wide pool of ethnicities subscribing to their foundation. Minorities tend to lack information on resources like these foundations that could help support their condition.

While there were 162 respondents, 39 records were excluded due to being incomplete surveys on REDcap. This could be due to participants who stopped filling out the survey mid-way and intending to come back to it. Participants needed a different link that required a code to resume the survey, however, participants were not given this unique link. Others found that the survey took them more than 20 minutes, which introduced a degree of response bias. Other potential biases include selection bias, as patients involved in advocacy groups may be more severely affected and of higher socioeconomic status. In the future, this survey will be advertised on many more platforms, in hospitals and across diverse patient organizations to increase data generalizability.

For forthcoming analyses, researchers may employ regression techniques to assess the relationships among various variables examined in this study. Exploring the correlations between alcohol use and cannabis consumption, smoking habits and cannabis use, as well as recreational versus medicinal usage, could yield intriguing insights. Furthermore, investigating the interplay between cannabis use and other alternative therapies, disability levels, and reported symptoms associated with cannabis usage could offer valuable perspectives.

CONCLUSION

In conclusion, this study lays the groundwork for future research endeavors and provides valuable insights to patients with MOGAD, NMOSD, ADEM, and TM regarding alternative approaches for managing their disease symptoms. These findings mark the initial steps towards uncovering novel treatments for rare central nervous system disorders.

APPENDIX

Survey Questionnaire

Cannabis in NMOSD/ MOGAD / ADEM/ TM Questionnaire
Version: January 29, 2024

This voluntary research survey study aims to explore strategies used to treat symptoms in Neuromyelitis Optica Spectrum Disorders (NMOSD), Myelin Oligodendrocyte Glycoprotein Antibody Disease (MOGAD), Acute Disseminated Encephalomyelitis (ADEM), or Transverse Myelitis (TM), and particularly cannabis use. We are interested in your survey responses REGARDLESS of whether you have ever used or thought about using cannabis. This survey is approved by the Mass General Brigham Institutional Review Board and we plan to get approximately 160 responses. We are looking for respondents who are diagnosed with one of the mentioned conditions – we are not surveying caregivers at this time.

*The primary risk of a survey is the risk of loss of privacy and confidentiality. However, this survey is a **fully anonymized** with no personal identifiers collected, so the risk of loss of privacy and confidentiality should be absolutely minimized. All data will also be stored securely and confidentially.*

We anticipate that the survey should take approximately 20 minutes to complete. Completion of the survey constitutes your indication that you have provided informed consent. No compensation will be provided for the completion of this survey.

By completing the survey, you are permitting the responses of these surveys to be used for research. Please note you have the option to withdraw from the survey by discontinuing survey completion at any point. Should you feel uncomfortable answering any questions, you may submit the survey with some answers left blank.

If you have any difficulty completing this survey please contact us at our study email, surveystudy@massgeneralbrigham.org. The Principal Investigators of this research study are Dr. Michael Levy and Dr. Anastasia Vishnevetsky. If you'd like to speak to someone not involved in this research about your rights as a research subject, or any concerns or complaints you may have about the research, contact the Mass General Brigham IRB at (857) 282-1900.

[Demographics – Screening]

1. What is your age (in years)?

2. What diagnosis has your doctor said you currently have?
   ☐ MOG Antibody Disease (MOGAD)
   ☐ Neuromyelitis Optica (NMOSD), Aquaporin-4 positive
   ☐ Neuromyelitis Optica (NMOSD), seronegative subtype
   ☐ Multiple Sclerosis (MS)
   ☐ Acute Disseminated Encephalomyelitis (ADEM) only (no diagnosis of NMOSD or MOGAD)
   ☐ Transverse Myelitis (TM) only (no diagnosis of NMOSD or MOGAD)
   ☐ Other
   ☐ I care for or am the parent of an individual with NMOSD, MOGAD, ADEM, or TM

If options 4, 7, or 8 are checked, or age <18 years → End survey and show:

Thank you for your interest in participating in this survey. We are focusing in on adults with MOGAD and NMOSD for the purposes of this survey, but may open this up to other individuals for participation in the future.

[Disease diagnosis information]

3. Looking back, how old were you when you first experienced symptoms related to [MOGAD, NMOSD, ADEM or TM]? *Provide answer as age in years.*

4. How old were you when you were first diagnosed with [MOGAD, NMOSD, ADEM or TM]? *Provide answer as age in years.*

Show the following question only if patient marks diagnosis as MOGAD or NMOSD.

5. Which disease manifestations have you had? (Mark all that apply)
   ☐ Optic Neuritis
   ☐ Transverse Myelitis
   ☐ ADEM
   ☐ Brain lesions (without ADEM diagnosis)

[Patient-Derived Disease Steps]

6. Please read the choices listed below and choose the one that best describes your own situation. This scale focuses mainly on how well you walk. *You might not find a description that reflects your condition exactly, but please mark the one category that describes your situation the closest.*

☐ Normal: I may have some mild symptoms, mostly sensory (some abnormal sensations like pain, numbness or tingling), due to NMOSD / MOGAD, but they do not limit my activity. If I do have an attack, I return to normal when the attack has passed.
☐ Mild Disability: I have some noticeable symptoms from my NMOSD / MOGAD, but they are minor and have only a small effect on my lifestyle.
☐ Moderate Disability: I don't have any limitations in my walking ability. However, I do have significant problems due to [NMOSD, MOGAD, ADEM, or TM] that limit daily activities in other ways.
☐ Gait Disability: [NMOSD, MOGAD, ADEM, or TM] does interfere with my activities, especially my walking. I can work a full day, but athletic or physically demanding activities are more difficult than they used to be. I usually don't need a cane or other assistance to walk, but I might need some assistance during an attack.
☐ Early Cane: I use a cane, a single crutch, or some other form of support (such as touching a wall or leaning on someone's arm) for walking all the time or part of the time, especially when walking outside. I think I can walk 25 feet in 20 seconds without a cane or crutch. I always need some assistance (cane or crutch) if I want to walk as far as 3 blocks.
☐ Late Cane: To be able to walk 25 feet, I have to have a cane, crutch or someone to hold onto. I can get around the house or other buildings by holding onto furniture or touching the walls for support. I may use a scooter or wheelchair if I want to go greater distances.
☐ Bilateral Support: To be able to walk as far as 25 feet I must have 2 canes or crutches or a walker. I may use a scooter or wheelchair for longer distances.
☐ Wheelchair / Scooter: My main form of mobility is a wheelchair. I may be able to stand and/or take one or two steps, but I can't walk 25 feet, even with crutches or a walker.
☐ Bedridden: Unable to sit in a wheelchair for more than one hour.

[Symptom severity and treatment]

7. Which symptoms of [NMOSD, MOGAD, ADEM, or TM] do you have at least on a weekly basis? *Please check all that apply.*

☐ Muscle spasms, cramps, or spasticity → **If not checked, skip questions 8-10**
☐ Tremors
☐ Overactive bladder / bladder symptoms
☐ Neuropathic Pain (electric, tingling, or burning pain) → **If this or next 'pain option not checked, skip question 11**
☐ Other Pain → **If this or prior 'pain' option not checked, skip question 11**
☐ Migraine / headaches
☐ Anxiety
☐ Depression
☐ Insomnia / sleep problems → **If not checked, skip question 12**
☐ Nausea / gastrointestinal problems
☐ Other
    ☐ Other, please specify:

8. Please rate the average level of your spasticity over the past week. *When rating the level of your spasticity, consider muscle spasms, and muscle tightness or stiffness in your answer*. *Please rate this on a 0 to 10 scale, with 0 being "no spasticity" and 10 being "worst possible spasticity."* **[adapted question]**

0 1 2 3 4 5 6 7 8 9 10

9. What treatment(s) are you currently receiving for spasticity? *Please check all that apply.* **[adapted question]**

☐ Oral (by mouth) medications → **if unchecked, skip to question 11**
☐ Botulinum toxin injections
☐ Stretching
☐ Home exercise program
☐ Cold therapy
☐ Heat therapy
☐ Light pressure/stroking
☐ Physical therapy
☐ Occupational therapy
☐ Other
    ☐ Other, please describe:

☐ None

10. Please indicate which oral medications you currently use to treat spasticity associated with [NMOSD, MOGAD, ADEM, or TM]. *Please check all that apply.* **[adapted question]**

☐ Oral Baclofen® (Gablofen and Lioresal)
☐ Zanaflex® (Tizanidine)
☐ Gabapentin (Neurontin)
☐ Diazepam (Valium)
☐ Clonazepam (Klonopin)
☐ Carbamazepine (Tegretol)
☐ Other
    ☐ Other, please describe:

11. Please rate the average level of your pain over the past week. *When rating the level of your pain, please include all forms of pain, such as nerve pain or musculoskeletal pain. Please rate this on a 0 to 10 scale, with 0 being "no pain" and 10 being "worst possible pain."* **[adapted question]**

0 1 2 3 4 5 6 7 8 9 10

12. Please rate the average level of your sleep problems over the past week. *When rating the level of your sleep problems, please include all causes of insomnia or night-time sleep disturbances. Please rate this on a 0 to 10 scale, with 0 being "no sleep problems" and 10 being "worst possible sleep problems."* **[adapted question]**

0 1 2 3 4 5 6 7 8 9 10

13. Which immunotherapy are you receiving, if any, for your NMOSD/MOGAD? **Answer options will be branched based on NMOSD vs. MOGAD diagnosis as follows (initial options are common to both diagnoses):**

☐ I am not receiving any immunotherapy.
☐ Rituximab (Rituxan)
☐ Mycophenolate mofetil (Cellcept)
☐ Azathioprine (Imuran)
☐ Chronic prednisone

MOGAD:

☐ IVIG or SCIG
☐ Tocilizumab

☐ Other
    ☐ Other, please describe:

NMOSD:

☐ Inebilizumab (Uplinza)
☐ Satralizumab (Enspryng)
☐ Eculizumab (Soliris)
☐ Other
    ☐ Other, please describe:

14. Have you utilized complementary or alternative medicine approaches for the treatment of your MOGAD / NMOSD symptoms? *Examples of complementary or alternative medicine include homeopathy, acupuncture, chiropractic, functional medicine, etc., but exclude exercise or lifestyle practices such as yoga or meditation.*

☐ Yes, I have used complementary or alternative medicine approaches in the past 3 months
☐ Yes, I have used complementary or alternative medicine in the past but not in the past 3 months.
☐ No, I have not used complementary or alternative medicine approaches. → **Skip Question 15**

15. What complementary or alternative medicine therapies have you utilized? *Check all that apply.*

☐ Homeopathy
☐ Acupuncture
☐ Chiropractic
☐ Osteopathy
☐ Functional medicine consultations
☐ Naturopathy
☐ Ayurvedic
☐ Aromatherapy
☐ Other
    ☐ Other, please describe

[Cannabis Use: Motivation, Relationship with Recreational Use, and Perceived Efficacy/Side Effects]

For the following questions, "cannabis/marijuana" refers to products derived from the cannabis/marijuana plant. This definition includes smoking, vaping, eating, ingesting, topical application, or any other method of use and includes products marketed as CBD (only) or hemp CBD.

16. Have you ever, even once, used cannabis / marijuana to treat your [NMOSD, MOGAD, ADEM, or TM]-related symptoms? **[adapted question]**

☐ Yes → **Skip question 18**
☐ No

17. Have you ever, even once, used cannabis / marijuana for prior to your NMOSD/MOGAD diagnosis? **[adapted question]**

☐ Yes
☐ No

Note: Changed order of questions to ask about medical usage of cannabis first to de-stigmatize question.

18. Which of the following are *MAJOR* reasons why you do not use cannabis/marijuana for [NMOSD, MOGAD, ADEM, or TM] symptoms? *Please check all that apply.* **Will randomize order of these answers.**

☐ Not enough data about how safe it is or how well it works
☐ My healthcare professional does not recommend it
☐ Cost, or lack of insurance coverage
☐ Concerns about its legality
☐ Concerns about effect on employment
☐ Stigma associated with using cannabis/marijuana
☐ It is difficult to obtain
☐ Concerns about losing insurance coverages (for example, if on disability)
☐ Other drug testing concerns
☐ Concerns about potential side effects or adverse events
☐ Concerns on ethical or moral grounds
☐ I have just never thought about it
☐ I don't need it for my symptoms
☐ Other:
  ☐ Other, please specify:

For those who answer 'Yes' to Question 16, these additional options will be available:

☐ I don't like the way it makes me feel / it makes me feel high
☐ Side effects that I have experienced (eg, psychiatric symptoms, nausea, headache, nasopharyngitis, somnolence)

If answer to both 16 and 17 are 'No', skip to Question 47.

19. How old were you the first time you used cannabis / marijuana (age in years)? **[adapted question]**

20. Within the past year, how often have you used cannabis / marijuana for any reason?

☐ Never → **Skip to Question 45**
☐ Monthly or less
☐ Two to four times per month
☐ Two to three times per week
☐ Four or more times per week

21. When you used cannabis/marijuana during the past year, was it for medical reasons (meaning to treat or decrease symptoms of a health condition), for non-medical reasons (meaning to get pleasure, relaxation, or for socializing, or for both medical and non-medical reasons?

☐ Only for medical reasons to treat or decrease symptoms of a health condition
☐ Only for non-medical purposes to get pleasure or satisfaction → **Skip Questions 23, and 40-42, 46**
☐ Both medical and non-medical reasons

Skip question 22 if answer to question 21 is 'only for non-medical purposes'.

22. Within the past year, how often have you used cannabis / marijuana for medical reasons (meaning to treat or decrease symptoms of a health condition)?

☐ Never → **Skip to Question 45**
☐ Monthly or less
☐ Two to four times per month
☐ Two to three times per week
☐ Four or more times per week

23. Which symptoms of NMOSD/ MOGAD do you use cannabis/marijuana to target or treat? *Please check all that apply.*

☐ Muscle spasms, cramps, or spasticity
☐ Tremors
☐ Overactive bladder / bladder symptoms
☐ Neuropathic Pain, numbness, tingling, or burning
☐ Other Pain
☐ Migraine / headaches
☐ Anxiety

☐ Depression
☐ Insomnia / sleep problems
☐ Nausea / gastrointestinal problems
☐ Other
    ☐ Other, please specify:

24. Please indicate how much cannabis/marijuana helps or worsens with each of the following symptoms. If you do not experience this symptom, please mark "N/A". **Matrix formatting will be done in REDCap, and symptom order will be randomized. Current matrix with likely symptoms that may be helped first, and likely adverse effects second for clarity.**

	Worsens a lot	**Worsens a little**	**No change**	**Helps a little**	**Helps a lot**	**N/A (Not applicable)**
Potential 'helped symptoms'						
25. Muscle spasms, cramps, or spasticity	☐	☐	☐	☐	☐	☐
26. Tremors	☐	☐	☐	☐	☐	☐
27. Overactive bladder / bladder symptoms	☐	☐	☐	☐	☐	☐
28. Neuropathic pain, numbness, tingling, or burning	☐	☐	☐	☐	☐	☐
29. Other Pain	☐	☐	☐	☐	☐	☐
30. Migraine / headaches	☐	☐	☐	☐	☐	☐

31. Anxiety	☐	☐	☐	☐	☐	☐
32. Depression	☐	☐	☐	☐	☐	☐
33. Insomnia / sleep problems	☐	☐	☐	☐	☐	☐
34. Nausea / gastrointestinal problems	☐	☐	☐	☐	☐	☐
Potential adverse effects						
35. Dizziness	☐	☐	☐	☐	☐	☐
36. Balance problems	☐	☐	☐	☐	☐	☐
37. Thinking problems, 'brain fog', or confusion	☐	☐	☐	☐	☐	☐
38. Speaking problems	☐	☐	☐	☐	☐	☐
39. Sexual function	☐	☐	☐	☐	☐	☐

40. Compared to your prescription medications, when did you start using cannabis/marijuana for your [NMOSD, MOGAD, ADEM, or TM] symptoms? **[adapted question]**

☐ Before trying any symptom management medications (for example, gabapentin, baclofen, or Prozac)

☐ After trying one or more [NMOSD, MOGAD, ADEM, or TM] symptom management medications

☐ Never tried symptom management medications

[Cannabis Use: Frequency, patterns of use, mode of use]

41. On a typical day that you use cannabis/marijuana to treat symptoms, when do you use it? *Please check all that apply.*

☐ Use in the morning (after waking but before lunchtime)

☐ Use in the afternoon (after lunchtime but before dinnertime)

☐ Use in the evening (after dinnertime but before bedtime)
☐ Use overnight (at or after bedtime but before waking in the morning)

42. On a typical day that you use cannabis/marijuana to treat symptoms, how do you decide to use it?
☐ I use it at a regular, consistent time most days, in a way that is not related to my symptoms.
☐ I use it when I feel like it, but not particularly related to symptom presence or severity.
☐ I use it before symptoms come on to prevent symptoms.
☐ I use it when I start to feel my symptoms coming on or when my symptoms are mild.
☐ I use it when my symptoms are persistent or severe.
☐ Not applicable – I almost never use it to treat symptoms.

43. During the past year, what was the form of cannabis/marijuana which you used most often? **[adapted question]**
☐ Smoke it, for example in a joint, bong, pipe, or blunt
☐ Spray it, using an oral spray device
☐ Vaporize or "vape" it, or 'dab' it
☐ Swallow or drink it, for example as an oil, tincture, pill, or tea
☐ Administer sublingually, such as placing oil or tincture underneath the tongue or spraying into cheek or under the tongue
☐ Eat it, for example in brownies, cakes, cookies, or gummies
☐ Topically, for example as a patch or cream
☐ Use it some other way
    ☐ Please specify

44. If all of the below were readily available, what would be your preferred way to use cannabis/marijuana? **[adapted question]**
☐ Smoke it, for example in a joint, bong, pipe, or blunt
☐ Spray it, using an oral spray device
☐ Vaporize or "vape" it, or 'dab' it
☐ Swallow or drink it, for example as an oil, tincture, pill, or tea
☐ Administer sublingually, such as placing oil or tincture underneath the tongue or spraying into cheek or under the tongue
☐ Eat it, for example in brownies, cakes, cookies, or gummies
☐ Topically, for example as a patch or cream
☐ Use it some other way
    ☐ Please specify

☐ No preference

Cannabis Use: Motivation (continued), and Physician relationship

45. Which of the following are MAJOR reasons for why you use less cannabis/marijuana for [NMOSD, MOGAD, ADEM, or TM] than you might otherwise? *Please check all that apply.*

☐ It does not help with my symptoms
☐ Not enough data about how safe it is or how well it works
☐ My healthcare professional does not recommend it
☐ Cost, or lack of insurance coverage
☐ Concerns about its legality
☐ Concerns about effect on employment
☐ Stigma associated with using cannabis/marijuana
☐ It is difficult to obtain
☐ Concerns about losing insurance coverages (for example, if on disability)
☐ Other drug testing concerns
☐ Concerns about potential side effects or adverse events
☐ Concerns on ethical or moral grounds
☐ I have just never thought about it
☐ I don't like the way it makes me feel / it makes me feel high
☐ I don't need it for my symptoms
☐ Other:
  ☐ Other, please specify:

46. Which of the following BEST describes the reason you began to use cannabis/marijuana for symptom relief?

☐ I was already using it recreationally and found that it was helpful for symptoms
☐ My doctor mentioned that cannabis / marijuana might be helpful for me or recommended that I use it
☐ I read about potential benefits in the media and decided to try it.
☐ I heard about potential benefits from other patients in-person (word-of-mouth)
☐ I heard about potential benefits from online patient message-boards, or online support groups.
☐ It was recommended to me by family or friends (excluding patients and treating medical providers).
☐ I just decided to try it

☐Other

☐ Other please specify

47. Have you ever talked to one of your neurologists about cannabis/marijuana use?

☐ No, I have never talked to my neurologist about cannabis/marijuana use

☐ Yes, after my doctor asked me about cannabis/marijuana use

☐ Yes, after I brought up questions about cannabis/marijuana

48. Would you feel comfortable discussing cannabis / marijuana use with your doctors if you had questions or concerns?

☐ No, not with any of my doctors

☐ Yes, with some of my doctors

☐ Yes, with all of my doctors

49. Which barriers do you experience regarding discussing your cannabis / marijuana use with your doctors? *(Check all that apply)*

☐ Not enough time during the visit

☐ I am concerned about legal implications of discussing this

☐ I do not want information about cannabis use to be in my medical chart

☐ I believe my provider would disapprove or be judgmental about my cannabis use

☐ I believe my physician is unlikely to have helpful knowledge or experience with cannabis use.

☐ Other

☐ Please specify

☐ I do not experience any barriers to discussing cannabis / marijuana use, but it has not come up.

[*Demographics, continued]*

50. Do you consider yourself…? **[adapted question]**

☐ Male,

☐ Female

☐ Non-binary

☐ Other, please specify:

51. Please check the highest educational level you have completed. **[adapted question]**

☐ High school diploma/GED
☐ Associate's degree
☐ Bachelor's degree
☐ Postgraduate education (master's, doctorate)
☐ Technical degree

52. How often did you have a drink containing alcohol in the past year? *Consider a "drink" to be a can or bottle of beer, a glass of wine, a wine cooler, or one cocktail, or a shot of hard liquor (like scotch, gin, or vodka).* **[adapted question]**
☐ Never → **Go to question 52**
☐ Monthly or less
☐ Two to four times per month
☐ Two to three times per week
☐ Four or more times per week

53. How often did you have 5 or more drinks on one occasion in the past year? **[adapted question]**
☐ Never
☐ Less than monthly
☐ Monthly
☐ Weekly
☐ Daily or almost daily

54. Have you ever smoked cigarettes (regular or e-cigarettes)? **[adapted question]**
☐ Yes
☐ No → **Go to question 55**

55. Have you smoked in the past 30 days (regular or e-cigarettes)?
☐ No → **Go to question 55**
☐ Yes, some days
☐ Yes, everyday

56. On average, how many cigarettes do you now smoke per day? **[adapted question]**
(1 pack = 20 cigarettes) Answer in number of cigarettes.

57. Are you currently employed? **[adapted question]**
☐ Yes, full time → **Go to question 57**
☐ Yes, part time → **Go to question 57**
☐ No

58. Which of the following best describes your employment situation? **[adapted question]**
☐ Unemployed (seeking employment)
☐ Unemployed (not seeking employment)
☐ Full time homemaker
☐ Student
☐ Disabled
☐ Retired (not due to medical reasons or disability)
☐ Retired (due to medical reasons or disability)
☐ Other
    ☐ Other, please specify

59. How do you identify your race? *Please check all that apply.* **[adapted question]**
    ☐ White
    ☐ African American, Black
    ☐ American Indian or Alaska Native
    ☐ Asian Indian
    ☐ Hispanic/Latino
    ☐ Other race
        ☐ Other, please describe:

    Thank you for your participation in this survey. Your responses will remain fully anonymous when being analyzed by our team.

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