

Original research

What is brain fog?

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ABSTRACT

Background The term ‘brain fog’ is increasingly used colloquially to describe difficulties in the cognitive realm. But what is brain fog? What sort of experiences do people talk about when they talk about brain fog? And, in turn, what might this tell us about potential underlying pathophysiological mechanisms? This study examined first-person descriptions in order to better understand the phenomenology of brain fog.

Methods Posts containing ‘brain fog’ were scraped from the social media platform Reddit, using python, over a week in October 2021. We examined descriptions of brain fog, themes of containing subreddits (topic-specific discussion forums), and causal attributions.

Results 1663 posts containing ‘brain fog’ were identified, 717 meeting inclusion criteria. 141 first person phenomenological descriptions depicted forgetfulness (51), difficulty concentrating (43), dissociative phenomena (34), cognitive ‘slowness’ and excessive effort (26), communication difficulties (22), ‘fuzziness’ or pressure (10) and fatigue (9). 50% (363/717) posts were in subreddits concerned with illness and disease: including COVID-19 (87), psychiatric, neurodevelopmental, autoimmune and functional disorders. 134 posts were in subreddits about drug use or discontinuation, and 44 in subreddits about abstinence from masturbation. 570 posts included the poster’s causal attribution, the most frequent attribution being long COVID in 60/570 (10%).

Conclusions ‘Brain fog’ is used on Reddit to describe heterogeneous experiences, including of dissociation, fatigue, forgetfulness and excessive cognitive effort, and in association with a range of illnesses, drugs and behaviours. Encouraging detailed description of these experiences will help us better understand pathophysiological mechanisms underlying cognitive symptoms in health and disease.

INTRODUCTION

The term ‘brain fog’ is often used in descriptions of persistent symptoms post-COVID-19; both by individuals seeking treatment, and in communications between healthcare professionals. But just as research into cognitive symptoms post-COVID-19 has yet to yield a single straightforward pathophysiological mechanism, our parallel clinical experience of detailed cognitive phenotyping of patients with long COVID-19 suggests that this encompasses a range of illnesses which one would not expect to be explained by a single mechanism.

Some have suggested that the origins of brain fog are in ‘brain fag’, a neurasthenia-like complex of somatic and cognitive symptoms first described by

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The term ‘brain fog’ is commonly used, but the phenomenology poorly understood.

WHAT THIS STUDY ADDS

⇒ This study of first-person descriptions of brain fog suggests that the term is used to describe not one single experience, but a heterogeneous range of distinct and overlapping subjective experiences. Moreover, brain fog is described in association with a wide range of illnesses, drugs and behaviours.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Curiosity about—and precise description of—brain fog is an important precursor to study of underlying mechanisms and potential treatments.

Tunstall in 1850 as a consequence of ‘overworking (the) mental faculties without sufficient bodily fatigue’.^{1 2} The ‘brain fag syndrome’ was revived in the 1960s; included in the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, 4th Edition) as a culture-bound syndrome associated with excessive academic strain.³

Prior to the COVID-19 pandemic, ‘brain fog’ was perhaps most often used in the context of myalgic encephalomyelitis/chronic fatigue syndrome and fibromyalgia (also as ‘fibro fog’). A 2018 review proposed a unifying model for cognitive abnormalities in functional neurological disorder, fibromyalgia and chronic fatigue syndrome.⁴

Others have suggested that brain fog is a ‘constellation of cognitive symptoms’, which may be due to ‘inflammatory molecules’ and ‘focal brain inflammation’.⁵ Yet, we rarely hear reports of brain fog from patients with acute neuroinflammatory conditions or neurodegenerative dementia. And while we might describe a clouding of consciousness in patients with delirium in the context of an inflammatory condition of or affecting the brain, in our experience patients rarely report brain fog during delirium. While we may recognise feelings of malaise during and immediately after any febrile illness, it is hard to say whether this experience is subjectively different, or simply more chronic than that of brain fog persisting many months after the acute phase of an infection.

In the cognitive neurology clinic we might sometimes see patients who complain not of brain fog but of ‘clouded thinking’ or ‘cognitive clouding’.



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Similarly, patients with disordered sleep, and those taking sedative medications might complain of feeling ‘foggy’. And yet, we hear these descriptions without always inquiring further about what the cloudiness or foginess really feels like.

Curiosity about the nature of symptoms is important. In patients with breathlessness we might look to the lungs, or with a painful calf to blood clotting. But where in the brain might we look for the source of a fog? We must explore the subjective experience—the phenomenology—in much greater detail if we are to better target our efforts to understand and treat.

In this study, we describe analysis of qualitative data describing ‘brain fog’ from a non-clinical setting—the Reddit social media platform, used by 52 million people daily, and containing 2.8 million topic-specific ‘subreddit’ fora. We aimed to summarise the phenomenology and stated attributions of brain fog as contained in discussions on Reddit over a 1-week period in October–November 2021.

METHODS

Posts containing ‘brain fog’ were scraped from Reddit (<https://www.reddit.com>) for a 7-day period between 27 October 2021 and 3 November 2021, using Python V.3.9. Posts not describing or discussing brain fog as a symptom or experience were excluded. Duplicate posts were removed. The themes of containing subreddits (topic-specific discussion fora), and any stated causal attributions were summarised.

Simple thematic analysis was performed on descriptions of discrete brain fog experiences, aligning them where possible with recognised phenomena. Excel V.2203, meta-chart (<https://www.meta-chart.com/>) and displayr (<https://westeurope.displayr.com/>) packages were used for data analysis and visualisation.

RESULTS

A total of 1663 posts contained the term ‘brain fog’, of which 717 met inclusion criteria.

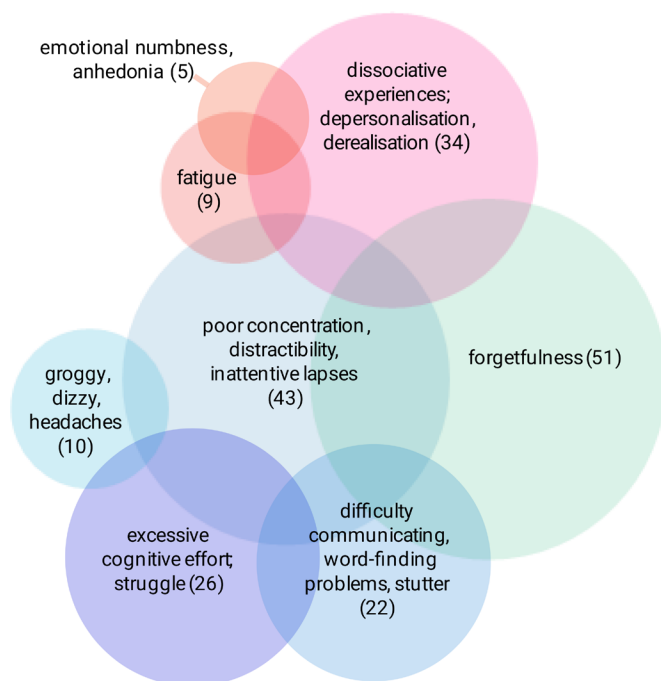


Figure 1 The distribution and overlap of different types of ‘brain fog’ experience in 141 first person descriptions on Reddit.

A total of 141 first person descriptions of brain fog included overlapping descriptions (figure 1 and box 1) of: forgetfulness (51; 36%); difficulty concentrating (43; 30%); dissociative phenomena (34; 24%); perceived cognitive ‘slowness’ and excessive effort (26; 18%); communication difficulties (22; 16%); a feeling of ‘fuzziness’, ‘grogginess’ or pressure in the head (10; 7%) and fatigue (9; 6%).

Table 1 summarises the names and themes of the subreddits in which ‘brain fog’ was identified by the search. 363 (50%) of these 717 ‘brain fog’ posts were in subreddits concerned with illness and disease, and of these, 87/361 (24%) were in COVID-19 subreddits.

Of the included posts, 570 attributed brain fog to a particular cause, which in 50% (282/570) was a type of illness or disease. Of these, 92 (16%) related to COVID-19, of which 60 (11%) long COVID-19, 17 (3%) acute COVID-19, 13 (2%) postvaccination and in 2 (<1%) a combination of acute and long COVID-19. Thirty-eight (7%) posts attributed brain fog to psychiatric illness, 34 (6%) autoimmune, 25 (4%) neurodevelopmental (most ADHD) and 93 (16%) other conditions. Of 570, 189 (33%) posts attributed brain fog to prescribed or non-prescribed drug use or discontinuation: 40 (7%) antidepressants, 37 (65%) recreational drug withdrawal (nicotine 17 (3%), cannabis 10 (2%), alcohol 7 (<1%), other/mixed 3 (<1%)), 22 (4%) recreational drug use, 15 (3%) other prescribed medication discontinuation, 11 (2%) contraceptive medication and 64 (11%) other drugs. Of the remaining 99/570 (17%) posts citing a specific causal attribution: 40 (7%) posts cited masturbation, ejaculation or abstinence from same; 20 (4%) dietary factors; 14 (2%) factors relating to the menstrual cycle, pregnancy or menopause and 25 (4%) cited other causes.

The single most common stated causal attribution was long COVID, in 60 of 570 posts (11%), followed by withdrawal from recreational drugs (44/570, 8%); psychiatric disorders (38/570, 7%); medications—most often selective serotonin reuptake inhibitors (SSRIs), in 27/570 (5%); and masturbation, in 24/570 (4%),

The 16 first person descriptions of the experience of brain fog in those attributing the symptom to long COVID included similar themes to the broader group: 10 (62%) described forgetfulness, 7 (44%) concentration problems, 5 (31%) word-finding or other communication difficulties, 2 (13%) dizziness, 2 (13%) increased cognitive effort or struggle, 2 (13%) fatigue and 1 derealisation.

DISCUSSION

What might a naïve listener think about when they hear the term ‘brain fog’? One would expect them to understand that it is a problem, that it is caused by the brain, and that it is experienced in subjective space. A ‘fog’ might descend and lift in an unpredictable way; or might dull our perceptions. A fog might impede progress, or make us inefficient, so that we make smaller gains for greater effort and feel frustrated, incapacitated or hopeless. Alternatively, a fog might make us feel altogether disoriented. The images suggested by the term ‘brain fog’ are vivid, but multidimensional. The data here, collected from the Reddit social media platform, demonstrates that the experiences and circumstances in which brain fog can arise are similarly multidimensional. A range of quite dissimilar experiences can be described as brain fog. This tells us that we should not expect the experience of ‘brain fog’ to mean the same thing to all people.

Exploring symptom phenomenology (the subjective experience) is key to diagnosis and in turn to determining the correct

Box 1 Examples of 'brain fog' descriptions on Reddit, grouped by theme

Forgetfulness

'Forgetting who had just given a presentation ... 20 min earlier'
 'Forgetting things, forgetting where put things'
 'Forget things like what i did 10 s ago, short-term memory'*
 'Really forgetful, memory issues'
 'I will forget things I took out, and someone else will find them and I will discover I completely forgot about it'
 'Short-term and long-term memory problems ... forgetfulness'

Poor concentration, distractibility, inattention

'Hard to focus, can't read for more than 30s'
 'Struggle to stay focused on one thought'
 'Can't think, can't read, can't write'*
 'Difficulty concentrating'
 'Can't focus on studying'
 'Difficulty understanding conversations, following TV plots, reading books for younger audiences'*

Dissociative

'I don't feel like myself at all. My entire life seems off, as if I'm in a constant state of *deja vu*.'
 'I feel out of tune with like reality or my mind, almost like my perspective is different or im in like a daze. I guess it almost feels like a hangover.'
 'Its like my brain is in dream mode. I question so much and i question my memory or the things I did 10 s ago. Feels like I'm on autopilot a lot'
 'I feel like I am a million miles away'
 'Its like i'm sleepwalking'
 'Feeling like I'm teleporting or outside my body'
 'My body does not feel like mine and I feel completely disconnected from my body'
 'Derealisation'*

Excessive cognitive effort, struggle

'Its like my brain is in slow motion, lagging behind my body reactions'
 'I'm noticeably not as sharp—when someone asks me a simple question I really have to think hard'
 'Struggle to understand books ... struggle to form coherent thought'*
 'Like my brain was severely stunted, didn't work right, and sort of like I was drugged up all the time, and not in a good way'
 'I struggle to complete the most simple of tasks. I can't think. I feel like my eyes aren't working properly like I can see, but I can't process what I'm seeing properly'

Difficulty communicating, word-finding problems, stutter

'... Unable to access simple words. Tonight, when picking up a food order, I could not for the life of me remember what I ordered. I knew what I had ordered but couldn't access the name'
 'I feel like I cannot form words or say things right'
 'I am constantly having what I call slow moments where I am referring to one thing but I actually say something else. For example, I could be referring to a blue backpack but I will accidentally say brown.'
 'Can have a hard time recalling words of common things'*
 'Issues finding words and occasionally even slurring of words'*
 'I basically can't talk ... I don't understand readily the meaning of extremely simple words such as

Continued

Box 1 Continued

Dog', 't-shirt', 'door' etc. I have to think about it and create a mental picture for my brain to process it. I forget words constantly, I forever have the sensation that I want to say a word but I can't retrieve it ... I developed a stutter ... I sound incoherent and constantly use the wrong words or make grammar mistakes.'

Groggy, dizzy, headaches, pressure

'Head feels like it is full of pudding'
 'My head feels foggy and full of pressure'
 'Feels like a rag has been stuffed in my head'
 'Constantly feel poisoned/drunk and like my brain is poisoned. No relief ever from this in the whole time I have been sick. It is 24/7. Gets worse with sugar, alcohol, coffee and stress.'
 'Dizziness/balance problems'*
 'Dizziness'*

Fatigue

'It's just a different kind of exhaustion that I can't fully describe but it feels as if I have a terrible influenza without the influenza, just the fatigue'
 'Feel like can't talk or recount words and has little to no energy'
 'Not able to imagine like I did before. Feeling like my brain is exhausted all the time. Feeling kinda weak...like seriously.'
 'Need to take breaks, etc'*

Emotional numbness, anhedonia

'For me I am still able to be socially aware, yet am not able to socially engage fluidity like I used to its, like the cloud is a window that prevents me from having the same level of closeness that I once felt with others, yet can still pick up social cues and the energy in a room'
 'Almost like my eyes are open but I can't see, always just feel tired and empty, and it's preventing me from doing or enjoying just about anything'
 'Like I am not feeling things ... Every single day is going by in a blur'
 'Cant find that much pleasure in music and anime like i once did.'

*In long COVID-19.

treatment in many areas of medicine, but particularly in those areas where objective measurement is impossible. A neurologist cannot measure the nature or severity of another person's pain, but in asking them to describe it we might establish that it is caused by nerve injury, or ischaemia, or migraine. Similarly, in psychological medicine, external observations alone give an incomplete impression of another person's mood state, thought content or social awareness; but when they speak, we can start to understand. When it comes to cognitive symptoms, however, reliance on purportedly-objective cognitive screening tests may have contributed to a loss of clinical curiosity about the nature, and therefore aetiology, of cognitive difficulties which do not follow a dementia trajectory. Because while psychometric tests can help to provide some measure of cognitive ability, they do not in themselves equate to a diagnosis. The validity of psychometric test results may be adversely affected by a range of illnesses and diseases.⁶ Specifically with regard to the sequelae of COVID-19, early reviews and cohort studies show impairment on psychometric tests but cannot at this stage tell us what the cause of that impairment might be.^{7,8}

Table 1 Names of subreddits containing 'brain fog', verbatim, grouped by theme

Illness and disease	363
COVID-19 and long COVID-19 subreddits: covidlonghaulers (60), COVID19positive (13), Long COVID-19 (6), COVID-19 Vaccinated (3), Other COVID-19 subreddits (1 post only) (5)	87
ADHD	32
BrainFog	30
Depression	12
Fibromyalgia	12
Other subreddits (<10 posts): cfs [chronic fatigue syndrome]* (9), Hypothyroidism (8), Celiac (7), mentalhealth (7), SIBO [small intestine bacterial overgrowth] (6), Migraine (6), Lupus (6), PMDD [premenstrual dysphoric disorder] (6), POTS [postural orthostatic tachycardia syndrome] (5), PCOS [polycystic ovary syndrome] (5), EDAnonymous [eating disorders] (5), tressless ['for sufferers of alopecia and balding']* (5), Multiple Sclerosis (4), gravesdisease (4), dpdr [depersonalization/derealization disorder] (4), Sleep Apnoea (4), Candida (4), Anxiety (4), Schizophrenia (3), dysautonomia (3), Finasteride Syndrome (3), Gastritis (3), Hashimoto's (3), MCAS [mast cell activation syndrome] (3), adhdwomen (3), bipolar2 (2), B12_Deficiency (2), GERD [gastro-oesophageal reflux disorder] (2), iih [idiopathic intracranial hypertension], (2) CrohnsDisease (2), AnorexiaRecovery (2), Mononucleosis (2), Narcolepsy (2), ibs [irritable bowel syndrome] (2), Concussion (2), ehlersdanlos (2), Derealization (2), Chemical Sensitivities (2), POIS [postorgasmic illness syndrome] (2), other subreddits with 1 post only (42)	190
Prescribed and non-prescribed drugs use or discontinuation	134
Antidepressants: antidepressants (6), Lexapro [escitalopram] (5), Zoloft [sertraline] (4), Wellbutrin_Bupropion [4], Prozac [fluoxetine] (3), SSRIs (2), bupropion (2)	26
Cannabis and related compounds: leaves [support in quitting cannabis and related compounds] (12), trees (3), petioles (2), delta-8 (2), weed (2)	21
Nicotine use and withdrawal: stopsmoking (8), QuitVaping (6), Cigarettes ['share your passion for smoking'] (2)	16
Other subreddits (<10 posts): Nootropics ['nootropics and cognitive enhancers] (8), Testosterone ['testosterone replacement therapy and testosterone levels'] (8), stopdrinking [alcohol] (6), floxies ['a subreddit those affected by fluoroquinolone antibiotics'] (5), Supplements ['supplements and nutraceuticals'] (4), dxm [dextromethorphan] (4), Drugs (3), Accutane (3), decaf (3), DPH [diphenhydramine] (2) TherapeuticKetamine (2), other subreddits with 1 post only (23)	71
Medical advice	44
AskDocs (30), medical_advice (6), DiagnoseMe (4), medical (4)	44
Other	170
Sexual: NoFap [not masturbating] (32), Semenretention ['to discuss the physical and spiritual benefits of'] (6), pornfree (4), NoFapChristians (2)	44
Other subreddits (<10 posts): birthcontrol (8), glutenfree (2), AutoImmuneProtocol ['the Auto Immune Protocol diet'] (2), CopperIUD [intrauterine device] (2), relationship_advice (4), Advice (4), StackAdvice (4), TheLongLived (3), self (3), offmychest (3), loseit [weight loss] (2), Microbiome (2), Neuropsychology (2), sexualhealth (2), Periods (2), medicalmedium (2), other subreddits with 1 post only (79)	126
Total	711
*(Additional information from subreddit homepage)', (clarifying information and expanded acronyms from authors of manuscript)).	
ADHD, Attention deficit hyperactivity disorder.	

In our experience, there is a tendency for some health professionals to acknowledge patients' reports of brain fog without curiosity or, therefore, interpretation about what this experience is and what it might mean. Our interpretation of this data is that mention of 'brain fog' is a cue to ask for a more detailed description. By doing so, we may find that our patient is experiencing distressing dissociative symptoms, dizziness or disequilibrium, or even daytime sleepiness. Alternatively, we may find cognitive difficulties which are primarily the result of dynamic changes in attention and concentration.

The Reddit posters here attributed their brain fog to a large range of circumstances: illness and disease, neurodevelopmental disorders (particularly ADHD), prescribed and non-prescribed medications, and, perhaps most unexpectedly to these authors, due to self-perceived excessive or deliberately inhibited masturbation.

The most common single attribution was to COVID-19, and specifically the post-COVID-19 syndrome, also called long COVID-19. Long COVID-19 brain fog posts depicted the same breadth of phenomena as those in other subreddits and reporting other causal attributions. In this data, long COVID-19 brain fog does not appear to have any unique phenomenological characteristics. Rather, 'brain fog' is used by those with long COVID-19 to describe an overlapping set of cognitive, emotional and physical symptoms which are also experienced in other conditions and circumstances. Importantly, COVID-19 was not the main

reported cause of brain fog—other causes were more common overall.

This should give us pause in how we formulate research into cognitive symptoms after COVID-19. If brain fog is not unique to long COVID-19, but is in fact a vivid but multifaceted image that encompasses a range of overlapping experiences, we might also question how likely it is that a single pathophysiological mechanism will underlie these experiences. Rather, in seeking the source of cognitive symptoms after long COVID-19, we should be casting a broad net, taking in the full range of medical, psychiatric, pharmacological and social factors.

There are some potential limitations to this study. The first concerns the source of data. The strengths of Reddit as a source of data are, first: comments and posts are located in the public domain, rather than contained within private groups as is often the case on Facebook; and that relatively long posts (up to 40 000 characters) are allowed, supporting richer description than on Twitter, where individual posts are restricted to 280 characters. Reddit is a rich source of anonymous but candid and detailed qualitative data, and there are many examples of similar methodologies.^{9 10} Nevertheless, it is likely that users of Reddit differ in their experiences of brain fog than users of other social media platforms, and of people who do not participate in social media. Future studies might collect qualitative descriptions of brain fog from a broader range of sources. Second, in this data brain fog was in many cases mentioned without detailed description,

and it is possible that those who did not describe the subjective experience of brain fog have different, or less distinctive, experiences than those providing detailed descriptions. Those posting on Reddit about brain fog may not be representative of those seeking healthcare because of brain fog. Finally, although duplicate posts to multiple forums were removed, and at face value all posts were from distinct individuals, the relative anonymity of data posted on Reddit (again, a strength when it comes to gathering candid accounts of experiences) means that we cannot exclude the possibility that some posts were from the same individuals using alternative usernames.

In conclusion, examination of subjective descriptions of 'brain fog' on a non-clinical social media platform reveal rich descriptions of distinct and overlapping phenomena. Better definition and understanding of these symptoms is a necessary prerequisite in formulating research into underlying mechanisms.

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Contributors LM, HS, AC, IH, JS and AJC formulated the study question and methods. AC provided specific guidance regarding the extraction and analysis of social media data. LM wrote the code and extracted the data. HS summarised and tabulated the data. LM drafted the manuscript which was subsequently reviewed and revised by all authors. LM, as guarantor, accepts full responsibility for the work and conduct of the study, had access to the data, and controlled the decision to publish.

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Competing interests LM is funded by the Scottish Government Chief Scientist's Office to undertake long COVID research. LM provides independent medical testimony in court cases regarding patients with functional disorders and other neuropsychiatric conditions. IH has received honoraria for speaking at medical conferences, undertakes medicolegal work, and is an NRS clinical fellow. JS reports personal fees from UptoDate, outside the submitted work, runs a selfhelp website for patients with functional neurological symptoms (www.neurosymbols.org) which is free and has no advertising, provides independent medical testimony in personal injury and negligence cases regarding patients with functional disorders, and is secretary of the International Functional Neurological Disorder Society. He is a Chief Scientists Office NHS Research Scotland Career Researcher. AJC is a director of a limited personal services company that provides independent medical testimony in court cases on a range of neuropsychiatric topics on a 50% pursuer 50% defender basis, a paid associate editor of the Journal of Neurology Neurosurgery and Psychiatry, and unpaid president elect of the International Functional Neurological Disorder Society.

Patient consent for publication Not applicable.

Ethics approval The study received ethical approval from the Edinburgh Medical School Research Ethics Committee (EMREC). Data were pseudonymised and potentially identifying information was removed prior to analysis. Our code and data are available to other researchers on request.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Data will be shared on reasonable request.

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