Treating Multiple Chemical Sensitivity as a Specific Phobia using Cognitive Behavioural Therapy: A Case Study in an Older Adult

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Abstract

Multiple Chemical Sensitivity (MCS) is a poorly understood condition characterised by physical symptoms triggered by minimal exposure to odorous or chemical agents, often without identifiable organic pathology. This case study describes the treatment of MCS in an older adult referred to the respiratory team who had developed persistent, generalised reactions to odorous stimuli following an acute toxic inhalation. These symptoms led to severe avoidance, functional impairment, and suicidal ideation. After no organic pathology was identified, the patient was referred for psychological assessment. Diagnostic assessment identified symptoms that were not consistent with other psychological disorders and led to a formulation instead underpinned by understanding the problem as a specific phobia. Treatment spanned 14 sessions, beginning with virtual delivery due to avoidance, progressing to in-vivo exposures, and concluding with relapse-prevention planning. Outcome measures indicated substantial reductions in anxiety and health-related worry, with all functional goals achieved. Gains were maintained at 10-month and 22-month follow-up, with remission of anxiety and large reduction in belief ratings for previously feared stimuli. This case highlights the possibility that some MCS presentations can be understood and treated as a type of specific phobia and supports the input of clinical psychologists in respiratory teams. This adds to the evidence base suggesting that there is a key psychological underpinning to the syndrome, and that CBT can support recovery.

Introduction

Multiple Chemical Sensitivity (MCS), also known as Idiopathic Environmental Illness (IEI), is a poorly recognised and poorly understood syndrome, with no consensus as to its aetiology, clinical presentation, or treatment approach. The central feature of MCS is the onset of mixed physiological symptoms - possibly including headaches, fatigue, and pain - triggered by minimal exposure to chemical agents including but not limited to cleaning products, exhaust fumes, perfumes, detergents, and other chemicals (Nethercott et al, 1993). Onset of the condition is triggered by exposure to harmful amounts of chemicals, either through repeated low-level exposure or a single high-intensity exposure (Fishbein, 1996; Kipen & Fiedler, 2000). Following this exposure and recovery from any organic damage, symptoms will remain and even spread, along with a persistent belief in the individual that organic damage remains and that they have developed a sensitivity to chemicals. Zucco and Doty (2022) describe this as a “two-phase” process: firstly, where symptoms are triggered by chemical exposure, and secondly where symptoms generalise to other chemicals or odours, leading to the heterogeneous presentation observed.

The lack of an existing medical framework that explains why low levels of exposure to apparently harmless amounts of chemicals and odours may trigger the reported symptoms has led to MCS being generally understood within the cluster of Medically Unexplained Symptoms (MUS), similar to conditions such as chronic fatigue syndrome and fibromyalgia (Latremoliere & Woolf, 2009; Yunus 2008). This lack of organic aetiology has led to consideration that MCS is, at least in part, a psychological condition (Caccappolo-van Vliet, et al, 2002; Das-Munshi, Rubin, & Wessely, 2006; Jacques, 2024; Kipen & Fiedler, 2000; Guglielmi, Cox, & Spyker 1994; Zucco & Doty, 2022). Experiments using techniques such as

olfactory masking and placebo have also supported this theory, with a systematic review concluding that symptoms were not specific to the chemical exposure but appeared to relate to symptoms and beliefs (Das-Munshi, Rubin, & Wessely, 2006). Contemporary reviews continue to debate putative neurological and immunological mechanisms while also highlighting the role of behavioural conditioning and encouraging CBT as a pragmatic treatment pathway alongside medical evaluation (Lavric et al., 2024).

A paper by Guglielmi et al (1994) was perhaps the first to call for MCS to be conceptualised as a specific phobia. They note that the development of the disorder fits with a classical conditioning model, whereby the initial toxic exposure to the chemical agent is an unconditioned stimulus and the initial physical reaction the unconditioned response. When harm occurs, the characteristics of the toxic substance, such as the smell or the sensory experience of inhalation become conditioned stimuli capable of triggering the same physical symptoms as a conditioned response. This behaviour is then maintained via operant conditioning, where escape and/or avoidance behaviours are negatively reinforced. As well as this behavioural explanation of the phobia, it was further noted that maladaptive cognitions were also present in the condition. Guglielmi *et al* report three case studies of patients with MCS who all fit the DSM-III criteria for a phobia diagnosis, utilising a cognitive-behavioural approach to formulate the condition and treat it using both *in-vivo* exposure and cognitive restructuring. For *in-vivo* exposure, a biofeedback-assisted relaxation technique was used. A hierarchy of triggering stimuli was created, whereby patients were exposed to the stimuli and viewed their own physiological reactivity increase, peak, and then decrease. After treatment, all three patients reported significant improvement in their ability to be exposed to previously triggering stimuli without the same level of physiological or psychological symptoms.

A systematic review and meta-analysis conducted by van Dis et al (2020) sought to establish the long-term outcomes for CBT treatment in various anxiety disorders, including specific phobia. They found that CBT produced medium effect size benefits for participants with specific phobia after treatment, and medium to large between one and six months. However, there were limited high-quality studies that gathered data beyond six months meaning that they could not establish longer-term changes. A rapid review conducted by Thng et al (2020) summarised research from 2014 to 2019 examining various approaches to treating specific phobia. It found again that evidence supported the use of CBT, finding it to be the superior intervention in comparison to other therapies with large effect sizes reported. In addition to these reviews, studies have demonstrated the efficacy of CBT when working in different cultural contexts (Peristianto & Astuti, 2022), working with children (Davis, Ollendick, & Öst, 2009), and when working with older adults (Pachana,et al, 2007). Based on this evidence, CBT appears a suitable and preferential model for treating specific phobia.

Case study

Presenting problem

Mr S was referred to the Older Adult Community Mental Health Team (CMHT) by the General Practitioner (GP) due to increases in anxiety related to concerns about his physical health. He had a historical diagnosis of bipolar affective disorder which had required inpatient treatment decades prior but was well managed. He was prescribed an antipsychotic, an SSRI, and Pregabalin. Several years prior he had experienced an acute systemic reaction following an accident involving the inhalation of a dangerous substance. The respiratory team noted normal functioning within six months of the inhalation. However, Mr S started to experience pain following the inhalation of low levels of various odorous agents. The respiratory team had continued tests, but no organic pathology was identified. He was prescribed an inhaler, which he reported provided transient symptomatic relief, although it did not prevent reactions to low-level odours or reduce avoidance. Given persistent symptoms despite respiratory follow-up and no identified organic pathology, psychological assessment was sought to clarify diagnosis and treatment options.

Detailed history and assessment of the problem

Mr S, an elderly man from the UK, had been in stable remission from bipolar disorder since early retirement. Following the inhalation of the substance, he reported ongoing physical symptoms that he attributed to permanent lung damage, despite medical reassurance. Over time, these symptoms were reliably triggered by minimal exposure to odours such as petrol fumes, cigarette smoke, and perfumes. In an effort to avoid these triggers, his functioning became severely restricted: he spent most of his time indoors, wore an industrial P3 mask for shopping and household chores, and held his breath when moving between his car and shops. His anxiety peaked when a neighbour installed a smokestack, prompting fears that smoke would infiltrate his home and irreparably harm his lungs. This fear contributed to intense suicidal thoughts and consideration of moving house, leading to referral to the CMHT.

Following psychological assessment, several possible diagnoses did not appear to fit the presentation. Health anxiety was excluded because, although Mr S believed he had a physical vulnerability, he did not report persistent health-related worry in the absence of triggers, did not fear a progressive or degenerative illness, and scored below the clinical threshold on the Health Anxiety Inventory (HAI-18; Salkovskis et al., 2002). PTSD was considered given the single-traumatic event preceding his anxiety, but he did not report re-experiencing, nightmares, or avoidance of trauma reminders; his avoidance was driven by a belief in ongoing physical harm from environmental exposure, not by distress associated with recalling the event. OCD was ruled out in the absence of compulsions, and panic disorder was excluded as his fear was restricted to specific odorous or sensory stimuli.

Mr S's presentation was consistent with Multiple Chemical Sensitivity (MCS) as described in the literature (Cullen, 1987; Kipen & Fiedler, 2000; Zucco & Doty, 2022). The onset of his symptoms followed a single high-intensity toxic exposure, after which respiratory recovery was confirmed and no organic pathology identified. Nevertheless, he experienced ongoing, non-specific symptoms when exposed to low levels of odorous agents, or agents that somatically replicated the dangerous substance (such as

breathing in fine particulates), with triggers gradually generalising beyond the original substance to include perfumes, smoke, paint, coffee and petrol fumes. These stimuli shared sensory characteristics with the original event and reliably provoked marked physiological discomfort and anxiety. His belief in lasting physical damage persisted despite medical reassurance, and his avoidance behaviours - such as wearing an industrial P3 mask indoors and restricting time outside - led to substantial functional impairment and social isolation. This combination of post-exposure symptom persistence, generalisation of triggers, absence of organic findings, and disproportionate fear and avoidance matched published descriptions of MCS and also met ICD-11 criteria for specific phobia (WHO, 2021).

Outcome Measures

Selecting an appropriate outcome measure for Mr S's presentation proved challenging. No validated anxiety-disorder specific measure (ADSM) exists for Multiple Chemical Sensitivity (MCS), and tools developed for specific phobias typically focus on common presentations such as animal or situational phobias (e.g., spider phobia; Arntz et al., 1993). These do not capture the heterogeneous and idiosyncratic triggers characteristic of MCS.

At the outset, diagnostic uncertainty meant that several measures were trialled to support assessment and to establish a baseline. The Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988) was initially used. However, the BAI appeared to underestimate severity, likely because Mr S's somatic complaints (e.g., chest tightness, palpitations) did not align closely with the inventory's physical symptom items – which is the source of greatest variance in older adults (Morin et al., 1999). The HAI was also administered to assess whether health-related worry was a prominent maintaining factor.

Once the working diagnosis shifted towards specific phobia, the Generalized Anxiety Disorder-7 (GAD-7; Spitzer et al., 2006) was introduced. While not a measure of specific phobia, the GAD-7 is sensitive to elevated anxiety irrespective of diagnosis (Kroenke, Baye, & Lourens, 2019) and has strong psychometric properties in older adults (Wild et al., 2014). However, its introduction later in therapy meant no true baseline score was available. As a result, interpretation of change relied on a combination of early measures, later GAD-7 scores, reduced belief and anxiety ratings, and observed functional improvements against pre-set goals.

Formulation

A collaborative formulation was developed early in therapy to help Mr S consider a psychological explanation for his difficulties. The model drew on the cognitive framework of specific phobia described by Kirk and Rouf (2017), which has been applied in other case reports (Harris et al., 2021). The working hypothesis was that the acute inhalation incident served as an unconditioned stimulus, with the associated physiological reaction functioning as an unconditioned response. Odorous or vaporous cues from the original event became conditioned stimuli capable of triggering anxiety and physical symptoms

even in the absence of actual harm. Over time, this response generalised to stimuli with similar sensory properties (e.g., perfume, smoke, petrol fumes).

Mr S's strong belief in lasting lung damage and his extensive avoidance behaviours maintained his symptoms. These behaviours prevented disconfirmation of his fears, reinforcing his anxiety cycle.

Course of therapy

Treatment rationale

Building on the agreed formulation and prior medical reassurance that exposure posed no physical risk, treatment focused on graded exposure and behavioural experiments targeting the most impairing avoidance behaviours. Multidisciplinary consultation, including with the consultant respiratory physician who had followed Mr S's case since the original incident, confirmed that exposure to identified triggers was safe. This was discussed explicitly with Mr S to support engagement. Although initially hesitant, he agreed to test the role of anxiety in his avoidance. Individualised, measurable goals were collaboratively developed to address areas of functioning most affected, including hoovering without a mask and walking through his front garden without holding his breath. These goals were operationalised into a graded hierarchy of exposure tasks, beginning with low-anxiety situations and progressing to more challenging stimuli.

Session Outline

The intervention was delivered in a 1:1 format over fourteen weekly sessions. The initial assessment was conducted face-to-face, with subsequent sessions held virtually via a video platform to accommodate Mr S's concern that walking through the car park and exposure to traffic fumes would trigger his symptoms. In-person sessions resumed later in treatment once avoidance had reduced. Risk was assessed at each contact.

Sessions 1–3: Assessment, Differential Diagnosis, and Psychoeducation

The early phase of therapy focused on assessment and diagnostic clarification. Initial hypotheses of health anxiety and post-traumatic stress disorder were ruled out through structured assessment and review of evidence from the respiratory team, who had conducted extensive investigations over several years without identifying organic pathology. A working hypothesis emerged that the symptoms were primarily maintained by psychological processes consistent with a specific phobia.

Psychoeducation was introduced to explain how anxiety can elicit physical sensations (e.g., chest tightness, palpitations) and how avoidance behaviours can intensify fear over time. This was linked to Mr

S's pattern of symptom onset and maintenance, establishing a foundation for a phobia-focused formulation.

Session 4: Formulation

A collaborative formulation was developed using the Kirk and Rouf (2017) cognitive model of specific phobia. The formulation linked the acute inhalation incident to the development of conditioned fear responses and explained the role of avoidance in preventing disconfirmation of harm beliefs. The idea that his symptoms could be understood as a phobic reaction was introduced, drawing parallels with the onset of other phobias following threatening incidents. With this shared understanding, Mr S cautiously agreed to trial behavioural experiments (BEs).

Sessions 5–8: Behavioural Experiments and Graded Exposure

Treatment targeted both maladaptive harm beliefs and elevated anxiety in response to odorous or vaporous stimuli. While beliefs were the primary focus, anxiety ratings were also monitored given Mr S's report that exposures sometimes caused transient but significant pain. A conservative exposure approach was taken, aiming to reduce anxiety without provoking intolerable discomfort.

A graded hierarchy was collaboratively developed, ranking feared stimuli according to the perceived likelihood they would cause pain (Table 1). Early tasks (e.g., making coffee without holding his breath) had lower predicted risk, while high-ranked items (e.g., using oil-based paint) were deferred until later.

Table 1
– An early exposure hierarchy

Feared behaviour	Predicted anxiety
Using an oil-based paint	95%
Using chemically-based cleaning products	70%
Breathing near diffuser	70%
Breathing near air freshener	55%
Putting dry compost into a pot	50%
Spraying glasses with a cleaning fluid	40%
Hoovering without a P3 mask on	30%
Making coffee without holding breath	20%
Putting tablet in the washing machine without holding breath	15%

Due to virtual delivery during this stage, in-vivo exposure was conducted as home practice, with Mr S recording pre- and post-exposure belief and anxiety ratings. Where relevant, delayed pain ratings (0–10) were also noted. Results from early BEs indicated consistent reductions in both harm belief and anxiety across tasks (Table 2).

Table 2
– Results from early behavioural experiments

Experiment	Belief Before	Anxiety Before	Belief After	Anxiety After
Putting tablet in the washing machine without holding breath	15%	15%	10%	5%
Making coffee without holding breath	20%	15%	10%	5%
Cleaning glasses with spray	40%	20%	30%	15%
Hoovering without a mask	30%	30%	10%	10%
Driving a new car	50%	40%	30%	30%
Changing bedding without a mask	50%	40%	25%	20%

Session 9: Pain Psychoeducation and Refined Formulation

Following early successes, Mr S felt confident enough to attend sessions face-to-face, treating the walk through the car park as an exposure task. This produced only a minimal pain response (1/10) and did not recur. Given his occasional delayed pain reports, in-session exposure was paused to allow for accurate attribution of symptom change. Instead, psychoeducation was provided on the role of anxiety and expectation in pain perception, using Socratic questioning to co-construct a refined formulation that integrated both fear and pain experiences.

Sessions 10–12: In-Vivo Exposure in Clinic

Face-to-face exposure sessions focused on stimuli such as deodorant, perfume, and scented candles. Anxiety and harm belief ratings fell rapidly, often to near zero within five minutes, and no lasting pain symptoms were reported. These rapid habituation effects appeared to increase Mr S's confidence in his ability to tolerate previously avoided triggers.

Sessions 13–14: Relapse Prevention

The final sessions focused on consolidating gains and planning for maintenance. Mr S developed a relapse-prevention plan that included tracking avoidance behaviours, continuing exposure tasks to heavy-traffic situations, and using behavioural experiments to test future harm beliefs. The plan

emphasised sustaining daily functioning without reliance on avoidance strategies such as mask use indoors.

Treatment Outcome

By the end of therapy, Mr S reported substantial improvements in functioning, anxiety, and mood. At assessment, he described being almost entirely homebound, avoiding a wide range of odorous stimuli, and experiencing anxiety so intense it had led to suicidal thoughts. Fourteen weeks later, he was engaging in activities he had previously avoided, including daily dog walks, driving and refuelling his car, wearing deodorant, and hoovering without a mask. Occasional acute anxiety persisted only in situations involving heavy traffic, which was targeted in ongoing behavioural experiments as part of his relapse-prevention plan.

Quantitatively, his scores showed marked reductions in both health-related worry and anxiety symptoms (Table 3). The Health Anxiety Inventory (HAI-18) score decreased by 9 points within the first five weeks of therapy, reflecting reduced preoccupation with perceived health threats. GAD-7 scores, introduced mid-treatment, were consistently below the recommended clinical cut-off for older adults (Wild et al., 2014). While the BAI indicated moderate–severe anxiety at baseline, this measure was considered an underestimate of severity due to poor mapping of its somatic items to Mr S's symptom profile.

Table 3
– Questionnaire changes over time

WEEK ADMINISTERED	QUESTIONNAIRE
	BAI
WEEK 1	25
10-month follow-up	6
22-month follow-up	3
	HAI
WEEK 1	21
WEEK 5	12
	GAD-7
WEEK 6	6
WEEK 9	4
WEEK 12	5
10-month follow-up	0
22-month follow-up	1

All pre-defined goals were achieved by treatment end, with Mr S describing the intervention as “life-changing” and expressing confidence in maintaining his progress using relapse-prevention strategies.

Follow-Up

10-month follow-up: Mr S continued to report feeling “very well,” with minimal anxiety and sustained reductions in fear regarding physical reactions to stimuli. When revisiting his exposure hierarchy, beliefs about the likelihood of pain following exposure were close to zero for all items, with the highest ratings (10%) for deodorant and walking down a busy road. This represented a further decrease from end-of-treatment levels. Scores reflected this improvement: GAD-7 = 0, BAI = 6.

22-month follow-up

Gains were fully maintained, with GAD-7 = 1 and BAI = 3. Mr S reported no significant anxiety, ongoing good functioning, and expressed continued gratitude for the treatment, stating that the changes had been lasting and transformative.

Discussion

This case report describes psychological assessment and CBT treatment of an older adult with Multiple Chemical Sensitivity (MCS)-like symptoms in the context of prior respiratory evaluation and ongoing medical reassurance. A specific-phobia formulation integrated persistent symptom-related fear, avoidance, and functional impairment following a medically investigated inhalation event. Across treatment and long-term follow-up, anxiety, health-related worry, and avoidance decreased substantially.

Conceptualising MCS as a specific phobia allowed the use of a formulation that clearly linked symptom onset to a conditioning process following the inhalation of a toxic substance, with subsequent generalisation of fear to odorous and vaporous cues. This approach was supported by existing literature (e.g., Guglielmi et al., 1994; Kirk & Rouf, 2017) and was crucial in identifying avoidance as the primary maintaining factor. Confirming medical safety of exposure through consultation with the respiratory physician was also pivotal, as it allowed Mr S to approach behavioural experiments with confidence that his feared harm was unlikely to occur. Despite the success of a psychological approach and the absence of identifiable organic pathology, these findings do not preclude a potential physiological contribution in some cases. However, this case does add to the limited literature on applying CBT to MCS presentations, particularly within an older adult population, and demonstrates the feasibility of using a specific phobia model in such contexts.

The intervention successfully reduced both harm-related beliefs and anxiety in response to a broad range of triggers, with change generalising to untrained stimuli. Early functional gains were consolidated and expanded over time, with Mr S achieving all pre-defined goals by treatment end. Long-term follow-up confirmed stability of these changes, with near-zero belief ratings for most triggers and anxiety scores well below clinical cut-offs.

Several factors likely contributed to the positive outcome. The collaborative nature of the formulation fostered engagement and increased willingness to test beliefs through exposure. Home-based behavioural experiments enabled progress despite the initial reliance on virtual sessions, while a conservative exposure approach (limiting anxiety arousal to tolerable levels) maintained adherence and reduced the likelihood of symptom exacerbation. Relapse-prevention planning ensured that gains were maintained, with Mr S continuing to use behavioural experiments independently to address any emerging fears.

There are limitations to consider. This was a single-case intervention, so results may not generalise to other MCS presentations, particularly where physical comorbidities or differing beliefs about causation are present, or with different symptom profiles. The absence of a disorder-specific outcome measure meant reliance on generic tools, which may have underestimated severity and improvement. Additionally, because GAD-7 measurement commenced mid-treatment, baseline-to-end comparisons are limited. However, the consistency between functional gains, belief change, and anxiety reduction provides converging evidence for a genuine therapeutic effect.

Alternative or supplementary approaches could be considered in future cases. Incorporating interoceptive exposure may help target anxiety about internal sensations that persist despite environmental desensitisation. More detailed idiographic measures, such as daily trigger logs or belief-strength ratings, could provide richer outcome data.

Nonetheless, the therapy as delivered was acceptable to Mr S, produced rapid and sustained change, and was described by the patient as “life-changing.”.

Overall, this case suggests that, after appropriate medical evaluation has not identified active organic pathology, some MCS presentations may be usefully formulated in terms of conditioned fear and treated with graded exposure and behavioural experiments. For psychologists working in medical settings, the case highlights the value of close collaboration with medical teams, careful differential diagnosis, and individualised behavioural treatment targeting avoidance and harm beliefs.

Declarations

Ethics

Written informed consent for publication was obtained from the patient. Formal research ethics approval was not required under local health board guidance for a retrospective anonymised case report.

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