

CASE REPORT

# A Cognitive-Behavioural Approach to Targeting Sensation-Based and Intrusion-Based Misinterpretations in Health Anxiety: A Single-Case Experimental Study

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## Abstract

Health anxiety (HA) is common in psychiatric and medical settings. Cognitive models of HA highlight the role of misinterpreting physical sensations as dangerous. This report presents the case of a 31-year-old man and the use of a cognitive-behavioural approach to treat his HA which also considers the role of misinterpreting intrusions as abnormal, by drawing on theoretical accounts of obsessive-compulsive disorder (OCD). A single-case experimental design demonstrated reliable improvements in symptom measures of HA and general distress. Distinguishing sensation-based versus intrusion-based appraisals in HA has implications for interventions in health settings and for refining cognitive theory.

**Keywords:** health anxiety; OCD; CBT; intrusions; single-case experimental design

## Introduction

Health anxiety (HA) is associated with an intense preoccupation with the belief that one has or would acquire a serious illness. In psychiatric terms, HA has also been referred to as illness anxiety disorder (American Psychiatric Association, 2013) or hypochondriasis (American Psychiatric Association, 1994), although it is proposed to also occur on a continuum in the general population (Salkovskis & Warwick, 1986). History of illness in the family is a risk factor for developing HA (Williams, 2004). HA has around 1% prevalence rate and is typically chronic and associated with significant impact on occupational functioning (Magariños, Zafar, Nissenon, & Blanco, 2002).

According to the cognitive model of HA, the misinterpretation of physical sensations as signs of long-term illness maintains distress in HA (Salkovskis & Warwick, 1986, 2001). This also leads to various maladaptive strategies that, while intended to reduce anxiety, serve to maintain/strengthen the misinterpretation, which can include reassurance-seeking (e.g., regular medical checks or asking family members), avoidance (e.g., of health-related information), and over-checking (e.g., of bodily sensations). Cognitive-behavioural therapy (CBT) protocols derived from this model are effective treatments for HA (Cooper, Gregory, Walker, Lambe, & Salkovskis, 2017; Olatunji et al., 2014). The most up-to-date meta-analysis indicated a large effect size of CBT in reducing HA by end of treatment and at both 6- and 12-months follow-ups (Cooper et al., 2017). Existing studies, however, have relied on wait-list controls (Cooper et al., 2017) and not tested mechanisms of change (Rachman, 2012).

HA has overlaps with obsessive-compulsive disorder (OCD) in symptoms and phenomenology (Barsky, Wyshak, & Klerman, 1992). Although the distinction between HA and OCD remains

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controversial (Abramowitz, 2005; Barsky, 1992; Fallon, Qureshi, Laje, & Klein, 2000; Hedman et al., 2017), cognitive models have identified shared maintenance processes between these disorders in terms of unhelpful cognition and counterproductive behaviours (Salkovskis, 1985; Salkovskis & Warwick, 1986). Yet the key distinguishing feature appears to be the locus of the misinterpretation of different types of normal experiences (Rachman, 1997). While for HA this lies in the meaning of the physical sensation (Salkovskis & Warwick, 1986), for OCD it is the meaning of the intrusions themselves (Salkovskis, 1985). For example, an individual with HA may misinterpret a mild headache as a sign of brain tumour, whereas an individual with OCD may interpret the intrusive thought of harming someone as meaning they must want to carry this into action. This cognitive specificity on health-related information in HA (Fergus, 2014; Salkovskis & Warwick, 2001) suggests that it is a different disorder to OCD rather than being a form of OCD (Abramowitz & Braddock, 2008) and crucially that treatment success for each disorder predicates on targeting specifically the misinterpretations involved in their maintenance.

This report presents a case of a CBT treatment for a client with a presenting problem of HA. The client reported misinterpretations (referred to as intrusions) of physical symptoms as sign of a dangerous tumour (typical of HA), but also of the intrusions themselves as abnormal experiences (more typical of OCD). The CBT protocol followed the cognitive model of HA which focuses on behavioural experiments to test the meaning of physical sensations (Salkovskis & Warwick, 1986, 2001), with an extension drawn from the cognitive model of OCD where understanding intrusions as normative cognitive experiences is a central component (Salkovskis, 1985), which otherwise is absent in the CBT protocol for HA (Salkovskis & Warwick, 1986, 2001).

## Methods

### *Introduction to the Case*

Nicholas is a 31-year-old White British, single male who was referred to Psychological Services by a Consultant Psychiatrist within an Adult Mental Health Team in South England. The psychiatrist described his current difficulties as worries about getting testicular cancer after repeated consultations and tests with medical professionals. His mood was described as 'up and down'. He had been prescribed clomipramine and quetiapine for alleviating symptoms of anxiety and depression.

### *Initial Assessment*

Nicholas described being troubled by intrusive thoughts about his health on a daily basis. Worries about his health began in 2010, when it was found that he had a small testicular cyst, which the doctor reassured him was benign at the time. For almost a decade, he had worries about having various types of illnesses, for which he sought medical investigations. While these worries have subsided over time, he continued to overthink the possibility of getting testicular cancer. There was no previous medical history except asthma, although his uncle was diagnosed with testicular cancer previously. He reported occasional suicidal thoughts but no current self-harm nor suicidal intent. Family support was a strong protective factor. Risk remained low throughout treatment.

Because of struggles with mental health, Nicholas had not been able to take up full-time employment and to live independently after finishing his university degree. His family was keen for him to return home to be supported. The intensity of his worries had a detrimental impact on his daily concentration. Furthermore, the amount of checking and reassurance he needed, particularly through frequent medical check-ups over the years to test for numerous conditions, meant that he spent a lot of time trying to 'catch' the problem. Understandably this process also undermined his confidence. For a long time, he felt low and unmotivated to get out of his house. He described a sense of seeing others 'moving on with their lives', while he has been 'stuck'. He had attended two courses of CBT 5 years ago (to address depression and social anxiety), which appeared to have had little impact on his difficulties at the time.

Despite his severe and long-standing difficulties, Nicholas had progressively made changes to become more active, including working part-time for a local sport centre and swimming regularly.

He reported a recent ‘lightbulb moment’ where he felt he needed to take risks and ‘roll the dice’. His goal was to better manage his health-related worries.

### Design

The effects of CBT on HA symptoms and general distress were evaluated using a single-case experimental (AB) design (Morley, 2018). Phase A was the baseline to establish a stable pattern (i.e., three sessions: one initial assessment and two formulation sessions). Phase B consisted of the treatment sessions (nine sessions) informed by the formulation and included a 2-week break (between sessions 7 and 8). Nicholas was asked to fill in two sets of weekly measures in this break, thus resulting in 10 rather than 9 data points. Key outcomes (see Section on *Outcome Measures*) were collected weekly to measure change across phases and were completed prior to the start of each session. The null hypothesis was that no improvements (baseline vs. treatment phases) would be observed for any outcome.

### Case Conceptualisation

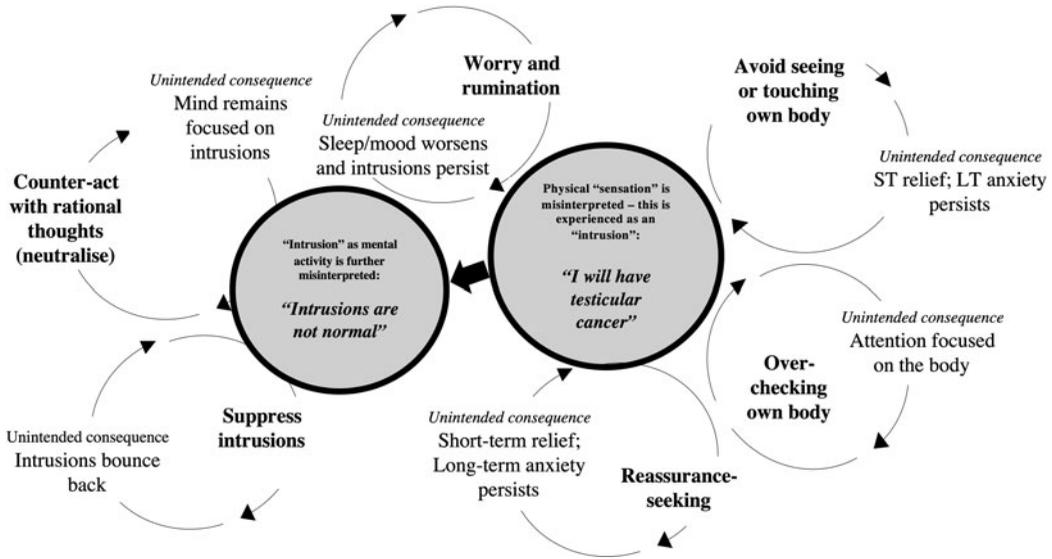
Nicholas agreed to focus on HA as the primary treatment target. A formulation was developed jointly as a theory of the development and maintenance of this anxiety. He described himself as always having been an anxious child. He recalled not wanting to go to the playground and wanting to stay close to his mum instead. He also had dyslexia. As a result of finding learning harder, he did not enjoy school and felt he did not fit in. He also described both of his parents as worriers (although neither had struggled with OCD/HA). These early experiences appeared to have led to a sense of the world as dangerous/unpredictable and a sense of the self as vulnerable, resulting in a rule of life as ‘everything needs to be certain’.

The detection of testicular cyst in Nicholas precipitated his HA. Around the same time, his grandmother passed away after a long-term illness. The latter foregrounded the idea of death in him while he was at university. He began to fear that physical sensations were signs of illnesses, especially in his testicles but also all over his body.

Each type of misinterpretation was linked to the use of a specific unhelpful coping strategy. Key to his current health concern, Nicholas would notice a sensation in either of his testicles (e.g., something ‘strange’) which would lead to an intrusion of ‘I have testicular cancer’ — this was conceptualised as a sensation-based misinterpretation (typical of HA). Sometimes these intrusions took the form of mental images of an aggressive black blob growing out of his testicle. A cognitive-behavioural model with a vicious flower diagram (Salkovskis & Warwick, 1986, 2001) was drawn to understand how his HA was maintained (Figure 1). His responses reflected attempted solutions with unintended consequences that maintained the cancer-related intrusions and hence his HA.

Nicholas would also overcheck his body (touching and rubbing). When he was in the shower and felt that the water was hitting his testicles unevenly, he would try to move around to even out the sensations. He would also ask his family, particularly his mum, for reassurance that his physical sensations were fine. Through exploration, he was able to recognise that both over-checking and reassurance-seeking had short-term benefits but did not relieve his anxiety in the long term. He also reported ‘going around in circles’ about worst possible scenarios of ‘what if’s’ (i.e., worrying about the future), which he recognised as making the intrusions worse. This would often leave him feeling demoralised and he would also often find himself ‘going around in circle’ about how his anxiety ruined his life and how all his friends have moved on with better lives (i.e., ruminating about the past and its consequences).

Following his sensation-based misinterpretations, Nicholas would also engage in a range of avoidant behaviours to prevent noticing physical sensations. He would avoid looking at himself naked in the mirror; avoid touching his body by using a thick sponge during showers; or dry himself quickly using a thick towel after shower. He was able to recognise that avoidance could be reinforcing his anxiety in the long term as it prevented disconfirmation of — and hence strengthened — his intrusive catastrophic thoughts.



**Figure 1.** A cognitive-behavioural model with an adapted 'double' 'vicious flower' formulation diagram for Nicholas' health anxiety.

Another set of unhelpful coping strategies was associated with intrusion-based misinterpretations instead, which are not typically characteristic of individuals with HA (but instead of those with OCD). Nicholas tried to suppress and neutralise the intrusion (countering with a rational thought, such as thinking to himself 'I won't have cancer'), but again these strategies were counterproductive and maintained the intrusions. He was able to identify that his need for eliminating intrusions was partly driven by a belief that 'intrusions are not normal' and that having intrusions signalled 'something is wrong'. Therefore, these were misinterpretations of the mental experience itself rather than of the physical sensations.

Hypotheses were derived from the formulation: (1) challenging unhelpful beliefs about intrusions would decrease counterproductive strategies thereby reducing HA; (2) reducing over-checking (of his body or through reassurance-seeking) would decrease HA; (3) reducing avoidance and dropping safety-seeking behaviours would increase HA in the short term but decrease HA in the long term overall; and (4) reducing worry/rumination will decrease HA.

### Sessions' Structure

All sessions were 60 min long and involved assessment (A), formulation (F), and treatment (T).

#### Assessment (Session 0)

Following referral, Nicholas was assessed (A0) for general suitability for psychological services and CBT was recommended as the appropriate treatment.

#### Formulation (Sessions 1–2)

A cognitive-behavioural formulation (F1–F2) using an adapted 'double' vicious flower diagram (Figure 1) was developed by focusing on his key cancer-related fear. The associated responses were explored alongside their role in maintaining the cancer-related fear. Using Nicholas' language, the term 'intrusion' was used to describe the key appraisal of his physical sensations (i.e., 'I will have testicular cancer'). Importantly, it was identified that he had unhelpful appraisals of both (1) the physical sensations and (2) the intrusions themselves (i.e., 'having intrusions is not normal'), the latter which

led to strategies to eliminate intrusions (i.e., neutralising and suppressing). The CBT approach involving collaborative empiricism was explained to Nicholas.

#### *Treatment (Sessions 3–11)*

The treatment phase (T3–T11) involved first addressing intrusion-based interpretations followed by sensation-based interpretations.

*Psychoeducation about intrusions.* Through Socratic question, the idea of intrusions as a normal experience rather than sign of psychopathology was introduced and explored, including normative data around population prevalence of different types of intrusions (Clark & Radomsky, 2014; Rachman & de Silva, 1978). Sharing of therapist's own intrusions was further used to normalise them together with a discussion of the potential benefits of involuntary mental experiences. Additional homework was set to keep an intrusion diary as a way to monitor his own general, non-health-related intrusions (Table 1) as another way to normalise these as part of his mental landscape. The backfiring effects of intrusion suppression and neutralising strategies were also discussed. An in-vivo demonstration was used to test the (counterproductive) effects of suppression on intrusion (Table 1).

*Reattribution of symptoms.* Theory A ('I have a physical health problem/cancer') versus theory B ('I have an anxiety problem') were introduced and rated in belief strength.

*Reducing over-checking.* An in-session experiment was also used to test the impact of hypervigilance on a specific part of the body (e.g., knee) on noticing further 'strange' sensations. Behavioural-experiment homework was set to test the impact of alternating days with checking versus non-checking his testicles during showers on illness beliefs and anxiety (Table 1).

*Overcoming avoidance.* The role of avoidance and safety-seeking behaviours were discussed. Behavioural-experiment homework was set to test the impact of dropping a safety-seeking behaviour on illness beliefs and anxiety (Table 1).

*Reducing reassurance-seeking.* The role of reassurance-seeking was explored, with Mum present in latter half of the session. Mum was able to recognise that while her reassurance-giving was well-intentioned, it could also maintain Nicholas' anxiety. Alternative ways of showing support

**Table 1.** Example of Behavioural Experiments Conducted

Hypothesis	Experiment	Nicholas' conclusion
Suppressing intrusions is not helpful as it keeps them in my mind	Provoke intrusions in session and attempt to mentally push them away	Suppression/neutralising is counterproductive
Intrusions are part of normal experience	Notice own intrusive thoughts/images of all kinds for a week	I also experienced many intrusions that are not health-related; I experienced intrusions (e.g., as a child) even before I developed health anxiety; having intrusions is not a sign of problem
The more I check my testicles during showers, the more likely I will notice strange sensations	Alternate checking (3 days) versus no-checking days (4 days)	Checking days were linked to more anxiety and stronger illness belief; checking makes me more anxious
The more I use music to distract myself during shower, the more my fear of getting cancer would remain	Increasingly lower volume of music during shower across the week	I am able to shower without loud music; using music as distraction fed into my irrational fear; I can cope with anxiety; I can continue to tackle my other avoidant behaviours

were discussed. Mum also reflected on her own identity as a ‘worrier’ and its potential developmental impact on him.

*Disengaging from worry/rumination.* Distinctions between hypothetical and practical worry and between worry and rumination were discussed. Disengagement strategies using attention-based (e.g., distracting activities; shifting attention) and self-soothing (e.g., self-compassionate statements) approaches were explored.

*Understanding cognitive distortions.* Thinking styles such as all-or-nothing thinking, catastrophising, and thought-action fusion were identified and discussed. Furthermore, the role of rules/assumptions were explored. For example, reflections were made about how Nicholas’ would start the session by saying he had a ‘bad’ week but then also had not worried much compared with the week before. He was able to recognise strict rules he held, such as ‘If I recognise the positive, I will go back to where I used to be’, ‘I must have no intrusions at all’, and ‘I need to be symptom free’. Ways to increase thought flexibility were explored (e.g., continuum idea). The inverted pyramid technique was used to challenge the overestimation of his own risk of unsuccessful cancer treatment.

*Relapse prevention.* Overall progress and learning were discussed in the last session. Additional behavioural experiments (e.g., to overcome avoidance) were encouraged building on confidence acquired. Verbal and visual materials (e.g., postcards) were used to strengthen knowledge consolidation and provide future reminders of learning.

### Outcomes Measures

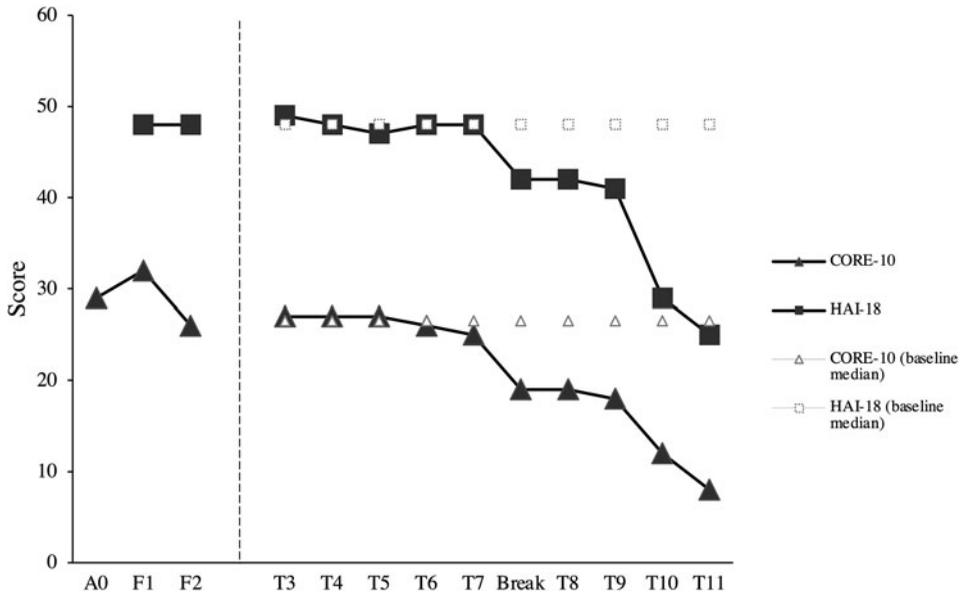
General clinical distress was assessed using the 34-item Clinical Outcomes in Routine Evaluation – Outcome Measure (CORE-OM; Evans et al., 2002) and the shortened 10-item version (CORE-10; Connell & Barkham, 2007). Both are self-report questionnaires assessing symptoms of depression and anxiety and indices of functioning. The CORE-OM has good internal consistency and test–retest reliability and show convergent validity with related measures (Evans et al., 2002). The CORE-10 also has good internal consistency (Barkham et al., 2013). Both versions are highly correlated (Barkham et al., 2013) and directly comparable by transforming raw scores into clinical scores (Connell & Barkham, 2007). As per service requirement, the CORE-OM was used for the first and final session, and the CORE-10 was used for the remaining.

Disorder-specific symptoms were assessed using the Health Anxiety Inventory – Short Week (HAI-18), which has shown to be specific to HA and also sensitive to detect weekly treatment benefits (Salkovskis, Rimes, Warwick, & Clark, 2002). The HAI-18 was introduced after the initial assessment and re-completed until the end of treatment.

### Results

Available weekly data were plotted (Figure 2). For ease of comparison, the median of each measure in the baseline phase (Sessions 0–2; initial assessment and two formulation sessions) was superimposed onto the treatment phase (Sessions 3–11). Visual inspection suggested a trend towards a decline in scores across time for both measures. There was a relatively high proportion of data points in the treatment phase that was below the median of the baseline phase (Ma, 2006) — 100% for the CORE and 56% for the HAI-18 — supporting the observation that treatment led to decline in scores relative to the baseline. Moreover, the point of change appeared to be around halfway the treatment phase (Figure 2).

For the CORE, trend analyses (Parker, Vannest, Davis, & Sauber, 2011) suggested that there were trends in improvement in both phases, although this was statistically significant for the treatment phase only (Tau-u = -0.71,  $z = -2.86$ ,  $p = .004$ ) and not for the baseline phase (Tau-u = -0.33,  $z = -0.52$ ,



**Figure 2.** Session-by-session key outcome measures.

Note. CORE = Clinical Outcome in Routine Evaluation; HAI-18 = Health Anxiety Inventory Short Form; A = initial assessment; F = formulation sessions; T = treatment sessions; CORE scores refer to clinical scores; HAI-18 refer to total raw score; baseline and treatment phases are separated by the dashed line; two set of measures were filled in during a two-week break (between sessions 7 and 8), resulting in 10 data points for 9 treatment sessions.

$p = 0.600$ ). By controlling for the influence of the baseline trend, the trend in improvement in the treatment phase was reduced possibly owing to loss in power ( $\text{Tau} = -0.73, z = -1.86, p = .063$ ). The equivalent analyses were not possible for the HAI-18 as there were insufficient (two only) data points at baseline for establishing a trend.

At baseline, Nicholas’ CORE clinical scores (26–32) were in the severe range (25 or above; Connell & Barkham, 2007). By the end of treatment, his CORE clinical score dropped to 8, which indicated a mild level of general distress. Thus, a clinically significant change was observed with general distress falling below clinical cut-off (score of below 10; Connell & Barkham, 2007).

Furthermore, following current guidelines (National Collaborating Centre for Mental Health, 2018), a baseline score of 48 on the HAI-18 indicated that his difficulties were consistent with a diagnosis of hypochondriasis based on DSM-IV (American Psychiatric Association, 1994). This score is also above 1.5 standard deviations of the mean score (38) reported for individuals with HA (Salkovskis et al., 2002), reflecting the severity of his HA at baseline even relative to individuals with similar difficulties. By the end of treatment, his HAI-18 score reduced by 23 points to a score of 25. While this remains above the cut-off for potential hypochondriasis (score of 18 or above), it also indicated a reliable change (change in 4 points or above; National Collaborating Centre for Mental Health, 2018).

Additional progress feedback was discussed in session. Nicholas was able to identify that an all-or-nothing thinking style has at times made it difficult for him to recognise the improvement he has made, especially given the chronicity of his difficulties. Nevertheless, he reported that while the frequency of his cancer-related intrusions appeared relatively unchanged, their duration and negative impact on functioning (disrupting work or rest) were reduced. Ratings for theory A (cancer) versus theory B (anxiety) reversed from 50% versus 35% to 15% to 65%, respectively, suggesting a shift in stronger attribution of his difficulties as reflecting a problem of anxiety. Finally, he reported 8 out of 10 for achieving the goal of ‘learning to manage my worries about testicular cancer’ (on a

scale from 0 to 10, anchored by *not at all* to *fully achieved*). He reported spending less time worrying about his health, more able to stay focused, and feeling more relaxed at his part-time work. He was also considering applying for a full-time position at the local swimming centre which he frequented.

## Discussion

This study reported the case of Nicholas, a man in his early 30s with long-standing and severe HA and who showed signs of benefiting from a course of CBT. This was demonstrated by changes in key outcome measures (CORE clinical scores and HAI-18) using a single-case experimental (AB) design. Analyses indicated symptom decline during the treatment phase even after taking account the trend in the baseline phase. While he continued to experience HA symptoms, overall a statistically reliable reduction in HA was observed with a clinically significant reduction in general distress (as revealed by the CORE) from severe to mild levels. This improvement was further corroborated by his ratings for the strength of belief in theory A (cancer) versus theory B (anxiety) as well as ratings for goal attainment and in-session feedback.

The treatment protocol was primarily based on the cognitive theory of HA (Rachman, 2012; Salkovskis & Warwick, 1986, 2001) but crucially augmented with a key component of the cognitive model of OCD, which has a major focus on normalising intrusions as everyday mental activities including taboo topics (Salkovskis, 1985). This involved challenging Nicholas' initial interpretation of intrusions through a range of in-session and homework tasks. Because he was particularly distressed by his intrusion-based misinterpretations, we decided that the first step required addressing those concerns. Subsequently, behavioural experiments were helpful for him to experientially understand the role of maintenance cycles of the vicious flower formulation (Figure 1). The benefit of this approach is captured in changes of ratings of theory A (cancer) versus theory B (anxiety), with stronger attribution of his symptoms as a problem of anxiety rather than of cancer risk towards the end of treatment. Inclusion of a family member (his mum) in the therapy strengthened the developmental aspects of the formulation and would likely maximise long-lasting impact after treatment by inviting external changes thought to maintain the HA. Exploring rumination and worry as shared processes was helpful to address both of his sensation-based as well as intrusion-based misinterpretations (Figure 1). He also reported being able to generalise this learning to other non-health-related domains, such as a reduction in the time spent ruminating on a job-related grievance (from 2 h daily to 30 min–1 h every other day).

This case highlighted the value of identifying limitations of disorder-specific models. Cognitive theories of HA focus on sensation-related appraisals as specific to it (Rachman, 2012; Salkovskis & Warwick, 2001) and thus should be the key treatment target, but critical to the success of this case was recognising the role of intrusion-related appraisals — within a presentation of HA — which is more typical of the phenomenology of OCD (Salkovskis, 1985). As illustration, appraising sensations as a sign of tumour led to body over-checking, whereas appraising intrusions as abnormal led to countering-act them with rational thoughts. The adapted vicious flower formulation (Figure 1) highlighted the link between sensation-based appraisals and intrusion-based appraisals, with the latter being key to understanding and addressing Nicholas' more covert coping (i.e., neutralising and suppressing) which otherwise could have been missed. This analysis lends support to the overlap between HA and OCD in phenomenology and maintenance processes (Barsky et al., 1992; Rachman, 1997) and may invite revisions of cognitive models of HA to more fully consider both types of appraisals. Indeed, intrusion-based interpretations are not mentioned in well-established protocols for HA (Salkovskis & Warwick, 2001). Intrusion-based misinterpretations may be missed by clinicians working with HA as the primary presenting complaint, a challenge that may be further fuelled by the theoretical assumption that HA and OCD are separable due to their presumed cognitive specificity (Fergus, 2014; Salkovskis & Warwick, 2001). The key implication is, therefore, the value of explicitly assessing for both sensation- and intrusion-based appraisals when treating HA — rather than just the former — to draw a more precise formulation of health worries in terms of cognitive and behavioural maintenance processes.

Some may wonder whether Nicholas had concurrent OCD and HA, which could have explained the presence of both types of misinterpretations. At assessment, his main concerns were circumscribed to health worries in the absence of other type of obsessions (e.g., of harm or sexuality), and therefore, an additional diagnosis of OCD was not considered at the time. However, it could be argued that the focus on his mental state itself (i.e., meaning of the intrusions) was an additional form of obsession. Had the HA-focused CBT protocol led to limited therapeutic gains, a further exploration of the OCD comorbidity would have been warranted. This could benefit from including a more fine-grained analysis of other possible misinterpretations of his intrusions (beyond these being ‘not normal’), for example, whether he believed that his mind somehow knew more about what was going on (and therefore, his intrusions themselves were a sign of cancer) or whether his intrusions were a sign that his mind was descending into madness as part of a broad organism decline of which cancer was just one manifestation. Further guidance on this process of differential diagnosis is welcomed as there is very little literature on the comorbidity between HA and OCD.

### *Challenges in the Treatment Process*

One challenge encountered was having to adjust expectation of change through treatment. Nicholas was unable to easily drop many of his avoidance and safety-seeking behaviours (during showers) — he was apprehensive about eliminating all of these coping methods he had used in the last 10 years. The fact that his anxiety (of testicular cancer) tended to be provoked during showers made therapist-assisted in-vivo behavioural experiments in this setting difficult. Nevertheless, a discussion of pros/cons for changing these behaviours was useful to motivate him as it foregrounded their potential impact on future romantic relationships. He was more motivated by a middle-ground approach, where he would aim for reduction of the target behaviours rather than full elimination. With this rationale, he successfully tackled the first step of his hierarchy list (reducing the volume of music he used to distract himself from physical sensations and intrusions rather than having no music at all). This approach had the additional benefit of helping him combat an all-or-nothing thinking style so he no longer aimed to eliminate all intrusions from surfacing as he had previously aspired to. Overall, he understood the principles of overcoming avoidance and expressed commitment to continue working through his hierarchy.

### *Limitations*

Inherent to the AB design, it remains possible that changes associated with treatment may be attributed to a concurrent external change in Nicholas’ life. The approach used interweaved interventions targeting intrusion-based versus sensation-based appraisals throughout treatment as the clinical need arose, but future work could consider more distinct phases targeting only one type of appraisals at a time to better test the unique impact of each phase. In addition, the baseline for the HAI-18 contained two data points only (precluding formal trend analyses), although it was consistently high and overall converged with severity levels indicated by the CORE (which had sufficient data points). This underscored the need to consider multiple outcome measures with chronic and severe conditions, as these measures may be differentially sensitive to detecting degrees/types of changes. The lack of process measures hampered conclusions about mechanisms of change. For example, measures of rumination/worry tendencies or intrusion interpretation could have been introduced to strengthen the claim that these were changed by treatment. In future, in-session feedback could inform the development of more relevant/idiosyncratic measures in similar cases (e.g., to differentiate intrusion frequency from impact). Follow-up measures were also not obtained due to service constraints. Had the number of sessions been more than what was possible due to service/time constraints, further success in overcoming avoidance could have been achieved after some time (together with potential additional reduction in scores on the HAI-18). Finally, this single case may also not be generalisable.

## Conclusions

This report presented the application of a CBT approach to treat severe and long-standing HA in a man in his early 30s. A formulation distinguished sensation-based misinterpretations (central to the cognitive model of HA) from intrusion-based misinterpretations (central to the cognitive model of OCD), which informed a treatment plan integrating strategies from two different cognitive models. The benefits of this approach were reflected in clinical measures and patient feedback. Thus, there may be cases of HA where cognitive specificity is less applicable and considering both types of interpretations can be crucial to treatment success. Clinicians ought to look out for intrusion-based misinterpretations in the context of HA, especially if faced by limited therapeutic gains.

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**Ethical standards.** The treatment ran as part of routine clinical cases within Oxford Health NHS Foundation Trust. Informed consent for publication was obtained.

## References

- Abramowitz JS** (2005). Hypochondriasis: Conceptualization, treatment, and relationship to obsessive compulsive disorder. *Annals of Clinical Psychiatry*, *17*, 211–217. doi:10.1080/10401230500295339.
- Abramowitz JS and Braddock AE** (2008). *Psychological treatments of health anxiety & hypochondriasis: A biopsychosocial approach*. Göttingen: Hogrefe & Huber Publishers.
- American Psychiatric Association** (1994). *Diagnostic and statistical manual of mental disorder* (4th ed.). Washington, DC: American Psychiatric Association.
- American Psychiatric Association** (2013). *Diagnostic and statistical manual of mental disorder* (5th ed.). Washington, DC: American Psychiatric Association.
- Barkham M, Bewick B, Mullin T, Gildbody S, Connell J, Cahill J, ... Evans C** (2013). The CORE-10: A short measure of psychological distress for routine use in the psychological therapies. *Counselling and Psychotherapy Research*, *13*, 3–13. doi:10.1080/14733145.2012.729069.
- Barsky AJ** (1992). Hypochondriasis and obsessive compulsive disorder. *Psychiatric Clinics of North America*, *15*, 791–801. doi:10.1016/s0193-953x(18)30209-0.
- Barsky AJ, Wyshak G and Klerman GL** (1992). Psychiatric comorbidity in DSM-III-R hypochondriasis. *Archives of General Psychiatry*, *49*, 101–108. doi:10.1001/archpsyc.1992.01820020021003.
- Clark DA and Radomsky AS** (2014). Introduction: A global perspective on unwanted intrusive thoughts. *Journal of Obsessive-Compulsive and Related Disorders*, *3*, 265–268. doi:10.1016/j.JOCD.2014.02.001.
- Connell J and Barkham M** (2007). *CORE-10 user manual, version 1.1*. CORE System Trust & CORE Information Management Systems Ltd.
- Cooper K, Gregory JD, Walker I, Lambe S and Salkovskis PM** (2017). Cognitive behaviour therapy for health anxiety: A systematic review and meta-analysis. *Behavioural and Cognitive Psychotherapy*, *45*, 110–123. doi:10.1017/S1352465816000527.
- Evans C, Connell J, Barkham M, Margison F, McGrath G, Mellor-Clark J and Audin K** (2002). Towards a standardised brief outcome measure: Psychometric properties and utility of the CORE-OM. *British Journal of Psychiatry*, *180*, 51–60. doi:10.1192/bjp.180.1.51.
- Fallon BA, Qureshi AI, Laje G and Klein B** (2000). Hypochondriasis and its relationship to obsessive-compulsive disorder. *Psychiatric Clinics of North America*, *23*, 605–616. doi:10.1016/S0193-953X(05)70183-0.
- Fergus TA** (2014). Health-related dysfunctional beliefs and health anxiety: Further evidence of cognitive specificity. *Journal of Clinical Psychology*, *70*, 248–259. doi:10.1002/JCLP.22012.
- Hedman E, Ljótsson B, Axelsson E, Andersson G, Rück C and Andersson E** (2017). Health anxiety in obsessive compulsive disorder and obsessive compulsive symptoms in severe health anxiety: An investigation of symptom profiles. *Journal of Anxiety Disorders*, *45*, 80–86. doi:10.1016/j.janxdis.2016.11.007.
- Ma HH** (2006). An alternative method for quantitative synthesis of single-subject researches: Percentage of data points exceeding the median. *Behavior Modification*, *30*, 598–617. doi:10.1177/0145445504272974.
- Magariños M, Zafar U, Nissenon K and Blanco C** (2002). Epidemiology and treatment of hypochondriasis. *CNS Drugs*, *16*, 9–22. doi:10.2165/00023210-200216010-00002.
- Morley S** (2018). *Single-case methods in clinical psychology: A practical guide* (1st ed.). London: Routledge.

- National Collaborating Centre for Mental Health** (2018). The improving access to psychological therapies manual – Appendices and helpful resources.
- Olatunji BO, Kauffman BY, Meltzer S, Davis ML, Smits JAJ and Powers MB** (2014). Cognitive-behavioral therapy for hypochondriasis/health anxiety: A meta-analysis of treatment outcome and moderators. *Behaviour Research and Therapy*, **58**, 65–74. doi:10.1016/j.brat.2014.05.002.
- Parker RI, Vannest KJ, Davis JL and Sauber SB** (2011). Combining nonoverlap and trend for single-case research: Tau-U. *Behavior Therapy*, **42**, 284–299. doi:10.1016/j.beth.2010.08.006.
- Rachman S** (1997). A cognitive theory of obsessions. *Behaviour Research and Therapy*, **35**, 793–802. doi:10.1016/S0005-7967(97)00040-5.
- Rachman S** (2012). Health anxiety disorders: A cognitive construal. *Behaviour Research and Therapy*, **50**, 502–512. doi:10.1016/j.brat.2012.05.001.
- Rachman S and de Silva P** (1978). Abnormal and normal obsessions. *Behaviour Research and Therapy*, **16**, 233–248. doi:10.1016/0005-7967(78)90022-0.
- Salkovskis PM** (1985). Obsessional-compulsive problems: A cognitive-behavioural analysis. *Behaviour Research and Therapy*, **23**, 571–583. doi:10.1016/0005-7967(85)90105-6.
- Salkovskis PM and Warwick HMC** (1986). Morbid preoccupations, health anxiety and reassurance: A cognitive-behavioural approach to hypochondriasis. *Behaviour Research and Therapy*, **24**, 597–602. doi:10.1016/0005-7967(86)90041-0.
- Salkovskis PM and Warwick HMC** (2001). Meaning, misinterpretations, and medicine: A cognitive-behavioral approach to understanding health anxiety and hypochondriasis. In V Starcevic and DR Lipsitt (eds), *Hypochondriasis: Modern perspectives on an ancient malady*. New York, NY: Oxford University Press, pp. 314–328.
- Salkovskis PM, Rimes KA, Warwick HMC and Clark DM** (2002). The health anxiety inventory: Development and validation of scales for the measurement of health anxiety and hypochondriasis. *Psychological Medicine*, **32**, 843–853. doi:10.1017/S0033291702005822.
- Williams PG** (2004). The psychopathology of self-assessed health: A cognitive approach to health anxiety and hypochondriasis. *Cognitive Therapy and Research*, **28**, 629–644. doi:10.1023/b:cotr.0000045569.25096.44.