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ARTICLE

A systematic review evaluating metacognitive beliefs in health anxiety and somatic distress

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Abstract

Purpose: Increasing evidence suggests metacognitive beliefs may underpin transdiagnostic mechanisms maintaining psychopathology. The objective of this systematic review was to evaluate published studies investigating the role of metacognitive beliefs in somatic distress in adult samples.

Method: A systematic review was conducted, spanning five data bases. Studies meeting eligibility criteria were qualitatively synthesized.

Results: Thirty-six studies (N = 12,390) met inclusion criteria with results suggesting a relatively consistent positive relationship between metacognitive beliefs and somatic distress. Both general and syndrome-specific metacognitive beliefs demonstrated relationships with not only emotional distress, but also physical symptoms themselves.

Conclusions: Results are discussed in terms of conceptualizing somatic distress through the Self-Regulatory Executive Function (S-REF) Model. Future research into metacognitive therapy for somatic populations is recommended.

KEYWORDS
health, metacognition, metacognitive belief, physical symptom, somatic

Statement of contribution

What is already known on this subject?

- Metacognitive beliefs are linked with a range of psychopathological presentations
- Metacognitive beliefs are associated with emotional distress in adults with physical illnesses
- Metacognitive beliefs may underpin transdiagnostic mechanism

What does this study add?

- Metacognitive beliefs are commonly positively correlated with somatic distress in adults
- Metacognitive beliefs are positively associated with both distress and physical symptomatology
- There are few longitudinal studies, thus the causative role of metacognitive beliefs is unclear.

A SYSTEMATIC REVIEW EVALUATING METACOGNITIVE BELIEFS IN SOMATIC DISTRESS AND HEALTH ANXIETY

Somatic distress is highly prevalent across a variety of conditions, although the extent to which these may be explained by a common mechanism is widely debated and has implications for how treatment protocols are developed and deployed (Chalder & Willis, 2017). There are several advantages to a transdiagnostic perspective, including providing a better understanding of common comorbidities, developing treatments applicable to multiple disorders and explaining the benefits observed among a variety of disorders within targeted randomized controlled trials (Harvey et al., 2004). By gaining an understanding of transdiagnostic processes such as dysfunctional metacognitive beliefs, this perspective has the scope to streamline treatment of disparate somatic presentations through transdiagnostic interventions such as metacognitive therapy (Wells, 2011).

Somatic distress, broadly defined as the manifestation of psychological distress via somatic complaints, is an area of conceptual controversy (Al Busaidi, 2010). Somatic complaints have often been termed 'medically unexplained syndromes' (MUS) in which functional somatic symptoms exist in the absence of clear identifiable pathological or organic causes (Chalder & Willis, 2017). To avoid the pitfall of mind–body dualism, the absence of medical aetiology is considered insufficient for diagnosing psychopathology (Brostrom, 2019; Walker, 2019). Indeed, the current, fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), emphasizes the *presence* of distress and impairment associated with physical symptoms rather than *absence* of organic causes (American Psychiatric Association, 2013). Consistent with the DSM-5 conceptualization, and for the purpose of the present review, 'somatic distress' is defined as significant and abnormal emotional distress and/or functional impairment associated with physical symptoms. Key terms used throughout this review are defined in Table 1. Notably, no assumptions are made regarding the origin of such symptoms. Further, to capture all potentially relevant studies on the topic and to retain a conventional conceptualization, we define somatic distress as a dimensional construct; thus, a clinical diagnostic threshold for distress severity or a diagnosed psychological disorder per se are not requisites for inclusion. Symptom clusters falling under this definition include: irritable bowel syndrome (IBS), chronic fatigue syndrome (CFS), chronic pain and fibromyalgia (Luty, 2018; Wessely et al., 1999). Other specific symptoms such as recurring headaches, abdominal pain and discomfort, gastrointestinal concerns and distress regarding bodily symptoms as captured by the DSM-5, somatic symptom disorder (SSD) and illness anxiety disorder (IAD)/health anxiety (HA) categories are also relevant with this conceptualization of somatic distress. Given the inclusion of HA, the related condition cyberchondria, that is the manifestation of HA specifically through internet searches (McElroy & Shelvin, 2014; Muse et al., 2012), is also included in our conceptualization of somatic distress.

TABLE 1 Key definitions

Term	Definition
Metacognitive	'Thinking about thinking'
Metacognitive beliefs	The beliefs an individual holds about their thinking processes. In some instances, metacognitive beliefs can encourage maladaptive self-regulation strategies. For example, 'worrying helps me cope' may encourage greater ruminative thinking
Somatic distress	Irrespective of symptom origin, somatic distress refers to significant and abnormal emotional distress and/or functional impairment associated with actual physical symptoms and/or a preoccupation with developing physical symptoms
Somatic symptoms	Physical symptoms (e.g., nausea, fatigue, pain), which are experienced in those with somatic distress
Somatic presentation	Somatic distress may be encapsulated by various somatic presentations such as health anxiety, cyberchondria, irritable bowel syndrome, chronic fatigue syndrome, chronic pain and fibromyalgia, somatic symptom disorder, illness anxiety disorder

Inclusion of health anxiety (HA)

Representing HA as a form of somatic distress is controversial. It has been argued that splitting the DSM-IV diagnosis of hypochondriasis into SSD and IAD was unnecessary (Bailer et al., 2016) and represents a misclassification. Some researchers further posit that HA might be better represented as an anxiety disorder (e.g., Olatunji et al., 2009; Weck et al., 2010). However, we have included HA in our conceptualization of somatic distress, based upon the current DSM-5 definition and classification. Although physical symptoms are minor and/or benign in HA, there is associated distress and impaired functioning. Recent hierarchical analysis of psychopathology symptoms indicates that somatic anxiety clusters together with a variety of somatic symptoms (Forbes et al., 2021), thus providing further support for the inclusion of HA for the purposes of this review.

Self-Regulatory executive function (S-REF) model

The Self-Regulatory Executive Function (S-REF) model provides a framework that may help explain the potential role of metacognitive beliefs in somatic distress (Wells & Matthews, 1994; Wells & Matthews, 1996). According to this model, both predisposition to and maintenance of psychological distress is underpinned by a style of information processing known as the Cognitive Attentional Syndrome (CAS). CAS is characterized by worry, rumination and ongoing monitoring for indicators of threat. With regards to somatic distress, threat monitoring may involve hypervigilance to bodily symptoms such as pain, fatigue and nausea. Such processes are evident in individuals experiencing somatic distress (Marcus et al., 2008; Ricci et al., 2016). Subsequent to CAS activation, maladaptive and ineffective attempts at self-regulation include thought suppression, avoidance and rumination. Metacognitive beliefs maintain these maladaptive strategies and may include positive beliefs (e.g., worrying helps me cope/solve problems) or negative beliefs (e.g., my worry is dangerous/cannot be stopped; Wells & Matthews, 1994; Wells & Matthews, 1996).

Evidence indicates that maladaptive metacognitive beliefs are elevated in individuals with various psychological disorders compared to healthy controls, supporting the notion that these may represent a transdiagnostic process (see Sun et al., 2017 for review). Evidence also indicates a relationship between elevated metacognitive beliefs and emotional distress in individuals with physical illnesses (Capobianco et al., 2020; Lenzo et al., 2020). However, there has yet to be a systematic investigation of whether metacognitive beliefs are related to somatic distress. Such an investigation may advance our understanding of the extent to which metacognitive beliefs may underpin transdiagnostic mechanisms, possibly contributing to a range of psychopathology presentations. Given ongoing debate regarding classification

of various conditions as 'somatic', examining metacognitive beliefs across somatic presentations may facilitate understanding of the degree to which there are similarities between various somatic presentations. Further, a comprehensive understanding of the role of metacognitive beliefs in somatic distress may facilitate implementation of appropriate intervention (Wells, 2011). Accordingly, the primary aim of this review is to investigate whether maladaptive beliefs are positively associated with increased somatic distress and physical symptoms.

METHOD

The review was registered with PROSPERO in 2019.

Search eligibility

Studies were included if they met the following criteria: (1) published in a peer review journal in English; (2) quantitative designs; (3) data reported for both metacognitive beliefs and somatic symptoms using validated measures; and (4) based on adult samples (aged 18 years or older). Treatment outcome and experimental studies were only included if baseline association between somatic symptoms and metacognitions were reported.

Study exclusion criteria comprised; (1) based on paediatric sample (aged less than 18 years); (2) the authors did not report original data (e.g., commentaries); (3) unpublished and grey literature (e.g., dissertations): (4) non-English publications; (5) samples experiencing severe mental illness (e.g., psychosis or active suicidal ideation), given the impact on cognitive functioning; (6) neurological conditions, such as Alzheimer's, given the impact on cognitive functioning.

Search strategy

The Cochrane Library and PROSPERO were initially searched for existing reviews or reviews in progress, and none were identified. Electronic searches were conducted using PsycINFO, EBSCOHost, Embase, the Cochrane Library and PubMed. No restrictions were placed on study publication date. Search terms included: Somatic OR somatiation* OR hypochondria* OR illness anxiety OR health anxiety OR chronic fatigue OR CFS OR irritable bowel syndrome OR IBS OR FGID OR functional* unexplained OR functional* somatic OR medically unexplained OR gastrointestinal OR conversion disorder OR somatoform OR factitious OR abdominal pain OR abdominal discomfort OR headache OR nausea OR migraine OR fibromyalgia AND metacognition OR meta-cognition OR metacognitive OR meta-cognitive. A search was also conducted using the above metacognitive terms and the term 'pain'. Filters were used to extract papers in English with human samples. Initial searches were undertaken on 1 March 2020, with updates conducted on 19 May 2020 and which was extended to include the term 'pain'. Searches were further updated on 17 March 2022.

Data extraction and synthesis

Titles and abstracts were initially screened and relevant studies were reviewed in full by the first author who assessed study eligibility. In the initial search, a subsample of papers, which underwent full-text review ($n = 18$, 25%) were double checked for eligibility by the second author. Agreement was high (94%). For the one arising disagreement, discussion was undertaken to reach a resolution.

A standardized form was developed to extract relevant data from included studies (full data available in Supporting Information; further summarized in Table 2). Primary outcomes of the

TABLE 2 Study characteristics and results

Study	Sample size (% female)	Mean age (standard deviation)	Clinical status (yes/no)	Comorbidities	Measure of metacognitive beliefs	Measure of somatic distress	Recruitment method	Key results
Health anxiety								
Akbari et al. (2021)	541 (44.0%)	53.8 (14.8)	No	–	MCQ-30	SHAI	Community	SHAI – MCQPos: $r = .15$* SHAI – MCQNeg: $r = .45$* SHAI – MCQCC: $r = .42$* SHAI – MCQNC: $r = .39$* SHAI - MCQSC: $r = .19$*
Bailey and Wells (2013)	351 (89.5%)	27.0 (7.5)	No	–	MCQ-30	WI	Nursing students	WI – MCQPos: $r = .51$* WI – MCQNeg: $r = .67$* WI – MCQCC: $r = .47$* WI – MCQNC: $r = .60$* WI - MCQSC: $r = .60$*
Bailey and Wells (2015a)	351 (89.5%)	27.0 (7.5)	No	–	MCQ-30	WI	Nursing students	WI – MCQPos: $r = .51$* WI – MCQNeg: $r = .67$* WI – MCQCC: $r = .47$* WI – MCQNC: $r = .60$* WI - MCQSC: $r = .60$*
Bailey and Wells (2015b)	259 (90.7%)	26.0 (6.9)	No	–	MCQ-HA; MCQ-30	WI	Nursing students	WI – MCQ-HA-B: $r = .60$* WI – MCQ-HA-C $r = .49$* WI – MCQ-HA-U: $r = .71$* WI – MCQ-HA-Total: $r = .69$*

TABLE 2 (Continued)

Study	Sample size (% female)	Mean age (standard deviation)	Clinical status (yes/no)	Comorbidities	Measure of metacognitive beliefs	Measure of somatic distress	Recruitment method	Key results
Bailey and Wells (2016a)	377 (88.1%)	27 (6.8)	No	–	MCQ-HA	WI	Nursing students	WI – MCQ-HA-B: $r = .58$* WI – MCQ-HA-C $r = .52$* WI – MCQ-HA-U: $r = .68$*
Bailey and Wells (2016b)	105 (72.4%)	26 (6.5)	No	–	MCQ-HA	WI	Nursing students	WI at Time 1, MCQ-HA-U and MCQ-HA-B were unique, prospective predictors of HA at Time 2
Bouman and Meijer (1999)	146 (91.1%)	43.4 (9.8)[a]	Yes (DSM-IV hypochondriasis)	–	MCQ-H; MCQ-65	WI	Attending group or individual therapy	WI – MCQ-65: $r = .40$* WI – MCQPos: $r = .03$ WI – MCQNeg: $r = .52$* WI – MCQCC: $r = .13$ WI – MCQNC: $r = .42$* WI - MCQSC: $r = .17$
Dai et al. (2018)	1191 (61.9%)	19.3 (1.3)	No	–	MCQ-HA; MCQ-30	SHAI	Medical students	SHAI – MCQ30: $r = .34$* SHAI – MCQ-HA-B: $r = .32$* SHAI – MCQ-HA-C $r = .28$* SHAI – MCQ-HA-U: $r = .49$*

(Continues)

TABLE 2 (Continued)

Study	Sample size (% female)	Mean age (standard deviation)	Clinical status (yes/no)	Comorbidities	Measure of metacognitive beliefs	Measure of somatic distress	Recruitment method	Key results
Fergus et al. (2022)	307 (88.9%)	33.5–37.6 (13.0–15.8)	No	–	MCQ-HA	WI	Community Health Centre	Beliefs about uncontrollability more strongly correlated with HA in white participants than Black or Latinx participants
Melli et al. (2016)	342 (61.4%)	37.7 (12.2)	No	–	MCQ-H	HAQ	Community	HAQ – MCQ-H-Pos: $r = .24$* HAQ – MCQ-H-Neg: $r = .20$* HAQ – MCQ-H-U: $r = .50$* HAQ – MCQ-H-CSC: $r = .21$*
Melli et al. (2018)	458 (67.0%)	33.97 (12.2)	Yes (self-reported)	–	MCQ-HA	HAQ	Community	HAQ – MCQ-HA-B: $r = .42$* HAQ – MCQ-HA-C $r = .34$* HAQ – MCQ-HA-U: $r = .61$*
Solem et al. (2015)	695 (60.0%)	34.6 (11.98)[a]	Yes (OCD confirmed by structured interview)	Severe mental health and substance abuse excluded (e.g., psychosis); 30.4% met WI cut-off for HA	MCQ-30	WI	Outpatients	WI – MCQ-30: $r = .48$*

TABLE 2 (Continued)

Study	Sample size (% female)	Mean age (standard deviation)	Clinical status (yes/no)	Comorbidities	Measure of metacognitive beliefs	Measure of somatic distress	Recruitment method	Key results
Cyberchondria								
Airoldi et al. (2021)	125 (58.4%)	34.5 (14.1)	No	Comorbid psychological disorders excluded	MCQ-HA	CSS	Community (social media recruitment)	CSS – MCQ-HA-B: $r = .23$* CSS – MCQ-HA-C $r = .18$* CSS – MCQ-HA-U: $r = .49$*
Fergus and Spada (2017)	260 (40.8%)	32.9 (9.2)	No	29.2% self-reported physical health condition	MCQ-HA	WI-6; CSS	Community	CSS – MCQ-HA-B: $r = .58$* CSS – MCQ-HA-C $r = .49$* CSS – MCQ-HA-U: $r = .66$*
Fergus and Spada (2018)	661 (60.0%)	Study 1. 19.4 (2.1)	No	–	MCQ-HA	WI-6	University students	Study1. CSS – MCQ-HA-B: $r = .49$* CSS – MCQ-HA-C $r = .32$* CSS – MCQ-HA-U: $r = .51$*
		Study 2. 38.7 (10.4)				CSS		Study 2. CSS – MCQ-HA-B: $r = .47$* CSS – MCQ-HA-C $r = .40$* CSS – MCQ-HA-U: $r = .64$*

(Continues)

TABLE 2 (Continued)

Study	Sample size (% female)	Mean age (standard deviation)	Clinical status (yes/no)	Comorbidities	Measure of metacognitive beliefs	Measure of somatic distress	Recruitment method	Key results
Hashemi et al. (2020)	651 (62.4%)	33.5 (10.8)	No	–	MCQ-30	CSS-12	Community	CSS – MCQPos: $r = .31$* CSS – MCQNeg: $r = .38$* CSS – MCQCC: $r = .29$* CSS – MCQNC: $r = .34$* CSS - MCQSC: $r = .18$*
Marino et al. (2020)	717 (87.0%)	27.3 (5.7)	No	Serious disease (e.g., cancer) excluded; 18% had common physical condition (e.g., lactose intolerance)	MCQ-HA	CSS	University students/community	CSS – MCQ-HA-B: $r = .52$* CSS – MCQ-HA-C $r = .33$* CSS – MCQ-HA-U: $r = .63$*
Chronic Pain								
Rachor and Penney (2020)	179 (81.6%)	22.2 (5.4)	Yes (Self-reported)	–	MCQ-HA	Chronic Pain Grade Scale; SHAI	University students	Pain Intensity– MCQ-HA-B: $r = .16$* Pain Intensity – MCQ-HA-C $r = .02$ Pain Intensity– MCQ-HA-U: $r = .19$* Pain Disability– MCQ-HA-B: $r = -.29$* Pain Disability – MCQ-HA-C $r = -.01$ Pain Disability– MCQ-HA-U: $r = .25$*

TABLE 2 (Continued)

Study	Sample size (% female)	Mean age (standard deviation)	Clinical status (yes/no)	Comorbidities	Measure of metacognitive beliefs	Measure of somatic distress	Recruitment method	Key results
Pahlevan et al. (2019)	391 (60.4%)	29.7% aged 31–40 years	Yes (ICD-11 criteria)	–	MCQ-30	Numeric Rating Scale	Patients of clinics/rehabilitation centre	Direct effect of immature defences upon alexithymia, which had a direct effect on pain intensity and indirect effects via behavioural inactivation and metacognitions
Schutze, Rees, Smith, Slater, and O'Sullivan (2019)	510 (60.0%)	37.5 (12.4)	Yes (Self-reported)	–	PMQ	Brief Pain Inventory	Community (MTurk)	Pain intensity – PMQ-P: $r = .23$* Pain intensity – PMQ-N: $r = .26$*
Schutze, Rees, Smith, Slater, Catley, and O'Sullivan (2019)	1374 (64.8%)	Study 1. 39.7 (12.6)	Yes (Self-reported)	24.9% self-reported comorbid mental health diagnosis	PMQ	Brief Pain Inventory	Community (online advertisement/MTurk)	Study 1. Pain intensity – PMQ-P: $r = .10$* Pain intensity – PMQ-N: $r = .16$*
		Study 2. 37.5 (12.4)			MCQ-30			Pain intensity – MCQ30: $r = .08$* Study 2. Pain intensity – PMQ-P: $r = .23$*
Spada et al. (2016)	308 (68.8%)	28.9 (11.8)	No	–	MCQ-30	Pain Catastrophizing Scale Pain Behaviour Checklist	University students	Pain catastrophizing and metacognitive beliefs had indirect effects, mediating relationship between neuroticism and pain behaviour

(Continues)

TABLE 2 (Continued)

Study	Sample size (% female)	Mean age (standard deviation)	Clinical status (yes/no)	Comorbidities	Measure of metacognitive beliefs	Measure of somatic distress	Recruitment method	Key results
Yoshida et al. (2012)	129 (56.0%)	52.0 (12.4)	Yes (physician confirmed)	100% muscular dystrophy	TCQ	Numerical Rating Scale Pain Catastrophizing Scale Survey of Pain Attitudes Control Scale	Participants of previous studies	Pain catastrophizing – Worry: $r = .25$* Pain catastrophizing – Punishment: $r = .37$* Pain catastrophizing – Reappraisal: $r = .03$ Pain catastrophizing – Distraction: $r = .04$
Ziadni et al. (2018)	211 (87.7%)	Not reported	Yes (self-reported)	–	MCQ-30	Numerical Rating Scale Pain Catastrophizing Scale	Community (listservs/online advertisement)	Pain intensity – MCQNeg: $r = .10$* Pain intensity – MCQNC: $r = .11$* Pain intensity - MCQSC: $r = .04$
Chronic Fatigue Syndrome								
Fernie et al. (2015)	124 (76.6%)	41.7 (range 18–70)	Yes (Oxford criteria)	Major depression and psychosis excluded	MaSCS	CFQ	Royal Free Hospital, London	CFQ – PMSC: $r = .24$* CFQ – NMSC: $r = .48$*
Fernie et al. (2019)	124 (75.8%)	41.7 (range 18–70)	Yes (Oxford criteria)	Major depression and psychosis excluded	MaSCS MCQ-30	CFQ	Royal Free Hospital, London	CFQ – MCQPos: $r = .19$* CFQ – MCQNeg: $r = .30$* CFQ – MCQCC: $r = .53$* CFQ – MCQNC: $r = .31$* CFQ – MCQSC: $r = .15$ CFQ – PMSC: $r = .24$* CFQ – NMSC: $r = .35$*

TABLE 2 (Continued)

Study	Sample size (% female)	Mean age (standard deviation)	Clinical status (yes/no)	Comorbidities	Measure of metacognitive beliefs	Measure of somatic distress	Recruitment method	Key results
Jacobsen et al. (2016)	137 (80.3%)	43.6 (9.4)	Yes (CFQ score >5)	Severe mental health/substance abuse excluded. 9.5% comorbid anxiety, 7.3% comorbid depression	MCQ-30	CFQ	Inpatient Occupational rehabilitation	Baseline metacognitive beliefs, depression and fatigue, positively associated with baseline subjective cognitive impairments
Maher-Edwards et al. (2011)	96 (81.3%)	41.2 (range 21–70)	Yes (Oxford criteria)	Major depression and psychosis excluded	MCQ-30	CFQ	Royal Free Hospital, London	CFQ-Physical – MCQPos: $r = .13$ CFQ-Physical – MCQNeg: $r = .22$* CFQ-Physical – MCQCC: $r = .43$* CFQ-Physical – MCQNC: $r = .28$* CFQ-Physical – MCQSC: $r = .08$
Fibromyalgia								
Kollmann et al. (2016)	348 (90.8%)	49.9 (8.5)	Yes (self-reported)	50.9% comorbid psychiatric diagnosis	MaSCS MCQ-30	FIQ	Community (online recruitment)	FIQ – MCQPos: $r = .18$* FIQ – MCQNeg: $r = .50$* FIQ – MCQCC: $r = .39$* FIQ – MCQNC: $r = .36$* FIQ – MCQSC: $r = .33$* FIQ – PMSC: $r = .05$ FIQ – NMSC: $r = .47$*

(Continues)

TABLE 2 (Continued)

Study	Sample size (% female)	Mean age (standard deviation)	Clinical status (yes/no)	Comorbidities	Measure of metacognitive beliefs	Measure of somatic distress	Recruitment method	Key results
Fernie et al. (2019)	347 (91.1%)	49.9 (range 23–74)	Yes (self-reported)	50.9% comorbid psychiatric diagnosis	MaSCS MCQ-30	FIQ	Community (online recruitment)	FIQ – MCQPos: $r = .18$* FIQ – MCQNeg: $r = .51$* FIQ – MCQCC: $r = .41$* FIQ – MCQNC: $r = .36$* FIQ – MCQSC: $r = .34$* FIQ – PMSC: $r = -.03$ FIQ – NMSC: $r = .45$*
Irritable Bowel Syndrome								
Quattropani et al. (2019)	120 (45.0%)	Study 1. 38.1 (12.2)[a] Study 2. 39.3 (19.8)[a]	Yes (physician diagnosed)	Psychological and neurological comorbidities excluded if interfering with completion of measures	MCQ-30	Gastrointestinal Symptom Rating Scale	Outpatients	Non-significant differences in MCB between IBS and IBD Non-significant differences in MCB between IBS, UC and CD
Zargar and Kavoosi (2021)	150 (30.6%)	35.4 (12.3)[a]	Yes (physician diagnosed)	Control group: no comorbidities, IBS group: -	MCQ-30	Physician diagnosis	Isfahan University Health Centres	Non-significant difference in MCB between IBS and CHD
Sen Demirdogen et al. (2021)	290 (73.5%)	32.3 (6.7)	No	–	MCQ-30	SS-AP	Healthcare workers in tertiary settings	SS-AP – MCQ-30: $r = .34$*

Abbreviations: CFQ, Chalder Fatigue Questionnaire; CSS, Cyberchondria Severity Scale; FIQ, Fibromyalgia Impact Questionnaire; HAQ, Health Anxiety Questionnaire; MaSCS, Metacognitions about Symptom Control Scale; MCB, Metacognitive beliefs; MCQ-30, Metacognitions Questionnaire (30 items); MCQ-65, Metacognitions Questionnaire (65 items); MCQ-H, Metacognitions about Health Anxiety Questionnaire; MCQ-HA, Metacognition Questionnaire - Health Anxiety; PMQ, Pain Metacognition Questionnaire; SHAI, Short Health Anxiety Inventory; SS-AP, DSM-5 APA Somatic Symptom Inventory – Adult Patient; WI, Whitely Index.

[a]Some papers did not provide the mean age for the entire participant group. In these instances, the age is provided for the target group of interest. Full age breakdown of the sample can be found in Supporting Information.

results included the relationship between somatic symptoms and metacognitions whilst secondary outcomes included distress and emotions, quality of life and well-being. Papers were organized according to the somatic presentation examined and results were qualitatively synthesized within these categories.

Quality assessment

Study quality was assessed using the Quality Assessment Tool for Studies with Diverse Designs (QATSSD; Sirriyeh et al., 2011). The QATSSD allows assessment of quality across a variety of research designs (Sirriyeh et al., 2011). The QATSDD has good inter-rater reliability and good to substantial test–retest reliability over six weeks (Sirriyeh et al., 2011). The 14 quantitative assessment items were used, whilst the two items used for assessing qualitative designs were excluded. For each item, a rating is given ranging from zero to three according to criteria outlined by Sirriyeh et al. (2011). An overall percentage rating was also given. Ratings are available in Supporting Information.

RESULTS

Study selection and characteristics

Database searches returned 5670 results, with two articles identified from journal alerts. A total of 32 published papers met inclusion criteria (see Figure 1). The 32 papers comprised a total of 36 individual studies, which met criteria. A total of 12, 390 participants were included, comprising $N = 8$, 598 females (69.4%). Mean participant age ranged from 19.3 to 52 years.

As summarized in Table 2, the most common somatic presentation assessed comprised HA or hypochondriasis (33%; $n = 12$ studies). Eight studies focused on chronic pain (22%), six studies (17%) examined cyberchondria, four studies assessed CFS samples (11%), three studies included IBS participants (8%), and two explored individuals with fibromyalgia (5%). One study assessed somatic symptoms (3%).

Over half the studies ($n = 20$; 56%) included the Metacognitions Questionnaire-30 (Wells & Cartwright-Hatton, 2004) to assess metacognitive beliefs, whilst a further study included the full Metacognitions Questionnaire (65 items; Cartwright-Hatton & Wells, 1997). Targeted metacognitive questionnaires were also used including Metacognitions about Health Anxiety (MCQ-HA; Bailey & Wells, 2015a, 2015b; $n = 10$; 28%), Metacognitions about Symptom Control Scale (MaSCS; Fernie et al., 2015; $n = 4$; 11%), Metacognitions about Health Anxiety (MCHA; $n = 2$; 6%; Bouman & Meijer, 1999), the Pain Metacognition Questionnaire (PMQ; $n = 3$; 8%; Schutze, Rees, Smith, Slater, Catley, & O'Sullivan, 2019) and the Thought Control Questionnaire (TCQ; $n = 1$; 3%; Wells & Davies, 1994). A summary of common measures, and their subscales, are outlined in Table 3.

Quality of studies

Nine studies (22%; Dai et al., 2018; Fergus et al., 2022; Kollmann et al., 2016; Marino et al., 2020; Melli et al., 2018; Schutze, Rees, Smith, Slater, Catley, & O'Sullivan, 2019; Sen Demirdogen et al., 2021; Yoshida et al., 2012) were evaluated to have relatively high quality, scoring a minimum of 65% on the QATSDD (Supporting Information). The remaining studies were evaluated to be of moderate quality, scoring between 50% and 64.9%. No studies were rated as poor/low quality.

Health anxiety and metacognitions

Twelve studies assessed the relationship between HA and metacognitions, of which nine were of moderate quality (Akbari et al., 2021; Bailey & Wells, 2013, 2015a, 2015b, 2016a, 2016b; Bouman & Meijer, 1999; Melli et al., 2016; Solem et al., 2015). The other three studies were rated as high quality (Dai et al., 2018; Fergus et al., 2022; Melli et al., 2018). Only three studies used clinical samples; two studies employed clinical samples diagnosed with hypochondriasis (Bouman & Meijer, 1999) or self-reported having a diagnosis of hypochondriasis or IAD (Melli et al., 2018). One study was based on an OCD sample (Solem et al., 2015), wherein 30% exceeded the Whitely Index cut-off score for significant symptoms of HA.

Six studies reported a correlation between HA and total metacognitive beliefs, either specific or health-related. All six studies, one of which was high quality, reported a significant positive correlation between total metacognitive beliefs and HA with correlation sizes ranging from small to large ($r = .34$ to .72; Bailey & Wells, 2013, 2015b, 2016a; Bouman & Meijer, 1999; Dai et al., 2018; Solem et al., 2015).

Of the four studies, which reported on the association between general metacognitions and HA, three found significant positive correlations between HA and all subscales of the MCQ-30; need to control thoughts ($r = .39$ to .60), cognitive confidence ($r = .42$ to .47), cognitive self-consciousness ($r = .19$ to .60), positive beliefs ($r = .15$ to .51) and negative beliefs ($r = .45$ to .67; Bailey & Wells, 2013, 2015a). However, the fourth study only found significant positive correlations between HA and two MCQ-30 subscales; need to control thoughts ($r = .53$) and negative beliefs ($r = .42$; Bouman & Meijer, 1999).

The five studies, which examined the correlation between HA and specific HA metacognitive beliefs using the MCQ-HA (Bailey & Wells, 2015b, 2016a; 2016b; Dai et al., 2018; Fergus et al., 2022; Melli et al., 2018) all found significant positive correlations between HA and biased thinking ($r = .19$ to .58), thoughts can cause illness ($r = .26$ to .52) and beliefs about uncontrollability of thoughts ($r = .49$ to .72). Three of these studies also reported a significant association between each of the three subscales and HA in regression analyses (Bailey & Wells, 2015b, 2016a; 2016b; Dai et al., 2018). However, Melli et al. (2018) only found that beliefs about uncontrollability of thoughts had a significant association with HA in their regression analysis. One study assessed whether the strength of the relationship between beliefs that thoughts are uncontrollable, and HA varies according to ethnicity, with results indicating a stronger association in White than Black and Latinx participants (Fergus et al., 2022).

Two studies reported on the association of specific HA metacognitive beliefs, and both Bouman and Meijer (1999) and Melli et al. (2016) found significant positive correlations for four subscales on the MCHA; cognitive self-consciousness ($r = .21$ to .34), uncontrollability and interference ($r = .50$ to .76), positive beliefs ($r = .19$ to .24) and negative beliefs ($r = .20$ to .46).

Three studies, which assessed metacognitive beliefs in moderation analyses all found significant effects (Bailey & Wells, 2015a; Melli et al., 2016). Bailey and Wells (2015a) reported that metacognitive beliefs were a significant moderator of the relationship between catastrophic misinterpretation of bodily symptoms and HA, while Melli et al. (2016) found a significant moderation between anxiety sensitivity and HA. Bailey and Wells (2016b) conducted prospective analyses with results gathered at two time points, six months apart, and found metacognitive beliefs were a significant moderator of the relationship between catastrophic misinterpretation of bodily symptoms and HA.

Cyberchondria and metacognitions

Six studies (testing non-clinical samples) examined the association between metacognitive beliefs and cyberchondria; with one rated as high quality (Marino et al., 2020), while the other five were of moderate quality (Airoldi et al., 2021; Fergus & Spada, 2017, 2018; Seyed Hashem et al., 2020). All studies used the Cyberchondria Severity Scale (CSS) to assess cyberchondria on a continuum. All five of the six studies, which assessed the relationship between cyberchondria and health-related metacognitive beliefs using the MCQ-HA (Bailey & Wells, 2015a, 2015b), found significant positive correlations between

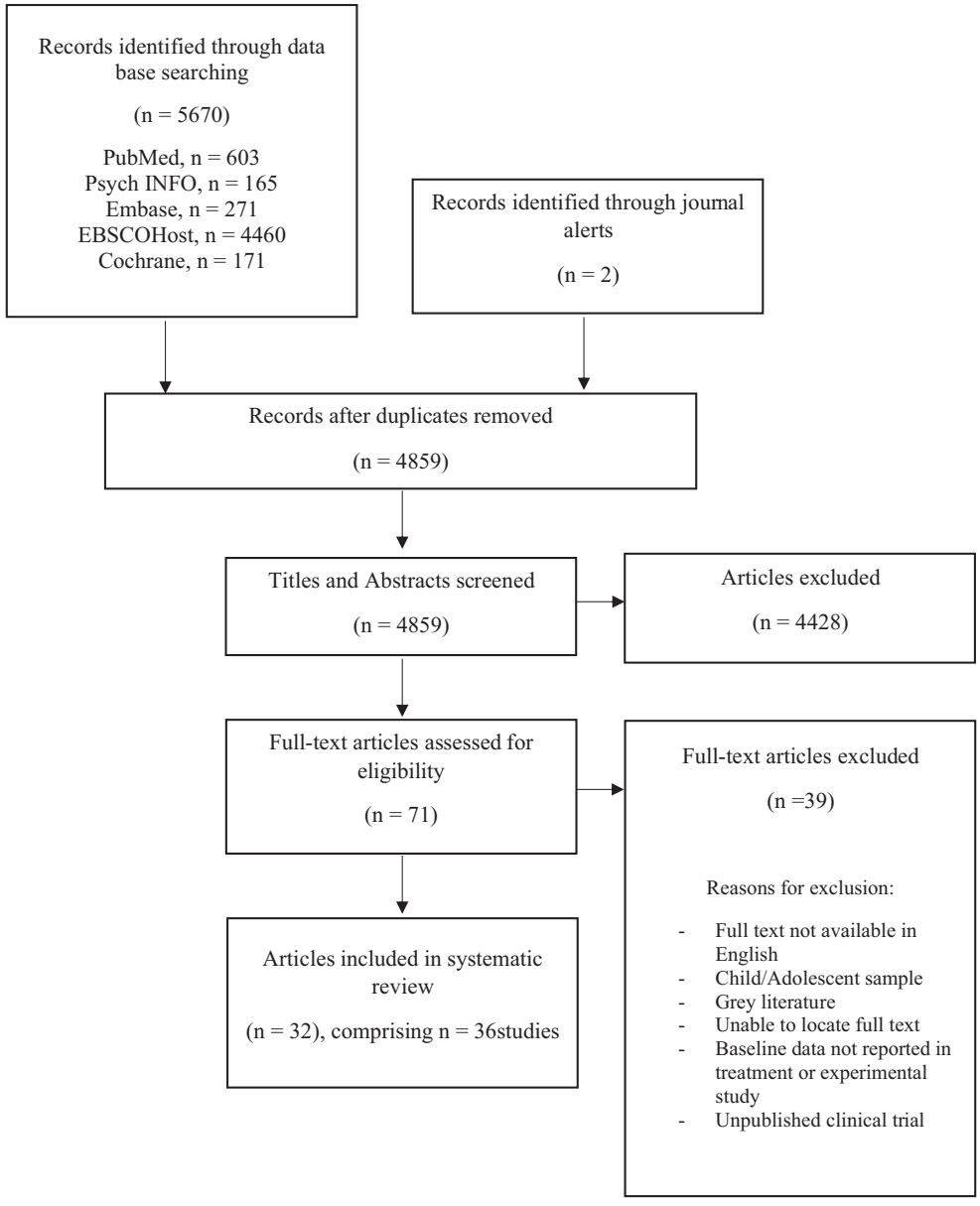

FIGURE 1 Flow diagram of study selection

cyberchondria and metacognitive beliefs about biased thinking ($r = .23$ to $.58$), beliefs that thoughts can cause illness ($r = .18$ to $.49$) and uncontrollability of thoughts ($r = .49$ to $.66$). Fergus and Spada (2017, 2018) found metacognitive beliefs about uncontrollability of thoughts and biased thinking significantly predicted cyberchondria. Extending on these findings Airoldi et al. (2021) found that uncontrollability of thoughts significantly predicted cyberchondria scores. Marino et al. (2020) reported that beliefs of thoughts being uncontrollable had the strongest link with four of five cyberchondria subscales.

One study assessed the relationship between cyberchondria and general metacognitive beliefs (Seyed Hashemi et al., 2020) and found a significant positive correlation between cyberchondria and positive metacognitions ($r = .31$), uncontrollability and danger of thoughts ($r = .38$), cognitive confidence ($r = .29$), need to control thoughts ($r = .34$) and cognitive self-consciousness ($r = .18$).

Chronic pain and metacognitions

Eight studies examined the association between chronic pain and metacognitive beliefs based on various pain conditions. Schutze, Rees, Smith, Slater, Catley, and O'Sullivan (2019) included two studies in their paper. One study used a non-clinical sample, the remainder used clinical samples. One study employed ICD-11 criteria, another used physician-confirmed diagnoses, the rest used self-report. Three studies were rated as high quality (Schutze, Rees, Smith, Slater, Catley, & O'Sullivan, 2019; Yoshida et al., 2012) and five were moderate quality (Pahlevan et al., 2019; Rachor & Penney, 2020; Schutze, Rees, Smith, Slater, & O'Sullivan, 2019; Spada et al., 2016; Ziadni et al., 2018). Three studies assessed the relationship between metacognitive beliefs and pain intensity (Schutze, Rees, Smith, Slater, Catley, & O'Sullivan, 2019; Schutze, Rees, Smith, Slater, & O'Sullivan, 2019; Ziadni et al., 2018); and three reported on pain specific metacognitions (Schutze, Rees, Smith, Slater, Catley, & O'Sullivan, 2019; Schutze, Rees, Smith, Slater, & O'Sullivan, 2019). These latter studies reported significant positive correlations between pain intensity and positive pain metacognitions (e.g., analysing my pain prepares me for the worst; $r = .10$ to $.23$) and negative pain metacognitions (e.g., when I start thinking about my pain, it is impossible to stop; $r = .16$–$.26$) Schutze, Rees, Smith, Slater, Catley, & O'Sullivan, 2019; Schutze, Rees, Smith, Slater, & O'Sullivan, 2019). Two studies reported on general metacognitions with Schutze, Rees, Smith, Slater, Catley, and O'Sullivan (2019) reporting a small significant positive correlation between overall metacognitions and pain intensity ($r = .08$) and Ziadni et al. (2018) reporting small positive correlations between pain intensity and uncontrollability of thoughts ($r = .10$) and need to control thoughts ($r = .11$). Cognitive self-consciousness was not significantly related to pain intensity ($r = .04$; Ziadni et al., 2018).

Five studies assessed the relationship between pain catastrophizing and metacognitive beliefs. Three of these studies, which assessed pain specific metacognitions, found weak to moderate correlations between pain catastrophizing and positive ($r = .28$ to $.35$) and negative ($r = .48$ to $.56$) pain metacognitions (Schutze, Rees, Smith, Slater, & O'Sullivan, 2019; Schutze, Rees, Smith, Slater, Catley, & O'Sullivan, 2019). Three of the four studies assessed general metacognitions beliefs in relation to pain intensity. Two studies found a significant positive correlation of a medium size between pain catastrophizing and overall general metacognitions ($r = .42$; Schutze, Rees, Smith, Slater, Catley, & O'Sullivan, 2019) and subscales of cognitive confidence ($r = .20$), uncontrollability of thoughts ($r = .32$), and need to control thoughts ($r = .30$; Ziadni et al., 2018). One study found significant positive correlations between pain catastrophizing and worry ($r = .25$) and punishment ($r = .37$) subscales but not the reappraisal or distraction subscales (Yoshida et al., 2012). Controlling for pain intensity, regression analyses also suggested that the TCQ punishment subscale were significantly related to pain catastrophizing and the reappraisal subscale was related to perceived control of pain (Yoshida et al., 2012).

Three studies assessed the relationship between chronic pain and metacognitions (Pahlevan et al., 2019; Schutze, Rees, Smith, Slater, & O'Sullivan, 2019; Spada et al., 2016). Spada et al. (2016) found that pain catastrophizing and negative metacognitive beliefs about worry significantly were related to pain behaviour and acted as mediators between neuroticism and pain behaviour. Pahlevan et al. (2019) reported a direct pathway from metacognitions to pain intensity using a pathway model. Schutze, Rees, Smith, Slater, and O'Sullivan (2019) found that metacognitive beliefs moderated the mediating effect of perseverative thinking on the association between pain intensity and pain catastrophizing.

One study examined the relationship between pain, HA and metacognitive beliefs in a chronic pain sample (Rachor & Penney, 2020) and found significant positive associations between uncontrollability of thoughts and pain intensity and disability. A significant positive correlation was also found between beliefs about biased thinking and pain intensity while a negative relationship existed with pain disability. Beliefs about biased thinking were significantly related to pain disability, controlling for pain intensity and HA.

Three studies reported significant small to medium positive correlations between metacognitions and depression and anxiety in chronic pain samples (Schutze, Rees, Smith, Slater, Catley, & O'Sullivan, 2019; Ziadni et al., 2018).

TABLE 3 Summary of common measures of metacognitive beliefs

Questionnaire	Subscales	Construct
Metacognitions Questionnaire	Cognitive Confidence (MCQCC)	Confidence in cognitive faculties such as attention and memory
30 items (MCQ-30)	Positive beliefs (MCQPos)	Beliefs that worrying serves a positive function
65 items (MCQ-65)	Cognitive self-consciousness (MCQSC)	Allocation of attention to thought processes
	Negative beliefs about uncontrollability/danger (MCQNeg)	Beliefs, which posit that worry is threatening/cannot be stopped
	Need to control thoughts (MCQNC)	Beliefs that control over thoughts is necessary
Metacognitions about Health Anxiety (MCQ-HA)	Beliefs about biased thinking (MCQ-HA-B)	Thought patterns can cause or avert illness
	Beliefs that thoughts can cause illness (MCQ-HA-C)	Health-related thoughts can produce negative health consequences
	Beliefs that thoughts are uncontrollable (MCQ-HA-U)	Thinking about illness/health is uncontrollable
Metacognitions about Symptom Control Scale (MaSCS)	Positive metacognitions about symptoms control (PMSC)	Beliefs that thinking about/monitoring symptoms will have beneficial outcomes
	Negative metacognitions about symptoms control (NMSC)	Beliefs that thinking about/monitoring symptoms will have negative outcomes
Metacognitions about Health Anxiety (MCHA)	Uncontrollability and interference of illness thoughts	Beliefs that thoughts about illness/health are uncontrollable/interfere with functioning
	Cognitive self-consciousness	Allocation of attention to thought processes
	Responsibility	Beliefs about responsibility
	Negative consequences	Thinking about illness has consequences, such becoming sicker
	Positive beliefs	Thinking about illness has benefits, such as improved coping
Pain Metacognitions Questionnaire	Positive metacognitions	Beliefs that thinking about pain has positive benefits such as problem solving or protection from injury
	Negative metacognitions	Beliefs that thinking about pain has negative consequences such as exacerbating pain and inducing stress, anxiety and depression
Thought Control Questionnaire	Distraction	Beliefs that use of distraction strategies can control thoughts
	Social Control	Using social networks to assist in control of thoughts
	Worry	Worrying about other matters to control thoughts
	Punishment	Use of punishment to control thoughts
	Reappraisal	Using reappraisal of thoughts to gain control over thinking

(Continues)

Chronic fatigue syndrome (CFS) and metacognitions

Four studies, of moderate quality, examined metacognitive beliefs in CFS clinical samples. Three studies used the Oxford criteria, and one used a CFQ cut-off score of five for diagnosis. Two studies reported on the relationship between fatigue and metacognitive beliefs about symptom control, based on the same sample (Fernie et al., 2015; Fernie et al., 2019) and found significant positive correlations between fatigue and both positive ($r = .24$) and negative ($r = .35$ to $.48$) beliefs about symptom control.

Two studies reported on the relationship between general metacognitive beliefs and fatigue (Fernie et al., 2019; Maher-Edwards et al., 2011). Beliefs about uncontrollability of thoughts, cognitive confidence and need to control thoughts were all significantly positively correlated with total fatigue including mental and physical fatigue. In contrast, positive metacognitions were significantly positively correlated with mental and total fatigue but not physical fatigue. Cognitive self-consciousness was not significantly associated with any fatigue scales (Fernie et al., 2019; Maher-Edwards et al., 2011).

One study assessed the relationship between metacognitive beliefs and subjective memory impairments in a CFS sample (Jacobsen et al., 2016) and found total metacognitive beliefs were significantly associated with memory impairment.

Three studies reported on the association between metacognitive beliefs and depression and anxiety symptoms in CFS samples (Fernie et al., 2015; Fernie et al., 2019; Maher-Edwards et al., 2011). Negative metacognitions about symptom control exhibited medium to large significant positive correlations with depression and anxiety symptoms in both samples (Fernie et al., 2015; Fernie et al., 2019). Positive metacognitions about symptom control were significantly positively associated with anxiety in one study (Fernie et al., 2019). Both Maher-Edwards et al. (2011) and Fernie et al. (2019) also reported that all MCQ-30 subscales demonstrated significant small to large positive correlations with both anxiety (range .27 to .62) and depression (range $r = .29$ to $.59$).

Irritable bowel syndrome (IBS) and metacognitions

Three studies, all of moderate quality, assessed the relationship between metacognitive beliefs and IBS, as compared to other organic diseases (Quattropani et al., 2019; Zargar & Kavoosi, 2021). Diagnoses of IBS were all physician-confirmed. In Quattropani et al.'s (2019) first study, results showed that negative metacognitive beliefs were significantly positively correlated with anger, fear and sadness (negative emotions on the Affective Neuroscience Personality Scale; ANPS; Davis et al., 2003) in both IBS and Inflammatory Bowel Disease (IBD) samples (with no significant differences on metacognitions between samples). Cognitive confidence was significant positively correlated with seek (a positive emotion involving feelings of curiosity and desire for problem solving) and fear (a negative emotion on the ANPS) variables in the IBS sample (Davis et al., 2003). For the second study, no significant differences were found for any metacognitive subscales for the IBS, Ulcerative Colitis and Crohn's disease groups. Similarly, Zargar and Kavoosi (2021) reported no significant differences on any of the MCQ-30 subscales between IBS and coronary heart disease (CHD) samples. When compared to controls, the IBS sample did demonstrate elevated positive beliefs about worry.

Fibromyalgia and metacognitions

Two studies examined the relationship between metacognitive beliefs and fibromyalgia in a clinical sample based, with self-reported diagnoses of fibromyalgia, on the same dataset, with one study rated as high quality (Kollmann et al., 2016) and the other of moderate quality (Fernie et al., 2019).

Results showed a significant association between fibromyalgia and negative metacognitions about symptom control ($r = .47$ to $.45$) but not positive metacognitions ($r = -.03$ to $.05$). Results indicated significant weak to strong correlations with general metacognitive subscales; positive beliefs ($r = .18$),

uncontrollability and danger ($r = .50$ to $.51$), cognitive confidence ($r = .39$ to $.41$), need to control thoughts ($r = .36$) and cognitive self-consciousness ($r = .33$ to $.34$; Fernie et al., 2019; Kollmann et al., 2016). These researchers also found all MCQ-30 subscales and negative, but not positive metacognitions about symptom control were significantly positively correlated with depression, stress and anxiety.

Somatic symptoms and metacognitions

One high quality study assessed the role of metacognitive beliefs as a mediator between childhood trauma and depression, anxiety, stress and somatic symptoms in a sample of adult healthcare workers working directly with COVID-19 patients (Sen Demirdogen et al., 2021). Using the DSM-5 APA Somatic Symptom Inventory to assess somatic symptoms, results demonstrated a significant positive correlation between somatic symptoms and metacognitive beliefs ($r = .34$). Based on structural equation modelling, the results further indicated that metacognitive beliefs partially mediated the relationship between childhood trauma and psychological outcomes, including somatic symptoms.

DISCUSSION

Thirty-six studies were identified assessing the association between metacognitive beliefs and somatic distress. Results indicate a mostly consistent positive relationship between dysfunctional metacognitive beliefs and somatic distress across adult samples including HA, cyberchondria, chronic pain, fibromyalgia, CFS, IBS and somatic symptoms. The pattern of results supports the notion that metacognitive beliefs are a common transdiagnostic factor. Current findings mirror results from other reviews (Capobianco et al., 2020; Lenzo et al., 2020: Sun et al., 2017), highlighting the robust positive relationship between metacognitive beliefs and psychological distress across various health and psychological conditions. Extending beyond these existing reviews, the current findings demonstrate not only a relationship between metacognitions and emotional distress, but also a consistent relationship between metacognitive beliefs and physical symptoms such as increased pain and fatigue.

Effect sizes varied across somatic presentations. In HA and cyberchondria samples, correlations with metacognitive beliefs tended to be in the medium to large range. Comparatively, effect sizes in chronic pain tended to be small. In fibromyalgia and CFS, there was substantial variation in the extracted effect sizes. Statistical comparison of these effect sizes is beyond the scope of this review, however, examining whether the strength of the relationship between somatic distress and metacognitive beliefs varies according to somatic presentation is likely to be an important avenue for future transdiagnostic investigations.

According to the S-REF model, metacognitive beliefs contribute to the exacerbation of distress and dysfunction by maintaining activation of the CAS. The current review confirms an important component of this model, that metacognitive beliefs are positively associated with distress (Wells & Matthews, 1994; Wells & Matthews, 1996). Indeed, the review further extends upon this model by demonstrating that metacognitive beliefs are also positively correlated with physical symptoms such as pain and fatigue. However, none of the included studies explored the role of the CAS. The CAS involves perseverative thinking patterns, attention to threat and maladaptive coping behaviours. Studies beyond this review have demonstrated the importance of the CAS in depression and anxiety presentations (Fergus et al., 2013). Future research should assess the CAS in somatic presentations through measures such as the Cognitive Attentional Syndrome Scale-1 (Wells, 2009) and determine whether the CAS mediates the relationship between metacognitive beliefs and increased psychological distress and dysfunction.

Fifteen studies assessed and found a significant positive relationship between somatic distress and syndrome-specific metacognitive beliefs in HA, cyberchondria and chronic pain. The importance of

syndrome-specific metacognitions was highlighted by Bailey and Wells (2015b) and Dai et al. (2018) who presented results that showed HA-specific metacognitive beliefs explain additional variance beyond general metacognitive beliefs, indicating the presence of syndrome-specific nuances. This may have implications for clinicians using the S-REF model to conceptualize somatic distress whereby identification of syndrome-specific metacognitive beliefs allows for a refined understanding of the exacerbation of distress (Wells, 2009).

In contrast to previous reviews that revealed metacognitive beliefs about uncontrollability and danger of worry had a notably elevated association with anxiety and depression across various physical illness (e.g., Capobianco et al., 2020), this pattern of results did not emerge in the current review. Instead, across the five MCQ-30 subscales (negative beliefs about uncontrollability and danger of worry, cognitive confidence, positive beliefs about worry, need to control and cognitive self-consciousness) there was substantial variation in the strength of relationship with somatic presentations. The discrepancy between the present results and Capobianco et al.'s (2020) findings may be partially attributable to the nature of items included in the negative beliefs about uncontrollability and danger of worry subscale, which target worry-related cognitions specifically. For example, items such as 'my worrying is dangerous for me' and 'worrying persists even when trying to stop' (Wells & Cartwright-Hatton, 2004) may be less relevant to somatic symptoms such as fatigue and pain than to anxiety and possibly depressive symptomatology, as was a focus of Capobianco et al.'s (2020) review.

A variety of scales were employed to measure metacognitive beliefs, some of which examined symptom-specific beliefs while most studies employed the more general MCQ-30. Within some somatic presentations, there was high consistency in measurement tools assessing somatic symptoms. For example, all CFS studies employed the CFQ, all cyberchondria studies used the CSS, and both fibromyalgia studies used the FIQ. Within HA and chronic pain, there was greater variability of measurement tools. However, across the entire review, measurement of somatic distress varied with regards to the construct(s) being measured. Inconsistency in which construct was being measured highlights a lack of consensus in measurement standards inclusive of instruments used in this field. For example, questionnaires for HA primarily measured levels of *health-related distress* whilst researchers examining pain and CFS primarily used scales to measure *physical symptomatology*. Indeed, this measurement discrepancy may further highlight debate regarding the classification of HA as a somatic presentation (Olatunji et al., 2009; Weck et al., 2010). Alternatively, measurement variation may indicate a need for further research investigating the relationship between metacognitive beliefs and somatic symptom-related *distress*, for example, assessing the distress associated with pain or fatigue symptoms through measurement tools such as Patient Health Questionnaire- 15 (Kroenke et al., 2002). Notably, across all somatic presentations there was a paucity of studies examining the relationship between metacognitive beliefs and impaired functionality.

Although DSM-5 has been available since 2013, only one study included in this review employed a sample with a DSM-5 diagnosis of IAD and no studies were identified that specifically included individuals with SSD when assessing metacognitive beliefs. This represents a gap in the literature examining metacognitive beliefs and the disordered end of the somatic spectrum. It is unclear what proportion of included participants may have met either IAD or SSD criteria, given this diagnostic framework was rarely used in recruitment or assessment of participant's characteristics. The absence of this framework may reflect ongoing controversies regarding the validity of these diagnoses (Allen, 2013; Dimsdale et al., 2013). Nonetheless, further research on participants meeting IAD or SSD criteria is warranted to examine whether metacognitive beliefs might present a viable treatment target in clinical samples who meet these criteria. Further, of the included clinical samples, a proportion self-reported their diagnosis. Thus, the validity of these diagnoses is indeterminable and the criteria with which these diagnoses were made were often unclear. Consideration must also be given to the representativeness of included samples. Six studies examining HA recruited nursing or medical student samples. These studies tended to show medium to large positive correlations between HA and metacognitive beliefs. While some research suggests that medical students have lower levels of HA than non-medical students (Singh et al., 2004), other evidence indicates that HA may fluctuate

through a nursing student's degree (Zhang et al., 2014). It is unclear whether the strength of the association found in these studies is attributable to the nature of the sample given another commonality to this subset of studies is their use of the Whitely Index to assess HA. Current findings need to be considered in light of limitations of included studies. Although the present investigation mirrored the predictions of the S-REF model in highlighting a consistent, positive association between metacognitive beliefs and somatic distress, a causal relationship could not be evaluated, given most studies were based on cross-sectional data (N = 34, 94%). Prospective and longitudinal designs in future studies are recommended to examine how maladaptive metacognitions contribute to the onset and/or maintenance of somatic distress. Further, few studies reported on the presence of comorbid physical conditions or psychological disorders. Even where comorbidities were reported, no efforts were made to control for the presence of comorbid physical or psychological disorders in statistical analyses, with the exception of studies, which controlled for anxiety and depression symptoms. This is a considerable limitation given the known association between metacognitive beliefs and a range of psychological disorders (Sun et al., 2017). The majority of studies were rated as being moderate quality (71.9%). Notably, most studies scored poorly on criteria requiring evidence that sample size was considered, involvement of users in study design, as well as a lack of detailed recruitment data. However, a notable strength of this body of literature is that 59% of studies provided a strong theoretical framework and a majority used appropriate data collection (97%) and statistical analysis in line with the stated research objectives.

The review findings also need to be considered in context of inclusion criteria selected. Only studies published in peer review journals in the English language were included. Given the developmental impact of cognitive maturation factors, the findings are restricted to adult samples. Despite these restrictions, a strength of the inclusion criteria was the use of a broad conceptualization of somatic presentations.

Current findings demonstrate that metacognitive beliefs are a common, transdiagnostic factor associated with somatic presentations, supporting the utility of the S-REF model for formulating somatic distress and accompanying psychological distress. Despite ongoing diagnostic and classification controversies, as well a non-uniform approach to measurement of somatic distress, metacognitive beliefs consistently emerged as a variable related to all included conditions. It is recommended that future research extend beyond reliance on cross-sectional evidence and explore casual relationships. Nonetheless, current research indicates that metacognitive factors could present a valuable intervention target through treatments such as metacognitive therapy.

AUTHOR CONTRIBUTIONS

Edwina Keen: Conceptualization; data curation; formal analysis; methodology; validation; writing – original draft; writing – review and editing. **Maria Kangas:** Conceptualization; methodology; supervision; validation; writing – review and editing. **Philippe T. Gilchrist:** Supervision; writing – review and editing.

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CONFLICTS OF INTEREST

All authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

The current article includes the complete raw data collected in the study including the standardized form for data extraction and quality ratings as Supporting Information.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Appendix S1 Study characteristics and results.

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