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Research report

Core belief content examined in a large sample of patients using online cognitive behaviour therapy

Abigail Millings^{a,*}, Katherine B. Carnelley^b^a Department of Psychology, Western Bank, University of Sheffield, Sheffield S10 2TP, UK^b Psychology Department, University of Southampton, Highfield Campus, Southampton SO17 1BJ, UK

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ABSTRACT

Background: Computerised cognitive behavioural therapy provides a unique opportunity to collect and analyse data regarding the idiosyncratic content of people's core beliefs about the self, others and the world.

Methods: 'Beating the Blues' users recorded a core belief derived through the downward arrow technique. Core beliefs from 1813 mental health patients were coded into 10 categories.

Results: The most common were global self-evaluation, attachment, and competence. Women were more likely, and men were less likely (than chance), to provide an attachment-related core belief; and men were more likely, and women less likely, to provide a self-competence-related core belief. This may be linked to gender differences in sources of self-esteem. Those who were suffering from anxiety were more likely to provide power- and control-themed core beliefs and less likely to provide attachment core beliefs than chance. Finally, those who had thoughts of suicide in the preceding week reported less competence themed core beliefs and more global self-evaluation (e.g., 'I am useless') core beliefs than chance.

Limitations: Concurrent symptom level was not available. The sample was not nationally representative, and featured programme completers only.

Conclusions: Men and women may focus on different core beliefs in the context of CBT. Those suffering anxiety may need a therapeutic focus on power and control. A complete rejection of the self (not just within one domain, such as competence) may be linked to thoughts of suicide. Future research should examine how individual differences and symptom severity influence core beliefs.

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1. Introduction

The global lifetime prevalence of depression has been estimated at 9.6%, and anxiety at 12.9% (Steel et al., 2014). Anxiety and depression are frequently comorbid (Kessler et al., 1996). In an age of increasing demand for psychological services, online interventions, also known as 'e-therapies', for common psychological problems such as depression and anxiety, have developed apace over the last decade. The majority of e-therapies are based on Cognitive Behavioural Therapy (CBT, Beck et al., 1979), because (i) CBT has a large evidence base for effectiveness in treating common mental health problems (Roth and Fonagy, 2005) and (ii) CBT is commonly manualised, comprises learning specific techniques and skills, and is therefore amenable to delivery via computer interface. Meta-analyses have found that online interventions can

be effective, acceptable to users (Andrews et al., 2010), cost-effective at reducing symptoms of depression and anxiety (Hedman et al., 2012), and are integrated into routine care in several countries (Christensen and Petrie, 2013; National Institute for Health and Clinical Excellence, 2009).

Online therapies have been categorised, according to features, level of therapist support/guidance, and extent of therapeutic relationship (Barak et al., 2009; Cavanagh and Millings, 2013; Newman et al., 2011). Newman et al. (2011) propose 4 groups according to level of therapist support: predominantly therapist administered treatments (regular contact, which online technology is used to augment); minimal-contact therapy (less active involvement of therapist); predominantly self-help (therapist involvement only in assessment and teaching clients how to use the programme); and self-administered therapy (if there is any therapist involvement, it is only for assessment purposes).

An interesting artefact of online interventions is the wealth of data stored by them that can offer insight into therapeutic processes (Taylor and Luce, 2003). In this paper we focus on the content of the core beliefs documented by users of a commercially

* Corresponding author.

E-mail addresses: a.millings@sheffield.ac.uk (A. Millings), k.carnelley@soton.ac.uk (K.B. Carnelley).

available online CBT predominantly self-help, or self-administered programme ('Beating the Blues'). We examine the content of these core beliefs, with the goals of establishing (a) what themes are present in core beliefs, and (b) whether they differ according to gender, mental health problem, and recent suicidal ideation.

2. Utility of data from online interventions

Online interventions can provide data that were previously more difficult or impossible to obtain, documenting both the process and the product of therapeutic work, within specific therapeutic techniques and across whole treatments. Researchers have examined stored text from interventions that are predominantly therapist administered or minimal-contact therapies. [Dirkse et al. \(2014\)](#) analysed the content of client messages sent to therapists in supported internet delivered CBT for anxiety ($n=59$ clients) using Linguistic Inquiry Word Count (LIWC, [Pennebaker et al., 2007](#)). Over the course of treatment, negative emotion, anxiety, causation, and insight words reduced, and past tense words increased. Additionally, negative emotion words were associated with heightened symptoms. [Van Der Zanden et al. \(2014\)](#) examined text produced in a chat box by users ($n=239$) of an online cognitive-behavioural group with high therapist involvement, and found greater use of discrepancy words ('should', 'would', which may indicate future-oriented aspirations) was associated with declining levels of depression over time. The authors argue that such words could be an indicator of mental health improvement.

In a final example, [Svartvatten et al. \(2015\)](#) examined email correspondence and in-programme text of users ($n=29$) of a guided, internet delivered, behavioural activation programme, supported by 15 min per week therapist time by text messages. [Svartvatten et al. \(2015\)](#) found, for example, that clients who had more 'indication of alliance' and 'observing positive consequences' had greater self-reported improvement in depression. These findings are a useful starting point from which to consider how therapeutic processes can be explicated by the analysis of text in internet therapies on an episodic scale. One can also examine single therapeutic exercises. Herein, in a large sample of patients, we examine text produced by a clearly delineated therapeutic technique (downward arrow technique) to derive core beliefs, in the context of a self-help online intervention 'Beating the Blues'.

3. CBT and core beliefs

CBT is based on the assumption of causal relatedness between cognitions, emotions, and behaviours. Central to CBT is the notion that changing negative thoughts and beliefs ([Beck, 1976](#)) can alleviate associated, symptomatic, negative feelings, and their behavioural maintenance (for example avoidance or social withdrawal). Beliefs about the self, others, the world, or future that are deeply held, persistent, and pervasive are known as 'core beliefs' ([Beck, 2011](#)). The content of core beliefs is important because they are presumed to be fundamental, and indeed even causal, to common mental health problems, and thus of interest to researchers and clinicians.

Past research into core beliefs has taken a generic approach, examining the extent to which a set of generic core beliefs are endorsed, often using questionnaires. The Young Schema Questionnaire (YSQ; and short form, [Young, 1998](#)) was developed "based on the observations and reasoning of experienced clinicians" ([Welburn et al., 2002](#), p. 520). The Short form of the YSQ assesses specific maladaptive cognitive schema (or core beliefs): emotional deprivation, abandonment, mistrust/abuse, social alienation, defectiveness, incompetence, dependency, vulnerability to

harm, enmeshment, subjugation of needs, self-sacrifice, emotional inhibition, unrelenting standards, entitlement, and insufficient self-control.

While such generic tools are useful in identifying potential core beliefs, it is also useful clinically and for research purposes to consider the content of clients' specific, personal core beliefs. [Wenzel \(2012\)](#) suggests that one should view core beliefs identified via self-report questionnaires as hypotheses to be tested during therapy. Specific techniques exist within CBT to 'discover' personal core beliefs. Although powerful, core beliefs are not necessarily consciously known ([Welburn et al., 2002](#)), and being idiosyncratic, they may not be included on a given questionnaire. The 'downward arrow' technique is a therapeutic exercise to enable the discovery of a core belief ([Beck et al., 1979](#)). The client begins with a negative automatic thought and 'drills down' to the core belief underlying that thought in a series of steps. In 'Beating the Blues', this is operationalised through the client beginning with a negative automatic thought they recorded during the previous week, and answering the question 'what does that mean to me?' repeatedly and sequentially, until they arrive at the underlying core belief that drives the negative automatic thought. The core belief is then subsequently tackled using thought challenging techniques. The downward arrow technique may capture core beliefs that are more relevant to the individual, given their personal nature, than generic questionnaires. We adopt an idiographic rather than nomothetic starting point for our analysis of core beliefs, by examining those derived through the downward arrow technique, rather than beginning with a predefined set.

4. Current study

Practitioners and researchers alike would recognise that issues such as relationship problems ([Simon and Barrett, 2010](#)), learned helplessness ([Abramson et al., 1978](#)), negative evaluations of the self ([Beck, 1967](#); [Pietromonaco, 1985](#)), expectations of negative evaluations from others ([Beck, 2002](#)), and feelings of incompetence ([Rush and Beck, 1978](#)) can be features of depression and anxiety. However, to the best of our knowledge, no systematic analysis of a collection of core beliefs exists to document the prevalence of these themes, or what factors predict them, such as gender, mental health problem, and suicidal ideation. In the current study, we examine a large, opportunistic dataset of core beliefs from 'Beating the Blues', develop a coding scheme, and categorize their content. We examine whether the prevalence of certain core belief themes differs according to gender, mental health condition, and suicidal ideation.

5. Gender and core beliefs

While there is an argument that men and women are more similar than they are different ([Hyde, 2005](#)), some research suggests that we might find gender differences in core beliefs. Women have higher levels of depression than men ([Simon and Barrett, 2010](#)). In addition, there are gender differences in self-esteem. Meta-analyses show men report higher global self-esteem than women ([Kling et al., 1999](#); [Major et al., 1999](#); [Twenge and Campbell, 2001](#)). [Gentile et al. \(2009\)](#) meta-analysis of gender differences in domain-specific self-esteem demonstrates that women score higher than men in behavioural conduct and moral-ethical self-esteem (arguably 'other' related), and men score higher than women in physical appearance, athletic, personal, and self-satisfaction self-esteem (small to medium effect sizes). Furthermore, among depressed patients, [McBride, Bacchiochi, and Bagby \(2005\)](#) found women scored higher than men in sociotropy, but did not

differ on autonomy. Friendships can be both a source of intimacy relatively more for females than males, for example involve more self-disclosure (Dindia and Allen, 1992), but can also be a source of distress, for example, women respond to rejection cues with self-criticism more than men (Baldwin et al., 2003). Further evidence comes from a metasynthesis of meta-analyses on gender differences (Zell et al., 2015). Zell et al. (2015) highlight that among the 10 largest effect sizes in the 106 meta-analyses they reviewed were peer attachment (Gorrese and Ruggieri, 2012), and interest in people versus things (Su et al., 2009), with women scoring higher than men in both.

Taken together, these differences indicate that the sources of self-esteem may be different for men and women (Josephs et al., 1992), and in the case of depression, where poor self-esteem is a cardinal symptom, core beliefs relating to value of the self may therefore show different themes for men and women. For example, we might expect a higher frequency of core beliefs with relational themes among women. We also might expect a higher frequency of core beliefs with self-efficacy themes among men.

6. Mental health problem type and core beliefs

Welburn et al. (2002) examined the associations between each dimension of the Short Form YSQ and the subscales of the Brief Symptom Inventory (Derogatis, 1993), including anxiety and depression, in a clinical sample. Results indicated that abandonment, vulnerability to harm, failure, self-sacrificing, and emotional inhibition were positive predictors of anxiety. Abandonment and insufficient self-control were positive predictors of depression. Glaser et al. (2002) found the same link between abandonment and depression in an outpatient clinical sample. Research with student samples show that dependency (helplessness and an inability to manage), defectiveness/shame (individual is flawed), insufficient self-control, incompetence/inferiority, vulnerability, and failure and social isolation predict depression scores (Baranoff et al., 2006; Harris and Curtin, 2002; Schmidt et al., 1995). Based on these findings, in the current study, we might expect different frequencies of core belief themes among clients reporting different primary mental health problems. Our research extends past work by examining personal, idiosyncratic core beliefs, and how they might differ as a function of psychological problem.

7. Suicidal ideation and core beliefs

Dutra et al. (2008) examined the association between the Short Form YSQ and suicidal ideation in a sample of trauma survivors receiving outpatient psychiatric treatment. Findings indicated that the core schema dimensions of social isolation/alienation, defectiveness/shame, failure, dependence/incompetence, subjugation of needs, emotional inhibition, and unrelenting standards were positively correlated with suicidal ideation. In a sample of individuals with major depression in later life, those who had attempted suicide in the past were more likely to report feelings of hopelessness (Rifai et al., 1994). Furthermore, predictive links have been found between hopelessness and negative self-concept and suicide (Beck and Weishaar, 1990). Our research extends these past findings by examining patients' personal, idiosyncratic, core beliefs derived through the downward arrow technique and entered into 'Beating the Blues', rather than relying on generic questionnaire items. The previous literature suggests that we might find differences in the core beliefs of those who have and have not experienced recent suicidal ideation.

8. Method

8.1. Participants

Participants were 2074 users (62.7% female) of 'Beating the Blues' who commenced the programme between March 22nd 2010 and 17th December 2010, and completed all eight sessions. Users agreed that their anonymous data could be used for research purposes. The dataset came from 198 primary care providers across the UK and Jersey.

We received ethical approval from the University of Southampton Psychology Ethics Panel to conduct analyses. Age range was recorded categorically: 10.8% were aged 16–25, 22.3% were 26–35, 27.2% were 36–45, 24.2% were 46–55, 13.1% were 56–65, and 2.5% were 66 or over. Participants identified their ethnicity as follows: 94.5% White, 2.4% Asian/East Asian, 1.7% Other/Mixed, and 1.4% Black. Participants identified their mental health problem from a choice of the following: depression (22.4%), anxiety (14.9%), depression and anxiety (59.8%) and 'other' (2.8%). Participants had suffered from their mental health problems for varying amounts of time: 12.4% reported less than 6 months, 20.1% reported 6 months to a year, 20.6% 1–3 years, 9.8% 3–5 years, 14.3% 5–10 years, 13.6% 10–20 years, 7.8% 20–40 years, and 1.4% more than 40 years.

Data on the PHQ9 depression measure (Kroenke et al., 2001) and GAD7 anxiety measure (Spitzer et al., 2006) were available from session 1 of the programme for 743 (38.5%) participants. Absence of data here indicates that the service provider elected not to use these measures. Participants had a mean PHQ9 score of 11.7 (*SD* 5.72, range 0–72), indicating moderate depression, and a mean GAD7 score of 10.27 (*SD* 5.13, range 0–21), indicating moderate anxiety.

8.2. Measures

Given that the dataset was pre-existing, the researchers were not able to add measures or find out what proportion of all users completed the programme. Demographics were recorded in session 1, along with mental health problem.

8.3. Suicidal ideation

Users were asked in every session whether they have experienced any thoughts of suicide in the preceding week (yes/no). In the current study, we focus on the suicidal ideation question referring to the week preceding the current downward arrow/core belief exercise.

8.4. Core belief

In session 4, users learned how to recognise negative automatic thoughts, and were set the task of recording those that occurred in-between sessions 4 and 5. In session 5, users began with a negative automatic thought that they had recorded since the last session, and learned how to use the downward arrow technique (described above) to drill down to their core belief. Users entered the core belief as free text.

8.5. Procedure

Of the 2074 core belief data points available, 221 of which were blank and 40 were un-codeable (e.g., punctuation marks only, or nonsensical letter strings). This yielded 1813 codeable core beliefs. We developed a coding scheme using a random 10% of the sample. (Fig. 1) Codes were informed by theory (as discussed above) but also developed inductively with the aim of creating an exhaustive list with which to capture the semantic content of the core beliefs.

Theme description	Guidance
1. Attachment schema	<ul style="list-style-type: none"> -Relates to an attachment relationship (partner, parent, child, sibling, very close friend) -Expresses attachment-related fears (e.g., abandonment, being alone, rejection) -Attachment relationship beliefs or styles (e.g., compulsive self-reliance, over-dependence) or cognition reflecting these (e.g. 'people never really care about me', 'I can't let people in', 'all men are users') -Unlovability/unlikeability/unattractiveness -Feelings of failing or being bad at an attachment relationship role (e.g., family member, friend, partner, but not coworker) -Caregiving themes – compulsive caregiving, fear of being a burden
2. Competence	<ul style="list-style-type: none"> -Relates to view of self in the context of competence domain, e.g. work, education, or other task -Refers to failure, competence, perfection, or a self evaluation linked to competence, finances -Useless/inadequate only if specific to work, education, or other specific competence (i.e. not global – 'I am useless' not relationship failure, but rather 'I'm useless at...[thing]') -Refers to theme of perfection -Refers to theme of global success/failure, but not relationship failure or relationship role failure -Job defines worth
3. Global self evaluation (non-domain-specific)	<ul style="list-style-type: none"> -Relates to self esteem, self confidence, shame, self worth, being no good, inferior, not nice -Global statement of being useless/inadequate -Themes of blame and deserving what you get because the self is seen as bad -Evaluations of self such as stupid, horrible, selfish, not worthy, deserving of bad things. (e.g., 'my fault', 'I'm useless', 'I'm inadequate', 'I'm a terrible person')
4. Health/medical concerns	<ul style="list-style-type: none"> -Refers to physical health (incl. weight) or mental health -Expresses fears about sanity, side effects of medication, disability, physical pain -Refers to bodily symptoms
5. Control/power[lessness]/strength/weakness	<ul style="list-style-type: none"> -Refers to perceptions of control/being out of control -Conscientiousness (e.g., 'if a job's worth doing....') and having a choice -Refers to feelings of being trapped -Power/weakness themes
6. Meta-cognition	<ul style="list-style-type: none"> -Statements which suggest self insight/observation of cognition (e.g., 'I have negative thinking' or 'I have a need to be needed') -Reflections on own cognitive processing
7. Other people/self in relation to others generally (not attachment relationships but people in general)	<ul style="list-style-type: none"> -Other people in general are good/bad/malicious/hurtful/disliking (e.g., 'people are out for themselves') -Global (non-attachment) relationships with others (e.g., 'I am not a people person' 'I don't get on with people')
8. Hopeless inevitability/overwhelmed	<ul style="list-style-type: none"> -Refers to themes of hopelessness (e.g., 'there's no point to life', 'life has no meaning', 'what's the point', 'there's nothing I can do', 'life is not worth living', 'I won't be able to cope', 'no faith', 'no future') Inevitability themes (e.g., 'I will always be unhappy', 'I will never be happy') -Fear themes (e.g. 'I'm always a target', 'I'm not safe alone') -Being overwhelmed by raw emotion (e.g., panic, anxiety, sadness, depression)
9. Other people's views about self	<ul style="list-style-type: none"> Refers to the importance of what others think about the self (e.g., 'I care too much what others think of me', 'people think I'm ...')
10. Other	<ul style="list-style-type: none"> -Any other theme not classifiable into the above -This might include indication that the user has not completed the task properly, or intends to do so at a different time point

Fig. 1. Core belief themes and coding guidance.

This coding scheme was then applied to the first 25% of the data. Codes were refined in light of this process, with examples added to each code for ease of use. The scheme, comprising 10 categories, then remained constant for the rest of the coding. Coding was undertaken by the first author. Each data item was assigned 1, 2, or 3 codes to capture the meaning, the first (primary) code was assigned to the main or strongest theme (79% were captured by a single code; 20% were captured by 2 codes; 1% were captured by 3 codes). Due to the very small proportion of core beliefs that were

coded with more than one code, we focus on primary codes only. A random 10% of the codeable core beliefs were then second-coded by the second author to check for interrater-reliability. Agreement was achieved on 76.3% of primary codes. Cohen's Kappa indicated substantial agreement .717 ($p < .001$). Where there was disagreement, the first coder's coding was retained.

9. Results

We first examined the frequency of the primary codes to see

Table 1
Frequencies of core belief themes by gender.

	Core belief theme										Totals
	1	2	3	4	5	6	7	8	9	10	
Males											
Count	129	172	164	16	30	67	10	42	5	32	667
Expected count	165.2	138.7	176.6	14.3	25.8	64.0	11.8	40.1	5.9	24.6	667
Freq (% males per theme)	28.7	45.6	34.2	41.0	42.9	38.5	31.3	38.5	31.3	47.8	36.8
Std. residual	-2.8	2.8	-0.9	.4	.8	.4	-.5	.3	-.4	1.5	n/a
Females											
Count	320	205	316	23	40	107	22	67	11	35	1146
Expected count	283.8	238.3	303.4	24.7	44.2	110.0	20.2	68.9	10.1	42.4	1146
Freq (% females per theme)	71.3	54.4	65.8	59.0	57.1	61.5	68.8	61.5	68.8	52.2	63.2
Std. residual	2.1	-2.2	.7	-.3	-.6	-.3	.4	-.2	.3	-1.1	n/a
Totals											
Count	449	377	480	39	70	174	32	109	16	67	1813
Freq (% per theme)	24.8	20.8	26.5	2.2	3.9	9.6	1.8	6.0	0.9	3.7	100

Table 2
Frequencies of core belief themes by mental health problem.

	Core belief theme										Totals
	1	2	3	4	5	6	7	8	9	10	
Depression											
Count	94	83	106	5	17	42	9	21	3	13	393
Expected count	97.3	81.7	104.0	8.5	15.2	37.7	6.9	23.6	3.5	14.5	393.0
Freq (% with depression per theme)	23.9	21.1	27.0	1.3	4.3	10.7	2.3	5.3	0.8	3.3	100.0
Std. residual	-.3	.1	.2	-1.2	.5	.7	.8	-.5	-.3	-.4	n/a
Anxiety											
Count	43	63	77	7	20	30	5	19	4	8	276
Expected count	68.4	57.4	73.1	5.9	10.7	26.5	4.9	16.6	2.4	10.2	276.0
Freq (% with anxiety per theme)	15.6	22.8	27.9	2.5	7.2	10.9	1.8	6.9	1.4	2.9	100.0
Std. residual	-3.1	.7	.5	.4	2.9	.7	.1	.6	1.0	-.7	n/a
Depression and anxiety											
Count	302	220	286	24	32	96	17	65	8	46	1096
Expected count	271.4	227.9	290.2	23.6	42.3	105.2	19.3	65.9	9.7	40.5	1096.0
Freq (% with depression and anxiety per theme)	27.6	20.1	26.1	2.2	2.9	8.8	1.6	5.9	0.7	4.2	100.0
Std. residual	1.9	-.5	-.2	.1	-1.6	-.9	-.5	-.1	-.5	.9	n/a
Other											
Count	10	11	11	3	1	6	1	4	1	0	48
Expected count	11.9	10.0	12.7	1.0	1.9	4.6	.8	2.9	.4	1.8	48.0
Freq (% with other per theme)	20.8	22.9	22.9	6.3	2.1	12.5	2.1	8.3	2.1	0.0	100.0
Std. residual	-.5	.3	-.5	1.9	-.6	.6	.2	.7	.9	-1.3	n/a
Total											
Count	449	377	480	39	70	174	32	109	16	67	1813
Freq (% total per theme)	24.8	20.8	26.5	2.2	3.9	9.6	1.8	6.0	0.9	3.7	100.0

which were most common (see totals rows in Tables 1 and 2). The most common core belief themes were global self-evaluation ($n=480$, 23.1%), attachment schema ($n=449$, 21.6%), and competence ($n=377$, 18.2%), with these three themes accounting for 72% of core beliefs, and the remaining 7 themes (in decreasing order: meta-cognition, hopeless inevitability/overwhelmed, control/powerlessness, other, health or medical concerns, other people, others' views about self) each accounting for less than 10%.

Secondly, we examined the frequency of primary codes by gender. To test whether the theme frequencies differed by gender, we conducted a chi square, which was significant ($\chi^2(9)=32.48$, $p < .001$) indicating that men and women showed a different

pattern of results with regard to the themes that characterize their core beliefs. Table 1 shows the counts, expected counts, frequencies, and standardized residuals for each category. Standardized residuals with an absolute value > 1.96 indicate a significant difference between the expected and observed counts (Field, 2013). Inspection of the standardized residuals shows that results differed significantly from chance for attachment and competence themes only. Women reported significantly more ($z=2.1$) attachment themed core beliefs than expected, and men reported significantly fewer ($z=-2.8$) attachment themed core beliefs than expected. Men had more competence themed core beliefs than expected ($z=2.8$), and women had fewer competence themed core

Table 3
Frequencies of core belief theme by presence or absence of thought of suicide in the preceding week.

	Core belief theme										Totals
	1	2	3	4	5	6	7	8	9	10	
No thoughts of suicide											
Count	407	350	424	32	67	163	30	97	15	59	1644
Expected count	402.3	340.9	438.1	33.0	64.2	160.5	29.3	99.1	15.1	61.4	1644.0
Freq (% with thoughts of suicide per theme)	24.8	21.3	25.8	1.9	4.1	9.9	1.8	5.9	0.9	3.6	100.0
Std. residual	.2	.5	−.7	−.2	.3	.2	.1	−.2	.0	−.3	n/a
Thoughts of suicide											
Count	19	11	40	3	1	7	1	8	1	6	97
Expected count	23.7	20.1	25.9	2.0	3.8	9.5	1.7	5.9	.9	3.6	97.0
Freq (% with no thoughts of suicide per theme)	19.6	11.3	41.2	3.1	1.0	7.2	1.0	8.2	1.0	6.2	100.0
Std. residual	−1.0	−2.0	2.8	.8	−1.4	−.8	−.6	.9	.1	1.2	n/a
Totals^a											
Count	426	361	464	35	68	170	31	105	16	65	1741
Freq (% per theme)	24.5	20.7	26.7	2.0	3.9	9.8	1.8	6.0	0.9	3.7	100.0

^a Totals for suicidal ideation differ from totals for gender and mental health problem due to the suicidal ideation question in Beating the blues being a service provider level option, and some service providers elected not to use this question.

beliefs than expected ($z = -2.2$).

Thirdly, we examined the frequency of primary codes by self-reported mental-health problem (depression, anxiety, depression and anxiety, or other). The chi-square was significant ($\chi^2(27) = 40.91, p = .042$) indicating that individuals reporting different mental health problems show a different pattern of results with regard to the themes that characterize their core beliefs. Inspection of the standardized residuals (Table 2) shows that results differed significantly from chance for attachment and power/control themes only. Individuals reporting to suffer from anxiety reported significantly less ($z = -3.1$) attachment themed core beliefs than expected, and more ($z = 2.9$) power/control themed core beliefs than expected.

Finally, we examined the frequency of primary core belief codes by self-reported thoughts of suicide (yes/no). The chi square was significant ($\chi^2(9) = 19.86, p = .019$) indicating that individuals with and without thoughts of suicide in the preceding week show a different pattern of results with regard to the themes that characterize their core beliefs. Inspection of the standardized residuals (Table 3) shows that results differed significantly from chance for competence and global self-evaluation themes only. Individuals reporting that they had thoughts of suicide in the preceding week reported significantly less ($z = -2$) competence themed core beliefs than expected, and more ($z = 2.8$) global self-evaluation themed core beliefs than expected.

10. Discussion

Our study was the first to examine the content of core beliefs from a large patient sample. We found that the core belief themes of global self-evaluation, attachment schema, and competence were most common. We also found that the frequency of core belief themes differed according to gender, mental health problem, and suicidal ideation in the preceding week. We here discuss each finding in turn with reference to extant literature and implications for future research and practice.

That the most common core belief themes were global self-evaluation, attachment schema, and competence is both interesting and congruent with relevant theories. The belief that the self is worthless, a failure, and disliked or loathed is a key diagnostic feature of depression (DSM-5, American Psychiatric Association, 2013) and core beliefs featuring globally negative self-evaluation

can be regarded as depressogenic (Wenzel, 2012). It is therefore not surprising that the most commonly occurring core belief theme in our sample (in which 22.4% reported depression and 59.8% reported depression and anxiety) was global self-evaluation.

The second most commonly occurring core belief theme was attachment schema. Attachment theory (Bowlby, 1969) posits that humans have an innate predisposition to seek and maintain close emotional ties ('attachments') to others throughout life. Infants form attachments to their primary caregivers, usually parents (Bowlby, 1969), and attachment networks expand in adolescence and adulthood to include peers and romantic partners (Hazan and Zeifman, 1994; Rowe and Carnelley, 2005). Repeated experiences of received care in attachment relationships are formative and shape an individual's beliefs about the lovability of the self and the trustworthiness of others. This information is stored in the form of chronically accessible 'internal working models' (Bowlby, 1969), which are conceptually similar to Beck's concept of schema (Beck, 1967), but are based specifically on close relationships (McBride and Atkinson, 2009). Internal working models comprising positive views regarding the lovability of the self, the trustworthiness of others, and the safety of close relationships (attachment security) are associated with good mental health and resilience (see Mikulincer and Shaver (2007) for a review). Internal working models comprising negative views of either or both the self and others, and resultant doubts over the safety of close relationships (attachment insecurity) are related to poor mental health, including depression and anxiety (see Mikulincer and Shaver (2007) for a review). That so many core beliefs were attachment-themed therefore supports the importance of attachment for mental health, and may be indicative of negatively valenced internal working models, and therefore attachment insecurity. However, further research is needed to establish whether this is the case given that we had no measures of attachment experiences or internal working models.

Gender affected core belief themes such that women's core beliefs were more likely to be attachment related and less likely to be competence related than would be expected by chance. This tallies with Gorrese and Ruggieri's (2012) meta-analytic finding that women tend to have higher levels of attachment to peers than men, and also Su et al.'s (2009) meta-analytic finding that women tend to be more interested in people than men (and men tend to be more interested in things than women). Our data are also consistent with McBride et al.'s (2005) finding that among

depressed patients, women scored higher than men in sociotropy, which has been proposed to create vulnerabilities to psychopathology through excessive worry about others' approval and acceptance (Beck, 1983). Carnelley et al. (1994) highlight the similarities between sociotropy (Beck, 1983) and dependence (Blatt, 1974) with attachment anxiety – a form of attachment insecurity, characterised by preoccupation with the availability of attachment figures and fear of being rejected (Bartholomew and Horowitz, 1991; Brennan et al., 1998) – in their role in depression. Indeed, Zuroff and Fitzpatrick (1995) showed a link between attachment anxiety and both sociotropy (Beck, 1983) and dependence (Blatt, 1974). Therefore, in our sample, women's core beliefs being more likely (than chance) to be attachment related and less likely (than chance) to be competence based may indicate greater levels of sociotropy, and attachment anxiety, both of which result in preoccupation with relationships. However, the literature on gender differences in levels of attachment anxiety is mixed, and age appears to be a moderator of the effect, with gender differences in anxiety peaking in young adulthood and then reducing with increasing age (see Del Giudice (2009) for a review). It is therefore possible that different age groups would have different frequencies of core belief themes, as a function of level of attachment anxiety. Further research is needed to test this hypothesis.

Among men, we found the opposite pattern, with their core beliefs more likely to be competence related and less likely to be attachment related than would be expected by chance. Unlike for women, these findings divert from McBride et al.'s study (2005) where no difference was found between genders in autonomy among depressed patients. However, Gentile et al. (2009) meta-analysis of gender differences in self-esteem found that men were consistently higher than women in self-esteem domains related to self-efficacy, including, athletic, personal, and self-satisfaction self-esteem.

Reported mental health problem also affected core belief themes. Those reporting anxiety were less likely to have attachment-themed core beliefs and more likely to have power/control-themed core beliefs than would be expected by chance. That having anxiety was associated with less likelihood of attachment-themed core beliefs is perhaps surprising, given the known relationship between generalised anxiety and attachment anxiety (see Mikulincer and Shaver (2007) for a review). However, attachment anxiety is arguably equally predictive of depression as it is generalised anxiety (Mikulincer and Shaver, 2007), and anxiety and depression are frequently comorbid (Kessler et al., 1996). As such, users of 'Beating the Blues' identifying themselves as having anxiety would not necessarily be expected to have greater attachment anxiety than those identifying themselves as having depression, or having depression and anxiety. Those with anxiety, therefore, would not necessarily be expected to be more preoccupied by attachment-related core beliefs than any other group. A logical next step for future research would be to measure attachment anxiety and avoidance to examine whether the frequency of core belief themes differs as a function of them. While some studies have examined the relationships between generic core beliefs measured by the YSQ and depression and anxiety (Glaser et al., 2002; Welburn et al., 2002), idiosyncratic, personal core beliefs have yet to be examined from an attachment perspective.

Participants with anxiety in our sample had more control-themed core beliefs than would be expected by chance. Perhaps this is because anxiety is related to perceived lack of control over internal (physiological and emotional) and external (environmental) states (Barlow, 2002; Rapee et al., 1996). Perceived lack of control may even play a causal role in anxiety – indeed perceptions of control over emotional states moderate the link between neuroticism and anxiety (Bourgeois and Brown, 2015), with lower

perceived control leading to a stronger relationship between neuroticism and anxiety. Furthermore, increased perceived control appears to be a mechanism by which CBT is effective in the treatment of anxiety (Gallagher et al., 2014). Our finding that participants reporting anxiety had a greater number of control-themed core beliefs is therefore consistent with previous theory and research linking perceived control and anxiety disorders.

We found that thoughts of suicide in the week preceding the downward arrow exercise affected the themes of core beliefs. Those who reported thoughts of suicide were less likely to have competence-themed core beliefs and more likely to have negative global self-evaluation themed core beliefs than would be expected by chance. This is interesting because it highlights the relative severity of these kinds of core beliefs, with those pertaining to the worthlessness of the whole self rather than domain-specific negative evaluation being associated with possible risk of suicide. It is interesting to note that we did not find more hopelessness-themed core beliefs in the individuals that thought about suicide in the previous week. Perhaps that is because none of these individuals went on to commit suicide while doing the 'Beating the Blues' sessions. Global negative self-evaluations may be a risk factor for suicide ideation but hopelessness may be necessary to enact suicide (Beck and Weishaar, 1990).

11. Limitations and caveats

Although ours is the first study to analyse the content of a large number of core beliefs derived through the downward arrow technique, it is not without limitations. One limitation is due to the nature of the data made available to us. We only had access to course completers, and this may have skewed our findings. It is possible that users of 'Beating the Blues' who do not complete all 8 sessions have different core beliefs to those that do. Furthermore, because we were not able to add any measures our investigation was constrained by what was available in the dataset. Future research is needed to examine further individual differences, such as in attachment orientation, and level of depressive and anxious symptomology. Our participants were also predominantly white and majority female, so future research should seek a more representative sample.

Further limitations pertain to our coding scheme, although our inter-rater reliability was good. Because of the nature of computerised context of the therapeutic task, it was not possible to probe any further than the actual text written. It is possible, for example, that attachment-themed core beliefs might be underreported as they could be implicitly embedded within global self-evaluation-themed core beliefs. Also related to the coding scheme, we only looked at one core belief and although some could be coded as representative of more than one code, we coded only the primary code. This might have led to an underrepresentation of some codes. Nevertheless, our large sample of idiosyncratic core beliefs suggests that it is a fairly representative sample of the sorts of underlying core beliefs characteristic of depression and anxiety in adults.

12. Implications for future research

In addition to measuring factors that might affect core belief themes, such as the suggestions made above, future research could examine whether certain kinds of core beliefs are more resistant to change than others. It might be that some core beliefs are more amenable to being challenged using cognitive techniques than others. For example, attachment schema are thought to be malleable but resistant to change (Mikulincer and Shaver, 2007)

whereas core beliefs with meta-cognition themes might be indicative of therapeutic change or progress, and therefore might be expected to shift more readily, as therapeutic change occurs. Furthermore, future research needs to examine whether and how differently themed core beliefs might correspond with symptom changes over time. Future research could also seek to compare core beliefs derived from the downward arrow technique in the context of an online intervention against the same technique used in the context of face-to-face therapy. It would be interesting to know whether clients would approach the task similarly, and arrive at similar core beliefs, across both contexts. Such research would speak to the issue of whether therapeutic processes are the same or different in online therapies compared to face-to-face therapies (Cavanagh and Millings, 2013; Newman et al., 2011).

In summary, we have conducted the first analysis of a large sample of core beliefs stored by a widely available online CBT intervention for depression and anxiety, and found that core belief theme frequency differs as a function of gender, mental health problem, and suicidal ideation. We hope that our work will inspire future researchers to fully utilise the potential of datasets collected by online interventions for providing insight into therapeutic processes.

Contributors

The first author handled the data, created the coding scheme, and coded the data. The second author second coded a subset of the data. Both authors conducted the analyses and wrote the manuscript.

Conflict of interest statement

The first author was formerly an employee of the company that produces 'Beating the Blues' (Ultrasik UK Ltd), and remains a minor shareholder.

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