Role of Anxiety, Depression and Neurocognition for Cognitive Behavioural Therapy Pre-Therapy Skills in People Living with Dementia, Older and Younger Adults

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None.

Abstract

Background: Anxiety and depression are common in people living with dementia (PLWD) and Cognitive behavioural therapy (CBT) seems to be one of the few efficacious interventions. However, PLWD's ability to engage with CBT has been questioned due to the presumed impact of neurocognitive impairment on core skills necessary to engage with CBT (pre-therapy skills). Here, we (i) compare CBT pre-therapy skills in PLWD to older and younger adults (OA, YA), (ii) examine potential confounders and mediators and (iii) explore associations of neurocognition, anxiety and depression with pre-therapy skills in PLWD. *Methods:* Pre-therapy skills were compared between PLWD (n=102), OA (n=77) and YA (n=56). Structural equation modelling was used to assess mediators and confounders of differences in pre-therapy skills between groups. Spearman's rank correlations were used to examine the relationship of pre-therapy skills with neurocognition and mood in PLWD. *Results*: Group differences in pre-therapy skills were found, following the pattern YA>OA>PLWD. Neurocognition mediated the difference between OA and PLWD. In PLWD, language was associated with performance on all skills. There was little evidence that anxiety or depression contributed to variability in skill performance within PLWD. *Limitations:* Cross-sectional design limited ability to ascertain cause and effect. Pre-therapy skill measures have not been used in the context of actual CBT; consequently, their relationship with CBT outcomes needs to be established. *Conclusions:* PLWD may have a relative difficulty in CBT pre-therapy skills. Yet, there seems to be substantial variability of skill level, independent of mood. Therefore, mild dementia does not necessarily preclude CBT readiness.

Key words: Dementia; Cognitive Behavioural Therapy; Neurocognition; Anxiety; Depression; Mood.

Introduction

Anxiety and depression are common in people living with dementia (PLWD). Estimates of their prevalence vary, but it seems that at least 25% of PLWD have diagnosable anxiety at any one time, with similar numbers for depression, and many more having sub-clinical levels of depressive and/or anxiety symptoms (Ballard et al., 1996; Seignourel et al., 2008). Both are associated with multiple negative outcomes (earlier mortality, earlier institutionalisation, greater caregiver burden) in this group (Livingston et al., 2017). Given the rising numbers of PLWD, establishing effective ways to support this population, not only with core symptoms but also additional difficulties, is one of society's major challenges to date (Livingston et al., 2017). The use of antidepressants as a first-line treatment in this group has been questioned, since some of the most commonly used antidepressants did not show beneficial effects on depression scores, but did increase the risk of adverse events compared to placebo (Banerjee et al., 2011). Instead, adapted Cognitive behavioural therapy (CBT) may be one of few efficacious interventions in this population, alleviating both depressive and anxiety symptoms and improving quality of life in pilot trials targeting anxiety in people with mild to moderate dementia (Spector et al., 2015; Stanley et al., 2013).

CBT is an umbrella term encompassing a set of cognitive and behavioural change focussed interventions commonly used to address anxiety and depression (Roth and Pilling, 2008), where 'cognitive' refers to unhelpful thought content or patterns, rather than the neurocognitive difficulties in memory, attention and executive function that are a feature of dementia (Salmon and Bondi, 2009).

Most adaptations to CBT for use with PLWD are based on the assumption that PLWD may have difficulties in comprehending or applying the cognitive

elements of CBT due to their neurocognitive difficulties (Spector et al., 2015; Stanley et al., 2013). However, to the authors' knowledge, no study has investigated this assumption, and doing so is the overarching goal of the current study.

A number of authors focusing on other client groups (e.g. intellectual disabilities; Oathamshaw and Haddock, 2006) have delineated key pre-therapy skills required to engage in the cognitive elements of CBT. These include (i) the ability to discriminate thoughts and feelings, (ii) the ability to link events to emotions, and (iii) the ability to recognise the interceding role of a cognition between an event and its emotional consequence (cognitive mediation; Greenberger and Padesky, 1995; Lickel et al., 2012; Oathamshaw and Haddock, 2006; Quakley et al., 2003; Quakley et al., 2004). Understanding, which, if any, of these skills is affected in a PLWD could inform the individual tailoring of a CBT intervention to maximise use of retained skills and either circumvent or rehabilitate lost skills. For example, understanding the link between events and emotions, but not cognition-emotion links, may suggest pleasant event scheduling is a more appropriate intervention strategy than cognitively-mediated cognitive restructuring (Oathamshaw and Haddock, 2006).

Consequently, the first aim of this study is to assess how PLWD perform on recently validated measures of CBT pre-therapy skills (Stott et al., 2019a; Stott et al., 2019b) in comparison to an older adult (OA) and a younger adult (YA) control group. We hypothesise that YA will score highest for all skills, followed by OA (as it has been hypothesised that OA may also have some mild difficulties in using cognitive elements of CBT (Mohlman, 2008, 2013)), and then PLWD. We expect that between-group differences for identifying cognitive mediation (theoretically the most complex skill) will have a larger effect size than differences in discriminating

thoughts, which, in turn will have a larger effect size than differences in discriminating emotions or linking feelings to events (since discriminating thoughts directly taps more ‘cognitive’ elements of CBT).

If the anticipated group differences are found, the second aim will be to explore the nature of these differences, and the potential mediating role of neurocognition, in the context of other potential confounders, such as anxiety and depression, age and level of education. We hypothesise that neurocognition will mediate any relationship between dementia and CBT pre-therapy skill performance, independent of potential confounders.

There is substantial heterogeneity within the diagnostic category of dementia, particularly in terms of the degree and type of neurocognitive deficit (Salmon and Bondi, 2009). Consequently, the final aim of this study is to explore whether within-group neurocognitive heterogeneity as well as within-group differences in anxiety and depression affect CBT pre-therapy skills. In particular, we hypothesise, that specific aspects of neurocognition, which are empirically related to CBT skills in other populations or are routinely adapted for in CBT interventions for other people with challenges related to language, executive function or memory (Dagnan et al., 2000; Dagnan et al., 2009; Joyce et al., 2006; Sams et al., 2006), will be associated with pre-therapy skill performance in a group of PLWD.

Methods

Participants

The PLWD (N=102) and OA (N=77) participants in this study substantially overlap with a previously described cohort (Stott et al., 2017b). PLWD were consecutive referrals from a memory clinic. Dementia was diagnosed according to

consensus criteria (Emre et al., 2007; McKhann et al., 2011; Neary et al., 1998; Román et al., 1993) by a psychiatrist-led, multi-disciplinary memory clinic. All clients had a cognitive assessment, the extent of which was driven by client need as per best practice guidelines (Guss et al., 2014). All PLWD participants had mild dementia characterized by a most recent MMSE score of 24 or higher, or equivalent on another cognitive screen (Law et al., 2013). Of the dementia group, 63 were diagnosed with Alzheimer's disease, 9 with vascular dementia, 17 with mixed Alzheimer's disease and Vascular dementia, two people with Parkinson's disease, one with Frontotemporal dementia and 10 with unspecified dementia.

OA were a convenience sample of 77 healthy volunteers over the age of 65 without a diagnosis of dementia (determined through self-report) and not reporting subjective memory problems. They were recruited by advertisement in community groups and from the Join Dementia Research database (Join dementia research, 2016).

In addition, a convenience sample of 56 young adults (YA) were recruited. They were university students aged 18 to 25, who had registered on the university's subject-pool website, not reporting any subjective cognitive problems, who had registered their interest in participating in research with the university's psychology subject-pool.

All participants were fluent in English, had no self-reported literacy issues and had capacity to consent. Exclusion criteria included a DSM-IV Axis 1 diagnosis of bipolar disorder or schizophrenia, diagnosed intellectual disability, or significant uncorrected sensory deficits. As past CBT experience may influence performance on the measure, participants reporting current or previous experience of CBT were

excluded. Demographics and clinical characteristics of the three groups are presented in Table 1.

Data collection

Demographic information was gathered prior to the administration of measures. Measures were presented in a randomised order. A researcher read out each question/task for all three participant groups, while also presenting supporting visual stimuli (large font statements and smile faces) on laminated paper cards, and then recorded participant's verbal responses on a computer.

Measures

Pre-therapy skill measures

Event emotion linkage – Reed and Clements' assessment (Reed and Clements, 1989). Six simple first-person scenarios are presented in writing. Participants are asked to identify whether they would feel happy or sad in each situation. A total score between 0-6 represents the number of scenarios answered correctly. This measure has been used previously in a dementia context with adequate acceptability and feasibility (Harter, 2003).

Thought/feeling discrimination questionnaire for dementia (BTFQ-D; Stott et al., 2019a) is a 14-item measure examining the ability to discriminate thoughts and feelings in PLWD. For each item, participants are asked to identify whether a prompt is a thought (e.g. 'this is hard') or a feeling (e.g. 'frightened'). Correct responses are summed to give separate thought and feeling scores (range 0-7 for each). Scores ≥6

on each subscale indicate above chance responding. Validity for this measure has been established previously using a partially overlapping sample (Stott et al., 2019a).

Cognitive mediation in dementia (*CM-DEM*; Stott, et al., 2019b). Hypothetical events are described each with an associated feeling of happiness or sadness. For each event, participants are asked to generate a thought that would be congruent with the presented emotion. Each event (total =5) is presented twice once associated with happy and once associated with sad emotions, meaning there are a total of 10 items. Responses are rated as correct by expert raters when the thought is deemed congruent with the valence of the presented emotion. The CM-Dem total score (ranging from 0-10) is calculated by summing correct responses. Validity for this measure has been established previously using a partially overlapping sample (Stott et al., 2019b).

Neurocognition

Addenbrooke's Cognitive Examination – 3rd Revision (ACE-III; Hsieh, et al., 2013)**:** The ACE-III is a brief assessment used in clinical and research settings to screen for cognitive impairment and as a severity marker for dementia progression. The measure has a maximum total score of 100, and shows high sensitivity and specificity to recommended cut-off scores: 88 (sensitivity =1.0; specificity = 0.96) and 82 (sensitivity = 0.93; specificity = 1.0). The measure has high internal reliability (Cronbach's α = 0.88). For the purpose of this study, subscale scores (attention (range 0-18), memory (range 0-26), fluency (range 0-14), language (range 0-26), visuospatial functioning (range0-16)) were used to measure different neurocognitive functions. There is some evidence for convergent and divergent validity of subscales derived from correlations with established neuropsychological measures of the respective constructs (Hsieh et al., 2013).

Anxiety and depression

The Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith, 1983; dementia-modified version; (Stott et al., 2016; Zigmond and Snaith, 1983). The original HADS comprises 14 items (scored 0 to 3; higher scores indicating greater psychopathology) and was used here to determine anxiety and depression caseness (cut-off score 8). However, Stott et al. (2016), while supporting the use of the HADS to measure two factors of anxiety and depression, suggest that a dementia-modified HADS comprising 12 of the original items is better suited to measuring depression and anxiety as continuous scores in PLWD. In this version, which was used for continuous measurement in the current study, the anxiety and depression subscales (HADS-A and HADS-D) each have six items and a maximum score of 18.

Statistical analyses

Sample size

Using Bentler and Chou (1987) heuristic of five observations per estimated parameter a minimum sample size of 105 was required for structural equation modelling analysis. The final sample exceeded this.

Missing data

Missing data ranged from 0-3% across the different measures. Visual inspection and Little's MCAR test revealed that all data were missing at random. As less than 5% of data were missing this was handled through list wise deletion for each analysis independently (Graham, 2009).

Aim 1: between-group performance on pre-therapy skills measures (and clinical and demographic indices)

For categorical variables, Chi-Square tests with post-hoc comparisons were used. Continuous data were found to be non-normally distributed (through visual inspection and Shapiro Wilkes' tests) so non-parametric Kruskall-Wallis was used with Dunn post hoc tests. Epsilon^2 was used to measure effect size in line with recommendations for non-parametric tests (Tomczak and Tomczak, 2014). To minimise type-II error inflation, the Benjamini-Hochberg (B-H) method was used to adjust for false discovery rate (Benjamini and Hochberg, 1995).

Aim 2: mediator and confounder analysis

The influence of potential confounders and mediators on any observed difference was tested using structural equation modelling. A binary variable was used to indicate membership of the OA or PLWD group. Potential mediators and confounders should be correlated with both the predictor and the outcome (Preacher and Kelley, 2011) and were assessed for this. Neurocognition was included as a potential mediator. Age, self-reported years of education, HADS-A and HADS-D scores were included as covariates in the model to account for any potentially confounding effects. The model was first tested for fit to data using robust versions of multiple indices, as recommended by Byrne (Byrne, 2013) including: the Root Mean Square Error of Approximation (RMSEA), the Tucker-Lewis Index (TLI), the Bentler's Comparative Fit Index (CFI) and the Standardized Root Mean Square Residual (SRMR). Standardized Beta coefficients of indirect and direct paths were used to examine mediating and confounding effects. Models were estimated using Diagonal Weighted Least Squares (DWLS) with robust versions of fit statistics, using the Lavaan package in R version 3.53 (Rosseel, 2012).

Aim 3: investigating correlations of neurocognitive variables, depression and anxiety with pre-therapy skills in PLWD

Spearman's rank correlation coefficients adjusted for false discovery rate using B-H method were used to examine correlations between pre-therapy skills, ACE-III subscale scores and HADS scores.

Results

Sample characteristics

Table 1 shows clinical and demographic characteristics for all groups. On average, PLWD had significantly lower ACE-III scores, were significantly older and had fewer years of education than both the YA and OA. They had higher HADS-A scores than OA, and HADS-D scores than both the YA and OA. By contrast, the YA had higher HADS-A scores than the OA and PLWD. There were also differences in terms of ethnicity, with the PLWD and OA containing a significantly smaller proportion of people from a BME background than the YA.

Table 1. *Demographic and clinical characteristics of PLWD, OA and YA samples*

Variable	PLWD (n=97)		OA (n=77)		YA (n=56)		Significant contrast[†]
	Median (min-max)	% (N)	Median (min-max)	% (N)	Median (min-max)	% (N)	
Age	81 (58-97)		72 (65-92)		21 (18-26)		PLWD>OA>YA
Sex (M)		43 (44)		36 (28)		27 (15)	N/S
Ethnicity (White)		90 (92)		100 (77)		63 (35)	PLWD, OA>YA
Education (years)	12 (5-25)		16 (7-25)		15 (12-19)		OA, YA>PLWD
ACE-III	74 (43-98)		95 (67-100)		96 (69-100)	-	OA, YA>PLWD
HADS-A score	5 (0-15)		3 (0-14)		6 (0-14)	-	YA>PLWD>OA
HADS-D score	3 (0-14)		1 (0-8)		1 (0-11)	-	PLWD>OA, YA
HADS-A or -D cases[§]		44(44)		14(11)		24(44)	

Note: [†]Significant at $p < .05$, adjusted for false discovery rate; Kruskall Wallis and post hoc tests used to examine differences in continuous and χ^2 in categorical variables across groups; median (range) reported due to non-normal distributions; [§] Caseness was ascertained using the 14-item HADS since cut-off scores are not available for the dementia modified version. Continuous scores were calculated using the 12-item dementia modified version.

Aim 1: between-group performance on pre-therapy skills measures

Table 2 shows between-group differences on CBT pre-therapy skills measures. Consistent with hypotheses, for BTFQ-D-Feelings, BTFQ-D-Thoughts and CM-DEM, the YA scored higher than the OA, who in turn scored higher than the PLWD. The Reed-Clements measure showed marked ceiling effects, with the median score at maximum for all groups. The only between group difference on the Reed-Clements measure was that the YA performed better than PLWD.

Table 2. *Between-group comparisons on pre-therapy skill measures*

Measure	PWD (n=102)		OA (n=77)		YA (n=56)		Significant Contrast[†]	Effect size[§]
	Median (min-max)	% (n) above chance	Median (min-max)	% (n) above chance	Median (min-max)	% (n) above chance		
BTFQ-D-Feelings	6 (0-7)	80.4 (82)	7 (0-7)	97.4(75)	7 (4-7)	98.2 (55)	YA>OA>PLWD	0.23
BTFQ-D-Thoughts	3 (0-7)	30.4 (31)	5 (0-7)	58.0 (45)	7 (4-7)	98.2 (55)	YA>OA>PLWD	0.46
CM-DEM*	4 (0-10)	-	8 (3-10)	-	9 (6-10)	-	YA>OA>PLWD	0.46
Reed Clements	6 (0-6)	89.1 (90)	6 (5-6)	88.3(68)	6 (6)	91.0 (51)	YA>PLWD	0.042

Note: [†]Dunn post-hoc test significant at $p < .05$, adjusted for false discovery rate, [§]Epsilon^2 used to measure effect size. Cut-offs for above-chance responding: BTFQ-D-Thoughts and feelings, ≥6; Reed-Clements, >6; *n for the dementia group in this comparison was 98 due to missing data.

Aim 2: mediator and confounder analysis

For the difference between PLWD and OA, ACE-III clearly met criteria as a potential mediator, differing significantly between groups (see Table 1) and correlating with pre-therapy skills measures in the combined OA-PLWD sample (see Table 3). YA were not included in the mediation analysis, as there was no difference between the YA and OA in ACE-III scores. All potential confounders differed between OA and PLWD groups (see Table 1). Age and education were also correlated with performance on all pre-therapy skills in the combined OA and PLWD sample in the expected directions (Lower age and more education were associated with better performance; see Table 3), although it should be noted that the effect size was small. Levels of anxiety and depression correlated with performance on some pre-therapy skills measures (BTFQ-D Feelings and CM-DEM correlated with HADS-D and BTFQ-D-Thoughts correlated with HADS-A scores; see Table 3), again with a small effect size. Thus, all potential confounders met criteria to at least some extent and were included in the mediation analysis.

Table 3. *Correlations between covariates and CBT pre-therapy skill measures in the combined OA and PLWD sample*

Measure	ACE-III	Age	Education	HADS-A	HADS-D
BTFQ-D-Thoughts	**.52**	**-.24**	**.23**	**-.14**	-.14
BTFQ-D-Feelings	**.46**	**-.28**	**.35**	.08	**-.20**
CM-DEM	**.66**	**-.4**	**.29**	-.07	**-.27**

Note: n= 171-175; correlations in bold are significant at $p < .05$ adjusting for B-H false discovery rate; all correlations were Spearman's rank due to assumptions of normality of distribution not being met.

A single model was tested with direct paths and indirect paths via ACE-III from the PLWD/OA group membership variable to scores on each pre-therapy skill measure (BTFQ-D-Feelings, BTFQ-D-Thoughts and CM-DEM; three paths). Age, years of education, anxiety and depression were included as control variables to account for potential confounding effects. The Reed-Clements was excluded from this analysis as there were no between-group differences.

Figure 1 shows the mediation models. For clarity, the mediation paths for each outcome are shown separately. However, they were tested as part of one model. Model fit was good on most indices (X^2=378.83 (N/S); CFI=0.94; TLI=0.93; RMSEA=0.03; SRMR=0.13). For all outcomes the effect of group was partially mediated via cognition (ACE-III) (BTFQ-D-Feelings = -0.2; BTFQ-D-Thoughts = -0.34; CM-DEM=-0.33). The proportion of the total effect that was indirect and thus the percentage that was mediated by ACE-III scores was 68.18% for BTFQ-D-Feelings, 66.23% for BTFQ-D-Thoughts, and 49.75% for CM-DEM.

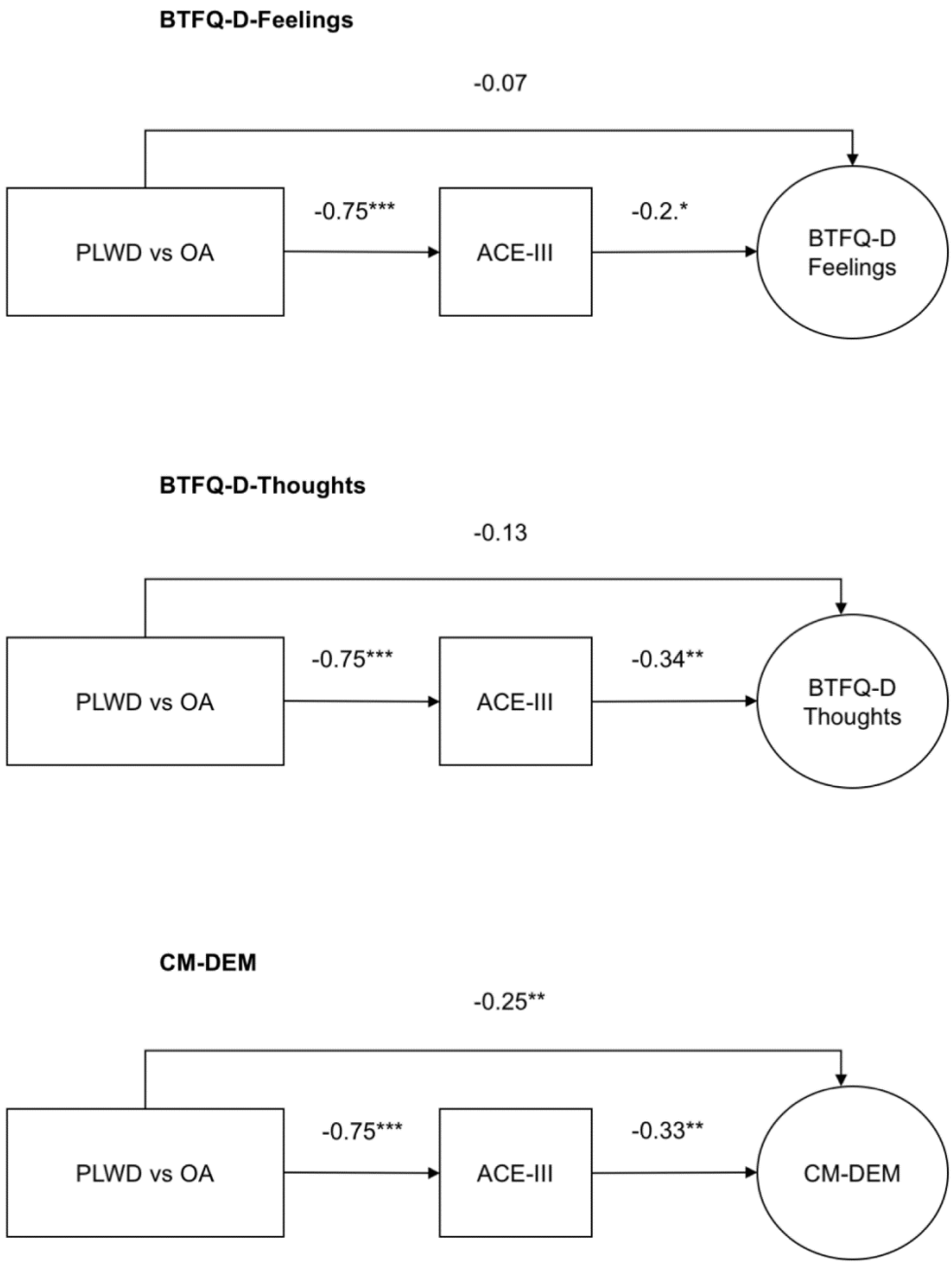

Figure 1. *Mediation of differences between PLWD and OA in pre-therapy skill performance* [1]

1 n=167; Figures are standardised regression coefficients (β), adjusted for covariates (age, years of education, anxiety and depression)

While the YA group were not included in the mediation analysis (due to lack of difference between YA and OA on ACE-III), years of education, HADS-A and HADS-D scores were investigated as possible confounders that might account for differences in pre-therapy skills between YA and OA groups. However, no variable met criteria for confounding of being correlated with predictor and dependent variables and no further analysis of this difference was undertaken.

Aim 3: Correlates of neurocognitive variables, depression and anxiety with pre-therapy skills in PLWD

Finally, the associations between particular aspects of neurocognition with CBT pre-therapy skills were explored (Table 4). Largely, in line with hypotheses, all pre-therapy skills measures were positively correlated with ACE-III language scores and all except BTFQ-D-Thoughts were associated with ACE-III fluency scores. CM-DEM was also associated with memory scores. Other significant un-hypothesised correlations were: BTFQ-D-Feelings and CM-DEM with visuospatial functioning scores, BTFQ-D-Thoughts with attention scores, and BTFQ-D-Feelings with HADS-A scores.

Table 4. *Correlations of CBT pre-therapy skill measures with neurocognitive and mood variables in the PLWD sample*

Measure	ACE language	ACE Fluency	ACE Memory	ACE Attention	ACE Visuospatial	HADS-A	HADS-D
BTFQ-D-Feelings	.**32**	**.32**	.10	.07	**.29**	.**26**	.001
BTFQ-D-Thoughts	**.27**	.20	.22	**.31**	.17	.05	-.05
CM-DEM	**.41**	**.30**	**.38**	.08	**.26**	.13	-.08

Note: Bold represents significant correlation at $p < .05$, adjusted for False Discovery rate; n=97.

Discussion

This study compared the performance of a group of PLWD on measures of CBT pre–therapy skills with both OA and YA control groups. As hypothesised, PLWD scored significantly lower on these measures compared to OA. This effect was mediated by overall neurocognitive ability, even when differences between the samples in age, education, anxiety and depression levels were accounted for. Performance on pre-therapy skills was also poorer in OA than in YA. However, this effect did not appear to be mediated by cognition or confounded by other measured variables. Within the PLWD group, language function was associated with all pre-therapy skills, with other aspects of neurocognitive functioning being associated with some but not all pre-therapy skills. There was little evidence that anxiety and depression contributed to the variability in skill performance within PLWD.

CBT pre-therapy skills: differentially affected in PLWD

Whilst there were between-group differences on all pre-therapy skills, the largest effect sizes for differences in performance were on the more complex measures, which required recognition of thoughts (CM-DEM; BTFQ-D-Thoughts) as opposed to the more feeling oriented measures (the BTFQ-D-Feelings and the Reed Clements). Event-emotion linkage, in particular, appeared to be largely unaffected with the performance only differing between PLWD and YA. Thus, the results suggest that, in general, PLWD struggle most with measures that require the identification or manipulation of thoughts.

One caveat to this interpretation is that task demands rather than skill difficulty per se may have contributed to the relative size of group differences. In particular, the CM-DEM required free as opposed to the forced-choice response used in other

tasks, which may be particularly hard for PLWD (Smith et al., 2005). The thought identification task requires comprehension of longer item stems than the feeling identification task, and although this is partly inherent in the constructs themselves (thoughts but not feelings are invariably more than one word) (Padesky and Greenberger, 2012), it may have affected results. Consequently, findings require replication using other measures, for example the cognitive mediation measure devised by Dagnan et al. (2000), which may reduce the difference in task demands although perhaps at the cost of ecological validity (Dagnan et al., 2000; Dagnan et al., 2009).

The centrality of neurocognition

Although longitudinal data causation cannot be established, the results are consistent with the hypothesis that PLWD may find CBT pre-therapy skills challenging due to neurocognitive deficits. However, the partial (rather than full) mediation of CM-DEM differences suggest, for this more complex skill at least, other unmeasured differences between groups may also play a role.

Subject to confirmation of causality using appropriate methods, findings further suggested that, in PLWD, language impairment may affect all pre-therapy skills. Executive function (represented by ACE-III fluency scores) may play an important role in two of three skills. This is in line with previous work (Dagnan et al., 2000; Johnco et al., 2014; Joyce et al., 2006). The role of memory was only supported for the CM-DEM, which is of interest given that many adaptations to CBT for PLWD focus on memory. The association of visuospatial functioning with CM-DEM and BTFQ-D-Feelings was not predicted. This could reflect the fact that visuo-constructional tasks making up the ‘visuospatial’ subscale of the ACE-III have

substantial executive components (Freeman et al., 2000) with CBT pre-therapy skill associations being due to this. The visuospatial finding may also be due to task demands as CBT pre-therapy tasks were presented visually as well as verbally. However, neither of these explanations account for the lack of association with BTFQ-D-Thoughts performance and further investigation is required.

A deficit in CBT pre-therapy skill performance in OA vs. YA

The OA had deficits in all pre-therapy skills (aside from event-emotion linkage) relative to the YA. However, in contrast to the above finding, there was no evidence for mediation of difference by neurocognition and neither was their evidence of a role for any measured potential confounder. This might be due to the ceiling effect on the ACE-III, which was unable to detect any group differences between these two groups. A more sensitive cognitive measure, perhaps including speed of processing aspects might have shown a mediating effect. Another possible explanation for the findings is that the observed effect of age was due to cohort effects with the current generation of OA having less of a culture of talking about thoughts, emotions and their linkage than the current generation of YA (Chand and Grossberg, 2013). Whilst the finding that age did not confound the effect of dementia (vs OA group) on outcomes may seem to contradict the importance of age, this could be because of the smaller differences in age between these two groups. In order to further elucidate mechanisms, future work could measure cohort beliefs across age groups and examine their association with CBT pre-therapy skill performance.

The role of anxiety and depression

In the current study there was little evidence that anxiety and depression contributed to the variability in skill performance within PLWD or confounded the difference between PLWD and the OA group (despite the PLWD group having higher levels of anxiety and depression). This suggests that the results here might be applicable to PLWD samples who are universally anxious and depressed (such as those attending CBT) and thus enhances the generalisability and clinical utility of results. Indeed, the PLWD sample in particular (44% meeting caseness for anxiety and depression) probably had considerable overlap with such CBT samples.

Research and clinical implications

If the findings of this study are confirmed by future research, the seemingly smaller impact of dementia on feeling identification and event-emotion linkage and high above chance performance on these skills (80 and 89% respectively) would support the use of pleasant event scheduling in PLWD (Jacobson et al., 1996), with these skills thought to be central to this approach (Jacobson et al., 1996).

Findings, however, should not be necessarily interpreted as implying the need to remove, avoid or minimise cognitive elements of CBT for PLWD. There was substantial variability in performance within the PLWD group, even on thought-related measures. Indeed, 30% of PLWD scored above chance on the BTFQ-D-Thoughts. Consequently, dementia might be better viewed as a risk factor for poor CBT pre-therapy skills. Within this conceptualisation, levels of pre-therapy skills necessary for cognitive aspects of CBT could be established through idiosyncratic assessment using the current measures in the context of clinical judgement, with changes being individually applied on a case-by-case basis. In their successful pilot

randomised controlled trial Spector et al. (2018) adapted their CBT delivery depending on the strength and needs of individual participants, with the degree to which ‘cognitive’ and ‘behavioural’ elements were used varying depending on participant’s level of functioning, rather than modifying certain elements for all participants.

If cross-sectional findings regarding neurocognition and the roles of language in particular were to represent causal relationships, it would support the use of strategies that focus on simplifying language. These might include frequent capsule summaries to reflect upon and summarise salient session content (Roth and Pilling, 2008), support of verbal with written material and regular checking of understanding for PLWD, all of which are already incorporated within standard CBT (Blackburn et al., 2001). Given the verbal fluency associations and the possible executive explanation for visuospatial findings, reducing executive demands (for example, imposition of a clear session structure) may also be useful. Indeed, some of these adaptations were employed Stanley et al. (2013) in their feasibility trial of CBT for anxiety in PLWD, including modifications in content (simpler and fewer skills) and learning strategies (increased repetition, spaced retrieval).

The moderate association of memory with CM-DEM in PLWD, but not other measures, suggests that for more complex skills where working memory may be required to process and manipulate information, memory deficits are important. Consequently, mini formulations which focus on reducing general neurocognitive load of cognitive elements of CBT (Charlesworth et al., 2015) may be a useful adaptation. Replication of the current findings and further longitudinal and experimental research into the causal role of neurocognition in CBT pre-therapy skill performance in PLWD are warranted.

The differences between OA and YA groups were not mediated by neurocognition and different strategies for amelioration in OA may be useful. It may well be that this is a cohort-based difference in emotional understanding and possibly the best way of supporting OA to develop pre-therapy skills will be through training and explanation of constructs. Again, within group performance in the OA group was highly variable with high above chance performance suggesting that idiosyncratic assessment may be a sensible strategy.

Strengths

This study was the first to examine CBT pre-therapy skills in PLWD using theoretically guided measures designed for and validated in PLWD (Stott et al., 2019a; Stott et al., 2019b). It improved methodologically on previous work in intellectual disabilities (Oathamshaw and Haddock, 2006) through comparison to a control group using a sample size with power to detect subtle differences. Measurement of potentially important dementia-relevant neurocognitive variables allowed hypothesising about the reasons for pre-therapy skill deficits in PLWD, something that was not possible in previous research.

Limitations

Several limitations should be noted. While structural equation modelling sample size was calculated a priori using a recognised heuristic, it may be more appropriate to use Monte-Carlo simulation techniques (Wolf et al., 2013) and future work should do this. The design was cross-sectional with consequent limitations on the ability to ascertain cause and effect. Whilst potential confounders were included

in the analysis it is still likely that residual confounding was present as cognitive ability will be associated with a range of other individual and social factors.

It should be noted, that in addition to the pre-therapy skills assessed in this study, there are other factors required of a client and their care system for them to make use of CBT (Stott et al., 2017a). The Reed Clements task had a ceiling effect in all groups and other measures had ceiling effects in the YA group in particular, meaning that the upper end of traits measured here might not be fully examined and lead to consequent lack of ability to detect important differences between groups. However, the lower end of the trait range is arguably of the greatest clinical significance. Most importantly, the measures used here have not been used in the context of actual CBT; consequently, their relationship with CBT outcomes is not known and needs to be established.

Conclusions

While PLWD may have a relative difficulty in CBT pre-therapy skills that require identification and use of thoughts, there is substantial variability in this. There was little evidence that anxiety and depression contributed to the variability in skill performance within PLWD or confounded the difference between PLWD and the OA group, suggesting that these findings might be applicable to PLWD samples who are universally anxious and depressed (such as those attending CBT). This study does not suggest that mild dementia in itself precludes readiness for cognitive elements of CBT. In PLWD, the role of neurocognition may be important and strategies to adapt CBT for PLWD should consider this. Older age is also associated with poorer performance on CBT pre-therapy skills (although not due to neurocognition, but perhaps through cohort effects). Future research should use a longitudinal design to

examine the role of cohort beliefs, with clinical strategies for OA perhaps focussed on idiosyncratic adaptation of socialisation to the model based on assessment of CBT pre-therapy skill levels.

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Ethics standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008,

Ethical approval was given by NRES Committee London – City Road & Hampstead (REC Reference 14/LO/0554).

Data statement

The data that support the findings of this study are available from the corresponding author, [JS], upon reasonable request.

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