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Long-Term Outcomes of the Benefit-Finding Group Intervention for Alzheimer Family Caregivers: A Cluster-Randomized Double-Blind Controlled Trial

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Running Head: Benefit-finding intervention

Key Words: dementia caregiving; depression; positive aspects of

caregiving; cluster-randomized controlled trial

Highights
1) What is the primary question addressed by this study? — This study examined the effects of the group benefit-finding intervention (BFT) for dementia family caregivers up to 10-month follow-up in a cluster-randomized double-blind controlled trial.
2) What is the main finding of this study? — Mixed-effects regression showed that BFT's strong intial effect on depressive symptoms leveled out after post-intervention and was maintained up to 10-month follow-up. Medium to long-term effects on psychological well-being and burden were also found.
3) What is the meaning of the finding? — These results provide strong support for the beneficial effects of constructing positive aspects of caregiving through cognitive reappraisal and alternative thinking (i.e., BFT).

ABSTRACT

Objectives: To examine the effects of the group benefit-finding intervention (BFT) for Alzheimer family caregivers up to 10-month follow-up. **Design:** Cluster-randomized double-blind controlled trial. **Setting:** Social centers and clinics. **Participants:** 129 caregivers. Inclusion criteria were (a) primary caregiver aged 18+ and without cognitive impairment, (b) providing ≥14 care hours per week to a relative with mild-to-moderate Alzheimer's disease, and (c) scoring ≥3 on the Hamilton Depression Rating Scale. Exclusion criterion was care-recipient having parkinsonism or other forms of dementia. **Interventions:** BFT (using cognitive reappraisal to find positive meanings) was evaluated against two forms of psychoeducation as controls— standard (STD-PE) and simplified (lectures only; SIM-PE) psychoeducation. All interventions had eight weekly sessions of 2 hours each. **Measurements:** Primary outcome was depressive symptom, whereas secondary outcomes were global burden, role overload, and psychological well-being. Measures were collected at baseline, post-intervention, and 4- and 10-month follow-up. **Results:** Mixed-effects regression showed that BFT's effect on depressive symptoms conformed to a curvilinear pattern, in which the strong initial effect leveled out after post-intervention and was maintained up to 10-month follow-up; this was true when compared against either control group. The effect on global burden was less impressive but moderate effect sizes were found at the two follow-ups. For psychological well-being, there was an increase in the BFT group at 4-month follow-up and a return to baseline afterwards. No effect on role overload was found. **Conclusions:** Benefit-finding reduces depressive symptoms as well as global burden in the long-term, and increases psychological well-being in the medium-term.

INTRODUCTION

Families caring for an aging population has become a "public health concern,"[1] while dementia (a.k.a. neurocognitive disorder) caregivers tend to face more challenges and to suffer more than those who care for relatives with chronic illnesses but without dementia.[2] Dealing with behavioral and psychological symptoms of dementia (BPSD) is often the most stressful aspect of caregiving, among which disruptive behaviors (e.g., agitation, disinhibition, aberrent motor behavior, and aggression) are most distressing and challenging because of the potential harm to the caregiver's bonding with the care-recipient (CR) and partly because they exacerbate difficulties in other domains (e.g., caring for activities of daily living [ADL]).[3] Together with other BPSD and functional dependencies, dementia caregivers put in a lot more hours, care for more basic or instrumental ADL, experience more conflict with family and occupational duties, report more physical and emotional strain, and have less time for self while receiving less support from other relatives, compared with other caregivers.[2] Severe social isolation has been reported for Chinese caregivers with traditionally strong values for family support.[4]

There is an urgent need to enhance support for dementia caregivers. Because of the intractable and chronic nature of the stressors they face, it is widely recognized that effective interventions need to improve caregivers' ability in regulating their emotional responses, as managing the psychological and behavioral disturbances alone is not going to be very effective.[5] For this reason, interventions based on cognitive-behavioral therapy (CBT) that tackle maladaptive thinking underlying negative emotional responses have been found to be especially effective in reducing caregiver distress.[6] In fact, supported by experimental data, such techniques have been incorporated into various psychoeducation programs for delivery in a structured and less costly format, reaching more caregivers. These programs may be characterized as psychoeducation with psychotherapeutic components. Though not strictly based on the

traditional CBT paradigm,[7] the benefit-finding therapeutic (BFT) intervention belongs to this category.

In earlier articles, we reported immediate (post-intervention) outcomes of two versions of BFT. The initial version is a weekly intervention consisting of eight group sessions of 1.5-2 hr each.[5] Subsequently, the group BFT was adapted for delivery on a one-to-one basis at the caregiver's own home for those caregivers who have difficulty joining training sessions at clinics or social centers. This individual BFT has four biweekly sessions of 3 hr each.[8] Both versions of BFT have been found to yield significant effects on caregiver outcomes when compared with two versions of psychoeducation without psychotherapeutic components, with the group intervention yielding strong effects on depressive symptoms and moderate effects on global burden, role overload, and psychological well-being.[5] By comparison, the individual intervention reported moderate effects on depressive symptoms and inconsistent effects on burden.[8] Lingler suggested that universality and mutual support in groups might have enhanced the effect of benefit-finding over and above one-to-one interventions.[9] Other principles, such as collaborative learning, mutual role models, benign competitive motivation, and "internalizing the therapist" (a.k.a. helper-therapy principle) were elaborated by Cheng.[7]

A distinctive feature of BFT is to use cognitive reframing to reappraise difficult situations along positive lines, and to integrate such reframing exercises into the psychoeducational program. Caregivers are asked to reappraise challenging situations, such as when dealing with paranoid delusions or incontinence, in positive ways and in *as many different ways as possible*. The intervention is called benefit-finding because the reappraisal is done with the goal of discovering benefits to self (a.k.a. positive aspects of caregiving), such as getting closer to the CR, a sense of purpose, enhanced mastery, and feeling gratified.[10] The emphasis is on positivity and alternative thinking rather than challenging caregivers' irrationality or cognitive errors as in

traditional CBT, although the basic premise of the thought-behavior-emotion triangle is covered.[7] It is believed that this strategy helps to reduce stigma and increase participants' acceptance of the intervention by minimizing their perception of being "fixed" psychotherapeutically.[7,11] BFT does not monitor whether participants give up their dysfunctional thoughts but instead aims to cultivate in them the ability to think alternatively and positively so that they would not fixate on negative cognitions. Moving away from the traditional CBT paradigm allowed the use of non-professional psychology graduates as trainers, thus reducing costs. Readers are referred to articles by Cheng and colleagues for further details, including specific techniques used to promote alternative thinking and benefit-finding.[5,7,8,12,13]

Nevertheless, these were preliminary conclusions because the previous reports covered post-intervention (2 months from baseline) effects only. It is necessary to examine whether the effects lasted beyond the intervention. This article focuses on outcomes at 4- and 10-month follow-up (i.e., 6 and 12 months from baseline respectively) of the group BFT.

METHODS

Participants and Procedure

129 caregivers referred by physicians/staff in 15 clinical units (e.g., memory clinics) or social centers for older people met the inclusion/exclusion criteria and provided informed consent to participate. The inclusion criteria were: (a) being a primary caregiver aged 18+ years, without cognitive impairment, providing ≥14 care hours per week, and scoring ≥3 on the Hamilton Depression Rating Scale,[14-16] and (b) the CR having mild-to-moderate Alzheimer's disease operationalized by the NINCDS–ADRDA criteria for possible Alzheimer's disease[17] or diagnosed by a physician, with stage of dementia confirmed by Clinical Dementia Rating.[18] The exclusion criterion was parkinsonism or other forms of dementia in the CR.

The previous trial on BFT showed a large effect on depressive symptoms and moderate effects on burden and well-being, along with a very small intraclass correlation at ~0.01.[5] With four repeated measurements (see Measures), power=0.80, alpha=0.05 (two-tailed), ratio of time-effect variance at person level to the sum of random-intercept variance and time-level residual variance=0.30, and ratio of time-effect variance at cluster level to the sum of random-intercept variance and time-level residual variance=0.02, seven participants per cluster and five clusters per treatment arm would be sufficient to detect a treatment x time effect size of d=0.50.[19,20]

Interventions

As described previously,[5,12] there were three treatment arms, all in group format. The BFT was evaluated against two psychoeducational programs (treatment-as-usuals) without psychotherapeutic components, namely simplified psychoeducation (SIM-PE) and standard psychoeducation (STD-PE). The two psychoeducational programs were identical in content other than the level of participation required of caregivers. SIM-PE caregivers received, in a didactic manner, information on dementia, community resources, coping with BPSD, caring for functional dependencies, the home environment and home-based activities, communication skills, and stress management and self-care. However, in STD-PE, caregivers got to practice the skills taught. A meta-analysis found that psychoeducational programs that provided opportunities for skill practice/acquisition were more effective than those that did not.[21]

The BFT, on the other hand, is identical to STD-PE but includes also training and exercises for positive reappraisal and benefit-finding using videos, hypothetical scenarios, personal stories/journals, group sharing and inter-subgroup contest.[5,7] Thus, while SIM-PE provided a minimally active control, STD-PE provided a more rigorous control and a reference point for whether benefit-finding is helpful.

All groups (average size=8.6 persons, range=7-11) met once a week for eight consecutive weeks. To control for differential exposure, all groups met for approximately 1.5-2 hr each time. Materials were either presented more slowly or more quickly to suit the time alloted. For example, materials were covered in a faster pace in the BFT group to enable the conduct of positive reappraisal training. Research assistants with an undergraduate degree in psychology or a related field who were trained and supervised by the first author (a clinical psychologist), served as instructors. Fidelity was checked by means of a checklist that was filled out after each session by the instructor as to whether key components and tasks of the session had been carried out and whether any problems encountered were successfully dealt with. The Joint CUHK-NTEC Clinical Research Ethics Committee and the Central Research Committee of the Hong Kong Institute of Education provided ethical clearance. The trial was registered with the Chinese Clinical Trial Registry (identifier# ChiCTR-TRC-10000881).

Randomization and Blinding

This is a cluster-randomized controlled trial because participants were randomized by clinic/center, with five clusters per treatment arm assigned by a true random number generator (n=45, 42 and 42 for SIM-PE, STD-PE and BFT respectively). Figure 1 shows the flow diagram of the study. Both participants and raters were blind to the treatment assignment.

Measures

All measures were obtained via individual face-to-face interviews at baseline (T1), post-intervention (T2), 4-month follow-up (T3) and 10-month follow-up (T4). Cronbach's alphas reported below were average values over four measurements. The primary outcome was depressive symptom, whereas the secondary outcomes were burden and psychological well-

being.

Depressive symptoms were assessed by the 17-item Hamilton Depression Rating Scale[14] (α=0.76), administered by trained raters. We measured *burden* using two instruments, namely Pearlin's 4-item measure of role overload (1=*not at all*, 4=*completely*; α=0.78),[22] and the 22-item Zarit Burden Interview (0=*not at all*, 4=*extremely*; α=0.90)—hereafter called global burden.[23] For *psychological well-being*, we used the 18-item version of Ryff's Psychological Well-being Scale (1=*strongly disagree*, 5=*strongly agree*) tapping self-acceptance, autonomy, environmental mastery, positive relatedness, life purpose, and personal growth[24] (α=0.79).

Covariates. The following caregiver variables were examined as potential covariates: age, sex (0=*male*, 1=*female*), educational attainment, employment (0=*unemployed*, 1=*employed*), household income, relationship with the CR (0=*spouse or sibling*, 1=*child, child-in-law, or niece/nephew*), whether living together with the CR (0=*apart*, 1=*together*), caregiving duration (in years), care hours per week, number of chronic illnesses (sum of 21 conditions), and use of psychotropic medications (0=*nil*, 1=*some*). For CR measures, BPSD and functional impairment were included, as well as utilization of community services (0=*nil*, 1=*some*). BPSD was measured by multiplying the frequency score (1=*occasionally or less than once a week*; 4=*very frequently, once or more per day or continuously*) and the severity score (1=*mild*, 3=*severe*) across 12 symptoms on the Neuropsychiatry Inventory[25] (α=0.78). Functional impairment was summed by ratings (1=*dependent*, 2=*needs assistance*, 3=*independent*; reversed before summing) of 7 basic and 7 instrumental ADL on the OARS Multidimensional Functional Assessment Questionnaire[26,27] (α=0.91).

Data Analysis

Alphas were set at 0.05, two-tailed, throughout. Chi-square tests and ANOVAs showed no

significant group difference at baseline in any of the study variables, covariates, and the CR's

dementia severity. Detailed baseline comparison results have been reported in an earlier article in

this journal[5] and will not be repeated here.

Cluster-level intraclass correlations were, on the average, 0.012 (range=0.000-0.033) for the

four outcome measures, suggesting that correlations between observations had little to do with

cluster membership. Hence the cluster level was omitted in further analysis. To set up the main

analyses, we first performed mixed-effects regressions in Stata 15 (StataCorp, College Station,

Texas), regressing the four time-varying outcome measures separately on the caregiver's age, sex,

education, whether employed, income, chronic illnesses, psychotropic medication use,

relationship to the CR, whether living with the CR, caregiving duration, care hours per week, as

well as the CR's BPSD and functional impairment (other than age, sex, education, relationship to

the CR, and caregiving duration, all were time-varying predictors). Age, sex, chronic illnesses,

care hours, BPSD, and functional impairment were significant in one or more of the equations

and were included as covariates in subsequent analyses.

Subsequently, we performed modified intent-to-treat analyses using mixed-effects

regression, specifying four repeated measurements (level-1) nested within individuals (level-2).

We computed full information maximum likelihood models which does not require missing data

imputation as it estimates parameters while taking the conditional distribution of missing data

into account. BFT was coded as 1 while the two psychoeducational controls were coded as 0;

BFT was compared with SIM-PE in one set of analyses and then with STD-PE in another set.

Although our main interests were in T3 and T4 outcomes, we included T2 because having more

time points enabled more accurate estimation of the follow-up results and because we wanted to

see whether the treatment effect took a different turn (e.g., diminishing) after T2. To examine the

long-term trajectories of the outcomes, we included time (mean-centered) and time^2 as predictors

to identify linear and curvilinear trends over time. Besides the BFT main effect which reflected overall mean difference with either control group, we examined BFT x time and BFT x time^2 interaction effects to see if the treatment effects were represented by linear or quadratic trends. The intercepts and effects of time were allowed to vary randomly at participant levels, whereas the predictors (including BFT) were specified to have fixed effects. Within-person covariance over time was specified using an unstructured model. When a significant BF x time, BF x time^2, or BF main effect was found, we conducted a Wald χ^2 test with the null hypothesis that the three effects were simultaneously zero. It provides an omnibus test of whether a difference between BFT and control existed, while maintaining the overall Type I error at 0.05. When a significant χ^2 was found, we probed at which time point a group difference existed by computing the *Z* test for mean difference. Effect size was indexed by Cohen's *d*; values of 0.20, 0.50, and 0.80 are generally considered as representing small, medium, and large effects respectively Treatment x time interactions was illustrated by diagrams.

RESULTS

Effects of Covariates

Referring to Tables 1 and 2, the caregiver's chronic illnesses and the CR's BPSD and functional impairment were generally associated with depressive symptoms and burden. There were main effects of time in five of the eight analyses, which indicated a trend of decreasing depressive symptoms, burden, and well-being over time. In the analysis with SIM-PE as control, older age was associated with less global burden and women reported higher psychological well-being.

Treatment Effects

Depressive symptoms. As shown in Tables 1 and 2, there were significant BFT x time and

BFT x time^2 interaction effects as well as BFT main effects, regardless of the control condition.

These results indicated curvilinear patterns for the BFT effect. As the BFT x time interaction

effects were negative, the positive BFT x time^2 interaction effects suggested that the BFT

treatment effects leveled off or diminished over time. The trajectories of depressive symptoms by

treatment arms are shown in Figure 2a, and indeed the treatment effects leveled off after post-

intervention, regardless of control.

The omnibus Wald test confirmed that BFT was superior to both SIM-PE (χ^2[3]=19.99,

p<0.001) and STD-PE (χ^2[3]=18.11, p<0.001) in terms of reducing depressive symptoms. Z tests

showed significant differences between BFT and SIM-PE at T3: mean difference (M_{diff})=-3.00

(95% confidence interval: -4.45, -1.55), d=-0.89, Z=-4.11, p<0.001; and T4: M_{diff}=-3.06 (-4.94, -

1.19), d=-0.70, Z=-3.24, p=0.001. When compared with STD-PE, the corresponding values were

M_{diff}=-2.53 (-3.92, -1.13), d=-0.80, Z=-3.61, p<0.001 (T3) and -2.51 (-4.19, -0.83), d=-0.65, Z=-

2.97, p=0.003 (T4).

Burden. No treatment effect whatsoever was found for role overload. As for global burden,

there were BFT main effect and a small BFT x time interaction effect in the comparison with SIM-

PE, suggesting that as time progressed, the effect of BFT slightly increased. The Wald test resulted

in χ^2(3)=7.81, p=0.050. BFT participants were found to report less burden than SIM-PE

participants at both T3 (M_{diff}=-7.22 [-12.93, -1.51], d=-0.55, Z=-2.51, p=0.012) and T4 (M_{diff}=-8.07

[-14.27, -1.89], d=-0.56, Z=-2.58, p=0.010).

When BFT was compared with STD-PE, only a main treatment effect on global burden was

found but no interactions with time. As there was no significant difference between BFT and

STD-PE at baseline, these results suggested that BFT resulted in reduced global burden over

time that was sufficient enough to lead to detectable overall mean difference with STD-PE, but the time pattern did not follow a clear linear or quadratic trajectory. Nevertheless, the Wald test yielding $\chi^2(3)=7.92$ (p=0.048) supported a difference between BFT and STD-PE. Compared with STD-PE, less burden was found for BFT at T3 (M_{diff}=-5.96 [-11.56, -0.36], d=-0.47, Z=-2.12, p=0.034) and T4 (M_{diff}=-6.75 [-12.61, -0.89], d=-0.51, Z=-2.29, p=0.022). Looking at Figure 2b, there was also a drop in burden in STD-PE participants after T2, which might explain why BFT's effect over STD-PE did not reveal a linear pattern.

Psychological well-being. On top of BFT main effects, there were BFT x time and BFT x time^2 interaction effects in the comparison with SIM-PE, but only a BFT x time^2 interaction effect when STD-PE was the control. On the whole, these results suggested that a curvilinear pattern best described the effect of BFT on psychological well-being. As the BFT x time interaction effect was positive (though nonsignificant in one case), the negative BFT x time^2 interaction effects suggested a pattern in which BFT led to better well-being initially but the gains plateaued or subsided over time. Figure 2d showed that BFT's effect on well-being returned to baseline after T3.

As the Wald test yielded significant results, with $\chi^2(3)$=19.45 (p<0.001) and 10.75 (p=0.013) respectively for BFT's comparison with SIM-PE and STD-PE, we probed the results at specific time points. We found significantly higher psychological well-being in the BFT group at both T3 and T4, when compared with SIM-PE (T3: M_{diff}=7.32 [3.64, 11.00], d=0.86, Z=3.96, p<0.001; T4: M_{diff}=4.63 [0.80, 8.46], d=0.52, Z=2.40, p=0.016). However, the comparison with STD-PE yielded significant difference at T3 only (M_{diff}=6.57 [2.85, 10.28], d=0.78, Z=3.52, p<0.001), but not T4 (M_{diff}=2.79 [-0.66, 6.25], Z=1.61, p=0.108). (Supplemental Digital Content 1, available online, provides modeled means and SDs of all the outcomes across the four waves.)

DISCUSSION

Studies of interventions for dementia caregivers have not reported longitudinal outcomes on a typical basis. However, it is important to ascertain to what extent the effects of interventions are sustainable. Given the chronic and changing needs of people with dementia, we may not expect the effects of a one-off intervention to last a very long time, but some sustainability is necessary for interventions to be of practical aids to caregivers and cost-effective from a policy perspective.

In this study, we examined the outcomes of the group BFT up to 10-month follow-up. Some interesting findings are noted, which have to be interpreted in light of the fact that BFT was evaluated against two psychoeducational conditions, rather than nil treatment controls. We focus on effects on the secondary outcomes before moving on to the effects on depressive symptoms, the primary outcome. First, effects on global burden were found; the effect was represented by a small linear trend in the comparison with SIM-PE but no trajectory could be identified in the comparison with STD-PE. The effect sizes were mostly moderate, hovering around -0.50, regardless of the control condition. Note also that BFT was not found to have an effect on global burden against STD-PE at post-intervention[5] but an overall main effect was found now with more time points, reflecting stabilization of treatment gains over time (Figure 2b). These results were notable as two psychoeducational group interventions with CBT components found no effect on global burden at 3-month[28] and 1-year follow-up.[29]

However, there was no overall effect on role overload in the present analyses. Thus, although BFT participants were found to report lower role overload than SIM-PE (but not STD-PE) participants at post-intervention,[5] that effect was short-lived. Taken together, there was only weak evidence suggesting that BFT might reduce role overload. The role overload measusre may not be sensitive to change because of having only four items and because the kind of burden it

taps (e.g., exhausted at night, having too many tasks to do) is unlikely amenable to cognitive reappraisal. Another trial of a multicomponent intervention that included role overload as an outcome also did not find any effect on this measure.[30]

Second, the intervention effect on psychological well-being was characterized by a quadratic trend, whether SIM-PE or STD-PE was the reference group. An examination of the trajectories of psychological well-being (Figure 2d) showed a sharp increase in well-being reported by BFT participants at T3, which returned to baseline at T4. Why an elevation of psychological well-being was seen at 4-month follow-up (T3) but not at other time points was not clear at all. We could not come up with a reasonable explanation for this pattern. Note that T3 was the only time point at which a significant difference in well-being between BFT and STD-PE existed, as a significant difference was not observed at T2 (previous study)[5] and T4 (this study). On the other hand, SIM-PE participants reported a decrease in well-being over time, as revealed by the significant time effect (Table 1). This decrease in well-being also contributed to a significant difference with the BFT group at T4, on top of the difference at T2 found earlier.[5]

Finally, it was found that BFT's effect on depressive symptoms was stabilized after the intervention and were maintained up to 10-month follow-up. The effect sizes were moderate to large (d=-0.65 to -0.89) and were similar, regardless of control. It appeared that BFT had altered the way the caregivers responded to the challenges in caregiving in a way that made these challenges less distressing. Between SIM-PE and STD-PE as control, the effects of BFT were similar, suggesting that the effects were driven primarily by engaging the individual in the search for rewards in being a caregiver and in constructing as many rewards from challenges as possible (as this was the only difference between BFT and STD-PE). Given the training in cognitive reappraisal and alternative thinking, it was not surprising that the strongest and most consistent effects were found on depressive symptoms. It has been suggested that such training promotes

mental flexibility, thereby avoiding fixation on negative thoughts while promoting benefit-finding.[5,7,8]

Our findings lend support to the general observation that educational interventions incorporating psychotherapeutic components are generally superior to educational interventions without such components in terms of reducing psychological distress. For example, whereas several studies of the latter type did not report effect on depressive symptoms at 3-[31] and 6-month follow-ups,[32] results of the present study supported long-term effects of BFT. As a point of interest, we draw reference from a trial comparing two forms of individual psychotherapy (not group-educational interventions) with minimal support control for dementia caregivers. At 6-month folow-up, an effect size of d=-0.74 for CBT, but no effect for acceptance-and-commitment therapy, was found.[33] Thus, our BFT compares favorably to individual psychotherapy, which is a lot more expensive to administer, in terms of relieving depressive symptoms in caregivers.

These results provide strong support for the application of BFT for dementia caregivers. The fact that BFT does not require professionally trained personnel to deliver makes translation to practice settings less complicated. Such applications may not be limited to running full-scale interventions for caregivers. Recently, Cantó discussed successful derivation of clinical techniques from BFT principles and applying the techniques in therapeutic sessions with individual caregivers in Spain.[34] His work also provides support to the cross-cultural generalizability of BFT principles and techniques although more studies are needed to see whether BFT can be successfully implemented in different cultures and translated to various clinical settings.

There are two limitations of this study. First, although the sample size was comparable to most intervention studies for dementia caregivers, it was not large enough to detect small effects.

Second, this study did not test the mediational pathways (i.e., teatment mechanisms) through

which BFT worked. In earlier studies, we found that most of the BFT effects at post-intervention

were mediated by treatment gains in self-efficacy in controlling upsetting thoughts while one

effect on depressive symptoms was mediated by gains in perceived benefits.[5,8,35] However, in the

present analysis with missing data at the follow-up waves, the analysis of mediation is not

straightforward. As one cannot impute *both* mediator and outcome in a causal pathway, the only

option is to model longitudinal mediation at the latent variable level using full information

models, for which a much larger sample size is needed.[36,37] Despite these limitations, the present

analysis showed sustained effects of BFT on depressive symptoms up to 10-month follow-up as

well as effects on global burden and psychological well-being.

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TABLE 1. Results of Mixed-effects Regression, Simplified Psychoeducation as Control

	Depressive symptoms		Global burden		Role overload		Psychological well-being	
	B (95% CI)	p	B (95% CI)	p	B (95% CI)	p	B (95% CI)	p
Age	-0.040 (-0.103, 0.023)	0.217	-0.366 (-0.629, -0.102)	**0.007**	-0.018 (-0.064, 0.027)	0.432	-0.023 (-0.185, 0.140)	0.786
Sex (female)	-0.311 (-2.042, 1.419)	0.724	0.142 (-7.584, 7.867)	0.971	0.834 (-0.431, 2.099)	0.196	6.485 (1.723, 11.246)	**0.008**
Chronic illnesses	1.156 (0.702, 1.610)	**<0.001**	2.215 (0.631, 3.799)	**0.006**	0.206 (-0.117, 0.529)	0.212	-0.522 (-1.498, 0.455)	0.295
Care hours per week	0.005 (-0.003, 0.013)	0.212	0.029 (-0.0004, 0.058)	0.053	0.0005 (-0.006, 0.007)	0.876	-0.010 (-0.028, 0.007)	0.247
BPSD	0.044 (0.023, 0.066)	**<0.001**	0.096 (0.022, 0.169)	**0.011**	0.022 (0.006, 0.038)	**0.008**	-0.029 (-0.074, 0.015)	0.198
Functional impairment	0.096 (0.011, 0.181)	**0.026**	0.409 (0.071, 0.748)	**0.018**	0.075 (0.012, 0.137)	**0.019**	0.010 (-0.198, 0.218)	0.924
BF	-2.622 (-4.043, -1.201)	**<0.001**	-6.001 (-11.676, -0.325)	**0.038**	-0.963 (-2.061, 0.134)	0.085	6.410 (2.882, 9.938)	**<0.001**
Time	-0.094 (-0.222, 0.034)	0.152	-0.351 (-0.848, 0.146)	0.167	-0.199 (-0.304, -0.093)	**<0.001**	-0.325 (-0.592, -0.059)	**0.017**
Time^2	0.019 (-0.010, 0.047)	0.198	0.028 (-0.052, 0.109)	0.487	0.012 (-0.009, 0.033)	0.266	0.042 (-0.011, 0.094)	0.118
BF x time	-0.323 (-0.503, -0.143)	**<0.001**	-0.703 (-1.403, -0.004)	**0.049**	0.032 (-0.117, 0.182)	0.671	0.581 (0.207, 0.955)	**0.002**
BF x time^2	0.041 (0.001, 0.082)	**0.045**	0.077 (-0.037, 0.192)	0.186	-0.001 (-0.032, 0.029)	0.926	-0.107 (-0.181, -0.032)	**0.005**

Notes: P values were based on Z tests. Those < 0.05 were boldfaced.

TABLE 2. Results of Mixed-effects Regression, Standard Psychoeducation as Control

	Depressive symptoms		Global burden		Role overload		Psychological well-being	
	B (95% CI)	p	B (95% CI)	p	B (95% CI)	p	B (95% CI)	p
Age	-0.018 (-0.073, 0.037)	0.522	-0.206 (-0.448, 0.036)	0.095	0.003 (-0.041, 0.046)	0.909	-0.013 (-0.163, 0.137)	0.864
Sex (female)	0.729 (-0.617, 2.076)	0.288	4.177 (-2.160, 10.514)	0.196	1.034 (-0.062, 2.129)	0.064	0.049 (-3.902, 4.001)	0.980
Chronic illnesses	0.681 (0.256, 1.106)	**0.002**	1.174 (-0.452, 2.801)	0.157	0.392 (0.072, 0.711)	**0.016**	-0.316 (-1.300, 0.667)	0.528
Care hours per week	0.005 (-0.003, 0.013)	0.194	0.014 (-0.015, 0.043)	0.337	0.002 (-0.004, 0.007)	0.612	-0.011 (-0.028, 0.007)	0.226
BPSD	0.051 (0.029, 0.073)	**<0.001**	0.139 (0.057, 0.221)	**0.001**	0.030 (0.014, 0.046)	**<0.001**	-0.048 (-0.098, 0.002)	0.059
Functional impairment	0.031 (-0.047, 0.108)	0.437	0.446 (0.110, 0.782)	**0.009**	0.121 (0.060, 0.183)	**<0.001**	0.093 (-0.111, 0.297)	0.373
BF	-2.549 (-3.822, -1.275)	**<0.001**	-6.614 (-11.888, -1.340)	**0.014**	-0.895 (-1.922, 0.132)	0.088	5.451 (2.071, 8.832)	**0.002**
Time	-0.177 (-0.307, -0.047)	**0.008**	-0.645 (-1.091, -0.199)	**0.005**	-0.096 (-0.191, -0.001)	**0.049**	-0.123 (-0.409, 0.164)	0.402
Time^2	0.022 (-0.009, 0.052)	0.161	0.057 (-0.030, 0.145)	0.199	0.011 (-0.010, 0.033)	0.295	0.031 (-0.027, 0.089)	0.291
BF x time	-0.226 (-0.406, -0.046)	**0.014**	-0.376 (-0.992, 0.239)	0.231	-0.065 (-0.197, 0.067)	0.333	0.346 (-0.050, 0.742)	0.086
BF x time^2	0.050 (0.008, 0.092)	**0.021**	0.052 (-0.071, 0.174)	0.407	-0.004 (-0.034, 0.026)	0.804	-0.092 (-0.172, -0.011)	**0.026**

Notes: P values were based on Z tests. Those < 0.05 were boldfaced.

Figure Captions

FIGURE 1. Study flow chart. AD = Alzheimer's disease, CDR = Clinical Dementia Rating, CR = care-recipient, CG = caregiver, Unavailable = temporarily unavailable at the specific time point.
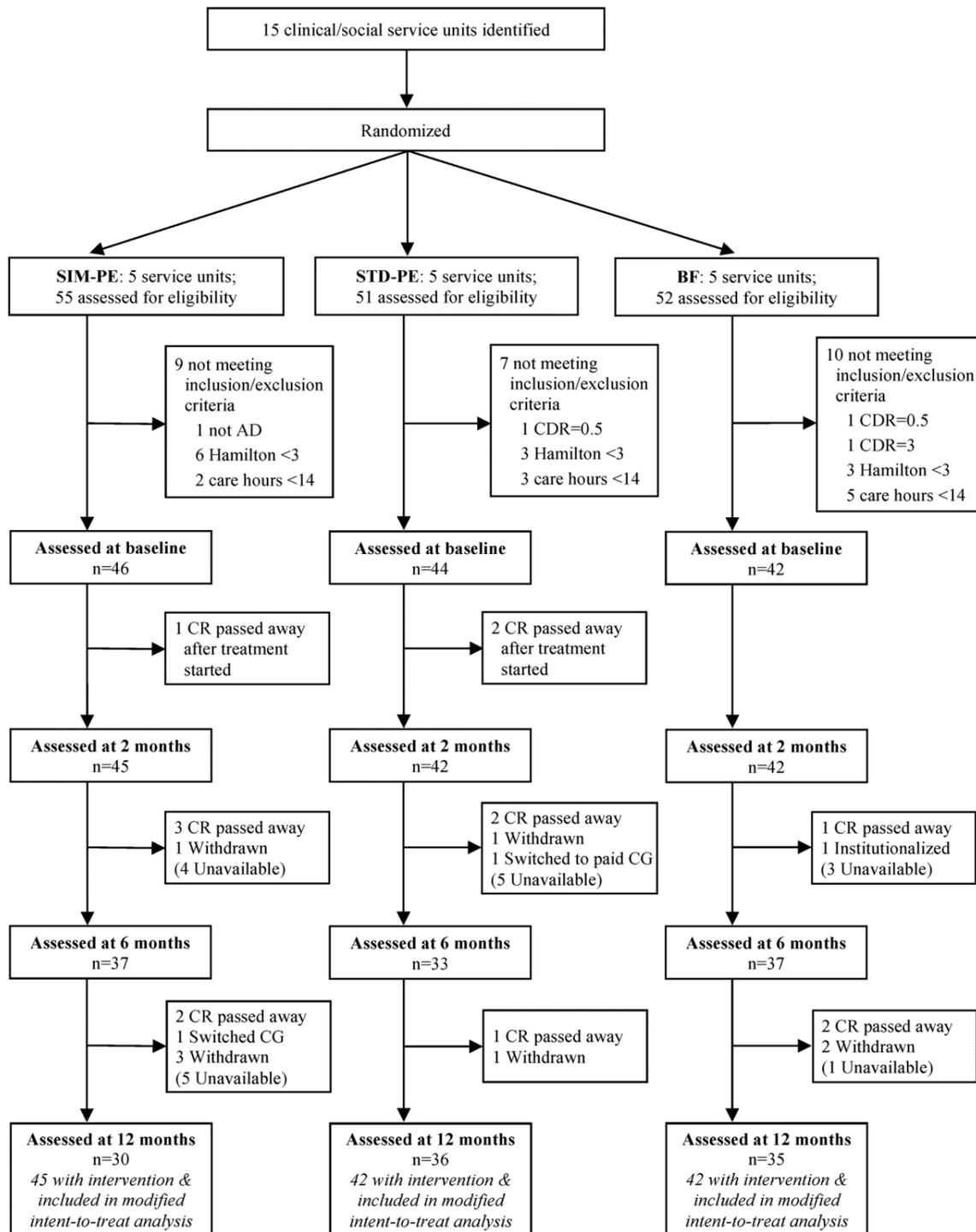
FIGURE 2. Trajectories of (a) depressive symptoms, (b) global burden, (c) role overload, and (d) psychological well-being by treatment arm, adjusted for caregiver age, sex, chronic illnesses, care hours per week, as well as care-recipient's behavioral and psychological symptoms of dementia and functional impairment. Error bars indicate 95% confidence interval. SIM-PE = simplified psychoeducation; STD-PE = standard psychoeducation; BFT = benefit-finding intervention.