Journal of Contextual Behavioral Science 15 (2020) 235–244

Contents lists available at ScienceDirect

Journal of Contextual Behavioral Science

journal homepage: www.elsevier.com/locate/jcbs

How much is enough in brief Acceptance and Commitment Therapy? A randomized trial.

Emily B. Kroska*, Anne I. Roche, Michael W. O'Hara

University of Iowa, Department of Psychological and Brain Sciences, USA

Major depression is a recurrent, debilitating disorder that is associated with poor quality of life, functional impairment, and substantial physical health risks (Spijker et al., 2004; Üstün, Ayuso-Mateos, Chatterji, Mathers, & Murray, 2004). In fact, a recent World Health Organization report indicated that "globally, depressive disorders are ranked as the single largest contributor to non-fatal health loss." (World Health Organization, 2017). Similarly, a recent publication describing burden of disease in the United States showed major depressive disorder to be the second leading cause of years lived with disability in the US (Mokdad et al., 2018). One general population prevalence study indicated that in the United States, the lifetime prevalence of depression is 19.2%, and the average age of onset is 22.7 years (Bromet et al., 2011). Though the burden of depression is substantial, estimates from the 2017 National Survey indicate that among adults with a major depressive episode in the past year, 33.2% had not received treatment (Substance Abuse and Mental Health Services Administration, 2018). Psychotherapy is one empirically supported treatment option for depression, but requires a significant time commitment and monetary resources by both patients and health systems. Thus, optimizing treatment to provide efficient psychotherapeutic interventions is essential in providing adequate access to quality patient-centered care.

Acceptance and Commitment Therapy (ACT) is part of the "third wave" of cognitive behavioral therapies and is based in a philosophy of science called functional contextualism, which conceptualizes the function of behavior in context, including internal and external factors (Hayes, Strosahl, & Wilson, 2011). ACT conceptualizes experiential avoidance as the transdiagnostic process that results in human suffering, with substantial basic research providing evidence to indicate that pathological behaviors may be conceptualized as inflexible, avoidant responses to thoughts, emotions, bodily sensations, memories, and urges (Chawla & Ostafin, 2007). In depression, experiential avoidance may function to minimize, control, or prevent unpleasant internal experiences and provide short-term relief. Avoidance is negatively reinforced by relief, thus increasing an individual's propensity to avoid. Furthermore, when dedicating a substantial amount of time to avoiding unpleasant experiences, this time cannot be devoted to creating a life based upon one's values, causing a loss of contact with vitality and meaning. A review by Ruiz (2010) included an examination of the association between experiential avoidance and depressive symptoms across 20 studies and indicated that individuals who reported higher levels of avoidance also reported higher depressive symptoms (weighted correlation $r = 0.55$) (Ruiz, 2010). Thus, the primary goal of ACT is to decrease avoidance and increase psychological flexibility, which is defined as engaging in values-based behavior while being aware of and open to associated internal experiences. Psychological flexibility is approached in therapy using six interconnected core processes: values clarification, committed action, present moment awareness, acceptance, defusion, and self-as-context (Hayes et al., 2011).

To date, ACT has garnered moderate empirical support in treating depression. A meta-analysis (Öst, 2014) described ACT as a possibly efficacious treatment for depression based on preexisting criteria for evidence-based treatments. Additionally, numerous studies comparing 8–12 session ACT to traditional cognitive therapy (CT) or cognitive behavior therapy (CBT), a widely supported treatment for depression (Butler, Chapman, Forman, & Beck, 2006), have indicated few identifiable differences in depressive symptom outcomes at post-treatment or follow-up (Losada et al., 2015; Tamannaeifar, Gharraee, Birashk, & Habibi, 2014; Zettle and Hayes, 1986; Zettle & Rains, 1989). One meta-analysis that specifically compared ACT to CBT found a non-significant effect that trended toward favoring ACT over CBT for depressive symptoms ($g = 0.271$) (Ruiz, 2012). Additionally, studies examining relatively brief ACT for elevated depressive symptoms have shown promising results. One study (Kohtala, Lappalainen, Savonen, Timo, & Tolvanen, 2015) found significantly greater reductions in depression at post-treatment for four sessions of ACT relative to wait-list control (between-group effect size; $d = 0.93$). Both groups eventually received the intervention, and combined outcomes continued to be positive at 6-month (pre-to follow-up within-group effect size; $d = 1.09$) and five-year (pre-to follow-up within-group effect size; $d = 1.45$) follow-up (Kohtala et al., 2015; Kohtala, Muotka, & Lappalainen, 2017). Furthermore, 6-session ACT interventions have been shown to maintain reductions in depression at 18-month (pre-to 18-month follow-up; $W = 96.35$, df = 3, $p < .001$; Lappalainen et al., 2014) and 36-month (pre-to 36-month follow-up; $d = 1.77$) (Kyllönen et al., 2018) follow-up. Additionally, research exploring the utility of single-session brief group ACT interventions in medical populations has been promising

* Corresponding author. G60 Psychological and Brain Sciences Building, 340 Iowa Avenue, Iowa City, IA, 52242, USA.
E-mail address: emily-kroska@uiowa.edu (E.B. Kroska).

https://doi.org/10.1016/j.jcbs.2020.01.009
Received 28 August 2019; Received in revised form 19 November 2019; Accepted 18 January 2020

(Dindo, 2015). For example, studies examining single-session ACT interventions applied to individuals with comorbid health conditions and elevated depression or anxiety symptoms have indicated that after 5 h of ACT, reductions in depression were significant at follow-up relative to the control conditions (12- and 24-weeks, 12-weeks, respectively (Dindo, Marchman, Gindes, & Fiedorowicz, 2015; Dindo, Recober, Marchman, Turvey, & O'Hara, 2012).

Although several studies have provided support for brief ACT interventions, there is little information about the appropriate *amount* of time required to implement an intervention that results in significant improvement in functioning and behavior. Single-session interventions may be particularly advantageous for maximizing efficiency of services, particularly in primary care settings, because participants only have to allocate time in a single day for the intervention, rather than several sessions over a period of weeks. To address this question, the present study compared the effectiveness of three time-variant single-session Acceptance and Commitment Therapy (ACT) interventions (90-min, 3-h, and 6-h) in a sample of individuals with elevated depressive symptoms in an effort to determine the amount of therapeutic time necessary to result in clinically significant improvements.

The study had three main objectives. First, it examined longitudinal change in ACT processes (psychological flexibility, mindfulness, satisfaction with participation in social roles and activities) across conditions from pre-intervention to 1-, 3-, and 6-month follow-up. These process-based measures were chosen because of their relevance as targets within ACT interventions. ACT aims to increase nonjudgmental awareness and acceptance of internal and external experiences (mindfulness) and to foster a flexible, values-driven, behavioral repertoire even in the presence of unpleasant internal experiences (psychological flexibility). Finally, values exploration in ACT typically involves an examination of whether or not current actions align with their values and goals in various life domains (e.g., social roles and relationships that are important). Second, the study examined the comparative effects of three brief ACT interventions on depressive symptoms at 1-, 3-, and 6-month follow-up by analyzing whether one of the conditions was superior to another over time. Finally, the study examined whether the 3-h and 6-h conditions were therapeutically equivalent.

1. Method

1.1. Participants

Adults (N = 271) were recruited between April 2015 and May 2017. See Fig. 1 for information on recruitment and enrollment flow. Participants were on average middle-aged (M = 33.2), primarily female (80.1%), well-educated (M = 16.15), and Caucasian (79.9%).

1.2. Procedure

Recruitment. Recruitment methods included a University mass e-mail system, as well as flyers in the community and on campus. The mass e-mail system sent out a recruitment email that described the study and provided a link to the screening survey; mass e-mails are sent to all faculty, staff, and students with a University address. The e-mail is typically sent to 40,000–45,000 addresses. Account holders can unsubscribe from research recruitment emails if they are not interested. The mass e-mail was sent 17 times between 4/15/2016 and 4/14/2017.

Two waves of screening were completed: 1) the initial online screening survey, and 2) if eligible based on the survey, a screening phone call. The screening survey included: the first eight items of the Patient Health Questionnaire-9 (PHQ-9; Kroenke, Spitzer, & Williams, 2001), as well as items assessing recent medication changes, history of brain injury, and current psychotherapy. The screening survey also requested contact information. Adults with scores of ≥10 on the PHQ were eligible for inclusion. Exclusion criteria were: 1) medication changes within the last 60 days, 2) history of brain injury, and 3) current psychotherapy. Also rendering an individual ineligible was failure to provide contact information, as no follow-up was then possible due to the anonymity of the screening survey.

Based on screening wave one, eligible individuals were contacted by the research team to schedule a screening interview (wave two), wherein the suicidality, mania, and psychosis modules of the Mini International Neuropsychiatric Interview (M.I.N.I. (Sheehan et al., 1998) were administered by phone. Individuals were considered ineligible if they scored in the *high* category on suicidality, screened positive for *past or current mania*, or screened positive for *past or current psychosis*. Ineligible individuals were offered referral resources within the community, and if expressing suicidality, assessment of safety and subsequent safety planning measures were taken. If an individual was eligible, the consent form was reviewed by phone, and for individuals who remained interested in participating, an electronic consent form and baseline survey were sent via email. Participants who consented to participate and completed the baseline survey online were then randomized to condition.

Randomization. Randomization was conducted using Power Analysis Software, version 10 "NCSS 11 Statistical Software" (2016) with a 1:2:2 (90 min: 3 h: 6 h) randomization scheme, with an initial sample size of n = 210 (35:70:70). Random assignments were provided to the principal investigator by a non-clinical research team member. After 210 participants were recruited and after difficulties with participants not attending scheduled groups, a second randomization was conducted (n = 65; 13:26:26). 61 additional participants were ultimately randomized.

Participants were notified of the random assignment by email and phone after completing the baseline assessment. They were then prompted to supply available times for scheduling of the assigned intervention.

Groups were scheduled based on availability.

Group Procedure. Participants were informed of the scheduled time for the group intervention and asked to confirm attendance, and reminder phone calls and emails were provided. Groups were cancelled if only one participant attended. Six groups were cancelled, two groups from each condition.

Participants completed the BDI-II upon arrival to the group. Groups consisted of 2–6 participants and 2 facilitators. Groups took place in the University's psychology building. Group members were encouraged to converse with, listen to, and observe each other. Participants were encouraged to share to the degree that they were comfortable. There was no compensation for attending the group session.

Each condition (90 min, 3 h, or 6 h) was delivered in one session. The interventions consisted of the same core content, but consistent with the ACT model, there was flexibility on the part of the therapists. All interventions were based on Kirk Strosahl's Focused Acceptance and Commitment Therapy (FACT) model (Strosahl, Robinson, & Gustavsson, 2012). The six core processes of ACT were emphasized in each condition. Each of the interventions focused on six essential questions posed by Strosahl et al. (2012): "what are you struggling with?", "what have you tried?", "what do you want for your life?", "what gets in the way of pursuing what you want?", "are you at war with the barriers?", "if group were helpful to you in making a change, what would we see you doing differently in life?". All sessions were audiotaped for fidelity and competency assessments.

Interventionists were encouraged to address each of the six questions while also attending to the relevant processes introduced by the participants during group. No specific exercises or metaphors were identified as necessary, as the intention was to maintain focus on process-based, targeted case conceptualization and real-time intervention, rather than manualized content. The six questions were the only required criterion to provide direction and consistency across groups. The first question regarding what symptoms the participants were experiencing was intended to elicit the participants' personal experience with depression and the functional interference of said symptoms. The

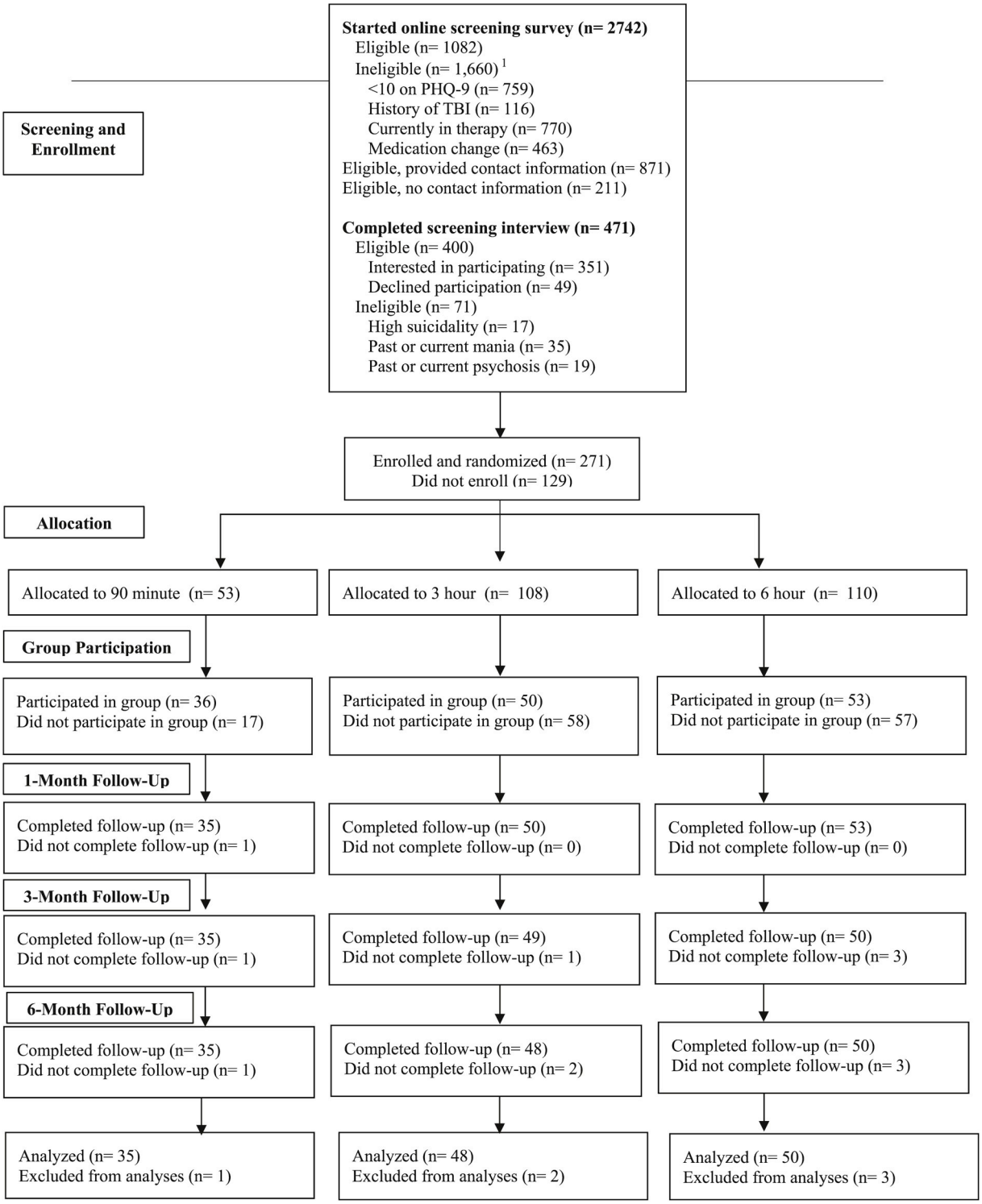


Fig. 1. Consort diagram.

facilitators focused on the participants' behavioral responses to symptoms, rather than elimination of the symptoms themselves. In each intervention, values were identified and clarified, with associated goals being identified in pursuit of such values. Furthermore, mindfulness of present experience was repeatedly emphasized to encourage awareness of one's internal and external context. Lastly, acceptance of one's internal experiences was also explored as an alternative to experiential avoidance, and this often involved integration of perspective taking and defusion processes.

Training of Interventionists. All groups were facilitated by two of five trained doctoral clinical psychology students. Students had prior exposure to ACT and behavior therapies. Facilitators completed 40 h of additional training in ACT, which included reading, discussion, and practicing delivery of the group, with particular emphasis on conceptualization and targeted intervention.

Treatment Fidelity and Competency. Fidelity and competency were rated by a post-doctoral level psychologist with substantial experience in ACT. Given the time-variant nature of the groups, all

audiotapes were divided into 30-min segments and then compiled for random selection of 15% of the segments for coding.

Treatment fidelity was assessed using a measure created for this study, which assessed whether facilitators addressed the six core ACT processes (0 = *Not covered*, 1 = *Covered*) and processes that should *not* occur in an ACT treatment (e.g., challenging content of thoughts). Key items from an established measure of ACT competency (Hayes & Strosahl, 2004) were also used. The 14-item scale used a 7-item Likert scale (1 = *Never true*, 7 = *Always true*). Example items include: "The facilitators avoid use of 'canned' ACT interventions," and "The facilitators create a separation between an individual and his or her thoughts, feelings, and experiences."

Assessments. Participants completed assessments at baseline and at 1-month, 3-months, and 6-months post-intervention. Follow-up assessments continued until November 2017 when data collection concluded. Participants also completed the BDI-II immediately before the start of their assigned group (the pre-intervention measurement). Baseline and follow-up assessments were administered using Qualtrics survey software. Participants were compensated for completing study assessments.

1.3. Measures

Depressive Symptoms. The Beck Depression Inventory—II (BDI-II (Beck, Steer, & Brown, 1996) is a commonly used 21-item measure that quantifies severity of depressive symptoms. The measure has demonstrated high internal consistency in a variety of samples (α = 0.93-0.96; Beck et al., 1996). Internal consistency of the BDI-II in the present sample was good across the four measurement time points as well as pre-treatment (α range = 0.87 to 0.93).

Psychological Inflexibility. The Acceptance and Action Questionnaire-II (AAQ-II; Bond, Hayes, & Baer, 2011) was used to measure psychological inflexibility. The measure is factor analytically derived and internally consistent (α = 0.78-0.87; Bond et al., 2011) and has demonstrated convergent, concurrent, predictive, and discriminant validity. Participants rate items on a 7-point Likert scale with higher scores indicating higher psychological inflexibility. Internal consistency in this sample was good across the four measurement time points (α range = 0.82 to 0.89).

Mindfulness. The Five Facet Mindfulness Questionnaire (FFMQ) was used to assess different facets of mindfulness, including observation, description, action with awareness, nonjudgment, and nonreactivity (Baer, Smith, & Hopkins, 2006). Internal consistency was adequate among four of the five facets (α = 0.83-0.91), with the reliability of the nonreactivity scale being slightly lower (α = 0.75) in the validation study. Convergent, discriminant, predictive, and incremental validity were demonstrated (Baer et al., 2006). Participants rate items on a 5-point Likert scale. The total score, including all five facets, was used in analyses. Internal consistency of this sample was good across the four measurement time points (α range = 0.89 to 0.95).

Social Satisfaction. The Patient Reported Outcome Measurement Information Systems (PROMIS) Satisfaction with Participation in Social Roles and Activities scale was used to measure social satisfaction (Cella et al., 2010). Extensive research indicates the reliability and validity of the scale (Hahn et al., 2010). Participants are asked to rate items on a 5-point Likert scale. Total scores are converted to T scores. Internal consistency of this sample was good across time points (α range = 0.92 to 0.95).

Demographics. Participants were asked several questions regarding demographic information, including age, gender, education, race and ethnicity, and relationship status.

1.4. Power analysis

To test the superiority hypothesis, power analyses for a between-groups repeated measures *F*-test were conducted using GPower 3.0.10. Power estimations were calculated with an alpha of .05, 80% power, and effect size *f* of 0.25. The analysis indicated that a sample of 102 participants (approximately 35 participants per condition) was required.

Because the 90-min group was intended to serve as a control group, equivalence analyses were utilized for the 3-h and 6-h conditions. Power analyses were also conducted in accordance with sample size calculations in equivalence studies, wherein a 95% confidence interval is used (Piaggio et al., 2006). The equivalence margin for this study was established using the maximum acceptable difference in depressive symptoms. Among data from clinically symptomatic individuals (*N* = 3339), average depression scores were aggregated, *M* = 25.45, *SD* = 9.99, and reliable change in symptoms was 8.46 points (Seggar, Lambert, & Hansen, 2002). A conservative margin of equivalence (−4, +4) was used to denote clinically significant differences in depressive symptoms. To estimate 80% power, power analyses were conducted using PASS software (version 14), a well-established approach (Phillips, 1990). Results indicated that 70 participants in each condition were needed.

Because two power analyses were completed with different sample size estimations, the total required sample size was computed based on both analyses. The 3- and 6-h groups required 70 participants, and the 90-min control group required 35 participants. Given that attrition was anticipated, additional participants were recruited. With an estimated 20% attrition, 35 participants were expected to be lost to follow-up. A total sample of 210 participants were recruited to test all hypotheses and account for attrition. After difficulties with attrition between randomization and group completion, an additional 61 participants were recruited by the same procedure.

1.5. Statistical analyses

Data were examined for outliers. In equivalency trials, intent-to-treat analyses are considered anticonservative because the likelihood for confirming equivalency is greater in these analyses (Weins & Zhao, 2007). As such, completers were used in the current analyses.

Mean imputation was utilized when less than 20% of the items were missing on a measure. In all cases, this resulted in a single item being imputed on a scale. Single-item imputation was required in very few instances across measures and measurement time points. Similarly, only in a small number of cases were measures excluded because of excessive missing items. Item-level missing data were imputed in the following quantities and for the following scales: baseline (BDI-II: 8; FFMQ-Observe: 5, Describe: 3, Act with Awareness: 4, Nonjudgment: 4, Nonreactivity: 4), pre-intervention (BDI-II: 6), 1-month follow-up (BDI-II: 7; AAQ-II: 1; FFMQ-Observe: 2, Describe: 3, Act with Awareness: 1, Nonjudgment: 3, Nonreactivity: 4; SPSR: 2), 3-month follow-up (BDI:II-5; AAQ-II: 1; FFMQ-Observe: 2, Describe: 1, Act with Awareness: 2, Nonjudgment: 2, Nonreactivity: 2; SPSR: 2), and 6-month follow-up (BDI-II: 7; AAQ-II: 1; FFMQ-Observe: 3, Describe: 2, Act with Awareness: 5, Nonjudgment: 4). The following values represent how many cases were excluded due to the majority of items being missing on the scale: baseline (AAQ-II: 3, FFMQ: 8; SPSR: 2), 1-month follow-up (FFMQ: 2; SPSR: 3), 3-month follow-up (BDI-II: 1; AAQ-II: 2; FFMQ: 3; SPSR: 2), and 6-month follow-up (BDI-II: 1; AAQ-II: 1; FFMQ:; SPSR: 1). In cases where the majority of items were missing, data could not be imputed, and these data were excluded from analysis.

Mixed-effects modeling was used to analyze the longitudinal change from pre-intervention to follow-up across all conditions using the lmer function in the lme4 package (Bates, Mächler, Zurich, Bolker, & Walker, 2014) in R (R Core Team, 2018). To estimate degrees of freedom and *p* values, the lmerTest package was used (Kuznetsova, Brockhoff, & Christensen, 2017). Effect sizes were calculated using established procedures that are appropriate for mixed-effects models (Oishi, Lun, & Sherman, 2007; Rizk & Treat, 2015). The full fixed-effects model, including the main effects (β0, β1) and interaction, was examined.

Table 1
Comparisons between group attenders and non-attenders.

	Total (N = 271), M(SD) or N (%)	Attenders (N = 139), M(SD)	Non-attenders (N = 132), M(SD)	Between-group differences
Age	33.2 (14.39)	36.04 (14.7)	30.19 (13.46)	t (268) = −3.40, p = .001
Females, N (%)	217 (80.1%)	114 (86.4%)	103 (74.1%)	X^2 (1) = 6.38, p = .01
Years of Education	16.15 (2.68)	16.64 (2.79)	15.64 (2.48)	t (267) = −3.12, p = .002
In a romantic relationship	175 (64.6%)	84 (48%)	91 (52%)	X^2 (1) - = 1.69, p = .19
Caucasian, N (%)	218 (79.9%)	113 (82.5%)	105 (78.9%)	X^2 (1) = 0.54, p = .46
BDI-II	24.65 (9.43)	25.44 (9.23)	23.82 (9.59)	t (269) = −1.42, p = .16
AAQ-II	28.15 (7.63)	28.90 (7.10)	27.36 (8.10)	t (266) = −1.66, p = .10
FFMQ-Mindfulness	111.06 (17.07)	111.48 (16.93)	110.60 (17.28)	t (263) = −0.42, p = .68
Social Satisfaction	20.16 (7.18)	19.68 (6.69)	20.66 (7.65)	t (267) = 1.11, p = .27
Psychiatric medication use	106 (39.1%)	59 (43.1%)	47 (35.6%)	X^2 (1) = 1.57, p = .21

Note. BDI-II = Beck Depression Inventory, 2nd edition. AAQ-II = Acceptance and Action Questionnaire, 2nd edition. FFMQ = Five Facet Mindfulness Questionnaire. Social Satisfaction = PROMIS Satisfaction with Participation in Social Roles and Activities. Psychiatric medication use = self-reported current psychiatric medication.

Overall change over time and across condition were evaluated with the main effect analyses, and subsequently, analyses between specific time points were examined (e.g., pre-intervention to 3-month follow-up). A random effect of subject was included to account for individual variability. In order to test the superiority hypotheses, standard hypothesis testing was used. The 90-min group was compared to the 3- and 6-h groups. Superiority can be concluded if significant differences are indicated.

In order to test the equivalency hypotheses, a prespecified margin of equivalence was identified (−4, +4), which is the range by which depressive symptom scores can vary between groups and be of no clinical significance (Jones, Jarvis, Lewis, & Ebbutt, 1996). Both ends of the confidence intervals are important, and the treatments are considered equivalent in the case that the mean difference in treatment outcome and the 95% confidence interval fall within this margin. The analyses were conducted in NCSS11 (NCSS 11 Statistical Software, 2016). Analyses examined the mean difference between conditions at each follow-up time point and used the Two One-Sided Test.

2. Results

Sample characteristics are reported in Table 1. Less than half of the participants were taking psychiatric medications (39.1%), with the majority of reported medications classified as antidepressants (61.9%). Approximately half (51.29%) of participants attended a group. Participants who did not attend group were unresponsive to the email requesting participant availability, did not present at the time of group, or elected to drop out of the study prior to attending group. Comparisons between attenders and non-attenders were conducted across baseline measures. Results of the analyses indicated no significant differences in depression, psychological inflexibility, mindfulness, or social satisfaction (ps > .05). Differences were observed in gender (X^2 (1) = 6.38, p = .01), with males being more likely to attend than females, and age (t (268) = −3.40, p = .001), with older participants being more likely to attend. Differences were observed in years of education, with attenders (M = 16.64) having more education than non-attenders (M = 15.64; X^2 (1) = −3.12, p = .002). Findings indicated that those assigned to the 90-min condition were more likely to attend (67.9%) than those assigned to the 3-h (46.3%) or 6-h (48.2%) conditions, X^2 (2) = 7.37, p = .03. Bivariate correlations among measures for attenders are reported in Table 2.

Table 2
Correlations between baseline measures among attenders, N = 139.

	1	2	3	4	5
1. Age					
2. BDI-II	-.18*				
3. AAQ	-.36***	.65***			
4. FFMQ	-.12**	.09	.12		
5. Social Satisfaction	.10	-.42***	-.32***	-.01	

Note. *p < .05; **p < .01; ***p < .001. BDI-II = Beck Depression Inventory, 2nd edition.
AAQ-II = Acceptance and Action Questionnaire, 2nd edition. FFMQ = Five Facet.
Mindfulness Questionnaire. Social Satisfaction = PROMIS Satisfaction with Participation in Social Roles.

All participants who presented for group completed the intervention and were contacted for follow-up assessments. Completion was excellent at 1-month (99.23%), 3-month (96.4%), and 6-month (94.96%).

2.1. Fidelity and competency

Ratings were examined across the entire randomly selected sample of segments, as well as compared across conditions. No differences in fidelity were observed across conditions (ps > .05). Among the entire randomly selected sample, processes were addressed in the majority of segments: self-as-context (84.8%), present moment awareness (100%), defusion (97%), acceptance (93.9%), values (97%), and committed action (60.6%). Findings indicated that 6 processes were addressed in 48.5% of the segments, 5 processes in 39.4%, 4 processes in 9.1%, and 3 processes in 3%. Competency ratings were averaged across items. On average among the sample of selected segments, competency was high (M = 6.30, SD = 0.29, Range = 1–7). Competency did not significantly differ across conditions, p = .49.

2.2. Depression

Longitudinal mixed-effects modeling examined change from pre-intervention to 1-month, 3-month, and 6-month follow-up (see Table 3). Baseline depressive symptoms score was included as a covariate. Results indicated a significant main effect of time, F (3, 372.73) = 54.93, p < .001. There was not a significant main effect of condition, F (2, 118.72) = 0.47, p = .63) or a time by condition interaction, F (6, 372.78) = 0.80, p = .57. Baseline depression was a significant covariate, F (1, 517.74) = 14.58, p < .001. Graphical depiction of the results can be found in Fig. 2. Differences between pre-intervention and specific time points, as well as condition-specific differences are portrayed in Table 3.

Equivalency Analyses. Equivalency analyses examined whether mean differences between conditions fell within the predetermined margin of equivalence (−4, 4). At 1-month follow-up, the confidence interval of the mean difference did not fall within the margin of equivalence, M_{diff} = 4.00, CI: [-0.29, 8.29]. At 3-month follow-up, confidence intervals of the mean difference also did not fall within the margin of equivalence, M_{diff} = 0.35, CI: [-4.24, 4.93]. At 6-month

Table 3
Longitudinal mixed-effects modeling analyses of depressive symptoms, psychological flexibility, mindfulness, and social satisfaction from baseline, pre-intervention, and follow-up measurements.

Outcome: Depressive Symptoms	Estimate	SE	df	*t* value	*p* value
Intercept	**20.69**	**1.89**	**297.3**	**10.94**	**< .001**
Time, Pre-1 month	**−7.17**	**1.55**	**371.8**	**−4.62**	**< .001**
Time, Pre-3 month	**−7.50**	**1.55**	**371.8**	**−4.83**	**< .001**
Time, Pre-6-month	**−10.05**	**1.57**	**371.9**	**−6.41**	**< .001**
Condition, 90-min vs. 3-hour	1.32	2.24	239.2	0.59	0.56
Condition, 90-min vs. 6-hour	−0.12	2.22	238.4	−0.06	0.96
Baseline depressive symptoms	**0.13**	**0.04**	**517.7**	**3.82**	**< .001**
Time x Condition, Pre-1 month, 90-min vs. 3-hour	1.52	2.03	371.7	0.75	0.46
Time x Condition, Pre-3 month, 90-min vs. 3-hour	−0.66	2.04	372.4	−0.32	0.75
Time x Condition, Pre-6 month, 90-min vs. 3-hour	−0.28	2.09	373.1	−0.13	0.89
Time x Condition, Pre-1 month, 90-min vs. 6-hour	−0.82	2.01	372	−0.41	0.68
Time x Condition, Pre-3 month, 90-min vs. 6-hour	0.37	2.02	372.8	0.18	0.86
Time x Condition, Pre-6 month, 90-min vs. 6-hour	0.53	1.01	372.4	0.47	0.64
Outcome: Psychological Inflexibility					
Intercept	**28.83**	**1.41**	**260.8**	**20.43**	**< .001**
Time, Baseline-1 month	**−3.59**	**1.04**	**395.3**	**−2.80**	**< .001**
Time, Baseline-3 month	**−3.91**	**1.04**	**395.3**	**−3.05**	**< .001**
Time, Baseline-6 month	**−5.62**	**1.29**	**395.4**	**−4.35**	**< .001**
Condition, 90-min vs. 3-hour	0.19	1.85	260.8	0.10	0.92
Condition, 90-min vs. 6-hour	−1.10	1.83	260.8	−0.60	0.55
Time x Condition, Baseline-1 month, 90-min vs. 3-hour	1.27	1.67	394.8	0.76	0.45
Time x Condition, Baseline-3 month, 90-min vs. 3-hour	−1.84	1.68	395.1	−1.10	0.27
Time x Condition, Baseline-6 month, 90-min vs. 3-hour	−0.18	1.71	396.0	−0.11	0.91
Time x Condition, Baseline-1 month, 90-min vs. 6-hour	0.68	1.65	394.4	0.41	0.68
Time x Condition, Baseline-3 month, 90-min vs. 6-hour	0.53	1.67	395.5	0.32	0.75
Time x Condition, Baseline-6 month, 90-min vs. 6-hour	1.21	1.67	395.2	0.72	0.47
Outcome: Mindfulness					
Intercept	114.73	3.60	340.6	31.85	< .001
Time, Baseline-1 month	1.81	3.80	388.8	0.48	0.63
Time, Baseline-3 month	1.02	3.81	391.6	0.27	0.79
Time, Baseline-6 month	**8.55**	**3.81**	**390.8**	**2.24**	**0.03**
Condition, 90-min vs. 3-hour	−4.39	4.69	334.7	−0.94	0.35
Condition, 90-min vs. 6-hour	−4.47	4.63	334.9	−0.96	0.34
Time x Condition, Baseline-1 month, 90-min vs. 3-hour	5.68	4.91	387.7	1.16	0.25
Time x Condition, Baseline-3 month, 90-min vs. 3-hour	9.37	4.96	390.3	1.89	0.06
Time x Condition, Baseline-6 month, 90-min vs. 3-hour	6.20	4.87	388.0	1.45	0.15
Time x Condition, Baseline-1 month, 90-min vs. 6-hour	7.03	4.87	388.0	1.45	0.15
Time x Condition, Baseline-3 month, 90-min vs. 6-hour	**11.24**	**4.90**	**390.3**	**2.29**	**0.02**
Time x Condition, Baseline-6 month, 90-min vs. 6-hour	1.89	4.88	389.4	0.39	0.70
Outcome: Social Satisfaction					
Intercept	**21.25**	**1.30**	**302.7**	**16.35**	**< .001**
Time, Baseline-1 month	2.37	1.30	396.6	1.83	0.07
Time, Baseline-3 month	**3.27**	**1.30**	**396.6**	**2.52**	**0.01**
Time, Baseline-6 month	**5.39**	**1.31**	**396.8**	**4.12**	**< .001**
Condition, 90-min vs. 3-hour	−2.07	1.70	302.7	−1.21	0.23
Condition, 90-min vs. 6-hour	−2.53	1.68	302.7	−1.50	0.13
Time x Condition, Baseline-1 month, 90-min vs. 3-hour	0.28	1.70	396.0	0.17	0.87
Time x Condition, Baseline-3 month, 90-min vs. 3-hour	0.71	1.70	396.5	0.42	0.68
Time x Condition, Baseline-6 month, 90-min vs. 3-hour	0.08	1.73	397.6	0.05	0.96
Time x Condition, Baseline-1 month, 90-min vs. 6-hour	1.14	1.68	396.0	0.68	0.50
Time x Condition, Baseline-3 month, 90-min vs. 6-hour	−0.14	1.69	396.9	−0.09	0.93
Time x Condition, Baseline-6 month, 90-min vs. 6-hour	−1.47	1.69	396.6	−0.87	0.39

Note. Bolded rows indicate significant parameters. The first set of analyses examined depressive symptoms from pre-intervention to follow-up, while controlling for baseline depressive symptoms. The latter sets examined psychological inflexibility, mindfulness, and social satisfaction from baseline to follow-up measurements.

follow-up, confidence intervals of the mean difference did not fall within the margin of equivalence, $M_{diff} = -0.38$, CI: [-4.56, 3.80].

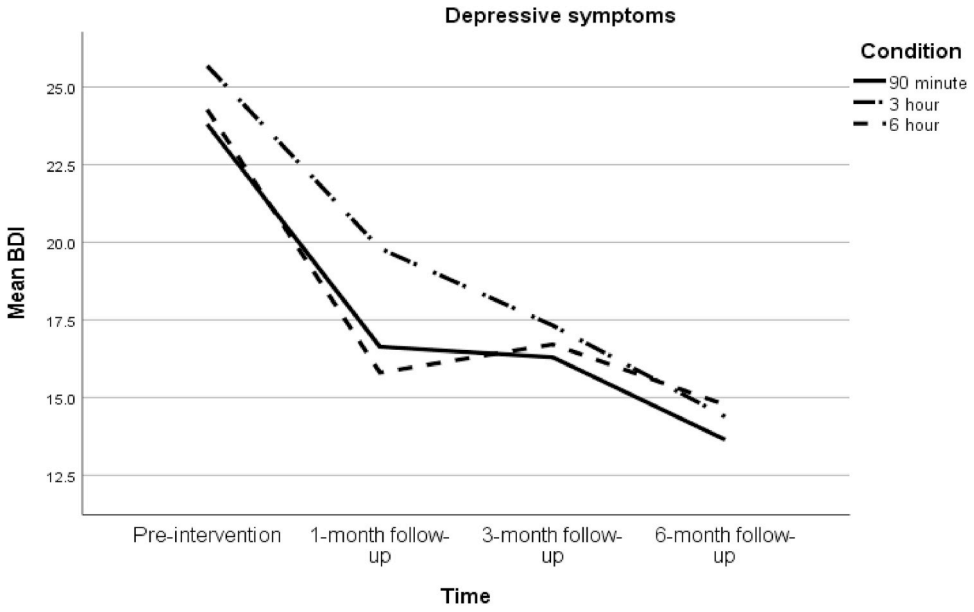
Reliable Change Analyses. Reliable change scores were calculated for each follow-up time point. The formula for reliable change was: (pre-intervention – follow-up)/$SE_{difference}$ (Jacobson & Truax, 1991). The standard error of the difference was 4.71. If the RCI was 1.96 or greater, this was considered to be reliable change. At 1-month follow-up, 34.3% of the sample met the criteria for reliable change. No significant differences across conditions were observed, X^2 (2) = 3.17, p = .21. At 3-month follow-up, 46.2% of the sample met the criteria for reliable change, with no significant differences across condition, X^2 (2) = 0.24, p = .89. At 6-month follow-up, 53.4% of the sample met the criteria for reliable change, and no significant differences by condition were observed, X^2 (2) = 0.25, p = .88.

2.3. Psychological inflexibility

Longitudinal mixed-effects analyses examined change from baseline to 1-month, 3-month, and 6-month follow-up measurements (see Table 3). Results indicated a significant main effect of time, F (3, 395.44) = 24.06, p < .001. There was not a significant main effect of condition, F (2, 135.99) = 0.08, p = .92, or time by condition interaction, F (6, 395.42) = 0.99, p = .43.

2.4. Mindfulness

Mixed-effects analyses examined change from baseline to 1-month, 3-month, and 6-month follow-up measurements (see Table 3). There was a main effect of time, F (3, 389.45) = 11.68, p < .001. There was



Note. BDI = Beck Depression Inventory.

Fig. 2. Depressive symptoms by time and condition.

not a significant main effect of condition, F (2, 136.88) = 0.03, p = .97 or time by condition interaction, F (6, 389.34) = 1.35, p = .23.

2.5. Social satisfaction

Mixed-effects analyses examined change from baseline to 1-month, 3-month, and 6-month follow-up measurements (see Table 3). Results indicated a significant main effect of time, F (3, 396.88) = 18.79, p < .001. The main effect of condition was not significant, F (2, 137.02) = 1.96, p = .14. There was not a significant interaction between time and condition, F (6, 396.86) = 0.61, p = .72.

3. Discussion

The present study sought to examine the relative effectiveness of three single-session time-variant interventions in reducing depressive symptoms over the course of one, three, and six months. A substantial body of psychotherapy research has focused on the amount of time required to make a clinically meaningful change in symptoms. However, much of this research has examined data from multiple studies via meta-analysis, or the data were collected in real-world settings where participants were not randomized to condition. The current study directly compared three randomized, time-variant conditions longitudinally to elucidate how much time in treatment is required to make both a statistically and clinically meaningful change in depressive symptoms.

Analyses indicated that there was a main effect of time, such that depressive symptoms decreased across the sample over time. However, there were no significant differences between conditions over time. Furthermore, when comparing the metrics of clinically significant change, the groups did not vary in terms of reliable change. The findings suggest that the group intervention reduced depressive symptoms at 1-, 3-, and 6-month follow-up, regardless of the length of intervention provided. Though significant differences were not observed, equivalency analyses indicated that the 3- and 6-h conditions were not equivalent at 1-, 3-, or 6-month follow-up. As such, further examination of the processes by which brief interventions impact depressive symptoms is necessary.

The current study's finding of a lack of significant time by condition interaction across depression, psychological flexibility, mindfulness, and social satisfaction requires close consideration. The lack of differences in depressive symptoms cannot be attributed to differences in baseline depression symptom level, given that this was included as a covariate. It is possible that passage of time or regression to the mean can account for the observed longitudinal changes in depressive symptoms. Also possible is that the act of participating in a study reduces symptoms, which is consistent with findings from previous studies with multiple arms (Powell, Penick, Read, & Ludwig, 1985; Zettle & Rains, 1989). Other studies have indicated that depressive episodes can remit spontaneously (Spijker et al., 2002; Spijker & Nolen, 1998). Further, it is possible that the conditions were too similar in time interval to affect meaningful differences in symptom outcome. The intention was to include the 90-min condition as a control group, given the cited research examining treatments for depression that amass substantially greater time with patients. Nevertheless, the 90-min condition demonstrated reductions in depressive symptoms over time, and as such, was an ineffective control condition and rather, a potentially effective intervention. The study did not directly examine these conditions compared to a no-treatment or wait-list control condition, and as a result, definitive conclusions regarding the depressive symptom changes cannot be drawn.

Differences in targeted processes such as psychological flexibility and mindfulness over time are less likely attributable to the passage of time or regression to the mean. Furthermore, fidelity and competency data suggest that the conditions did not differ and may support the view that change occurred as a result of participating in an intervention. Given that the 90-min group was originally intended to serve as a control condition, the changes observed in psychological flexibility, mindfulness, and social satisfaction in the 90-min group are promising and may indicate that some change in these processes can be achieved in a relatively brief time period.

Though the current study lacked a pure control group, it appears that each of the three ACT conditions (90-min, 3-h, 6-h) had a similar effect on outcomes. This poses an interesting question as to how such change is possible after a single-session, and in some cases very brief, intervention. If improvement in psychological functioning was a result of the intervention, these results provide an opportunity to consider how this rapid change occurs, as well as how it is sustained over time.

While several studies have demonstrated the effectiveness of very brief ACT, few studies have speculated as to *why* such change is observed and sustained. ACT is supported by a large body of basic empirical research in Relational Frame Theory (RFT; Hayes, 2004). This research bridges the science of cognition, specifically human language, behavior analysis, and behavior change. A key concept in psychotherapy proposed in RFT is *transformation of stimulus function*, which is selecting, amplifying, or creating new meanings of an experience in order to change the response to this experience (Villatte, Villatte, & Hayes, 2016). ACT intentionally introduces the opportunity for a variety of transformations of function by altering the context surrounding relevant stimuli. For example, therapists may relate thoughts to "leaves on a stream," or emotions with "weather patterns," using metaphor to alter behavioral responses to internal stimuli. Similarly, identifying the connection between values and intense emotion may transform the function of said emotions from something to be avoided into an informative signal that indicates its value. The ultimate goal of altering the function of stimuli is to reduce unworkable avoidant behavior and promote engagement in values-based living. It is hypothesized that these transformations of function may create the opportunity for rapid, sustainable change. The transformation of functions may strengthen as individuals apply concepts and make behavioral changes in day-to-day life subsequent to the single-day intervention, providing opportunities for additional experiential learning. Further research into *how* brief ACT works to facilitate change is necessary to examine the mechanisms by which behavior change occurs.

3.1. Clinical and public health implications

Though the current study does not provide clear evidence for alterations to current empirically-supported treatments for depression, the results do lend initial support to a brief approach to therapeutic intervention, indicating that a small dose of ACT can impact depressive symptoms, and this change was sustained at six-month follow-up. As with all intervention trials, not all participants benefited from the brief intervention. Even still, these findings may have implications for public health initiatives to increase access to mental health care. A 2004 review explored the utilization of mental health services by reviewing studies examining access and use of treatment (Kohn, Saxena, Levav, & Saraceno, 2004), and in particular, studies examined the difference between the number of individuals in need of mental health treatment and the number receiving treatment. Overall, the gap in the treatment of depression was 56.3%, dysthymia 56%, and GAD 57.5% (Kohn et al., 2004). When considering these substantial gaps in light of the current findings, there is promise that increasing access to treatment is in fact possible. In a relatively limited time period, and by delivery via group instead of individual therapy, psychotherapists' time can be maximized to increase the reach of psychotherapy. For example, brief group-based interventions may be usefully implemented within a stepped care approach in which individuals who significantly benefit from a brief group may not choose to pursue further treatment, while those who do not significantly benefit progress to longer-term individual therapy. Finally, the single-day treatment modality is particularly compelling from a public health perspective. For many individuals with physical and mental disabilities, those who live in rural or underserved communities, or those with a high number of life demands, weekly treatments may simply not be feasible, which limits access to care. A single-day intervention does not eliminate potential treatment barriers, but it does reduce the burden of them.

The findings reported herein may also have substantial implications for clinical practice. Given that the current study did not include either a waitlist control group or a "gold standard" intervention comparison, the results do not provide clear evidence for the reduction in number of sessions or time in therapy for the treatment of depression. Even still, the popularly held belief that more therapy is always better is not supported by the present results. Previous research has made the assumption that change is linear and gradual, but examination of individual outcomes over time indicates that change can be discontinuous and nonlinear (Hayes, Laurenceau, Feldman, Strauss, & Cardaciotto, 2007). The present findings are more consistent with prior research indicating that number of sessions does not predict treatment outcome, but that participating in *any* length of treatment has the potential to be beneficial for depressive symptoms (Baldwin, Berkeljon, Atkins, Olsen, & Nielsen, 2009). For example, research with a depressed sample indicated a rapid response pattern, finding that symptoms decreased by session four, after which change was not substantial (Ilardi & Craighead, 1994). Thus, psychotherapists should be mindful of the variability in responses to psychotherapy and allow patients to determine the course.

3.2. Limitations

A considerable proportion of individuals either completed the baseline survey and chose to decline participation before randomization or were randomized, but did *not* participate in their assigned group. Despite substantial effort to retain participants, approximately half of all randomized participants ultimately did not participate in group. Nevertheless, for participants who attended the group, minimal attrition was observed at follow-up. Though specific explanations for high initial drop-out cannot be determined, this considerable attrition is relevant when exploring how individuals view a brief group approach to treatment. Relatedly, data on the acceptability of the treatment were not collected. Future research examining acceptability of treatments of varying lengths would be valuable from a public health perspective. Furthermore, given that recruitment procedures were completed first online and second by phone, the participants had yet to present in-person until the time of group. This limited in-person behavioral engagement prior to the intervention could have contributed to the substantial dropout observed. Additionally, the mass e-mail recruitment method spans a wide demographic, but retains anonymity, and as such, participants may have perceived less accountability to attend the assigned intervention group.

Additionally, the sample was substantially biased to females and primarily Caucasian, well-educated individuals, so results may not be generalizable to populations that are substantially different. Nevertheless, limited exclusion criteria were utilized in recruitment in an effort to improve the generalizability of results and avoid strict inclusion criteria that may not apply to community settings. Individuals with a variety of conditions known to coexist with depression (e.g., anxiety, chronic pain) were *not* excluded. Finally, the study was designed for the 90-min condition to serve as a minimal treatment condition, but results indicated that it was no less effective than the 3- and 6-h conditions. The study would have benefited from a no-treatment or wait-list control group. Future research should examine the effectiveness of brief time-variant ACT groups in comparison with a wait-list or no-treatment control group. Further, the study utilized only self-report measures to assess symptoms, and future studies could benefit from the use of clinician-administered interviews. This would also potentially yield diagnostic information, which was not collected in the current study. Finally, the trial was not pre-registered through a national registry (e.g., clinicaltrials.gov).

3.3. Conclusions

In conclusion, a large body of research supports the effectiveness of ACT in the treatment of a number of psychiatric and physical conditions. Several studies have established that ACT can effectively promote change in very small doses (e.g., 6 h; Dindo et al., 2015; Lillis, Hayes, Bunting, & Masuda, 2009). Nevertheless, research has yet to examine how much is enough to promote behavioral change among individuals with depression. The present study compared three time-variant group ACT interventions among individuals with elevated depressive

symptoms. The results indicated that depressive symptoms decreased over time, and this decrease was observed regardless of condition. This indicates that improvements in depression can occur in as little as 90 min of group ACT, and this change is sustained at three- and six-months post-intervention. The findings are important to consider in light of public health and clinical implications, given that far more people suffering from depression and co-morbid conditions could be reached if brief interventions were utilized effectively.

Funding

Support for this work was provided by a dissertation year fellowship from the University of Iowa and a dissertation grant from the Department of Psychological and Brain Sciences. Efforts on the study were also supported in part by the National Institute of Health T32 pre-doctoral training grant: T32GM108540 (supporting A.I.R.).

Research involving human participants and informed consent

Study was approved by University of Iowa IRB. Written informed consent was obtained from all participants.

Contributors

EBK and MWO conceptualized and designed the project. EBK, AIR, and MWO executed the project. EBK conducted all analyses and wrote the first draft of the manuscript. All authors revised and approved the manuscript for publication.

Declaration of competing interest

Authors EBK, AIR, and MWO have no conflicts or competing interests to report.

Acknowledgement

The authors thank the participants for sharing their stories and participating in the study. Many thanks to James Marchman, Mark Vander Weg, Kristian Markon, Natalie Denburg, and Susan Lutgendorf for assistance in the development and evaluation of the study. Thank you to many your vital participation in the study—Michelle Miller, Marianne Rizk, Kelsey Spalding, Rebecca Grekin, Cara Solness, Alex Miller, Kelsie Strait, Isabella Brauhn, Nick Gallivan, Hannah Hinkel, and Brianne Richson.

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