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BRIEF REPORTS

Improving Diabetes Self-Management Through Acceptance, Mindfulness, and Values: A Randomized Controlled Trial

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Patients in a low-income community health center with Type 2 diabetes ($N = 81$) taking a one-day education workshop as part of their diabetes medical management were randomly assigned either to education alone or to a combination of education and acceptance and commitment therapy (ACT). Both groups were taught how to manage their diabetes, but those in the ACT condition also learned to apply acceptance and mindfulness skills to difficult diabetes-related thoughts and feelings. Compared with patients who received education alone, after 3 months those in the ACT condition were more likely to use these coping strategies, to report better diabetes self-care, and to have glycated hemoglobin (HbA_{1C}) values in the target range. Mediational analyses indicated that changes in acceptance coping and self-management behavior mediated the impact of treatment on changes in HbA_{1C}.

Keywords: diabetes education, acceptance and commitment therapy, mindfulness, Type 2 diabetes, primary care

The self-management of Type 2 diabetes requires attention to diet, physical activity, blood glucose monitoring, and consistent administration of diabetes medication and/or insulin. Good self-management is related to lower glycated hemoglobin (HbA_{1C}) levels, which reflects a decreased likelihood of developing diabetes-related complications of as much as 37% (U.K. Prospective Diabetes Study Group [UKPDS], 1998). However, only about 36% of patients have HbA_{1C} levels in the recommended range (Koro, Bowlin, Bourgeois, & Fedder, 2004).

Education regarding nutrition, physical activity, blood glucose self-monitoring, and medication and insulin administration are essential components of diabetes treatment (American Diabetes Association [ADA], 1997), but education per se does not necessarily lead to adequate self-management (Norris, Engelgau, & Narayan, 2001). Adding direct behavior change interventions is helpful (Norris et al., 2001) but costly. A recent meta-analysis found that most such studies used 10 or more treatment sessions and that, on average, 24 hr of intervention was needed to reduce HbA_{1C} levels by 1% (Norris, Lau, Smith, Schmid, & Engelgau, 2002).

Previous research demonstrates that patient distress reduces regimen adherence, which in turn reduces glycemic control (e.g., Anderson, Freedland, Clouse, & Lustman, 2001). Psychologically focused interventions, however, such as cognitive–behavior therapy (CBT), have demonstrated mixed results in addressing this factor in diabetes self-management (Ismail, Winkley, & Rabe-Hesketh, 2004). Consistent with CBT assumptions, in many of these studies researchers attempted to teach patients to control diabetes-related thoughts and feelings in order to reduce or eliminate distress. However, eliminating distress may not be a realistic strategy with this population. Each time patients with diabetes monitor blood glucose, look at an item of food, or notice an ache or pain, a psychological connection may be made to the very real and inherently distressing possible results of their disease. Self-management behaviors may thus evoke thoughts of the illness and reactions to its dangers, which could itself be distressing if a patient believes that distress, fear, worry, and other negative diabetes-related emotions and cognitions must be stopped, altered, or reduced.

Teaching acceptance and mindfulness skills may provide a more realistic alternative. Correlational research on coping styles has shown that acceptance of diabetes and diabetes-related cognitions are significantly related to lower HbA_{1C} values (Richardson, Adner, & Nordstrom, 2001). Similarly, avoidance of negative thoughts and feelings associated with diabetes has been shown to be related to higher levels of depression (Boey, 1999), lower quality of life (Coelho, Amorim, & Prata, 2003), and lower adherence to medical regimen (Weijman, Ros, & Rutten, 2005).

The present study sought to apply an acceptance approach to coping with diabetes. Acceptance and commitment therapy (ACT; Hayes, Strosahl, & Wilson, 1999) teaches individuals to accept

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their feelings, to "defuse" or disengage from the content of their thoughts by focusing more mindfully on the process of thinking itself, and to link all of this to goal-based action. In short, ACT attempts to teach individuals to experience their thoughts and feelings rather than attempting to alter or stop them. Individuals are asked to work toward those goals and values they hold while experiencing their thoughts and feelings.

ACT has shown positive outcomes for a wide variety of conditions (see Hayes, Luoma, Bond, Masuda, & Lillis, 2006, for a recent meta-analysis), including for chronic medical conditions, even when presented in very brief form. For example, a 9-hr ACT intervention had a positive impact on epilepsy over the next year (Lundgren, Dahl, Melin, & Kees, in press), and a 4-hr ACT intervention had an impact on chronic pain over the next 6 months (Dahl, Wilson, & Nilsson, 2004). Thus, as compared with diabetes education alone, it seems possible that a limited ACT intervention might have a significant impact on diabetes self-management behaviors, and perhaps glucose control. In addition, we hypothesized that changes in HbA_{1C} may be mediated by changes in acceptance coping and self-management behavior. These possibilities were examined in the present study.

Method

Participants, Setting, and Assignment

English-speaking participants with Type 2 diabetes receiving medical care at a low-income community health center and referred to diabetes education by their primary care provider (N = 81), came in six separate waves of 10 to 24 participants to a daylong diabetes educational workshop in the San Francisco area from October 2002 through July 2003. There were no exclusion criteria based on psychiatric, medical, or substance use disorders. Characteristics of the sample are shown in Table 1.

Psychosocial assessments and a blood draw for HbA_{1C} were administered during the 1st hr (and again at 3-month follow-up) by clinic and research personnel blind to group assignment. After pre-assessment, participants were then randomly assigned (using a random numbers table) to one of two concurrent workshops at either end of the clinic that then began immediately. Participant flow is shown in Figure 1. Of those initially screened for eligibility (N = 106), 1 refused and 24 patients did not enter the study because of scheduling problems and time constraints.

The two groups did not differ on body mass index, medication–insulin protocols, pretreatment complications, or any demographic variable. Following the workshop, primary care providers continued to manage participants' diabetes in a normal fashion, but through follow-up they were unaware of participants' treatment condition assignment.

Table 1
Demographic Variables

Characteristic	ACT (n = 43)	Education (n = 38)	Overall (n = 81)	p
Mean age (years)	51.9	49.8	50.9	.159
Gender (% female)	48.8	57.9	46.9	.277
Race (%)				.116
Caucasian	32.6	13.2	23.5	
African American	9.3	10.5	9.9	
Hispanic	30.2	26.3	28.4	
Native American	2.3	0.0	1.2	
Asian-Pacific Islander	16.3	44.7	29.6	
Arabic	4.7	2.6	3.7	
Other	4.7	2.6	3.7	
Marital status (%)				.409
Never married	16.3	13.2	14.8	
Married	53.5	42.1	48.1	
Separated-divorced	23.3	26.3	24.7	
Widowed	7.0	18.4	12.3	
Education (%)				.938
Eight grades or less	7.1	5.4	6.3	
Some high school	11.9	13.5	12.7	
High school graduate or GED	21.4	27.0	24.1	
Some college or technical school	38.1	29.7	34.2	
College graduate	16.7	21.6	19.0	
Graduate degree	4.8	2.7	3.8	
Employment (%)				.508
Working full-time	9.3	10.8	10.0	
Working part-time	7.0	10.8	8.8	
Unemployed; looking for work	18.6	32.4	25.0	
Unemployed; not looking for work	7.0	5.4	6.3	
Homemaker	9.3	8.1	8.8	
In school	0.0	2.7	1.3	
Retired	9.3	5.4	7.5	
Disabled; not able to work	30.2	24.3	27.5	
Diabetes duration (mean years)	5.3	6.6	6.0	.257
Body mass index (M)	33.1	32.1	32.6	.441
Medication treatment-complications (%)				
Insulin	23.7	33.3	28.4	.442
Oral medication	84.2	77.8	81.1	.560
Hypertension	33.3	42.1	37.8	.296
Nephropathy	2.6	5.6	4.1	.479
Neuropathy	2.6	8.3	5.4	.287
Retinopathy	0.0	8.3	4.1	.110
Cerebrovascular accident	0.0	0.0	0.0	—
Renal failure	0.0	0.0	0.0	—

Note. ACT = acceptance and commitment therapy; GED = general equivalency diploma.

Treatment Protocols

Education alone. Participants randomly assigned to education alone (n = 38) were given a workshop that followed a patient education manual (Callaghan, Gregg, Ortega, & Berlin, 2005) based on ADA diabetes education principles. In 7 hr it covered the diabetes disease process; nutritional management; importance of physical activity; diabetes medications; blood glucose monitoring; use of glucose results; and the prevention, detection, and treatment of complications. Workshops were led by the senior author of the manual or one of four master's-level graduate students trained by him.

ACT and education. Participants randomly assigned to ACT (n = 43) were given a workshop based on an ACT manual (Gregg, 2004; available at http://www.psych.sjsu.edu/~jgregg) that covered each of the above educational topics in an abbreviated form (approximately 4 hr), plus mindfulness and acceptance training

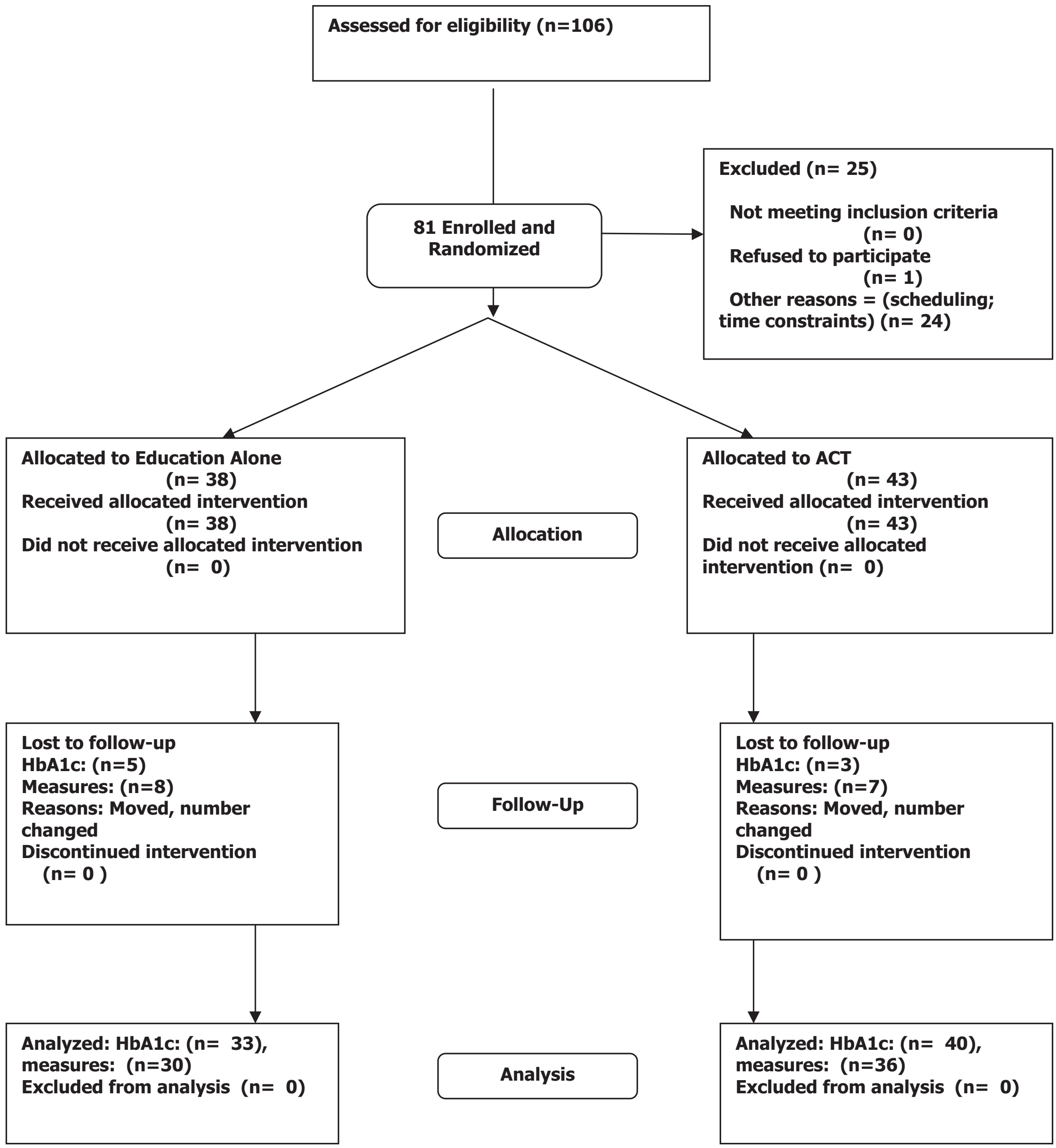

Figure 1. Attrition numbers for acceptance and commitment therapy (ACT) and education-alone conditions. HbA_{1C} = glycated hemoglobin.

regarding difficult thoughts and feelings about diabetes, exploration of personal values related to diabetes, and a focus on the ability to act in a valued direction while contacting difficult experiences. The workshop was led by the author of the manual.

Measures

The primary medical outcome variable was HbA_{1C}, which is commonly used in diabetes research. By measuring the number of glucose molecules attached to hemoglobin, laboratory assay of a single blood draw reveals the average blood glucose levels over the previous 2 to 3 months in the form of a percentage value. Individuals without diabetes typically have HbA_{1C} levels ranging from 3% to 6.5%; in this study HbA_{1C} values less than 7% were scored as showing diabetic control. Throughout, references to percentage changes in HbA_{1C} are meant additively (e.g., a change in HbA_{1C} from 9% to 8% is a 1% improvement).

Self-management scores were totals of three self-report items on exercise, diet, and glucose monitoring based on a widely used diabetes adherence measure (Toobert, Glasgow, & Hampson, 2002).

Understanding of diabetes and satisfaction with treatment (the latter collected only at follow-up) were assessed by two subscales of the Diabetes Care Profile (DCP; Cronbach's α = .60–.95; Fitzgerald et al., 1996). These measures were included to test whether differences found were related to increased understanding or satisfaction.

Changes in ACT processes were measured by the Acceptance and Action Diabetes Questionnaire (AADQ; Cronbach's $\alpha = .94$), an 11-item Likert-type scale constructed for this study by refocusing items from a widely used ACT process measure toward diabetes (the Acceptance and Action Questionnaire; Hayes et al., 2004). The AADQ measures acceptance of diabetes-related thoughts and feelings and the degree to which they interfere with valued action (e.g., "I avoid thinking about what diabetes can do to me."). See the Appendix for the measure and scoring information.

Attrition

All randomized participants received at least the minimal requirement of treatment to be considered completers. Fifteen participants did not attend the follow-up assessment. Thus, complete assessment data were available for 81% of the original sample (66 of 81). HbA_{1C} values for 7 participants missing follow-up assessment were obtained from the clinic. Complete blood data were therefore available for 73 of the participants (90%). The main outcome analysis was done on an intent-to-treat basis, and missing follow-up values were assumed not to have changed.

Analytic Strategy

Using a significance level of $p < .05$ and power of 80%, a sample size of 34 per group ($N = 68$) was needed to detect a standardized effect of 0.65, estimated from a review of a meta-analysis of diabetes self-management interventions (Brown, 1990) and conditions of the present study. Follow-up scores for each measure were examined using an analysis of covariance (ANCOVA) with the prescore values as a covariate. Parametric analyses were also supplemented by nonparametric analyses to deal with possible problems in the normality of the underlying distributions (see Table 2). The method of mediational analysis is described in the Results section. Throughout, comparisons were two-tailed and were interpreted using the language of significance

Table 2
Means, Standard Deviations, and Nonparametric Tests for Study Variables

	Pretreatment			Follow-up			Difference			
Variable	*n*	*M*	*SD*	*n*	*M*	*SD*	*M*	*SD*	*d*	Nonparametric tests
				No. in glucose control ($HbA_{1C} < 7\%$)						
Control	10/38			9/38			−0.03	0.37		Pre/follow-up sign test $p = 1.0$
ACT	11/43			21/43			0.23	0.48		Pre/follow-up sign test $p = .006$
Between-conditions comparison									0.61	MWU: 621, $z = -2.61^{**}$
				HbA_{1C}						
Control		8.21	1.91		8.07	2.22	−0.19	1.42		WMPSR $z = -0.74$
ACT		8.17	1.86		7.47	1.46	−0.72	1.59		WMPSR $z = -2.46^{*}$
Between-conditions comparison									0.35	MWU: 543.5, $z = 0.20$
				Self-management						
Control		10.28	5.99		12.41	5.21	1.62	6.84		WMPSR $z = -1.98^{*}$
ACT		7.49	5.87		13.58	5.56	5.83	5.52		WMPSR $z = -4.50^{***}$
Between-conditions comparison									0.68	MWU: 331.5, $z = -2.40^{*}$
				Acceptance and Action Diabetes Questionnaire						
Control		50.48	16.12		48.43	14.86	−1.30	9.94		WMPSR $z = -1.55$
ACT		46.23	16.97		54.10	15.24	8.66	15.20		WMPSR $z = -3.38^{***}$
Between-conditions comparison									0.78	MWU: 349.5, $z = -3.22^{**}$
				Understanding						
Control		45.61	16.88		48.13	17.37	2.96	8.18		WMPSR $z = -1.76^{\dagger}$
ACT		49.56	16.66		55.53	15.73	5.91	11.07		WMPSR $z = -2.68^{**}$
Between-conditions comparison									0.30	MWU: 378.5, $z = -1.08$

Note. ACT = acceptance and commitment therapy; WMPSR = z score for the Wilcoxon matched-pairs signed rank test of the within-group pretreatment to follow-up differences; MWU = Mann–Whitney U values and z scores for between-groups comparisons of the pretreatment to follow-up change scores. Between-groups d values were calculated on the pretreatment to follow-up difference scores.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

($p \leq .05$) and marginal significance ($p \leq .1$), and cutoffs for effect sizes termed *small*, *medium*, or *large* were those suggested by Cohen (1992).

Results

Means, standard deviations, effect sizes, and nonparametric tests of study measures assessed at pretreatment and follow-up are shown in Table 2.

Diabetic Control

The ultimate goal of diabetes management is the achievement of diabetic control. A one-way ANCOVA on follow-up diabetic control status ($HbA_{1C} < 7.0\%$) using pretreatment status as the covariate showed significant and medium effect for ACT over education alone, $F(1, 78) = 7.14$, $p = .009$, partial $\eta^2 = .08$. Nonparametric methods revealed the same finding. In the education condition, 10 of 38 participants were initially in diabetic control ($HbA_{1C} < 7.0\%$). At follow-up, 3 of these were no longer in control, and 2 of the remaining 28 participants now were. In the ACT condition, 11 of 43 participants were in control at preassessment. At follow-up, 1 of these was no longer in control, and 11 of the remaining 32 participants now were. Using a sign test from pretreatment to follow-up, the number of patients in diabetic control did not change in the education-alone condition ($p = 1.0$) but did in the ACT condition ($p = .006$). A Mann–Whitney U comparing changes from pretreatment to follow-up revealed that the ACT condition produced a significant improvement in diabetic control status as compared with education alone ($U = 621$, $z = –2.61$, $p = .009$).

Overall Glucose Levels

A one-way ANCOVA using HbA_{1C} prescores as the covariate showed a nonsignificant trend and small effect for ACT over education alone on follow-up HbA_{1C} values, $F(1, 78) = 3.13$, $p = .081$, partial $\eta^2 = .04$.

Self-Management

An ANCOVA using self-management prescores as the covariate showed a statistically significant and medium effect for ACT over education alone on follow-up self-management scores, $F(1, 60) = 4.29$, $p = .043$, partial $\eta^2 = .07$.

Acceptance, Mindfulness, and Values

Using AADQ prescores as the covariate, an ANCOVA showed a statistically significant and large effect for ACT over education alone on follow-up AADQ scores, $F(1, 52) = 23.87$, $p = .011$, partial $\eta^2 = .12$.

Understanding of Diabetes

An ANCOVA using understanding prescores as the covariate showed no significant differences between the conditions in participants' understanding of diabetes, $F(1, 70) = 2.06$, $p = .16$, partial $\eta^2 = .03$.

Satisfaction

Participants were equally satisfied with both conditions, $t(42) = 0.42$, $p = .68$, as measured by follow-up treatment satisfaction scores.

Evidence of Mediation

The mediational impact of pretreatment to follow-up differences in self-management and acceptance on differences in HbA_{1C} was assessed using a bootstrapped multivariate extension of the Sobel (1982) test (see also Baron & Kenny, 1986) developed by Preacher and Hayes (2004, 2006). The Sobel test, arguably the most powerful current method of detecting indirect effects (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002), assesses the statistical significance of the product of the coefficients for treatment–mediator and mediator–outcome effects (what is termed the *ab path*). The test is sensitive to violations of normality, however, and the ab distribution is generally not normal in finite data sets (MacKinnon et al., 2002). This problem is addressed in the current procedure by a nonparametric resampling procedure known as bootstrapping. Three thousand random samples of the original size were taken from the obtained data, replacing each value as it was sampled, and the indirect effect (ab) was computed in each sample. The point estimate of the indirect effect is the mean ab value computed over the samples; the 95% confidence interval is similar to the 2.5 and 97.5 percentile scores of the obtained distribution of ab scores over the samples but with z-score based corrections for bias due to the underlying distribution (see Preacher & Hayes, 2004, 2006). If the upper and lower bounds of these bias-corrected confidence intervals do not contain zero, the indirect effect is significant at the level specified. The product of the coefficients approach was applied to multiple mediators using multivariate analytic methods based on Bollen (1987, 1989) and others (see Preacher & Hayes, 2006). This approach examines both the total indirect effect and the individual effect of each specified mediator, controlling for the other.

In the present analysis, bias-corrected 95% confidence intervals showed that changes in acceptance and self-management (individually while controlling for the other mediator, and in total) significantly reduced the impact of treatment on follow-up changes in HbA_{1C} ($p < .05$; see Table 3).

Discussion

In a group of low-SES, dominantly minority patients being treated in the public health care system, this study showed that a 1-day traditional diabetes education workshop (education-alone condition) was associated with improved reported self-management but no improvements in diabetic control. If, however, a little less than half of the time was focused on acceptance, mindfulness, and values-based action, patient reported self-management improved significantly more, as did the changes in the numbers of patients in diabetic control at a 3-month follow-up. Further, changes in blood glucose from pretreatment to follow-up were mediated both by changes in self-management and in diabetes-related acceptance. Thus, both at an outcome and process level, this randomized trial provides initial support for the importance of an acceptance, mindfulness, and values-based approach to

Table 3
Bootstrapped Point Estimates and Confidence Intervals (CIs) for the Total and Specific Indirect Effects of Change in Study Variables at Follow-Up as Mediators of HbA_{1C} at Follow-Up

Variable	Point estimate	Product of coefficients			Bootstrapping BCa 95% CI	
		SE	*Z*	*p*	Lower	Upper
Change in acceptance	−.33	.21	−1.67	<.1	−0.720	−0.004
Change in self-management	−.28	.18	−1.57	<.12	−0.847	−0.071
Total	−.61	.27	−2.24	<.05	−1.353	−0.119

Note. Negative signs indicate that higher levels of acceptance and self-management were associated with lower blood glucose levels. BC_a = bias-corrected and accelerated confidence interval.

helping medical patients develop the psychological resources to manage a chronic and life-threatening disease.

Diabetes researchers have called for the development of interventions designed to reduce diabetes-related distress in order to increase adherence with medical regimens (Melkus et al., 2003). Given this, there may be practical advantages to acceptance, mindfulness, and values-based action as a method of dealing with the psychological challenges of this chronic disease. Diabetes carries a substantial risk of disability and death, and it is reasonable for a person to respond to such threats with fear, worry, sadness, and avoidance. It can be invalidating and disempowering not to address these difficult thoughts and feelings.

Still, psychological approaches mandating a focus on the content of these domains seemingly require the patient to sort through which thoughts and feelings are rational or irrational, excessive or expected. This sorting process might actually increase self-focus and make nonavoidant effective actions difficult. Acceptance and mindfulness provides a generally applicable and relatively easy alternative to this dilemma, especially when combined with values-based action. The simplicity of the ACT model is suggested by the very short intervention used in this study. The general applicability of the model is supported by the fact that it has been demonstrated to be useful with other health-related problems such as chronic pain (Dahl et al., 2004; McCracken, Vowles, & Eccleston, 2004), epilepsy (Lundgren et al., in press), and positive health care actions such as smoking cessation (Gifford et al., 2004).

In determining the clinical implications of an educational intervention for diabetes self-management, it is important to examine its effects on the ability of participants to achieve recommended levels of control, given the clear evidence that obtaining these suggested levels is related to lower incidence of diabetes complications such as stroke, heart attack, and even death (UKPDS, 1998). Diabetes treatments addressing lifestyle or behavior change have typically involved a large investment of time, money, and other resources by both medical staff and patients and tend not to be delivered in primary care and community health center settings where they are needed the most (Glasgow, Strycker, Toobert, & Eakin, 2000). Low-SES and minority patients often face severe practical challenges in accessing complex and frequent forms of treatment, such as difficulties with transportation and child care. These challenges are lessened with a short, intense workshop. Other research has shown that ACT is helpful with minority populations with severe mental illness (Gaudiano & Herbert, 2006) and with low-SES native South Africans with epilepsy (Lundgren et al., in press).

There are several methodological weaknesses that need to be noted in the present study. Fidelity to the treatment manuals was not assessed, and the ACT intervention was delivered by a single individual; thus, therapist effects are possible. In addition, the follow-up period was only 3 months, and the trial was modest in size. Future studies will need to address these issues.

The self-management measure used in this study focused on only certain aspects of self-management (days per week of diet, exercise, and glucose monitoring). These behaviors do not represent a comprehensive list of diabetes self-management. Including items on medication adherence, smoking, alcohol use, weight management, foot care, and eye care would be helpful in future studies. In addition, the psychometric properties of the composite self-management measure used are not yet known, although the measure on which the items were modeled has demonstrated good psychometric properties (Toobert, Glasgow, & Hampson, 2002).

There is growing evidence that acceptance-based coping is associated with less distress across chronic medical conditions (Classen et al., 2001; Greer, 1991) and that avoidant and passive coping is less effective than active coping strategies across a wide array of stressors (Thompson, Gil, Abrams, & Phillips, 1992). The present study shows that it is possible to impact these coping strategies quickly through a psychoeducational intervention, providing an alternative to existing approaches that emphasize the role of control of emotions and thoughts in the maintenance of good self-management behaviors (e.g., Henry, Wilson, Bruce, Chisholm, & Rawling, 1997). Taken together, the results of the present study provide an alternative approach worth exploring in the management of this chronic disease.

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Appendix

Acceptance and Action Diabetes Questionnaire (AADQ) With Scoring Information

1	2	3	4	5	6	7
never true	very seldom true	seldom true	sometimes true	frequently true	almost always true	always true

1. I try to avoid reminders of my diabetes.
2. I have thoughts and feelings about being diabetic that are distressing.
3. I do not take care of my diabetes because it reminds me that I have diabetes.
4. I eat things I shouldn't eat when the urge to eat them is overwhelming.
5. When I have an upsetting feeling or thought about my diabetes, I try to get rid of that feeling or thought.
6. I avoid taking or forget to take my medication because it reminds me that I have diabetes.
7. I avoid stress or try to get rid of it by eating what I know I shouldn't eat.
8. I often deny to myself what diabetes can do to my body.
9. I don't exercise regularly because it reminds me that I have diabetes.
10. I avoid thinking about what diabetes can do to me.
11. I avoid thinking about diabetes because someone I knew died from diabetes.

(*All items are reverse scored except Item 2*)

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