

Evaluation of mediators of change in the treatment of epilepsy with acceptance and commitment therapy

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Abstract The present study examined the mediators of change accounting for outcomes of a previously published study on acceptance and commitment therapy for the self-management of epilepsy and its life restricting impact. Conducted with 27 poor South Africans, a 9-h ACT protocol that included seizure management methods was shown to greatly reduce epileptic seizures and to increase quality of life over the next year as compared to an attention placebo control. A series of bootstrapped non-parametric multiple mediator tests showed that pre to follow-up changes in: seizures, quality of life, and well-being outcomes were mediated to a degree by ACT process measures of epilepsy-related acceptance or defusion, values attainment, persistence in the face of barriers, or their combination. The results of this study contribute to the understanding of the contextual conditioning mechanisms at work for those suffering from epilepsy and may show that helping people live vital lives may also help to reduce seizures.

Keywords Acceptance and commitment therapy · Mediation analysis · Epilepsy · Values · Acceptance · Defusion · Psychological flexibility · South Africa

Introduction

Epilepsy has a substantial impact on physical, emotional, interpersonal, cognitive, and behavioral health (Austin 1989; Hitiris et al. 2007; Lambert and Robertson 1999). Although psychologists have long been involved in documenting these effects and in understanding their causes, there is also a small existing literature on the impact of psychosocial interventions on epilepsy itself. Researched methods include: relaxation training, behavior modification, self-management, and cognitive behavior therapy. A recent Cochrane review (Ramaratnam et al. 2004) identified seven methodologically adequate studies that showed significant reductions in seizure occurrence and used randomized controlled experimental designs, objective dependent measures, use of blood serum levels to control for antiepileptic drug use, 1-year follow up, and adequate statistical methods (Dahl et al. 1985, 1987; Fried et al. 1984; Lindsay and Baty 1986; Montgomery and Epsie 1986; Rosseau et al. 1985; Tan and Bruni 1986). Ramaratnam et al. (2004) concluded that none of these methods could yet be recommended due to the small number and size of these trials, but these studies raise the possibility that epilepsy can be viewed as more than a neurological dysfunction.

In much the same way that a panic attack is a physiologically substantial event, but yet is modifiable by psychological methods, it appears possible that epileptic seizures may be able to be regulated in at least in some patients. Wolf (2005) has proposed that seizures may be either triggered or inhibited by specific sensory or cognitive inputs activating circumscribed cortical areas or functional anatomic systems that respond with an epileptic discharge due to functional instability. Instead of conceptualizing the epileptic seizure merely as a symptom of a

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neurological dysfunction, epilepsy can be thought of as a phenomena consisting of a predisposition (seizure tendency) and contextual or psychological factors that may increase or decrease the probability of seizure occurrence (Dahl 1992). This raises the possibility that psychological and conditioning mechanisms may be involved in the triggering and inhibition of an epileptic seizure.

Psychology is relevant to epilepsy in a second way, however. A number of studies have shown that negative thoughts and emotions and avoidant behavior associated with the epileptic seizure may be more handicapping than the seizure itself (Newson et al. 1998; Spector et al. 1994). Chronic epilepsy is correlated with psychiatric disorders such as depression, low quality of life and general poor health outcome (Tomson et al. 2004; Johnson et al. 2004; Cummins 1997). The stigmatization of the diagnosis of epilepsy, along with all the potential threats associated with seizure occurrence, leads to stressful emotions, which in turn, lead to additional seizures (Haut et al. 2003). Thus, a psychological approach to epilepsy should consider both the specific context of the seizure behavior itself as well as the general avoidant behavior patterns and negative thoughts and emotions associated with having the diagnosis of epilepsy.

A recent study (Lundgren et al. 2006) did just that using Acceptance and Commitment Therapy (ACT) (Hayes, Strosahl 1999). ACT is a specific model of behavioral and cognitive therapy that combines traditional methods with acceptance, mindfulness, and values so as to change a client's relationship to difficult emotions and thoughts, and produce more psychological flexibility. In a randomized controlled trial comparing an ACT protocol containing behavioral seizure management methods to a supportive treatment with 27 institutionalized poor South Africans suffering from epilepsy, Lundgren et al. (2006) found that a 9-h individual and group program reduced seizures dramatically. In the first month following exposure to the ACT protocol, 57% were seizure free compared to none in the control group. Twelve months later, 86% were seizure free, compared to 8% in the control group (Yates $\chi^2 = 13.5$, $p < .0003$, $d = 1.99$). Over a 1-year follow-up, quality of life, personal well-being, and life satisfaction measures continued to improve.

Despite its relatively small size, this study is one of the largest psychosocial trials ever conducted for epilepsy. It is also the first, so far as we can determine, that has collected process data that might allow mechanisms of action to be studied through mediational analysis. Mediational analysis is important in therapy research because it allows the underlying model to be tested, not merely the treatment outcome. Mediational analysis requires theoretical specificity and measures that assess the targeted change processes, but even well specified psychosocial models often

fail mediational tests (e.g., Longmore and Worrell 2007). In the case of ACT, successful mediational analyses have been reported on ACT for: smoking (Gifford et al. 2004), burnout (Hayes, Bissett, Roget et al. 2004; Hayes, Strosahl, Wilson et al. 2004), stress (Bond and Bunce 2000), diabetes management (Gregg et al. 2007), depression (Zettle and Hayes 1986, as reanalyzed in Hayes et al. 2006), and psychosis (Gaudiano and Herbert 2006) among other problems (see Hayes et al. 2006 for a review).

Mediational analysis is particularly important in the case of ACT because it is conceptualized as a therapy model linked to functional processes, not a topographically defined set of techniques. We will briefly explain the model and why mediational analysis is particularly important.

ACT focuses on helping the client to contact the present moment more fully as a conscious person and to change or persist in behavior in the service of chosen values. This is established through six core functional processes: acceptance, cognitive defusion, focusing on the present, enhancing a transcendent sense of self, values clarification, and encouraging committed action. These areas are conceptualized as positive psychological skills rather than as methods of avoiding psychopathology and its emotional results.

Acceptance is taught as an alternative to experiential avoidance. Acceptance involves an active and conscious embracing of those private events occasioned by one's history without unnecessary attempts to change their frequency or form, especially when doing so would cause psychological harm. In the case of epilepsy, acceptance involves embracing the fears associated with having seizures, acknowledging the predisposition to seize, and making room for frightening thoughts about the disorder. Acceptance also means teaching clients to relate to the "aura" or start of seizures with an open, embracing attitude, becoming aware of all the sensations, thoughts and feelings related to the impending seizure rather than adopting a posture of avoidance and struggle related to these sensations, thoughts and feelings. Acceptance is not construed an end in itself but rather as a method of increasing flexible values-based actions.

Cognitive defusion techniques attempt to reduce the unnecessary behavioral impact of thoughts by learning to see them merely as thoughts, unfolding in the moment. In other words, clients are taught to look at the process of thinking in a more mindful way, rather than merely dealing with the world structured by that thinking. By changing how clients relate to their thoughts, more flexible forms of action can occur with regard to them. For example, in the case of epilepsy, therapists might role-play being thoughts and fears about seizures, so that clients can view them from a different perspective and see how they function as obstacles. Such procedures attempt to add new more helpful functions to existing negative thoughts and without

any disputation, and thus, weakening the tendency to treat the thought as believable “truth” instead of being simply a thought.

Being present in the here and now, is encouraged by using mindfulness exercises to promote ongoing non-judgmental contact with psychological and environmental events as they occur. The goal is to help clients experience the world more directly and increase psychological flexibility. In the Lundgren et al. (2006) study, clients were encouraged to experience seizures more fully rather than to resist and struggle with thoughts, feelings and sensations related to the seizures.

In ACT, clients are encouraged to note the sense of perspective from which awareness of experiences is possible without attachment to their content. ACT theorists label this sense “self as context” and foster it through mindfulness exercises, metaphors, and experiential processes. In this study, clients learned to discriminate between “self as epilepsy” and “self as context”. Identifying oneself with epilepsy, means seeing the world from the perspective of epilepsy and seizures and letting that perspective steer life choices. From the “self as context” perspective, clients could see that epilepsy was just one content of life, among many others, none of which they identified with. From the “self as context” perspective, clients could connect with human values and make choices in alignment with those values.

Values in ACT are chosen qualities of purposive action that can never be obtained as an object but can be instantiated moment by moment. ACT uses a variety of exercises to help a client choose life directions in various domains (e.g., family, career, spirituality) while undermining verbal processes that might lead to choices based on avoidance or social compliance. In this study, all of the participants filled in a “life compass” in the first session where they identified deeply held constant valued intentions in a number of life domains.

Finally, ACT fosters the development of larger and larger patterns of effective action linked to chosen values. Clients are encouraged to make and keep commitments to move in directions they value but either persisting or changing as the situation requires. Almost any traditional behavior change strategy is encompassed in this aspect of an ACT model.

In an ACT model, all six ACT processes are argued to be intertwined to create greater psychological flexibility in movement toward a more vital, values consistent life. ACT is in some ways like traditional behavior therapy and almost any behaviorally coherent behavior change method can fit into an ACT protocol, including exposure, skills acquisition, shaping methods, goal setting, and the like.

Because ACT is part of the cognitive and behavioral therapies at large (Hayes, Bissett, Korn et al. 1999; Hayes,

Strosahl, Wilson 1999), it is important to show that ACT processes are critical to ACT outcomes. One way to do this, is to compare specific components of ACT to specific components of traditional cognitive behavior therapy and see if the differences found comport with ACT theory. This has been successfully done in several subclinical studies in areas such as food urges or pain (e.g., Forman, Hoffman et al. 2007; Vowles et al. 2007). However, it is a prohibitively expensive approach in early work with clinical populations due to the very large studies it requires. Meditational analysis presents a very useful alternative, and so far mediational results suggest that ACT is not the same as existing methods. There have been nine comparisons of ACT and traditional behavioral or cognitive therapy (Bond and Bunce 2000; Forman, Herbert et al. 2007; Forman, Hoffman et al. 2007; Hayes, Bissett, Korn et al. 1999; Hayes, Strosahl, Wilson 1999; Lappalainen et al. 2007; Masedoa and Esteve 2006; Zettle 2003; Zettle and Hayes 1986; Zettle and Rains 1989). All have found differences in processes of change that comport with an ACT model.

This is important in the case of an ACT approach to epilepsy because ACT uses behavioral methods in an acceptance and values-based context. If ACT for epilepsy works through specific ACT processes, it makes it less likely outcomes are due to technological components alone, outside of an ACT approach. This point includes general psychosocial processes, (e.g., demand) which is one reason mediational analysis is garnering such substantial attention in modern psychology (MacKinnon et al. 2007).

The present study examined the relevance of these factors empirically by conducting a set of mediational analyses on key ACT processes as they related to the 1-outcomes of ACT for epilepsy, to see if the ACT model could help explain the results obtained. The processes examined were: acceptance and action, and values. Acceptance and action assesses a cluster of ACT concepts related to psychological flexibility (acceptance, defusion, and values action) and have been examined in several previous ACT studies (e.g., Bond and Bunce 2000; Gifford et al. 2004; Gregg et al. 2007). This is the first study to report mediational results for values measures in ACT. These two areas were selected because they are central to an ACT model and measures were available for use with the population studied.

Method

Lundgren et al. (2006) should be consulted for a full description of the procedure and samples, but a basic outline will be given here. Participants were institutionalized South African patients who had been admitted to an

inpatient epilepsy institution operated by Epilepsy South Africa under the aegis of the World Health Organization. Patients were diagnosed by a neurological examination as having drug refractory EEG verified epilepsy ($N = 28$). Patients with seizures secondary to psychiatric or other medical diagnoses were also screened out as part of the admission procedures and additional assessment of psychiatric or medical status was not conducted by the investigators. Patients were randomly assigned to Acceptance and Commitment Therapy (ACT; $N = 14$) or to supportive treatment ($N = 14$). One of the participants in the supportive treatment condition died of natural causes during the trial leaving 13 participants in that condition. There were no other dropouts or missing data elements.

There were no significant differences between the groups in terms of age, gender, seizing time or type of epileptic seizure. The most frequent seizure type was Generalized Tonic Clonic (GTC). Two clients in the ACT group and one client in the supportive treatment group were diagnosed with Partial Complex Seizure (PCS). All clients in both groups were undertaking medical treatment with antiepileptic drugs, Phenytoin and Carbamazepine. While diagnosis was confirmed by EEG monitoring, there was no physiological assessment of the seizure results of the study. Seizure counts recorded as 'seizing time' was monitored and charted by the nursing staff. Participants kept prospective seizure diaries throughout the study.

ACT participants were exposed to the six core processes in ACT (acceptance, defusion, contact with the present moment, a transcendent sense of self, values, and committed action; Hayes et al. 2006) combined with behavioral seizure management methods (Dahl et al. 1992). The behavioral principles included teaching the participants to: (1) *predict* a seizure response by discriminating intrinsic and extrinsic factors associated with seizure onset, (2) *prevent* seizure occurrence by encouraging clients to engage in activities generally and specifically those previously avoided due to fear of seizures, (3) *interrupt* an ongoing seizure by means of increasing or decreasing activity or stimulation (visual, tactile, sensory, olfactory, gustation) and (4) alter the function of the seizure by encouraging alternative behaviors fulfilling similar functions (attention seeking, withdrawal of demands, physical contact, etc).

There was no informational psychoeducation regarding epilepsy per se. Supportive treatment participants were given the same amount of professional attention by the same therapists (the first two authors of this paper), reflecting on their epilepsy in a non-judgmental and accepting way. Each participant was given 9 h of therapy consisting of one individual session, two group sessions and one individual session. The duration of the group sessions were 3 h and the individual sessions 1.5 h each.

Measures

There were two primary process measures used in this study, yielding three scores.

Psychological flexibility: AAEPQ

Acceptance and Action Epilepsy Questionnaire (AAEPQ) is an eight item Likert scale (see Table 1) that is based on a modification of items from the Acceptance and Action Questionnaire (AAQ; Hayes, Bissett, Roget et al. 2004; Hayes, Strosahl, Wilson et al. 2004). Two of the items are identical to those in the AAQ; the others were modified to focus on epilepsy-related thoughts or feelings. The AAQ is a widely used ACT process measure that assesses several aspects of psychological flexibility including emotional acceptance, cognitive defusion, and action in the face of difficult emotions. A number of specific forms of the AAQ have been successfully developed by changing the wording of AAQ items to focus on disorder specific content such as the Acceptance and Action Diabetes Questionnaire (AADQ; Gregg et al. 2007) which has been shown to mediate the effects of an ACT protocol for diabetes management (Gregg et al. 2007).

Items were keyed so that low scores indicate lower levels of avoidance and cognitive fusion (i.e., greater flexibility). Chronbach's alpha of the measure at baseline in this study was .65, and increased above .76 in both groups in subsequent administrations (after baseline, these were calculated within group to avoid contaminating alpha with between group differences). These values are considered acceptable for a scale in early use, particularly one with few items.

Values attainment and persistence with barriers: values Bull's eye

Values attainment and persistence when encountering barriers were measured by use of a series of dartboards. For the first three dartboards, the client is asked to describe a specific deeply held valued direction that could see improvement in living according to that value. The center of the dartboard (the "bull's eye") represents living fully in accord with that value and the client is asked to place an X representing how close to the bull's eye he or she is currently living. In a final dartboard, the client is asked to write down the psychological barriers to living in accord with values and to make an X representing his or her persistency in pursuing valued action in the face of the described barriers. The distance between bull's-eye and the edge of all four dartboards is 4.5 cm. Scores represent the distance between the mark and the bull's eye. Thus, scores

Table 1 AAEPQ items and format Below you will find a list of statements. Please rate the truth of each statement as it applies to you using the scale below to make your choice

1	2	3	4	5	6	7
Never true	Very seldom true	Seldom true	Sometimes true	Frequently true	Almost always true	Always true
1. _____ Anxiety is bad						
2. _____ If I could magically remove all the painful experiences I've had in my life, I would do so						
3. _____ My thoughts and feelings about having epilepsy are too distressing						
4. _____ When I have upsetting feelings or thoughts about my epilepsy, I try to get rid of those feelings or thoughts						
5. _____ I am too scared of what epilepsy can do to me to think about it every day						
6. _____ I cannot exercise regularly because it reminds me that I have epilepsy (or because I was told not to exercise by my doctor)						
7. _____ I want to avoid thinking about what epilepsy can do to me						
8. _____ I want to avoid thinking about epilepsy because someone I know/knew has hurt themselves from epilepsy						

can vary from 0 to 4.5, with lower scores equaling greater attainment or persistence. Values attainment constitutes the mean of the first three dartboards; persistency through barriers is generated by the single measure. The Bulls-Eye has a test–retest reliability of .86 and good criterion related validity (Lundgren 2006).

Outcome measures

The primary outcome measure was the total time of seizures per month taken from seizure diaries and verified by nurses' records. Three self-reported outcome measures were also obtained: the World Health Organization Quality Of Life measure (WHOQOL), the Subjective Well Being Life Scale (SWLS), and the Personal Well Being Index (PWI).

The WHOQOL is an abbreviated, 26 item measure of physical, psychological, social and environmental health (World Health Organization 1996). It has good internal consistency (Amir et al. 2000). Scores range from 0 to 130 with higher scores indicating better life quality.

The SWLS is a brief 5 item questionnaire that measure global life satisfaction (Diener et al. 1985). The SWLS has shown good internal reliability and temporal stability (Diener et al. 1985). Higher scores equal higher satisfaction.

The PWI, in this study, consists of seven questions about general well being for intellectual disabilities (Cummins 1991). Participants are asked to rate how happy or sad they feel about their life situation in several areas. Higher scores equal higher well-being.

Analytic strategy and rationale

Mediational analysis compares the X (treatment)–Y (outcome) relation (the “c path”) with that relation accounting for the mediators of interest (the “c’ path”). In causal steps mediational analyses, such as the well-known method popularized by Baron and Kenny (1986), the difference

between c and c’ is not directly tested, but is inferred indirectly on the basis of the significance of the treatment-mediator (X–M or the “a path”) and mediator-outcome (M–Y controlling for X, or “b path”) relations, and the loss or reduction of significance of the c path when the variance due to the a and b paths are removed. Because the maximum amount of variance to be explained is set by the X–Y (c path) relation, however, the larger the a path the smaller the b path and vice versa. Since the a and b paths are mutually related, if treatment has a very strong effect on a mediator there is limited opportunity in a causal steps model for the b path to be significant.

This is one major reason why the cross-product of the coefficients approach is a notably better method of detecting indirect effects than causal steps analysis (MacKinnon et al. 2002). Cross-product of the coefficients tests multiply the coefficients for the a and b paths, and test the statistical significance of the result, providing a single test for the X–M–Y relations. Since a*b equals c – c’ in finite data sets (MacKinnon et al. 2002), these tests directly assesses the statistical significance of the mediational or indirect effect without needlessly spending power to conduct separate tests on the a and b paths, which are best examined as a whole due to their mutuality.

The best known cross product of the coefficients test is the Sobel (1982; see also Baron and Kenny 1986) which uses multivariate delta logic to generate an error term, thus enabling a statistical test of the cross product. Unfortunately, the Sobel is sensitive to violations of normality, and the a*b distribution is generally not normal in finite data sets even if the underlying measures are normally distributed (MacKinnon et al. 2002).

In the present study the mediational impact of post measures of ACT processes on pre to follow-up differences in quality of life, well-being, and seizure outcomes were assessed using a non-parametric bootstrapped multivariate approach to the cross-products of the coefficients developed by Preacher and Hayes (2004, 2008). For each

analysis 1,000 random samples of the original size were taken from the obtained data, replacing each value as it was sampled, and the indirect effect ($a*b$) was computed in each sample. The point estimate of the indirect effect is the mean $a*b$ value computed over the samples. Confidence intervals are then derived from the obtained distribution of $a*b$ scores over the samples (with Z -score based corrections for bias due to the underlying distribution; see Preacher and Hayes 2004, 2008). Thus, a 95% confidence interval would consist of the bias corrected 2.5 and 97.5 percentile scores of the actual distribution of obtained $a*b$ values in the bootstrapped samples. 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. This requires no assumption regarding the underlying distributions since the statistical significance level is determined non-parametrically.

Only values that reached conventional levels of significance were interpreted. Because of the small number of participants ($N = 27$) the present study had adequate power (.8 or above) only to detect large outcome effect sizes (Cohen 1992). Mediation analysis is notably less powerful than outcome analysis (MacKinnon et al. 2004), which means that only very strong mediational effects would be likely to be detected in the present study.

In addition to the analysis of ACT mediators, we also examined post scores for the psychological health subscale of the WHOQOL as a mediator since it might be argued that any impact seen on seizures might be due to reductions in psychological distress (e.g., anxiety, depression).

Results

Although outcomes were examined in Lundgren et al. (2006), the impact of ACT on the PWI and on the mediators used here was not reported in the original study. Thus, we first report the between group results for post scores for process measures and pre to follow-up scores for outcome measures since these will be used in the mediational analyses. These are shown in Table 2.

ACT had a very large and statistically significant impact on all outcome measures (assessed here as pre to follow up changes scores) and all process measures measured at post. Cohen's d was above 1.72 for these measures, which means that at least 42% of the variance in each was explained by treatment differences.

The strength of the relationships between post ACT processes and follow-up changes in outcome can be initially characterized by correlating the process and outcome measures. These values are shown in Table 3. Post-treatment ACT process measures correlated with 1-year follow-up changes in outcomes between .42 and .74, accounting for as much as 55% of the variance. This seems particularly notable in light of the fact that some of these outcomes (e.g., WHO quality of life) had not yet changed significantly when the post process measures were taken. Note that the sign of the correlations can be confusing because of the directional scoring in these measures (see measures section) so it is less confusing just to focus on the magnitude of the correlations rather than the sign since in all cases the correlations are supportive of the ACT model.

Table 2 Means and standard deviations for study measures, and between group effect sizes and t -test results

Measure	Condition	Mean	SD	Cohen's d	t test (df = 25; $p < .000$ in all cases)
<i>Outcome measures (pre to follow-up change scores)</i>					
Seconds seizing/month	Control	-12.7	36.0	1.78	4.52
	ACT	-415.9	319.23		
WHO quality of life	Control	-2.8	7.05	-2.02	-5.23
	ACT	13.7	9.19		
Subjective well-being life scale	Control	-1.5	3.31	-2.60	-6.68
	ACT	10.9	5.82		
Personal well-being index	Control	-9.2	12.91	-2.02	-5.25
	ACT	17.3	13.22		
<i>Process measures (post scores)</i>					
Attainment	Control	3.6	0.55	2.83	7.29
	ACT	1.7	0.74		
Barriers	Control	3.3	0.74	2.44	6.32
	ACT	1.4	0.87		
Acceptance and action epilepsy questioner	Control	24.2	8.06	1.72	4.48
	ACT	10.9	7.38		

Table 3 Pearson correlations between post-treatment ACT process and changes in outcomes at the 1-year follow-up

	Seizures	Satisfaction with life scale	WHO quality of life	Personal well being
Psychological flexibility	.62	-.42*	-.59	-.48*
Values attainment	.63	-.61	-.72	-.71
Overcoming barriers	.62	-.65	-.68	-.73

All correlations are significant at $p < .001$ (two tailed) except * = $p < .03$

Mediation

The primary purpose of the present study is to examine formal mediation. For each of the four outcome measures, using pre to follow-up change scores, the three post score measures of ACT processes were examined individually and as multiple mediators, in all combinations. The point estimate of the cross product of the coefficients and their associated alpha levels taken from bias corrected and accelerated non-parametric confidence intervals (Preacher and Hayes 2004, 2008) of the statistically significant overall mediational models are shown in Table 4. Three of the four measures showed evidence of mediation by ACT processes. In the description below the c (treatment effect on outcome) and c' (treatment effect on outcome with the indirect effect removed) effects will also be described for the strongest models since that difference ($c - c'$) that is being directly tested.

Seizures

ACT process measures post-treatment significantly mediated changes from pre-assessment to the 1-year follow-up in the total seconds of seizures per month (see Table 4). As measured by statistical significance and the size of the products of the coefficients relative to the standard error, the strongest mediational model was based on post levels of epilepsy-related psychological flexibility. Models involving values attainment and persistence in the face of barriers, either alone or in combination with epilepsy-related psychological flexibility, also functioned as mediators.

The impact of treatment on seizures at the 1-year follow up was highly significant ($t = 4.52, p < .001$) but when the mediational effect of the post values of epilepsy-related psychological flexibility was included, treatment was no longer related to seizure outcomes ($t = 1.86, p = ns$). The same was true with all significant models (Table 4) on this outcome measure. It should be noted, however, that many epileptic patients also suffer from non-epileptic seizures (Alsaadi and Vinter-Marquez 2005), so some of these effects may go beyond epileptic seizures per se.

Post scores for the psychological health domain of the WHOQoL were not a significant mediator of seizure follow-up outcomes, suggesting that the impact of ACT on psychological distress was not responsible for the seizure reductions seen.

Quality of life: WHOQoL

Quality of life was mediated by a combination of values attainment and persistence in valued action in the face of

Table 4 Significant bootstrapped point estimates and bias corrected, percentage of outcome effect mediated, and accelerated (BCa) confidence intervals for the total and specific indirect effects on primary outcomes

Product of ab coefficients	Point estimate				Percent mediated ($1 - (c'/c)*100$)	Bootstrapped BCa 95% CI	
	SE	Z	p<	Lower		Upper	
<i>Seconds of seizures per month</i>							
Epilepsy-related psychological flexibility	-156.9	83.4	1.88	.01	58.8	-654.2	-22.7
Epilepsy-related psychological flexibility and values attainment	-234.1	151.2	1.55	.02	78.8	-915.5	-23.1
Epilepsy-related psychological flexibility and persistence in overcoming barriers	-255.9	191.3	1.34	.02	81.2	-1,382.1	-9.8
Values attainment and persistence in overcoming barriers	-169.3	158.3	1.07	.05	67.7	-843.4	-1.0
Epilepsy-related psychological flexibility and values attainment and persistence in overcoming barriers	-263.5	202.3	1.30	.02	85.6	-1,740.7	-5.0
<i>WHO quality of life</i>							
Values attainment and persistence in overcoming barriers	9.3	5.4	1.73	.05	73.8	.62	22.3
<i>Personal well being</i>							
Persistence in overcoming barriers	12.8	7.2	1.66	.05	64.4	.74	28.9
Values attainment and persistence in overcoming barriers	15.9	9.5	1.67	.03	74.5	.18	50.0

barriers. The impact of treatment on quality of life as measured by the WHOQoL at the 1-year follow up was highly significant ($t = 5.23$, $p < .0001$) but when the mediational effects of values attainment and persistence in valued action were included, treatment was no longer related to quality of life outcomes ($t = 1.37$, $p = .ns$).

Quality of life: SWLS

There were no mediational effects for the 1-year follow-up changes in the Satisfaction With Life Scale.

Well being

The largest and most statistically significant ($p < .05$) mediational model for the 1-year follow-up changes in the Personal Wellbeing Index was based on a combination of values attainment and persistence in valued action in the face of barriers (Table 4). Each of these values measures also functioned independently as mediators. The impact of treatment on personal well being at the 1-year follow up was highly significant ($t = 5.25$, $p < .0001$) but when the mediational effect of the two values measures at post were included, treatment was no longer related to well-being outcomes ($t = 1.34$, $p = ns$).

Discussion

The ACT model emphasizes the importance of developing greater behavioral flexibility by teaching acceptance and mindfulness skills designed to reduce entanglement with thoughts and undermine the avoidance of feelings. Clinical attention then shifts to the vitality that comes from living a valued life and the strength that comes from persisting in the face of psychological barriers. The goal is to see thoughts, memories or other private experiences for what they are and to take steps in a valued direction which experiencing these private events as ongoing events that echo the past but do not determine the present.

Previous mediational analyses of ACT have emphasized defusion, acceptance, and committed action (Hayes et al. 2006). The AAEPQ includes items in these areas. The present study expands the analysis of ACT processes by strengthening the assessment of values and for the first time examining their mediational role in ACT.

The results in this study indicate that these processes, alone or in combination, had a mediational role in three of the four outcomes in the first test of ACT for epilepsy (Lundgren et al. 2006). It is unusual to obtain significant mediational results with such a small sample, considering also that the cross-products test is a rather demanding test of mediation (MacKinnon et al. 2002). The present study is

too small to examine precisely how these separable but related processes and specific outcomes correlate over time, but it does provide evidence that these processes are worth further exploration. As predicted by the underlying model, psychological flexibility and engaging in activities that are valued appear to be important processes in the ACT treatment of epilepsy in its ability to produce reductions in seizures and improvements in quality of life and well being. There are other aspects of the ACT model that were not tested in the present study, however, including contact with the present moment, a transcendent sense of self, and commitment. Thus, the present results confirm the utility of only parts of an ACT model.

Behavioral seizure management was not originally designed to target processes of valued action, defusion, and the like, yet the current results show that the package used by Lundgren et al. (2006) was mediated by ACT processes. It is still possible, that the behavioral methods alone could have been mediated in the same way but it would be surprising given the specificity of the processes involved and the fact that in all other studies so far conduct (e.g., Bond and Bunce 2000) behavioral methods alone do not alter ACT processes. The present results thus make it more likely but still not certain that an ACT approach per se was important in the effects seen in Lundgren et al. (2006), despite the fact that the package included behavioral methods (as recommended in ACT—Hayes, Bissett, Korn et al. 1999; Hayes, Strosahl, Wilson 1999).

Until mediation is understood, some may view the impact of ACT on these processes merely as a matter of treatment socialization. That is not what successful mediation assesses, for the following reason. In mediational analysis it is necessary to control for treatment in the regression of the mediation on outcomes, because otherwise any variable that increased with treatment would be a “mediator” of outcomes. Common-sense shows how inappropriate that would be. For example, merely knowing the unique terms used in a particular treatment would be thought to be important to clinical outcome, when in fact no one without exposure to the specific approach would know these terms. Such concerns are why mere correlations of potential mediators on outcomes (such as those in Table 3) do not directly indicate mediation. If treatment accounted for all of the variance in a potential mediator, for example, mediation is impossible even if the mediator also correlated strongly with outcome. This is because the b path would necessarily be equal to zero when treatment is included, resulting in a zero value for the $a*b$ cross product.

In the present case, understanding these points allows the mediational results to be more fully appreciated. These mediational results do not assess a mere process of socialization to a treatment model. Values and psychological flexibility are strongly moved by ACT, but they

also relate to outcome above and beyond that fact. It is the factual basis of these two claims that is statistically assessed by the non-parametric bootstrapped cross-product tests in this study, and that is confirmed by the present results.

Mediation does not mean causation, but it is important to note that the mediators in this study were collected 1 year before the outcomes tested in this paper, and in some cases before outcomes had changed significantly (Lundgren et al. 2006). In combination with experimental studies that show the value of targeting specific ACT processes such as acceptance (e.g., Forman, Herbert et al. 2007; Forman, Hoffman et al. 2007; Levitt et al. 2004) or defusion (Masuda et al. 2004), the present results strengthen the view that the ACT model is worth exploring in behavioral health.

As a practical matter the processes assessed in the present study deserve further attention in the area of epilepsy, which has received only limited attention by psychosocial researchers. There are many processes that need to be evaluated and tested to build a behavior health model that suits the challenge of helping those who suffer from epilepsy and related problems. In this study values attainment and psychological flexibility are evaluated processes that show that there may be important parts of an effective treatment model. Mere reduction in psychological distress, conversely, did not lead to improvements in seizure outcomes. Nevertheless other possible mechanisms of change could also explain the results in this study. Future research needs to investigate other possible mechanisms in the behavior change process.

It is worth noting that the South African context is unique in many ways. People living inside the present institution were deprived important parts of life such as contact with their children, friends and family, due in large part to the stigma of epilepsy in this traditional society. When we asked “what do you want in your life that you don’t have today” the answers were usually quite obvious. These patients wanted to have contact with their children, family, and friends, and to contribute to society. Working with psychological flexibility around obstacles really fostered a very strong urge to take action in important valued directions. When the participants started to be active in valued directions (measured by the Bulls-Eye) they flourished. The mediational analysis suggests that these changes played an important role in the long term outcome obtained. These contextual factors would be very different in a developed western country. Thus, this until the study is replicated elsewhere, it should not be assumed that the outcome and process results will generalize.

Although the Lundgren et al. (2006) study requires replication, particularly with continuous EEG monitoring,

the combination of unusually strong outcomes and the mediational effects identified in the present study, suggests that at least in this context seizures and the life restriction they produce may be modifiable using behavioral seizure management methods in the context of an ACT approach that emphasizes acceptance, mindfulness, and valued action. Given preliminary evidence that ACT may have similarly robust effects due to changes in ACT processes in other behavioral medicine areas such as diabetes (Gregg et al. 2007), smoking (Gifford et al. 2004), and weight control (Lillis 2007), it seems worthwhile for clinicians and researcher to explore these processes as possible sources of health change.

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