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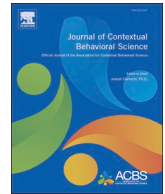
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Mediators of change in online acceptance and commitment therapy for psychological symptoms of parents of children with chronic conditions: An investigation of change processes



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1. Introduction

Acceptance and Commitment Therapy (ACT) is one of the *third-wave* cognitive behavioral therapies that incorporates methods of acceptance, mindfulness and values (Hayes, Luoma, Bond, Masuda, & Lillis, 2006), and that has been applied widely to different problems and populations (Hayes et al., 2006; Ruiz, 2010). An increasing number of studies applying ACT for parents are supporting its suitability for this population, including parents of children with autism (Blackledge & Hayes, 2006), cerebral palsy (Whittingham, Sanders, McKinlay, & Boyd, 2016), chronic pain (Wallace, Woodford, & Connelly, 2016), and cancer or life-saving cardiac surgery (Burke et al., 2014). Especially parents who have a child with a chronic condition could benefit from an intervention providing them with tools to handle everyday stressors and worries (e.g., mindfulness skills). These parents have an increased risk for stress-related problems (Anclair, Hoven, Lannering, & Boman, 2009; Lindström, Åman, & Norberg, 2010; Whalen, Odgers, Reed, & Henker, 2011) and less time to take care of their own well-being.

Online treatments provide an opportunity to improve the accessibility of evidence-based treatments for parents whose lives are often rushed and have difficulty finding time for themselves. An increasing number of studies support the suitability and effectiveness of ACT for online treatments. Promising results of web-based ACT interventions have been reported, for example, for stress (Brinkborg, Michanek, Hesser, & Berglund, 2011), anxiety (Levin, Haeger, Pierce, & Twohig, 2017), chronic pain (Buhrman et al., 2013), and depression (Lappalainen et al., 2014; Lappalainen, Langrial, Oinas-Kukkonen, Tolvanen, & Lappalainen, 2015; Levin, Pistorello, Seeley, & Hayes, 2014).

Developing effective online treatments demands an understanding of the processes that can be affected in web-based treatments in order to produce behavioral changes. Online treatments lack components of treatment that have been shown to be effective in face-to-face interventions, such as therapeutic alliance (Martin, Garske, & Davis, 2000). Online treatments are also usually more protocolized and there are less

possibilities to individualize treatment. Thus, effective ingredients in online treatments can differ from traditional forms of treatment.

Based on the theoretical framework and empirical evidence, the effective ingredients in ACT are suggested to be practices increasing psychological flexibility, defined as the ability to persist or change one's own behavior in the service of chosen values while being aware of the situational context and one's own present-moment experience (Kashdan & Rottenberg, 2010). More detailed, suggested processes of change in ACT interventions include experiential avoidance (e.g., Gifford et al., 2004; Gregg, Callaghan, Hayes, & Glenn-Lawson, 2007; Sairanen et al., 2017), mindfulness (Forman et al., 2007) and defusion (Lundgren, Dahl, & Hayes, 2008). These psychological flexibility-related processes are affected both during face-to-face and online treatments (Lappalainen et al., 2014; Räsänen, Lappalainen, Muotka, Tolvanen, & Lappalainen, 2016). However, the number of studies that have performed formal mediational analyses of change processes in web-based ACT interventions is small (Bricker, Wyszynski, Comstock, & Heffner, 2013; Pots, Trompetter, Schreurs, & Bohlmeijer, 2016; Trompetter, Bohlmeijer, Fox, & Schreurs, 2015). Furthermore, despite the increased evidence of the effectiveness of ACT in the field of caregiving (Blackledge & Hayes, 2006; Burke et al., 2014; Wallace et al., 2016; Whittingham et al., 2016), processes of change have been less thoroughly examined in regard to ACT interventions for parents. A recent study investigating a parenting intervention combined with or without ACT for families of children with cerebral palsy found that parent psychological flexibility mediated intervention effect on parental over-reactivity as well as stress and depressive symptoms in ACT-combined group (Whittingham, Sanders, McKinlay, & Boyd, 2019).

The aim of the present study was to examine treatment processes in a recently conducted randomized controlled trial (RCT) examining the effectiveness of guided online ACT for supporting the well-being of parents of children with chronic conditions compared to a waiting list control (WLC) group (Sairanen et al., 2019). The results of the RCT indicated that an ACT online treatment was effective in decreasing burnout and depression symptoms and improving mindfulness skills

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among parents. A significant mediation effect was predicted for general psychological flexibility, cognitive fusion and mindfulness skills in relation to changes in symptoms of burnout, depression, anxiety, and stress.

2. Methods

2.1. Participants

The participants ($N = 74$) were parents of children (0–18 years old) with type 1 diabetes or functional disabilities. To be eligible for this study, the parents had to have a score exceeding 2.75 points on the Shirom-Melamed Burnout Questionnaire (SMBQ) (Shirom & Melamed, 2006), indicating significant burnout symptoms (see the *Outcome measures* section for further details). Persons with a poor knowledge of Swedish (i.e., those who could not fill out the questionnaires in Swedish) were excluded from the study, as were those undergoing any other psychological treatment. The participants were required to have access to the Internet and use a computer daily.

The participants' mean age at the start of the study was 42.7 years ($SD = 6.9$), and 19% were men and 81% women. The majority of participants were married or living with a partner (80%) and had a post-secondary level or university education (73%). 48% of the children had type 1 diabetes and 52% had long-term inherent or early psychological or physiological functional disabilities, including mostly Attention-deficit/hyperactivity disorder (ADHD), autism, Asperger syndrome, and cerebral palsy.

2.2. Procedure

The study was approved by the Regional Ethical Review Board at Uppsala University, Uppsala, Sweden. All participants gave written, informed consent to their participation in the study.

The participants were recruited through the pediatric clinic of the County Council of Värmland, who sent invitation letters to parents of children with type 1 diabetes, as well as through the pediatric habilitation center of the County Council of Värmland, who sent an invitation to parents of children with functional disabilities.

After completing the online screening questionnaires (SMBQ) (Shirom & Melamed, 2006) and submitting their informed consent, the participants who met the inclusion criteria were randomly assigned by a researcher outside of the research group to the web-based ACT intervention or to a waiting list control (WLC) group. Furthermore, each participant was randomly assigned to one of 17 coaches. Four participants dropped out before the intervention started (two in the ACT group and two in the control group). At the start of the study, the ACT group comprised 37 participants, including three couples; the control group comprised 37 participants, including five couples.

Participants completed a web-based survey including outcome (SMBQ, DASS) and process measures (AAQ-II, FFMQ and CFQ; see the Measurements section for further details) before and at the end of the intervention, as well as 4 months post-intervention.

2.3. Web-based Acceptance and Commitment Therapy intervention

Detailed information about the online ACT intervention can be found in (Sairanen et al., 2019), and the intervention is presented more briefly here.

The purpose of the 10-week intervention was to teach parents skills and strategies to prevent and handle stress and exhaustion in everyday life. Before the participants started the web program, they had a semi-structured phone interview with their assigned coach concerning their lifestyle and other factors affecting their personal well-being. The web-based program was called *ACTparent*. It consisted of five themed modules that the participants were instructed to process during the

course of 1 week (Module 1) or 2 weeks (each of Modules 2–5). The program was based on the processes of ACT and included themes such as life values, mindfulness, acceptance, defusion, and self-compassion. Each module consisted of text and/or a video, exercises with digital audio files, questionnaires, and homework assignments. In addition, there was a discussion forum, where participants could discuss issues with each other and a diary for doing notes for oneself. At the end of each module (i.e., after every 1–2 weeks), the participants had to complete a home assignment based on the theme of the module, write a reflection based on their experiences with the assignment, and submit the reflection to their coach via the program platform. After the completion of the home assignment, the participants received semi-structured, written feedback from their assigned coach.

The 17 coaches were psychology students in their first to third academic year and who had no previous experience with ACT or online interventions. They received a 4-h training in ACT and web coaching before the start of the intervention. They received 2 h of supervision once during the intervention period and further supervision when needed.

2.4. Measurements

2.4.1. Outcome measures

Burnout symptoms were measured with the Shirom-Melamed Burnout Questionnaire (Lundgren-Nilsson, Jonsdottir, Pallant, & Ahlberg, 2012; Melamed et al., 1999; Shirom & Melamed, 2006). The SMBQ measures four elements of burnout: *Emotional exhaustion and physical fatigue*, *Listlessness*, *Tension*, and *Cognitive weariness*. It consists of 22 items that are rated on a 7-point scale ranging from 1 = “Never or almost never” to 7 = “Always or almost always.” High scores correspond to more severe burnout symptoms. The cut-off scores for burnout in the SMBQ are 2.75–3.74 indicating low burnout, 3.75–4.46 indicating high burnout, and ≥ 4.47 indicating a pathological level of burnout. Parents reporting at least low burnout were included in the current study. The SMBQ's psychometric characteristics and factorial validity have been previously demonstrated (Lundgren-Nilsson et al., 2012; Shirom & Melamed, 2006). In our data, Cronbach's alpha at the baseline was 0.91.

The emotional states of depression, anxiety, and stress were measured using the 21-item Depression, Anxiety and Stress Scale (DASS-21) (Henry & Crawford, 2005). The DASS-21 is a self-report assessment tool that contains three subscales scored on a 4-point Likert-type scale ranging from 0 = “Strongly disagree” to 3 = “Totally agree.” Each subscale of the DASS consists of seven items that evaluate the emotional states of depression, anxiety, and stress, respectively. The factor structure and validity of the DASS-21 have been demonstrated elsewhere (Alfonsson, Wallin, & Maathz, 2017). In our data, Cronbach's alpha was 0.93 for the total DASS score, and 0.89, 0.83 and 0.85, respectively, for the subcategories depression, anxiety, and stress.

2.4.2. Process measures

General psychological flexibility was measured with the Acceptance and Action Questionnaire (AAQ-II) (Bond et al., 2011). This includes seven items that assess a person's ability to accept negative emotions and other internal experiences and take value-based actions in the presence of these experiences. The questions in the AAQ-II are based on statements like: “I worry about not being able to control my worries and feelings.” The items are rated on a 7-point Likert-type scale ranging from 1 = “Never true” to 7 = “Always true,” with higher scores indicating lower levels of psychological flexibility. The structure, reliability, and validity of the AAQ-II have been reported elsewhere (Bond et al., 2011). In this data, Cronbach's alpha was 0.90.

Mindfulness was assessed with the Five-Facet Mindfulness Questionnaire (FFMQ) (Baer et al., 2008). It includes 39 items that are rated on a 5-point Likert-type scale ranging from 1 = “Never or very rarely true” to 5 = “Very often or always true,” with higher scores

Table 1
Estimated Sample Statistics: Mean ± Standard Deviation (SD) and the Effects of the Intervention on the Outcomes.

	ACT			Control			Effect ^a	Pre-post ^b	Post-fup ^c	d ^d
	Pre n = 37	Post n = 27	Fup n = 21	Pre n = 37	Post n = 25	Fup n = 25				
SMBQ	4.79 ± 0.91	4.01 ± 1.30	3.39 ± 1.56	4.87 ± 0.82	4.74 ± 1.06	4.78 ± 1.32	0.001	0.004	0.159	1.05
DASS	40.76 ± 26.67	30.66 ± 24.70	23.90 ± 27.11	41.24 ± 21.28	34.44 ± 20.10	47.73 ± 38.74	0.027	0.038	0.397	0.54
Depression	12.76 ± 10.06	8.45 ± 8.95	6.35 ± 9.26	13.19 ± 8.69	10.92 ± 8.04	16.10 ± 13.02	0.012	0.067	0.276	0.57
Anxiety	8.70 ± 9.37	6.60 ± 8.45	5.30 ± 8.95	8.00 ± 6.80	6.04 ± 7.14	11.32 ± 15.00	0.137	–	–	0.37
Stress	19.30 ± 9.96	15.60 ± 11.17	12.25 ± 10.57	20.05 ± 9.39	17.48 ± 9.13	20.32 ± 12.41	0.167	–	–	0.41
AAQ	22.32 ± 9.75	19.46 ± 8.80	17.96 ± 8.26	22.62 ± 9.40	21.43 ± 11.42	21.23 ± 11.22	0.378	–	–	0.22
CFQ	28.19 ± 10.40	19.96 ± 9.72	17.58 ± 10.70	27.27 ± 9.51	20.96 ± 7.98	20.21 ± 9.34	0.219	–	–	0.38
FFMQ	117.84 ± 16.25	132.28 ± 21.83	137.55 ± 23.06	116.92 ± 18.15	124.98 ± 31.55	116.23 ± 21.06	0.002	0.015	0.180	0.98
Observing	24.62 ± 6.09	26.40 ± 5.32	28.41 ± 5.75	23.84 ± 5.69	23.71 ± 7.54	24.61 ± 5.03	0.018	0.035	0.882	0.56
Describing	26.51 ± 6.69	29.86 ± 5.54	29.97 ± 6.63	25.97 ± 7.54	28.53 ± 9.67	25.97 ± 8.55	0.000	0.047	0.000	0.40
Acting with awareness	22.76 ± 7.04	26.15 ± 7.14	27.36 ± 6.90	22.51 ± 6.13	25.46 ± 8.49	21.15 ± 8.50	0.011	0.389	0.007	0.58
Non-judgment	24.76 ± 7.39	26.57 ± 7.41	28.04 ± 6.14	25.43 ± 7.80	26.87 ± 9.70	24.53 ± 7.88	0.131	–	–	0.45
Non-reactivity	19.19 ± 5.20	23.31 ± 5.39	23.78 ± 5.91	19.16 ± 4.73	20.42 ± 6.16	19.98 ± 5.48	0.003	0.001	0.913	0.73

AAQ = Acceptance and Action Questionnaire; ACT = Acceptance and Commitment Therapy; CFQ = Cognitive Fusion Questionnaire; DASS = Depression, Anxiety and Stress Scale; FFMQ = Five Facet Mindfulness Questionnaire; fup = follow-up; SMBQ = Shirom-Melamed Burnout Questionnaire.

Note: Sample statistics of CFQ has been reanalyzed for this study by using the 7-item version instead of the 13-item version that was used in the previous RCT study.

^a p-value for differences in changes between the study groups using all measured time points (pre, post, fup) using estimated parameters (hierarchical linear model, Wald test). Bold text indicates significant p-value < 0.05.

^b p-values of the post hoc analyses: difference in change between pre and post.

^c p-values of the post hoc analyses: difference in change between post and follow-up.

^d Cohen's d from baseline to follow-up between the ACT group and the control group using estimated parameters.

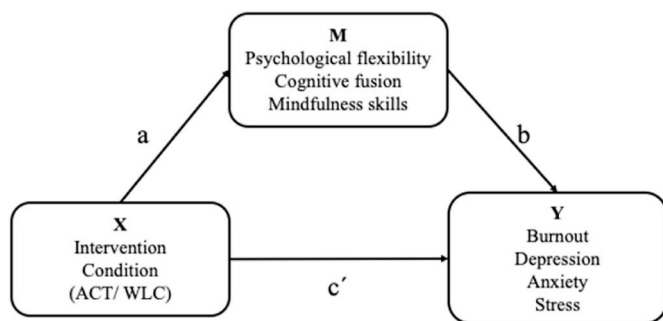


Fig. 1. Mediation model.

indicating higher levels of mindfulness skills. It consists of the following subscales: (a) *Observing* includes noticing internal and external experiences; (b) *Describing* involves naming and labeling internal experiences; (c) *Acting with awareness* means paying attention to one's own activities in the moment; (d) *Non-judgment of inner experiences* means taking a non-evaluative stance toward inner experiences; (e) *Non-reactivity to inner experiences* is the ability to let thoughts and feelings come and go without struggling with them. The structure, reliability, and validity of the FFMQ have been demonstrated (Baer et al., 2008). In our data, Cronbach's alpha was 0.86 for the total FFMQ score, and 0.78, 0.92, 0.91, 0.92 and 0.82, respectively, for the subscales Observing, Describing, Acting with awareness, Non-judgment, and Non-reactivity.

Cognitive fusion was measured using the Cognitive Fusion Questionnaire (CFQ) (Gillanders et al., 2014). This includes 7 items that are rated on a 7-point Likert-type scale ranging from 1 = "Never true" to 7 = "Always true," with higher scores indicating higher levels of cognitive fusion. The CFQ contains items reflective of the believability of thoughts, getting stuck on thoughts, and taking action in contrast to thinking. The questions of the CFQ are based on statements like, "I struggle with my thoughts." The reliability and validity of the CFQ have been demonstrated (Gillanders et al., 2014). For the current data, Cronbach's alpha was 0.94.

The measures were administered in Swedish. The measures have been translated and back-translated for previous studies (Alfonsson et al., 2017; Lilja et al., 2011; Lundgren & Parling, 2017; Lundgren-

Nilsson et al., 2012), except for the CFQ, which was translated and back-translated for this study by a group of researchers with long experience in acceptance, mindfulness, and value-based interventions. The internal consistency of the measures and subscales was good (Cronbach's $\alpha = 0.78-0.94$).

2.5. Summary of previously reported RCT results

In our previous article (Sairanen et al., 2019), hierarchical linear modeling (HLM, Wald test) was used to analyze the *group × time* interaction, that is, whether the ACTparent online intervention changed differently compared to the waiting list control group across the measured time points (pre, post, follow-up). Regarding the outcome measures, intervention effects (*group × time* interaction) were found for burnout symptoms (SMBQ), the total DASS score, and depression. Regarding the process measures, the intervention effects were significant for the total mindfulness score (FFMQ) and its subscales Observing, Describing, Acting with awareness, and Non-reactivity to inner experiences (see Table 1). The between-group effect sizes of all the variables ranged from small to large (0.31–1.62).

2.6. Statistical analysis

The statistical analyses were conducted using Mplus (version 8). The parameters were estimated using the full information maximum likelihood method (MLR estimation in Mplus).

To assess the indirect effect ($a \times b$) of the treatment on the outcomes through changes in process variables, the model depicted in Fig. 1 was proposed. Mediation models were tested by using both pre to post and pre to follow-up changes in process variables in predicting the pre to follow-up changes in outcomes.

Structural Equation Modeling (SEM) was used to investigate if changes in process variables mediated changes in the assessed outcomes. The product of the coefficients approach was used to compute the product of the $a \times b$ path, assessing the indirect effect of the intervention (X) on the outcome (Y) through the mediator (M) directly (Fig. 1). The only requirement to demonstrate mediation is a significant indirect effect ($a \times b$). Note that a statistically significant total effect of X on Y is not necessary for mediation to occur, and that mediation

Table 2
Estimates, Standard Errors, p-Values and 95% Confidence Intervals for Indirect and Direct Effects of Changes in the AAQ, CFQ and FFMQ Totals on Changes in the Outcome Variables as well as b-paths of the mediation models.

Mediator Pre-fup	Outcome Pre-fup		Estimate	S.E.	p-value	Confidence interval
AAQ	SMBQ	Indirect $a \times b$	-0.058	0.059	0.326	-0.214, 0.025
		b-path	0.341	0.124	0.006	0.068, 0.556
		Direct c'	-0.350	0.130	0.007	-0.601, -0.078
	Stress ^b	Indirect $a \times b$	-0.071	0.066	0.279	-0.241, 0.023
		b-path	0.399	0.137	0.004	0.109, 0.642
		Direct c'	-0.200	0.144	0.165	-0.479, 0.065
	Depression	Indirect $a \times b$	-0.078	0.073	0.285	-0.263, 0.034
		b-path	0.457	0.125	0.000	0.216, 0.691
		Direct c'	-0.279	0.117	0.017	-0.500, -0.041
	Anxiety	Indirect $a \times b$	-0.085	0.074	0.249	-0.240, 0.043
		b-path	0.500	0.097	0.000	0.209, 0.639
		Direct c'	-0.148	0.109	0.174	-0.341, 0.081
CFQ	SMBQ	Indirect $a \times b$	-0.054	0.050	0.279	-0.198, 0.008
		b-path	0.279	0.149	0.062	-0.045, 0.531
		Direct c'	-0.339	0.130	0.009	-0.593, -0.076
	Stress ^b	Indirect $a \times b$	-0.086	0.060	0.155	-0.229, -0.001^a
		b-path	0.368	0.170	0.030	0.032, 0.660
		Direct c'	-0.178	0.126	0.158	-0.414, 0.079
	Depression ^b	Indirect $a \times b$	-0.081	0.053	0.130	-0.191, 0.008
		b-path	0.427	0.121	0.000	0.148, 0.630
		Direct c'	-0.261	0.110	0.018	-0.463, -0.022
	Anxiety	Indirect $a \times b$	-0.104	0.067	0.121	-0.241, 0.010
		b-path	0.454	0.125	0.000	0.064, 0.614
		Direct c'	-0.121	0.099	0.221	-0.294, 0.114
FFMQ	SMBQ ^b	Indirect $a \times b$	-0.219	0.095	0.021	-0.429, -0.055^a
		b-path	-0.516	0.150	0.001	-0.750, -0.148
		Direct c'	-0.185	0.138	0.179	-0.467, 0.078
	Stress ^b	Indirect $a \times b$	-0.264	0.086	0.002	-0.450, -0.120^a
		b-path	-0.575	0.130	0.000	-0.800, -0.275
		Direct c'	-0.011	0.151	0.940	-0.373, 0.246
	Depression ^b	Indirect $a \times b$	-0.145	0.063	0.020	-0.284, -0.041^a
		b-path	-0.343	0.121	0.005	-0.546, -0.074
		Direct c'	-0.221	0.132	0.094	-0.479, 0.031
	Anxiety	Indirect $a \times b$	-0.114	0.067	0.089	-0.263, 0.012
		b-path	-0.254	0.138	0.066	-0.493, 0.056
		Direct c'	-0.101	0.132	0.441	-0.338, 0.181

AAQ = Acceptance and Action Questionnaire; CFQ = Cognitive Fusion Questionnaire; FFMQ = Five-Facet Mindfulness Questionnaire; fup = follow-up; SMBQ = Shirom-Melamed Burnout Questionnaire.

Note: Only the significant indirect effects (not direct) are bolded in the table.

^a Significant indirect effects based on the 95% confidence intervals not including zero.

^b A change in a mediator was controlled by the pre-treatment level of an outcome variable in order to improve modification indexes of the model fit.

analysis does not require evidence of a total effect prior to investigating direct (c') and indirect ($a \times b$) effects (Zhao, Lynch, & Chen, 2010).

To assess the significance of the indirect and direct effects, bias-corrected 95% confidence intervals (CI) were calculated using non-parametric bootstrapping procedures as recommended by Preacher and Hayes (Preacher & Hayes, 2008). Confidence intervals are based on 1000 bootstrap resamples. Indirect effects are deemed statistically significant at the .05 level, if the 95% confidence interval (CI) for the estimate of the indirect effects does not include zero. Standardized estimates, their corresponding standard errors, and p-values (two-tailed) are reported. The standardized indirect effect provides a scale-free measure that allows a direct comparison of effects across differently scaled outcomes and can be used for synthesis across studies (Preacher, Zychur, & Zhang, 2010).

The model fit was assessed using the fit indices Standardized Root Mean Square Residual (SRMR), with values lower than 0.08 indicating a good fit, and the Comparative Fit Index (CFI), with values of 0.95 or higher indicating a good fit (Hu & Bentler, 1999).

3. Results

Pre, post and follow-up scores of the variables and the effects of the intervention on outcomes have been reported in a previous RCT study (Sairanen et al., 2019) and are presented here as background information (Table 1). Number of the participants in each measurement

points are reported in Table 1. The ACTparent intervention significantly affected burnout and depression symptoms as well as mindfulness skills (significant p-values in bold type).

3.1. Mediation analysis

Standardized parameter estimates of the direct and indirect paths as well as b-paths, standard errors, their corresponding significance effects and confidence intervals are provided in Tables 2 and 3. Statistically significant total effects were found only for outcome measures of burnout (SMBQ) and depression, and not for anxiety and stress as reported in Table 1. Mediation models were tested by using both pre to post and pre to follow-up changes in process variables in predicting the pre to follow-up changes in outcomes. Indirect effects of pre to post changes in mediators were significant only for FFMQ total mediating intervention effects for stress (CI: 0.281, -0.021) and burnout (SMBQ; CI: 0.290, -0.010). All other indirect effects of pre to post changes were non-significant and therefore only results of the models using pre to follow-up changes are presented in detail.

In parts of the models, a change in a mediator was controlled by the pre-treatment level of the outcome variable (see Tables 2 and 3). This correction was undertaken based on the modification indexes in order to improve the model fit. After the correction, two of the models had modification indexes slightly outside the cut-off criteria (AAQ/Non-reacting mediated the intervention effect on stress, CFI = 0.89/0.948).

Table 3
Estimates, Standard Errors, p-Values and 95% Confidence Intervals for Indirect and Direct Effects of Changes in the FFMQ Subscales on Changes in the Outcome Variables as well as b-paths of the mediation models.

Mediator Pre-fup	Outcome Pre-fup		Estimate	S.E.	p-value	Confidence interval	
Observe	SMBQ	Indirect $a \times b$	-0.112	0.075	0.137	-0.282, 0.021	
		b-path	-0.321	0.172	0.062	-0.593, 0.100	
		Direct c'	-0.316	0.130	0.016	-0.555, -0.059	
	Stress	Indirect $a \times b$	-0.024	0.063	0.705	-0.171, 0.077	
		b-path	-0.068	0.159	0.669	-0.373, 0.239	
		Direct c'	-0.250	0.164	0.128	-0.564, 0.066	
	Depression	Indirect $a \times b$	0.002	0.049	0.967	-0.094, 0.105	
		b-path	0.006	0.130	0.964	-0.229, 0.265	
		Direct c'	-0.370	0.128	0.004	-0.592, -0.088	
	Anxiety	Indirect $a \times b$	0.021	0.047	0.649	-0.051, 0.139	
		b-path	0.061	0.121	0.612	-0.149, 0.303	
		Direct c'	-0.250	0.122	0.040	-0.440, 0.049	
	Describe	SMBQ	Indirect $a \times b$	-0.098	0.068	0.148	-0.291, -0.013^a
			b-path	-0.344	0.127	0.007	-0.573, -0.089
			Direct c'	-0.317	0.136	0.019	-0.557, -0.050
Stress		Indirect $a \times b$	-0.092	0.066	0.167	-0.281, -0.006^a	
		b-path	-0.321	0.135	0.017	-0.541, 0.030	
		Direct c'	-0.171	0.149	0.252	-0.490, 0.105	
Depression ^b		Indirect $a \times b$	-0.053	0.051	0.304	-0.195, 0.019	
		b-path	-0.199	0.154	0.196	-0.495, 0.142	
		Direct c'	-0.316	0.120	0.009	-0.545, -0.062	
Anxiety		Indirect $a \times b$	0.012	0.056	0.835	-0.077, 0.177	
		b-path	0.041	0.167	0.808	-0.245, 0.428	
		Direct c'	-0.243	0.136	0.074	-0.464, 0.092	
Awareness		SMBQ ^b	Indirect $a \times b$	-0.157	0.097	0.107	-0.385, -0.011^a
			b-path	-0.539	0.161	0.001	-0.811, -0.169
			Direct c'	-0.254	0.143	0.077	-0.538, 0.027
	Stress ^b	Indirect $a \times b$	-0.166	0.077	0.030	-0.356, -0.041^a	
		b-path	-0.476	0.116	0.000	-0.681, -0.225	
		Direct c'	-0.109	0.147	0.460	-0.414, 0.164	
	Depression ^b	Indirect $a \times b$	-0.089	0.059	0.132	-0.241, -0.002^a	
		b-path	-0.287	0.130	0.028	-0.499, 0.012	
		Direct c'	-0.275	0.127	0.031	-0.542, -0.024	
	Anxiety ^b	Indirect $a \times b$	-0.133	0.064	0.039	-0.292, -0.033^a	
		b-path	-0.342	0.119	0.004	-0.545, -0.078	
		Direct c'	-0.107	0.118	0.363	-0.307, 0.156	
	Non-react	SMBQ ^b	Indirect $a \times b$	-0.143	0.067	0.034	-0.281, -0.018^a
			b-path	-0.411	0.147	0.005	-0.633, -0.040
			Direct c'	-0.257	0.133	0.054	-0.520, 0.001
Stress ^b		Indirect $a \times b$	-0.112	0.064	0.082	-0.266, 0.000	
		b-path	-0.288	0.134	0.032	-0.534, 0.015	
		Direct c'	-0.159	0.162	0.325	-0.485, 0.149	
Depression ^b		Indirect $a \times b$	-0.079	0.056	0.157	-0.220, 0.004	
		b-path	-0.236	0.135	0.079	-0.515, 0.029	
		Direct c'	-0.286	0.127	0.024	-0.524, -0.029	
Anxiety ^b		Indirect $a \times b$	-0.017	0.060	0.780	-0.136, 0.116	
		b-path	-0.039	0.138	0.776	-0.306, 0.252	
		Direct c'	-0.212	0.135	0.115	-0.455, 0.076	
Non-judge		SMBQ	Indirect $a \times b$	-0.039	0.045	0.377	-0.161, 0.022
			b-path	-0.165	0.151	0.273	-0.432, 0.157
			Direct c'	-0.370	0.131	0.005	-0.616, -0.106
	Stress	Indirect $a \times b$	-0.108	0.059	0.067	-0.229, -0.001^a	
		b-path	-0.452	0.116	0.000	-0.647, -0.197	
		Direct c'	-0.152	0.141	0.279	-0.444, 0.092	
	Depression	Indirect $a \times b$	-0.053	0.044	0.225	-0.162, 0.019	
		b-path	-0.250	0.135	0.064	-0.488, 0.050	
		Direct c'	-0.306	0.129	0.018	-0.541, -0.036	
	Anxiety	Indirect $a \times b$	-0.098	0.054	0.071	-0.200, 0.009	
		b-path	-0.410	0.108	0.000	-0.595, -0.171	
		Direct c'	-0.122	0.110	0.267	-0.307, 0.112	

FFMQ = Five-Facet Mindfulness Questionnaire; fup = follow-up; SMBQ = Shirom-Melamed Burnout Questionnaire.

Note: Only the significant indirect effects (not direct) are bolded in the table.

^a Significant indirect effects based on the 95% confidence intervals not including zero.

^b A change in a mediator was controlled by the pre-treatment level of an outcome variable in order to improve modification indexes of the model fit.

Otherwise all models had good fit (SRMR < 0.08, CFI > 0.95 (Hu & Bentler, 1999)).

The results of the mediation models comparing the ACT treatment to the waiting list condition regarding general psychological flexibility (AAQ), cognitive defusion (CFQ), and the total score of mindfulness skills (FFMQ total) are presented in Table 2. Cognitive defusion had a

statistically significant indirect treatment effect ($a \times b$) on changes in stress (95% confidence intervals did not include zero). A change in the total score of the FFMQ had statistically significant indirect effects on all of the other outcome variables except anxiety. In these models, none of the direct effects were significant meaning that the mediating pathway fully accounted for between condition effects on outcomes.

General psychological flexibility (AAQ) had no significant indirect effects on any of the outcomes.

Since the ACTparent intervention had significant effects on many of the subscales of the FFMQ (reflecting a significant treatment effect on subskills of mindfulness), the mediation effects on these subscales are presented separately in Table 3. As regards the subscales of the FFMQ, acting with awareness had a statistically significant indirect treatment effect on changes in all outcome variables (symptoms of burnout, stress, depression, and anxiety). In these models, a significant direct effect on depression was found meaning that the mediating pathway did not fully account for between condition effects on outcomes, which remained significant. However, for burnout, stress and anxiety the direct effects remained non-significant after accounting the $a \times b$ path. Describing had significant indirect effects on burnout and stress. A direct effect of the intervention on burnout could be found in addition to the indirect effect of describing. In addition, non-reacting had significant indirect effects on burnout, and non-judgment had significant indirect effects on stress, while direct effects were non-significant.

4. Discussion

An increased number of studies have shown that ACT-based treatments can be delivered successfully online (Brinkborg et al., 2011; Buhman et al., 2013; Lappalainen et al., 2014, 2015; Levin et al., 2014, 2017). In order to enhance the effectiveness of online treatments, there is a need to understand the processes of change producing beneficial outcomes. This could enable the development of more focused online treatments enhancing specific psychological skills. This study is one of the first studies examining the processes of change in an ACT-based online intervention. The purpose of the present analysis was to examine the role of psychological flexibility processes—specifically, general psychological flexibility, cognitive defusion, and mindfulness—as mechanisms of change in an ACT-based online intervention for the well-being of parents of children with chronic conditions. The results call attention to the role of different type of psychological skills as mechanisms of change.

Acting with awareness was the most important mediator. It had significant indirect treatment effects (ACT vs. the waiting list) on changes in all outcome variables, that is, symptoms of burnout, depression, anxiety, and stress. Thus, these findings suggest that paying attention to one's own activities in the moment instead of functioning on “autopilot” is especially useful for the parents of children with chronic conditions in reducing psychological symptoms. Regarding other mindfulness subscales of the FFMQ, non-reacting and describing had significant indirect effects on burnout, and describing and non-judgment had significant indirect effects on stress. In addition, cognitive defusion (i.e., an ability to “hold one's thoughts more lightly”) mediated intervention effects on stress.

Our results are mostly in line with previous research supporting processes of change in an ACT model. Cognitive defusion and mindfulness have been shown to mediate outcomes in ACT interventions with different populations (Forman, Herbert, Moitra, Yeomans, & Geller, 2007; Lundgren et al., 2008; Varra, Hayes, Roget, & Fisher, 2008). Partly differing results were found in a study investigating a web-based ACT treatment for depressive symptoms concerning the general adult population, where the significant mediators were found to be psychological flexibility (AAQ) and subscales of the FFMQ, but not acting with awareness (Pots et al., 2016). These differences in processes of change might be explained by the different populations or differences in the content of the online interventions. In future studies, more detailed investigating of online ACT interventions is warranted in order to examine, for example, how conducting particular exercises in such a program are related to mechanisms of change and outcomes of the treatment.

Changes in the general psychological flexibility measure (AAQ) did not mediate any effects on the outcomes in the present data. This result

was surprising, since, in our previous analysis with the same population, the baseline levels of the AAQ predicted more variance in symptoms of burnout, depression, anxiety and stress than cognitive fusion (CFQ) and mindfulness (FFMQ)—in multiple regression analyses (Sairanen, Lappalainen, & Hiltunen, 2018). Thus, the level of psychological flexibility (as measured by the AAQ) explained the symptom severity but did not function as a mechanism of change in the online ACT treatment for parents. However, the changes in AAQ predicted changes in all outcomes (i.e., b -paths in the mediation analysis were significant). Thus, the lack of significant mediation effects could be due to the reason that the online treatment was not effective in increasing general psychological flexibility even though the program improved mindfulness skills and reduced symptoms of burnout and depression.

The lack of significant an indirect effect of general psychological flexibility might also imply that change processes associated with parental distress would be better assessed by specific measures targeted to describe thoughts, feelings and actions relating to parenting. A general measure of psychological flexibility may not capture worries and emotions that are relevant for parents having children with chronic conditions. Research with different populations has indicated that targeted measures of psychological flexibility may be more accurate in explaining processes of change in psychological and behavioral outcomes (Gifford et al., 2004; Gregg et al., 2007; Sairanen et al., 2017). Previous analyses of mediators in web-based ACT have supported psychological flexibility as a process of change, such as when psychological flexibility was assessed with population-targeted measures with respect to smoking cessation (Bricker et al., 2013) and concerning chronic pain (Trompetter et al., 2015), and with the general AAQ regarding depressive symptoms in the general population (Pots et al., 2016). Recently, several targeted measures for psychological flexibility related to parenting have been developed (Burke & Moore, 2015; Wallace, McCracken, Weiss, & Harbeck-Weber, 2015), and psychological flexibility measured by the AAQ child disability version was found to mediate an intervention effect on parents' stress and depressive symptoms in a parenting intervention combined with ACT for families of children with cerebral palsy (Whittingham et al., 2019). In future studies, it could be useful to include targeted measures of psychological flexibility to explain change in psychological and behavioral outcomes in parents.

4.1. Limitations

The findings should be taken in the context of certain limitations. Firstly, the mediation models were analyzed by using the pre to post and the pre to follow-up changes in mediators predicting the pre to follow-up changes in outcomes, and, thus, all of the present tests of mediation do not meet all of the criteria that are desirable in mediation analysis (Stice, Presnell, Gau, & Shaw, 2007). Based on the theoretical model of ACT, it was assumed that the changes in process variables mediated the intervention effect on outcomes, but it is possible that changes in outcomes took place before changes in psychological processes. In the current study, the models using the pre to post changes in mediators were largely non-significant, whereas the pre to follow-up mediation models had more significant indirect effects. This might be due to the fact that changes in mediators continued during the 4 months follow-up period and the longer time span might be needed for the mediation process to take place. Some previous ACT studies have shown the possibility of a successful mediation of outcomes through psychological flexibility processes when these were assessed before the outcomes changed, thus providing stronger evidence for psychological flexibility as a mechanism of change (e.g., Gifford et al., 2004; Gregg et al., 2007).

Secondly, a limitation concerning the measures was the use of self-reports, which could influence the validity of the study. For the future, the assessment of both process and outcome variables at multiple time points, such as daily or weekly ratings, and the use of behavioral or

physiological measures are needed to allow for more sophisticated methodological approaches and designs in order to more closely examine change mechanisms in treatments.

Thirdly, it is important to notice the limitations of the generalizability of the results. The majority of the participants were female (81%) and there were a notable number of dropouts during the intervention (27%) and follow-up (43%). This may have affected the results, although this was taken into consideration in the analysis using the MLR method. Ultimately, these results should be interpreted in the context of parents (mostly mothers) suffering from burnout symptoms, whose children have chronic conditions, and who participated in an online guided ACT-based treatment.

5. Conclusions

This study provides evidence for the processes of change stated by an ACT-model. Increased mindfulness skills, especially acting with awareness, mediated the effects of the treatment on psychological symptoms of burnout, stress, depression and anxiety in an online guided ACT-oriented intervention for parents of children with chronic conditions. The results suggest there to be benefits in improving, in particular, different type of mindfulness skills that aid in optimizing treatment effects in online interventions.

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