Title Page

Further validation of the 18-item Portuguese CompACT scale using a multi-sample design: Confirmatory Factor Analysis and correlates of psychological flexibility

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Abstract

An 18-item Portuguese-language version of the CompACT scale has recently been proposed for the Portuguese population. This study aims at conducting the first Confirmatory Factor Analysis of the Portuguese CompACT in participants from two different samples (community adults and women in the post-partum period; total $N = 1090$). Given that the CompACT had yet to be subjected to gender invariance testing, the present study also presents an invariance analysis between male and female community participants. The measurement invariance of the Portuguese CompACT between community and post-partum women was also examined. The current study additionally explored the scale's relationships with theoretically relevant outcomes associated in the literature with psychological flexibility. Results showed that the three-factor correlated model of the Portuguese CompACT was an adequate fit for the data taken from the complete sample, with most items presenting statistically and practically significant loading values. The Portuguese CompACT presented acceptable to good internal consistencies for all factors - Openness to Experience (OE), Behavioral Awareness (BA), and Valued Action (VA). Full measurement invariance was found, with results further indicating that community women presented lower scores in BA than community men, and that women in the post-partum period scored higher than community women in BA and VA, and lower in OE. The three subscales of the Portuguese CompACT, that underpin the overarching construct of psychological flexibility, demonstrated different patterns of association from one another with various aspects of individual functioning. Although those associations were in the expected directions with flexibility being associated with lower distress, some forms of psychological flexibility

assessed by the CompACT were not significantly associated with measures of positive affect or resilience. This result underscores the difficulty of measuring psychological flexibility as a single construct, as it comprises a number of sub-component processes. Further implications of findings are discussed.

Keywords

Acceptance and Commitment Therapy

Assessment

CompACT

Confirmatory Factor Analysis

Measurement invariance

Psychological flexibility

Introduction

Acceptance and Commitment Therapy (ACT; Hayes et al., 2012) has emerged as an effective transdiagnostic psychological intervention for the treatment of a number of conditions such as anxiety disorders, depression, addiction, pain, and somatic health problems (e.g., Gloster et al., 2020; A-Tjak et al., 2015). ACT has been found to be generally superior to inactive controls, treatment as usual (protocolized medical treatment), and even most active intervention conditions (combination of psychological interventions with treatment as usual) in addressing such psychological and emotional problems (Gloster et al., 2020). These observed changes are theoretically expected to be due to increases in psychological flexibility, the process which ACT overall aims to promote (Ciarrochi et al., 2010). Psychological flexibility is conceptualized as the ability to contact the present moment, while being fully aware and accepting of one's internal experiences, and to change

or persist in behavior in the service of chosen life values (Hayes et al., 2006). This ability is considered to be a result of six intertwined processes: acceptance, cognitive defusion, contact with the present moment, self as context, values, and committed action (Hayes et al., 2006).

There has recently been an increased focus on research regarding the assessment of psychological flexibility (e.g., Kashdan et al., 2020; Ong et al., 2020; Rochefort et al., 2019; Rolffs et al., 2016; Tyndall et al., 2019). This interest comes from discontentment with the most used and, until recently, exclusive general measure of ACT processes, the Acceptance and Action Questionnaire (AAQ-II; Bond et al., 2011). The AAQ-II has specifically received criticism due to its lack of discriminant validity in relation to measures of psychological distress (Tyndall et al., 2019; Wolgast, 2014) and to its neglect of some ACT processes due to selected focus on acceptance/experiential avoidance and defusion/fusion processes (Gámez et al., 2011).

To overcome the limitations in the assessment of psychological flexibility associated with the AAQ-II, Francis, Dawson, and Golijani-Moghaddam (2016) developed the Comprehensive Assessment of Acceptance and Commitment Therapy (CompACT) scale (see Francis et al., 2016 for an overview on the scale's development). This is a 23-item measure of psychological flexibility that takes into consideration three dyadic ACT processes, through its three different subscales: openness to experience (OE), behavioral awareness (BA), and valued action (VA). This scale was developed and validated using a non-clinical sample of UK adult participants. Results showed good internal consistency, confirmed the three-factor structure, and demonstrated theoretically consistent associations with other variables (e.g., anxiety, depressive symptoms, stress, quality of life). Ong et al. (2020) compared the CompACT against the AAQ-II and a measure of experiential avoidance, the Brief Experiential Avoidance Questionnaire (BEAQ; Gámez et al., 2014), which is often regarded as a proxy measure of psychological *in*flexibility, in community, student, and treatment-

seeking samples. In general, the CompACT had stronger discriminant validity than the AAQ-II and the BEAQ with respect to measures of psychological distress, suggesting that it does appear to measure a different construct than negative emotionality.

A recently conducted Portuguese adaptation and validation of the CompACT (see Trindade et al., 2021) resulted in a shorter version of the scale. This new version was obtained by the removal of 5 items in the OE subscale that were loading on more than one factor in the conducted Exploratory Factor Analysis (EFA), thus creating an 18-item version of the scale. This version demonstrated partial metric invariance between the Portuguese sample, mostly composed of community adults, and the original UK sample from Francis and colleagues (2016). The Portuguese 18-item version of the CompACT additionally presented acceptable to good internal consistencies, and correlations in the expected directions and magnitudes with the AAQ-II, and with measures of cognitive fusion, mindful awareness, committed action, and psychological distress (Trindade et al., 2021).

The adequacy of the Portuguese 18-item version of the CompACT is, nonetheless, yet to be confirmed through a confirmatory factor analysis (CFA) with larger and more diverse samples. The aim of the current study is to fill this gap by conducting a CFA in a large sample of Portuguese participants from two different populations (adults from the community and women in the post-partum period). Furthermore, given that the CompACT has yet to be subjected to gender invariance testing, particularly as previous studies have generally sampled primarily female respondents, the present study will also present an invariance analysis between male and female community participants, which will provide information on how the scale performs and is interpreted across these genders. An examination of gender invariance is pertinent if psychological flexibility is proposed to reflect to a general human dispositional behavior across genders.

This study will also include a CompACT measurement invariance analysis between community women and women from a post-partum sample. The rationale for selecting a post-partum sample as a comparison population is that the perinatal period is strongly linked with increased levels of psychological distress (e.g., depression and anxiety) in mothers (e.g., Dennis et al., 2017; O'Hara & McCabe, 2013; O'Hara & Wisner, 2014). Fonseca and Canavarro (2018) highlighted that it was the appraisal of post-partum specific negative thoughts that maintained and heightened depressive symptoms in the perinatal period, rather than the presence of negative thoughts and feelings per se. As psychological flexibility-based interventions focus on increasing acceptance and non-judgment of negative private events, psychological flexibility would appear a promising protective factor against the development of psychological suffering in post-partum mothers (Monteiro et al., 2019; Stotts et al., 2019). Indeed, research suggests that higher levels of psychological flexibility in mothers are associated with a lower likelihood of psychological distress (Monteiro et al., 2019), and are also linked to enhanced mother-infant emotional availability on subscales of mutual attunement and affect quality (Whittingham & Mitchell, 2021), and to stronger bonds between mothers and preterm infants (Evan et al., 2012). However, much of this research on psychological flexibility in postpartum mothers has been conducted (e.g., Whittingham & Mitchell, 2021) with the Acceptance and Action Questionnaire-II (AAQ-II; Bond et al., 2011), or the Portuguese (e.g., Fonseca et al., 2018; Monteiro et al., 2019) adaptation of the AAQ-II (Pinto-Gouveia et al., 2012).

Given the well documented concerns over the construct and discriminant validity of the AAQ-II (e.g., Kashdan et al., 2020; Rochefort et al., 2019; Tyndall et al., 2019; Wolgast, 2014), there is an imperative to provide psychometric evidence on measures of psychological flexibility such as the Portuguese CompACT. Moreover, there is potential for conceptual confusion in the postpartum literature in that the AAQ-II has been administered to assess

psychological flexibility (e.g., Monteiro et al., 2019; Whittingham & Mitchell, 2021), but also experiential avoidance (e.g., Fonseca et al., 2018), which is a sub-component process of psychological inflexibility. Thus, a further test of the validity of the Portuguese CompACT as a measure of psychological flexibility, with its coherent factor structure, could help reduce reliance on the AAQ-II in the scientific literature, and the continued confusion over what exactly it measures.

Additionally, with the aim of adding evidence to the ACT theoretical framework proposing psychological flexibility as an asset to mental health (Ciarrochi et al., 2010; Hayes et al., 2006), the current work intends to explore the Portuguese CompACT's relationships with theoretically relevant outcomes associated in the literature with psychological flexibility (e.g., mental health, self-compassion). In alignment with research conducted using previous psychological flexibility measures or measures of singular psychological flexibility component processes, it is expected that the Portuguese CompACT will be positively associated with self-compassion (e.g., Davey et al., 2020; Marshall & Brockman, 2016; Mclean et al., 2018), resilience (Daks et al., 2020), mental health (e.g., Kashdan & Rottenberg, 2010; Masuda et al., 2011), and mindful parenting (e.g., Brassell et al., 2016; Coyne et al., 2020), and negatively linked to psychological distress (e.g., Rochefort et al., 2019; Tyndall et al., 2019; Tyndall et al., 2020) and loneliness (e.g., Frinking et al., 2020).

Methods

Participants

The complete sample includes 1090 Portuguese adult participants, taken from two subsamples: a community subsample and a post-partum subsample. Table 1 presents each group's demographic characteristics. The community sample (n = 523, 48% of the complete sample, comprising both men and women aged between 18 and 64 years) included participants gathered from Higher Education institutions and the general Portuguese

population. The post-partum subsample (n = 567, 52% of the complete sample, aged between 16 and 46 years) included women who had given birth over the 12 previous months. Most women had babies aged between one and six months (53.4%) or over 6 months (30.9%); 15.7% had babies aged between zero and one month. Most were on maternity leave when data was collected (55.6%).

Procedures

Sampling.

The community group originated from two different studies (Vagos et al., in preparation; Trindade et al., in preparation) conducted during the COVID-19 pandemic. Though both studies used the Portuguese CompACT, they had different data collection protocols and so the sample size to assess for construct validity differs in relation to which instrument is under analysis (see Table 2). The post-partum group comprised participants from a study also conducted during the pandemic (Fernandes et al., 2021). All samples were recruited online, via posts on social media platforms (through Facebook and Instagram unpaid cross-posting and paid boosting campaigns). The posts presented information about each study and included a web link to a survey hosted in LimeSurvey® or GoogleForms. Informed consent was obtained from all participants prior to data collection. All participants were of legal age to consent (i.e., older than 18 years old). All the studies from which the current subsamples were taken were approved by the Ethical committee of the Faculty of Psychology and Education Sciences of the University of Coimbra.

Data analyses

The measurement model underlying the Portuguese CompACT was analyzed via Confirmatory Factor Analyses on a three-correlated factors model that considered items loading onto one of three factors (i.e., Openness to experience, Behavioral awareness, and

Valued action). That model was also subjected to multi-group analyses for testing measurement invariance. Two multi-group analyses were conducted: 1) comparing female participants from the two subsamples (i.e., community and post-partum), and 2) comparing male and female participants within the community subsample. Three levels of invariance were tested (van de Schoot, 2012): when no equality constraints were applied between groups meaning the pattern of factors were similarly applicable to the groups; when loading values were forced to be equal across groups (i.e., metric invariance); and when loading and intercept values were forced to be equal across groups (i.e., scalar invariance). Finally, when at least partial scalar invariance was achieved, latent mean comparisons were conducted between the groups under analysis on the measures from the Portuguese CompACT, following the guidelines provided by Dimitrov (2006).

The data taken from the Portuguese CompACT using our complete sample was not multivariate normal ($\chi^2_{(36.44)} = 6438.04$ and $p < .001$ for multivariate skewness and $\chi^2_{(463.72)} = 63.81$ and $p < .001$ for multivariate kurtosis). As such, the Maxim Likelihood Robust estimator was used for confirmatory factor analyses and multi-group analyses. These analyses were conducted using Mplus V7.4 (Muthén & Muthén, 2015).

Internal consistency of each of the three measures underlying the Portuguese CompACT was analyzed using the Cronbach Alpha value; values of $\alpha \geq .70$ were considered acceptable for internal consistency (Nunally, 1978). Spearman correlation values were computed between the measures of the Portuguese CompACT and other external variables, to explore construct validity; all available data was used for correlation analyses, which differed for each set of instruments (see Table 2). These analyses were carried out using IBM SPSS Statistics 26.

Measures

The subsamples were collected using different specific goals and, hence, diverse data collection protocols. Table 2 presents which self-report questionnaires were collected within each sample, and a description of all the instruments is presented below.

Psychological Flexibility

The Portuguese Comprehensive Assessment of Acceptance and Commitment Therapy Processes (Portuguese CompACT; Francis et al., 2016) is a self-report 18-item multidimensional scale that assesses psychological flexibility. The CompACT is proposed to have three subscales assessing key processes of psychological flexibility: 1) Openness to Experience (OE; assesses one's willingness to experience internal events without controlling or avoiding them; "I try to stay busy to keep thoughts or feelings from coming"); 2) Behavioral Awareness (BA; assesses one's mindful attention to the present moment; "I find it difficult to stay focused on what's happening in the present"); and 3) Valued Action (VA; assesses one's engagement in valued actions; "I make choices based on what is important to me, even if it is stressful"). Items are responded to on a 7-point Likert scale ranging from 0 (*strongly disagree*) to 6 (*strongly agree*). Similar to the Portuguese validation study of the CompACT (Trindade et al., 2021), but different from the CompACT's original authors' approach (Francis et al., 2016), in this study the Portuguese CompACT was scored as so higher scores reflect higher levels of overall psychological flexibility, OE, BA, and VA. The Portuguese CompACT can be found at Supplementary Table 1. For psychometric results on the scores of the Portuguese CompACT found using the current samples, see the results section.

Self-Compassion

The short version of the Self-Compassion Scale (SCS-SF; Castilho et al., 2015; Raes et al., 2011) was used in this study to assess self-compassion. This scale has 12 items, rated on a 5-point Likert scale that ranges from 1 (*almost never*) to 5 (*almost always*). The SCS

measures six components of self-compassion: Self-Kindness (e.g., “I try to be understanding and patient towards those aspects of my personality I don’t like”), Self-Judgment (e.g., “I’m intolerant and impatient towards those aspects of my personality I don’t like”), Common Humanity (e.g., “I try to see my failings as part of the human condition”), Isolation (e.g., “When I fail at something that’s important to me, I tend to feel alone in my failure”), Mindfulness (e.g., “When something upsets me, I try to keep my emotions in balance”), and Over-Identification (e.g., “When I’m feeling down I tend to obsess and fixate on everything that’s wrong”). After reverse coding negative items, it is possible to obtain a global measure of self-compassion by estimating the mean of all the items, with higher scores indicating higher self-compassion. Internal consistency values for the SCS-SF were $\alpha = .88$ for the community sample and $\alpha = .90$ for the post-partum subsample.

Psychological distress

The Hospital Anxiety and Depression Scale (HADS; Pais-Ribeiro et al., 2007; Zigmond & Snaith, 1983) was used to assess participants’ levels of depressive and anxious symptomatology in the previous seven days. The scale contains 14 items distributed across two subscales (Anxiety and Depression) and answered in a 4-point Likert scale that ranges from 0 (*not at all/only occasionally*) to 3 (*most of the time/a great deal of the time*). The total score of each subscale is the sum of the items, with higher scores indicating higher levels of symptomatology. Internal consistency values using the current sample were as follows: $\alpha = .86$ for anxiety and $\alpha = .85$ for depression for the community subsample, and $\alpha = .85$ for anxiety and $\alpha = .80$ for depression for the post-partum subsample.

Loneliness

The UCLA Loneliness Scale, version 3 (UCLA-3; Russell, 1996; Zeas-Sigüenza et al., under review) is a 20-item unidimensional scale designed to measure one’s subjective feelings of loneliness and of social isolation (e.g., “How often do you feel that you lack

companionship?"). Participants indicate the frequency they feel the way described by each item, using a 4-point Likert scale that ranges from 1 (*never*) to 4 (*always*). After reverse coding negative items, the total score is computed by summing all items, with higher scores indicating higher levels of loneliness. The internal consistency within the current work (with the community sample) was excellent: $\alpha = .94$.

Mental Health

The Mental Health Inventory (MHI; Veit & Ware, 1983; Pais-Ribeiro, 2001) uses 38 items to evaluate a positive and negative dimension of mental health; the positive dimension refers to emotional ties and general positive affect, whereas the negative dimension refers to anxiety, depression, and loss of emotional/behavioral control. A 6-point scale is used for answering each item, ranging from 1 (yes, very much/ all the time) to 6 (not at all). The total score is the sum of the respondents' options for the items that compose each measure. The items pertaining to depression, anxiety and loss of emotional/behavioral control were reversed, and higher scores indicate lower psychological well-being (i.e., higher level of anxiety and depressive symptoms, higher levels of loss of emotional/behavioral control, and lower general positive affect). Internal consistency values using the current community sample were: $\alpha = .91$ for general positive affect, $\alpha = .84$ for loss of emotional/behavioral control, $\alpha = .91$ for anxiety, and $\alpha = .87$ for depression; the emotional ties measure was not used because it had a very low internal consistency value ($\alpha = .57$).

Resilience

The Resilience Scale for Adults (RSA; Friborg et al., 2003; Hjemdal et al., 2006; Pereira et al., 2013) is a multidimensional self-report scale that assesses different resilience characteristics. This scale comprises 33 items and six subscales (Perception of self, Planned future, Social competence, Family coherence, Social support, and Personal structure). Items are answered on a 7-point semantic differential scale where each item has a

positive and a negative attribute at each end of the scale. Higher scores reflect greater levels of resilience. The RSA subscales presented the following Cronbach's alphas: α = .65 for perception of self, α = .82 for planned future, α = .79 for social competence, α = .89 for family cohesion, α = .86 for social resources; the personal structure subscale was not used in the current study due to its low Cronbach alpha (.49).

Mindful Parenting

To assess mindful parenting, the Portuguese Interpersonal Mindfulness in Parenting Scale (IM-P - Infant version; Caiado et al., 2020; Duncan, 2007) was used. The infant version is similar to the original Portuguese IM-P, but items were adapted for parents of infants. For instance, the item "I often react too quickly to what my child says or does" was modified to "I often react too quickly when my baby gets agitated or cries". Item four was deleted ("I listen carefully to my child's ideas, even when I disagree with them"). Therefore, the final Portuguese IM-P - Infant version contains 28 items scored on a 5-point response scale, ranging from 1 (never true) to 5 (always true). The total score is the sum of the items, and higher scores indicate higher levels of mindful parenting. The internal consistency value found using the current post-partum sample was α = .84

Results

Internal structure validity

Measurement model

The fit of the models was judged based on the guidelines provided by Hair et al. (2014): for a sample larger than 250 and between 12 to 30 indicators, acceptable fit may be concluded based on a combination of Comparative Fit Index (CFI) ≥ .92 and Root Mean Square Error of Approximation (RMSEA) ≤ .07 or a combination of CFI ≥ .92 and a Standardized Root Mean Square Residual (SRMR) ≤ .08.The three-factor correlated model achieved fit indices very close to the acceptability threshold (see Table 3); however, for it to

surpass the cut-off values of acceptability, four residual covariances were added to the model, between items pertaining to the same factor (see Table 3 for a full description of those residual covariances). All completely standardized loading values were statistically significant ($p < .001$) and practically significant (i.e., $\lambda \geq .50$; Hair et al, 2014), except for item 4 within the OE measure and item 6 within the VA measure (see Table 4).

Reliability analysis

The Portuguese CompACT presented acceptable to good internal consistencies for all factors in this study's complete sample: $\alpha = .71$ for OE; $\alpha = .88$ for BA; $\alpha = .84$ for VA. Item-total correlations within each scale presented values between .40 (item 2) and .83 (item 16). Removing any of the items within each scale would not lead to relevant increase in Cronbach's alphas values. Internal consistency values were also found to be at least good for all measures considering our distinct subsamples (i.e., $\alpha \geq .85$ for the community subsample and $\alpha \geq .79$ for the post-partum subsample except, in this case, for the OE measure which had $\alpha = .60$, see Table 5).

Measurement invariance

For invariance to be defined and for groups to be credibly compared on scores for the latent variables, each new equality constraint should not significantly worsen the fit of the model, as expressed by $\Delta CFI \leq .01$, $\Delta RMSEA \leq .015$, and $\Delta SRMR \leq .03$ when comparing the metric invariance model with the unconstrained model; when comparing the scalar and the metric invariance model, the same criteria was applied except for $\Delta SRMR \leq .01$ (Chen, 2007).

Female participants by sample

Results for the unconstrained model were acceptable, thus indicating configural invariance between female participants in both samples; in other words, this result points to the adjusted three-factor model being an adequate representation of the data for female

participants within the two subsamples (see Table 4). Full metric invariance was also found (ΔCFI = -.001, ΔRMSEA = -.001, and ΔSRMR = .003); only partial scalar invariance was achieved after allowing the intercepts of 4 items to vary from one group in comparison to the other (ΔCFI = -.008, ΔRMSEA = .002, and ΔSRMR = -.001). Loading values were higher than .56 (item 1) for the community women and higher than .40 (item 6) for the post-partum women (Table 4). Given that only a minority of parameters differed across subsamples (i.e., 4/18 intercepts, in a total of 18 loading values and 18 intercepts constraint to equality between samples), women from these subsamples may be accurately compared. Latent means, as error-free measures of the constructs underlying the Portuguese CompACT, were then compared based on the guidelines provided by Dimitrov (2006). Results show that female participants from the post-partum sample scored significantly higher than community women in BA (latent mean for community women = 0.00 and for postpartum women = .248, $p < .001$) and VA (latent mean for community women = 0.00 and for postpartum women = .391, $p < .001$) and significantly lower in OE (latent mean for community women = 0.00 and for postpartum women = -.554, $p < .001$). Descriptive values (i.e., mean and standard deviation) for those measures also indicate that post-partum women scored higher in BA and VA and lower on OE, in comparison with community women (see Table 5).

Community participants by gender

The values of the fit indicators for the unconstrained model show that the three-factor correlated model holds for configural invariance; given that its fit indicators were considered at least adequate for male and female participants taken from the community sample, that measurement model seems to be an overall good representation of the constructs under analysis for male and female participants. Furthermore, full metric (ΔCFI = .001, ΔRMSEA = -.001, and ΔSRMR = .005) and full scalar (ΔCFI = -.001, ΔRMSEA = -.001, and ΔSRMR = .000) invariance was found, indicating that those male and female participants attribute the

same meaning to the measures with similar mean values at the item level. Loading values were higher than .47 (item 2) for men and higher than .58 (item 1) for women (Table 4). Again, comparison of latent mean was carried out, to provide for comparison of error-free measurement of the constructs under analysis. Latent mean comparison analysis showed that male and female participants only differed significantly in the BA measure, with women presenting lower scores than men (latent mean for men = 0.00 and latent mean for women = -.238, p = .03). Descriptive values (i.e., mean and standard deviation) presented in Table 5 also show that men scored higher than women on the BA measure.

Correlates of psychological flexibility

Correlation values between psychological flexibility and the other variables considered in this work are presented in Table 6 for the community sample and Table 7 for the post-partum sample. Concerning the measures that were used in both samples, we found consistent positive significant associations between measures of psychological flexibility and self-compassion, and consistent negative significant associations between measures of psychological flexibility and anxiety and depression. In other words, for both community participants and post-partum women, higher levels of openness to experience (OE), behavioral awareness (BA),s and valued action (VA) were associated with higher self-compassion and lower anxiety and depressive symptoms.

As for the community sample, results further showed that higher levels of psychological flexibility were associated with lower levels of loneliness. The three psychological flexibility processes behaved differently in what concerns the measure of mental health and of resilience (MHI). OE and BA correlated negatively with the MHI's measures of loss of control, depression, and anxiety meaning that the higher the OE and BA, the lower the level of loss of control, depression, and anxiety. In turn, VA did not correlate significantly with those measures. BA additionally correlated significantly and negatively

with general positive effect, meaning that the higher the BA, the higher the general positive effect. As for resilience, BA and VA correlated positively with all facets of resilience, whereas OE only correlated (positively) with personal competence. Concerning the post-partum sample, results also showed that higher scores on psychological flexibility were linked to higher levels of mindful parenting.

Discussion

The present study provided important methodological contributions in further assessing the factorial structural validity of the Portuguese CompACT across a large sample comprising community adults and women who had given birth over the previous 12 months. This study also examined relations between psychological flexibility and theoretically relevant constructs, and tested for sample-based (female participants from the general vs from the post-partum sample) and gender-based invariance in terms of response to the instrument. In general, results support the three-factor structure of the 18-item Portuguese CompACT (Openness to Experience, Behavioral Awareness, and Valued Action), alike the original 23-item CompACT that was developed with a UK sample (Francis et al., 2016), in the Portuguese community adults and post-partum mothers subsamples.

Trindade et al. (2021) were unable to test for gender invariance as all three of their samples were predominantly women (>80%), and Francis et al. (2016) did not conduct this analysis in the original CompACT validation study. Thus, the present study represents a clear advance in our psychometric knowledge underpinning the validity of the Portuguese CompACT across both genders, insofar as gender invariance was observed in the community adults sample. As such, reliable comparisons can be made on the scores of women and men. The one difference that emerged in the community sample was a lower level of Behavioral Awareness for women than men. There is little in the empirical literature to suggest that there

are gender differences in dispositional trait mindfulness, which Behavioral Awareness most closely reflects, and thus this finding could be followed up by future researchers in different cultures and contexts to see how stable it is.

The importance of testing for metric invariance within genders but across samples was also clear to be seen from the current study. It was noteworthy that community adult women scored significantly lower on Behavioral Awareness and Valued Action than post-partum women, but significantly higher on Openness to Experience. The reasons for these differences are unclear, but it is likely that having a newborn infant to care for is something that requires a lot of committed action and thus the behavior of caring and nurturing for their baby makes this valued action much more apparent and salient. It might also be that, as infants are so highly dependent on their carer, post-partum mothers, have their primary focus on feeding, nurturing, and establishing routines around sleeping and feeding, leaving little time for thinking about an imagined future or travelling back to a conceptualized past (hence higher scores on Behavioral Awareness). Therefore, this might help partly explain why they might be more aware of the present moment and viewing themselves within a maternal caregiver context while looking after their helpless infant. A reasonable explanation for lower scores of post-partum mothers on Openness to Experience scale is less apparent. However, it is feasible that the post-partum period could be characterized by increased experiential avoidance of unwanted thoughts, feelings, and emotions regarding motherhood and unpleasant bodily sensations such as extreme tiredness following sleep deprivation (Fonseca, Monteiro, & Canavarro, 2018), alongside increased cognitive fusion with unpleasant thoughts such as they 'might not be a good enough mother'. Furthermore, the timing of the data collection during the global COVID-19 pandemic should be taken into consideration, given that these post-partum mothers likely had less access to familial, social, and community medical support networks in comparison with what new mothers typically would have, which

could also partially account for lower levels of Openness to Experience reported here compared to community sample.

The three factors of psychological flexibility assessed by the Portuguese CompACT correlated in expected directions with other constructs under analysis: negatively with psychological distress, poor mental health, and loneliness, and positively with self-compassion, and resilience. In the post-partum sample, all Portuguese CompACT factors correlated highly with mindful parenting, supporting a burgeoning literature (e.g., Whittingham & Coyne, 2019), further highlighting the potential for incorporating interventions to enhance psychological flexibility in mindful parenting programs (e.g., Fernandes et al., 2020). It was interesting to observe differences in internal consistency across the two samples for the three factors of psychological flexibility. Cronbach's alphas were at .88 or above for all three for the Community sample, but ranged from .60 for Openness to Experience to .87 for Behavioral Awareness in the post-partum sample. There could be a number of explanations for the low internal reliability for Openness to Experience for relatively new mothers. For example, being in the post-partum period is often accompanied by doubts about parenting ability, lack of sleep, exhaustion, and perhaps even some private experiences of regret and loss for the pre-child life. It could be that post-partum mothers are not willing to acknowledge these feelings or thoughts that they think they ought not to have, because they might be perceived as a failure or a bad mother, and thus it is possible that this could lead to mixed responding on the experiential avoidance-based items.

However, the data from the present study underscores the acknowledged difficulty in the literature (see Ong et al., 2020; Kashdan et al., 2020) of measuring psychological flexibility as a single construct, as it comprises a number of sub-component processes (typically described as three or six components; Hayes et al., 2006; Hayes et al., 2011; Francis et al., 2016). In simple terms, the three core factors of the CompACT that underpin

the overarching construct of psychological flexibility (i.e., Openness to Experience; Behavioral Awareness, and Valued Action), demonstrated different patterns of association from one another with various aspects of individual functioning. For example, although all three subscales correlated significantly with depression and anxiety as measured by the HADS and the MHI, Valued Action did not correlate with the measure of mental health (MHI). Furthermore, of the six factors that comprised the resilience scale employed, Openness to Experience only correlated with a single factor (i.e., personal competence), whereas Behavioral Awareness and Valued Action correlated significantly with all six.

These were interesting results considering that the CompACT's subscales have, in previous studies, presented similar correlation patterns. In Trindade et al. (2021), all subscales were significantly associated with the other variables employed in that study, in which depression, anxiety, and stress were included. The original CompACT study (Francis et al., 2016) also showed consistency between the subscales' associations with variables such as depression and anxiety (which were significantly linked to each subscale), or general health and physical functioning (to which no subscale was significantly associated). Furthermore, in a study by Rogge et al. (2019), conducted with the original 23-item version of the CompACT, all three subscales were associated with depressive symptoms and satisfaction with life, although Behavioral Awareness was more weakly associated with higher current life satisfaction.

The present data generally support Ong et al.'s (2020) finding that the CompACT has good discriminant validity properties, insofar as non-significant associations with scales measuring negative emotionality and loneliness were observed. Moreover, the data also augment Ong et al.'s suggestion that researchers and clinicians should focus more on the three separate component factors rather than rely on calculating a *total* psychological flexibility score when linking psychological wellbeing and behavior changes to interventions

designed to alter levels of psychological flexibility in clients. Indeed, Ong et al. (2020) reported that Openness to Experience and Valued Action had particularly strong item performance in an item response theory analysis.

These results should, nonetheless, be interpreted considering some limitations. First, it should be highlighted that it was the Portuguese version of the CompACT that was examined in this study. Although the current results may generally inform future research on the CompACT, as well as on psychological flexibility processes, one should be aware that our findings may not be replicable across cultures. In fact, cultural differences (between UK and Portuguese samples) have been demonstrated regarding some of the items of the 18-item version of the CompACT (Trindade et al., 2021), indicating that in different cultural contexts the same content may lead to different patterns of responses. The cross-sectional nature of this study is another limitation that should be considered, especially in the interpretation of the correlation results, which are not indicative of any causal relationships among variables. The Portuguese CompACT's performance and correlates in clinical samples (e.g., samples with psychiatric disorders) would be of interest to further analyze this scale's psychometric quality, as well as to complement and add to previous psychological flexibility research conducted with the AAQ-II. As noted above, while not a limitation per se, the fact that this data was collected during a pandemic with enforced government lockdowns in place means it is possible that levels of psychological flexibility, resilience and mental health were lower than what might be expected in non-pandemic times. Thus, future research with similar samples post-pandemic with a full open society would be desirable to assess for the stability and reliability of the findings of the present study. Regarding the measurement invariance analysis between community women and post-partum women, it is important to highlight that no information was available on whether community women were in the post-partum period, and therefore the results related to this analysis should be taken with caution. Finally, as is

quite typical of such cross-sectional online survey designs, interpretation of the present study data is potentially limited by common method variance (e.g., Lindel & Whitney, 2001).

It remains for future researchers to test the reliability and validity of the Portuguese CompACT across a range of samples with clinical conditions to assess structural validity in a variety of mental health and wellbeing contexts. However, given the diversity of the samples with different situational contexts such as women with breast cancer in Trindade et al. (2021) and post-partum mothers as well as community adults in the present study, the evidence for the utility of the Portuguese CompACT in different groups is growing.

Data availability statement

Data is available upon reasonable request

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Table 1: Demographic characteristics of subsamples

	Community subsample			Female post-partum subsample (n = 567)
	Total participants (n = 523)	Female participants (n = 421, 80.5%)	Male participants (n = 102, 19.5%)	
Age, M (SD)	33.17 (12.59)	32.54 (12.51)	35.77 (12.69)	32.97 (5.07)
Marital status, n (%)				
Married or cohabitating	148 (34.4)	116 (27.6)	32 (31.4)	239 (42.2)
Unmarried/ non-marital partnership	[a]	[a]	[a]	255 (45)
Single	240 (55.8)	183 (43.5)	57 (55.9)	61 (10.8)
Divorced	38 (8.8)	36 (8.6)	2 (2.0)	12 82.1)
Widowed	4 (0.9)	3 (0.7)	1 (1.0)	-
Professional status, n (%)				
Employed or working-student	287 (54.8)	224 (53.2)	63 (61.7)	467 (82.4)
Unemployed	73 (14.0)	61 (14.5)	12 (11.8)	95 (16.8)
Full-time student	154 (29.4)	131 (31.1)	23 (22.5)	4 (0.7)
Retired	9 (1.7)	5 (1.2)	4 (3.9)	-

Note: Within the community sample, 83 women and 10 men did not provide information on their marital status. Within the post-partum sample, 1 participant did not provide information on her professional status.

[a] not assessed in the community sample.

Table 2: Self-report measures complected by each subsample and period of data collection

	Community subsample (n = 523)	Post-partum subsample (n = 567)
Self-report instruments		
Portuguese CompACT	n = 523	n = 567
SCS-SF	n = 430	n = 567
HADS	n = 430	n = 567
UCLA	n = 430	-
MHI[a]	n = 93	-
RSA	n = 430	-
IM-P	-	n = 567
Time of data collection	January - May 2020	April - May 2020

Note: Portuguese CompACT = Portuguese version of the Comprehensive Assessment of Acceptance and Commitment Therapy Processes, SCS-SF = Self-Compassion Scale – Short form, HADS = Hospital Anxiety and Depression Scale, UCLA-Loneliness = UCLA Loneliness Scale, MHI = Mental Health Inventory, RSA = Resilience Scale for Adults, IM-P = Interpersonal Mindfulness in Parenting Scale.

[a] The study from which this data was collected included only the MIH and the Portuguese CompACT.

Table 3: Fit indicators for confirmatory factor analyses and multi-group measurement invariance analyses

	X^2	df	RMSEA	90% CI for RMSEA	CFI	SRMR
Measurement models						
Three-correlated factors	761.73	132	.066	.062; .071	.89	.074
Adjusted three-correlated factors[a]	611.03	128	.059	.054; .064	.92	.074
Multi-group analyses						
Female participants by sample						
Unconstrained model	671.12	256	.057	.052; .063	.92	.074
Metric Invariance	692.60	271	.056	.051; .061	.92	.077
Scalar invariance	938.59	286	.068	.063; .073	.88	.087
Partial scalar invariance[b]	743.73	282	.058	.053; .063	.92	.078
Community participants by gender						
Unconstrained model	463.09	256	.054	.047; .064	0.944	.059
Metric Invariance	472.77	271	.053	.045; .061	.945	.064
Scalar invariance	490.52	286	.052	.044; .060	.944	.064

Note: All $\chi 2$ values were significant at $p > .001$.

[a] Includes the following four residual covariances: item 14 with item 16 and item 8 with item 11, all pertaining to Behavioral Awareness, item 4 with item 7 referring to Openness to Experience, and item 9 with item 15 concerning Valued Action. [b] The intercept of items 1, 4, 7, and 8 were allowed to vary between subsamples.

Table 4: Loading values for the complete sample and subsamples considered under measurement invariance analyses

		Female participants		Community sample	
	Complete sample	Community subsample	Post-partum subsample	Male participants	Female participants
Openness to Experience					
2. One of my big goals is to be free from painful emotions	.50	.59	.44	.47	.59
4. I try to stay busy to keep thoughts or feelings from coming	.48	.70	.42	.57	.71
7. I tell myself that I shouldn't have certain thoughts	.50	.67	.43	.55	.69
10. I go out of my way to avoid situations that might bring difficult thoughts, feelings, or sensations	.72	.76	.60	.61	.74
13. I work hard to keep out upsetting feelings	.68	.78	.58	.67	.79
Behavioral Awareness					
3. I rush through meaningful activities without being really attentive to them	.67	.72	.67	.64	.74
8. I find it difficult to stay focused on what's happening in the present	.63	.64	.63	.54	.65
11. Even when doing the things that matter to me, I find myself doing them without paying attention	.90	.92	.59	.84	.92
14. I do jobs or tasks automatically, without being aware of what I'm doing	.79	.82	.77	.73	.82
16. It seems I am "running on automatic" without much awareness of what I'm doing	.85	.86	.84	.78	.86
Valued Action					
1. I can identify the things that really matter to me in life and pursue them	.61	.56	.61	.67	.58

5. I act in ways that are consistent with how I wish to live my life	.73	.78	.66	.78	.76
6. I make choices based on what is important to me, even if it is stressful	.48	.62	.40	.59	.64
9. I behave in line with my personal values	.61	.64	.55	.62	.63
12. I undertake things that are meaningful to me, even when I find it hard to do so	.63	.69	.53	.76	.71
15. I am able to follow my long terms plans including times when progress is slow	.69	.71	.64	.80	.69
17. My values are really reflected in my behaviour	.61	.69	.52	.69	.70
18. I can keep going with something when it's important to me	.78	.78	.74	.84	.80

Note: Completely standardized loading values are presented.

Table 5: Internal consistency and descriptive values in the study's subsamples

	Community subsample			Post-partum subsample		
	OE	BA	VA	OE	BA	VA
Cronbach's alpha	.88	.89	.88	.60	.87	.79
Descriptive values [M(SD)]						
Men	11.53 (5.79)	16.38 (6.74)	35.93 (7.95)	-	-	-
Women	10.41 (6.65)	14.56 (7.61)	36.14 (7.58)	10.22 (5.19)	17.15 (7.53)	38.32 (5.96)

Table 6: Correlates of psychological flexibility in the community sample

	OE	BA	VA	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MHI											
General positive affect	-.11^{ns}	-.27**	-.11^{ns}	-	-	-	-	-	-	-	-
Loss of behavioral/ emotional control	-.43***	-.45***	.06^{ns}	-	-	-	-	-	-	-	-
Anxiety	-.33**	-.32**	.08^{ns}	-	-	-	-	-	-	-	-
Depression	-.36***	-.34***	.03^{ns}	-	-	-	-	-	-	-	-
(1) SCS-SF	.35***	.46***	.52***		-	-	-	-	-	-	-
HADS											
(2) Anxiety	-.41***	-.58***	-.40***	-59***	-	-	-	-	-	-	-
(3) Depression	-.31***	-.53***	-.47***	-.58***	.69***	-	-	-	-	-	-
(4) UCLA	-.28***	-.38***	-.45***	-.53***	.52***	.64***	-	-	-	-	-
RSA											
(5) Perception of self	.28***	.46***	.57***	.71***	-.62***	-.61***	-.55***	-	-	-	-
(6) Planned future	.22***	.37***	.55***	.52***	-.46***	-.58***	-.50***	.71***	-	-	-
(7) Social competence	.10*	.25***	.35***	.36***	-.29***	-.39***	-.56***	.39***	.36***	-	-
(8) Family coherence	.05^{ns}	.19***	.34***	.29***	-.27***	-.36***	-.54***	.38***	.35***	.32***	-
(9) Social support	.09^{ns}	.24***	.38***	.34***	-.29***	-.46***	-.70***	.44***	.39***	.49***	.68***

Note: OE = Openness to Experience, BA = Behavioral Awareness, VA = Valued Action, MHI = Mental Health Inventory, SCS-SF = Self-Compassion Scale – Short form, HADS = Hospital Anxiety and Depression Scale, UCLA-Loneliness = UCLA Loneliness Scale, RSA = Resilience Scale for Adults. Participants who completed the MHI (n = 93; see Table 2) did not fill in any of the other measures, except for the Portuguese CompACT.

* p < .05; ** p < .01; *** p < .001; ^{ns} non-significant

Table 7: Correlates of psychological flexibility in the post-partum sample

	OE	BA	VA	(1)	(2)	(3)	(4)
(1) SCS-SF	.27***	.56***	.52***		-	-	-
HADS							
(2) Anxiety	-.37***	-.53***	-.42***	-.62***	-	-	-
(3) Depression	-.28***	-.57***	-.48***	-.58***	.68***	-	-
(4) IM-P-I	.12***	.51***	.44***	.63***	-.42***	-.44***	-

Note: OE = Openness to Experience, BA = Behavioral Awareness, VA = Valued Action, SCS-SF = Self-Compassion Scale – Short form, HADS = Hospital Anxiety and Depression Scale, IM-P = Interpersonal Mindfulness in Parenting Scale.

* $p < .05$; ** $p < .01$; *** $p < .001$; ^{ns} non-significant