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Between-Individual Differences in Baseline Wellbeing and Emotion Regulation Strategy Use Moderate the Effect of a Self-Help Cognitive-Behavioral Intervention for Typical Adults

Running Head: Moderators of a self-help intervention

Jean-Baptiste Pavani[a], Guillaume Berna[b], Eva Andreotti[b], Theo Guiller[a], Pascal Antoine[b], Bruno Dauvier[a] and Anne Congard[c]

[a] Center for Research on the Psychology of Cognition, Language and Emotion (PsyCLE), Aix Marseille University, Aix en Provence, France

[b] Cognitive and Affective Sciences Laboratory (SCALab), University of Lille 3-CNRS, Villeneuve d'Ascq, France

[c] Pays de la Loire Psychology Laboratory (LPPL), University of Nantes, Nantes, France

Author note :

Corresponding author's email address: jean-baptiste.pavani@univ-amu.fr ; postal address: Centre PsyCLE, Aix-Marseille Université, Maison de la Recherche, 29, Av. Schuman, 13621 Aix en Provence Cedex 1, France. Tel.: +334 13 55 37 58.

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Abstract

Background: Self-help interventions intended to help nonclinical individuals regulate their emotions can have important social benefits (i.e., mental disorder prevention, wellbeing promotion). However, their mean effect size on wellbeing is generally low, possibly because there are considerable between-individual differences in the response to these interventions. The present study examined whether individuals' baseline levels of emotional wellbeing and engagement in emotion regulation strategies moderate the effects on these same variables of a 4-week self-help cognitive-behavioral intervention intended for typical adults.

Methods: Data were collected from 158 nonclinical French adults (n = 95 for the control group, n = 63 for the cognitive-behavioral group) using experience sampling. Emotional wellbeing was assessed, as well as the engagement in three emotion regulation strategies (i.e., cognitive reappraisal, problem solving, and appreciation).

Results: As expected, the posttest scores on some variables were significantly predicted by the interactions between the intervention and the pretest scores on these same variables. In particular, it was the participants with the most *negative* baseline levels (i.e., low emotional wellbeing, low engagement in appreciation) who benefitted most from the intervention.

Discussion: Results are discussed in the light of current knowledge on between-individual differences in how individuals respond to interventions.

***Keywords**:* between-individual differences, moderator, self-help, cognitive-behavioral therapy, emotion regulation

Introduction

Emotion regulation

Emotion regulation encompasses the whole range of behavioral and cognitive processes that individuals can use to modify the intensity of their emotions (Gross, 2015; Parkinson & Totterdell, 1999). These processes are commonly labelled *emotion regulation strategies* (Gross, 2015; Naragon-Gainey, McMahon, & Chacko, 2017). Depending on which strategies they use to regulate their emotions, individuals will end up with different levels of mental health and wellbeing. For instance, the frequent use of *rumination* (i.e., strategy whereby individuals passively focus on negative experiences) puts individuals at risk of emotional disorders (Nolen-Hoeksema, 2000). This risk is also increased by the rare use of strategies like *cognitive reappraisal* (i.e., strategy whereby individuals evaluate a situation they initially appraised as negative in a more favorable light) and *problem solving* (i.e., strategy whereby individuals take direct actions to modify situations they perceive as negative; Jenness et al., 2016; Pryce et al., 2011). Correspondingly, the rare use of strategies like cognitive reappraisal, and the frequent use of strategies like rumination, are associated with lower *emotional wellbeing* (i.e., frequent/intense negative emotions and/or rare/nonintense positive emotions; Pavani, Le Vigouroux, Kop, Congard, & Dauvier, 2017).

If the emotion regulation strategies used by individuals influence their mental health and wellbeing, then emotion regulation can be viewed as a prime target for mental disorder prevention and wellbeing promotion. This may explain the increasing number of emotion regulation-focused interventions aimed at nonclinical individuals.

Emotion regulation-focused interventions for nonclinical individuals

Emotion regulation-focused interventions cover the whole range of treatments intended to promote specific behavioral or cognitive processes by which individuals can modify the intensity of their emotions. Thus defined, they include various types of treatments, such as cognitive-behavioral

therapy (Beck, 2011)[1], positive psychology interventions (Bolier et al., 2013), and mindfulness meditation interventions (Schumer, Lindsay, & Creswell, 2018)[2].

When designed for nonclinical individuals, emotion regulation-focused interventions commonly consist of self-help programs (Muñoz et al., 2016). The most frequently studied self-help emotion regulation-focused programs are positive psychology interventions and mindfulness meditation interventions, owing probably to their proven effectiveness in enhancing emotional wellbeing (Bolier et al., 2013; Schumer et al., 2018). Other, albeit rarer, self-help emotion regulation-focused programs have nevertheless emerged. In particular, some researchers have begun to borrow from the therapeutic techniques used in cognitive-behavioral therapy for depression or anxiety disorders to design self-help programs aimed at nonclinical individuals (Geraghty, Wood, & Hyland, 2010a, 2010b; Levin, Haeger, An, & Twohig, 2018).

Designing these interventions is a tentative process, as the main emotion regulation strategies promoted by cognitive-behavioral therapy (i.e., cognitive reappraisal via therapeutic techniques inviting individuals to record and change the content of their negative thoughts, problem solving via step-by-step techniques ranging from brainstorming to the assessment of the results of one's actions) may be hard to learn without the support of a clinician (Beck, 2011). Nevertheless, it might be important to design such interventions, as the emotion regulation strategies promoted by cognitive-behavioral therapy, like the therapeutic techniques through which these strategies are promoted in this type of therapy, have been robustly shown to increase emotional wellbeing (Cuijpers, Cristea, Karyotaki, Reijnders, &Huibers, 2016). Consistent with this, some recently-designed self-help cognitive-behavioral interventions aimed at nonclinical individuals have already been shown to

[1] In this article, the adjective *cognitive-behavioral* refers to the most traditional cognitive-behavioral therapy, which focuses mainly on changing negative thoughts (Beck, 2011).

[2] The term *cognitive-behavioral therapy* covers a wide range of treatments depending, for instance, on the type of disorder being targeted. Similarly, positive psychology interventions and mindfulness meditation interventions cover numerous subtypes of treatments of varying length (i.e., brief vs. long) and content (e.g., expressing gratitude vs. cultivating one's strengths for positive psychology interventions). Nevertheless, we chose to use a single label to refer to each of these three types of interventions, as the subtypes of treatments nested within each of these types seem to share common features (e.g., all subtypes of mindfulness meditation interventions are designed to promote experiential acceptance, and all subtypes of positive psychology interventions are designed to enhance the intensity of positive emotional experiences).

enhance emotional wellbeing. If we exclude studies that only tested a very brief intervention in the laboratory, we can identify three of these interventions.

The first two interventions were designed by Geraghty et al. (2010a, 2010b). The first is aimed at individuals interested in worrying less (Geraghty et al., 2010a), while the second is aimed at individuals interested in being less dissatisfied with their bodily appearance (Geraghty et al., 2010b). In both these interventions, participants receive workbooks containing psychoeducational information about how negative thoughts could contribute to their problems, the importance of recording and challenging these negative thoughts, and the way to do so using record sheets and the challenging techniques that are typical of cognitive-behavioral therapy. For each intervention, recording and challenging automatic thoughts has been shown to reduce the intensity of the targeted psychological tendency (i.e., worrying or body dissatisfaction).

The third self-help cognitive-behavioral intervention whose effect on emotional wellbeing has been tested is a mobile app treatment (Levin et al., 2018). One of the app's main features is that participants receive a message 3 times a day between 9 a.m. and 9 p.m., asking them whether they are experiencing a negative and troubling thought. If they are, the app recommends that they practice cognitive-behavioral skills that it helps them to implement, via its interactive exercises and menus of skill-coaching sessions. Consistent with the results for Geraghty et al. (2010a, 2010b)'s two interventions, the use of this mobile phone app significantly reduces the intensity of the negative emotions felt by participants.

Albeit statistically significant, the effects of self-help emotion regulation-focused interventions on nonclinical individuals' emotional wellbeing are generally small in size. Because of their rarity, the effects of self-help cognitive-behavioral interventions have not been examined with meta-analyses. However, such analyses have been conducted on the effects of positive psychology interventions and mindfulness meditation interventions. Specifically, according to Bolier et al. (2013)'s meta-analysis, the mean effect size of positive psychology interventions on depressive

symptoms is d = -0.23, while the meta-analysis conducted by Schumer et al. (2018) found a mean effect size of g = -0.21 for the effect of mindfulness meditation interventions on negative emotional experiences. Such low mean effect sizes, that are likely to be found again regarding self-help cognitive-behavioral interventions considering the initial results obtained with this type of intervention (Geraghty et al., 2010a, 2010B; Levin et al., 2018), may suggest that there are considerable between-individual differences in the response to interventions such as these.

Between-individual differences and emotion regulation-focused interventions for nonclinical individuals

Several remarkable studies have attempted to identify baseline individual characteristics that could robustly explain between-individual differences in the response to psychological interventions (e.g., Schneider, Arch, & Wolitzky-Taylor, 2015; Snow, 1991). However, the identification of such variables is hindered by several factors. Considerable methodological inconsistencies between studies exist, regarding for instance the importance of analyzing putative nonlinear moderation effects (Schneider et al., 2015; Snow, 1991). More surprisingly, inconsistencies also emerge in the theoretical arguments researchers advance to justify examining one baseline characteristic rather than another (Schneider et al., 2015). These later inconsistencies are more surprising because hypotheses on the moderating effect that baseline individual characteristics can have on the impact of an intervention have been around for at least four decades. In particular, Cronbach and Snow (1977; Snow, 1991) advanced the *compensation of weaknesses* hypothesis, according to which an intervention is more effective if it specifically targets an individual's weaknesses.

A number of studies have provided initial support for this hypothesis in the context of self-help emotion regulation-focused interventions. These studies did not look at self-help cognitive-behavioral interventions, whose differential effects have not been examined up to now. Instead, they focused on self-help positive psychology interventions and mindfulness meditation interventions, potentially providing information on the psychological phenomena that can be

observed in other types of self-help interventions too. For instance, the main weakness targeted by mindfulness meditation interventions is probably a weak disposition to be mindful in everyday life (i.e., a weak tendency to pay attention to the present moment and to do it in an open, nonjudging, manner). Thus, self-help mindfulness meditation interventions should be more beneficial for individuals with a low versus high baseline mindfulness disposition. As this disposition is strongly negatively correlated with neuroticism (Giluk, 2009), self-help mindfulness meditation interventions should also be of greater benefit to individuals with high versus low baseline neuroticism. This has indeed been shown to be the case in several initial studies of this issue (Antoine, Congard, et al., 2018; Bhayee et al., 2016; Nyklíček & Irrmischer, 2017).

Importantly, initial findings regarding positive psychology interventions also support the *compensation of weaknesses* hypothesis (Antoine, Dauvier, Andreotti, & Congard, 2018; Froh, Kashdan, Ozimkowski, & Miller, 2009). Positive psychology interventions promote the use of a variety of strategies that are supposed to upregulate positive emotions (e.g., appreciating the present, being grateful, anticipating future positive events). Thus, according to the *compensation of weaknesses* hypothesis, these interventions should be mostly effective among the individuals who display the lowest baseline levels of positive emotional experiences and/or engagement in positive emotion-enhancing strategies. This has been shown to be the case in a few studies (Antoine, Dauvier, et al., 2018; Froh et al., 2009), although other studies encourage to have a more complex view on positive psychology interventions, as each positive psychology intervention seems to target a distinctive individual weakness (e.g., Schueller, 2012).

By contrast, as mentioned above, although interesting self-help cognitive-behavioral interventions for nonclinical individuals have been designed (Geraghty et al., 2010a, 2010b; Levin et al., 2018), no attempt has been made to identify baseline individual characteristics liable to moderate their effects. The objective of the present study was thus to made just such an attempt. Increasing knowledge on this issue is potentially important for two reasons. First, as mentioned above, self-help emotion regulation-focused interventions for nonclinical individuals may be useful for preventing

mental disorders and promoting wellbeing. Thus, they represent important ingredients of current applied psychology. Second, clinical improvements can come from knowing which types of individuals are most likely to benefit from a given intervention (Cronbach & Snow, 1977; Snow, 1991).

The Present Study

The goal of the present study was to determine whether baseline individual characteristics moderate the effects on emotional wellbeing and emotion regulation strategy use of a self-help cognitive-behavioral intervention for nonclinical individuals. As well as tackling an original topic, this study featured a rather innovative method. First, for the pre- and posttest assessments, rather than using classic questionnaires inviting participants to evaluate themselves over a long period of time, we used 3 days of experience sampling (Hektner, Schmidt, & Csikszentmihalyi, 2006). This method is less likely to be contaminated by memory biases than the classic questionnaires we mentioned, and is therefore a useful tool for investigating the effects of interventions (Andreotti et al., 2018). Second, the statistical analyses we performed to test whether baseline characteristics moderated the effects of an intervention are rare, having recently been used in only two recent studies (Antoine, Congard, et al., 2018; Antoine, Dauvier, et al., 2018).

To our knowledge, two main weaknesses may be targeted by cognitive-behavioral therapy. The first is emotional distress (i.e., low emotional wellbeing; Beck, 2011). The second is the underuse or nonintense use of the emotion regulation strategies that cognitive-behavioral therapy promotes via its therapeutic techniques (i.e., cognitive reappraisal and problem solving as mentioned above, but also positive emotion-enhancing strategies such as appreciation via the mastery and pleasure technique; see Beck, 2011). On this basis, we predicted that the self-help program used in the present study would enhance emotional wellbeing and the use of cognitive reappraisal, problem solving, and appreciation more among individuals with low versus high baseline levels for these variables.

Method

Participants

Participants were 158 adults (79% female) aged 18-63 years (*M* = 36.18, *SD* = 11.79). Our recruitment method was guided by the wish to maximize ecological validity (i.e., to collect data among individuals interested in improving their emotional life). This determined the manner in which we advertised for participants. Specifically, by presenting the study as a possible way to acquire knowledge about and/or learn new ways of regulating one's emotions within a scientific framework, we found volunteers to take part via our own social networks, as well as via advertisements posted on social media pages devoted to wellbeing and personal development. Potential volunteers were initially directed to a webpage containing sufficient information for them to understand the different experimental groups in which they could engage, and decide whether they were interested in taking part[3]. Our emphasis on ecological validity also determined the manner in which participants were allocated to either the control group or the cognitive-behavioral group. Instead of being random, this allocation was based on participants' preferences. Thus, no attempt was made to balance the two groups in terms of sex, age, or any other variable. On the contrary, if the participants who preferred one group differed from those who preferred the other group, we viewed this information as interesting and therefore did not suppress it (see Table 1). There were two exclusion criteria (i.e., age below 18 and the displayed of a diagnosed emotional disorder).

(Insert Table 1 about here)

[3] The translation of the text displayed on this webpage is contained in an open-access file available at https://osf.io/3bd9m/files/.

As shown in Figure 1, a total of 191 individuals (n = 115 for control group, n = 76 for cognitive-behavioral group) initially volunteered to take part in the study[4]. Similar proportions (i.e., 17%) dropped out in each group. These participants who dropped-out did not differ from the individuals who completed the study on any of the variables assessed before the experience-sampling period: sex (χ^2 = 1.77, p = .18), age (t = -1.64, p = .11), and education level (χ^2 = .44, p = .83).

(Insert Figure 1 about here)

Procedure

The procedure we followed was in accordance with the ethical standards of the institutional research committee and with the 1964 Declaration of Helsinki and its later amendments. Written informed consent was obtained from each participant. Participants were informed that they could quit the study whenever they wanted without providing any explanation. Furthermore, they were informed that a licensed psychologist would be available to answer any questions they might have regarding the study material during the experiment. Thus, although no approval from an ethics committee was sought for this study for practical reasons (i.e., redesign of the university ethics committee at the start of the study), the most stringent ethical standards were upheld. Depending on their stated preference and their geographical proximity to the experimenters, potential participants received information about the project through face-to-face meetings, phonecalls, or emails. Participants were nonrandomly assigned to the control or cognitive-behavioral groups according to their preference. The study was rolled out in two phases.

[4] This difference in numbers does not mean that more individuals preferred to be in the control group rather than in the cognitive-behavioral group. The study reported here was a part of a broader, ongoing project in which participants interested in following an intervention can choose between a cognitive-behavioral group and two other groups with emotion regulation-focused interventions, thus reducing the number of participants in each interventional condition.

The first phase involved the completion of a questionnaire battery that included a sociodemographic questionnaire, as well as a more original questionnaire. The latter was designed to neutralize the considerable interindividual differences that probably characterized the labeling of emotional experiences, as done in previous studies (Le Vigouroux, Pavani, Dauvier, Kop, & Congard, 2017; Pavani et al., 2017). More precisely, this questionnaire was inspired by the studies of Nesselroade, Gerstorf, Hardy, and Ram (2007), and Nesselroade and Molenaar (2017), on how to tailor a construct to each individual, all the while leading all the individuals to assign the same core meaning to this construct. More specifically, for each emotion- and emotion regulation-related item we wanted to include in the brief questionnaire for the experience-sampling period (see below), participants were each asked to choose the wording they felt best described this item out of three wording options[5]. These choices were used to compile the brief questionnaire that each participant would subsequently be asked to complete in the second phase.

This second phase consisted of an experience-sampling period. For reasons related to the intervention schedule, the second phase began on the Friday following each participant's completion of the questionnaire battery. For 32 consecutive days, all participants received the above-mentioned brief questionnaire twice a day (i.e., at noon and at 7 p.m.). A hyperlink to this questionnaire was sent by SMS or e-mail, according to participants' preference. The brief questionnaire asked participants to provide information about different aspects of their emotional life. It contained visual analogue scales yielding scores ranging from 0 to 100, and could be completed in less than 5 minutes. Participants responded to 8,446 of the 10,112 brief questionnaires sent (i.e., 84%). The difference between the proportions of brief questionnaires completed in the two groups was negligible (i.e., 83% for the control group, 85% for the cognitive-behavioral group).

Completing the brief questionnaire was the only task that participants in the control group were asked to perform during the experience-sampling period. By contrast, participants in the

[5] The wording options for each item in the experience-sampling period questionnaire are contained in an open access file available from https://osf.io/3bd9m/files/.

cognitive-behavioral group also had to follow a self-help intervention. This intervention did not begin on the first day of the experience-sampling period. Instead, it began on the fourth day (i.e., first Monday of this period), in order to have a 3-day *pretest period* (i.e., preceding Friday, Saturday, and Sunday) during which participants in the cognitive-behavioral group only had to respond to the brief questionnaire.

Described in detail below, the intervention consisted of one activity per day, except at weekends, when participants were given a break. These activities were sent at 9 a.m., so that participants could consult them during the day, even if they could only perform them in the evening. The hyperlink to each activity was sent either by SMS or by e-mail, according to participants' preferences. The intervention lasted 4 weeks, and therefore comprised 20 activities (i.e., 4 x 5 activity days), and ended on the Friday of the fourth week. The following Saturday, Sunday, and Monday, with no more activities to accomplish, served as a *posttest period*, equivalent in length (i.e., 3 days) to the pretest. Importantly, at the end of each activity, there was an item on which participants had to click when the activity was completed. This enabled us to determine the extent to which participants actually followed the intervention. Specifically, participants completed 976 of the 1260 activities sent (i.e., 77%). Lastly, it is worth noting that as the participants in the cognitive-behavioral group only had to respond to the brief questionnaire during the 3-day pre- and posttests, these two periods were equivalent for the two groups.

Cognitive-Behavioral Intervention Overview

Week 1 was devoted to functional analysis. Activity 1 invited participants to perceive the causal link between the situations in which they engaged and their level of wellbeing, by completing the initial phase (i.e., monitoring/recording) of the mastery and pleasure technique (Beck, 2011, chap. 6). Activity 2 introduced participants to the causal link between thoughts and emotions, while also stressing the existence of different types of negative emotions, with an exercise derived from Beck (2011, chap. 10)'s emotion chart. Activities 3 and 4 invited participants to record the coincidences between situations, negative automatic thoughts, and negative emotions in their lives, by completing

typical automatic thoughts record sheets (Beck, 2011, chap. 12). Activity 5 encouraged participants to attempt to summarize what they had learned from the four previous activity days.

Week 2 focused mainly on the reappraisal of negative automatic thoughts. Activity 6 consisted of a relaxation breathing exercise based on hypoventilation (Cungi, 2010, chap. 3). Activities 7-9 encouraged participants to question their negative automatic thoughts using typical Socratic methods, seek evidence for and against them (Beck, 2011, chap. 11 and 12). They also invited participants to practice the relaxation technique from Activity 6 in their everyday lives. Activity 10 introduced a *shortcut* to challenging negative automatic thoughts (Beck, 2011, chap. 12).

Week 3 was devoted to the practice of behavioral skills. In Activity 11, participants practiced another relaxation technique, this time based on imagery (Cungi, 2010, chap. 3). Activities 12 and 13 encouraged participants to choose and attempt to solve one external problem using a 6-step procedure derived from D'Zurilla and Nezu (2006)'s recommendations. Activities 14 and 15 invited participants to perform all the phases of the mastery and pleasure technique (Beck, 2011, chap. 6). Moreover, Activities 12-14 encouraged participants to practice the imagery-based relaxation technique.

Week 4 was devoted to the restructuring of negative core beliefs. Activities 16 and 17 encouraged participants to attempt to uncover their negative core beliefs, by identifying the main rules they try to follow, as well as the redundant themes of their negative automatic thoughts (Beck, 2011, chap. 13 and 14). Activities 18 and 19 invited participants to challenge a core belief of their choice, by reflecting on its development (Beck, 2011, chap. 13 and 14). Finally, Activity 20 encouraged participants to summarize what they had learned from the program6.

Materials

Emotional wellbeing: At each assessment point in the experience-sampling period, participants were asked to indicate on 12 visual analogue scales (one per emotion) the intensity with

[6]The full content of the program is available from the corresponding author on request.

which they currently felt the 12 emotions identified in the 12-point circumplex model (Yik, Russell, & Steiger, 2011). This model distinguishes between five positive emotions (i.e., E1 = highly activated positive affect; E2 = activated positive affect; E3 = neither activated nor deactivated positive affect; E4 = deactivated positive affect; E5 = highly deactivated positive affect). It also distinguishes between five negative emotions (i.e., E7 = highly deactivated negative affect; E8 = deactivated negative affect; E9 = neither activated nor deactivated negative affect; E10 = activated negative affect; E11 = highly activated negative affect). Lastly, it identifies two neutrally valenced emotions: one activated (E12), the other deactivated (E6).

Three wellbeing indicators (i.e., overall, activated, and deactivated emotional wellbeing) were computed on the basis of responses to the items assessing each indicator, in accordance with previous studies that have used these items (Dauvier, Pavani, Le Vigouroux, Kop, & Congard, 2019; Le Vigouroux et al., 2019; Pavani et al., 2017). Subtracting the averaged responses to Items E6-E11 from the averaged responses to Items E1-E5 yielded an indicator of overall emotional wellbeing (α = .86 at pretest and .87 at posttest). Subtracting the averaged responses to Items E6-E8 from the averaged responses to Items E3-E5 yielded a deactivated emotional wellbeing indicator (α = .77 at pretest and .75 at posttest). Finally, subtracting the averaged responses to Items E10 and E11 from the averaged responses to Items E1 and E2 yielded an activated emotional wellbeing indicator (α = .66 at pretest and .63 at posttest). We distinguished between different types of wellbeing according to their activation level because emotion regulation strategy use differs according to this level (Gross, 2015). For instance, effortful strategies like cognitive reappraisal appears to be hard to implement to regulate emotions that are high in activation (Raio, Orederu, Palazzolo, Shurick, & Phelps, 2013).

Emotion regulation strategy use.: At each assessment point, individuals were asked to use the visual analogue scale provided for each strategy we examined (one item per strategy) to rate the intensity with which they had engaged in cognitive reappraisal, problem solving, and appreciation since the previous assessment. Several previous studies have yielded information supporting the

construct validity of such items (e.g., Brans, Koval, Verduyn, Lim, & Kuppens, 2013; Brockman, Ciarrochi, Parker, & Kashdan, 2017; Pavani et al., 2017).

Data Analysis Strategy

The data analyzed corresponded to participants' responses to the questionnaire administered during the experience-sampling period-more precisely, their responses to this questionnaire during the 3-day pretest and 3-day posttest periods. Some critics may argue that we should have analyzed the whole 32-day experience-sampling period, to establish the whole trajectories of change in the two groups. However, given that our goal was to examine between-individual differences in the effects of an intervention, a pretest/posttest comparison seemed sufficient and more parsimonious. Collecting data throughout the whole experience-sampling period was made for the purposes of other research devoted to the identification of precise dynamical phenomena[7]. By averaging participants' scores on each of our variables of interest across each of these 3-day periods, we obtained one pretest score and one posttest score for each variable for each participant.

We adopted the data analytic strategy used by Antoine, Congard, et al. (2018) and Antoine, Dauvier, et al. (2018), which consisted of regression analyses. For each variable we examined, the posttest score was regressed on three predictors: 1) the pretest score of the variable, to neutralize the regression toward the mean in the variable of interest; 2) the group as a dichotomous variable, distinguishing between the cognitive-behavioral group and the control group, to examine the main effect of the intervention; and 3) the interaction between these two variables, to examine whether the effect of group depended on individuals' baseline levels of the variable being considered. This strategy is fully described in an open-access file available at https://osf.io/3bd9m/files/.

[7] It should be noted that we ran multilevel models on all observations nested within individuals, to examine the trajectories of change for individuals in the control and cognitive-behavioral groups. Had these trajectories been characterized by *special* features (e.g., nonlinearity), it would have been ill-advised on our part to restrict our analyses to pre/posttest comparisons. However, nonlinear effects (i.e., quadratic or cubic effects of time on our outcome variables), and their cross-level interactions with individual and group baseline levels, were negligible in size.

Importantly, we only included the interaction between group and pretest score in the regression analyses reported below when it significantly increased model fit, as assessed with an *F* test for model comparison. Sex, age (linear, quadratic and/or cubic), and/or education level were only entered as predictors in these analyses when they changed the statistical significance of an effect[8].

Results

Initial Analyses

Descriptive statistics are displayed in Table 2. The groups differed slightly at baseline. The greatest differences between the control and cognitive behavioral groups was for cognitive reappraisal use (31 vs. 38; $d = 0.33$). Student t tests indicated that only this baseline difference in cognitive reappraisal use was statistically significant ($t = 1.99$, $p < 0.05$). Another potentially interesting observation at this descriptive level was that in the control group, there was a decrease in emotional wellbeing between the pretest and posttest (e.g., from 64 to 61 for overall emotional wellbeing). Schueller and Parks (2014)'s review suggested that nonclinical individuals may engage in lengthy protocols like the one we used when they are in a particularly positive state, which naturally tends to decline thereafter. Regardless of the reasons for this decline, it suggests that the overall positive change participants exhibited in our cognitive-behavioral group, compared with controls, reflected the maintenance of wellbeing, and thus a relative rather than an absolute increase.

(Insert Table 2 about here)

Effect of the intervention

[8] The present study was not preregistered, but post-registered. To promote transparency, the dataset on which our analyses were based is contained in an open-access file available at https://osf.io/3bd9m/files/.

Results are displayed in Table 3 and Figure 2. As hypothesized, individuals' baseline levels of overall emotional wellbeing moderated the effect of the intervention on this variable (β = -0.29, $p < 0.05$). Those individuals who had the lowest initial levels of overall emotional wellbeing were the ones who experienced the greatest increases in this variable as a result of the intervention (see Fig. 2a). We found the same result for activated emotional wellbeing (β = -0.34, $p < 0.05$; see Fig. 2b). By contrast, contrary to our expectations, posttest deactivated emotional wellbeing was not significantly predicted by the interaction between pretest deactivated emotional wellbeing and group. Rather, the intervention produced a relative increase in deactivated emotional wellbeing, compared with the control group, regardless of participants' baseline level on this variable (β = 0.34, $p < 0.05$; Fig 2c).

(Insert Table 3 and Figure 2 about here)

Results on emotion regulation strategy use were more mixed. As expected, individuals' baseline levels of appreciation moderated the effect of the intervention on this variable (β = -0.32, $p < 0.05$). Those individuals who had the lowest initial tendencies to engage in appreciation were the ones who experienced the greatest increases in this variable as a result of the intervention (see Fig. 2d). By contrast, the intervention appeared not to have a significant effect on problem solving use. Finally, the intervention produced a marginal relative increase in cognitive reappraisal use, compared with the control group, regardless of participants' baseline level on this variable (β = 0.28, p = 0.052).

Discussion

Cognitive-behavioral interventions mainly address individuals' emotional distress (Beck, 2011; Levin et al., 2018). To help individuals reduce this distress, these interventions promote the use of certain processes, including what emotion regulation researchers call *cognitive reappraisal* and *problem solving*, as well as positive emotion-enhancing strategies such as *appreciation*, albeit to a lesser extent (Beck, 2011; Gross, 2015; Levin et al., 2018). In the present study, those individuals

with the lowest initial levels of emotional wellbeing (i.e., highest baseline levels of emotional distress) and the lowest initial levels of engagement in appreciation were the ones who benefitted the most from the intervention, in terms of emotional wellbeing and appreciation enhancement. This result is consistent with the *compensation of weaknesses* hypothesis (Cronbach & Snow, 1977; Snow, 1991) and with initial findings in the field of self-help emotion regulation-focused interventions (e.g., Antoine, Congard, et al., 2018; Froh et al., 2009). The intervention we studied exerted more important beneficial effects when it could target an individual's weaknesses.

The effect of our program on appreciation among some individuals may appear surprising. Cognitive-behavioral interventions mainly involve techniques for regulating negative emotions (Beck, 2011). Nonetheless, these interventions, and in particular the one we designed, also feature positive emotion-enhancing techniques, such as relaxation and the *mastery and pleasure* technique. This technique invites individuals to pay attention to what generates pleasure and mastery feelings in their lives, and to organize their daily schedules accordingly-two processes at the core of the implementation of appreciation (Pavani et al., 2017).

Deactivated emotional wellbeing and (marginally) cognitive reappraisal were increased by the intervention, relative to the control group. However, these effects were not moderated by the baseline levels of these variables. This suggests that the *compensation of weaknesses* hypothesis has boundary conditions. Finally, the use of problem solving was not affected by the intervention, even among participants with a low initial use of this strategy. A possible explanation of this unexpected finding is that this effortful strategy may be too hard to implement without support.

Taken together, our results may have several implications. Research on the moderators of individuals' responses to interventions has been characterized by several theoretical inconsistencies (e.g., Schneider et al., 2015; Snow, 1991). Nonetheless, our results suggest that, as Snow (1991) argued, the *compensation of weaknesses* mechanism may serve as a meta-hypothesis, guiding the formulation of specific hypotheses on the differential effects of different interventions. At a more

clinical level, our results suggest that self-help emotion regulation-focused interventions designed for nonclinical individuals may, in fact, be more effective for subclinical individuals (i.e., individuals with certain emotion regulation difficulties, albeit nonpathological).

The above-mentioned ideas should nonetheless be viewed with caution, as the present study had several limitations. Its main limitation was that individuals were allocated to one or other group according to their stated preferences. This allocation was therefore nonrandom. We made this choice to maximize ecological validity, for in the real world, individuals generally opt for the self-help treatments that interest them the most. As a variety of self-help interventions are available at any one time or place on the Internet, practical considerations such as the local availability of a clinician delivering the desired treatment do not influence individuals' engagement in self-help treatments (Munoz et al., 2016; Schueller & Parks, 2014). Therefore, individuals' interest in a particular self-help intervention may have an especially important influence on their engagement in that intervention. For this reason, we wished to collect data and make inferences on a sample composed of individuals who were specifically interested in following the intervention that was subsequently delivered to them. Nevertheless, this choice meant that we could not exclude the possibility that confounding variables (i.e., placebo effect, greater motivation to learn emotion regulation skills in the cognitive-behavioral group than in the control group) determined the effects we identified. Then again, this possibility was not very great in the present study for two reasons. First, although participants may have understood that the control group was more passive than the cognitive-behavioral group, this condition was presented to them in the same manner as the cognitive-behavioral group, namely as a means of acquiring positive skills (i.e., gaining knowledge about themselves, their emotions, and therefore how to manage them). Second, the placebo effect, as well as the motivation to engage in one treatment or another, is supposed (and has actually been shown) to influence mean responses to distinct interventions. However, it is less certain that between-individual differences in responses to particular interventions are impacted by these confounding variables and, to the best of our knowledge, there is a dearth of studies on this issue. Nevertheless, in

future studies, the randomized allocation of participants to self-help cognitive behavioral interventions should help to determine the robustness of our results.

A second limitation is that the 3 experience-sampling days in our pre- and posttest assessments may have been insufficient. Nevertheless, the participants' reports over these 3 days were probably largely representative of what they experienced over longer periods (e.g., 1 week). For instance, when we correlated participants' pre- and posttest levels on the 13 variables of interest over the first 3 and last 3 days with their levels over the first 7 and last 7 days, to determine how far they were independent, we obtained a mean correlation of 0.91. In other words, what participants experienced over the first 3 and last 3 days was almost perfectly correlated with what they experienced over the first 7 and last 7 days.

A third limitation is the narrow scope of our hypotheses. The present study specifically focused on the between-individual differences that may emerge in pretest/posttest comparisons measuring the effect of an intervention. We could also have formulated hypotheses on other important issues, such as the between-individual differences that may arise in the shape (e.g., nonlinearity) of the trajectories of change displayed by individuals in one condition or another. Likewise, we could have developed hypotheses about the mediating processes (e.g., does the intervention influence emotional wellbeing via its effect on emotion regulation strategy use or vice versa?). These are important issues that should be addressed in future research.

To conclude, in the present study, between-individual differences in baseline emotional wellbeing and engagement in appreciation moderated the effects of a self-help cognitive-behavioral intervention for nonclinical individuals. The participants who displayed the lowest initial levels on these variables were the ones who experienced the greatest improvements in these variables during the intervention. These results are consistent with the *compensation of weaknesses* hypothesis and previous findings on self-help interventions. However, this pattern of results was not found for all variables.

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Table 1

Sex, Age, and Education Level According to Group

Variable	Value	Control group (n = 95)	CB group (n = 63)	χ^2 (p)	t (p)
Sex	Female (%)	67 (70.5)	58 (92.1)	9.37 (.002)	
Age	Mean (SD)	33.79 (12.47)	39.79 (9.68)		-3.396 (.001)
No high-school diploma	n (%)	8 (8.4)	7 (11.1)	.08 (.774)	
High-school diploma	n (%)	15 (15.8)	6 (9.5)	.80 (.370)	
Higher education qualification	n (%)	72 (75.8)	50 (79.4)	.11 (.741)	

Note. CB = cognitive-behavioral.

Table 2

Means of the Variables Examined According to Phase and Group

	Pretest			Posttest			Posttest - Pretest			
Variable	Ctrl	CB	*d*	Ctrl	CB	*d*	Ctrl	*d*	CB	*d*
WB	64.44	63.14	-0.11	60.87	64.28	0.28	-3.57	-0.31	1.13	0.08
Deactivated WB	64.80	62.85	-0.15	60.2	63.97	0.29	-4.59	-0.37	1.12	0.07
Activated WB	63.75	64.09	0.03	61.98	64.81	0.23	-1.77	-0.14	0.71	0.05
Cog. reappraisal	30.61	37.78	0.33	33.95	45.11	0.43	3.34	0.12	7.33	0.31
Problem solving	31.98	37.25	0.24	31.76	39.71	0.33	-0.22	-0.01	2.46	0.12
Appreciation	55.15	57.85	0.12	48.8	57.11	0.33	-6.36	-0.27	-0.73	-0.02

Note. Posttest - Pretest = difference between pre- and posttest; Ctrl = control condition; CB = cognitive-behavioral; WB = wellbeing; Cog. = cognitive.

Table 3

Estimated Regression Coefficients and P *Values*

	Autoregressive effect		Group effect		Interactive effect	
Variable	*β*	*p*	*β*	*p*	β	*p*
Wellbeing	0.59*** [0.39, 0.79]	< 0.001	0.30 [-0.02, 0.62]	0.064	-0.29* [-0.57, -0.01]	0.048
Deactivated wellbeing	0.47*** [0.33, 0.61]	< 0.001	0.34* [0.06, 0.62]	0.02		
Activated wellbeing	0.64*** [0.44, 0.83]	< 0.001	0.21 [-0.08, 0.49]	0.15	-0.34* [-0.61, -0.06]	0.018
Cognitive reappraisal	0.44*** [0.30, 0.58]	< 0.001	0.28 [0, 0.57]	0.052		
Problem solving	0.51*** [0.37, 0.64]	< 0.001	0.21 [-0.07, 0.49]	0.135		
Appreciation	0.55*** [0.35, 0.75]	< 0.001	0.28 [-0.01, 0.57]	0.056	-0.32* [-0.60, -0.04]	0.028

Note. *Autoregressive effect* refers to the effect of the variable at pretest on its version at posttest. *Interaction effect* refers to the interaction between the autoregressive and group effects. This interaction was only considered when it significantly increased model fit. 95% confidence intervals are in brackets.

* $p < .05$. *** $p < .001$.

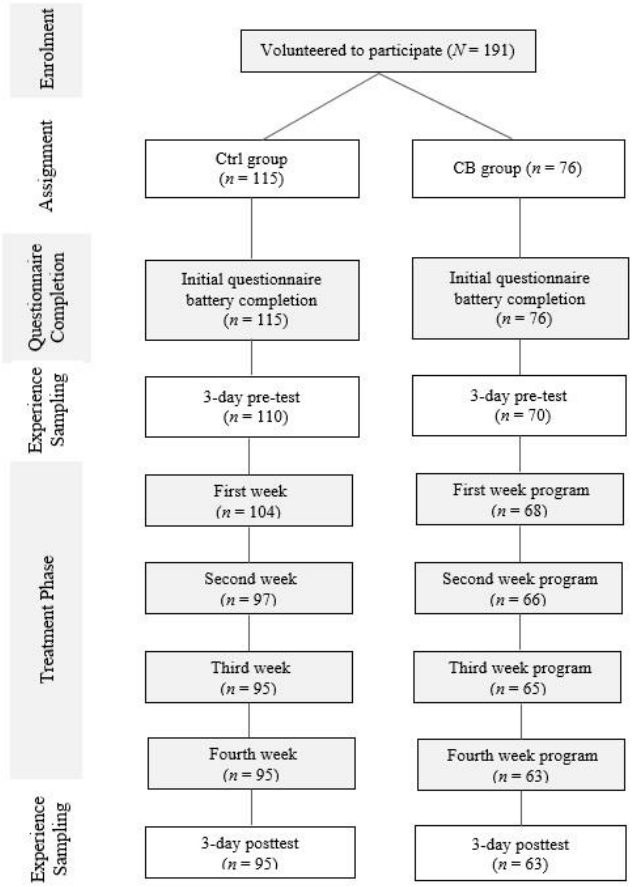

Figure 1

Flowchart depicting the study procedure.

Note. Ctrl = control group; CB = cognitive-behavioral group.

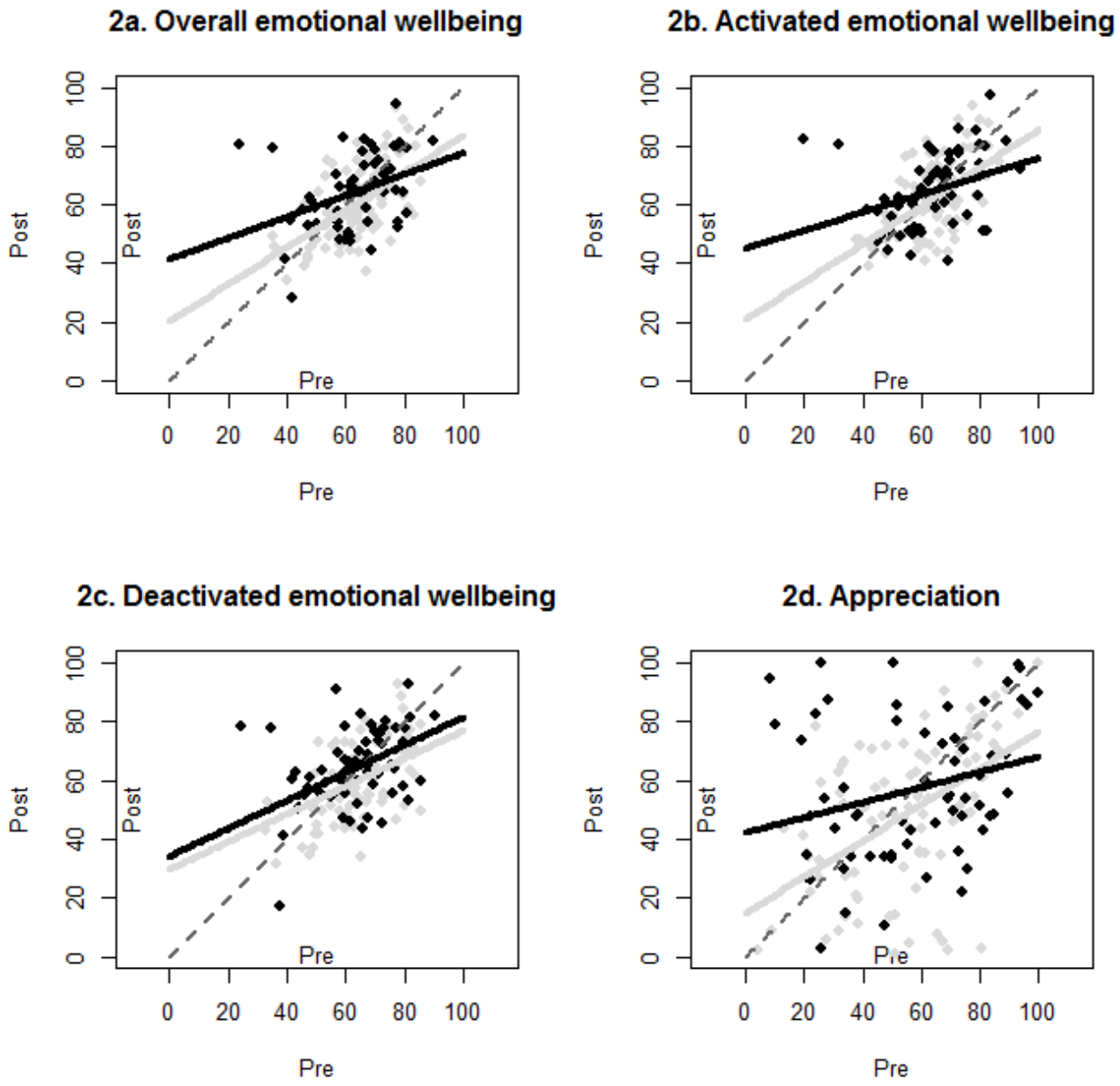

Figure 2

Changes in variables where the effect of group or its interaction with baseline level was significant.

Note. Pre = pretest; Post = posttest. The gray dots and lines correspond to the control group, and the black dots and lines to the cognitive-behavioral group. The dashed diagonal line represents what would have occurred if participants had experienced no change.