Emotion Regulation in Times of COVID-19:
A Person-Centered Approach Based on Self-Determination Theory

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Abstract

Although the COVID-19 crisis is a worldwide threat to individuals' physical health and psychological well-being, not all people are equally susceptible to increased ill-being. One potentially important factor in individuals' vulnerability (versus resilience) to ill-being in the face of stress is emotion regulation. On the basis of Self-Determination Theory, this study examined the role of three emotion regulation styles in individuals' mental health during the COVID-19 crisis, that is, integration, suppression, and dysregulation. Participants were 6584 adults (77 % female, $M_{age} = 45.16$ years) who filled out well-validated measures of emotion regulation, depression, anxiety, life satisfaction, and sleep quality. To examine naturally occurring combinations of emotion regulation strategies, hierarchical k-means clustering was performed, yielding 3 profiles: (a) low scores on all strategies (indicating rather low overall levels of worry; 27%), (b) high scores on integration only (41%), and (c) high scores on suppression and dysregulation (33%). Participants in the profiles scoring high on suppression and dysregulation displayed a less favorable pattern of outcomes (high ill-being, low life satisfaction, and poorer sleep quality) compared to the other two groups. Between-cluster differences remained significant even when taking into account the corona-related worries experienced by people. Overall, the findings underscore the important role of emotion regulation in individuals' mental health during mentally challenging periods such as the COVID-19 crisis. Practical implications and directions for future research are discussed.

Keywords: COVID-19, emotion regulation, self-determination theory, mental health

47 The COVID-19 crisis brought about many different types of stressors that could undermine
48 individuals' mental health (Vindegard & Benros, 2020). However, not all individuals are equally
49 susceptible to this risk. Emotion regulation has been forwarded as a key factor to understand individual
50 differences in the way people adjust to the COVID-19 crisis (Schimmenti et al., 2020). Unfortunately
51 however, research on the role of emotion regulation on people's mental health during the COVID-19
52 crisis is scant. Furthermore, the few studies available (e.g., Jiang et al., 2020) typically focused on one
53 or a few emotion regulation strategies, without considering the interplay between different emotion
54 regulation strategies and the consequences of this interplay for mental health in the context of COVID-
55 19. Accordingly, there is a need for research identifying within-person combinations of different
56 emotion regulation strategies (i.e., profiles) and examining associations between these profiles and
57 individuals' mental health during the COVID-19 crisis.

58 Empirically, an examination of within-person combinations requires a person-centered
59 statistical approach such as cluster analysis rather than a variable-centered approach (Bergman &
60 Wangby, 2014). Conceptually, such research needs to be conducted from a theoretical perspective
61 distinguishing between multiple dimensions of emotion regulation that differ in terms of their
62 functional role in mental health. The current study relies on Self-Determination Theory (SDT; Ryan
63 & Deci, 2017), a motivational theory offering a multidimensional conceptualization of emotion
64 regulation and considering integrative regulation as the most effective type of emotion regulation.

65 The current study aims to contribute to the literature in two ways. First, at the empirical level,
66 the study aims to strengthen the literature on COVID-19 and mental health by adopting a person-
67 centered statistical approach to emotion regulation. Second, at the conceptual level, this study aims to
68 be innovative by relying on SDT and by introducing the relatively new concept of integrative emotion
69 regulation in research on COVID-19. Corresponding to these two anticipated contributions of the
70 study, we next discuss (a) the importance of adopting a person-centered approach to emotion regulation

71 during COVID-19 and (b) the value of considering integrative emotion regulation as a novel and
72 potentially adaptive strategy to deal effectively with COVID-related stressors.

73 **Combinations of Emotion Regulation Strategies and Mental Health during COVID-19**

74 The COVID-19 crisis entails both immediate and more long-term stressors that potentially
75 erode individuals' resources and mental health (Panchal et al., 2020). During the initial phases of the
76 COVID-19 crisis, when governments across the world declared lockdown measures to contain the
77 spreading of the virus, people had immediate concerns about their own health and about the availability
78 of food and medical supplies (Carroll et al., 2020; Stephens et al., 2020). People also had more long-
79 term concerns, for instance about their financial situation and about the duration and the
80 unpredictability of the situation at large (Kämpfen et al., 2020). Confronted with these various stressors
81 during the COVID-19 crisis, many people displayed increased risk for ill-being and decreased well-
82 being. Indeed, several studies reported an elevated prevalence of depressive symptoms (Choi et al.,
83 2020) and anxiety (Roy et al., 2020) as well as reductions in life satisfaction (Satici et al., 2020), sleep
84 quality (Altena et al., 2020; Cellini et al., 2020), and overall well-being (Zhang et al., 2020). At the
85 same time, people were found to differ widely in terms of adjustment to this challenging period, with
86 many people also maintaining stable and high levels of mental health (e.g., Grossman et al., 2021;
87 Wang et al., 2021).

88 Emotion regulation, which can be broadly defined as the process of 'monitoring, evaluation,
89 and modification of emotional reactions' (Compas et al., 2017, p. 941), is key to understand
90 individuals' responses to stress, worries, and concerns regarding negative life events (Parkinson et al.,
91 2016). Therefore, there have been several calls to examine the role of emotion regulation in
92 individuals' mental health during the COVID-19 period (Restubog et al., 2020; Schimmenti et al.,
93 2020). However, to date, the number of studies examining emotion regulation in the context of
94 COVID-19 is rather limited. The few studies currently available have focused mostly on the effects of
95 cognitive reappraisal, that is, a mental re-interpretation of the situation to prevent a strong emotional

96 response (Gross, 1998, 2014). To illustrate, Jiang et al. (2020) showed that Chinese adults who
97 engaged in cognitive reappraisal were less likely to display symptoms of post-traumatic stress during
98 the COVID-19 period. Similarly, Xu et al. (2020) found, among Chinese adults in quarantine, that
99 cognitive reappraisal was related negatively to anxiety, and that this strategy also dampened the
100 association between stress and anxiety. Further, cognitive re-appraisal was related negatively to
101 COVID-19 worries and concerns (e.g., Luu, 2021; Prikhidko et al., 2020). For instance, Muñoz-
102 Navarro and colleagues (2021) showed that the use of cognitive reappraisal resulted in less concerns
103 regarding COVID-19 contamination, even when scoring high on general anxiety. Other studies have
104 relied on general measures that aggregate several (supposedly) adaptive emotion regulation strategies
105 (e.g., acceptance and cognitive reappraisal). Using such an aggregated measure, Jungmann and
106 Witthöft (2020) found in a sample of German adults that adaptive emotion regulation related
107 negatively to corona-related anxiety.

108 Although studies have begun to show that emotion regulation may play an important role in
109 mental health during the COVID-19 crisis, research needs to go beyond a focus on one specific
110 strategy or the use of summary measures of emotion regulation. That is, to better understand the role
111 of emotion regulation in adaptation to the COVID-19 crisis, it is important to rely on a
112 multidimensional conceptualization distinguishing between emotion regulation strategies with
113 differential consequences for mental health (e.g., Bergman & Wangby, 2014). Further, because
114 different emotion regulation strategies tend to co-occur within persons, these strategies should not be
115 considered in isolation. People typically have different emotion regulation strategies available in
116 their repertoire (Aldao et al., 2013; Blanke et al., 2020; Ford et al., 2019). As such, it is important to
117 examine within-person profiles of emotion regulation strategies and associations of these profiles
118 with mental health outcomes (Dixon-Gordon et al., 2015; van den Heuvel et al., 2020). Person-
119 centered statistical analyses, such as cluster analysis, allow for the identification of such profiles,
120 thereby detecting in a dataset the most common and naturally occurring combinations of emotion

regulation strategies among all possible combinations of a given set of strategies. To conceptualize different emotion regulation strategies, this study relied on the theoretical framework of Self-Determination Theory (SDT; Ryan & Deci, 2017), a general theory on motivation and mental health that provides a differentiated approach to emotion regulation.

A Self-Determination Theory Perspective on Emotion Regulation

SDT distinguishes between three modes of emotion regulation that vary in their level of autonomy (Roth et al., 2009; Ryan et al., 2016). *Integrative emotion regulation* is the most autonomous type of regulation. It is characteristic of people who adopt a welcoming and accepting stance towards emotions, even when these emotions are painful and difficult (Roth et al., 2014; Shahar et al., 2018). People high on integrative emotion regulation take an active interest in their negative emotions, thereby trying to understand how these emotions inform them about their preferences and values. Ultimately, this better understanding of one's emotions also provides direction to people's actions. They know better how to act upon their emotions, feel free to either communicate or withhold their emotions, and see how they can respond more adequately to similar emotion-laden situations in the future (Benita, 2020; Roth et al., 2019). *Emotional suppression* represents a more controlled type of emotion regulation where people deny and minimize the strength and importance of emotions towards themselves (Kim et al., 2002; Roth et al., 2019). In addition to this experiential suppression, people also feel compelled to hide their negative emotions towards others, thereby suppressing the expression of emotions (Roth et al., 2009). With *emotional dysregulation*, people feel overwhelmed by their negative emotions, unable to understand the origins of these emotions, and incapable of canalizing or communicating about their emotions effectively (Houle & Philippe, 2020). Therefore, they feel helpless in the face of negative emotions (Ryan et al., 2016).

The concept of integrative emotion regulation is relatively new (Roth et al., 2019). It is akin to, yet conceptually and empirically distinct from, related constructs such as acceptance (Dan-Glauser & Gross, 2015) and mindfulness (Brown & Ryan, 2003). Emotional integration shares with these

146 constructs a welcoming and open attitude towards emotions. However, it also includes a more action-
147 oriented attitude. It is not only about experiential openness for emotions but also about learning from
148 these emotions and using emotions to inform future behaviors, decisions, and goals (Roth et al., 2019).
149 Recent research has begun to corroborate the benefits associated with emotional integration, showing
150 positive associations with personal well-being (Benita, 2020) and adaptive social outcomes such as
151 prosocial behavior, empathy, and intimacy (Benita et al., 2017; Roth & Assor, 2012). Longitudinal
152 research showed that emotional integration even predicted increases across time in mental health
153 (Brenning et al., 2015). Experimental studies demonstrated causal effects of situationally induced
154 emotional integration on adaptive processing of threatening stimuli (Roth et al., 2014, 2018). In these
155 experimental studies, people instructed to engage in emotional integration during a fear-eliciting
156 movie, compared to participants instructed to suppress or minimize their emotions, displayed less
157 anxiety and stress when confronted again with this movie on another occasion (Roth et al., 2014, 2018).
158 In contrast, SDT-based studies (Benita, 2020; Brenning et al., 2015; Houle & Philippe, 2020) and
159 research in the broader literature on emotion regulation (Gross, 2015) have shown that both emotional
160 suppression and dysregulation are related to lower mental health and greater risk for ill-being. These
161 maladaptive effects of suppression and dysregulation have also been demonstrated in longitudinal
162 (e.g., Brenning et al., 2015; McLaughlin et al., 2011) and experimental research (Gross, 1998; Gross
163 & Levenson, 1997).

164 Although research has begun to document the mental health benefits associated with emotional
165 integration relative to suppression and dysregulation, no studies to date directly examined the
166 relevance of these strategies for individuals' adjustment to the COVID-19 crisis. This is unfortunate
167 because emotional integration is considered a resource for resilience in the context of highly stressful
168 conditions (Roth et al., 2019; Weinstein et al., 2013). In contrast, suppression may have momentary
169 benefits but is likely to backfire during more prolonged periods of stress, such as a stay-at-home

170 lockdown (Gross, 2015). Similarly, dysregulation is a risk factor for mental health problems during
171 unpredictable periods because it leads to a sense of uncontrollability (Compas et al., 2017).

172 Importantly, SDT's conceptualization of emotion regulation allows for an application of the
173 person-oriented approach discussed before. Applied to the SDT taxonomy of emotion regulation, such
174 a person-centered analysis could reveal a profile characterized by a combination of the two
175 maladaptive emotion regulation strategies. It has indeed been argued that emotional suppression may
176 go hand in hand with dysregulation across time (Gross, 2015). Because suppression is mentally
177 effortful, people can suppress their negative emotions only for so long. During an extensive period of
178 stress, emotional suppression may ultimately result in dysregulation once people's mental energy is
179 drained. Another possibility is that some people combine both adaptive and more maladaptive emotion
180 regulation strategies, with people for instance switching back and forth between emotional integration
181 and dysregulation. Indeed, the openness to negative emotions characteristic of emotional integration
182 may from time to time give rise to dysregulation among people who feel occasionally overwhelmed
183 by their strong emotions. To the best of our knowledge, no studies to date adopted such a person-
184 centered approach to the emotion regulation strategies identified in SDT. Such an approach can yield
185 innovative findings that are important from both a fundamental and an applied perspective. In practice,
186 people display combinations of emotion regulation strategies and practitioners (e.g., therapists and
187 counselors) are more likely to recognize such profiles of strategies than isolated strategies.

188 **The Present Study**

189 Based on SDT, this study aimed to identify profiles of emotion regulation and to relate these
190 profiles to individuals' mental health during a COVID-19 lockdown period. We focused on
191 individuals' regulation of feelings of insecurity and threat as these emotions were very salient during
192 the first weeks after the outbreak of the COVID-19 crisis. In general, we expected that individuals in
193 profiles characterized by higher levels of emotional integration would display better mental health (i.e.,
194 more life satisfaction, better sleep, and less anxiety and depression) than individuals in profiles

195 characterized by higher levels of suppression and dysregulation. Profiles characterized by a mix of
196 adaptive and maladaptive strategies, if any, were expected to be situated in between profiles
197 characterized uniquely by either adaptive or maladaptive strategies. In testing this hypothesis, we
198 controlled for the degree to which people experienced worries due to the COVID-19 crisis. This is
199 important because individuals in different profiles may be exposed to different levels of worries, with
200 the amount of worry (rather than individuals' style of dealing with the worries) explaining differences
201 between the profiles.

202 **Method**

203 **Procedure and Sample**

204 Data were collected during the first two weeks of the stay-at-home lockdown in [*blinded for*
205 *review*], specifically between March 19th and April 2nd, 2020. The questionnaire was presented online
206 in Qualtrics and was completed by 6584 adults (77% female) with a mean age of 45.16 years (SD =
207 15.71; range: 18 – 89). They all completed an active consent which stated their responses would be
208 handled confidentially, that no negative consequences would follow after quitting the questionnaire,
209 and that the data would be anonymized to avoid a link to their personal information. In this sample,
210 38% of the participants reported to be single or widowed and 62% was married or in a relationship
211 (but not married). In terms of educational level, 72% graduated in higher education or university, 26%
212 graduated in secondary school and only 2% did not finish secondary school. In response to a question
213 about their current health (i.e., “Are you suffering from lung disease, diabetes, hypertension,
214 autoimmune diseases?”), 81% of the participants reported having no medical problems at this moment.
215 Finally, an open-ended item asked participants about their employment status. When participants
216 indicated that they were currently employed, we also asked whether they work from home (or not).
217 After coding participants' answers to this question, 47% indicated being employed and working from
218 home, 24.3% indicated being employed and working on-site, 4.2% is unemployed, 3.8% is a student,
219 3.3% is disabled, 3.2% indicated being laid off, 2.1% is on sick leave and 12.1% is retired.

220 The survey was distributed online using the social networks of the researchers and multiple
221 organizations and media (e.g., online newspapers). The instructions of the survey clarified that the
222 focus of the study was on the psychological wellbeing of the [blinded for review] population during
223 the lockdown period. Both at the beginning and at the end of the questionnaire, contact information
224 was provided in case participants needed psychological assistance or had questions regarding the
225 study. Before participants were thanked, the possibility was provided to receive a summary of the
226 results. On average, it took 11.35 minutes to complete the full questionnaire. The procedure used in
227 this study was approved by the ethical committee of [details removed for peer review] (nr. 2020/37).

228 Measures

229 **Worries.** Inspired by the measures of psychological (in)security used in Chen et al. (2015),
230 four items were developed to assess people's COVID-specific worries during the lockdown. Following
231 the stem "In the past week during the corona crisis, I was worried about...", participants were asked
232 to indicate their COVID-specific worries concerning their health, financial situation, medication
233 availability, and how the situation at large would evolve. Each item was rated on a scale ranging from
234 1 '*not true at all*' to 5 '*totally true*'. Internal consistency was moderate ($\alpha = .64$).

235 **Emotion Regulation.** To measure emotion regulation, we used the Dutch translation (Brenning
236 et al., 2015) of the Emotion Regulation Inventory (Roth et al., 2009). Participants were asked to rate
237 how they regulate feelings of threat and uncertainty related to the COVID-19 crisis during the previous
238 week. For each subtype of emotion regulation, six items were rated on a scale ranging from 1 '*not true*
239 '*at all*' to 5 '*totally true*'. The scales for integrative emotion regulation (e.g., 'I examine my negative
240 feelings to understand their sources', $\alpha = .78$), suppression (e.g., 'When I'm having these negative
241 feelings, I make sure not to show them', $\alpha = .86$) and dysregulation (e.g., 'When I'm experiencing
242 these negative feelings, I can't concentrate on other things I have to do', $\alpha = .82$) displayed adequate
243 internal consistency.

244 **Subjective Well-Being.** As for indicators of subjective well-being, participants rated single
245 items tapping into their overall level of life satisfaction and sleep quality in the previous week (e.g.,
246 Fujita & Diener, 2005). Using the most face valid item of the Satisfaction with Life Scale (Pavot &
247 Diener, 1993), participants were asked to rate to what extent they were satisfied with their life during
248 the past week on a scale going from 1 (*seldom or never, less than 1 day*) to 4 (*mostly or all the time, 5*
249 *to 7 days*). Using the most face valid item from the Pittsburgh Sleep Quality Index (Buysse et al.,
250 1989), participants were asked to rate their overall sleep in the past week on a scale ranging from 1
251 (*very bad*) to 4 (*very good*).

252 **Ill-Being.** To measure participants' ill-being, we administered two scales tapping into anxiety
253 and depressive symptoms experienced during the past week. Anxiety was measured with a 5-item
254 version of the State Trait Anxiety Inventory (STAI, Marteau & Bekker, 1992) and depressive
255 symptoms were measured with a 6-item version (Van Hiel & Vansteenkiste, 2009) of the Center for
256 Epidemiological Studies – Depression scale (CES-D; Radloff, 1977). Items for both scales had to be
257 rated on the same response scale, ranging from 1 (*seldom or never, less than 1 day*) to 4 (*mostly or all*
258 *the time, 5 to 7 days*). Both questionnaires had acceptable reliability ($\alpha_{\text{anxiety}} = .87$; $\alpha_{\text{depression}} = .80$).

259 **Plan of Analysis.**

260 **Preliminary analysis.** Analyses were performed in R (R Development Core Team, 2019). In a
261 set of preliminary analyses, associations between background variables [gender, age, duration of the
262 crisis (in weeks), educational level, health status, relationship status, employment status, and worries]
263 and the study variables were examined with a Multivariate ANalysis of COVAriance (MANCOVA).

264 **Clustering procedure.** To perform person-centered analysis on the emotion regulation
265 strategies, multivariate cluster analysis was used. Cluster analysis is ideally suited to determine which
266 limited set of combinations of emotion regulation styles (among all theoretically possible
267 combinations) naturally occur in a given sample. Much like a factor analysis reduces a set of items to
268 a more limited number of underlying factors, cluster analysis aims to provide a parsimonious solution,

269 thereby identifying the smallest possible number of profiles to represent the combinations of the study
270 variables in the population. Specifically, we used Hierarchical K-Means clustering and we preferred
271 this method to other commonly used person-oriented methods such as Latent Profile Analysis (LPA),
272 for two reasons. First, we sought to identify clearly distinct and non-overlapping profiles of emotion
273 regulation strategies. Because LPA assumes differences in the variances of the variables by profile, it
274 allows for covariance between the profiles. By contrast, K-Means clustering does not include such
275 geometric flexibility and as such results in profiles that do not overlap. Because Hierarchical K-Means
276 clustering assumes ‘statistical independence’ between profiles, it also allows for a cleaner examination
277 of between-group differences unaffected by statistical problems such as multicollinearity. As such, it
278 allows for an easier interpretation. Second, LPA (which is based on the method of Gaussian Mixed
279 Modelling) assumes multivariate normality within profiles, while Hierarchical K-Means clustering is
280 model-free and a better fit with data that are not normally distributed within profiles.

281 The cluster analysis was performed in a number of steps. First, we standardized all study
282 variables to make them comparable and to detect univariate outliers (based on a Median Absolute
283 Deviation larger than 3, Leys et al., 2019) and multivariate outliers (i.e., values higher than a Median-
284 based Mahalanobis distance of 22). Because the cluster analysis procedure is based on means, which
285 are not robust to outliers, we decided to remove all detected outliers from the dataset (e.g., Hautamäki
286 et al., 2005). Next, we performed a well-validated 2-step clustering procedure (Gore, 2000). It starts
287 with a hierarchical clustering procedure (i.e., the most similar cases are linked to each other) from
288 which the output is used as input for a K-Means clustering procedure (i.e., minimizing the within-
289 cluster variation and maximizing the between-cluster variation). This 2-step approach has been
290 proposed as the most efficient and valid way of clustering (Arai & Barakbah, 2007). Instead of starting
291 the K-Mean clustering algorithm with random starting points (i.e., minimizing the within-cluster
292 variation by comparing each case to its position towards another cluster; Hartigan & Wong, 1979), the
293 centroids emerging from the Hierarchical clustering procedure were used as initial starting points to

294 avoid a number of statistical issues (i.e., sensitivity to the order of cases, number of iterations, etc.).
295 At the start, an Euclidian distance matrix is calculated, as the most common measure of ‘cluster
296 compactness’, followed by the calculation of the agglomerative coefficient (ac) for different linkage
297 methods. The closer the ac is to 1, the more optimal the linkage method is for the dataset. In the second
298 step, the K-Means clustering procedure is performed using the Hartigan and Wong algorithm (Hartigan
299 & Wong, 1979).

300 We evaluated the quality and the validity of the clustering procedure using three criteria. First,
301 we checked the ‘cluster tendency’, which represents the suitability of the dataset to be clustered into
302 meaningful clusters. To do so, we calculated the Hopkins statistic H (Lawson et al., 1990) which
303 indicates better suitability when closer to 1. Second, the optimal number of numbers is checked by
304 four different validation techniques: *the Elbow method* (i.e. the number of clusters with both a
305 minimum of within-cluster variation and a maximum of between-cluster variation), *the Average*
306 *Silhouette method* (i.e. the number of clusters with the highest average silhouette, indicating the best
307 quality of clustering; Kaufman & Rousseeuw, 1990), *the Gap statistic method* (i.e. the number of
308 clusters with the highest Gap-statistic; Tibshirani et al., 2001) and, at last, *a summary of 30 indices*
309 reporting the most optimal number of clusters using the ‘NbClust’ function (Charrad et al., 2014),
310 including the CH index (Calinski & Harabasz, 1974). Third, the stability of the cluster solution was
311 checked with a ‘double split cross-validation’ procedure (e.g., Vansteenkiste et al., 2009). Herein, the
312 total sample is divided into two equal random samples on which the hierarchical clustering procedure
313 is performed. Instead of using the results from this procedure as initial values for the K-Means
314 clustering procedure, the centroids are switched between datasets. The stability is checked with a
315 Cohen’s Kappa-index k testing the correspondence between the subsample-clustering results and the
316 clustering results forming from the original clustering procedure. Acceptable cluster stability is
317 assumed when k is .60 or higher (Asendorpf et al., 2001). The final results of the clustering procedure

318 will be presented in a barplot with the standardized cluster variables as a function of the cluster
319 classification.

320 ***Between-cluster differences.*** In the final step of the analyses, a MANCOVA is performed with
321 the relevant covariates, cluster membership as a predictor, and with the dependent variables (subjective
322 well-being and ill-being) as outcomes using Wilks' Lambda. In the univariate tests, post-hoc Tukey
323 tests are performed for multiple comparison in case the predictor 'cluster' has more than 2 levels. Here,
324 we applied the Bonferroni correction for p -values. The assumptions for linearity, normal residuals and
325 homoscedasticity are checked.

326 **Results**

327 **Preliminary Analyses**

328 Pearson correlations and descriptive analyses can be found in Table 1. First, as a continuous
329 demographic variable, age is related significantly to all study variables, with older participants
330 reporting less dysregulation, integration, anxiety, depressive symptoms, and worries and reporting
331 more suppression, higher life satisfaction, and better sleep quality. Corona-related worries are
332 correlated positively with all three emotion regulation strategies, with the highest correlation for
333 dysregulation and the lowest correlation with integration. Corona-related worries were also associated
334 with more depressive symptoms and more anxiety and with poorer sleep quality and less life
335 satisfaction.

336 As regards the emotion regulation strategies, dysregulation is related positively to both
337 integration and suppression, with the latter two strategies being related negatively. Further,
338 dysregulation and suppression both relate positively to more depressive and anxious symptoms and
339 negatively to sleep quality and life satisfaction. Integration was largely unrelated to the dependent
340 variables, demonstrating only very small correlations with more anxious and depressive symptoms and
341 more life satisfaction.

Next, associations between categorical background variables (gender, educational level, health status, crisis duration, working status, and relationship status) and the study variables were inspected using a MANCOVA. Multivariate significant effects were found for all background variables. In terms of gender, women displayed more dysregulation and integration, more anxious symptoms, depressive symptoms, worries, and lower sleep quality compared to men (Wilks' $\lambda = .951$; $F(8, 5926) = 37.89$, $p < .001$). Participants with a lower educational level showed higher scores for dysregulation, suppression and lower scores for integration and well-being (Wilks' $\lambda = .949$; $F(16, 11298) = 18.83$, $p < .001$). Next, participants without health problems reported less suppressive emotion regulation, less worries and less depressive symptoms (Wilks' $\lambda = .975$; $F(16, 11850) = 9.26$, $p < .001$). Participants who completed the questionnaire in the second week of the lockdown period reported lower integration, dysregulation, poorer sleep quality as well as more depressive symptoms compared to participants who completed the questionnaire in the first week (Wilks' $\lambda = .963$; $F(8, 5926) = 28.09$, $p < .001$). In terms of employment status, participants working from home reported less suppressive emotion regulation, more integrative emotion regulation, better sleep quality, and fewer worries compared to those not working from home (Wilks' $\lambda = .881$; $F(59, 31799) = 13.50$, $p < .001$). Similarly, participants working from home had lower scores on these variables compared to all categories of unemployed participants. Only the retired status was an exception to this pattern, with those being retired reporting lower dysregulation, less depressive and anxiety symptoms, more life satisfaction, and similar sleep quality and worries compared to those working from home.

Finally, participants with a partner displayed lower integration, fewer symptoms of depression, and more dysregulation and life satisfaction than participants without a partner (Wilks' $\lambda = .873$; $F(40, 25816) = 20.40$, $p < .001$). Given these findings, we controlled for all of these covariates in the main analyses.

A person-centered approach: Hierarchical K-Means Analyses

366 After standardization of the emotion regulation variables and inspection of the Mahalanobis
367 distance values, 6% of the participants were identified as outliers and excluded from the cluster
368 analysis (leaving a total N of 6182). Studying the ac 's for all linkage methods in the Hierarchical
369 clustering procedure showed that the Ward's method was most optimal (.994) compared to the
370 complete (.969), average (.925), and single (.798) linkage method.

371 To determine the number of clusters and the quality of the solution, the clustering procedure
372 was explored for a range of 0 to 10 clusters. First, a H -statistic of .62 ($>.50$) was found, indicating a
373 moderate clustering tendency. Figure 1 presents a graphical representation of all validation techniques
374 to test the most optimal number of clusters in the current dataset. The elbow-method figure (Figure 1,
375 upper left) showed a balance between within- and between-cluster variance on the three-cluster
376 solution. Next, two clusters have the highest silhouettes, followed by three and four clusters (Figure 1,
377 upper right). The Gap-statistic (Figure 1, bottom left) indicates two and three clusters as the most
378 optimal solutions. Finally, the frequency plot (Figure 1, bottom right) shows a visualization of the
379 majority rule, demonstrating that 9 out of 30 indices (including the CH-index) point to the three-cluster
380 solution as the most optimal number of clusters. Considering all criteria, we chose the three-cluster
381 solution as the most optimal representation of the current data.

382 The double-split cross-validation procedure to determine cluster stability revealed a weighted
383 k of .60 ($z = 47.46$, $p < .001$) for subset A and a weighted k of .48 ($z = 34.09$, $p < .001$) for subset B.
384 The average of both kappa's is .54, indicating moderate cluster stability (Asendorpf et al., 2001).

385 The barplot in Figure 2 shows the outcome of the clustering procedure, presenting the
386 standardized values of the study variables per cluster. To test the differences between clusters in terms
387 of the study variables, a MANCOVA with Tukey post-hoc tests was performed with dysregulation,
388 integration, and suppression as dependent variables, cluster membership as a predictor, and all
389 covariates included. A significant multivariate effect (Wilks' $\lambda = .206$, $F(6, 11788) = 2362.91$, $p <$
390 $.001$, $\eta^2 = .55$) was found. In terms of univariate differences, Cluster 1 (27%) has the lowest scores for

integration ($F(2, 6190) = 3166.77, p < .001, \eta^2 = .51$) and dysregulation ($F(2, 6190) = 2679.75, p < .001, \eta^2 = .46$). This cluster is characterized by low overall emotion regulation. Cluster 2 (41%) has significantly higher scores on integration and the lowest scores on suppression ($F(2, 6190) = 2533.35, p < .001, \eta^2 = .45$). This cluster is characterized mainly by uniquely high values of integration. Cluster 3 (32%) shows the highest scores for dysregulation and suppression. Because this cluster combines two non-autonomous emotion regulation strategies, it reflects overall dysfunctional emotion regulation.

To examine associations between cluster membership and participants' age and levels of worry, we conducted an ANOVA with cluster membership as a predictor. Participants in Cluster 1 ($M = 2.74, SD = .68$) showed the lowest levels of worry, followed by Cluster 2 ($M = 2.92, SD = .70$) and Cluster 3 ($M = 3.29, SD = .70; F(1, 5971) = 265.68, p < .001$), with differences between each of these clusters being significant. No effects were found for age ($F(1, 5971) = 3.38, p = .08$). Next, a series of chi-squared tests demonstrated that male participants ($\chi^2(2) = 133.15, p < .001$) and participants working from home ($\chi^2(14) = 123.24, p < .001$) were overrepresented in Cluster 1, that participants with a higher education diploma ($\chi^2(4) = 133.6, p < .001$) and retired participants were overrepresented in Cluster 2, and that students and single participants ($\chi^2(2) = 50.34, p < .001$) were overrepresented in Cluster 3. Also, participants in Cluster 2 were more likely to have completed the questionnaire in week 1 of the crisis, compared to week 2 ($\chi^2(2) = 24.17, p < .001$). No differences were found regarding health status ($\chi^2(4) = 13.76, p < .001, p = .08$).

Associations between Cluster Membership and Mental Health

To study between-cluster differences in terms of the mental health outcomes, accounting for the effect of corona-related worries, a MANCOVA was conducted including all covariates (including worries) and cluster membership as a predictor of anxiety, depression, life satisfaction, and sleep quality. There was a multivariate significant effect of cluster membership (Wilks' $\lambda = .79; F(6, 11292) = 173.98, p < .001, \eta^2 = .11$). The descriptive statistics with univariate tests and annotation of Tukey

416 post-hoc tests are presented in Table 2. No assumptions were violated for any of the univariate
417 analyses, the residuals being normally distributed, a diagonal Q-Q plot, and horizontal fitted values
418 versus residual values plot with a random data cloud.

419 These results show that participants in Cluster 3 (i.e., high on dysregulation and suppression)
420 show higher scores for ill-being (i.e., anxious and depressive symptoms) and lower scores for well-
421 being (i.e., life satisfaction and sleep quality) compared to participants in the two other clusters.
422 Participants in Cluster 1 (i.e., low overall emotion regulation) show the most adaptive pattern of
423 outcomes with the highest scores for well-being and the lowest scores for ill-being. Participants in
424 Cluster 2 (i.e., high on integration) scored in between those in Cluster 1 and 3 but leaned more closely
425 to the adjustment profile of those in Cluster 1 than those in Cluster 3. However, we should be cautious
426 about interpretations based on the p -values given the large sample size (i.e., increased type-I error).
427 Therefore, the eta-squared (Table 2) provides a clearer understanding of the practical significance with
428 small effects for sleep quality and life satisfaction and large effects for anxiety and depression (Cohen,
429 1988).

430 Discussion

431 This study aimed to investigate the role of three emotion regulation strategies, as defined in
432 Self-Determination Theory, in individuals' mental health during the first two weeks of the first
433 COVID-19 lockdown in *[blinded for review]*. In doing this, we used a person-centered approach to
434 identify within-person combinations of the emotion regulation strategies in relation to multiple
435 measures of well- and ill-being.

436 Identification of the Emotion Regulation Profiles

437 This study identified three profiles of emotion regulation. Participants in the first profile
438 overall displayed low emotion regulation, thereby scoring low on both adaptive and more
439 maladaptive emotion regulation strategies. The few previous studies adopting a person-centered
440 approach to emotion regulation (in pre-corona times) similarly identified a profile of 'low regulators'

441 (Dixon-Gordon et al., 2015). Individuals in this profile likely experience few stressors and, as such,
442 do not face high levels of distress that require regulation. We indeed found that participants in the low
443 emotion regulation profile displayed the lowest levels of corona-related worries. With the current data,
444 it cannot be determined whether these participants were confronted with less actual stressful events
445 (e.g., less financial and health problems) or whether they are less inclined to subjectively experience
446 such events as stressful. Future research could examine (e.g., using hypothetical scenarios) whether
447 people in this profile have more benign and less catastrophizing appraisals of potentially stressful
448 events than people in the other profiles.

449 A second profile was characterized by high levels of integrative emotion regulation and low
450 levels of both dysregulation and suppression. From an SDT perspective, this profile can be viewed as
451 adaptive because people in this profile display an open and sincere interest in their negative emotions,
452 rather than minimizing and denying their emotions or feeling overwhelmed by their negative emotions
453 (Roth et al., 2019). We did not find evidence for a profile characterized by both integrative emotion
454 regulation and dysregulation. Although it seems plausible that some people who actively attend to
455 negative emotions (i.e., integrative emotion regulation) risk evolving towards dysregulation, this
456 combination of integrative emotion regulation and dysregulation was not observed in the current study.
457 One element of integrative emotion regulation may be particularly helpful in avoiding the pitfalls of
458 dysregulation, that is, individuals' use of negative emotions as input for behavior (Roth et al., 2019).
459 People high on integrative emotion regulation not only attend to their emotions but also try to learn
460 from these emotions and direct their behavior based on previous negative emotions. By doing so, they
461 feel that negative emotions can be useful guideposts for behavioral adjustment. The latter experience
462 probably protects against the sense of helplessness characteristic of dysregulation. Future research
463 could adopt a person-centered analysis with different facets of integrative emotion regulation (thereby
464 including more items for each facet than was the case in the current study). Possibly, such an analysis
465 does yield a profile of people merely attending openly to their negative emotions (but failing to use

these emotions in a constructive way as input for behavior) and at the same time feeling overwhelmed by these emotions, thus combining elements of integrative emotion regulation with dysregulation.

Participants in a third profile scored high on both emotional suppression and dysregulation and low on emotional integration. Because this profile combines a pressured and minimizing approach to negative emotions with helplessness and concerns of being overwhelmed with negative emotions, it can be considered a more maladaptive profile (e.g., Ciuluvica et al., 2019). Most likely, individuals in this profile attempt to dismiss and deny their negative emotions as long as possible. Because this downregulation of emotions is mentally draining, people at some point no longer manage to keep their negative emotions under control. These emotions then backfire with heightened valence, thereby exceeding the individual's capacity to regulate them effectively.

Although we had anticipated a profile characterized by emotional suppression only, strikingly we did not obtain evidence for this profile. Possibly, such a profile does exist in emotionally less troubling situations and during less taxing periods. Indeed, the fact that we found only evidence for a profile in which suppression co-occurs with dysregulation may be due to the unique historical period during which these data were collected. The COVID-19 lockdown period was challenging in many ways and stressful for many people. Under such challenging conditions, a unique reliance on emotional suppression may not be feasible across a long period of time and this strategy may inevitably spill over into dysregulation. Perhaps during less challenging and stressful periods, at least some people do manage to maintain high levels of emotion suppression without evolving towards dysregulation. Future research would do well to directly compare profiles of emotion regulation between challenging and more normative historical periods.

Associations of Profile Membership with Mental Health

Having identified these three emotion regulation profiles, a key aim of this study was to examine between-profile differences in terms of individuals' mental health during the COVID-19 lockdown. The most pronounced differences observed were between the maladaptive profile

491 (combining suppression and dysregulation) and the two other profiles. Participants in the maladaptive
492 profile reported the highest levels of anxiety and depression, the lowest levels of life satisfaction, and
493 the poorest sleep quality. These findings are consistent with previous studies showing that both
494 suppression and dysregulation increase the risk for mental health problems (Compare, et al., 2014).
495 The findings also confirm the SDT-based hypothesis that non-autonomous forms of emotion
496 regulation, where people either feel compelled to dismiss their emotions or feel unable to regulate
497 emotions effectively, render individuals more vulnerable to distress (Roth et al., 2019).

498 Differences between the profile characterized by low emotion regulation and the profile
499 characterized predominantly by integrative emotion regulation were less pronounced than differences
500 with the maladaptive emotion regulation profile. Participants in the low regulation profile even
501 reported somewhat better adjustment than those in the integrative emotion regulation profile, thereby
502 displaying less anxiety and depression and more life satisfaction and sleep quality. It should be noted
503 that the effect size of these differences was small and that several of these effects reached significance
504 only because of the large sample size. Still, the high levels of mental health displayed by people in the
505 low regulation profile are interesting. The few person-centered studies identifying a similar profile of
506 ‘low regulators’ also typically found that individuals in this profile are generally well-adjusted and do
507 not differ substantially from individuals in an adaptive emotion regulation profile (Dixon-Gordon et
508 al., 2015; van den Heuvel et al., 2020). Probably the main reason for these individuals’ high levels of
509 mental health is that they encounter fewer stressors than individuals in other profiles and, as such, do
510 not feel a need to engage in emotion regulation. An important aim for future research is to examine
511 how these individuals would respond when they suddenly do encounter negative life events (e.g.,
512 health problems due to COVID-19 or a worsening financial situation). Would most of these people
513 still refrain from using emotion regulation strategies (perhaps relying only on problem-solving as a
514 coping strategy) or would some of them transition to a profile characterized by higher levels of emotion
515 regulation? In the latter case, what factors would determine whether they switch to a maladaptive

516 emotion regulation profile or to a profile with more integrative emotion regulation? Longitudinal
517 research would be ideally suited to examine the role of life events in transitions across time between
518 emotion regulation profiles.

519 The finding that individuals in the integrative emotion regulation profile displayed higher levels
520 of mental health compared to individuals in the maladaptive emotion regulation profile is consistent
521 with SDT-based predictions and previous findings (e.g., Berking & Wupperman, 2012). This finding
522 indicates that, when people have a need to engage in emotion regulation, it is better for them to rely
523 on integrative regulation than on the more maladaptive strategies. Possibly, the benefits associated
524 with integrative emotion regulation manifest even stronger across time. Experimental studies have
525 shown that integrative emotion regulation does not reduce anxiety immediately after having been
526 exposed to a fear-eliciting stimulus but does protect against anxiety upon repeated exposure to this
527 stimulus (Roth et al., 2014). Because we assessed integrative emotion regulation concurrently with the
528 mental health outcomes, it is possible that the benefits of this emotion regulation style were somewhat
529 underestimated and become even more visible across time. Thus, longitudinal research is needed to
530 examine whether integrative emotion regulation predicts changes across time in mental health. Such
531 research would do well to include also measures of negative life events. Perhaps integrative emotion
532 regulation matters most when people are confronted with stress and adversity. Specifically, during
533 challenging episodes, individuals in the integrative emotion regulation profile may fare better than
534 individuals in the low regulation profile.

535 **Practical Implications**

536 Our findings have a number of potential implications for practice. First, because individuals
537 combining suppression and dysregulation were found to display the highest levels of risk for mental
538 health problems, they may benefit the most from interventions targeting emotion regulation. This is
539 important because the effectiveness of universal prevention programs focusing on emotion regulation
540 has been found to be relatively limited in terms of effect size (Durlak et al., 2011). One potential

541 explanation for the limited effectiveness of universal prevention programs is that many participants
542 following these programs, much like the individuals in the low emotion regulation profile identified in
543 this study, do not encounter high levels of stress and negative affectivity. As such, these people may
544 not experience a strong need to improve their emotion regulation skills. Other participants in these
545 programs, such as those in the profile characterized by high emotional integration, may already
546 routinely engage in effective emotion regulation and may also benefit only to a limited extent from the
547 program. By using a selective prevention approach and by including mainly individuals with a
548 vulnerable profile, such as those combining suppression and dysregulation, the cost-effectiveness of
549 prevention programs could be enhanced.

550 Second, our findings point to the importance of targeting integrative emotion regulation in
551 intervention programs or individual counseling. People struggling to deal effectively with stress and
552 negative affect could be taught to approach negative emotions with open awareness and to consider
553 such emotions as informational input for volitional action. Such interventions are particularly likely to
554 strengthen individuals' resilience during challenging times as the COVID-19 crisis. Although, to the
555 best of our knowledge, no intervention programs have been developed focusing specifically on
556 emotional integration, findings from experimental studies are promising and show that people can be
557 instructed to engage in emotional integration, with positive consequences for their affective
558 functioning (Roth et al., 2014, 2018). As such, it seems worthwhile to complement existing emotion
559 regulation programs, many of which focus on cognitive reappraisal and problem-solving, with
560 information and exercises about emotional integration. Before engaging in a mental reappraisal of an
561 emotional episode or actively trying to solve the problem causing the negative emotions, it may be
562 important to learn people to first welcome and acknowledge their feelings, to understand the source of
563 their own emotions, and then to decide volitionally how to act upon them (Roth et al., 2019).

564 **Limitations**

565 Although this study had a number of notable strengths (including the large sample, the inclusion
566 of several emotion regulation strategies, and the person-centered approach), several limitations need
567 to be addressed in future research. First, to collect the sample, we relied on a convenience sampling
568 approach. Because participants were recruited through social media and because the assessment was
569 online, the sample is not entirely representative for the population. A particular risk of this sampling
570 approach is that people facing strong adversity during the COVID-19 crisis (e.g., people in very low
571 SES conditions or confronted personally with severe health issues) were underrepresented in this
572 study. This is unfortunate because contextual adversity threatens individuals' emotion regulation
573 capacities. As such, future research would do well to actively recruit and oversample people living in
574 at-risk conditions.

575 Second, due to the cross-sectional design of this study, we could not examine the effects of
576 emotion regulation profiles on over-time changes in mental health. In addition, this design precludes
577 conclusions about the direction of effects. Although we assumed, based on theorizing and previous
578 longitudinal and experimental research (e.g., Brenning et al., 2015; Roth et al., 2014, 2018), that
579 emotion regulation affects mental health, it seems equally likely that mental health problems contribute
580 to more dysfunctional emotion regulation. People suffering from severe psychological distress may
581 not have the mental energy available to engage in integrative emotion regulation and may instead look
582 for shortcuts to minimize negative emotions as fast as possible (i.e., suppression). Longitudinal
583 research measuring both emotion regulation and mental health repeatedly on several occasions is
584 needed to examine the possibility of such transactional associations. Another relevant direction for
585 future research in this regard is to experimentally induce the use of emotion regulation strategies.
586 Research has shown that it is possible to induce integrative emotion regulation through experimental
587 instructions. Using such instructions, people could be encouraged to engage in integrative emotion
588 regulation on a daily basis during a period of time in the COVID-19 crisis. Their mental health could
589 then be compared with a group of individuals receiving no such instructions. Experimental

manipulations of emotion regulation allow for more causal conclusions and at the same time may inform interventions aimed at strengthening adaptive emotion regulation.

Third, because this study relied only on self-report measures some of the associations obtained may be inflated due to shared method bias. Future research would do well to adopt a multi-informant approach, with family members of the target individual for instance reporting on the individual's mental health. Another possibility is to include psychophysiological indicators of stress reactivity. For instance, experience sampling methodology would allow for the collection of self-report ratings and physiological indicators of stress several times during the day. Emotion regulation could then be examined as a moderator of the within-person association between (objectively assessed and subjectively experienced) stress and mental health problems. Moreover, the survey used in this study had to be short in order to motivate people to participate during a challenging time period. Therefore, the constructs were measured using a limited number of items and sometimes even with single items. Particularly with regard to the assessment of emotion regulation strategies, a disadvantage of this approach was that not all facets of these rich concepts could be measured. Accordingly, future research would do well to use more elaborate and multi-dimension measures (perhaps in a smaller sample with participants receiving an incentive for their more intensive efforts).

Conclusion

Using a person-centered approach and based on SDT as a theoretical framework, we found evidence for three profiles of emotion regulation during the COVID-19 crisis. One group of people overall displayed low emotion regulation, probably because they encountered few stressors and corresponding negative emotions. These people displayed the highest levels of mental health. Among the people who did engage in emotion regulation during the COVID-19 crisis, two qualitatively distinct profiles emerged. One profile involved high levels of emotional integration only and the other profile was characteristic of people who combined (and perhaps switched back forth between) suppression and dysregulation. People in the integrative emotion profile reported less distress, more life

satisfaction, and better sleep quality than people engaging in the more maladaptive emotion regulation strategies. To the extent that future longitudinal and experimental research confirms the beneficial role of integrative emotion regulation in individuals' adaptation to the COVID-19 crisis (and to stress more generally), this emotion regulation strategy could be an important target for intervention.

Data Availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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838 Table 1

839 Means, standard deviations, and correlations between background and study variables.

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Age	45.26	15.66								
2. Worries	2.99	.75	-.04***							
3. Dysregulation	2.27	.72	-.20***	.38***						
4. Suppression	2.31	.74	.05***	.23***	.39***					
5. Integration	3.28	.66	-.08***	.07***	.11***	-.29***				
6. Anxiety	2.20	.80	-.20***	.56***	.60***	.32***	.06***			
7. Depression	1.72	.61	-.20***	.45***	.61***	.37***	.02	.77***		
8. Sleep quality	2.83	.73	.05***	-.29***	-.34***	-.23***	.00	-.44***	-.40***	
9. Life satisfaction	2.97	.97	.14***	-.31***	-.43***	-.31***	.07***	-.59***	-.58***	.30***

840 Note. *M* and *SD* are used to represent mean and standard deviation, respectively. * $p < .05$, ** $p < .01$, *** $p < .001$

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848 Table 2. Means and standard deviations per cluster with results of univariate tests

	Cluster 1		Cluster 2		Cluster 3		<i>F</i>	<i>p</i> -value	η^2
	(Low overall emotion regulation)		(High integration)		(High suppression and dysregulation)		(2, 5649)		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
1. Anxiety	1.77 ^a	.61	2.05 ^b	.70	2.71 ^c	.73	482.31	< .001	.15
2. Depression	1.41 ^a	.40	1.57 ^b	.45	2.14 ^c	.63	633.48	< .001	.18
3. Sleep quality	3.02 ^c	.65	2.94 ^b	.68	2.54 ^a	.73	123.08	< .001	.04
4. Life satisfaction	3.27 ^c	.85	3.19 ^b	.86	2.45 ^a	.96	283.88	< .001	.09

849 Note. Letters refer to annotation of Tukey post-hoc tests.

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Figure 1. Visualizations of cluster validation techniques

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Figure 2. Barplot of clusters and features in terms of study variables.