

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

3
4
5 Waterschoot, Joachim¹

6 Morbée, Sofie¹

7 Vermote, Branko¹

8 Brenning, Katrijn¹

9 Flamant, Nele¹

10 Vansteenkiste, Maarten¹

11 Soenens, Bart¹

12
13 ¹ Department of Developmental, Personality, and Social Psychology, Ghent University

14 Ghent, Belgium

15
16
17 Conflict of Interest: The authors declare they have no conflict of interest.

18
19 Corresponding author: Joachim Waterschoot, Faculty of Psychology, Department of Developmental,

20 Personality, and Social Psychology, Henri Dunantlaan 2, B-9000, Ghent, Belgium. E-mail:

21 Joachim.Waterschoot@ugent.be, Tel. + 09 264 62 70, <http://orcid.org/0000-0003-0845-9310>

22
23
24
25 Word count: 10437 (incl. tables, figures, references and supplementary materials)

26 Submission date: 04/05/2021

Abstract

27

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

45

46 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 (Vindegaard & 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 Withhöft (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

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

125 **A Self-Determination Theory Perspective on Emotion Regulation**

126 SDT distinguishes between three modes of emotion regulation that vary in their level of
127 autonomy (Roth et al., 2009; Ryan et al., 2016). *Integrative emotion regulation* is the most autonomous
128 type of regulation. It is characteristic of people who adopt a welcoming and accepting stance towards
129 emotions, even when these emotions are painful and difficult (Roth et al., 2014; Shahar et al., 2018).
130 People high on integrative emotion regulation take an active interest in their negative emotions, thereby
131 trying to understand how these emotions inform them about their preferences and values. Ultimately,
132 this better understanding of one's emotions also provides direction to people's actions. They know
133 better how to act upon their emotions, feel free to either communicate or withhold their emotions, and
134 see how they can respond more adequately to similar emotion-laden situations in the future (Benita,
135 2020; Roth et al., 2019). *Emotional suppression* represents a more controlled type of emotion
136 regulation where people deny and minimize the strength and importance of emotions towards
137 themselves (Kim et al., 2002; Roth et al., 2019). In addition to this experiential suppression, people
138 also feel compelled to hide their negative emotions towards others, thereby suppressing the expression
139 of emotions (Roth et al., 2009). With *emotional dysregulation*, people feel overwhelmed by their
140 negative emotions, unable to understand the origins of these emotions, and incapable of canalizing or
141 communicating about their emotions effectively (Houle & Philippe, 2020). Therefore, they feel
142 helpless in the face of negative emotions (Ryan et al., 2016).

143 The concept of integrative emotion regulation is relatively new (Roth et al., 2019). It is akin to,
144 yet conceptually and empirically distinct from, related constructs such as acceptance (Dan-Glauser &
145 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.

342 Next, associations between categorical background variables (gender, educational level, health
343 status, crisis duration, working status, and relationship status) and the study variables were inspected
344 using a MANCOVA. Multivariate significant effects were found for all background variables. In terms
345 of gender, women displayed more dysregulation and integration, more anxious symptoms, depressive
346 symptoms, worries, and lower sleep quality compared to men (Wilks' $\lambda = .951$; $F(8, 5926) = 37.89$, p
347 $< .001$). Participants with a lower educational level showed higher scores for dysregulation,
348 suppression and lower scores for integration and well-being (Wilks' $\lambda = .949$; $F(16, 11298) = 18.83$,
349 $p < .001$). Next, participants without health problems reported less suppressive emotion regulation,
350 less worries and less depressive symptoms (Wilks' $\lambda = .975$; $F(16, 11850) = 9.26$, $p < .001$).
351 Participants who completed the questionnaire in the second week of the lockdown period reported
352 lower integration, dysregulation, poorer sleep quality as well as more depressive symptoms compared
353 to participants who completed the questionnaire in the first week (Wilks' $\lambda = .963$; $F(8, 5926) = 28.09$,
354 $p < .001$). In terms of employment status, participants working from home reported less suppressive
355 emotion regulation, more integrative emotion regulation, better sleep quality, and fewer worries
356 compared to those not working from home (Wilks' $\lambda = .881$; $F(59, 31799) = 13.50$, $p < .001$). Similarly,
357 participants working from home had lower scores on these variables compared to all categories of
358 unemployed participants. Only the retired status was an exception to this pattern, with those being
359 retired reporting lower dysregulation, less depressive and anxiety symptoms, more life satisfaction,
360 and similar sleep quality and worries compared to those working from home.

361 Finally, participants with a partner displayed lower integration, fewer symptoms of depression,
362 and more dysregulation and life satisfaction than participants without a partner (Wilks' $\lambda = .873$; $F(40,$
363 $25816) = 20.40$, $p < .001$). Given these findings, we controlled for all of these covariates in the main
364 analyses.

365 **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

391 integration ($F(2, 6190) = 3166.77, p < .001, \eta^2 = .51$) and dysregulation ($F(2, 6190) = 2679.75, p <$
392 $.001, \eta^2 = .46$). This cluster is characterized by low overall emotion regulation. Cluster 2 (41%) has
393 significantly higher scores on integration and the lowest scores on suppression ($F(2, 6190) = 2533.35,$
394 $p < .001, \eta^2 = .45$). This cluster is characterized mainly by uniquely high values of integration. Cluster
395 3 (32%) shows the highest scores for dysregulation and suppression. Because this cluster combines
396 two non-autonomous emotion regulation strategies, it reflects overall dysfunctional emotion
397 regulation.

398 To examine associations between cluster membership and participants' age and levels of worry,
399 we conducted an ANOVA with cluster membership as a predictor. Participants in Cluster 1 ($M = 2.74,$
400 $SD = .68$) showed the lowest levels of worry, followed by Cluster 2 ($M = 2.92, SD = .70$) and Cluster 3
401 ($M = 3.29, SD = .70; F(1, 5971) = 265.68, p < .001$), with differences between each of these clusters
402 being significant. No effects were found for age ($F(1, 5971) = 3.38, p = .08$). Next, a series of chi-
403 squared tests demonstrated that male participants ($\chi^2(2) = 133.15, p < .001$) and participants working
404 from home ($\chi^2(14) = 123.24, p < .001$) were overrepresented in Cluster 1, that participants with a
405 higher education diploma ($\chi^2(4) = 133.6, p < .001$) and retired participants were overrepresented in
406 Cluster 2, and that students and single participants ($\chi^2(2) = 50.34, p < .001$) were overrepresented in
407 Cluster 3. Also, participants in Cluster 2 were more likely to have completed the questionnaire in week
408 1 of the crisis, compared to week 2 ($\chi^2(2) = 24.17, p < .001$). No differences were found regarding
409 health status ($\chi^2(4) = 13.76, p < .001, p = .08$).

410 **Associations between Cluster Membership and Mental Health**

411 To study between-cluster differences in terms of the mental health outcomes, accounting for
412 the effect of corona-related worries, a MANCOVA was conducted including all covariates (including
413 worries) and cluster membership as a predictor of anxiety, depression, life satisfaction, and sleep
414 quality. There was a multivariate significant effect of cluster membership (Wilks' $\lambda = .79; F(6, 11292)$
415 $= 173.98, p < .001, \eta^2 = .11$). The descriptive statistics with univariate tests and annotation of Tukey

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

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

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

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

487 **Associations of Profile Membership with Mental Health**

488 Having identified these three emotion regulation profiles, a key aim of this study was to
489 examine between-profile differences in terms of individuals' mental health during the COVID-19
490 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

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

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

606 **Conclusion**

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

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

619 **Data Availability statement**

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

622 **References**

- 623 Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across
624 psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*(2), 217–237.
625 <https://doi.org/10.1016/j.cpr.2009.11.004>
- 626 Altena, E., Baglioni, C., Espie, C. A., Ellis, J., Gavrilloff, D., Holzinger, B., Schlarb, A., Frase, L.,
627 Jernelöv, S., & Riemann, D. (2020). Dealing with sleep problems during home confinement
628 due to the COVID-19 outbreak: Practical recommendations from a task force of the European
629 CBT-I Academy. *Journal of sleep research, 29*(4), e13052. <https://doi.org/10.1111/jsr.13052>
- 630 Arai, K., & Barakbah, A. R. (2007). Hierarchical K-means: an algorithm for centroids initialization
631 for K-means. *Reports of the Faculty of Science and Engineering, 36*(1), 25–31.
- 632 Asendorpf, J. B., Borkenau, P., Ostendorf, F., & van Aken, M. A. G. (2001). Carving personality
633 description at its joints: Confirmation of three replicable personality prototypes for both
634 children and adults. *European Journal of Personality, 15*, 169–198.
- 635 Benita, M. (2020). Freedom to feel: A self-determination theory account of emotion regulation. *Social
636 and Personality Psychology Compass, 14*.
- 637 Benita, M., Levkovitz, T., & Roth, G. (2017). Integrative emotion regulation predicts adolescents'
638 prosocial behavior through the mediation of empathy. *Learning and Instruction, 50*, 14–20.
639 <https://doi.org/10.1016/j.learninstruc.2016.11.004>

- 640 Bergman, L. R., & Wangby, M. (2014). The person-oriented approach: A short theoretical and
641 practical guide. *Eesti Haridusteaduste Ajakiri*.
- 642 Berking, M., & Wupperman, P. (2012). Emotion regulation and mental health: recent findings, current
643 challenges, and future directions. *Current opinion in psychiatry*, 25(2), 128–134.
644 <https://doi.org/10.1097/YCO.0b013e3283503669>
- 645 Blanke, E. S., Brose, A., Kalokerinos, E. K., Erbas, Y., Riediger, M., & Kuppens, P. (2020). Mix it to
646 fix it: Emotion regulation variability in daily life. *Emotion*, 20, 473–485.
- 647 Brenning, K., Soenens, B., Van Petegem, S., & Vansteenkiste, M. (2015). Perceived maternal
648 autonomy-support and early adolescent emotion regulation: A longitudinal study. *Social
649 Development*, 24(3), 561–578.
- 650 Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in
651 psychological well-being. *Journal of Personality and Social Psychology*, 84, 822–848.
- 652 Buysse, D. J., Reynolds, C. F., 3rd, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh
653 Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry
654 Research*, 28(2), 193–213. [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4)
- 655 Calinski, T., and Harabasz, J. (1974) A Dendrite Method for Cluster Analysis Communications in
656 Statistics. *Theory and Methods*, 3, 1-27.
- 657 Carroll, N., Sadowski, A., Laila, A., Hruska, V., Nixon, M., Ma, D., Haines, J., & On Behalf Of The
658 Guelph Family Health Study (2020). The impact of COVID-19 on health behavior, stress,
659 financial and food security among middle to high income canadian families with young
660 children. *Nutrients*, 12(8), 2352. <https://doi.org/10.3390/nu12082352>
- 661 Cellini, N., Canale, N., Mioni, G., & Costa, S. (2020). Changes in sleep pattern, sense of time and
662 digital media use during COVID-19 lockdown in Italy. *Journal of Sleep Research*, 29, e13074.

663 Charrad, M., Ghazzali, N., Boiteau, V., & Niknafs, A. (2014). NbClust Package for Determining the
664 Best Number of Clusters. *R package version 2.0.3*, URL [http://CRAN.R-project.org/
665 package=NbClust](http://CRAN.R-project.org/package=NbClust).

666 Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Duriez, B., Lens, W., Matos, L.,
667 Mouratidis, A., Ryan, R. M., Sheldon, K. M., Soenens, B., Van Petegem, S., & Van der Kaap-
668 Deeder, J., & Verstuyf, J. (2015). Basic psychological need satisfaction, need frustration, and
669 need strength across four cultures. *Motivation and Emotion*, *39*, 216–236.
670 <https://doi.org/10.1007/s11031-014-9450-1>

671 Choi, E. P. H., Hui, B. P. H., & Wan, E. Y. F. (2020). Depression and Anxiety in Hong Kong during
672 COVID-19. *International Journal of Environmental Research and Public Health*, *17*(10),
673 3740. doi:10.3390/ijerph17103740

674 Ciuluvica, C., Fulcheri, M., & Amerio, P. (2019). Expressive Suppression and Negative Affect,
675 Pathways of Emotional Dysregulation in Psoriasis Patients. *Frontiers in psychology*, *10*, 1907.
676 <https://doi.org/10.3389/fpsyg.2019.01907>

677 Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd edition). Hillsdale, New
678 Jersey: L.

679 Compare, A., Zarbo, C., Shonin, E., Van Gordon, W., & Marconi, C. (2014). "Emotional Regulation
680 and Depression: A Potential Mediator between Heart and Mind", *Cardiovascular Psychiatry
681 and Neurology*, vol. 2014, Article ID 324374, 10. <https://doi.org/10.1155/2014/324374>

682 Compas, B. E., Jaser, S. S., Bettis, A. H., Watson, K. H., Gruhn, M. A., Dunbar, J. P., Williams, E., &
683 Thigpen, J. C. (2017). Coping, emotion regulation, and psychopathology in childhood and
684 adolescence: A meta-analysis and narrative review. *Psychological bulletin*, *143*(9), 939–991.
685 <https://doi.org/10.1037/bul0000110>

686 Dan-Glauser, E. S., & Gross, J. J. (2015). The temporal dynamics of emotional acceptance:
687 Experience, expression, and physiology. *Biological Psychology*, *108*, 1-12.

688 Dixon-Gordon, K. L., Aldao, A., & De Los Reyes, A. (2015). Repertoires of emotion regulation: A
689 person-centered approach to assessing emotion regulation strategies and links to
690 psychopathology. *Cognition and Emotion*, *29*, 1314-1325.

691 Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The
692 impact of enhancing students' social and emotional learning: A meta-analysis of school-based
693 universal interventions. *Child Development*, *82*(1), 405-432.

694 Ford, B. Q., Gross, J. J., & Gruber, J. (2019). Broadening our field of view: The role of emotion
695 regulation. *Emotion Review*, *11*, 197-208.

696 Fujita, F., & Diener, E. (2005). Life Satisfaction Set Point: Stability and Change. *Journal of*
697 *Personality and Social Psychology*, *88*(1), 158–164. [https://doi.org/10.1037/0022-](https://doi.org/10.1037/0022-3514.88.1.158)
698 [3514.88.1.158](https://doi.org/10.1037/0022-3514.88.1.158)

699 Gore, P. (2000). Cluster analysis. In H. Tinsley & S. Brown (Eds.), *Handbook of applied multivariate*
700 *statistics and mathematical modeling* (pp. 297-321). San Diego, CA: Academic Press.

701 Gross, J. J. (1998). Antecedent-and response-focused emotion regulation: divergent consequences for
702 experience, expression, and physiology. *Journal of Personality and Social Psychology*, *74*,
703 224–237. doi: 10.1037/0022-3514.74.1.224

704 Gross, J. J. (2014). “*Emotion regulation: conceptual and empirical foundations,*” in *Handbook of*
705 *Emotion Regulation*, ed J. J. Gross (New York, NY: Guilford Press), 3–20.

706 Gross, J. J. (2015). Emotion regulation: Current status and future prospects. *Psychological Inquiry*, *26*,
707 1– 26.

708 Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: The acute effects of inhibiting negative and
709 positive emotion. *Journal of Abnormal Psychology*, *106*(1), 95–103.
710 <https://doi.org/10.1037/0021-843X.106.1.95>

711 Grossman, E. S., Hoffman, Y. S., Palgi, Y., & Shrira, A. (2021). COVID-19 related loneliness and
712 sleep problems in older adults: Worries and resilience as potential moderators. *Personality and*
713 *individual differences, 168*, 110371.

714 Hartigan, J. A., & Wong, M. A. (1979). "Algorithm AS 136: A k-means clustering algorithm". In:
715 Applied Statistics 28.1, pp. 100–108.

716 Hautamäki, V., Cherednichenko, S., Kärkkäinen, I., Kinnunen, T., & Fränti, P (2005). *Improving*
717 *kmeans by outlier removal*. In H. Kalviainen et al. (Eds.): SCIA 2005, LNCS 3540, pp. 978–
718 987.

719 Houle, I., & Philippe, F. L. (2020). Is the negative always that bad? Or how emotion regulation and
720 integration of negative memories can positively affect well-being. *Journal of Personality, 1–*
721 *13*. doi: 10.1111/jopy.12544

722 Jiang, F., Deng, L., Zhang, L., Cai, Y., Cheung, C. W., & Xia, Z. (2020) Review of the Clinical
723 Characteristics of Coronavirus Disease 2019 (COVID-19). *Journal of General Internal*
724 *Medicine, 35*, 1545–1549. <https://doi.org/10.1007/s11606-020-05762-w>

725 Jungmann, S. M., & Witthöft, M. (2020). Health anxiety, cyberchondria, and coping in the current
726 COVID-19 pandemic: Which factors are related to coronavirus anxiety? *Journal of Anxiety*
727 *Disorders, 73*, 102239.

728 Kämpfen, F., Kohler, I. V., Ciancio, A., Bruine de Bruin, W., Maurer, J., & Kohler, H. P. (2020).
729 Predictors of mental health during the Covid-19 pandemic in the US: Role of economic
730 concerns, health worries and social distancing. *PloS one, 15*(11), e0241895.

731 Kaufman, L., & Rousseeuw, P. J. (1990). *Finding Groups in Data*. John Wiley & Sons, New York.

732 Kim, Y., Deci, E. L., & Zuckerman, M. (2002). The development of the self-regulation of withholding
733 negative emotions questionnaire. *Educational and Psychological Measurement, 62*, 316-336.

734 Lawson, Richard G., & Peter C. J. (1990). New Index for Clustering Tendency and Its Application to
735 Chemical Problems. *Journal of Chemical Information and Computer Sciences, 30*(1), 36–41.

736 Luu, T. T. (2021). Worker resilience during the COVID-19 crisis: The role of core beliefs challenge,
737 emotion regulation, and family strain. *Personality and Individual Differences*, *179*, 110784.

738 Leys, C., Delacre, M., Mora, Y. L., Lakens, D., & Ley, C. (2019). How to classify, detect, and manage
739 univariate and multivariate outliers, with emphasis on pre-registration. *International Review of*
740 *Social Psychology*, *32*(1). <https://doi.org/10.5334/irsp.289>

741 Marteau, T. M., & Bekker, H. (1992). The development of a six-item short-form of the state scale of
742 the Spielberger State-Trait Anxiety Inventory (STAI). *The British journal of clinical*
743 *psychology*, *31*(3), 301–306. <https://doi.org/10.1111/j.2044-8260.1992.tb00997.x>

744 McLaughlin, K. A., Hatzenbuehler, M. L., Mennin, D. S., & Nolen-Hoeksema, S. (2011). Emotion
745 dysregulation and adolescent psychopathology: a prospective study. *Behaviour Research and*
746 *Therapy*, *49*(9), 544–554. <https://doi.org/10.1016/j.brat.2011.06.003>

747 Muñoz-Navarro, R., Malonda, E., Llorca-Mestre, A., Cano-Vindel, A., & Fernández-Berrocal, P.
748 (2021). Worry about COVID-19 contagion and general anxiety: Moderation and mediation
749 effects of cognitive emotion regulation. *Journal of Psychiatric Research*, *137*, 311-318.

750 Panchal, N., Kamal, R., Orgera, K., Cox, C., Garfield, R., Hamel, L., Muñana, C., & Chidambaram,
751 P. (2020). The implications of COVID-19 for mental health and substance use. Kaiser Family
752 Foundation (KFF). Retrieved from: [www.kff.org/coronavirus-covid-19/issue-brief/the-](http://www.kff.org/coronavirus-covid-19/issue-brief/the-implications-of-covid-19-for-mental-health-and-substance-use/)
753 [implications-of-covid-19-for-mental-health-and-substance-use/](http://www.kff.org/coronavirus-covid-19/issue-brief/the-implications-of-covid-19-for-mental-health-and-substance-use/)

754 Parkinson, B., Simons, G., & Niven, K. (2016). Sharing concerns: Interpersonal worry regulation in
755 romantic couples. *Emotion*, *16*(4), 449.

756 Pavot, W., & Diener, E. (1993). Review of the Satisfaction With Life Scale. *Psychological Assessment*,
757 *5*(2), 164–172. <https://doi.org/10.1037/1040-3590.5.2.164>

758 Prikhidko, A., Long, H., & Wheaton, M. G. (2020). The effect of concerns about COVID-19 on
759 anxiety, stress, parental burnout, and emotion regulation: the role of susceptibility to digital
760 emotion contagion. *Frontiers in public health*, *8*, 894.

761 R Development Core Team (2019). *R: A Language and Environment for Statistical Computing*.
762 Vienna, Austria: R Foundation for Statistical Computing.

763 Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general
764 population. Retrieved from the University of Minnesota Digital Conservancy,
765 <https://hdl.handle.net/11299/98561>.

766 Restubog, S., Ocampo, A., & Wang, L. (2020). Taking control amidst the chaos: Emotion regulation
767 during the COVID-19 pandemic. *Journal of Vocational Behavior*, 119, 103440.
768 <https://doi.org/10.1016/j.jvb.2020.103440>

769 Roth, G., & Assor, A. (2012). The cost of parental pressure to express emotions: Conditional regard
770 and autonomy support as predictors of emotion regulation and intimacy. *Journal of*
771 *Adolescence*, 35, 799-808. doi: 10.1016/j.adolescence.2011.11.005

772 Roth, G., Assor, A., Niemiec, C. P., Ryan, R. M., & Deci, E. L. (2009). The emotional and academic
773 consequences of parental conditional regard: Comparing conditional positive regard,
774 conditional negative regard, and autonomy support as parenting practices. *Developmental*
775 *Psychology*, 45, 1119–1142.

776 Roth, G., Benita, M., Amrani, C., Shachar, B.-H., Asoulin, H., Moed, A., Bibi, U., & Kanat-Maymon,
777 Y. (2014). Integration of negative emotional experience versus suppression: addressing the
778 question of adaptive functioning. *Emotion*, 14(5), 908–919. doi: 10.1037/a0037051

779 Roth, G., Shachar, B.-H., Zohar-Shefer, Y., Benita, M., Moed, A., Bibi, U., Kanat-Maymon, Y., &
780 Ryan, R. M. (2018). Benefits of emotional integration and costs of emotional distancing.
781 *Journal of Personality*, 86, 919–934. doi:10.1111/jopy.12366

782 Roth, G., Vansteenkiste, M., & Ryan, R. (2019). Integrative emotion regulation: Process and
783 development from a self-determination theory perspective. *Development and Psychopathology*,
784 31(3), 945-956. doi:10.1017/S0954579419000403

- 785 Roy, D., Sarvodaya, T., Sujita, K., Nivedita, S., Sudhir, K., & Vika, K. (2020). Study of knowledge,
786 attitude, anxiety & perceived mental healthcare need in Indian population during COVID-19
787 pandemic. *Asian Journal of Psychiatry*, 51, 102083. [https://doi.org/10.1016/j.
788 ajp.2020.102083](https://doi.org/10.1016/j.ajp.2020.102083).
- 789 Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation,
790 development, and wellness*. The Guilford Press. <https://doi.org/10.1521/978.14625/28806>
- 791 Ryan, R. M., Deci, E. L., & Vansteenkiste, M. (2016). *Autonomy and autonomy disturbances in self-
792 development and psychopathology: Research on motivation, attachment, and clinical process*.
793 In D. Cicchetti (Ed.), *Developmental psychopathology: Theory and method* (p. 385–438). John
794 Wiley & Sons, Inc. <https://doi.org/10.1002/9781119125556.devpsy109>
- 795 Satici, B., Gocet-Tekin, E., Deniz, M. E., & Satici, S. A. (2020). Adaptation of the fear of COVID-19
796 scale: its association with psychological distress and life satisfaction in Turkey. *International
797 Journal of Mental Health and Addiction*, Epub ahead of print. [https://doi.org/10.1007/s11469-
798 020-00294-0](https://doi.org/10.1007/s11469-020-00294-0).
- 799 Schimmenti, A., Billieux, J., & Starcevic, V. (2020). The four horsemen of fear: An integrated model
800 of understanding fear experiences during the COVID-19 pandemic. *Clinical Neuropsychiatry*,
801 17, 41–45
- 802 Shahar, B. H., Kalman-Halevi, M., & Roth, G. (2018). Emotion regulation and intimacy quality: the
803 consequences of emotional integration, emotional distancing, and suppression. *Journal of
804 Social and Personal Relationships*. Advance online publication. doi:
805 10.1177/0265407518816881
- 806 Stephens, E. C., Martin, G., van Wijk, M., Timsina, J., Snowe, V. (2020). Impacts of COVID19 on
807 agricultural and food systems worldwide and on progress to the sustainable development goals,
808 *Agricultural System*, 183, 102873 doi:<https://doi.org/10.1016/j.agsy.2020.102873>.

809 Tibshirani, R., Walther, G., & Hastie, T. (2001). Estimating the number of clusters in a data set via the
810 gap statistic. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, 63(2),
811 411-423.

812 van den Heuvel, M. W., Stikkelbroek, Y. A., Bodden, D. H., & van Baar, A. L. (2020). Coping with
813 stressful life events: Cognitive emotion regulation profiles and depressive symptoms in
814 adolescents. *Development and Psychopathology*, 32, 985-995.

815 Van Hiel, A., & Vansteenkiste, M. (2009). Ambitions fulfilled? The effects of intrinsic and extrinsic
816 goal attainment on older adults' ego-integrity and death attitudes. *International Journal of*
817 *aging & human development*, 68(1), 27–51.

818 Vansteenkiste, M., Ryan, R. M., & Soenens, B. (2020). Basic psychological need theory:
819 Advancements, critical themes, and future directions. *Motivation and Emotion*, 44, 1–31.
820 <https://doi.org/10.1007/s11031-019-09818-1>

821 Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., & Lens, W. (2009). Motivational profiles
822 from a self-determination perspective: The quality of motivation matters. *Journal of*
823 *Educational Psychology*, 101, 671-688.

824 Vindegaard, N., & Benros, M. E. (2020). COVID-19 pandemic and mental health consequences:
825 Systematic review of the current evidence. *Brain, Behavior, and Immunity*, 89, 531-542.

826 Wang, Q.-Q., Fang, Y.-Y., Huang, H.-L., Lv, W.-J., Wang, X.-X., Yang, T.-T., Yuan, J.-M., Gao, Y.,
827 Qian, R.-L., & Zhang, Y.-H. (2021). Anxiety, depression and cognitive emotion regulation
828 strategies in Chinese nurses during the COVID-19 outbreak. *Journal of Nursing Management*.

829 Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2013). The integrative process: New research and
830 future directions. *Current Directions in Psychological Science*, 22, 69-74.

831 Xu, C., Xu, Y., Xu, S., Zhang, Q., Liu, X., Shao, Y., Xu, X., Peng, L., & Li, M. (2020). cognitive
832 reappraisal and the association between perceived stress and anxiety symptoms in COVID-19
833 isolated people. *Frontiers in Psychiatry*, 11, 858. <https://doi.org/10.3389/fpsy.2020.00858>

834 Zhang, X., Wang, Y., Lyu, H., Zhang, Y., Liu, Y., & Luo, J. (2020). The Influence of COVID-19 on
835 Well-Being. <https://doi.org/10.31234/osf.io/znj7h>

836

837

838 Table 1

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

Variable	M	SD	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. * $p < .05$, ** $p < .01$, *** $p < .001$

841

842

843

844

845

846

847

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

	Cluster 1 (Low overall emotion regulation)		Cluster 2 (High integration)		Cluster 3 (High suppression and dysregulation)		<i>F</i> (2, 5649)	<i>p</i> -value	η^2
	<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

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

849

850

851

852

853

854

855

856

857

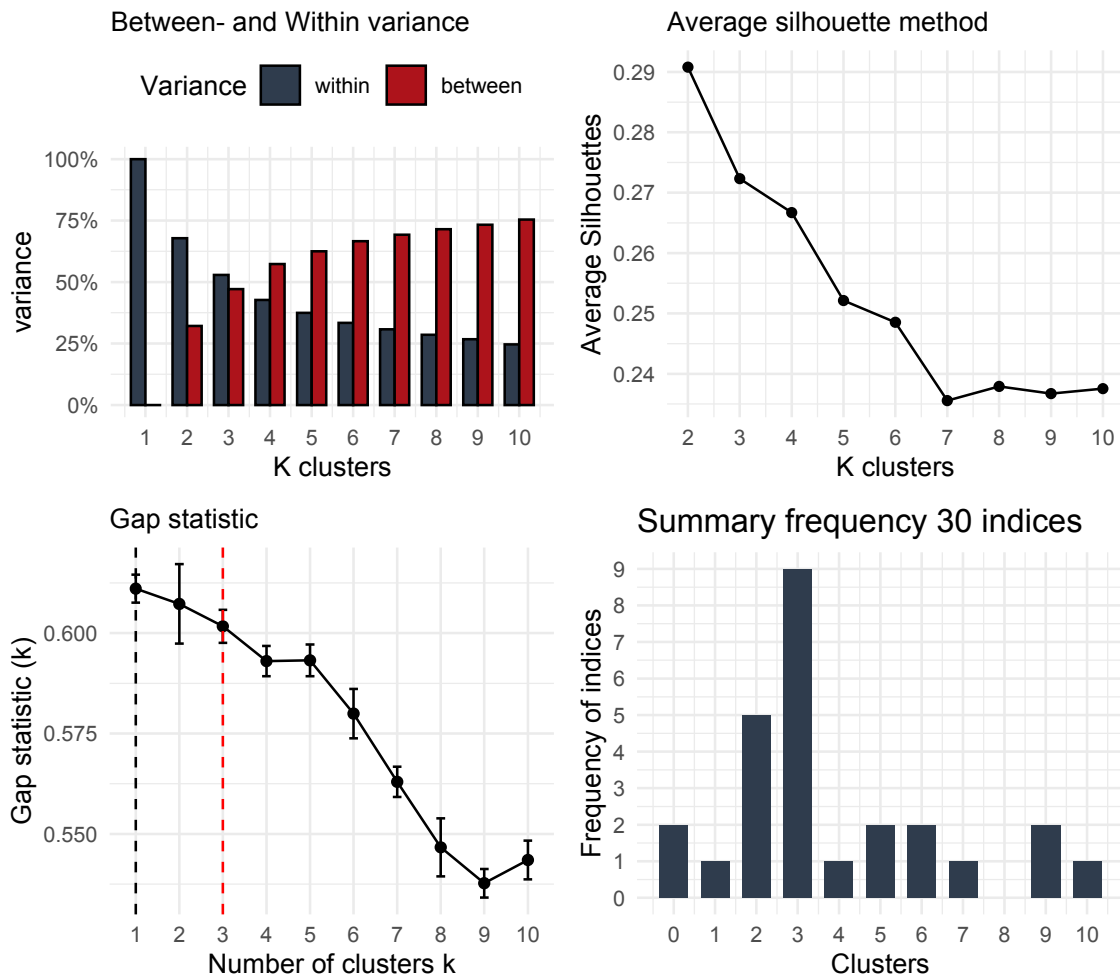
858

859

860

861

Figure 1. Visualizations of cluster validation techniques



COVID-19 AND EMOTION REGULATION

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

