

1 **Trajectories of symptoms of depression, distress and resilience in health care workers**
2 **during the COVID-19 pandemic and towards its end in Czechia**

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18 **Abstract**

19 **Background and objectives:** Mental health of health care workers may have improved after
20 the COVID-19 pandemic. We aimed to model the trajectories of psychological distress,
21 depressive symptoms and resilience during the COVID-19 pandemic and towards its end in
22 HCWs in Czechia and investigate, which COVID-19 work stressors were associated with these
23 trajectories.

24 **Methods:** The study included 322 health care workers from the Czech arm of the international
25 HEROES Study who participated in an online questionnaire in two waves during the pandemic
26 and one wave towards its end. Growth mixture modelling identified trajectory patterns of
27 depressive symptoms (measured with Patient Health Questionnaire), distress (General Health
28 Questionnaire) and resilience (Brief Resilience Scale). Logistic regression was applied to
29 estimate the association of COVID-19 stressors with mental health trajectories, adjusting for
30 baseline characteristics.

31 **Results:** Trajectory classes revealed both high and low depressive symptoms (high in 61%
32 participants), distress (high in 82% participants) and resilience (low in 32% participants).
33 Depressive symptoms and distress trajectories demonstrated the same shape, first increasing
34 during the pandemic and decreasing towards its end, while resilience remained constant.
35 Exposure to COVID-19 stressors, in particularly the experience of stigmatization,
36 discrimination and violence, was associated with high depressive symptoms and distress
37 trajectories, but not with resilience.

38 **Conclusions:** Interventions provided to health care workers during crises such as pandemic
39 should target distress and depressive symptoms and need to address stigmatization,
40 discrimination and violence.

41 **Key words:** health care; stress; resilience; depression; pandemic

42 **INTRODUCTION**

43 Health care workers (HCWs) faced an elevated risk of emotional strain and mental health issues
44 during the COVID-19 pandemic due to their exposure to the virus and the demands of their
45 profession [1]. In our prior study involving HCWs in Czechia, we observed that the prevalence
46 of depression among HCWs doubled during the pandemic. This increase was primarily
47 attributed to heightened distress, exposure to COVID-19 patient deaths, and direct contact with
48 COVID-19 patients. Conversely, greater resilience and access to adequate personal protective
49 equipment were strongly linked a reduced occurrence of depression among HCWs [2]. The
50 pandemic may have significantly eroded the resilience of HCWs, due to the inherent
51 unpredictability of infectious diseases, their ability to affect young, previously healthy people,
52 and the instilled fear of contracting the disease among caregivers themselves. Resilience may
53 be viewed as an individual ability to adapt to external stressors like trauma or threats, and
54 resilience in HCWs during pandemics is underpinned by professional identity, collaboration,
55 effective communication, supportive leaders, and potential for growth.

56 As opposed to a large body of evidence on the trajectories of mental health symptoms in the
57 general population [3-8, 10, 11], it is less understood how mental health of HCWs changed
58 during the pandemic and towards its end. A study on Italian HCWs found that their mental
59 health improved after the initial peak of the pandemic and the decrease in depressive symptoms
60 was related to being a frontline HCW [12]. However, high depressive symptoms and distress
61 were found to persist among Spanish HCWs over the duration of the pandemic [13]. In HCWs
62 hailing from Northern Ireland, it was predominantly observed that the majority exhibited a
63 trajectory characterized by low depressive symptomatology throughout the pandemic.
64 However, a notable minority, comprising 13-16% of the total, fell into the high-symptom

65 category. Members of this group consistently experienced symptom levels within the moderate-
66 to-severe range, persisting throughout the fluctuating peaks and troughs of the pandemic [14].
67 In German HCWs during the first year of the pandemic, it was observed that depressive
68 symptoms have risen, but perceived stress did not change over time [15].

69 Thus far, the findings concerning the trajectories of mental health among HCWs have been
70 inconsistent and have not consistently addressed the evolution of symptoms throughout the
71 entire duration of the pandemic, including the period leading up to its conclusion. Furthermore,
72 although resilience has emerged as a significant predictor of reduced depression and distress
73 symptoms, there remains a gap in understanding whether the resilience levels of individuals
74 have undergone changes over the course of the pandemic. In the present study, we aimed to
75 model the trajectories of psychological distress, depressive symptoms and resilience during the
76 COVID-19 pandemic and towards its end in HCWs in Czechia and investigate, which COVID-
77 19 work stressors were associated with these trajectories.

78

79 **METHODS**

80 **Participants**

81 Participants were healthcare and social service workers, including physicians, nurses,
82 paramedics, social workers, and administrative staff in the Czech arm of the international
83 COVID-19 HEalth caRe wOrkErS (HEROES) Study. This global study assessed the
84 pandemic's impact on their mental health [16]. Data collection used an online questionnaire,
85 starting in Czechia in June 2020 (wave 0: June 24th to August 30th; n=1,778) post the first
86 peak. A follow-up was in spring 2021 (wave 1: February 15th to April 31st; n=1,840) during
87 the second peak. The last data collection was in fall 2022 towards the end of the pandemic

88 (wave 2: September 15th to November 15th, 2022; n=1,451). To be able to model the
89 trajectories of mental health symptoms, at least three measures of the outcome are needed.
90 Therefore, in the present study, we included in total 322 individuals who participated in all three
91 waves. Not all participants, however, had complete data in all measures (see more information
92 in the Supplement). All participants gave informed consent prior to survey completion. The
93 HEROES Study was approved by the Columbia University Institutional Review Board. The
94 Czech arm of the HEROES Study was approved by the Ethics Committee of the Ministry of
95 Health as well as the Ethical Review Board of the University Hospital Motol, Prague, Czechia.
96 All methods were performed in accordance with relevant guidelines and regulations.

97

98 **Depressive symptoms**

99 Depressive symptomatology was quantified employing the Czech version [17] of the Patient
100 Health Questionnaire (PHQ-9), a widely recognized and validated instrument encompassing
101 nine distinct items that gauge the severity of depression [18]. These items encompass inquiries
102 into diminished interest, emotional despondency, sleep disturbances, diminished vitality,
103 alterations in appetite, reduced self-assurance, difficulties in concentration, altered pace, and
104 contemplation of suicidal ideation. Respondents were tasked with indicating the frequency of
105 their experience of these symptoms over the preceding fortnight, with available response
106 options encompassing "not at all" (yielding a score of 0), "several days" (yielding a score of 1),
107 "more than half the days" (yielding a score of 2), and "nearly every day" (yielding a score of
108 3). Consequently, the cumulative score spanned from 0 to 27, encapsulating the overall extent
109 of depressive symptomatology.

110

111 **Distress**

112 Psychological distress was evaluated utilizing the 12-item General Health Questionnaire
113 (GHQ-12) [19], a well-established instrument frequently employed for the assessment of
114 psychological distress within non-clinical populations. Respondents were prompted to gauge
115 the extent, to which they had experienced specific symptoms associated with psychological
116 functioning and mental well-being during the past week, including aspects such as
117 concentration ability, usefulness, feelings of strain, problem-solving capacity, and the capacity
118 to derive satisfaction from day-to-day activities. These responses were subject to a four-point
119 scale, encompassing options denoted as "less than usual," "no more than usual," "rather more
120 than usual," and "much more than usual." Participants' score was calculated by reverse coding
121 the negatively phrased items and summing up all items using the Likert scoring method (0–1–
122 2–3), with a potential maximum score of 36 points.

123

124 **Resilience**

125 The assessment of resilience was executed through the utilization of the Brief Resilience Scale
126 [20], an instrument designed to capture an individual's capacity for recuperation in the face of
127 stress. This scale comprises six items, each designed to gauge one's ability to rebound from
128 challenging circumstances and navigate through stressful events. The items are subject to
129 evaluation using a five-point scale, with response options ranging from "1=strongly disagree"
130 to "5=strongly agree." Notably, the scale encompasses three positively worded items and three
131 negatively worded items. To ensure consistency in scoring, the negatively worded items were
132 reverse-coded. Consequently, the overall resilience score is computed as the mean of these six
133 items, yielding a range of values from one to five points.

134

135 **Cumulative exposure to COVID-19 stressors**

136 Cumulative exposure to COVID-19 stressors was assessed throughout all three waves using
137 seven items on individual stressor. The item was counted if the stressor was reported at least
138 once during the follow-up in any wave. They included contact with COVID-19 patients (close
139 contact with suspect or confirmed COVID-19 patient within the last seven days; yes / no),
140 experience of death due to COVID-19 (close contact at work with someone or caring for a
141 patient who later passed away; yes / no), experience of stigmatization, discrimination, or
142 violence (having felt stigmatized or discriminated against or having experienced violence as a
143 HCW due to the COVID-19 pandemic; yes / no), assignment of new tasks (assignment to a new
144 team or assignment of new functions since the beginning of the pandemic; yes / no), patient
145 prioritization (having had to decide how to prioritize patients with COVID-19; yes / no),
146 insufficient personal protective equipment (yes / no), and low trust in workplace (trusting that
147 the workplace can manage the COVID-19 pandemic; originally options low / moderate / high;
148 here recoded as yes / no). In the end, we created a sum of these seven items (sum of the total
149 exposure to COVID-19 stressors) and divided this variable into low (0-2 points), medium (3-4
150 points), and high (5-7 points).

151 **Other characteristics**

152 Participants' characteristics were chosen as factors associated with mental health of HCWs
153 during the COVID-19 pandemic and COVID-19 stressors. All characteristics were assessed at
154 baseline, wave 0. In case of missing data, information from a later wave was used. They
155 included age (years), gender (men / women), occupation (physician / nurse or other medical
156 staff / management / other) and chronic physical illness (presence of a chronic physical illness
157 before the pandemic; yes / no).

158 **Statistical analysis**

159 Trajectories of depressive symptoms, distress and resilience were created following the
160 recommended guidelines and the most recent advances in growth mixture modelling [21, 22].
161 Growth mixture modelling (GMM) is a probabilistic technique that extracts distinct
162 longitudinal trajectories of repeated measures variables. The yielded latent class variables will
163 give an approximation of unobserved memberships among the participants following similar
164 patterns. The most widely used GMM model (where the variances of the latent growth factors
165 were held equal across classes) did not yield interpretable class sizes (e.g., subgroup of $n = 28$),
166 did not converge, or obtained negative residual variance for the latent slope factor. Thus, as an
167 alternative method, for the latent trajectories of depressive symptoms we employed the
168 covariance pattern growth mixture modelling (CPGMM), estimating unique variances and
169 covariances of the latent slopes and intercepts within each extracted class. This method has the
170 advantage of allowing the classes to be unique and it was developed to avoid methodological
171 artefacts [19]. The trajectories of distress and resilience were extracted with Latent Class
172 Growth Models (LCGM; i.e., fixing the variances of the latent slope and intercept factors at
173 zero) as these models yielded more distinctive classes than the CPGMM. The analyses found
174 the 2-class solutions the most parsimonious in all three variables. Extracting more classes (i.e.,
175 three classes) were decided against, as the patterns of the three classes were essentially the same
176 (i.e., consistently low, medium, and high levels), with very small class sizes (smallest class was
177 $n = 58$ in depression, $n = 6$ in distress, and $n = 18$ in resilience), and were not supported by
178 model indicators. See further details of the analysis in the supplementary methods and tables
179 (Tables S1-S3).

180

181 We compared depressive symptoms, distress, and resilience between waves with repeated
182 measures analysis of variance (ANOVA) with Bonferroni type post hoc comparisons between
183 the individual waves. We compared characteristics of participants between classes using

184 independent samples' t-test and chi-squared test. Effect size was expressed by Cohen's d (<0.2
185 very small; $0.2-0.5$ small; $0.5-0.8$ moderate; >0.8 large) Cramer's V (<0.1 very small; $0.1-0.3$
186 small; $0.3-0.5$ moderate; >0.5 large). We performed a multivariable analysis, estimating with
187 logistic regression odds ratio (OR) with 95% confidence interval (CI) for the association of
188 exposure to COVID-19 stressors with the trajectory of high depressive symptoms, high distress
189 and low resilience (separate outcomes in separate models). First, we entered all individual
190 stressors into the model at the same time, adjusting for baseline characteristics (age, gender,
191 occupation and chronic physical illness). Second, instead of the individual stressors, we entered
192 the variable sum of total exposure to COVID-19 stressors into the model, adjusting for baseline
193 characteristics. Third, instead of the sum of total exposure to COVID-19 stressors, we entered
194 the 3-level variable (low, medium, high) into the model, adjusting for baseline characteristics.
195

196 **RESULTS**

197 We studied 322 HCWs (74% women, mean age at baseline 46 years), from whom 36% were
198 physicians, 36% nurses or other medical staff and 17% in management (Table 1). Over the three
199 waves of the follow-up, 60% of them have had contact with COVID-19 patients, 48% had
200 experience of death due to COVID-19, 41% experienced stigmatization, discrimination or
201 violence, 48% underwent an assignment of new tasks, 20% had to prioritize patients, 42%
202 reported insufficient personal protective equipment and 28% low trust in their workplace.

203 Depressive symptoms differed between waves ($F[2, 478] = 14.0, p < .001, \eta_p^2 = .1$). In wave 0,
204 depressive symptoms were distributed around the mean of 4.2 (\pm standard deviation 4.0), then
205 increased in wave 1 ($5.5 \pm 4.7, p < .001$) and again decreased in wave 2 ($4.5 \pm 4.3, p = .001$).
206 A similar pattern was observed for distress ($F[2, 498] = 40.7, p < .001, \eta_p^2 = .1$). In wave 0, the
207 average distress score reached 11.6 ± 4.6 , then increased in wave 1 ($13.9 \pm 5.5, p < .001$) and

208 again decreased in wave 2 (11.2 ± 4.5 , $p < .001$). On the contrary, resilience remained constant
209 across waves (mean 3.4 ± 0.7 in waves 0-2; $F[2, 478] = .6$, $p = .4$, $\eta_p^2 < .1$).

210 There were two classes of the development of depressive symptoms, distress and resilience over
211 time, for each outcome, there was a class of high symptoms and low symptoms (Figure 1). Low
212 depressive symptoms trajectory was present in 39% of the sample, while 61% had high
213 depressive symptoms trajectory. However, it needs to be acknowledged that when considering
214 the cut-off criteria based on PHQ, the high depressive symptoms trajectory corresponds largely
215 to mild or moderate symptomatology, while the low symptoms trajectory group includes largely
216 asymptomatic individuals. However, to ensure readability, here we used the terms high
217 symptoms and low symptoms. Both classes had the same trajectory shape - first, the symptoms
218 increased between wave 0 and wave 1 and then decreased between wave 1 and wave 2. Low
219 distress trajectory was present in 72% of the sample, while 28% had high distress trajectory.
220 Similar to the classes of depressive symptoms was the trajectory of distress - first, there was an
221 increase in distress from wave 0 and wave 1, followed by a decrease between wave 1 and wave
222 2. Concerning resilience, 68% of the sample was classified with high resilience trajectory and
223 32% with low resilience trajectory. Within both classes, there were no changes in resilience
224 over time.

225 There were small differences in participants' characteristics between the trajectory classes
226 (Table 2). In particular, younger people, women, people with the experience of stigmatization,
227 discrimination or violence and those with greater exposure to COVID-19 stressors had more
228 often high depressive symptoms. People with the experience of stigmatization, discrimination
229 or violence, insufficient protective equipment, and greater exposure to COVID-19 stressors had
230 more often high distress. Women, people with the experience of stigmatization, discrimination
231 or violence and low trust in their workplace had more often low resilience. Furthermore, those

232 with low resilience were also more depressed and distressed than those with high resilience
233 (Table S4).

234 Table 3 presents association of cumulative exposure to COVID-19 stressors with the
235 trajectories classes. Looking at the stressors separately, only the experience of stigmatization,
236 discrimination or violence was associated with the high depressive symptoms trajectory (OR
237 1.92; 95% CI 1.15; 3.24) and high distress trajectory (OR 1.73; 95% CI 1.01; 2.97). Insufficient
238 personal protective equipment was associated with the low resilience trajectory (OR 1.99; 95%
239 CI 1.16; 3.42). Considering the total cumulative exposure to COVID-19 stressors, the sum of
240 the stressors was associated with greater odds of belonging to the high depressive symptoms
241 trajectory (OR 1.29; 95% CI 1.10; 1.52). When compared to the low total exposure, only the
242 medium total exposure was related to greater odds of belonging to the high depressive
243 symptoms trajectory (OR 1.88; 95% 1.10; 3.28), while the odds for the high exposure were
244 lower and did not reach statistical significance. The sum of the stressors was also associated
245 with greater odds of high distress trajectory (OR 1.32; 95% CI 1.12; 1.56), showing a dose-
246 response pattern as the high total exposure was related to the greatest odds of belonging to the
247 high distress trajectory class (OR 2.53; 95% CI 1.24; 5.18). Total exposure to COVID-19
248 stressors was not related to trajectories of resilience.

249

250 **DISCUSSION**

251 Our analysis unveiled that, during the initial wave of the pandemic, a substantial 61% of HCWs
252 exhibited pronounced depressive symptoms, a figure that escalated as the pandemic progressed,
253 subsequently receding upon its abatement. The remaining 39% of HCWs manifested
254 comparatively lower levels of depressive symptoms; nevertheless, they too witnessed an
255 increase and subsequent decrease in symptomatology. Intriguingly, only experiences of

256 stigmatization, discrimination, or violence were found to independently correlate with the
257 trajectory characterized by heightened depressive symptoms. While overall exposure to
258 COVID-19-related stressors demonstrated an association with the trajectory of elevated
259 depressive symptoms, this relationship did not adhere to a linear dose-response pattern.
260 Moreover, 28% of individuals experienced high distress, whereas the majority, constituting
261 72%, reported a trajectory marked by low distress levels. The trajectories of distress mirrored
262 those observed for depressive symptoms. Similarly, only reported encounters with
263 stigmatization, discrimination, or violence bore independent association with the trajectory
264 marked by elevated distress. The cumulative exposure to COVID-19-related stressors exhibited
265 a distinct pattern, displaying a dose-response relationship with the trajectory characterized by
266 heightened distress symptoms. Lastly, our findings indicated that 32% of the study participants
267 exhibited low levels of resilience, with the majority, accounting for 68%, demonstrating high
268 resilience. Remarkably, resilience levels remained relatively stable throughout the follow-up
269 period. We observed that low resilience was linked to reports of inadequate personal protective
270 equipment, although it did not correlate with the overall extent of exposure to COVID-19-
271 related stressors.

272 A large body of evidence has pointed to poor mental health of HCWs during the pandemic [23-
273 26]. Here we uniquely show great improvements in the symptoms of distress and depression in
274 HCWs towards the end of the pandemic. We found that the trajectory characterized by high
275 levels of depressive symptoms was strongly linked to experiences of stigmatization,
276 discrimination, or violence. This observation is consistent with existing knowledge indicating
277 that experienced stigma [27], discrimination [28], and workplace violence [29, 30] are
278 established risk factors for depression. Moreover, this connection extends to the long-term
279 association of discrimination with subsequent depression [31]. While the pathway from

280 exposure to discrimination due to COVID-19 to depression has not been explicitly described, a
281 social cognitive model developed to understand racial discrimination [32] could be applied for
282 explanatory purposes. This model, inclusive of relational schemas reflecting concerns about
283 rejection and invalidation, social vigilance, and mistrust, serves as a mediator in the link
284 between discrimination and depression [32]. In the context of the COVID-19 pandemic, HCWs
285 who have experienced discrimination may harbor feelings of rejection, vigilance, and mistrust
286 within society, thereby contributing to the development of depressive symptoms. Notably,
287 although the trajectory characterized by high levels of depressive symptoms demonstrated an
288 association with the overall exposure to COVID-19-related stressors, this relationship did not
289 exhibit a linear dose-response pattern, suggesting a likely absence of causality. This
290 phenomenon can be elucidated by the pandemic's capacity to induce an increased prevalence
291 of depression across the Czech general population [33], precipitating significant mental health
292 consequences irrespective of the level of exposure to COVID-19 stressors. This prompts
293 questions regarding the threshold at which stressors become clinically significant. It is,
294 therefore, likely that there are confounding factors at play, which we did not take into account.

295 The trajectory of psychological distress exhibited an upward trend during the initial wave,
296 which coincided with the lockdown measures implemented in Czechia at the peak of the
297 pandemic. This trend aligns with the findings of a study conducted in Australia [34]. Similarly
298 as to depressive symptoms, the trajectory characterized by high distress levels was also
299 associated with experiences of stigmatization, discrimination, or violence. These distressing
300 encounters represent significant risk factors for psychological distress and may exert enduring
301 effects on psychological well-being that extend beyond the pandemic's immediate impact.
302 HCWs, having experienced such stressors, may retain concerns that others will treat them
303 similarly to their experiences during the outbreak. Moreover, the trajectory marked by high

304 distress levels exhibited a dose-response relationship with the overall exposure to COVID-19
305 stressors, implying a potential causal link and suggesting that the stressors cumulatively meant
306 a more substantial effect than each individually. This observation aligns with findings from a
307 systematic review [35] indicating that risk factors for psychological distress during infectious
308 disease outbreaks primarily involve infection exposure factors, such as contact with infected
309 individuals or colleagues. Frontline HCWs [36] emerge as particularly vulnerable to distress.

310 Interestingly, resilience levels remained relatively stable throughout the pandemic. Notably, the
311 low resilience trajectory did not exhibit an association with the overall exposure to COVID-19
312 stressors. This supports the idea that the measure of resilience we used is trait-like and does not
313 capture a dynamic state [37]. Our results therefore cannot suggest that HCWs should be offered
314 interventions that would increase their resilience [38]. In another study, resilience scores did
315 not change significantly during the COVID-19 pandemic either [39]. To et al found significant
316 associations of resilience with physical activity and psychological distress, suggesting that
317 future interventions to enhance or nurture resilience should be particularly targeted at people
318 identified as at risk of psychological distress [39]. In our study, we found that the low resilience
319 trajectory was associated with reporting insufficient personal protective equipment. This
320 finding is corroborated by an Italian study [40], which observed that HCWs satisfied with their
321 personal protective equipment had higher levels of resilience. HCWs possess an understanding
322 of the protective properties of different personal protective equipment and maintain confidence
323 that inadequate personal protective equipment offers no protection against the risk of infection
324 [41].

325 Several strengths and limitations need to be mentioned. The observation of changes in mental
326 health over three waves of COVID-19 pandemic in Czechia (longitudinal design) belongs to
327 the strengths of the study. The comparison among trajectory groups provides valuable insight

328 into the relationship between the level of exposure, both cumulative and individually, and the
329 severity of mental health deterioration. On the other hand, self-reporting used in the data
330 collection may introduce information bias. Also, the relatively small sample size (n=322) is a
331 limitation of this study. This study is also limited by a large drop out of the sample during the
332 assessments as individuals who are likely healthier and more motivated may have remained in
333 the study. Furthermore, this study is based only on one nation and its results can be influenced
334 by specific Czech population mental health and conditions and cannot be generalized. In
335 addition, the scale used in our study may not be optimal for measuring resilience. Although
336 several resilience scales have been published [42], each tends to include different traits and in
337 general these scales fail to explain why so many of the empirically identified correlates of
338 resilient outcomes are not included in the personality, or why these factors may nonetheless
339 still influence resilient outcomes. Most critically, although resilience scales are generally
340 correlated with health and well-being, they do not hold up to their promise when tested in
341 longitudinal or prospective research. In the end, this study did not consider a specific
342 occupational field of HCWs, which could have provided more nuanced results.

343 To conclude, policy makers should address stigmatization, discrimination and violence in
344 healthcare and make safe and supportive work environments to protect HCWs.
345 Destigmatization could be realized through communication, open dialogue and promotion of
346 reliable sources of information. Self-help training and psychological support should be
347 available in healthcare facilities.

348

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352

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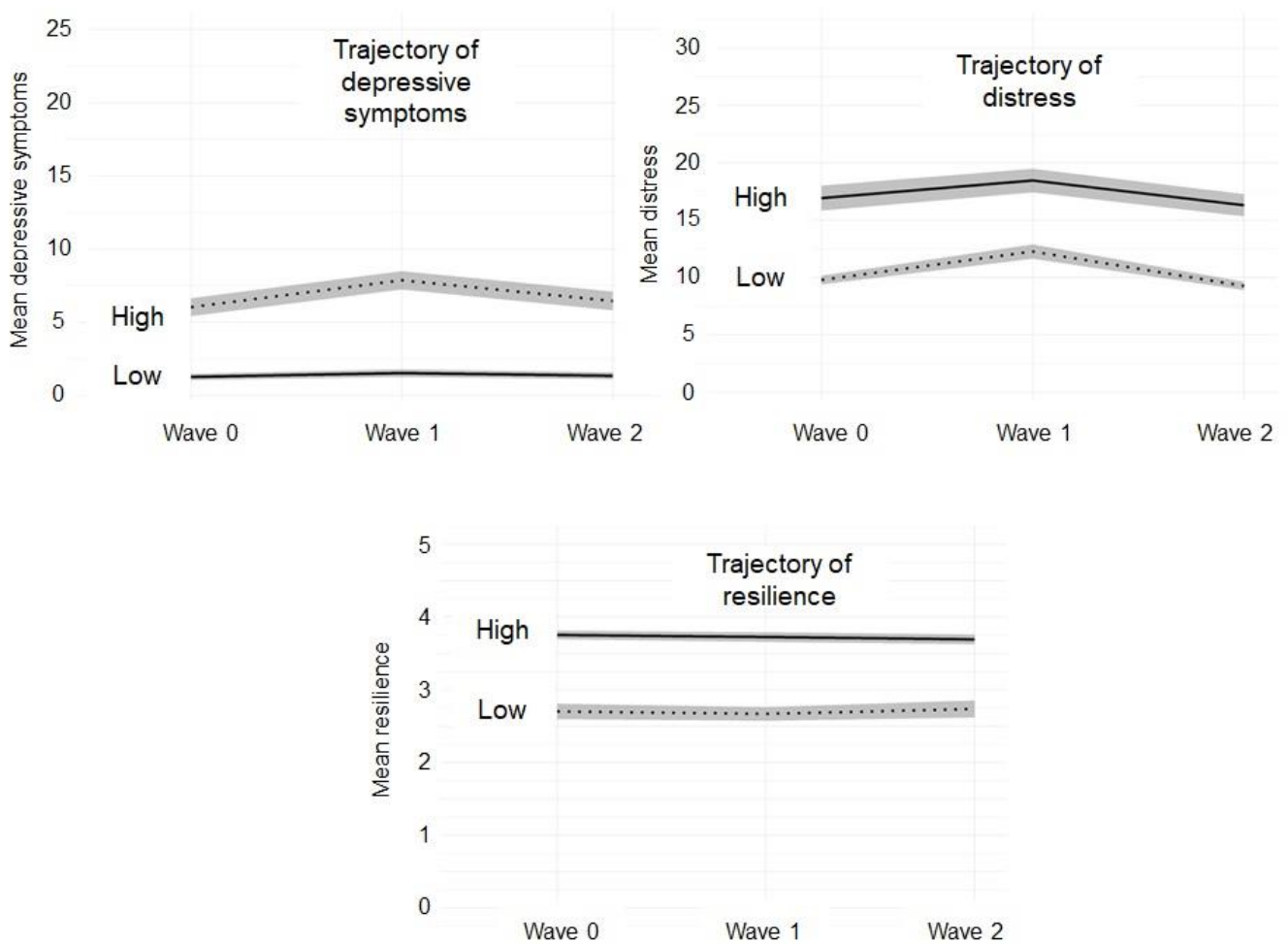
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504 **Figure 1** Classes of trajectories of mental health symptoms

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507 **Table 1** Characteristics of participants (n=322)

Baseline characteristics	Distribution
Age, years, mean \pm SD	45.5 \pm 11.4
Women, n (%)	239 (74.2)
Occupation, n (%)	
Physician	116 (36.0)
Nurse or other medical staff	115 (35.7)
Management	54 (16.8)
Other	37 (11.5)
Physical illness, n (%)	87 (27.5)
Cumulative exposure to COVID-19 stressors, n (%)	
Contact with COVID-19 patients	191 (59.5)
Experience of death due to COVID-19	155 (48.3)
Experience of stigmatization, discrimination or violence	133 (41.3)
Assignment of new tasks	154 (47.8)
Patient prioritization	65 (20.4)
Insufficient personal protective equipment	132 (41.6)
Low trust in workplace	91 (28.3)
Total exposure to COVID-19 stressors, mean \pm SD	2.9 \pm 1.7
Low, n (%)	146 (45.3)
Medium, n (%)	117 (36.3)
High, n (%)	59 (18.3)

508 *Note: SD, standard deviation*

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Table 2 Differences in participants' characteristics between classes

Baseline characteristics	Depressive symptoms			Distress			Resilience		
	Low (n=124)	High (n=196)	d/V	Low (n=231)	High (n=90)	d/V	Low (n=102)	High (n=217)	d/V
Age, years, mean \pm SD	47.8 \pm 11.1	44.1 \pm 11.3	0.33	45.9 \pm 11.5	44.6 \pm 11.2	0.12	44.2 \pm 10.9	46.2 \pm 11.5	0.18
Women, n (%)	80 (64.5)	157 (80.1)	0.17	165 (71.4)	73 (81.1)	0.10	84 (82.4)	153 (70.5)	0.13
Occupation, n (%)									
Physician	45 (36.3)	70 (35.7)	0.03	85 (36.8)	30 (33.3)	0.08	33 (32.4)	82 (37.8)	0.06
Nurse or other medical	45 (36.3)	69 (35.2)		81 (35.1)	34 (37.8)		40 (39.2)	73 (33.6)	
Management	21 (16.9)	33 (16.8)		36 (15.6)	18 (20.0)		18 (17.6)	36 (16.6)	
Other	13 (10.5)	24 (12.2)		29 (12.6)	8 (8.9)		11 (10.8)	26 (12.0)	
Physical illness, n (%)	32 (26.0)	55 (28.5)	0.03	60 (26.4)	27 (30.3)	0.04	31 (31.0)	56 (25.9)	0.05
Cumulative exposure to COVID-19 stressors, n (%)									
Contact with COVID-19 patients	72 (58.1)	118 (60.5)	0.02	130 (56.3)	60 (67.4)	0.10	56 (55.4)	133 (61.3)	0.06
Experience of death due to COVID-19	53 (43.1)	102 (52.0)	0.09	104 (45.2)	51 (56.7)	0.10	44 (43.1)	110 (50.9)	0.07
Experience of stigmatization, discrimination or violence	40 (32.3)	93 (47.4)	0.15	85 (36.8)	48 (53.3)	0.15	51 (50.0)	82 (37.8)	0.12
Assignment of new tasks	51 (41.1)	102 (52.0)	0.11	109 (47.2)	44 (48.9)	0.02	50 (49.0)	102 (47.0)	0.02
Patient prioritization	21 (17.2)	44 (22.6)	0.06	46 (20.2)	19 (21.1)	0.10	21 (20.6)	43 (20.1)	0.01
Insufficient personal protective equipment	44 (36.1)	88 (45.6)	0.09	86 (37.7)	46 (52.3)	0.13	53 (53.0)	78 (36.4)	0.16
Low trust in workplace	34 (27.4)	57 (29.1)	0.02	59 (25.5)	32 (35.6)	0.10	38 (37.3)	53 (24.4)	0.13
Total exposure to COVID-19 stressors, mean \pm SD	2.5 \pm 1.6	3.1 \pm 1.7	0.33	2.7 \pm 1.7	3.3 \pm 1.7	0.40	3.1 \pm 1.7	2.8 \pm 1.6	0.18
Low, n (%)	65 (52.4)	79 (40.3)	0.12	113 (48.9)	32 (35.6)	0.14	44 (43.1)	100 (46.1)	0.04
Medium, n (%)	39 (31.5)	78 (39.8)		82 (35.5)	35 (38.9)		37 (36.3)	80 (36.9)	
High, n (%)	20 (16.1)	39 (19.9)		36 (15.6)	23 (25.6)		21 (20.6)	37 (17.1)	
Depressive symptoms, mean \pm SD									
Wave 0	1.3 \pm 1.2	6.0 \pm 4.2	1.43	2.7 \pm 2.5	8.0 \pm 4.8	1.62	6.3 \pm 5.0	3.2 \pm 3.1	0.82
Wave 1	1.5 \pm 1.4	7.9 \pm 4.3	1.83	4.1 \pm 3.9	8.9 \pm 4.6	1.15	7.8 \pm 4.9	4.3 \pm 4.0	0.83

Wave 2	1.4 ± 1.3	6.5 ± 4.3	1.50	2.8 ± 2.7	8.5 ± 4.6	1.68	6.5 ± 5.0	3.5 ± 3.4	0.77
Distress, mean ± SD									
Wave 0	9.1 ± 2.9	13.5 ± 5.0	1.04	9.8 ± 2.9	16.9 ± 5.0	1.98	14.1 ± 5.5	10.7 ± 4.1	0.75
Wave 1	9.9 ± 3.4	16.6 ± 4.8	1.54	12.3 ± 4.6	18.5 ± 4.7	1.33	16.8 ± 5.3	12.6 ± 4.9	0.85
Wave 2	8.4 ± 2.2	13.2 ± 4.7	1.22	9.3 ± 2.7	16.3 ± 4.5	2.15	13.6 ± 5.2	10.2 ± 3.8	0.79
Resilience, mean ± SD									
Wave 0	3.7 ± 0.6	3.2 ± 0.7	0.71	3.6 ± 0.6	3.0 ± 0.7	0.82	2.7 ± 0.5	3.8 ± 0.4	2.29
Wave 1	3.7 ± 0.6	3.2 ± 0.6	0.90	3.5 ± 0.6	3.0 ± 0.7	0.73	2.7 ± 0.5	3.7 ± 0.5	2.27
Wave 2	3.7 ± 0.6	3.2 ± 0.7	0.82	3.6 ± 0.6	3.0 ± 0.7	0.96	2.7 ± 0.6	3.7 ± 0.5	1.88

Note: Differences between groups were assessed using independent samples t-test or chi-squared test. Significant results ($p < 0.05$) are in bold.

1 **Table 3** Association of cumulative exposure to COVID-19 stressors with trajectories of mental

	OR (95% CI) High depressive symptoms trajectory	High distress symptoms trajectory	Low resilience trajectory
A) Individual stressors			
Contact with COVID-19 patients	1.00 (0.57; 1.76)	1.57 (0.85; 2.94)	0.89 (0.50; 1.59)
Experience of death due to COVID-19	1.47 (0.85; 2.55)	1.46 (0.81; 2.64)	0.68 (0.38; 1.20)
Experience of stigmatization, discrimination or violence	1.92 (1.15; 3.24)	1.73 (1.01; 2.97)	1.37 (0.81; 2.32)
Assignment of new tasks	1.32 (0.79; 2.22)	0.78 (0.44; 1.36)	1.07 (0.63; 1.83)
Patient prioritization	1.14 (0.57; 2.31)	0.97 (0.47; 1.95)	1.12 (0.55; 2.25)
Insufficient personal protective equipment	1.42 (0.84; 2.43)	1.72 (0.99; 3.02)	1.99 (1.16; 3.42)
Low trust in workplace	0.96 (0.54; 1.70)	1.37 (0.76; 2.44)	1.37 (0.78; 2.39)
B) Total exposure to stressors			
Sum of stressors	1.29 (1.10; 1.52)	1.32 (1.12; 1.56)	1.15 (0.98; 1.34)
Exposure to stressors			
Low	Reference		
Medium	1.88 (1.10; 3.28)	1.58 (0.89; 2.85)	1.13 (0.65; 1.97)
High	1.60 (0.81; 3.24)	2.53 (1.24; 5.18)	1.34 (0.67; 2.68)

2 health

3 Note: In part A), all variables on individual stressors were entered into the model at the same time and
4 the model was additionally adjusted for age, gender, occupation and chronic physical illness. In part B),
5 the variable sum of stressors (continuous) was entered alone into the model, which was adjusted for age,
6 gender, occupation and chronic physical illness. The variable exposure to stressors (categorical) was
7 entered alone into the model, which was adjusted for age, gender, occupation and chronic physical
8 illness. OR=odds ratio; CI=confidence interval

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