***Impact of COVID-19 on public mental health and the buffering effect
of sense of coherence***

Sarah K. Schäfer¹, M. Roxanne Sopp¹, Christian G. Schanz¹, Marlene
Staginnus², Anja S. Göritz³ & Tanja Michael^{1*}

¹ *Clinical Psychology and Psychotherapy, Saarland University, Saarbruecken, Germany*

² *Department of Psychology, University of Bath, 10 West, Claverton Down, Bath, BA2
7AY, United Kingdom*

³ *Department of Occupational and Consumer Psychology, Freiburg University, Freiburg,
Germany*

Short Title: Impact of COVID-19 on public mental health

* Corresponding author:

Prof. Tanja Michael, Clinical Psychology and Psychotherapy, Saarland University,
Building A 13, 66123 Saarbruecken, Germany

Phone: +49 681 302 71001

Fax: +49 681 302 4437

E-mail: t.michael@mx.uni-saarland.de

Keywords: COVID-19, mental health, sense of coherence, psychopathology,
prospective

Abstract

Introduction. It is claimed that the COVID-19 pandemic has a negative impact on mental health. However, to date, prospective studies are lacking. Moreover, it is important to identify which factors modulate the stress response to the pandemic. Previously, sense of coherence (SOC) has emerged as a particularly important resistance factor.

Objective. This prospective study aimed to assess the impact of the COVID-19 outbreak on mental health and to investigate the ability of pre-outbreak SOC levels to predict changes in psychopathological symptoms.

Methods. The study assessed psychopathological symptoms and SOC before and after the COVID-19 outbreak as well as post-outbreak COVID-19-related traumatic distress in a German-speaking sample ($N=1,591$). Bivariate latent change score (BLCS) modelling was used to analyse pre-to-post outbreak changes in psychopathological symptoms and the ability of SOC to predict symptom changes.

Results. Overall, there was no change in psychopathological symptoms. However, on individual-respondent level 10% experienced a clinically significant increase in psychopathological symptoms, and 15% met cut-off criteria for COVID-19-related traumatic distress. Using BLCS modelling, we identified a high-stress group experiencing an increase in psychopathological symptoms and a decrease in SOC and a low-stress group showing the reversed pattern. Changes in SOC and psychopathological symptoms were predicted by pre-outbreak SOC and psychopathological symptom levels.

Conclusions. Although mental health was stable in most respondents, a relevant proportion of the sample experienced increased psychopathological symptoms due to COVID-19. Since higher SOC was predictive of smaller changes in symptom levels, SOC training might be a promising approach to enhance resistance to stressors.

1 Introduction

In March 2020, the outbreak of the Coronavirus Disease 2019 (COVID-19) reached all countries of the Western world (1). To reduce the speed of its spread, many countries slowed down their economies and enforced pronounced restrictions on public life, resulting in a pervasive impact on daily life.

1.1 Effects of COVID-19 on mental health

It is well known that pandemics pose a threat to mental health (2–4). Thus far, research on the mental health consequences of COVID-19 has been limited to mostly cross-sectional studies from China (5). Two recent reviews found a consistent negative impact of COVID-19 on mental health with 16% to 18% of respondents showing symptoms of anxiety and depression (6,7). Correspondingly, first studies from Italy (8) and Spain (9) also reported relevant levels of mental distress.

First evidence shows that women (10,11), younger people (12) and people with poor sleep quality (10,12) seem to be at increased risk for the development of COVID-19-related psychopathological symptoms.

However, so far, no study has assessed whether mental health in the general population has genuinely changed from pre- to post-outbreak of the pandemic. We had conducted a panel study in Germany shortly before the outbreak (17–23rd February 2020), which served to investigate associations between mental health and health-promoting factors. We were able to contact respondents again in mid-March after the outbreak and gather data reflective of the pandemic's impact on mental health. Furthermore, we were able to examine factors that are associated with changes in mental health, which constitutes an important step towards developing interventions aimed at buffering the effects of stressors (13–15).

1.2 Potential use of resistance factors

Such interventions may target resistance factors such as sense of coherence (SOC), the key component of the salutogenesis framework (16,17). Individuals with high levels of SOC perceive life as comprehensible and manageable and believe that life challenges reflect a potential source of growth. SOC is conceptualized as a stable disposition that is particularly relevant in highly demanding situations (18) [see Online Supplementary

Material Part A (OSM-A)]. It shows a robust positive correlation with mental health (19–21). Moreover, SOC may also reflect an aspect of euthymia (22,23). The positive component of euthymia is characterized by resistance, psychological flexibility and a unifying outlook on life guiding actions and feelings to shape one's future, whereby the latter of which may be encompassed by SOC.

Yet, little is known about SOC's ability to predict changes in mental health across time. Only two prospective studies - assessing women after pregnancy loss and patients with mental health disorders in a psychosomatic rehabilitation clinic - found SOC to be predictive of changes in mental health (24,25). However, these studies did not apply state-of-the-art methods for prospective data (26).

1.3 Study aim

The first aim of the current study was to examine the proportion of respondents that experienced a clinically relevant change in psychopathological symptom levels from pre-to-post outbreak assessment and significant levels of COVID-19-related traumatic distress. Based on previous studies, we hypothesized significant levels of COVID-19-related traumatic distress to be present in 10–20% of the sample (6,27). Moreover, longitudinally (28), we hypothesized that psychopathological symptoms would increase from pre-to-post outbreak assessment in a relevant number of participants. We expected stronger stress responses in females, younger respondents, and those reporting poor sleep quality. The second aim was to examine SOC's ability to predict symptom changes after the COVID-19 outbreak. We hypothesized that COVID-19-related stress (comprising rumination and traumatic distress) would act as a moderator of the association between SOC and psychopathology: The impact of SOC on psychopathology should thus be stronger in those experiencing high levels of COVID-19-related stress. Moreover, in line with previous research (29), we expected SOC to decrease over time in those experiencing high levels of stress.

2 Materials and Methods

2.1 Study Design and Sample Recruitment

The current study is part of a larger project investigating the factorial structure of health-promoting factors. For sample recruitment, we used an online panel

(WiSoPanel, <https://www.wisopanel.net>, (30), see OSM-B for details). Data were collected via the online platform SoSci Survey (31) and respondents gave written informed consent in accordance with the Declaration of Helsinki (32). See Fig. 1 and OSM-D for details.

Fig 1. Details of the study design.

2.2 Measures

Sense of coherence was assessed using a nine-item short version of the Antonovsky scales (33). *Psychopathological symptoms* were measured using the Mini-Symptom Checklist (34). *Sleep quality* during the last week was measured at post-outbreak assessment using the Single-Item Sleep Quality Scale (35). *COVID-19-related rumination* was assessed at post-outbreak assessment using a modified version of the Perseverative Thinking Questionnaire (36). Post-outbreak *COVID-19-related traumatic distress* was measured using a modified version of the Peritraumatic Distress Inventory (PDI; 37). Following Bunnell and colleagues (38), scores ≥ 23 were considered to indicate greater risk for COVID-19-related traumatic distress. See OSM-C for details.

2.3 Calculation of COVID-19-related stress scores

To assess individual COVID-19-related stress, we calculated a COVID-19 stress index as the sum of the z-standardized scores (due to different numbers of items) of COVID-19-

related rumination and COVID-19-related traumatic distress. Higher scores indicate more severe stress. Scores >0 reflect an above-average COVID-19-related stress burden. In all analyses, respondents with above-average scores are referred to as the high COVID-19-related stress group whereas those with below-average scores are referred to as the low COVID-19-related stress group.

2.4 Data Analyses

Analyses were conducted using RStudio (28) and the *lavaan* package (29). We calculated reliable change indices (RCI) according to the Mini-SCL manual to quantify clinically relevant changes in psychopathological symptoms (see OSM-C). To further analyse pre-to-post changes in psychopathological symptoms and SOC and the ability of SOC to predict symptom changes, we applied bivariate latent change score (BLCS) models (27,40, see OSM-C).

3 Results

3.1 Sample characteristics

The mean age of participants who completed the second assessment ($N=1,591$) was 55.03 years ($SD=13.90$; range: 20–95) and 53.6% were female. The majority lived in Germany (96.2%), 2.3% in Austria, 1.1% in Switzerland, and 0.4% were German-speaking but reported living in other countries (i.e., French-German border area). Results did not differ when excluding respondents not living in Germany (see OSM-D).

3.2 Reliable change in psychopathological symptoms

We analysed RCIs and found significant changes from pre-to-post outbreak in 18% of the respondents ($n=287$), whereby 10% ($n=152$) showed a significant increase and 8% ($n=135$) a significant decrease in psychopathological symptom levels. Moreover, 15% exceeded the PDI cut-off for traumatic distress.

3.3 Pre-to-post-outbreak change using BLCS

The separate BLCS models for the total sample, the high-stress group (stress score >0 ; $n=634$) and the low-stress group (stress score ≤ 0 ; $n=862$) showed good fit ($CFIs=1.00$; $SRMRs=0.00$). In the total sample, there was no change in psychopathological

symptoms and SOC levels from pre-to-post outbreak (see Fig. 2 and Table 1). By contrast, in the high-stress group, symptom levels increased while SOC levels decreased. Changes in SOC levels and psychopathological symptoms were negatively correlated. In the low-stress group, psychopathological symptoms decreased from pre-to-post outbreak assessment and SOC levels increased. Again, both changes were negatively correlated.

[Table 1]

⁺ Due to missing data for COVID-19-related rumination and traumatic distress, not all respondents could be included in the subgroup analyses.

Fig. 2. Estimated parameters for the bivariate latent change score model of the relationship between psychopathological symptoms [assessed using the Mini Symptom Checklist (Mini-SCL)] and sense of coherence (SOC). Unstandardized parameters are reported for the total sample as well as separately for the low and the high COVID-19-related stress groups.

3.4 Differences between high and low-stress group

Analyses of group differences revealed that individuals in the high-stress group reported poorer sleep quality [$t(1469)=6.72$, $p<0.001$, $d=0.35$, $OR=1.16$], were younger [$t(1470)=3.74$, $p<0.001$, $d=0.20$; $OR=1.01$], and more likely to be female [$\chi^2(1)=12.69$, $p<0.001$; $OR=1.46$]. Groups did not differ in education level [$\chi^2(5)=7.06$, $p=0.217$]. Moreover, respondents of the high-stress group were not more likely to live in federal states of Germany (i.e., Bavaria and North-Rhine Westphalia) that had reported the highest numbers of COVID-19 cases at post-outbreak assessment [$\chi^2(1)=0.00$, $p=0.974$; $OR=1.00$].

3.5 Ability of SOC to predict symptom changes

In the total sample, individual changes in psychopathological symptoms were significantly predicted by pre-outbreak symptoms and pre-outbreak SOC levels. The same pattern of results was found in the high-stress group and the low-stress group (see Table 1).

3.6 Ability of psychopathological symptoms to predict SOC changes

In the total sample, individual changes in SOC were significantly predicted by pre-outbreak SOC and pre-outbreak symptoms. The findings were the same for the high-stress and the low-stress group (see Table 1).

Across all analyses, higher pre-outbreak SOC levels were associated with smaller changes (i.e., increases and decreases) in individual symptom levels. Likewise, higher pre-outbreak symptom levels were related to smaller changes in SOC levels.

4 Discussion

This study was the first study to examine mental health before and after the COVID-19 outbreak and potential modulatory effects of SOC. Our findings did not show a significant increase in psychopathological symptoms from pre-to-post outbreak assessment in the majority of respondents (82%). Despite overall stability, we were able to identify a clinically relevant increase of symptoms in 10% of respondents. Moreover, 15% of respondent showed COVID-19-related traumatic distress. Taking COVID-19-related stress into account, we identified a group that experienced above-

average stress levels and another group that experienced below-average stress levels. While symptoms increased in the high-stress group, the low-stress group showed reduced symptoms at post-outbreak assessment. Moreover, we consistently identified SOC as a predictor of individual symptom change, with higher SOC levels predicting smaller changes in psychopathological symptoms.

In line with previous research, we found stress to be higher in women (10,11) and younger respondents (12). One may assume that as-of-yet-unknown factors contributed to this observation (e.g., women may be more stressed during lockdown, as they may be over-proportionately burdened by childcare duties; socializing with peer-groups may be particularly vital for young people). Furthermore, corresponding to prior studies (10,12) stress levels were higher in respondents experiencing poor sleep quality. Interestingly, respondents living in regions with the highest numbers of COVID-19 cases were not more likely to report higher levels of COVID-19-related stress. As such, factors that are associated with greater psychological vulnerability seem to be more important than factors associated with risk of infection and/or a severe course of COVID-19 in predicting the mental health consequences of the pandemic.

Beyond insights on risk factors of COVID-19 related psychopathology, the current study sheds further light on SOC's impact on psychopathology: Our results firstly show that pre-stressor SOC predicts symptom changes over a short pre-to-post assessment interval. Higher levels of pre-outbreak SOC were related to smaller changes (i.e., increases and decreases) in psychopathological symptoms. SOC may thus buffer the impact of stressors on mental health without necessarily resulting in lower symptom levels. Moreover, we did not find differences between the high-stress and low-stress group concerning SOC's ability to predict symptom changes. Thereby, our findings challenge the assumption that SOC is of particular importance in situations of perceived high stress and may thus suggest its universal relevance as a component of euthymia (22,23). Additionally, our study provides important insights into SOC's temporal stability. Consistent with the salutogenesis framework (13), we did not find an overall change in SOC levels. In line with previous research that found SOC to be reduced by stressful life events (29), respondents reporting above-average stress levels showed a decrease in SOC. By contrast, those experiencing below-average stress

reported increased levels of SOC. No study to date has demonstrated such a steeling effect of stressful life events on SOC (40). These findings indicate that SOC-targeting trainings (41,42), may be useful to enhance resistance by enabling individuals to buffer negative mental health consequences of stressors.

The current study has the following limitations. First, the study used a non-representative sample and was purely observational. We aimed to account for different responses to COVID-19 by conducting subgroup analyses. However, changes in psychopathological symptoms also occur in a percentage of respondents when assessing cohorts over time without specific stressors (43,44), which may account for some of the presented findings. However, comparing both COVID-19-related stress groups for significant symptom increases, these were more likely in the high-stress group than in the low-stress group, $\chi^2(1)=52.87$, $p<0.001$. Second, to assess COVID-19-related stress we had to adapt well-established instruments, thereby affecting cross-study comparability. Third, the time of assessment may not capture the most stressful period of the COVID-19 outbreak but a marked change in policy-making in Germany. Thus, we plan to conduct two further assessments in the current sample, which will also explore the surprising finding that higher pre-outbreak psychopathological symptom levels were related to smaller symptom changes.

Despite these limitations, the findings of the current study improve our understanding of how the COVID-19 outbreak affected mental health. Despite the majority of respondents showing no clinically relevant symptom change, our results demonstrate that a substantial number of people may be at risk for the development of clinically relevant symptom change. One can assume that this effect is more pronounced in countries that have fewer resources to cushion adverse consequences of the pandemic. Importantly, our results show that high SOC levels seem to thwart these negative mental health consequences. Future studies should investigate the pandemic's impact on public mental health, but also its influence on mental health of health care professionals (45,46). Furthermore, future research should address a broad range of psychosocial consequences of COVID-19 (14) and its impact on treatment access for mental health problems (47,48). Such research may also support the development of resilience trainings (49).

Statements

Acknowledgements

-

Statement of Ethics

The study was conducted in accordance with the ethical standards of the ethics committee of Saarland University and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. According to the ethics committee of Saarland University, the study was exempt from ethical approval.

Disclosure Statement

This article received no support from any funding agency, commercial business, or not-for-profit institution. In the last 3 years, the authors have had no commercial conflicts of interest.

Funding Sources

None.

Author Contributions

SKS, MRS, CGS, TM, and ASG designed and planned the study. ASG collected data. SKS, MRS, CGS, and MS analysed data and interpreted the results. SKS, MRS, MS, and TM wrote the manuscript. All authors reviewed and approved the final manuscript.

References

1. Dong E, Du H, Gardner L. An interactive web-based dashboard to track COVID-19 in real time. *The Lancet Infectious Diseases*. 2020;20(5):533–534.
2. Mak IWC, Chu CM, Pan PC, Yiu MGC, Ho SC, Chan VL. Risk factors for chronic post-traumatic stress disorder (PTSD) in SARS survivors. *General Hospital Psychiatry*. 2010;32(6):590–8.
3. Mak IWC, Chu CM, Pan PC, Yiu MGC, Chan VL. Long-term psychiatric morbidities among SARS survivors. *General hospital psychiatry*. 2009;31(4):318–326.
4. Lu Y-C, Chang Y-Y, Shu B-C, others. Mental symptoms in different health professionals during the SARS attack: A follow-up study. *Psychiatric quarterly*. 2009;80(2):107.
5. Thombs BD, Bonardi O, Rice DB, Boruff JT, Azar M, He C, et al. Thombs BD, Bonardi O, Rice DB, et al. Curating evidence on mental health during COVID-19: A living systematic review [published online ahead of print, 2020 Apr 21]. *J Psychosom Res*. 2020;110113. doi:10.1016/j.jpsychores.2020.110113
6. Rajkumar RP. COVID-19 and mental health: A review of the existing literature. *Asian Journal of Psychiatry*. 2020;102066. doi:10.1016/j.ajp.2020.102066.
7. Vindegaard N, Benros ME. COVID-19 pandemic and mental health consequences: systematic review of the current evidence [published online ahead of print, 2020 May 30]. *Brain, Behavior, and Immunity*. 2020. doi:10.1016/j.bbi.2020.05.048.
8. Mazza C, Ricci E, Biondi S, Colasanti M, Ferracuti S, Napoli C, et al. A Nationwide Survey of Psychological Distress among Italian People during the. *Int J Environ Res Public Health*. 2020 May 2;17(9).
9. González-Sanguino C, Ausín B, Castellanos MÁ, Saiz J, López-Gómez A, Ugidos C, et al. Mental health consequences during the initial stage of the 2020 Coronavirus pandemic (COVID-19) in Spain [published online ahead of print, 2020 May 13]. *Brain, Behavior, and Immunity*. doi:10.1016/j.bbi.2020.05.040.
10. Liu N, Zhang F, Wei C, Jia Y, Shang Z, Sun L, et al. Prevalence and predictors of PTSS during COVID-19 Outbreak in China Hardest-hit Areas: Gender differences matter. *Psychiatry research*. 2020;112921.
11. Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS, et al. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health*. 2020;17(5):1729.
12. Huang Y, Zhao N. Mental health burden for the public affected by the COVID-19 outbreak in China: Who will be the high-risk group? *Psychology, Health & Medicine*. 2020; doi:10.1080/13548506.2020.1754438.
13. Holmes EA, O'Connor RC, Perry VH, Tracey I, Wessely S, Arseneault L, et al. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. *The Lancet Psychiatry*. 2020. doi: 10.1016/S2215-0366(20)30168-1.
14. Van Bavel JJ, Boggio P, Capraro V, Cichocka A, Cikara M, Crockett M, et al. Using social and behavioural science to support COVID-19 pandemic response. *Nature Human Behaviour*, 2020; 4:460–471.
15. Gordon JA, Borja SE. The COVID-19 Pandemic: Setting the Mental Health Research Agenda [published online ahead of print, 2020 May 18]. *Biol Psychiatry*. 2020; doi:10.1016/j.biopsych.2020.05.012.

16. Antonovsky A. Health, Stress, and Coping. San Francisco, CA, US: Jossey-Bass; 1979.
17. Antonovsky A. Unraveling the mystery of health: How people manage stress and stay well. San Francisco, CA, US: Jossey-Bass; 1987.
18. Mittelmark MB, Sagy S, Eriksson M, Bauer G, Pelikan JM, Lindström B, et al., editors. The Handbook of Salutogenesis. Springer International Publishing; 2017 [cited 2020 April 22]. Available from: www.springer.com/gp/book/978331904599
19. Eriksson M, Lindström B. Antonovsky's sense of coherence scale and the relation with health: a systematic review. *Journal of epidemiology and community health*. 2006;60(5):376–381.
20. Schäfer SK, Becker N, King L, Horsch A, Michael T. The relationship between sense of coherence and post-traumatic stress: a meta-analysis. *European Journal of Psychotraumatology*. 2019;10(1):1562839.
21. del-Pino-Casado R, Espinosa-Medina A, López-Martínez C, Orgeta V. Sense of coherence, burden and mental health in caregiving: A systematic review and meta-analysis. *Journal of Affective Disorders*. 2019;242:14–21.
22. Fava GA, Bech P. The concept of euthymia. *Psychotherapy and Psychosomatics*. 2016;85(1):1–5.
23. Fava GA, Guidi J. The pursuit of euthymia. *World Psychiatry*. 2020;19(1):40–50.
24. Engelhard IM, van den Hout MA, Vlaeyen JW. The sense of coherence in early pregnancy and crisis support and posttraumatic stress after pregnancy loss: a prospective study. *Behavioral Medicine*. 2003;29(2):80–84.
25. Schäfer SK, Schanz CG, Sopp MR, Lass-Hennemann J, Käfer M, Michael T. Pre-Rehabilitation Sense of Coherence as a Predictor of Symptom Change During Rehabilitation. *Stress and Health*. 2020;1–9.
26. Kievit RA, Brandmaier AM, Ziegler G, Van Harmelen A-L, de Mooij SM, Moutoussis M, et al. Developmental cognitive neuroscience using latent change score models: A tutorial and applications. *Developmental cognitive neuroscience*. 2018;33:99–117.
27. Mukhtar S. Psychological health during the coronavirus disease 2019 pandemic outbreak [published online ahead of print, 2020 May 21]. *Int J Soc Psychiatry*. 2020. doi: 10.1177/0020764020925835.
28. Bonanno GA, Ho SM, Chan JC, Kwong RS, Cheung CK, Wong CP, et al. Psychological resilience and dysfunction among hospitalized survivors of the SARS epidemic in Hong Kong: a latent class approach. *Health Psychology*. 2008;27(5):659–667.
29. Volanen SM, Suominen S, Lahelma E, Koskenvuo M, Silventoinen K. Negative life events and stability of sense of coherence: A five-year follow-up study of Finnish women and men. *Scandinavian journal of psychology*. 2007;48(5):433–441.
30. Göritz AS, Borchert K, Hirth M. Using attention testing to select crowdsourced workers and research participants. *Social Science Computer Review*. 2019;0894439319848726.
31. Leiner DJ. SoSci Survey (Version 2.5. 00-i1142)[Computer software]. 2019.
32. World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA*. 2013 Nov 27;310(20):2191–4.
33. Singer S, Brähler E. Die »Sense of Coherence Scale«: Testhandbuch zur deutschen Version. Göttingen: Vandenhoeck & Ruprecht; 2007.

- 374 34. Franke G. BSCL-53®-S. Brief Symptom-Checklist-Standard – Deutsches Manual.
375 Göttingen: Hogrefe; 2017.
- 376 35. Snyder E, Cai B, DeMuro C, Morrison MF, Ball W. A new single-item sleep quality
377 scale: results of psychometric evaluation in patients with chronic primary insomnia
378 and depression. *Journal of Clinical Sleep Medicine*. 2018;14(11):1849–1857.
- 379 36. Ehring T, Zetsche U, Weidacker K, Wahl K, Schönfeld S, Ehlers A. The Perseverative
380 Thinking Questionnaire (PTQ): Validation of a content-independent measure of
381 repetitive negative thinking. *Journal of behavior therapy and experimental*
382 *psychiatry*. 2011;42(2):225–232.
- 383 37. Maercker A. Der Peri-Trauma-Belastungs-Fragebogen – Deutsche Übersetzung.
384 Zürich: Universität Zürich. 2002.
- 385 38. Bunnell BE, Davidson TM, Ruggiero KJ. The Peritraumatic Distress Inventory:
386 Factor structure and predictive validity in traumatically injured patients admitted
387 through a Level I trauma center. *Journal of anxiety disorders*. 2018;55:8–13.
- 388 39. Schermelleh-Engel K, Moosbrugger H, Müller H, others. Evaluating the fit of
389 structural equation models: Tests of significance and descriptive goodness-of-fit
390 measures. *Methods of psychological research online*. 2003;8(2):23–74.
- 391 40. Höltege J, Mc Gee SL, Maercker A, Thoma MV. A salutogenic perspective on adverse
392 experiences. *European Journal of Health Psychology*. 2018;25:53–69.
- 393 41. Ando M, Natsume T, Kukihara H, Shibata H, Ito S. Efficacy of mindfulness-based
394 meditation therapy on the sense of coherence and mental health of nurses.
395 *Health*. 2011;3(02):118–122.
- 396 42. Valtonen M, Raiskila T, Veijola J, Laksy K, Kauhanen M-L, Kiuttu J, et al. Enhancing
397 sense of coherence via early intervention among depressed occupational health
398 care clients. *Nord J Psychiatry*. 2015;69(7):515–522.
- 399 43. Wetherell JL, Gatz M, Pedersen NL. A longitudinal analysis of anxiety and
400 depressive symptoms. *Psychology and aging*. 2001;16(2):187–195.
- 401 44. Merikangas KR, Zhang H, Avenevoli S, Acharyya S, Neuenschwander M, Angst J.
402 Longitudinal trajectories of depression and anxiety in a prospective community
403 study: the Zurich Cohort Study. *Archives of general psychiatry*. 2003;60(10):993–
404 1000.
- 405 45. Zhang W, Wang K, Yin L, Zhao W, Xue Q, Peng M, Min B, Tian Q, Leng H, Du J,
406 Chang H, Yang Y, Li W, Shangguan F, Yan T, Dong H, Han Y, Wang Y, Cosci F, Wang
407 H: Mental Health and Psychosocial Problems of Medical Health Workers during
408 the COVID-19 Epidemic in China. *Psychother Psychosom* 2020. doi:
409 10.1159/000507639
- 410 46. Theorell T: COVID-19 and Working Conditions in Health Care. *Psychother*
411 *Psychosom* 2020. doi: 10.1159/000507765
- 412 47. Wright JH, Caudill R. Remote Treatment Delivery in Response to the COVID-19
413 Pandemic. *Psychotherapy and Psychosomatics*. 2020;89(3):130–2.
- 414 48. Zhai Y: A Call for Addressing Barriers to Telemedicine: Health Disparities during the
415 COVID-19 Pandemic. *Psychother Psychosom* 2020. doi: 10.1159/000509000
- 416 49. Fava GA, Cosci F, Sonino N. Current Psychosomatic Practice. *Psychotherapy and*
417 *Psychosomatics*. 2017;86(1):13–30.

418 **Table 1.** Results of bivariate latent change score modeling

	Change in psychopathological symptoms (Δ_{SCL})	Change in SOC (Δ_{SOC})	Association of change (ρ)	Ability of pre- outbreak SOC to predict symptom change (γ_{SOC})	Ability of pre- outbreak SOC to predict SOC change (β_{SOC})	Ability of pre- outbreak symptoms to predict SOC change (γ_{SCL})	Ability of pre- outbreak symptoms to predict symptom change (β_{SCL})
Total sample							
	0.00	-0.01	-0.13	-0.17	-0.22	-0.11	-0.38
<i>z</i>	0.10	-0.33	-9.07	-5.52	-11.51	-5.45	-8.10
<i>p</i>	0.924	0.744	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
High stress group							
	0.16	-0.13	-0.16	-0.15	-0.29	-0.09	-0.32
<i>z</i>	5.44	-5.54	-.623	-.295	-8.88	-4.04	-5.62
<i>p</i>	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001
Low stress group							
	-0.18	0.08	-0.08	-0.21	-0.20	-0.09	-0.62
<i>z</i>	-7.07	4.09	4.09	-6.95	-.824	-2.50	-9.45
<i>p</i>	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.012	< 0.001

419 *Note.* SCL = Mini Symptom Checklist, SOC = sense of coherence.