(IQR: 135-157). During this period, 615 COVID-19 survivors (14.2%) were found to have clinically defined depression (i.e., a score of at least 5 on the PHQ-9) and 528 (12.2%) to have clinically defined anxiety (i.e., a score of at least 5 on the GAD-7). Four survivors attempted suicide. Compared to the reference group, the risk of both depression and anxiety in COVID-19 survivors was significantly higher (relative risk, RR=1.2, 95% CI: 1.1-1.4, p=0.002; and RR=1.4, 95% CI: 1.2-1.7, p=0.001, respectively).

Among the 615 survivors with depression, the risk for a severe condition (i.e., a score of at least 10 on the PHQ-9) was significantly higher in individuals living alone (odds ratio, OR=5.2, 95% CI: 3.6-7.1, p<0.001), in females (OR=3.4, 95% CI: 2.8-5.3, p<0.001), in those with a low income level (OR=2.4, 95% CI: 1.8-3.5, p=0.012), in those with a comorbid chronic physical disease (OR=2.8, 95% CI: 2.1-3.7, p=0.032), and in those who retested positive for SARS-CoV-2 (OR=10.4, 95% CI: 8.3-12.5, p<0.001). Age did not significantly influence the severity of depression.

Among the 528 COVID-19 survivors with anxiety, the risk for a severe condition (i.e., a score of at least 10 on the GAD-7) was significantly higher in individuals with a low educational level (OR=3.5, 95% CI: 3.1-4.2, p<0.001), in unmarried subjects (OR=1.7, 95% CI: 1.2-2.8, p=0.025), and in those who retested positive for SARS-CoV-2 (OR=4.7, 95% CI: 3.7-5.8, p<0.001). Age, gender and other social status indices did not influence the severity of anxiety.

All the four COVID-19 survivors who attempted suicide were elderly, had retested positive for SARS-CoV-2, and had experienced severe levels of depression and anxiety.

In summary, this follow-up study documents that mental health problems among COVID-19 survivors in Wuhan are significantly more common than in the general population of the Hubei province. Risk factors for more severe mental health problems include retesting positive for SARS-CoV-2, living alone, female gender, comorbid chronic physical diseases, and low education and income levels. Clinicians and policy makers should be aware of the risk of mental health sequelae in COVID-19 survivors and implement appropriate preventive and treatment measures.

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Differential impact of COVID-related lockdown on mental health in Germany

The World Health Organization declared COVID-19 outbreak a global pandemic on March 11, 2020. Following the rapid and uncontrollable course of the pandemic, many governments decided to massively restrict public and private life to prevent further spread of the virus. Especially the measures to enforce "physical distancing" during the "lockdown" can be seen as a global macro-stressor affecting a major part of mankind in an unprecedented manner.

Lockdown can have manifold psychosocial consequences, including unemployment and precarious economic situations, marital and familial discord, and domestic violence. Subsequent psychological responses, such as feelings of loneliness, anger or preoccupation about the future, are likely. This was picked up by mass media as well as experts[e.g.,1], warning the public about possible negative effects of the lockdown on mental health.

While many speculations and hypothetical considerations arose, there is a paucity of empirical real-world data. Initial *ad hoc* studies have been conducted quickly, reporting high incidence of negative mental health outcomes, such as depression and anxiety[e.g.,2]. Thereby, reports inferred detrimental consequences for the mental state of the general population.

However, those studies have several shortcomings. Most of them applied cross-sectional designs, which may capture very transient symptoms rather than long-lasting fluctuations in mental states, and do not allow comparison with pre-lockdown measures. Also, the questionnaires that were used are often only screening tools rather than in-depth assessment instruments. In contrast, more meaningful insights can be gathered from longitudinal studies built on continuous, detailed assessments of mental health before and during the lockdown.

We present here extensive data on behavioral and mental health changes in relation to the lockdown of public life in Germany. We capitalize on a population-based, prospective, longitudinal cohort study termed LORA (Longitudinal Resilience Assessment[3]), conducted in the Rhine-Main region since 2017. Its main aim is investigating resilience – i.e., the ability to maintain mental health despite difficult life circumstances – in initially healthy adults (assessed by the Mini International Neuropsychiatric Interview[4]). After an extensive baseline evaluation, major life events, micro-stressors in the form of daily hassles, and mental

health status (primary outcome, assessed by the German version of the General Health Questionnaire, GHQ-28[5]) are recorded every three months using an online monitoring system.

The pandemic and the lockdown during the ongoing study provided a unique natural experiment for investigating how initially mentally healthy subjects respond to a major macro-stressor. Lockdown started in Germany on March 22 and was gradually relaxed from May 6 onwards. We immediately increased the sampling rate of our LORA study to once per week, the first assessment taking place on March 31. Ethical approval was obtained from the ethical review boards of the University Hospitals of Mainz and Frankfurt.

Data presented here are from the first eight weeks of the weekly assessments, compared to the last measurement time point in LORA prior to lockdown. Almost half of the overall sample (N=523) contributed data; this sample was not significantly different from the complete initial one.

The sample consisted of 69% females, and had a mean age of 31.5±8.4 years. Among participants, 47.8% were cohabiting with a partner and 22.8% had children under 18 years; 40.9% were working full-time and another 34.8% were studying or undergoing a professional training. Six participants were positively tested for SARS-CoV-2 since mid-March, and 57 had to undergo strict quarantine. As much as 362 participants worked and studied from home during lockdown.

Overall, the number of daily hassles per week *decreased* from an average of 60.0±27.2 prior to the lockdown to 41.2±22.3 at week 8. This decrease was significant when comparing pre-lockdown values to those at weeks 1-4 (t_{508}=13.5, p<0.001) and weeks 5-8 (t_{475}=17.7, p<0.001). Parallel to this, mental health status significantly *improved* over the entire post-lockdown period, indicated by a decrease of GHQ-28 mean values from 20.5±9.7 before lockdown to 16.8±7.6 averaged across weeks 1-4 (t_{508}=7.8, p<0.001), and to 16.2±7.1 averaged across weeks 5-8 (t_{474}=8.8, p<0.001).

A quadratic latent growth mixture model revealed the existence of three subpopulations among the study sample, with distinct mental health trajectories from pre-lockdown through week 8 of the assessment. Group 1 (8.3% of the sample, mean age 28.0±5.9 years, 86.8% female) showed high initial mental dysfunction values, that increased until week 3 and then decreased, returning to the baseline level by week 6 of the assessment. Group 2 (83.6% of the sample, mean age 31.7±8.5, 66.7% female) maintained or improved their mental health during the entire assessment period. Group 3 (8.1% of the sample, mean age 32.7±9.2, 73.7% female) significantly deteriorated in mental health from week 3 onwards.

The overall reduced amount of daily hassles and increase of mental health scores is, at first sight, counterintuitive. However, our analyses revealed subpopulations differentially affected by the pandemic. For Groups 1 and 2, the lockdown measures resulted in reduced mundane stress-inducing factors, such as less commuting or reduced workload. Thus, these groups experienced a short-term reduction of micro-stressors. However, in our sample of initially mentally healthy participants, we identified a susceptible group, whose mental health deteriorated over the course of the assessment. The existence of this "vulnerable group" may explain the rise in mental disorders seen in some cross-sectional studies: while the majority of people cope well with the consequences of the pandemic (at least if the economic impact is buffered against), a subgroup of individuals is susceptible to adversities and develops mental health problems.

Vulnerability towards such lockdown effects might be higher in people already suffering from psychiatric disorders, or in elderly populations with impoverished social networks. Indeed, Group 1 of our study had significantly younger participants than the other two ($F_{2,520}$=4.0, p=0.02). Further, it is likely that socioeconomic challenges and risk factors such as unemployment or poverty, less powerful in Germany than in many other countries, will have later negative influences.

Our results indicate that unspecific, general interventions may not be the optimal response to lockdown measures. Resources should rather be allocated to early identification and support of particularly vulnerable individuals in times of crisis. Future studies should quantify risk and especially protective factors playing a role in coping with the stressors of the current pandemic, followed by tailored interventions targeting the identified factors in susceptible individuals to prevent the manifestation of mental disorders.

In sum, we refute the undifferentiated view that lockdown *per se* has a negative effect on mental health. Rather, it affects a vulnerable group of individuals, while the vast majority of people remain healthy or even improve their mental well-being, as everyday stressors are reduced.

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