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RESEARCH ARTICLE

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Resilience and depressive symptoms in inpatients with depression: A cross-lagged panel model

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Abstract

Background: Resilience—the ability to bounce back or quickly recover from stress—has been found to predict treatment outcome in patients with mental disorders such as depression. The current study aimed to test whether resilience itself changes during treatment and whether resilience exclusively predicts changes in depressive symptoms or whether depressive symptoms also predict changes in resilience.

Methods: Inpatients with depression ($N = 2165$; average length of stay $M = 60$ days, $SD = 32$) completed the Brief Resilience Scale and the Patient Health Questionnaire Depression Scale at admission and discharge, scores of which were used to run a cross-lagged panel model.

Results: Resilience increased and depressive symptoms decreased from admission to discharge. Cross-sectionally, higher resilience was related to lower depressive symptoms at admission and at discharge. Prospectively, higher resilience at admission predicted stronger decreases in depressive symptoms, and higher depressive symptoms at admission predicted smaller increases in resilience.

Limitations: Self-report questionnaires may potentially be biased (e.g., through recall bias, social desirability, or demand effects).

Conclusions: The current study further supports that resilience is related not only to fewer mental health problems cross-sectionally but also is sensitive to change and a predictor of treatment outcome in patients with mental disorders. Given this pivotal role in mental health, the current findings highlight the importance of prevention and intervention approaches for promoting resilience in the general population and in persons with mental disorders in particular.

KEYWORDS

Brief Resilience Scale, depression, inpatient treatment, Patient Health Questionnaire, resilience

1 | INTRODUCTION

Resilience can be defined as the ability to bounce back or quickly recover from stress (Kalisch et al., 2015, 2017). Accordingly, higher levels of resilience relate to fewer mental health problems cross-sectionally (Mesman et al., 2021). In addition, higher resilience has also been found to predict larger decreases in symptom severity during psychotherapeutic or psychopharmacological treatment in persons with mental disorders such as depression (Davidson et al., 2012; Laird et al., 2018; Min et al., 2012). Recent studies have examined the

temporal dynamics and longitudinal relationships between resilience and mental health in more detail. For this, so-called cross-lagged panel models are usually used, which are special types of structural equation models. In the most basic cross-lagged panel model, there are two variables that were measured at two time points. In such a model, there are two cross-lagged paths, that is, the effects of one variable on another variable at a later time point. The cross-lagged effects are adjusted for the effect of each variable at one time on the same variable at a later time (the so-called autoregressive paths), which represents the stability of each variable over time (Falkenström et al., 2020).

In a study by Pakalniškienė et al. (2016), resilience increased during a day-patient psychotherapeutic treatment in 95 patients with affective and anxiety disorders. Moreover, cross-lagged panel models suggested that resilience at admission predicted increases in well-being and overall functioning during and after treatment, but well-being and overall functioning did not predict changes in resilience. Most recently, Lau (2022) investigated a sample of 125 university students without mental disorders and defined resilience as the ratio of perceived stress to general health. Here, cross-lagged panel models suggested reciprocal relationships between resilience and anxiety symptoms (i.e., higher resilience predicted larger decreases in anxiety, but lower anxiety also predicted larger increases in resilience). Relationships with depressive symptoms, however, were inconsistent in that higher depressive symptoms predicted decreases in resilience, but resilience did not reliably predict changes in depressive symptoms.

The current study aimed to gain further insights into the temporal dynamics of resilience and its longitudinal relationship with depressive symptoms. To this end, we examined a large sample of inpatients with depression who completed self-report measures of resilience and depressive symptoms at admission and discharge. We expected that depressive symptoms would significantly decrease from admission to discharge and—based on the findings by Pakalniškienė et al. (2016)—that resilience would significantly increase from admission to discharge. We further examined the predictive effects of resilience and depressive symptoms at admission on changes in resilience and depressive symptoms in a cross-lagged panel model, which—based on inconsistent previous findings (Lau, 2022; Pakalniškienė et al., 2016)—may reveal that resilience exclusively predicts changes in depressive symptoms or a reciprocal relationship such that depressive symptoms also predict changes in resilience.

Key Practitioner Message

- Resilience refers to the ability to bounce back or quickly recover from stress.
- Inpatients with depression completed questionnaires at admission and discharge.
- Higher resilience at admission predicted stronger decreases in depressive symptoms.
- Higher depressive symptoms at admission predicted smaller increases in resilience.

2 | METHODS

2.1 | Sample

Clinical records of patients with depressive episode or recurrent depressive disorder (ICD–10 codes F32 or F33) were analysed who received inpatient treatment at the Schoen Clinic Roseneck (Prien am Chiemsee, Germany) between February 2020 and June 2022. The inpatient treatment offered at the hospital adheres to the German S3-guidelines for the treatment of depression (DGPPN/BÄK/KBV/AWMF, 2017) in terms of admission criteria, treatment elements and therapy goals. Thus, patients receive a cognitive-behavioural therapy-oriented, multimodal treatment that includes several treatment elements, such as individual psychotherapy sessions, group therapy sessions and—if indicated (e.g., in patients with a moderate or severe depressive episode)—antidepressant medication.

At the Schoen Clinic Roseneck, data from the diagnostic assessments (e.g., age, sex, diagnoses, medication, length of stay, questionnaire scores) are automatically transferred to a database from which they can be exported without any identifying information (e.g., name, date of birth, place of residence) by authorized employees. Thus, accessing individual patient charts is not necessary. According to the guidelines by the ethics committee of LMU Munich, retrospective studies conducted on already available, anonymized data are exempt from requiring ethics approval.

Of the 2485 patients with depression that were treated at the hospital between February 2020 and June 2022, neither resilience nor depressive symptoms data were available at admission and discharge for 320 patients, leaving a sample of 2165 patients. Sample characteristics are displayed in Table 1. For these patients, data on depressive symptoms at admission or discharge were available for 1877 and 1397 patients, respectively, and data on resilience at admission or discharge were available for 1892 and 1414 patients, respectively. For the cross-lagged panel model, however, the data of all 2165 patients were used in the full information maximum likelihood estimation. For other analyses, the sample size was smaller, as indicated in Section 3.

2.2 | Measures

2.2.1 | Brief Resilience Scale (BRS)

Resilience at admission and discharge was measured with the German version (Chmitorz, Wenzel, et al., 2018) of the BRS (Smith et al., 2008), which is part of the routine diagnostic assessment at the hospital. The BRS has six items that are answered on a five-point scale (0 = *strongly disagree* to 5 = *strongly agree*). Higher mean scores

TABLE 1 Sample characteristics.

Variables	Descriptive statistics
Age (years)	*Mdn* = 39, *M* = 37.9, *SD* = 18.1, range: 12–88
Adolescents	21.4%, *n*/*N* = 463/2165
Adults	78.6%, *n*/*N* = 1702/2165
Sex	
Female	66.5%, *n*/*N* = 1440/2165
Male	33.5%, *n*/*N* = 725/2165
Diagnosis	
Depressive episode (ICD–10 code F32)	39.3%, *n*/*N* = 850/2165
Recurrent depressive disorder (ICD–10 code F33)	60.7%, *n*/*N* = 1315/2165
Comorbid mental disorders	
Any[a]	51.7%, *n*/*N* = 1120/2165
None	48.3%, *n*/*N* = 1045/2165
Antidepressant medication during stay	
Yes	52.9%, *n*/*N* = 862/1630
No	47.1%, *n*/*N* = 768/1630
Length of stay (days)	*Mdn* = 57, *M* = 60.0, *SD* = 32.4, range: 1–303

[a]The most common comorbid mental disorders were neurotic, stress-related and somatoform disorders (ICD–10 code F4, e.g., anxiety disorders, obsessive–compulsive disorder, somatoform disorders; *n* = 758, 35.0%), behavioural syndromes associated with physiological disturbances and physical factors (ICD–10 code F5, e.g., eating disorders, nonorganic sleep disorders; *n* = 246, 11.4%) and disorders of adult personality and behaviour (ICD–10 code F6, e.g., personality disorders; *n* = 238, 11.0%).

indicate higher resilience. Internal reliability was ω = .716 (95% CI [.693; .738]) at admission and ω = .810 (95% CI [.791; .827]) at discharge.

2.2.2 | Patient Health Questionnaire–depressive symptom severity scale (PHQ–9)

Depressive symptoms at admission and discharge were measured with the German version (Löwe et al., 2002) of the PHQ–9 (Kroenke et al., 2001; Kroenke & Spitzer, 2002), which is part of the routine diagnostic assessment at the hospital. The PHQ–9 has nine items that are answered on a four-point scale (0 = *not at all* to 3 = *nearly every day*). Higher sum scores indicate higher depressive symptom severity. Internal reliability was ω = .835 (95% CI [.824; .846]) at admission and ω = .898 (95% CI [.890; .906]) at discharge.

2.2.3 | Other information

Other information was also taken from the clinical records of the hospital: age (in years), sex (0 = *female*, 1 = *male*), any comorbid mental disorders (0 = *no comorbid mental disorder*, 1 = *at least one comorbid mental disorder*), antidepressant medication during treatment (0 = *no*, 1 = *yes*; information available for 75.3% [*n*/*N* = 1630/2165] of patients) and length of stay (in days).

2.3 | Data analyses

All analyses were run with JASP version 0.16.3 (JASP Team, 2022) and RStudio version 2022.07.1 (RStudio Team, 2022) using R version 4.2.1 (R Core Team, 2022). Changes in resilience and depressive symptoms from admission to discharge were tested with paired-samples *t*-tests. Between-person associations between resilience and depressive symptoms at admission and at discharge were tested with Pearson's correlation coefficients.

To examine the predictive effects of resilience at admission on changes in depressive symptoms and of depressive symptoms at admission on changes in resilience, we specified a cross-lagged panel model with the R package *lavaan* version 0.6-12 (Rosseel, 2012). Specifically, exogenous variables were resilience and depressive symptoms at admission, and endogenous variables were resilience and depressive symptoms at discharge. The model included both autoregressive paths and both cross-lagged paths, as well as the covariances between resilience and depressive symptoms at admission and between the residual variances of resilience and depressive symptoms at discharge (Figure 1). Because of incomplete data, full information maximum likelihood estimation with robust (Huber–White) standard errors was used.

In additional models, we examined whether adding paths of age, sex, any comorbidity, antidepressant medication and length of stay on the endogenous variables would change the estimates of the original model. The R code for the cross-lagged panel models and the data

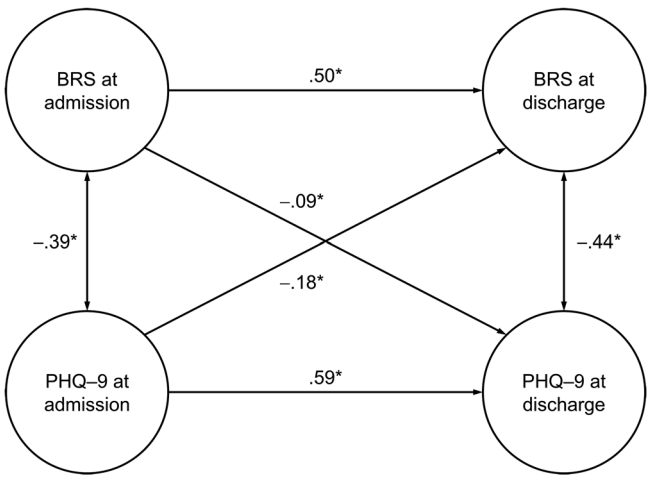

FIGURE 1 Standardized estimates of the cross-lagged panel model. Asterisks indicate *p* < .001. Coefficients for intercepts and (residual) variances are not displayed for the sake of simplicity and clarity. BRS, Brief Resilience Scale; PHQ–9, Patient Health Questionnaire–depressive symptom severity scale.

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3 | RESULTS

3.1 | Changes in resilience and depressive symptoms from admission to discharge

BRS scores significantly increased from admission ($M = 2.27$, $SD = 0.71$) to discharge ($M = 2.48$, $SD = 0.78$) with a small effect size ($t_{(1154)} = 10.3$, $p < .001$, $d = 0.30$, 95% CI [0.25; 0.36]). PHQ–9 scores significantly decreased from admission ($M = 15.1$, $SD = 5.70$) to discharge ($M = 10.2$, $SD = 6.31$) with a large effect size ($t_{(1147)} = 31.0$, $p < .001$, $d = 0.92$, 95% CI [0.85; 0.99]).

3.2 | Associations between resilience and depressive symptoms at admission and discharge

BRS and PHQ–9 scores significantly, negatively correlated with medium-to-large effect sizes at admission ($r_{(n = 1841)} = -.395$, 95% CI [−.434; −.353], $p < .001$) and discharge ($r_{(n = 1383)} = -.546$, 95% CI [−.581; −.508], $p < .001$).

3.3 | Cross-lagged panel model

Standardized estimates of the cross-lagged panel model are displayed in Figure 1. Similar to the correlation analyses, the covariances for resilience and depressive symptoms were significant and negative at admission and discharge, indicating that higher resilience was related to lower depressive symptoms cross-sectionally. Both autoregressive paths were also significant, indicating that resilience at admission predicted resilience at discharge and depressive symptoms at admission predicted depressive symptoms at discharge. Importantly, both cross-lagged paths were significant, indicating that higher resilience at admission predicted larger decreases in depressive symptoms and higher depressive symptoms at admission predicted smaller increases in resilience.

To test whether the size of the two cross-lagged paths differed, we compared the original model with a restricted model, in which the paths were fixed to be equal. The restricted model had a significantly worse model fit ($\Delta\chi^2 = 11.3$, $p < .001$, $\Delta AIC = 9$, $\Delta BIC = 3$), indicating that the size of cross-lagged path estimates in the original model were different. That is, the effect of depressive symptoms at admission on changes in resilience was larger than the effect of resilience at admission on changes in depressive symptoms.

Adding paths of age, sex, any comorbidity, antidepressant medication and length of stay on the endogenous variables to the cross-lagged panel model resulted in a poorly fitting model (Robust Comparative Fit Index = 0.87, Robust Tucker–Lewis Index = 0.65, Robust Root Mean Square Error of Approximation = 0.12, Standardized Root Mean Square Residual = 0.08). Although most of the covariates showed significant paths on the endogenous variables, this did not change the significance or direction of the cross-lagged paths (depressive symptoms at admission → resilience at discharge: estimate = −.12, $p < .001$; resilience at admission → depressive symptoms at discharge: estimate = −.09, $p = .001$).

A reviewer suggested further running the original cross-lagged panel model in subgroups of patients with depressive episode versus recurrent depressive disorder and in subgroups of patients without versus with antidepressant medication. As can be seen in Figure 2, the coefficients were almost identical in each subgroup and similar to the coefficients in the full sample. Specifically, coefficients of the cross-lagged paths were negative (i.e., had the same direction), statistically significant ($p < .027$), small (between −.09 and −.21), and the cross-lagged effect of depressive symptoms at admission on resilience at discharge was larger than the cross-lagged effect of resilience at admission on depressive symptoms at discharge.

4 | DISCUSSION

In the current study, higher resilience was related to lower depressive symptoms cross-sectionally with medium-to-large effect sizes, which is in line with a plethora of studies showing that resilience negatively relates to depression in particular and mental health problems in general (Hu et al., 2015; Mesman et al., 2021). Moreover, resilience significantly increased from admission to discharge (but with a smaller effect size than depressive symptoms decreased), showing that—in line with previous findings (Pakalniškienė et al., 2016)—resilience is a dynamic and modifiable process that can be fostered by psychotherapeutic interventions (Chmitorz, Kunzler, et al., 2018; Kalisch et al., 2017; Kunzler et al., 2018).

In contrast to previous findings (e.g., Pakalniškienė et al., 2016), our cross-lagged panel model suggested a reciprocal, longitudinal relationship between resilience and depressive symptoms: higher resilience predicted larger decreases in depressive symptoms, and higher depressive symptoms predicted smaller increases in resilience. Furthermore, both effects were robust in that they remained almost unaffected when controlling for potential confounding variables such as age, sex, the presence of comorbid mental disorders, antidepressant medication, and treatment duration or when re-running the model in subgroups of patients with depressive episode versus recurrent depressive disorder and subgroups of patients without antidepressant medication versus with antidepressant medication. Of note, the effect of depressive symptoms on changes in resilience was significantly larger than the effect of resilience on changes in depressive symptoms. We speculate that this might be due to the general large decreases in depressive symptoms from admission to discharge, which may attenuate the effect of any interindividual differences as predictors of these changes. However, we cannot exclude the possibility that differences in effect sizes may also be due to other variables that we did not measure in the current study that may be more important when predicting changes in depressive symptoms than when

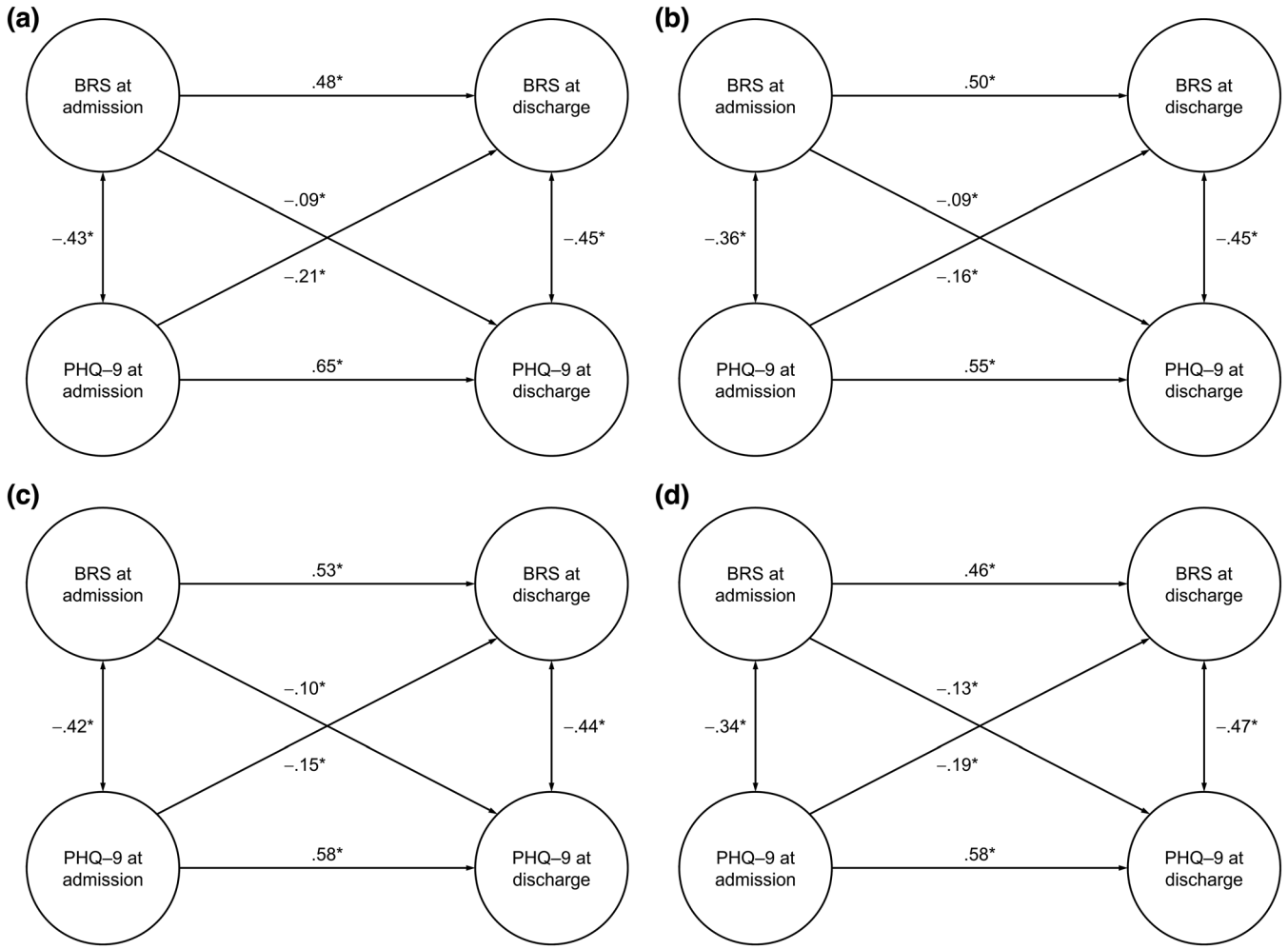

FIGURE 2 Standardized estimates of the cross-lagged panel model in subgroups of patients with (a) depressive episode, (b) recurrent depressive disorder, (c) without antidepressant medication and (d) with antidepressant medication. Asterisks indicate $p < .027$. Coefficients for intercepts and (residual) variances are not displayed for the sake of simplicity and clarity. BRS, Brief Resilience Scale, PHQ–9, Patient Health Questionnaire–depressive symptom severity scale.

predicting changes in resilience. Notably, however, both effects were small and, therefore, may be rather negligible in clinical practice.

A major strength of the current study is that we examined a very large and naturalistic sample of inpatients with depression, thus minimizing selection bias and the likelihood of spurious effects (e.g., due to outliers). Yet, the interpretation of the current findings is, of course, limited to inpatients with depression in Germany. Moreover, resilience and depressive symptoms were assessed by self-report measures, which may potentially be biased (e.g., through recall bias, social desirability or demand effects). Thus, it would be desirable to examine in future studies if the current findings also translate to other treatment settings, other mental disorders, or countries with substantially different health care systems, and whether they can be reproduced by using assessment methods that may be less susceptible to biases, such as expert ratings or ecological momentary assessment. Finally, as this was an observational study, we cannot exclude the possibility that resilience did not increase directly as a result of inpatient treatment (i.e., that it may merely be a 'byproduct' of general symptom improvements) or infer which treatment elements contributed to increased resilience. Similarly, there is a range of lifestyle factors related to mental health (e.g., substance use, physical activity) that we did not measure, which might be involved as mediators or moderators of the effects found in the current study.

In conclusion, the current study further supports that resilience is related not only to fewer mental health problems cross-sectionally but also is sensitive to change and a predictor of treatment outcome in persons with mental disorders. Given this pivotal role in mental health, the current findings highlight the importance of prevention and intervention approaches for promoting resilience in the general population and in persons with mental disorders in particular (Chmitorz, Kunzler, et al., 2018; Lehr et al., 2018).

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