

Carolin Rehnisch, Oskar Feußner, Isabell Klima, Nadja Rabkow, Lilith Pukas, Alexandra Sapalidis, Emilia Ehring, Lea Keuch, Stefan Watzke

Depressive symptoms in dentistry students – prevalence, risk factors and resilience factors

Introduction: Depression is a leading cause of illness-related disability worldwide. An initial peak of illness is recorded in the young adult years. Among epidemiologic studies of young people, studies of students are primarily available. The mental health of dental students has received little research attention. Many students subjectively report mental health complaints, while studies on this topic are scarce nationally and internationally. This study investigates the mental health of dental students at a medium-sized German university.

Methods: A sample of $n = 153$ dental students completed the Beck Depression Inventory-II to assess depressive symptoms, the NEO Five-Factor Inventory to assess the personality trait neuroticism, and a self-description and study questionnaire that included 8 risk factors, 5 study-related stress factors, and 8 resilience factors described in literature.

Results: 41,8 % of the students showed mild (18,3 %), moderate (17,0 %), or severe (6,5 %) depressive symptoms. 5 potential risk factors, 4 potential stress factors and 5 potential resilience factors were identified, which also revealed a cumulative effect: The more risk and stress factors the students indicated, the more depressive symptoms they showed. The opposite was true for the resilience factors.

Discussion: The prevalence of depressive symptoms in dental students exceeds that of both the general population and previous national and international studies of depressive symptoms in students. Neuroticism and the use of drugs and medications are potential risk factors, and excessive demands and pressure to perform are study-related stress factors. Emotional support and satisfaction with studies have a protective effect against depressive symptoms.

Conclusion: The results are of great significance not only because of the current psychological strain on dental students but also regarding their role in the health care system. Students should be informed and sensitized regarding this issue. Specific education on depression is useful to destigmatize the issue and raise awareness of the condition. University programs can also contribute to an early recognition and prevention of depressive symptoms to protect the mental health of potential future dentists.

Keywords: dentistry students; mental health; depression; depressive symptoms; prevalence; risk factors; resilience factors; prevention

University Hospital and Polyclinic for Psychiatry, Psychotherapy and Psychosomatics, University Hospital Halle (Saale), Martin-Luther-Universität Halle-Wittenberg, Julius-Kühn-Str. 7, 06112 Halle/Saale: Carolin Rehnisch, Oskar Feußner, Isabell Klima, Nadja Rabkow, Lilith Pukas, Alexandra Sapalidis, Emilia Ehring, Lea Keuch, Stefan Watzke
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1 Introduction

According to the Global Burden of Disease Study of the WHO, depression is one of the main causes of disease-related disability worldwide [45], has an alarmingly high share of the global burden of disease and ranks eleventh among the causes of disability-adjusted life years (DALYs) [38]. Mental disorders account for 22.7% of DALYs worldwide, while caries, periodontitis and edentulism account for only 6.1% [45]. The point prevalence for depression in the German general population is 8.1% (women: 10.2%, men: 6.1%) [10]. Lifetime prevalence is reported to be 19%, and women are affected twice as often as men (25%, 12%) [46].

A first peak of the disease is recorded in the young adult years. For both sexes, the prevalence of relevant depressive symptoms of disturbance value is highest among 18- to 29-year-olds (women: 11.8%, men: 8.0%); it decreases with increasing age [10].

Among epidemiologic studies of young people, studies for students are most available. In 2016, Rotenstein and colleagues reported a prevalence of depressive symptoms of 27.2% in a meta-analysis of 183 papers and $n = 122,356$ medical students from 43 countries [40]. An ongoing study (Pukas et al., in preparation) investigated the psychological distress of medical students at a medium-sized German university. Of the students surveyed, 19% had a BDI-II sum score indicative of mild, moderate, or severe symptomatology. Two other papers from this group by Kindt et al. [32] and Rabkow et al. [39] show a point prevalence of 28% and 33.4%, respectively, for undergraduate students in psychology and law, respectively, indicating at least mild depressive symptomatology.

Certain risk factors have been confirmed for the multifactorial genesis of depressive disorders. A distinction is made between biological and psychosocial factors.

Biological factors include genetic predisposition [34], female gender [10], and neurobiological and hormonal changes [3, 9]. Psychosocial factors include low socioeconomic status [11], growing up in the former

East Germany [43], critical life events [31], financial worries [1], use of alcohol, drugs, or medication to calm down or enhance performance [6, 25, 33], and the personality trait neuroticism [15, 36].

Factors explicitly associated with students are exam and performance pressure [1], competitive behavior among students [19], experience of being overwhelmed, a subjectively perceived heavy workload and time pressure [29, 37], and loneliness [12, 39].

While the mental health of medical students is increasingly becoming the focus of public attention, both internationally and nationally, the mental health of dental students has received little attention to date. However, there is little difference in the risk- and study-related stressors of the two courses, suggesting similar symptomatology.

A national study from Giessen with $n = 101$ dental students compared to $n = 237$ medical students concluded that one in five dental students showed mild to moderate depressiveness according to BDI-II. Medical students were more satisfied with their studies than dental students despite heavier workloads [28].

In addition to the pressure of suffering during studies, the consequences for the later profession must also be taken into account. Physicians suffering from depressive symptoms have been shown to commit more professional errors than non-depressed colleagues [17, 18]. Negative effects can also be suspected in dentists. Höfel [24] and Heinze [22] emphasize the comparatively greater risk among dentists of suffering from mental and psychosomatic illnesses than among medical colleagues. Dentists are exposed to high time and organizational pressure due to bureaucratic requirements of health insurance companies and quality management. In contrast to other medical professions, dentists are often confronted with very anxious patients whose psychological problems become particularly apparent in stressful situations. In addition, precise treatment in the very small area of the oral cavity under unhealthy pos-

ture and close patient contact is very strenuous [22, 24].

Finally, there are only insufficient empirical findings on the burden of depressive symptoms and relevant risk factors for dental students in Germany.

The aim of the present study is to assess the prevalence of depressive symptoms among students and to identify risk and resilience factors associated with depressive symptoms.

2 Materials and methods

2.1 Sample

The data of the present study was collected in the summer semester 2019 from April to May at the Martin Luther University Halle-Wittenberg. Of $n = 188$ enrolled dental students in all semesters, $n = 153$ (81.4%) participated in the survey. The sample included $n = 33$ (21.6%) second semester students, $n = 23$ (15%) fourth semester students, $n = 37$ (24.2%) sixth semester students, $n = 30$ (19.6%) eighth semester students, and $n = 30$ (19.6%) tenth semester students. The mean age of the students was 23.7 years (range: 18 to 38 years). Among the subjects, $n = 96$ (62.7%) were female and 57 (37.3%) were male students.

2.2 Study design

The depressiveness of dental students was quantitatively assessed in the form of a cross-sectional analysis. Risk, stress, and resilience factors were additionally surveyed. Self-report questionnaires were used for the survey. These were taken from a study on depressive symptoms in medical and law students, respectively [39], and were adapted only with regard to some formulations (e.g., “dental studies” instead of “medical studies”). The responsible ethics committee voted positively for the study (Vote No. 2017-138, Amendment 03/19).

Students were informed about the aim of the study, the voluntary and anonymous nature of participation, and the possibility to withdraw from the survey at any time. Data were kept confidential at all times during the study in accordance with the Data Protection Act.

Risk factors	Stress factors	Resilience factors
Family history of mental illness	Experienced competition between students	Use of relaxation techniques
Growing up in NBL	Perceived increased time pressure	Satisfaction with studies
low socioeconomic status of family of origin	Experience of being overwhelmed	Significance of religion
Separation of parents/loss of parent in childhood	Pressure to perform	Healthy diet
Financial burden	Loneliness	Actively making music
Alcohol abuse		Actively participating in sports
Drug/medication abuse		Experienced emotional support
Neuroticism		Sufficient social contacts

Table 1 Presentation of risk, stress and resilience factors extracted from the literature with reference to depressiveness

2.3 Measuring instruments

The self-description and study questionnaire included 68 questions on sociodemographic variables and possible risk, stress, and resilience factors related to depression. The first part of the questionnaire contained questions on self-description, and the second part contained questions on study. A total of 13 risk factors, including 5 study-related stress factors and 8 resilience factors, were recorded using this questionnaire, which are shown in Table 1 and described in more detail below.

Risk factors

The risk factor familial burden of mental illness is present if a first- or second-degree family member (sibling, parent, or grandparent) is or was undergoing treatment for a mental illness, excluding dementia. Female gender is assumed to be a risk factor if the “biological sex” item is answered “female.” If students grew up in one of the 5 eastern states of Germany, the risk factor of growing up in the new states is present. Low economic status is assumed if at least one of the following response alternatives applies to both the father and the mother of the family of ori-

gin: “no school qualification”, “lower secondary school” or “unskilled professional activity”. The risk factor loss of a parent in childhood is present if participants indicate having lost mother or father through death or separation. Financial stress is assumed if students have “sometimes too little” or “often too little” financial resources or if participants indicate that they are “usually under a lot of financial pressure.” The risk factors of alcohol consumption or use of drugs and medications are present if students consume 8 (male) or 6 (female) drinks per occasion more than once a month or if they use drugs or medications to calm down or enhance performance. The risk factor neuroticism is assessed using a separate questionnaire and explained in the corresponding section.

Stress factors

Daily stresses during studies are surveyed with the question “Are there things that make it difficult for you to be happy with your study decision?” Competition among students, time constraints, pressure to perform, excessive demands and loneliness are considered as stress factors.

Resilience factors

If students answer “Yes” to the item “Do you use specific techniques for relaxation (e.g. yoga, PMR [...]), it is assumed that the resilience factor is present. Satisfaction with the studies is assumed to be present in the case of a positive response to the questions “Do you enjoy your studies?”, “From today’s perspective, would you decide to study dentistry again?” and “Overall, how satisfied are you with your studies?”. The importance of religion counts as a resilience factor if students rate it as “extremely important” or “moderately important. The resilience factor healthy nutrition is present if the items “Do you eat regular meals?” and “Do you pay attention to healthy nutrition?” are answered positively. When answering the questions “How many hours per week do you actively exercise?” with “more than two hours per week” and “How many hours per week do you actively play music?” with “more than one hour per week,” these same resilience factors are considered.

Sufficient emotional support and social contacts are taken as given when answering the items with “enough” or “more than enough”.

The Beck Depression Inventory-II (BDI-II [5]) was used to assess depressive symptoms. The BDI-II is an established self-report instrument that measures the severity of depressive symptoms within the last 2 weeks. Although the BDI-II is not suitable for diagnosing depressive disorder, it is used in both clinical and healthy subjects and has reliable classification criteria [23]. Symptoms of depression are recorded based on 21 items. Each item is answered using a 4-point Likert scale, and the item values are added to a sum score (0–63 points). The psychometric parameters of the BDI-II are reliable in both clinical and non-clinical samples and show good objectivity, reliability and validity [23].

The NEO Five-Factor Inventory (NEO-FFI) is also a self-report instrument [8]. It is used to assess personality traits according to Costa and McCrae [15]. In the past, a relationship between the factor neuroticism and depression has been confirmed [36], which is why only the subscale

neuroticism from the current edition of the NEO-FFI is used in this questionnaire. Neuroticism describes the tendency to emotional lability, high stress sensitivity, anxiety and sadness, irritability, anger, rage, and easy vulnerability [20]. Correlations of neuroticism and depression are generally described as high [30, 36]. For its part, neuroticism has a strong genetic component, which in turn is associated with alterations in cortisol release, attentional and learning processes, and consequently has a strong correlation with the genetics of depressive disorders [44]. The subscale consists of 12 items, each of which is answered using 5-point Likert scales. The responses in the items are summed (after reversing the polarity of individual items) to give a total score, and the total score is divided by the item number. This results in a mean value, which can be between 0 and 4. The higher the mean, the stronger the expression of the personality trait neuroticism; a score above 2.54 represents one standard deviation above the age-related population mean. The risk factor neuroticism was assumed to be present in the present study if the individual score was above this cut-off.

2.4 Evaluation

The collected data was analyzed using the statistical software “Statistical Package for Social Sciences” (SPSS 25.0). The sociodemographic description of the total sample as well as the determination of the prevalence of depressive symptoms and the description of the total sample with regard to the BDI-II sum score were carried out using descriptive statistics and the determination of absolute and relative frequencies. The frequency of occurrence of each risk, stress, and resilience factor was also described using descriptive statistics and the determination of relative frequencies. Due to violated normal distribution assumptions in the BDI-II sum score (Kolmogorov goodness-of-fit test: $Z = 0.127$; $p < 0.001$), associations between it and the recorded risk and resilience factors were determined using Spearman rank correlation. Due to the calculation of multiple correlations in each case,

BDI-II-total score				
Semester of study	M	SD	MD	Range
2 (n = 33)	10.2	8.1	8	0–30
4 (n = 23)	11.3	7.5	10	0–30
6 (n = 37)	13.2	8.3	12	1–28
8 (n = 30)	11.8	8.2	8.5	1–32
10 (n = 30)	19.2	9.2	17.5	5–34
Total (n = 153)	13.2	8.8	11	0–34

Table 2 BDI-II total scores in semester levels

the critical α -error level in each variable group was Bonferroni-corrected. Finally, to account for the intercorrelation of the included variables and to correct for multicollinearity, a multivariate linear regression model (stepwise with $p_{in} = 0.05$ and $p_{out} = 0.10$) was calculated to predict the BDI-II sum score including all univariate significantly correlating variables.

3 Results

3.1 Results of the BDI II sum score

Including all students surveyed ($n = 153$), the mean BDI-II sum score was $M = 13.2$ points ($SD = 8.80$). Norm scores of university students are reported by Beck and colleagues [5] and given as $M = 12.6$, $SD = 9.9$. Compared to this sample, no deviant scores are found in the collective studied here ($t = 0.801$; $p = 0.424$). However, when compared to students in other fields of study studied at the same university, deviations are found. Kindt et al. [32] reported $M = 9.95$ ($SD = 7.34$) for $n = 109$ students in an undergraduate psychology program and $M = 8.84$ ($SD = 7.12$) points in the BDI-II for $n = 564$ students in preclinical human medicine. Rabkow et al. [39] studied $n = 306$ law students and found a mean BDI-II score of 11.9 ($SD = 8.45$) points. In the present study, scores deviating from this were found in comparison to psychology students ($t = 4.53$; $p < 0.001$) and to

human medicine students ($t = 6.01$; $p < 0.001$), but not to law students ($t = 1.79$; $p = 0.076$).

An elevated BDI-II sum score was recorded in $n = 64$ of 153 students (41.8%) (≥ 14 p.), and a scale score indicative of major depression (≥ 29 points) was found in 10 (6.5%) dental students [5].

Women and men do not differ significantly in the extent of depressive symptoms ($t = 0.771$; $p = 0.441$). However, a significant difference in symptom burden is found between included semesters ($F[df = 4] = 5.58$; $p < 0.001$; see Table 2). Post hoc individual comparisons show that this global difference is due to increased scores in the 10th FS. Students in this group differ significantly from all other semester groups in post hoc analyses (all $p < 0.04$).

The BDI II items with the most frequent elevated scores in the present sample were change in sleep behavior, fatigue, loss of energy, self-criticism, lack of concentration, and irritability. The items worthlessness, feelings of punishment, and suicidal ideation had the lowest scores. The question about suicidality was answered affirmatively by 19 (12.4%) students, but only the phrase “I have suicidal thoughts, but I would not carry them out.” (item value = 1) was used.

3.2 BDI-II sum score in relation to risk factors

Table 3 shows the bivariate correlations between BDI-II sum score

Risk factor	BDI-II- total scores <i>r</i>	prevalence (%)
(1) family burden with mental illness	0.17	36.4
(2) grew up in NBL	0.07 n.s.	74.0
(3) low socioeconomic status	0.11 n.s.	2.7
(4) loss of parent	0,19	13,2
(5) financial burden ⁹	0,18	26,7
(6) alcohol use	–0,04	23,3
(7) drugs/medication	0,31*	11,3
(8) neuroticism (> M + 1 SD) ^a	0,58*	22,9

Table 3 Bivariate correlations (Spearman rank correlation) between risk factors and BDI-II sum score, prevalences of risk factors within student group

r = Pearson correlation coefficient, total sample *n* = 153,

BDI-II = Beck Depression Inventory-II, NBL = new federal states.

^a Neuroticism as a scale score correlates to *r* = 0.737*** with the BDI-II sum score.

* *p*_{crit} < 0,006 (Bonferroni-correction)

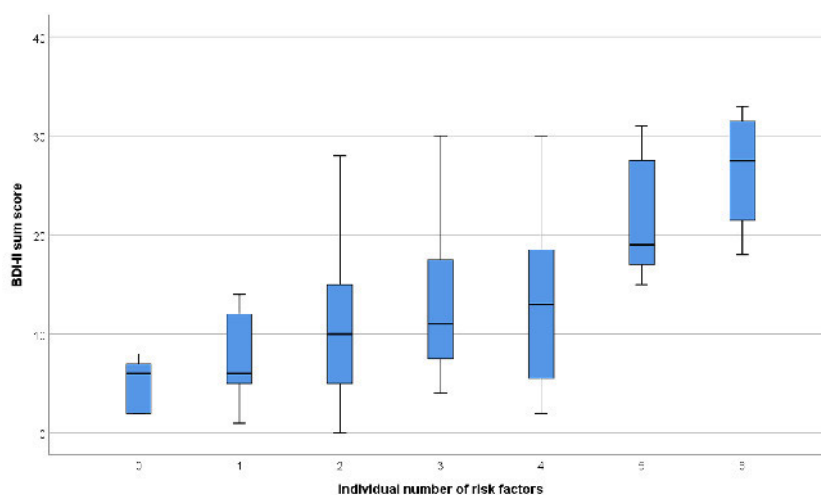


Figure 1 Distribution of BDI-II sum score for individual sums of present risk factors using boxplots (mean, interquartile range, and range)

and the risk factors as well as the relative frequencies (prevalence) of the students' risk factors.

Significant correlations emerged between the BDI-II sum score and the risk factors neuroticism and use of drugs and medications. Loss of a parent in childhood, financial worries, and family history of mental illness showed small tendential correlations, but these did not reach statistical significance after Bonferroni correction. The characteristics of female gender, growing up in the new German states, low socioeconomic status, and

alcohol consumption did not prove to be significantly associated with depressiveness in the sample studied.

The individual sum of all risk factors correlates significantly with the BDI-II sum score (*r* = 0.39; *p* < 0.001) (see Figure 1).

A stepwise linear regression model including all significantly correlating variables clarifies a total of 59% of the variance in the individual BDI-II sum score; neuroticism (*R*² = 0.57) and drug use remain as significant predictors in the model. The variance inflation factor

(VIF) of the included predictors was 1.03; collinearity is therefore negligible.

3.3 BDI-II sum score in the context of stress factors

Table 4 shows the bivariate correlations between each study-related stress factor and the BDI-II sum score and the frequency of the stress factors.

Significant correlations emerged between the BDI-II sum score and the following 4 stress factors: Overwork, Pressure to Perform, Loneliness, and Time Pressure.

Concordant to the risk factors, the sum of study-related stress factors also correlated significantly with the BDI-II sum score (*r* = 0.41, *p* < 0.001). Accordingly, the more stress factors students report, the higher the BDI-II sum score. The relationship is illustrated in Figure 2 by boxplots showing the distribution of the BDI-II sum score for the respective number of stress factors present.

In a joint stepwise linear regression model, excessive demands and pressure to perform jointly clear up 13% of the variance in the individual BDI-II sum score (VIF = 1.08).

3.4 BDI-II sum score in the context of resilience factors

Table 5 shows the bivariate correlations between the individual resilience factors and the BDI-II sum score and the respective prevalence of the resilience factors.

Significant correlations were found between the BDI-II sum score and the following 5 resilience factors: sufficient emotional support, satisfaction with studies, sports, social contacts, and healthy diet. The factors use of relaxation techniques, importance of religion, and active music making were not found to be significantly associated with depressiveness in the sample studied

The sum of resilience factors correlated significantly negatively with the BDI-II sum score (*r* = –0.50; *p* < 0.001, see Figure 3).

A stepwise linear regression model explains 37% of the variance of the individual BDI-II sum score. The largest proportion of explained variance comes from emotional sup-

Stress factor	BDI-II-total score <i>r</i>	Prevalence (%)
(1) Competition among students	0.13	7.8
(2) Time pressure	0.16	66.0
(3) Excessive demands	0.34*	34.6
(4) Pressure to perform	0.28*	64.7
(5) Loneliness	0.20*	13.7

Table 4 Bivariate correlations (Spearman rank correlation) between stress factors and BDI-II sum score, prevalences of stress factors within student groups

Notes: *r* = Spearman rank correlation coefficient, total sample *n* = 153, BDI-II = Beck Depression Inventory-II
* *p* < 0,01 (Bonferroni-correction)

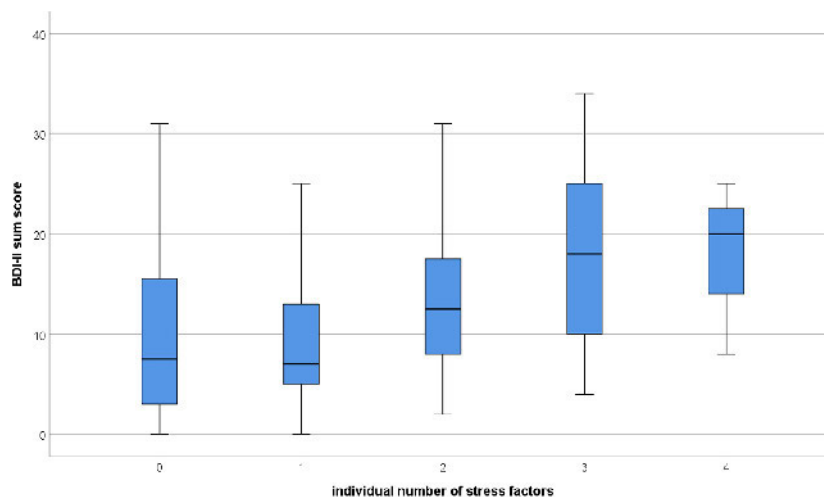


Figure 2 Distribution of BDI-II sum score for individual sums of present risk factors using boxplots (mean, interquartile range, and range)

port ($R^2 = 0.23$), followed by satisfaction with studies (additional $R^2 = 0.10$) and sports (additional $R^2 = 0.04$, all $VIF < 1.1$).

A final model including the significant predictors of the individual variable groups yields a joint variance explanation of $R^2 = 0.66$ (all $VIF = 1$). The most significant predictors of depressive symptoms in the model are neuroticism, emotional support, sports, satisfaction with studies, pressure to perform, and excessive demands.

4 Discussion

Depressive symptoms are common in the general population [10]. This study investigated the previously poorly studied mental health situation of dental students in their indi-

vidual semesters. Risk factors, stress factors, and resilience factors associated with depressive symptoms were also collected. Consequently, the aim of the study was to assess the prevalence of depressive symptoms in dental students and to clarify the influence of risk and resilience factors on students' mental health. Last but not least, this should contribute to the development of preventive measures against mental overload for future dentists.

4.1 Discussion of the results of the BDI-II

The average BDI-II sum score only minimally exceeds the norm values of university students reported by Beck et al. [4], but it shows to be elevated in comparison to the scores of

psychology and human medicine students in the preclinical section collected by Kindt et al. [32] and Rabkow et al. [39], as well as to the scores for law students determined by Rabkow et al.

The prevalence of at least mild depressive symptoms is 41.8%, which is higher than that of 18- to 29-year-olds from the general population (women: 11.8%, men: 8.0%) [10]. Furthermore, the prevalence exceeds the findings of Rotenstein et al. (27.2%), Jurkat et al. (20%), Pukas et al. (19%), Kindt et al. (28%), and Rabkow et al. (33.4%) [28, 32, 39, 40], thus underscoring the greater average burden of dental students.

However, the survey contains only data that emerges from the students' self-assessment. These self-reported depressive symptoms cannot be equated with a sound clinical diagnosis made by professional staff.

Nevertheless, the BDI-II is the gold standard for assessing the severity of depressive symptoms. The psychometric scores are reliable in both clinical and nonclinical samples and have good objectivity, reliability, and validity [23].

4.2 Discussion of results on risk factors, stress factors, and resilience factors

Risk- and study-related stress factors were assessed using self-description questionnaires. Neuroticism, use of drugs and medication, loss of a parent in childhood, financial worries, and family history correlate significantly. Of the study-related stress factors, overwork, pressure to perform, loneliness, and time pressure correlate significantly with depressiveness. The BDI-II sum score is higher the more risk or stress factors the students have.

Risk factors

The risk factor neuroticism shows the greatest correlation with the BDI-II sum score. On the one hand, emotionally unstable individuals are at increased risk for depressive symptoms [36], on the other hand, depressive states influence the self-assessment of the trait neuroticism [21]. The second strongest correlation is found for the risk factor use of

Resilience factor	BDI-II- total score <i>r</i>	Prevalence (%)
(1) Use of relaxation techniques	-0.02	26.3
(2) Satisfaction in studies	-0.41*	74.8
(3) Importance of religion	-0.02	20.7
(4) healthy nutrition	-0.23*	54.9
(5) active music making	0.02	21.4
(6) sports	-0.27*	70.0
(7) emotional support	-0.44*	75.0
(8) social contacts	-0.25*	34.4

Table 5 Bivariate correlations (Spearman rank correlation) between resilience factors and BDI-II sum score, prevalences of resilience factors within student groups

Notes: R = Pearson correlation coefficient, total sample n = 153, BDI-II = Beck Depression Inventory-II

* p < 0,006 (Bonferroni-correction)

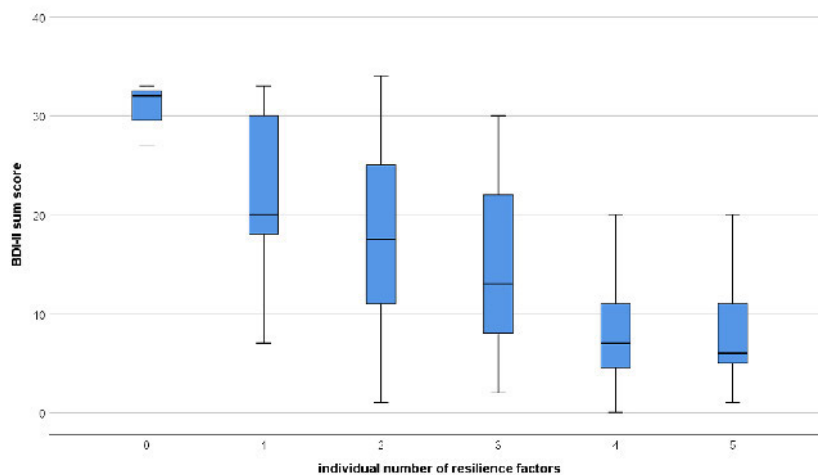


Figure 3 Distribution of BDI-II sum score for individual sums of available resilience factors using boxplots (mean, interquartile range, and range)

drugs and medications with a high BDI-II sum score, as also found in other works [25, 33]. A positive correlation between the prevalence of depressive episodes and the loss of a parent was postulated by Kendler [31] and can only be confirmed to a limited extent in the present study. After correction for the critical alpha error level due to multiple comparisons, this feature fails to reach statistical significance. However, follow-up studies with larger samples should continue to investigate this feature. Depressiveness represents a multifactorial phenomenon. Variables with

smaller effects should therefore not be neglected, as they certainly contribute additively to the individual experience of stress.

Similarly, findings on financial strain and a positive family history of mental illness showed small effects in the present study, but failed to reach statistical significance, but have been discussed as relevant determinants of depressiveness in other studies [1, 34]. No significant association was found between alcohol consumption and depressive symptoms in students in the present study. This result is not in line with the study of Boden and Fer-

gusson, but is similar to the data of Collin et al [6, 14].

Contrary to the results of Seliger and Brähler, students who grew up in the new states of Germany do not have a higher prevalence for depressive symptoms than fellow students who grew up in the old states [43]. However, this is not very surprising in the cohort studied here, as the majority of students (74%) come from the new federal states and thus live close to home, which presumably has a positive effect on mental health. Also, no significant relationship was found between gender and depressiveness in the present study. This result in a sample of dental students is thus not consistent with the data postulated by Busch et al. for the general population [10]. Kindt et al. and Rabkow et al. also show differences in the extent of depressive symptoms between women and men. This is all the more remarkable as these papers are studies at the same university. Thus, this risk factor appears to be less important in dental students than in the general population and in other courses of study.

Stress factors

The greatest correlation of study-related stress factors with the extent of depressive symptoms is found for the factor overwork. Such a correlation was already reported by Misra et al [37]. According to our survey, almost two-thirds of students suffer from pressure to perform. Students affected by this factor have a significantly higher BDI-II sum score, as also reported by Aselton [1]. Confirmation was also found for the relationship between loneliness [12] and depressiveness. Two thirds of all students reported suffering from time pressure. A correlation with depressiveness could be confirmed in a previous study [28], but presents itself in the present study only as a tendential correlation.

For the study-related stress factor competitive pressure, no significant relationship to depressive symptoms can be found. Consequently, the result is not consistent with the studies by Gilbert and colleagues and by Aselton [1, 19]. Whereas the latter studied American college students

Fig. 1–3: C. Rehnisch

and British patients diagnosed with depression, the sample studied here represents people who basically have a secure perspective from a professional point of view. The profession of dentist is associated with secure job opportunities, a high income and great social prestige.

Resilience factors

Three quarters of students report receiving sufficient emotional support from friends and family during their studies. The more support students experience, the lower their depressiveness [16]. Likewise, three quarters of students report being satisfied with their studies. Dyrbye et al. also proved this relationship in their study [16]. The third strongest relationship was found between the resilience factor sport and a low BDI-II sum score. Students who engage in several hours of active per week have a lower prevalence of depressive symptoms than fellow students to whom this resilience factor does not apply, in agreement with Babiss et al. and Johnson and Taliaferro [2, 27]. Only one-third of students reported having sufficient time for social contact. The reason for this could be the excessive demands stated by students as well as pressure to perform and lack of time. According to the results of this study, there is a negative correlation between social contacts and depressiveness, so time spent with friends and families has a positive effect on students' mental health [12]. More than half of the students reported eating a healthy diet. This relationship was already postulated by Schek and confirmed by the results of the present study [41].

No relationship was found between the importance of religion, playing a musical instrument, and practicing relaxation techniques and depressiveness in the present work. In this respect, our results do not coincide with previous studies [7, 35, 42].

It should be emphasized that it is not the factors individually, but the combination of several factors that is crucial for a high BDI-II sum score. The more risk factors and study-related stressors the study participants have, the higher their prevalence for depressive symptoms. The reverse is

true for resilience factors. The more the students indicated, the lower their BDI-II sum score. Overall, neuroticism, emotional support, sports, satisfaction with studies, pressure to perform, and excessive demands proved to be significant predictors of depressiveness, largely independent of each other.

5 Limitations and outlook

The present study emphasizes the high psychological stress of dental students and highlights the relationship between selected risk and resilience factors and depressive symptoms. Correlations between the factors surveyed and depressive symptoms are evident; however, causal conclusions cannot be drawn.

It should be emphasized that the sample covers 81.4% of the students in the study program of the university under investigation and thus promises good generalizability for the addressed population. However, students with depressive symptoms might still be over- or underrepresented in the survey, either because they stayed away from the university due to increased depressive symptoms, refused to participate for personal reasons, or – in the opposite case – the more personally relevant the study seemed, the greater their affinity to participate.

Furthermore, the present sample is limited to a medium-sized German university, which is why a generalization of the results for the entirety of all dental students is only possible to a limited extent. To strengthen the validity of the results, future studies at other universities are desirable.

It should also be noted that the present study does not involve the diagnosis of depression by psychotherapists or physicians. The questionnaires used in the survey are only self-report instruments, which is why the assessment of the severity of depressive symptoms can be falsified. Participants might have underreported or overreported scores regarding depressive symptoms [13, 26]. Nevertheless, the good convergent validity of the BDI-II should be emphasized, as there is high agreement between results of the BDI-II and a clinical diagnosis [4].

Because the data in the present cross-sectional analysis were collected at only one point in time, no conclusions can be drawn about the progression of symptoms among individual participants. Further work, for example in the form of longitudinal studies, is needed to record individual students' depressive symptoms over a longer period of time, i.e., throughout their studies and beyond.

Also limiting is the limited selection of risk, stress, and resilience factors without claiming to be exhaustive. To identify additional depressive symptom-triggering and protective factors, further research on larger samples in a more comprehensive regional context is needed in the future.

6 Conclusion

The present study provides alarming results about the mental health of dental students. More than one in three students achieved a BDI-II sum score indicative of at least mild depression.

Neuroticism and use of drugs and medications show the highest association with depressive symptoms. Overwork, pressure to perform, loneliness, and time constraints are stress factors that should be minimized in everyday study life. Resilience factors such as emotional support, satisfaction with their studies and sport, on the other hand, have a protective effect and protect students from depressive symptoms.

The findings are significant not only because of the current distress experienced by dental students, but also in terms of their potential role in the health care system. In the past, depressive symptoms in male and female physicians have been associated with a qualitative reduction in patient care. Similar findings can be hypothesized for dentists [17, 18]. Accordingly, risk-, study-related stress- and resilience factors were surveyed in order to be able to provide prevention during studies in the future. The studies show that the more risk factors students are exposed to, the more depressive symptoms they exhibit.

Students should be informed and sensitized with regard to this topic.

Education on the subject of depression makes sense in order to destigmatize and raise awareness of the disease. Seminars or lectures on the subject of coping with stress and dealing with risk and stress factors can already be held in early semesters in order to point out help options to those affected in the future in the sense of primary prevention. University programs can also contribute to early detection and secondary prevention of depressive symptoms.

Further risk factors, study-related stress factors and resilience factors should be identified in order to provide the best possible prevention and support already during studies.

Further studies should investigate the development of depressive symptoms during studies and beyond, i.e. in the everyday working life of dentists, in order to determine whether depressiveness persists after studies.

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Conflict of interest

The authors declare that there is no conflict of interest as defined by the guidelines of the International Committee of Medical Journal Editors.

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Photo: S. Watzke

Corresponding author**STEFAN WATZKE**

University Hospital and Polyclinic for
Psychiatry, Psychotherapy and
Psychosomatics, University Hospital
Halle (Saale)

Martin-Luther-University
Halle-Wittenberg
Julius-Kühn-Str. 7
06112 Halle/Saale

E-Mail: stefan.watzke@uk-halle.de