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Original Article

Beck's Depression Inventory II Suicidal Ideation in Medical Students – Prevalence and Associated Factors

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Abstract

Background: Suicide is the second leading cause of death in 15- to 29-year-olds in Germany. Studies have shown that compared to the general population students are more affected by suicidal ideation, as one major indicator of an attempted suicide. This effect is observed all over the world, interestingly, it is also true for physicians. Therefore, we investigated whether medical students are at an even higher risk than their peers to develop suicidal ideation. **Methods:** N=1,103 medical students at a German university completed a self-reporting survey investigating socio-demographic, potential risk, and protective factors. The Beck's Depression Inventory (BDI)-II Item 9 "Suicidality" served as the dependent variable. **Results:** N=130 students (11.8% of the total sample) reported suicidal ideation within the last two weeks. Stepwise computed logistic regression models including all potential risk factors resulted in 40% explained variance. The most significant independent risk factors were the BDI-score, usage of tranquilizers, feeling lonely, insufficient time for hobbies and prior personal mental health issues, whereas focus enhancing drugs showed to be the only independent protective predictor. The BDI-II score correlated positively with the number of students suffering from suicidal ideation. **Conclusion:** The prevalence of suicidal ideation in our sample medical student population exceeds that of the general population greatly, confirming existing data and emphasizing the need to raise awareness and establish prevention programs.

Key Words: Suicidal Ideation; Suicide; Medical Students; Prevalence; Depression; Neuroticism (Source: MeSH-NLM).

Introduction

According to the World Health Organization (WHO) there are 800,000 deaths by suicide every year worldwide, and of those, 9000 suicides occur in Germany.[1] This exceeds deaths by road accidents by almost three times.[1] Worryingly, it is also the second leading cause of death in the age group of 15 – 29-year-olds,[1] an age group in which most people receive their education. Not only is suicide an unspeakable individual tragedy but it is also an immense economic and public health loss.

A reliable indicator for an actual suicide attempt in the future is a prevailing suicidal ideation. Therefore, it is important to get a better understanding of this stage, which is also a point in time where the society can still intervene.[2]

The nationwide prevalence in the general population for suicidal ideation in the two weeks prior to conducting out survey resulted at 2.8%.[3] According to Hawton and Van Heeringen (2009), there are several risk factors leading to suicide: demographic factors such as male sex (completed suicide) or female sex (attempted suicide or ideation), age (peak in adolescence and old age), low socioeconomic status, and single relationship status. Furthermore, there are biographic or psychobiological factors that often build a fundamental predisposition to develop suicidal behavior: hopelessness, social isolation and loneliness, impulsivity, genetics, childhood experiences, and suicide within family or friends. Additionally, psychological autopsies have shown that 90% of people who committed suicide suffered from a psychiatric disorder. The most important associated factor being depression, closely followed by substance abuse. Multiple co-morbidities increase the risk of suicidal behavior significantly.[4] Since neuroticism correlates positively with depression, it is also shown that people with a high personality trait of neuroticism suffer from suicidal ideation.[5]

Upon enrolling to a university, students are exposed to many of these risk factors, including loneliness due to moving away from home, relationship break-ups, poor financial status, performance

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pressure, substance abuse, and less time for hobbies and friends. Santos et al. (2017) confirmed that university students with low income, homo-/bisexual orientation, presence of depressive symptoms, high alcohol consumption and suicide attempts among friends or family have a higher prevalence of suicidal ideation than their peers.[6] The prevalence of college students' suicidal ideation varies from 10.6% - 13.3% within one year to 2.7% - 11.1% within the last month prior to survey.[7,8]

Within this particular age group, there is yet another subgroup this study aims to examine more closely, namely medical students. Trained to become physicians, thus maintaining everyone else's wellbeing, including mental disorders and suicide prevention, medical students' own mental health benefits the whole society. Once in professional life, the risk to commit suicide is 1.4 times higher for a male physician and 2.3 times higher for a female physician compared to the general population.[9] Studies attempting to shed light on whether this effect is already active for medical students show consistent results: an online-survey from France showed every fourth medical student to have thought of suicide,[10] and a Spanish study reported a prevalence of 15.8%.[11] According to Tyssen et al. (2001), who conducted a longitudinal study among Norwegian medical students, 14.0% have thought about suicide and within one year continue doing so after graduation.[12] A definite effect, albeit with lower prevalence, was found by Dyrbye et al. (2008) and Rotenstein et al. (2016) with 11.2% and 11.0%, respectively.[13,14] Finally, Schwenk et al. (2010) state that only 4.4% of medical students "seriously consider committing suicide during medical school", implying an already advanced action-oriented stage of suicidal behavior.[15] It is obvious that medical students' prevalence of suicidal ideation greatly exceeds that of the general population even though the precise percentages differ between studies. Therefore, it is long overdue to investigate the circumstances of those young individuals and help prevent drastic mental or even fatal consequences.

Since depression is one of the most important risk factors of suicide, it would be interesting to observe whether or not it is also more common in medical students than in the general population. A systematic review and meta-analysis of 24 international studies by Rotenstein et al. (2016) estimated 27.2% of medical students are suffering from depression or depressive symptoms.[14] After discovering this, a study on medical students' mental health was carried out. And indeed, we found almost every fifth student presenting mild to severe depressive symptom constellations. Compared to the 11.5% prevalence in 15–29-year-olds of the general German population, an additional mental burden cannot be denied.[16]

With the current literature findings and the increased presence of depressive symptoms within our previous study in mind, the following question arose: do the medical students of this study sample have a higher prevalence of suicidal ideation compared to the general population or students of other major graduate courses? Can additional risk factors be detected or known ones be confirmed? Knowledge of these factors is vital to implement effective prevention strategies in the susceptible age range and right before starting an even more demanding career. Therefore, this study aims to create a statistical basis for local projects and add to the understanding of students' mental health worldwide in order to better protect future generations by gaining prevalence and risk factors of suicidal ideation of medical students in a German university.

Methods

Study design

Between 2017 and 2018 we conducted an observational cross-sectional study in a medium-sized public university with about 20,000 enrolled students in order to study suicidality and depressive symptoms as well as sociodemographic, risk, and protective factors of medical students. The local Ethics Committee approved this study (approval code: 2017-138).

Setting

The questionnaire was distributed during compulsory seminars either at the beginning or end of an academic term and anonymously completed in classroom as paper-pencil survey in the German language. For this paper we used the English-version BDI-II for translation..

Participants

Initially we handed out the questionnaire to 1,124 students from pre-clinical and clinical semesters. The response rate of the population was 91%, resulting in a total sample size of n=1,103 study participants. Subjects participated on a voluntary basis without compensation and 9% refused to participate or did not fill out the survey accurately.

Measurements

Our study surveyed sociodemographic data, protective and risk factors, neuroticism, and depression symptoms including suicidality.

a) Suicidality and Depressive Symptoms

The Beck's Depression Index II (BDI II) was embedded in our survey to assess severity of depressive symptoms. It served as a self-assessed test consisting of 21 items measuring depressive symptoms within the last two weeks prior to the survey. Good reliability and validity in clinical samples were confirmed by Kühner et al. (2007).[17] Each item rated on a scale from 0 - 3 (no symptoms - severe symptoms), and the total score resulted in categories from mild to severe depression.

Item 9 "suicidal ideation" of this index served as the dependent variable for the present study. In accordance with several other studies, this item is a valid measure for suicidal ideation.[11,18, 23, 24] In the original questionnaire, suicidal thoughts were identified using the following options: 0= "I don't have any thoughts of killing myself"; 1= "I have thoughts of killing myself, but I would

not carry them out"; 2= "I would like to kill myself"; and 3= "I would kill myself if I had the chance." Since answers greater than "1" are usually very rare, we dichotomized the originally ordinal variable. Thus, creating a dichotomous variable (no suicidality vs. suicidality) for the following analysis. Item 9 (suicidality) was excluded to calculate the depression score for correlation analysis within this study.

b) Sociodemographic

Sociodemographic data consisted of extraneous variables on sex and gender, current age, region of origin, relationship status and duration, vocational training, number of children and siblings, and parents' highest school degree and professional qualification. During analysis we differentiated between growing up in former Western or Eastern Germany, as well as abroad.

c) Risk factors

For prevailing risk factors, we inquired whether or not a first degree relative or the subject was treated for a mental illness and if so, which one. Furthermore, we estimated the socioeconomic status by asking if the financial status fell into deprivation categories "sometimes too little," "often too little," and "I am mostly under great financial pressure." Additionally, we inquired into whether the subject was separated from a parent due to death or divorce and whether he or she abused alcohol, sedating, or focus enhancing drugs, and their frequencies of use. To scale current stress levels, we asked whether the subjects were satisfied with their amount of free and study time and the amount of pressure they felt. Moreover, social isolation was determined by whether sufficient quality time was spent with friends or family. Finally, we checked the ability of the subject to share problems and feelings of loneliness.

To measure the personality trait of neuroticism, we used a subcategory of the fully standardized NEO-Five-Factor Inventory (NEO-FFI) containing 12 items.[19] Neuroticism acted as a variable in our correlation analysis if a student scored a standard deviation of 2.54 above the age-adjusted mean.[20]

d) Protective factors

Protective factors included coping mechanisms such as time spent playing an instrument, importance of religion in everyday life and during childhood, frequency of engaging in hobbies with an emphasis on sports, enjoyment of studies, and the availability of support from friends, family and teachers. Additionally, we assessed the students' behavior towards diet and body conception.

Data analysis

Data analysis was performed using the software IBM Statistical Package for Social Sciences (SPSS 25.0). The evaluation of the frequency of suicidal ideations was done by descriptive statistics and the determination of relative frequencies of the respective item score. The initial sociodemographic description of the study sample was based on the descriptive distribution characteristic (mean, standard deviation, range) and relative frequencies. Depending on scale characteristics, correlation between risk factors and suicidal ideation was calculated using Kendall-tau or point-biserial correlation. The influence of risk factors that proved to be correlated was determined by binary logistic regression (forward).

Results

The cohort of students consisted of an almost exact split into 51.1% attending the preclinical and 48.9% attending the clinical part of medical school. Demographic data of the sample is presented in *Table 1*.

Table 1. Sociodemographic Characteristics of Study Participants.

Socio-demographic features	Pre-clinical n = 564	Clinical n = 539	Total n = 1103
Sex at birth – n (%)			
Males	188 (33.3%)	199 (36.9%)	387 (35.1%)
Females	376 (66.7%)	340 (63.1%)	716 (64.9%)
Age – Mean ± SD	21.5 ± 3.7	24.8 ± 3.6	23.1 ± 4.0
Vocational training[1] – n (%)	135 (23.9%)	142 (26.3%)	277 (25.1%)

Legend: 1 completed vocational training prior to medical studies.
n = Frequency; M = Mean; SD = Standard deviation.

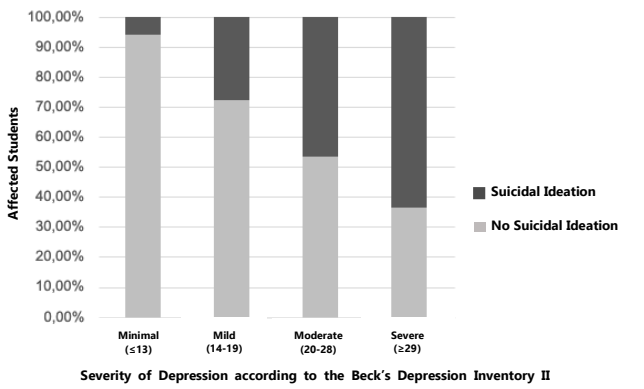
The participants' ages ranged from 17 to 45 years, with an average age of 23.1 years (Standard Deviation 4.0). The male to female ratio of 35% to 65% appropriately matches that of the overall men to women ratio of 38:62 in German medical students appropriately.[21] Suicidal ideation was stated by 130 students (11.8% of the total sample) students within the last two weeks. Most of these students (96.9%) showed the mildest form ("I have thoughts of killing myself, but I would not carry them out"), and only four students used more progressive options. The total 13.5% (n=76) prevalence of suicidal ideation was slightly higher in pre-clinical students compared to clinical students (n=54; 10.0%), however, this was not statistically significant (X^2 [df=1] =3.17; p=0.075).

Table 2 shows the correlation between suicidal ideation and potential risk factors. Highest coefficients were found for adjusted BDI-score (M±SD=8.2±7.0, point-biserial correlation (r_{pb})=0.456, p<0.001), neuroticism (M±SD=1.51±0.8, rpb=0.366, p<0.001), insufficient emotional support (17.7%, Kendall-tau (τ)=0.254, p<0.001), feeling lonely (13.2%, (τ)=0.274, p<0.001), using tranquilizers (6.5%, (τ)=0.211, p<0.001) and irregular meals (13.9%, (τ)=0.179, p<0.001).

Overall, 63% of students with suicidal ideation also showed at least mild symptoms of depression (BDI-II score ≥ 14). Conversely, only 13% of students with more than 14 BDI-II points

did not experience suicidal ideation. As displayed in *Figure 1*, the number of students suffering from suicidal ideation differs significantly between the groups of different levels of severity of depressive symptoms according to the corrected BDI-II sum score ($\chi 2$ [degrees of freedom = 3]=225.1; p<0.001; Standard error = 0.032): Suicidal ideation was reported by 6% students with no or minimal depressive symptoms (score ≤13). Nevertheless, 27.7% with a mild depression (score=14-19), 46.8% with a moderate depression (score=20-28) and 63.7% with a severe depression (score≥29) experienced suicidal ideation.

Figure 1. Relationship between Beck's Depression Inventory II Score and Percentage of Students Reporting Suicidal Ideation.



Stepwise forward logistic regression model including all potential risk factors resulted in 40% explained variance (Nagelkerke). Significant predictors for suicidal ideation were: "feeling lonely", "prior own mental health issues," "adjusted BDI-II-score," "confiding own worries to no one," "learning difficulties," "satisfied with time for hobbies," and "insufficient time for studies" (see *Table 2* for exponential value of B (Exp(B)) and 95% confidence interval (CI)).

Discussion

This study was conducted to highlight the mental pressure of medical students and found an 11.8% prevalence of suicidal ideation in this population. This suggests an immense problem not sufficiently addressed. The intention was to identify the main risk or protective factors for this high prevalence of suicidal ideation in order to raise awareness, reduce unnecessary stressors, and establish prevention programs. Our study showed several factors significantly correlated to suicidal ideation: mental health, sociodemographic factors, lifestyle, and study-related aspects. Variables concerning mental health such as current depressive symptoms, symptoms of fear, psychosomatic symptoms and prior mental health issues as well as a family history of mental illness, were associated. In terms of sociodemographic and lifestyle risk factors, we determined insufficient emotional support, loneliness, unsatisfying social relations, inability to share one's worries, insufficient financial funds, use of sedating or focus-enhancing drugs, irregular intake of meals, and weight issues were all players. The effects of medical school itself included stress factors such as time and performance pressure, mental overload, competition between class mates, learning difficulties, being an international student, and the uncertainty of being able to graduate.

To judge the correlation of neuroticism and suicidal ideation, one needs to keep in mind that current depressive symptoms alter self-perception, affecting the outcome of self-assessed neuroticism tests. Therefore, their correlation is likely to be overrepresented.[22]

All of the above are well established risk factors, confirming current knowledge. In a further step, we sought to identify the most important factors by using a logistic regression model. Here, feeling lonely, prior mental health issues, adjusted BDI-II-score, confiding own worries to no one, learning difficulties, satisfaction with time for hobbies, and insufficient time for studies significantly predicted suicidal ideation with 40% of variance explained. However, evolving suicidal ideation is complex and this gives future studies reason to investigate additional predictors.

As expected, the BDI-II-score predicted suicidal ideation reliably: 63% of students displaying suicidal ideation also suffered from mild to severe depression symptoms. Viewing it from the other side, only 13% of students with mild to severe depression symptoms did not state suicidal ideation.

Contrary to several findings,[6,8,23,24] we did not observe students with suicidal ideation consuming alcohol more frequently than their peers. This might be because alcohol consumption is more strongly associated with social activities and inclusion within this study's medical students, thus concealing alcohol consumption as coping mechanism for mental health problems. On the other hand, drug usage was associated with suicidal ideation and also served as a valid predictor. Studies show that drug abuse in general as a risk factor for suicidal behavior.[4] Likewise, our results show that consuming sedating drugs was correlated with suicidal ideation, as well as – to a smaller extend - consuming focus-enhancing drugs. These correlations suggest that the need for students to perform more effectively and reacting on their burdens may promote dysfunctional coping styles.

Prevalence

The prevalence found in our study is consistent with data from other medical student populations found in literature ranging from 9% - 15.8%.[11–13,15,25,26] In addition, Rotenstein et al. (2016) showed a mean prevalence of 11.1% within one year in a meta-analysis of 24 international studies on this topic.[14] Unfortunately, studies' inconsistent usage of screening tools (PHQ-9, CES-D, NCS-R, BDI, Meehan, individual questionnaires) and the time span of their questionnaires (two weeks, four weeks, one year, lifetime) lead to less comparable results. This emphasizes the importance of standardized survey methods for mental health studies.

Table 2. Correlation between Potentially Associated Factors and Suicidal Ideation and Exponents of Logistic Regression.

	Correlation	% of affected students or M±SD	Exp(B) [95%CI] in logistic regression
Sociodemographic			
Male sex[a]	-	35.1%	
Age[b]	-	23.1±4.0	
Loss of parent due to death/separation[a]	-	18.2%	
Being an international student[a]	0.067*	5.2%	
Lifestyle			
Regular meals[a]	-0.179***	86.1%	
BMI[b]	-	22.5±3.6	
Happy with weight[a]	-0.094**	58.3%	
Happy with diet[a]	-0.065*	27.3%	
Hours /w spent doing sports[b]	-	3.7±3.3	
Satisfied with time for hobbies[a]	-0.101***	24.2%	0.29 [0.14-0.61]
Number of days consuming alcohol / w[b]	-	1.4±1.4	
Number of smoked cigarettes / d[b]	-	0.8±3.0	
Using food to calm down[a]	0.099***	16.3%	
Using meds/drugs to calm down[a]	0.211***	6.5%	
Using meds/drugs to enhance focus[a]	0.088**	2.9%	
Social Life			
Living alone[a]	0.072*	41.8%	
Feeling lonely[a]	0.247***	13.2%	3.65 [1.97-6.79]
Relationship >3 months[a]	-0.069*	52.5%	
Happiness with relationship[a]	-0.143***	77.1%	
Happiness with family[a]	-0.164***	85.3%	
Happiness with friendships[a]	-0.169***	85.1%	
Insufficient emotional support[a]	.254***	17.7%	
Insufficient financial funds[a]	0.067*	19.6%	
Importance of religion[a]	-	22.9%	
Mental health			
Mental illness in FDR[1a]	0.064*	27.3%	
Prior own mental health issues[a]	0.193***	14.1%	2.73 [1.41-5.26]
Adjusted BDI-score[b]	0.456***	8.2±7.0	1.19 [1.14-1.24]
Symptoms of fear[a]	0.154***	56.0%	
Psychosomatic symptoms[a]	0.084**	44.7%	

Legend: 1 FDR: first degree relative.
a Kendall-tau, b point-biserial correlation.
* p<0.05; ** p<0.01; *** p<0.001; - no significance.
M = Mean; SD = Standard deviation; CI = Confidence interval; Exp(B) = Exponential Value of B.

The only other studies using the BDI item 9 as an indicator for suicidal ideation were Atienza-Carbonell & Balanzá Martínez (2020), Arria et al (2010) and Curran et al. (2009).[11,23,24] Curran's Irish medical student population showed a 6% prevalence within the last month. It is unclear why their prevalence is only half as high in a time period even longer compared to ours. One explanatory approach might be the difference in depression-prevalence of 14% compared to our 19%.[24] Arria's U.S. student population also showed a 6% prevalence but only within a few days compared to our two weeks.[23] Atienza-Carbonell's Spanish survey method resembles ours the most: their reported two-week prevalence of 15.8% exceeds ours by approximately 4% whereas, the prevalence of depression is around twice as high (39.1% vs. 19%).[11]

Overall, our results are generally in line with the observations described in literature, tending to exceed them. However, while comparing data, one must bear in mind that differences in results do not only stem from screening tools used and time frames captured but also from prevailing educational and socioeconomic systems.

The prevalence exceeded that of the general population by a factor of four, even though a comparison of those prevalences is limited due to different study methods, which is a cause for concern considering suicidal ideation as a main predictor for an actual attempt.[2] Few studies turned their focus on suicide cases in medical students. Those existing were reviewed by Blacker et al. (2019), concluding a lack of reliable recent sources but still finding medical students' suicide rates trending lower than those of the general population.[27] Furthermore, Barrios et al. (2000) showed students with suicidal ideations participated more frequently in "injury related risk behavior", such as driving after drinking alcohol or engaging in physical fights.[7] Therefore, supporting students with suicidal ideation is crucial to lower the risks not only for themselves but for others in society as well.

Additionally, the recent Covid-19 pandemic increased the presence of risk factors such as feeling lonely due to official social restrictions and decreased protective factors such as participating in clubs, team sports, in an orchestra or choir. Furthermore, fear of infection and unplanned changes in the curriculum added stress and anxiety. Earlier reviews suggest no change in prevalence but are still short on data.[28] Therefore, further longitudinal studies are needed to elucidate the causality of suicidal ideation related to the restrictions of social life like those during the COVID-19 pandemic.

Limitations

While analyzing the results of this study, several limitations must be kept in mind: even though our sample size of n=1,103 students and the resulting 130 students with suicidal ideation is substantial, the survey mirrors students' mental health of only one German university. Also, we did not include students of every year in school, potentially missing alternative risk factors. Additionally, our study was conducted at different points in time during classes or right after breaks, including acute stressful situations such as

exams or practical trainings, but not taking these into account during data analysis. As this study was originally designed to monitor depressive symptoms, important risk factors such as mood stability, suicides or suicide attempts in family and friends were not addressed. Fortunately, voluntary and anonymous participation should not have distorted our data since an actual response rate of 91% was achieved.[29] The environment the survey was conducted in (e.g., crowded classrooms, chitchatting) could have influenced self-reported responses, potentially concealing even higher rates of suicidal ideation or prevailing risk factors.

Prevention

Our findings show suicidal ideation is not a rarity amongst medical students. In order to help future generations of doctors, universities must establish prevention programs, educate fellow students and staff, and make psychological support more accessible to affected students. According to Givens et al. (2002), U. S. medical students were discouraged from using mental health services because of lack of time (48%), lack of confidentiality (37%), stigma associated with using mental health services (30%), cost (28%), fear of documentation on academic record (24%), and fear of unwanted intervention (26%).[30] Based on those findings, Thompson et al. (2010) established several intervention programs: staff training, distribution of mental health brochures among the students, mental wellbeing classes at another faculty, and free of charge sessions with psychologists. As a result, suicidal ideation was dramatically reduced from 30% to 3%.[31] Such measures are a great example of how to value and cater for the mental health of medical students, making student life more pleasant, safe, and healthy for everyone.

Summary – Accelerating Translation

„Beck-Depressions-Inventar II Suizidgedanken bei Medizinstudierenden – Häufigkeit und assoziierte Faktoren"

Selbstmord ist die zweithäufigste Todesursache unter den 15- bis 29-Jährigen in Deutschland. Studien zeigten bis jetzt, dass Studierende im Vergleich zur Gesamtbevölkerung häufiger unter Suizidgedanken leiden. Dieser Trend zeigt sich nicht nur in Deutschland, sondern weltweit. Zusätzlich wurde festgestellt, dass Ärzte eine höhere Suizidrate aufweisen. Um die mentale Belastung durch Suizidgedanken von Medizinstudierenden zu beleuchten und Risiko- sowie Schutzfaktoren ausfindig zu machen, führten wir also eine Querschnittstudie durch, in der wir die Medizinstudierenden der Martin-Luther-Universität Halle mit Hilfe eines Fragebogens analysierten. Die Rate der Suizidgedanken machten wir durch einen standardisierten Depressionsfragebogen ausfindig. Zudem erhoben wir Daten zu soziodemographischen Verhältnissen und potenziellen Risiko- bzw. protektiven Faktoren. Insgesamt berichteten 130 Studierende, das sind 11.8% der Befragten, von Suizidgedanken innerhalb der letzten zwei Wochen. Die wichtigsten Risikofaktoren waren das Vorhandensein depressiver Symptome, Gebrauch von Beruhigungsmitteln, das Gefühl von Einsamkeit, unzureichende Zeit für Hobbies und schon bestehende weitere psychische Probleme. Als protektiven Faktor konnten wir lediglich die Nutzung von Stimulanzien ausmachen. Es zeigte sich deutlich, dass die Schwere der Depression mit der Wahrscheinlichkeit vorliegender Suizidgedanken korrespondierten. Insgesamt konnten wir somit feststellen, dass Medizinstudierende eine erhöhte Rate an Suizidgedanken haben und das Studium selbst hierzu beiträgt. Es ist somit dringend notwendig unser vorherrschendes System an den Universitäten zu hinterfragen, psychische Gesundheit in den Fokus zu nehmen und Präventionsprogramme zu installieren.

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