Anxiety and depressive symptoms in medical and non-medical students: a literature review of comparison studies

A selective literature review

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ABSTRACT

Background: There is a conception that medical students experience higher level of anxiety and depression than other students do. The aim of this thesis is to review studies that compare the levels of depressive symptoms and anxiety among medical students with those among non-medical students.

Purpose: The purpose is to review the empirical evidence of the first mentioned conception. The questions we attempt to answer by this thesis are: 1) Is there a higher level of anxiety and depressive symptoms among medical students compared to that among non-medical students? 2) Are there particular factors associated with anxiety and depressive symptoms in the comparison studies of medical students and other students?

Method: We searched the databases Medline, PubMed, Embase. The search combined depression and anxiety with medical student and non-medical students, and it was limited to the last 20 years. English language was used as an inclusion criteria, as well as comparison studies.

Results: The search identified 17 articles most applicable for the review. Seven studies showed that depressive and/or anxiety symptoms are less common among medical students than among non-medical students. The ten articles remaining showed no significant difference between the two student groups. The non-medical students were included from different faculties. One of the studies did not specify discipline of the students they compared with medical students. The following factors contributed to depressive and anxiety symptoms among medical students: female gender, academic stress, life satisfaction, non-white ethnicity, previous episodes of psychiatric illness, and familial history of psychiatric disorder.

Conclusion: While more studies show that medical students experience lower or similar levels of depression and anxiety, some of the existing literature has major limitations that make it difficult to generalize the findings. These limitations are low response rates, selection bias, and not controlling for gender. This subject needs further research, in order to give more representative results

Introduction

The emphasis on mental health has become broad subject in today's society and people of all ages seem to be affected of either one or multiple mental health conditions. The past 10-20 years, there has been a shift in the health services where the focus on mental health has taken more place. [1] The shift has also created room to explore and treat people with different kinds of mental disorders. Mental disorders such as depression and anxiety have been viewed in several studies showing a strong correlation with suicidal ideation and suicide attempts [2-4].

There are studies that show that college and university students experience higher levels of depression than people in general [5, 6]. A particular group which has been associated with depressive and anxiety symptoms are medical students. While many studies have found that medical students may experience mental health issues, such as depressive and anxiety symptoms, few studies compare the prevalence of these symptoms between medical students and students in general. Though medical students experience distress, it is important to highlight whether it is a more common theme among students in general or is particularly common in medical students. This would be key information to highlight if the medical training is the main root for the mental health issues among medical students. It is also essential to reduce the stigma with medical training and how it affects medical students and young physicians.

A systematic review in 2006 pointed out that medical students have a higher prevalence of depression and anxiety, than the general population [5]. Still, four studies that compared distress among medical students with that among other students found no higher distress among the medical students. Another systematic review and meta-analysis studied both depressive symptoms and suicidal ideation, reviewing 195 studies in which they found that 27.2% of the medical students were depressed. The study included 16 longitudinal studies where 9 of the studies, found an increase in depressive symptoms during medical school [7]. This suggests that medical school might play a role in medical students experiencing depressive or anxiety symptoms. Several studies have also indicated that physicians experience high levels of burnout and that they have a higher risk of suicide [8, 9].

As medical students graduate and continue as physicians, they are required to work with patients in life threatening situations and the responsibility that comes with this heavy accountability can be extremely stressful. It could be that medical students get a sense of this responsibility already through medical school and therefore feel the pressure to perform well and beyond that.

Earlier studies have suggested that there are specific risk factors related to medical school which are associated with depressive symptoms. In a study with medical students from different curriculum stages, third year medical students seemed to score higher when measured for anxiety and depressive symptoms, which also was linked to a negative influence on perceived performance [10]. According to a longitudinal study in 2012, medical students had a significant reduction in depressive symptoms from their graduating year compared to 15 years later. This could potentially imply that medical school holds certain risk factors causing students to experience mental health issues. However, the study pointed at personality traits such as high neuroticism and earlier depressive symptoms to be important predictors for future severe depressive symptoms, emotional distress and suicidal ideation, not only for medical students but students in general [11, 12]

Medical students are often perceived as a group of young adults that are passionate about helping others, dutiful and have strong desire for learning. There is also a presumption that being a medical student is associated with higher levels of anxiety and depression than those found among other students. The heavy workload in the preclinical and clinical years because of a substantial curriculum may be one reason one would assume that medical students experience a higher level of burnout.

To examine whether or not medical students experience higher levels of mental health issues than their peers, do adds great value to further research on how students can be helped. According to The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) in 2019, both depression and anxiety ranked amongst the 25 leading causes of burden worldwide [13]. Both depressive and anxiety symptoms develop during adolescence, and individuals diagnosed with either one, has a higher risk for developing other mental health issues [14-16]. This implicates that an adult diagnosed with anxiety disorders may have experienced anxiety symptoms already as a teenager, though the stability of the anxiety diagnosis may have fluctuated [17]. This also emphasizes the need to address mental health issues among students as early as possible.

Medical school is quite demanding, and it includes many mandatory courses, tests and exams. Several studies have established that depressive symptoms can affect other important qualities that are necessary to perform cognitively and socially, in both medical school and as physicians. Depressive symptoms can cause impairments in daily functions and relationships but also in executive functions such as work-memory, self-regulation, problem-solving and concentration. While this have been shown to be reversible, the quality of life may be poorer due to the risk of reoccurrence or development of clinical depression [18, 19]. Therefore, anxiety and depression may reduce the students ability to perform and to cope throughout the medical school.

The association between mental and somatic health issues is another important consideration. Depressive and anxiety symptoms over time, can cause harmful long-term effects on the individuals somatic health. Multiple studies have shown a link between cardiovascular diseases and depression[19]. Another study found a significant association between migraine and anxiety [20]. Studies also show that people who experience depressive symptoms, without qualifying for a clinical diagnose, can be in risk for long-term effects such as development of dementia and Alzheimer Disease.[21] [22]. The associations between depressive and anxiety symptoms and other serious diseases indicates how important it is to prevent these symptoms and by that reducing the risk of developing other health issues.

While suffering from mental health issues, studies show that both medical students and physicians have a difficulties in seeking help regarding their mental health problems [23]. A meta-analysis from 2016 found that only 15.7% of medical students that screened positive for depression, sought professional help for their issues [7]. A 2020-study showed an increase in help seeking behavior amongst female medical students among those in need of treatment which may indicate a reduction of stigma in this group. The study also highlighted the link between low social support and mental distress, which implicates how important it is to apply certain measures in the to universities in order to prevent negative coping strategies [12]. Still, we need to study what factors in medical school that impact students' mental health, and especially anxiety and depression among them.

We have attempted to assemble the comparison studies in which we condense the findings of the current research. We find this topic to be highly important since mental health issues like anxiety and depression is closely linked to suicide and with depressive disorders being one of the leading causes for the increasing global mortality [24] [25]. There is a lack of reviews that compare both depressive and anxiety symptoms among medical students to those among non-medical students. Hence, these new findings can hopefully encourage prevention and intervention, as well as future research in this field.

Based on what described above, we would like to explore the following research question with this thesis:

1) Is there a higher level of anxiety and depressive symptoms among medical students compared to that among non-medical students?

2) Are there particular factors associated with anxiety and depressive symptoms in the comparison studies of medical students and other students, and in particular are there specific factors related to the medical curriculum?

Method

In order to make future publication of this project as a systematic review, we reported it to PROSPERO (19.04.21). PROSPERO is an international database of prospectively registered systematic reviews in health, social care etc [26]. To report the literature review we utilized The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [27]

The databases we used in this systematic review was EMBASE, Medline, and Psychinfo. We did the search on *08.03.21* and the search words used to find articles were *medical students, non-medical students, depressive symptoms, and anxiety symptoms.* We made two searches on each database: one for depressive symptoms and then another one for anxiety symptoms, using these search terms:

1. [students/ or non-medical students] AND [medical students] AND [depressive symptoms/ or depression]

2. [students/ or non-medical students] AND [medical students] AND [anxiety symptoms/ or anxiety]

We combined the search terms with "OR" and then connected the search terms with "AND". Limitations for the search applied to studies where English was the preferred linguistic. The years we selected was a period of 20 years, from 2000 to 2020. The search resulted in a total of 400 articles from all databases mentioned above. The two authors (A.I and M.A) individually reviewed these articles by evaluating the title and abstract: Articles in which there was uncertainty if they met inclusion criteria, were read in full text. Among all articles, we found 17 eligible articles.

Inclusion criteria used to include articles in this study, was 1) selected year range 2) student group had to include both medical and non-medical students 3) comparing depressive symptoms and anxiety between the two student groups. We also paid attention to the instruments used to measure anxiety and depressive symptoms, they were preferably valid instruments. Studies that did not compare medical students to non-medical students were excluded. Studies that assessed the prevalence of anxiety and depressive symptoms caused by a specific change globally or within the community, such as mental health associated with COVID-19, were also excluded. In addition, studies on topics other than anxiety and depressive symptoms, such as health anxiety and hypochondria were excluded.

A measurement-tool called Modified Newcastle-Ottawa (NOSm) scoring was used to measure the quality of the studies included in this systematic review. The scoring system is based upon 5 different questions regarding representativeness of the sample, sample size, response rate, measurement-instruments, and quality of descriptive statistics. Based upon these factors, the studies can earn 0-5 points each. To identify the study as a study with good quality, the study has to earn 3 points or more. [9]

Results

Seventeen studies were found eligible and got included in the systematic review. See table 1 for an overview. These studies include student's behavior in association with anxiety and depressive symptoms from different countries. Eight of the studies (Newbury-Birch et al, Curran et al, Honney et al, Prinz et al., Manchevska et al., Hilger-Kolb et., Dahlin et al., De Sousa et al.) are from European countries, while the remaining studies are from different countries in Asia, Middle-East and South-America (Table 1). Seven of the studies (Newbury-Birch et al., Samaranyake et al., Prinz et al., Naseem et al., De Sousa et al., Hilger-Kolb et al.) evaluate the prevalence of anxiety and depressive symptoms among the students, whereas the remaining studies evaluate the prevalence of either anxiety or depressive symptoms. The majority of the studies used well-known measurement-instruments such as BDI, HADS and PHQ as examples, although there is a great variety of the instrument-types which were used. See Appendix for a description of the commonly used instruments. One of the studies (Kongsomboon) used HRSR as the measurement-tool for depressive symptoms, which is quite a different instrument compared to the other instruments.

Newbury-Birch et al. (2002) [28] is the only longitudinal study assessed in this systematic review. The study from England used two cohorts with dental students and medical students at Newcastle University. Both students' groups were followed up in 1995, 1998 and also in 1999 after working for one year as qualified dentists and Pre-Registration House Officers (PRHO's). The total sample size consisted of 626 eligible participants, in which 132 were dental students and 295 medical students. Response rates were 71.2% and 80% respectively from second and final years, while for medical students the response rate were 79.2% and 79.7%

The Hospital Anxiety and Depression Scale (HADS) was used to measure the prevalence of both anxiety and depression, where cutoff score was set to 8, indicating higher scores as possible pathological anxiety/depression. Medical students had a lower prevalence of anxiety and depressive symptoms when compared with dental students in second and final year. A higher percentage of dental students in final year (67%%) experienced anxiety symptoms, compared to their peers in the medical studentgroup (26%). Overall, the prevalence of depressive symptoms was lower compared to that of anxiety symptoms, but still resulting in a

lower score among medical student's vs dental students, both in second year (15% vs 4%) and final year (14% vs. 5%). The study also found a slightly negative correlation between alcohol consumption and anxiety among only medical students.

Kaya et al. (2007) [29] is a cross-sectional study from 2007 which focus on the prevalence of depressive symptoms, ways of coping stress and their relationships to sociodemographic variables among medical students and Health services students (HSHES) at Inönü University in Turkey. Among the medical students, 437 participated in the study and 499 from HSHES, in total 936 eligible students. The response rate was 80.5% (n =754), in which 352 were medical students and 402 were HSHES, 182 students declined participation. The Beck Depression Inventory (BDI), a well-known self-report questionnaire was used to measure the prevalence of depressive symptoms, using a cutoff score of 17, indicating scores above as depressive symptoms of clinical importance. Medical students had a significantly lower prevalence of depression compared to that among HSHES (21.9% vs 31.8%, p<0.001) For both, medical students and Health services students there seemed to be an association between the family's income and the prevalence of depressive symptoms; as the family income decreases, the prevalence of depressive symptoms increased among the students.

Bunevicius et al. (2008) [30] completed a randomized comparison study among students trial from Lithuania in 2008. The study aimed to measure the prevalence of depressive and anxiety symptoms among medical students and humanities students. The sample size consisted in a total of 444 eligible students. thereby including 360 medical students and 84 humanities students. The response rate was as following: 94% medical students (n = 338) and 87% humanities students (n =73). The Hospital Anxiety and Depression Scale (HADS) was used as the measurement-instrument to measure the prevalence of depressive and anxiety symptoms among the students. The cut-off score was set to 8 or above. Medical students had a significantly lower prevalence of anxiety symptoms than did the humanities students (43% vs. 53%, p=0.02). When comparing the prevalence of depressive symptoms, there were no significant difference (14% vs. 13%). The trend remained after controlling for gender. The study also found that medical students scored significantly higher on emotional stability trait and significantly lower on the personality traits extroversion and openness to new experiences when compared to a humanities student group.

Bayati et al. (2009) [31] is a study that included 350 eligible medical students and non-medical students from Arak University in Iran. Three hundred and four students completed the questionnaire, giving a response rate of 86.8% in which 56.6% (n=172) were medical students and 43.4% (n=132) non-medical students. Non-responders were in the first term of education or did not return questionnaire. The study's purpose was to compare the prevalence of emotional disorders in medical and non-medical students, with an interest in depressive symptoms. GHQ-28 was used to evaluate the prevalence of severe depressive symptoms among the students, and the cut-off score was set to a score of 23 or more. The results showed no significant difference comparing depressive symptoms among the two student groups (54% vs. 50%).

Curran et al. (2009) [32] is a cross-sectional study from Ireland that studied depressive symptoms, alcohol abuse and suicidal ideation among totally 539 eligiable students, including 317 medical students and 222 business students. The samples were collected from both University college (UCD) and Trinity college in Dublin (TCD), The study included fifth year medical students at both universities, and third-year business students at UCD and economics students at TCD got included. at TCD got included. BDI was used to measure the prevalence of depressive symptoms, and one BDI-item was used to measure suicidal ideation among the students. The response rate was 62,7%, a total of 338 students. The individual response rates for medical and business students were 47.6% (n = 148) and 85.5% (n = 190). Totally 13.9% (n = 47) of the students had depressive symptoms, in which there were no significant difference between the student group. The study shows that depression was associated with lower social support and a great number of stressful life-events. As for the suicidal ideation, 5.9% (n = 25) of the students had a suicidal thought in the past month. The prevalence of suicidal ideation differed not between different students, although it correlated negatively with social support and positively with alcohol abuse (CAGE). Business students were more likely to score above the cut-off score on CAGE than were medical students.

Alexandrino-Silva et al. (2009) [33] is a cross-sectional study from 2009 that consisted of 989 eligible students, in which 603 were medical students, 187 nursing students and 199 pharmacy student at Medical School of Fundacao do ABC in Brazail, to evaluate the presence of suicidal ideation, depressive symptoms, and symptoms of hopelessness. The response rates

were 56% (n=338), 56% (n= 105) and 61% (n=123) for medical, nursing and pharmacy students. The Beck Scale for Suicidal Ideation, the Beck Depression Inventory and the Beck Hopeless scale measured mental health in the student groups. The results showed that there was not significantly difference in the prevalence of depressive symptoms in the students from the three different studies (8.3% vs. 8.5%, vs. 4.9). Similar results were found when comparing the prevalence of suicidal ideation and hopelessness between students from the different programs. Depressive symptoms were associated with lower social support and a greater number of stressful life events.

Honney et al. (2009) [34] is a cross-sectional study that compares the prevalence of depressive symptoms between medical students and non-medical (life-sciences) students studying at University College London (UCL). The study used a web-based questionnaire prearranged to the students through their university e-mail accounts. In the web-based questionnaire, PHQ-9, a depression specific inventory, was also included. The study included 4223 eligible students but only 20% responded in the total sample, yielding the following response rates ion each group, 24% among medical students (n=533) and 16% among the non-medical students (n=500). Medical students had a significantly lower prevalence of *severe* depressive symptoms (5.6% vs. 12.7) and moderate (17.7% vs. 10.8%) depressive symptoms than had non-medical students. Still, the medical students had a significantly higher prevalence of *mild* depressive symptoms than non-medical students had (32.4% vs. 28.7%). The questionnaire contained demographic details and questions about vulnerability factors associated with depression as following, financial burden, ethnicity, family, personal history of depression, previous degree and their motivation for their particular degree. The prevalence of depression was higher? in students who had non-white ethnicity and in those who had familial history of depression or previous depression themselves.

Kittipong et al. (2010) [35] is a cross-sectional study from Thailand that collected data from 749 eligible students, 646 medical students from Faculty of Medicine and 103 students from the Division of Children's Literature, Faculty of Humanity from Srinakharinwirot University in Thailand, to compare the prevalence of stress, depression, daytime sleepiness, sleep deprivation and overweight. The study used a questionnaire which contained four parts. The first part included questions regarding general information such as gender, age, height, weight, sleep time etc. The second part contained the screening test for depression and used The Health-Related Self-Reported scale from the Psychology Department as measurement-instrument for depressive symptoms. The third and fourth parts contained Suanprung stress test from Suanprung Hospital in Thailand and Epworth sleepiness scale. The response rate was 91.8% (n= 593) among medical and 96.1% (n= 99) among humanities students. The study found no significant difference in levels of depression scores between medical and humanities students (11.5% vs 12.2%). Medical students had lower prevalence of stress and sleep deprivation than the students from the Faculty of Humanity.

Lupo-Strous et al. (2011) [36] is a cross-sectional study from Israel that focused on the association between religiosity and depression and/or anxiety among 170 responding students; 119 medical students and 51 non-medical students (humanities and exact sciences) from Medical school and other faculties in the University in Central Israel. The students received a package of instruments including The Beck anxiety and Depression Inventory, a questionnaire on religiosity and questions regarding psychosocial and demographic variables. Anxiety and depressive symptoms were measured by the Hebrew versions of Beck Anxiety/Depression Inventory. The results showed that the medical students had significantly lower levels of depression and anxiety, than non-medical students (25.2% vs. 52,9%, p<0.01, and 29,4% vs. 51,0%, p<0.01 respectively) There was a positive correlation between religiosity and anxiety among the medical students (p < 0,01). Having a first-degree relative with depression overall increases the risk of depression among the subjects.

Samaranayake-Fernando et al. (2011) [37] is a cross-sectional study from New Zealand that focused on associations between students and psychological disorders such as Anxiety and Depression among 778 eligible students. The study included 594 responding students from medicine (n = 255) , nursing (n =36), health science (n = 208) and architecture (n = 95) at the University of Auckland in New Zealand. The total response rate was 76.4%.

The study used the Patient Health Questionaire (PHQ) for depression and the Generalised Anxiety Disorder Questionaire (GAD) for anxiety to measure the self-reported prevalence of the symptoms among the students. The results showed that medical students had significantly lower levels of depression and anxiety, than the non-medical students (16,9% vs. 23,6%, p=0.045 and 13,7% vs. 24,8%, p = 0,001, respectively). The lower prevalence of depressive symptoms among the medical students may be because of fewer female students in this student group

Prinz et al. (2012) [38] is a cross-sectional study from 2012, which focused on stress, depression, anxiety, burnout and depersonalization among medical and dental students at Friedrich-Alexander University of Erlangen/Nuremberg. A total of 182 responding students were included in the study, in which 109 students were medical students and 73 dental students. The study do not report eligible sample number. The German version of Hospital Anxiety and Depression Scale (HADS-D) with cut-off above 10 was used to measure the prevalence of anxiety and depressive symptoms among the students. The medical students scored significaly lower on anxiety and depression than did dental students (6,8% vs. 27,5%, p<0.001; and 1,4% vs. 2,8%, p= 0.028)

Manchevska et al. (2014) [39] is a cross-sectional study from Macedonia that used the Beck Anxiety Inventory (BAI) to measure the levels of anxiety symptoms and a self-administered questionnaire to evaluate demographic variables and substance use/abuse among the students at Ss. Cyril and Methodius University in Skopje. The study sample consisted of 742 responding students from the first (n = 188) and second (n = 257) year of study at the Medical Faculty, Faculty of Dentistry (n = 242) and Faculty of Law (n = 55). The study do not report eligible sample number. The prevalence of high anxiety in first and second year of medical students, and dental and law students from the second year are 20%,15%, 11.3% and 16,7%. The analyses showed that there were no significant differences in the levels of anxiety between medical students and non-medical students.

Amarasuriya et al. (2015) [40] is a cross-sectional study and it was a part of a larger Depression Literacy Survey done at the University of Colombo in Sri Lanka and included 620 medical and 4050 non-medical responding students. Participation rate was approximately 100%, the exact percentage is not specified. Data were collected from students from the Faculties of Medicine, Arts, Law, Management and finance, Science and the School of Computing. The aim of the study was to inspect the difference of the prevalence of depression and the intention/perception of help-seeking among medical and non-medical students. Depression was measured using a questionnaire with two languages (English-Sinhala and English-Tamil), along with Patient Health Questionnaire-9 (PHQ-9). The results showed that there were no significant differences in the prevalence of depressive symptoms among medical and non-medical students (10.2% vs 9.2%) findings suggest that being depressed was not associated with differences in help-seeking intentions among medical students.

Dahlin et al. (2011) [41] is a cross-sectional study from Sweden that measured levels of stress, burnout, alcohol habits and depression among medical students and business students from respectively Karolinska Institute and the business program of Stockholm School of Economics. The study sample consisted of 1000 eligible students, 500 from each student group. The response rate was 81.6% (n= 408) amongst medical students, and 69.3% (n= 342) from business students. The study used a web-based questionnaire sent to the participants by e-mail. The authors used MDI (Major Depressive Inventory) to measure depressive symptoms and a score above 27 as indicative for depression. The results showed that medical students had a significantly lower depression score than business students (9.1% vs. 12.3%).

Naseem et al. (2017) [41] is a cross-sectional study that assessed suicidal ideation, depression, anxiety, stress and life satisfaction. The study sample included 300 students; 100 medical students, 100 engineering students and 100 students from social sciences from different universities in Karachi, Pakistan. The study do not report eligible sample number or the response rates. The measurement-instrument for depression, anxiety and stress was Depression Anxiety Stress scale (DASS-21). There was a significant difference in the level of anxiety and depressive symptoms and stress among medical students compared to that among engineer students and students from social science, with highest scores among students from social sciences (p < 0,001). The mean values for medical, engineering and social sciences students were 29.1 vs. 38,2 vs. 41,0.

De sousa et al. (2018) [42] is a cross-sectional study from Portugal that measured the prevalence of anxiety and depressive symptoms in medical students from University of Lisbon and compared it to non-medical students from Lisbon School of Economics and Management (economics, finance, and management students). The study sample consisted of 761 eligible students, in which 750 were responding students including 512 medical students and 238 non-medical students. The authors used HADS to determine the prevalence of anxiety and depressive symptoms among the students (cut-off 11 and above). There was a significant higher prevalence of anxiety amongst medical students than among non-medical students (23,6% vs. 16,8%, p=0.034), but when controlled for gender the association was no longer significant, and there was no difference in p prevalence of depression between the two groups (3.5% vs. 4.2%, respectively).

Hilger-Kolb et al. (2018) [43] is a cross-sectional study that used data from the Nutrition and Physical activity (NuPha) study, an online survey among students from 46 universities in Germany. The NuPha study used PHQ-2 and GAD-2 (combined as the PHQ-4) to measure depressive and anxiety symptoms among the 689 responding students, including 284 medical students and 405 non-medical students. There was no significant difference in the prevalence for anxiety (15,5% vs. 15,9%) or depressive symptoms between the two student groups (14,9% vs. 15,6%). The study also studied the associations between academic stress (Effort-Reward Imbalance) and anxiety and depressive symptoms among the students. The association between Effort Reward Imbalance (or hazardous work stress) and the mental health measures (PHQ-2 and GAD-2) was stronger among the medical students compared to the non-medical students.

Summary of findings

Seventeen studies were included in this literature review. Seven of the studies assessed the prevalence of both anxiety and depressive symptoms among the students, whereas the remaining studies evaluate the prevalence of either anxiety or depressive symptoms. The main findings in our literature review is that the studies either show that there is not significant difference in the prevalence of anxiety and depressive symptoms between medical and non-medical students, or that medical students have a lower prevalence of anxiety and/or depressive symptoms. These findings seem to be different from the expectations of most people but are realistic findings in this systematic review. Seven out of 17 studies showed that medical students had a lower prevalence of anxiety and/or depressive symptoms compared to that among non-medical students [29, 30, 34, 36-38, 41]. Ten of the studies failed to find a significant difference in the prevalence of anxiety and/or depressive symptoms between medical and non-medical students.

The main finding in our literature review is that there is a lower or similar prevalence of anxiety and/or depressive symptoms among medical students compared to that among non-medical students. These findings seem to be different from the expectations of most people, but are realistic findings in this systematic review. Factors that are associated with anxiety and/or depressive symptoms among medical school in particular are: gender (female), curricular years, academic stress, life satisfaction, non-white ethnicity, previous mental health problems, and familial history of mental health problems

The studies were rated using Modified Newcastle-Ottawa scoring, and only eight of the 17 studies are qualified as good quality with low risk of bias. These articles had the same main findings, that medical students have a lower/similar prevalence of anxiety and depression compared to non-medical students.

Discussion

The major finding of this study was that the prevalence of anxiety and depressive symptoms among medical students was similar or lower than that among non-medical students. Seven articles out of 17 articles showed that prevalence of depressive and/or anxiety symptoms among medical students was lower than that among non-medical students. However, it is important to highlight that these articles have variation in quality, where only two articles are were high quality studies (Kaya et al., Honney et al.). Ten articles showed similar prevalence of depressive and anxiety symptoms between the two student groups.

Prevalence of depressive and anxiety levels among medical students compared with non-medical students

As mentioned in the introduction, mental health is common in the general public especially with depression being a contributor to global mortality [24]. While depressive and anxiety symptoms are rising, students seem to be more exposed to mental health issues. This reviews finding fits with the findings in other existing studies, showing that the prevalence of anxiety and depression symptoms are higher among students than in the general population. Starting university can be a big life transition for many people and with that follows a vulnerability for developing mental health issues. Higher anxiety and depressive symptoms among students could be explained by this vulnerability and time of change [34]. Many students also move from their partners or families, to live near campus. This implicates big lifestyle changes, with having to adjust to the new way of living [44]. With university there is also a lot of responsibility, not just for following the curriculum but also with excessive student related work such as extra classes and student associations, while also maintaining social activities. A study that researched the prevalence on perfectionism and imposter students, found a similar tendency between medical students and other student groups. Both groups had high prevalence of perfectionism and imposter syndrome, which again are factors related to psychological distress such as depressive and anxiety symptoms [45]. The trend towards perfectionism could be related to meeting a high expectation from both peers, family and even from oneself. Being in a position where they have to build their future, competing for jobs and paying of student debt could potentially be a driving force to academic pressure, with students setting unrealistic goals and expectations for themselves.

Our findings do however not fit with the assumption that medical students have a higher prevalence of anxiety or depressive symptoms than do other students. We found both lower prevalence of depressive and anxiety symptoms, or similar prevalence as the non-medical group. A reason why medical students may have scored lower on anxiety and depressive symptoms could be that fear of being judged or being stigmatized [34]. This has been suggested from previous studies as well. A study from 2014 found that medical students with moderate to severe depression felt embarrassed regarding their mental health condition or ashamed and even blamed for their mental health issues [46]. This could potentially be due to the fact that medical students work with patients themselves, therefore they feel like they have to be the caregiver and not the care receiver [47]. The fear of being labelled as week from other their peers may be a key reason for why medical students do not seek help for their problems. Another reason why medical students have lower prevalence of depressive and anxiety symptoms may be because they have great knowledge about diseases and symptoms, in which they perceive their psychological problems as medical. Earlier studies have also pointed out this perspective. A Portuguese study stated that some medical students might even self-medicate, which also have an impact on the prevalence of anxiety and depressive symptoms amongst medical students. [42, 48] Finally, medical students may not be very different to other clever students – they are part of the same socio-economic group – many with a similar family background to other students.

A study from New Zealand stated that the low prevalence in depressive symptoms among medical students compared to non-medical students could be due to a fewer number of female participants in the medical student group [37]. As with respect to anxiety in the study above, this could be due to not adjusting for sex in statistical analyses of samples that are not gender-balanced. Therefore, both sample sizes and gender distribution are crucial when evaluating studies on prevalence in mental health. This also highlight, that articles reviewed in this study include differences in sample size, which academic year the cross-sectional study took place and skewsness in some variables in the sample. Therefore, we cannot draw any precise correlations on these asssociations.

Factors associated with anxiety and depressive symptoms among the medical students

Some of our findings of contributing factors regarding anxiety and depressive symptoms amongst medical students, are contrary with the current studies.

The higher rate of anxiety among female medical student is in keeping with other research among students [49]. De Sousa et. al. found that anxiety symptoms were more prevalent in medical students compared to that in non-medical students. This finding was related to a higher number of female students in medical school and was supported because the study found a significant link between the female sex and the HADS-A scale. This implicates how the number of female participants in the selected group, affects the total prevalence of depressive and anxiety symptoms. Therefore, it is necessary to adjust for gender in statistical analyses of student samples. After adjusting for gender Bunevicius et. al. found that medical students had a significantly lower prevalence of anxiety symptoms compared to that among non-medical [30]

Prevalence of anxiety and depressive symptoms at different stages of medical school (academic years) were discrepant, in which there are contrary findings related academic year and prevalence of anxiety and depressive symptoms. Two studies pointed out that medical students experienced more depressive and anxiety symptoms near the end of medical school. This could be related with more contact with sick patients, while also having more responsibility regarding patientcare. While having to deal with both curriculum and in-clinic sessions, could affect both sleep and social activities which again is associated with mental health issues [35]. This finding has also been supported in a systematic review from the U.S, which implicated the prevalence of depressive symptoms to be higher in the later years rather than the first years of medical school [5]. Not only is it the workload and academic pressure that is present during the last years of medical training, but the distress could also be regarding future employment [29]. There is a high competition regarding enrollment in residency, and to stand out as an applicant students may put more pressure on themselves, which could implicate the reason why there is a higher pressure after the pre-clinical years [35].

Though the workload may be more during the following years in medical school, the increase in anxiety and depressive symptoms is contradictory to two studies that found higher prevalence of mental distress among students at first year/ preclinical year [36, 39]. The prevalence of anxiety among the first-year students, could be linked to stress concerning adaption to a new environment, while the decrease in symptoms later on may be because of adjusting to the environment [50, 51]. The discrepancy regarding mental health issues and curriculum years, could be related to these studies being cross-sectional, meaning they only assess information at a given time. To find more precise associations between curricular years and symptoms of mental illness among medical students, additional prospective studies are necessary.

Sleep is another factor contributing to mental health issues such as stress, among medical students [35]. One study in this review, examined the prevalence of sleep, stress, depressive and anxiety symptoms among medical students compared to non-medical students. The study found a correlation between sleep deprivation and stress, both being prevalent amongst medical students. These findings are in line with previous research. A study from 2017, presented similar findings, in which they found a high prevalence of poor sleep quality, with statistically significant association between stress and poor sleep [52]. Another literature review from 2015, pointed out the direct correlation between sleep deprivation and anxiety symptoms in medical students, identifying academic overload in medical school as a causal factor [53].

The high prevalence of stress amongst medical students compared to the general population is also in keeping with previous studies [2, 54, 55]. We found that stress among medical students were high, although it was not higher than other student populations. One study Nevertheless, high prevalence of stress among students correlates with anxiety and depressive symptoms [56] [57] [30] and other factors such as to academic performance [58] and suicidal ideation [59], making this an important factor which contribute to a negative influence on the mental health amongst medical student

Most of the studies we have used in this literature review assess a self-report questionnaire as the measurement-instrument for anxiety/depressive symptoms. HADS, BDI and PHQ are some examples of such measurement-instruments. Self-report questionnaires are frequently used in the general population but are also used by researchers. Making a choice of which kind of measurement-instrument to use in a study influences the study's validity and reliability.

Using Self-report questionnaires has advantages and disadvantages. One of the biggest advantages for our literature review is that using a Self-report questionnaire has given the studies used, the opportunity to utilize a large sample size. Using a Self-report questionnaire doesn't cost much and is very effective. It may also be an advantage that the questions are on a paper and aren't being asked by a person (the researchers), when it could be difficult to answer correctly in front of other people. It corresponds to a disadvantage of using Self-report questionnaires; the participants answer in a way that is more socially accepted, but not always correct (Social desirability bias). It could be that the answers given aren't valid. Another disadvantage of using a Self-report questionnaire is that it may be that the participants don't find the correct alternative to select, but they have to choose one of the alternatives, which would give a wrong a wrong answer [60]

Limitations and strengths

The initial focus on writing a systematic review helped us to do a specific and wide search, and we believe to have included nearly all comparison studies during the selected period, but we may still have missed some. A major strength is that we have included studies to compare the findings from different countries in the world, because this yields a broader and more representative view of this issue. The use of different instruments to measure anxiety and depressive symptoms might be a limitation, but, interestingly, the use of different measures has yielded similar main findings; a lower prevalence of anxiety and/or depressive symptoms among medical students [29, 34, 38]

A very important limitation is that it seems to be scarce research on this issue. We identified relatively few studies that compared medical students and non-medical students with respect to anxiety and depressive symptoms. Since we used a limited time period, we may also have lost important studies before 2000.

Another limitation to consider is the measurement-instrument HADS, which is the measurement-instrument used by three of the studies we have included in our literature review [38, 42, 57]. The measurement-instrument is designed for and validated among hospitalized patients, and it only measures the anxiety and depressive symptoms in the past week, whereas other instruments may have a longer timespan [42].Thus, we could have missed many students who have anxiety and/or depressive symptoms in these studies. Many of the students may have had anxiety and/or depressive symptoms earlier than the week before they filled out the questionnaire.

Conclusion

According to the articles we analyzed, medical students have either lower or similar prevalence of anxiety and/or depressive symptoms. Seven out of seventeen studies found a lower prevalence of anxiety and/or depressive symptoms among medical students compared to non-medical students. Nine of the articles reviewed found that there was a similar prevalence of the symptoms among medical students compared to non-medical students. Only one of the articles found a higher prevalence of anxiety and a similar prevalence of depressive symptoms among medical students compared to non-medical students. There are particular factors that are associated with anxiety and/or depressive symptoms regarding medical students specific, such as gender (female), curricular year, stress, sleep.

Our findings have a sparse quality because of the scarce research on this issue, and we need further research to be done to compare medical students with non-medical students. In particular, there is a need for larger and more representative sample studies, studies with diagnostic interviews that can assess valid anxiety and depressive disorder, and prospective and longitudinal studies that can identify possible risk factors associated with the medical curriculum.

Appendix 1

Some of the measurement instruments that were used in the studies:

BDI (Beck Depression Inventory) is a famous measurement-instrument for depressive symptoms worldwide. It measures the severity of depressive symptoms, and is often used for research. The measurement-instrument was first published in 1961, but has been altered since then. The current version of BDI is known as BDI-II and it was developed in 1996. The questionnaire is a self-report instrument with 21 items, where each item can be rated on a scale from 0-3. The total score determines the degree of depressive symptoms; minimal, mild, moderate or severe. The higher the score, the more severe are the depressive symptoms [29, 32, 36, 61, 62]

BAI (Beck Anxiety Inventory) is a self-report rating scale consisting of 21 items. It's used to measure the prevalence of anxiety symptoms in the same way as BDI is used to measure the prevalence of depressive symptoms. The questions are related to different features of anxiety and are rated on a scale from 0-3. As for the BDI, the sum in the BAI can also vary from 0-63, and determines the severity of depressive symptoms. Manchevska et. al. has ranked the different stages of depressive symptoms based upon the score on BAI as follows; 0-7: normal anxiety, 8-25: moderate anxiety, 26-63: high anxiety. [39, 61, 63]

HADS (Hospital Anxiety and Depression Scale) is a measurement-instrument developed in 1983 to detect the prevalence of anxiety and depression. It consists of 14 items in total, 7 related to anxiety and the other 7 related to depression. The measurement-instrument was originally developed to measure the prevalence of anxiety and depressive symptoms in hospitalized patients, but has also been used to detect symptoms in the general population. Each item is rated on a scale from 0-3, and the total score is made up by the two scores; one score (from 0-21 points) for anxiety and one score for depressive symptoms. The severity of the anxiety and depressive symptoms is ranked as follows; 0-7: normal, 8-10: borderline-normal, 11-21: moderate or severe symptoms (clinical relevant). [38, 42]

GHQ-28 (General Health Questionnaire - 28) is a self-administered measurement-instrument that measures how the participant's health in general has been over the past few

weeks. Several versions have been developed from the original version of GHQ with 60 items, and GHQ-28 that was developed in 1979 is one of these. This scaled version of GHQ focuses on 4 main areas; somatic symptoms, anxiety and insomnia, social dysfunction and severe depression. The original scoring system is that each item is rated according to the Likert scale that ranges from 0-3. Participants can get a score from 0-84. A score above 23 can indicate psychiatric symptoms..[31, 64]

DASS-21 (Depression Anxiety Stress Scale - 21) is a self-report questionnaire that appraise depression, anxiety and stress. The original version of DASS consists of 42 items. DASS-21 consists of 21 items, and each item is ranged from 0-3, following the Likert scale.[65]

PHQ (Patient Health Questionnaire) is a self-report questionnaire developed to be used as a measurement-tool to measure depression, anxiety, somatiaztion, alcohol and eating-disorder. There are different components of this questionnaire, including PHQ-9 and PHQ-2. PHQ-9 is The PHQ-9 is a depression specific questionnaire, containing 9 questions which are directly related to the diagnosis criteria in DSM-5. The short version for assessing depression is PHQ-2, which addresses depression while having a heart disease. PHQ-9 scores over 10 has a sensitivity of 88% and specificity of 88% for Major Depressive Disorder. [48, 66, 67]

Appendix 2:

This project thesis is written as a systematic review by two authors, Mariya Tehseen Anwar and Annam Iqbal. Supervisor professor Reidar Tyssen has given his contribution in the form of tutorials, correcting errors and contributing with writing the thesis and helping us with the grammar. He has also contributed with extra literature for us to discuss and to use in both introduction and discussion. Regarding the different parts of the thesis, both authors have been involved. Abstract is written in community by both authors. As for the results, we split up the studies in half so that we could effectively review and write down the finding. Both authors were involved with the selection process, regarding finding eligiable articles for the study. Our supervisor were involved with this as well, and helped us making the literature search using different databases.

	Country	Sample	Design	Assesment instrument	Sample size (=n)	Response rate	Results
Newbury-Birch et. al (2002)	England	Medical and dental students	Longitudinal study	HADS	295 and 132	Medical: 80%, 80 % Dental: and 71%, 80 %	MS had lower/similar prev MS had lower/ similar or
Kaya et al (2007)	Turkey	Medical and health services students	Cross sectional	BDI	437 and 499	80.5%	MS had lower prevalence
Bunevicius A. et al. (2008)	Lithuania	Medical and Humanities students	Randomized trial	HADS	360 and 84	94% and 87%	MS had significantly lowe MS had a similar prevalen
Bayati (2009)	Iran	Medical and. non medical students	Cross sectional	GHQ-28	172 and 132	57% and 43%	Not any difference in the p students
Curran et. al. (2009)	Ireland	Medical and business students	Cross sectional	BDI	317 and 222	48% and 86%	Not any significant differe
Alexandrino-silva et al (2009)	Brazil	Medical and non-medical students (nursing and pharmacy)	Cross sectional	BDI	989	56%, 56% and 61%	The prevalence of depressi nursing and pharmacy stud
Honney et al (2009)	England	Medical and non-medical students	Cross sectional	PHQ-9	2303 and 1920	24% and 16%	MS had a lower prevalence
Kongsomboon et al (2010)	Thailand	Medical and non-medical students (childrens literature, humanity studies)	Cross sectional	HRSR	646 and 103	91.8% and 96.1%	Not any significant differe NM- students
Lupo et al (2010	Israel	Medical and non medical students (humanities and science)	Cross sectional	BDI-2/BAI	119 and 51	- not specified	MS had lower levels of de students.
Samaranyake and Fernando (2011)	New Zealand	Medical and non-medical students (nursing, health science and architecture)	Cross sectional	PHQ and GAD	778	81%, and 78%, 50%, 78%	MS had a significantly low than non-medical students
Prinz et al (2012)	Germany	Medical and dental students	Cross sectional	HADS	109 and 73	- not specified	MS had a lower prevalence MS also scored lower on a

Author	Country	Population	Study design	Tool	Sample size	Response rate	Results
Manchevska et al (2014)	Macedonia	Medical and non-medical students (dental and law)	Cross sectional	BAI	742	- not specified	No significant difference i... students
Amarsuriya et al (2015)	Sri lanka	Medical and non-medical students	Cross sectional	PHQ-9/dual language questionnaire	620 and 4050	- not specified	No significant difference i... students
Dahlin et al (2011)	Sweden	Medical and business students	Cross sectional	MDI	500 and 500	81.6% and 69.3%	No significant difference i...
Naseem et al (2017)	Pakistan	Medical and non-medical students (ingenieer, social studies)	Cross sectional	DASS-21	100, 100 and 100	- not specified	MS had a significantly low... engineer and social studies
De sousa et. al (2018)	Portugal	Medical and non-medical students (economics, finance, management)	Cross sectional	HADS	521 and 240 (86, 81 and 73)	98% and 99%	No difference in the levels... No difference in the levels... students
Hilger-Kolb et al. (2018)	Germany	Medical vs. non-medical students	Cross sectional	PHQ-2/GAD-2	689	- not specified	No difference in the levels... No difference in the levels...

- *HADS: Hospital Anxiety and Aepression scale*
- *BDI: Beck Depression Inventory*
- *BAI: Beck Anxiety Inventory*
- *GHQ: General Health Questionnaire*
- *PHQ: Patient Health Questionnaire*
- *DASS: Depression Anxiety Stress Scale*
- *HRSR: Health-Related Self-Reported Scale*
- *MDI: Major Depression Inventory*
- *GAD: Generalized Anxiety Disorder*
- *MS: Medical students*
- *HS: humanities students*
- *HSHES: Health Services Higher Sducation School*
- *BS: business students*
- *NM: non-medical students*

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