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The effect of medical student debt on mental health, academic performance, and specialty choice: A systematic review

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The effect of medical student debt on mental health, academic performance, and specialty choice: A systematic review

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Key Words: medical student, debt, stress, mental health, academic performance, specialty choice, physician, well-being, vocation, loans, financial

Key Points:

Question: What are the effects of medical student debt on mental health, academic performance, and specialty choice?

Findings: Medical student debt was associated with the pursuit of higher paying specialties in the majority of studies. Debt was also associated with financial stress surrounding managing and repaying debt, and with worse academic outcomes.

Meaning: Medical student debt has multiple effects on medical students' and physicians' career choices, stress levels, and academic performance. Further work is warranted to better understand and mitigate the impact of medical student debt on the well-being of physicians and by extension, the quality of care delivered to their patients.

Abstract:

Objectives: With the high and rising total cost of medical school, medical student debt is an increasing concern for medical students and graduates, with significant potential to impact the well-being of physicians and their patients. We hypothesized that medical student debt levels would be negatively correlated with mental health and academic performance, and would influence career direction (i.e. medical specialty choice).

Design: We performed a systematic literature review to identify articles that assessed associations between medical student mental health, academic performance, specialty choice, and debt. The Databases PubMed, Medline, Embase, Scopus, and PsychInfo were searched on April 12, 2017 for combinations of the Medical Subject Headings *Medical Student* and *Debt*.

Results: 678 articles were identified, of which 52 met the inclusion criteria after being reviewed in full-text. The majority of studies were conducted in the United States of America (USA) with some from Canada, New Zealand, Scotland, and Australia. The most heavily researched aspect was the association between medical student debt and specialty choice, with the majority of studies finding that medical student debt was associated with pursuit of higher paying specialties. In addition, reported levels of financial stress were high among medical students, and correlated with debt. Finally, debt was also shown to be associated with poorer academic performance.

Conclusions: Medical student debt levels are negatively associated with mental well-being and academic outcomes, and high debt is likely to drive students toward choosing higher paying specialties. Additional prospective studies may be warranted, to better understand how educational debt loads are affecting the well-being, career preparation, and career choices of

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3 physicians-in-training, which may in turn impact the quality of care provided to their current
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5 and future patients.
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14 **Article Summary**

15 **Strengths and limitations of this study:**

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19 • **Strengths:**
 - 20 ○ A unique systematic review that evaluates and integrates the strength of the
 - 21 evidence for the effects of medical education debt on medical students' and future
 - 22 physicians' mental health, academic performance, and area of specialization.
 - 23 ○ 52 articles were included in the systematic review.
 - 24
25 • **Limitations:**
 - 26 ○ Does not assess evidence from primary literature that was not available in English.
 - 27 ○ Articles from only 5 countries met criteria for the systematic review.
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Introduction

As medical students' debt burdens rise along with the cost of education, the potential for this debt to significantly impact their well-being, career preparation, and career choices, and thus the quality of care that they can provide to their current and future patients, also grows. This debt has long been a concern for current and prospective medical students, as well as graduates. Education-related costs incurred by medical students may include, at minimum, housing and living expenses, health insurance, and tuition/fees, and most medical students incur significant debt to cover these costs, usually in the form of government or private loans. In the USA, median indebtedness at graduation was \$192,000 in 2017 compared to \$50,000 in 1992,^{1,2} which is an approximately 220% increase even after accounting for the rate of inflation. Increases in these costs have outpaced the relative compensation of primary care physicians and specialists, as well as grants and scholarships.³ The effects of this debt are significant and myriad; it can negatively impact mental health and academic performance, and influence specialty choice.^{4,5} This issue is of great importance with the recent focus on mental health concerns in medical students and physicians.^{6,7}

Background

Medical student debt is commonly accrued as a result of borrowing to cover the costs of medical school tuition fees, housing and living expenses. For many, this debt may be

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3 additive with pre-existing educational debt, the levels of which are already considered to
4 constitute a "student debt crisis" in many parts of the world, particularly the USA. Australia
5 has Commonwealth supported places (CSP) – i.e. subsidized university education, available to
6 all Australian Citizen university students through the Higher Education Contribution Scheme
7 – Higher Education Loan Programme (HECS-HELP), that does not incur interest and is repaid
8 once an income threshold is reached (\$51,957 for the 2018-2019 financial year).⁸ New Zealand
9 has a similar loan system to Australia, with Government Student Loan (GSL) schemes
10 available to all students. America offers 3 main types of loans: (1) Federal Loans, available to
11 all students studying at least half-time, the accumulating interest on which may be subsidized
12 (i.e. paid) or unsubsidized (not paid) by the government during the student's time in school, (2)
13 Stafford or Perkins loans that accrue interest but do not require repayment until 6 months after
14 graduation; and (3) private (unsubsidized) loans from third parties like banks or state loans,
15 sometimes offered directly from the student's college or state. Canada offers student loans to
16 those with financial need studying at least part-time, with a lifetime limit of 400 weeks for
17 those students enrolled in doctoral studies. These loans do not incur interest until the lifetime
18 limit is reached, and repayments are not commenced until 6 months after the student leaves or
19 completes their studies.⁹

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There is contrasting evidence regarding the extent to which debt influences choice of
medical specialty.¹⁰ Results have varied between studies, with high and low debt being
associated with desire for both high paying specialties and practice in primary care. The income
gap between primary care and subspecialist physicians has risen to nearly 3-fold in some
countries.¹¹ This wage gap may contribute to the role debt plays in specialty choice. It is
important to elucidate the extent to which debt affects these choices, particularly in regards to
high levels of physician burnout associated with unsatisfying career choices, and insufficient
numbers of primary care doctors in many countries.

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3 Despite these concerning statistics, few studies have explored how medical students'
4 debt affects their mental health and academic performance. It is important to investigate the
5 links between debt and these outcomes in order to inform interventions aimed at alleviating
6 links between debt and these outcomes in order to inform interventions aimed at alleviating
7 student stressors, and to guide specialty planning. This review was conducted to appraise the
8 available evidence regarding the extent to which medical student debt impacts mental health,
9 academic performance, and specialty choice.
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19 **Methods**

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21 Search Strategy: We searched the databases PubMed, Medline, Embase, Scopus, and
22 PsychInfo on April 12, 2017 for combinations of the Medical Subject Headings *Medical*
23 *Student* and *Debt* as search terms. A full string of search terms for PubMed is provided online
24 as a supplementary file (Figure S1). A language filter was then applied to exclude articles not
25 published in English. The databases were searched from inception: PubMed 1996, Medline
26 1946, Embase 1974, Scopus 2004, and PsychInfo 1967.
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35 Eligibility Criteria: After the application of this filter, articles were included if they
36 fulfilled the following criteria: 1) a primary clinical research paper; 2) specifically assessed
37 medical students (i.e. not mixed with other student groups); 3) reported on the effect of debt
38 on a) medical student mental health, b) academic performance, or c) specialty choice, and
39 finally; 4) available in full text.
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47 Selection of studies: We examined the titles and abstracts of the included publications
48 to determine if they met inclusion criteria. Those publications that were likely to meet the
49 eligibility criteria were reviewed in full-text before being included or excluded. Those for
50 which likely eligibility could not be determined from the title and abstract were also retrieved
51 in full text and analyzed for inclusion or exclusion. Inter-library requests were sent for any full
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3 texts that could not be accessed through the online databases. Reference lists of the included
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5 articles were searched for other studies that might be eligible.
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8 Data extraction and quality assessment: Extraction of the following data and quality
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10 assessment for each of the included articles was completed using a standardized form in
11
12 Microsoft Excel for Mac: study characteristics (description of study protocol, how results were
13
14 assessed); characteristics of the study population (sample size, stage of medical training,
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16 undergraduate or postgraduate degree, country of study); information to evaluate risk of bias
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18 (anonymity of surveys, selection bias, presence of control group, selective reporting bias,
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20 quality assessment as seen below); and finally, outcomes relevant to one of the three areas of
21
22 interest (mental health, academic performance or speciality choice).
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26 Quality of evidence: The quality of evidence of the included articles was assessed using
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28 the Oxford 2011 Level of Evidence, “Quality Rating Scheme for Studies and Other Evidence,”
29
30 a commonly accepted tool for rating evidence. It rates trials from 1-5 as follows: systematic
31
32 review with meta-analysis, prospective comparative cohort trial, retrospective cohort study,
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34 cross-section study, and case reports^{12,13}. The articles’ level of evidence assessment and
35
36 significant data points are summarised in Tables 1-3.
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40 Role of funding source: The University of Adelaide provided institutional funds for
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42 retrieval of inter-library requests.
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45 Patient and Public involvement: Patients and the public were not involved in this
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47 systematic review.
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51 **Results**

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53 On the initial database searches, 678 potential articles were identified. 667 of these were
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55 in English, and after reviewing these titles and abstracts, 220 were reviewed in full text. 52
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57 articles met the inclusion criteria and were included in this review (see Figure 1).
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4 **Figure 1:** Flowchart detailing results of the search strategy and application of the eligibility
5 criteria for a review of articles investigating the effects of medical student debt on mental
6 health, academic performance, or specialty choice.
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11 The majority of the identified (included) studies examined the influence of debt on
12 specialty choice. Only 13 articles assessed the influence of debt on (A) medical student mental
13 health^{5,14-25}. Four studies assessed debt in relation to (B) academic performance^{14,22,26,27}.
14 Forty-four articles assessed the relationship between debt and (C) specialty choice
15 4,5,10,11,16,17,20,21,24,25,28-61. Several articles fell under one or more of these categories.
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23 **A) Effect on mental health (see Table 1)**

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25 The 13 studies identified that assessed the impact of debt on different aspects of medical
26 student mental health included results from several countries: USA^{5,15,17,21,54}, Canada^{16,18,19,24},
27 New Zealand^{14,25}, Scotland²², and Australia²³ (Table 1). These studies mainly focused on the
28 effect of debt on stress levels, rather than on symptoms of anxiety or depression. Reported
29 levels of financial stress were typically high and correlated with debt levels.
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36 The publications with data collected from medical students in the USA found clear
37 correlation between higher levels of debt and stress levels. In a study of 3032 postgraduate
38 medical students, Rohlffing et al.²¹ found that each \$50,000 increase in medical student loan
39 debt was associated with increased self-reported stress. This stress was mainly financial, i.e.
40 related to concerns over repaying or managing debt. Another study found increasing debt levels
41 to be positively correlated with worry and negatively correlated with comfort.¹⁷
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50 Canadian studies demonstrated that junior students were more likely to report
51 significant stress associated with finances. For example, one study found first-year medical
52 students were more likely to report that their financial situation was very or extremely stressful
53 (20.5%) compared to fourth year students (17.5%).²⁴ Those earlier in their education were
54 found to have higher anticipated debt levels, which accounted for additional variance in
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3 reported stress levels.¹⁹ It was also found that rural students had higher levels of financial stress
4 compared to non-rural students.¹⁶ These results were consistent with those seen in a large study
5 by Merani et al.¹⁸ that examined the financial stress levels of 7795 medical students from
6 across Canada, including those in Quebec (where medical school tuition had remained stable),
7 compared to those outside Quebec (where medical student tuition had risen dramatically).¹⁸
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15 In contrast, a study of 170 New Zealand undergraduate students found that concern
16 about debt was higher in more senior (6th year) students, and predictably, in those who had
17 higher levels of debt.¹⁴ In this study, those who reported that they never worried about debt
18 (14%) had average debts of \$2500 (New Zealand Dollars; NZD), whereas those reporting that
19 they always worried about debt (7%) had on average \$86750 (NZD) in debt. These results were
20 supported by another New Zealand-based study, which showed a positive correlation between
21 worry and indebtedness, with 32% of all students reporting worrying about debt “often” or
22 “always.”²⁵ Studies from Scotland and Australia reported similar findings.^{22,23}
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Another study used a prompted-essay type format to examine how medical students in
the USA emotionally perceived debt in the context of career planning.⁵⁴ Common themes
highlighted by the authors suggested that the responding students felt their debt burdens
reflected a lack of societal investment in medical education; that their sacrifices related to that
debt were underappreciated by most outside of their profession; and that these debt burdens
and consequent sacrifices appeared to leave them feeling entitled to certain income and lifestyle
expectations going forward. Also concerning, Jackson et al. measured alcohol dependence in
medical students using the Alcohol Use Disorders Identification Test (AUDIT-C) screening
tool, and found alcohol abuse/dependence was significantly more common in those with
greater than \$100,000 (USD) in educational debt ($P < 0.01$).¹⁵ Nonetheless, the majority of
students considered their debt in a positive manner: 45% sought ways to avoid accumulating

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3 more, 22% managed debt proactively, and only 2% deliberately avoided thinking about debt's
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5 consequences and ways to manage it.⁵⁴
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8 9 **B) Effect on academic performance (see Table 2)**

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11 The correlation between academic performance and debt was only investigated in 4
12 articles^{4,22,26,27}, shown in Table 2. Debt was negatively correlated with academic performance
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14 in three of these reports^{4,22,26}, while one study showed no correlation between debt and attrition
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16 rates²⁷.
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20 One group found suboptimal academic outcomes in those with debts over \$10,000
21 (USD), and a progressive decrease in the percentage of students graduating with optimal
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23 outcomes as debt rose.²⁵ Ross et al. found that although there was no significant relationship
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25 between total debt and class rank, the students who reported that financial worries affected
26
27 their performance had lower class ranks and higher debt.²² Those who had a previous degree
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29 were also more likely to state that money affects their academic performance.²² Similarly, Gil
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31 et al. analyzed students' opinions of the effect of debt on their participation in the degree, and
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33 21% of respondents stated that debt "sometimes" impacted their ability to fully participate in
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35 their course of study.¹⁴ However, 46% stated debt never impacted them, and 31% said it rarely
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37 impacted them.¹⁴ Other studies have suggested that higher debt levels,⁶² or matriculation in
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39 MD-PhD programs that are not "fully funded" (i.e. not supported by federal MSTP funding),²⁷
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41 may increase likelihood of attrition from MD-PhD programs.
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49 **C) Effect on specialty choice (see Table 3)**

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51 The association between debt and specialty choice was assessed in a large number of
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53 studies^{4,5,10,11,16,17,20,21,24,25,28-61}, each of which are listed individually in Table 3. There were
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55 more longitudinal studies in this area than there were studies that assessed the impact of debt
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57 on mental health or academic performance. The studies typically divided specialty choices into
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3 high paying specialties versus low paying areas (most commonly family practice/primary care).
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5 Higher paying specialties typically included surgery, dermatology, neurology, ophthalmology,
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7 radiology, and other surgical and medical subspecialties. The results were varied. Overall, the
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9 majority (17) of the articles found that the presence of debt was associated with the choice of
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11 higher paying specialties ^{5,10,11,21,28-31,35,37,39,42-44,49,53,55,57}. 9 articles found that the presence of
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13 debt was associated with lower paying specialty choices ^{17,21,30,36,38,40,42,54,61}. A further 10
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15 articles said there was no or minimal effect, ^{32,33,41,45,46,50-52,60} and 11 articles found there was
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17 an association but did not further explore the nature of this relationship ^{4,16,17,24,25,34,47,48,54,58}.
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19 The majority of these studies were conducted in the USA.
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25 **i) Studies conducted in the USA examining the effect of debt on specialty choice**

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27 Sixteen articles from the USA ^{5,10,11,21,28-31,35,37,39,42-44,49,53,55,57} found that the presence
28
29 of significant debt was associated with higher paying specialty choice. Eight articles
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31 ^{17,21,30,36,38,40,42,54,61} found debt was associated to a greater degree with lower paying specialties
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33 like primary care/family practice and academic medicine, compared to other medical and
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35 surgical specialties. Nine USA publications found that debt did not significantly influence
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37 specialty choice ^{32,33,41,45,46,50-52,60}. Four studies ^{17,47,54,58} found that debt levels had an effect on
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39 specialty choice, but did not clarify in which direction.
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44 One of the most authoritative studies in this area was a longitudinal study of 4916 US
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46 medical students, conducted by Grayson et al. ³⁵ from 1992-2012. This study found that first-
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48 and fourth-year medical students wanting to pursue high paying non-primary care careers
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50 anticipated a greater debt burden, placed higher importance on income, and anticipated greater
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52 incomes, compared to their same-year peers seeking a career in primary care. Moreover, 31%
53
54 of those reporting intending to pursue primary care at Year 1 had decided to switch to a higher
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56 paying speciality by Year 4, with debt and income appearing to be driving factors.³⁵ Another
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58 longitudinal study by Jeffe et al. ³⁹ found that from 1997-2006, the proportion of medical
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3 students with at least \$150,000 total debt at graduation rose from 6.7% to 35.9%, in conjunction
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5 with a decline in the number of physicians pursuing generalized primary care. Similarly,
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7 Schwartz et al.¹¹ found greater debt in 2007 compared to 1990, and students in 2007 were
8
9 more likely to report that debt repayments pushed them away from primary care careers.
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12 Although less frequently examined, loan types were also found to play a role in
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14 specialty choice. For example, Bazzoli³⁰ examined both subsidized loans with lower interest
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16 rates that only accrue after graduation/residency, and Health Education Assistance Loans
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18 (HEAL) which had comparatively higher interest rates with accrual beginning from the date of
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20 taking the loan (i.e. unsubsidized). Higher relative debt accrued from subsidized loan programs
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22 seemed to predict primary care as a specialty choice, whereas higher (unsubsidized) HEAL
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24 debt was associated with higher paying specialties.³⁰
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30 **ii) Studies conducted outside of the USA examining the effect of debt on specialty choice**

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32 There were five Canadian studies^{16,24,34,49,59} that looked at the effect of debt on specialty
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34 choice. Three articles found there was an affect but did not specify the influence^{16,24,34}, one
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36 found higher debt was associated with a preference for family medicine⁵⁹, and the remaining
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38 publication found debt to be associated with higher paying specialties⁴⁹. Two reports found
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40 that current debt load affected urban students' preference for specialty choice, but had no
41
42 statistically significant influence for rural students.^{16,34} Vanasse et al.⁵⁹ found that higher
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44 expected debt upon completion of medical school was a strong predictor of desire to do family
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46 medicine. Morra et al.⁴⁹ provided an interesting possible insight into this pattern. This study
47
48 found that a large number of students agreed with the rationale that they should "Do family
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50 medicine as the residency is shorter and you can start paying off debt faster."⁴⁹
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55 Several studies were identified that studied the influence of debt on specialty choice in
56
57 New Zealand.^{4,25,48} In these studies, debt was found to influence specialty choice, but generally
58
59 it was not specified whether the directionality was toward higher paying specialties or primary
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3 care. McHardy et al.⁴⁸ found that 11% of students reported debt would have a significant
4 influence on their career choice. Likewise, Gill et al.⁴ found 16% of students stated level of
5 debt as an important and strong influence on their career choice. They also noted that in 6th
6 year students there was a slight trend for those with higher debt to exclude general practise
7 from their top 3 preferences but not to a statistically significant level.
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17 **Discussion:**

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19 The majority of studies meeting the eligibility criteria and examined in this review
20 support the notion that educational debt burden has a profound and often negative impact on
21 medical students. Many studies reported debt as having adverse effects on student stress levels,
22 and in some cases being associated with troubling patterns of alcohol use.¹⁵ Other reports
23 strongly suggested that debt may also adversely affect academic performance.
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31 Although few studies explored other aspects of students' mental health, one example
32 that did assess other aspects of their mental health was an Australian study by Rogers and
33 colleagues.²³ This study identified personality traits that accounted for variances in levels of
34 psychological stress: students with higher levels of extraversion, conscientiousness,
35 professional expectations, and lifestyle expectations, and lower levels of neuroticism, reported
36 better well-being. In addition, we are currently engaged in an ongoing prospective study aimed
37 at determining how debt levels, together with one's resiliency, interact and contribute to
38 psychological distress in medical students. Results from this study may underpin future
39 targeted interventional strategies to maximize medical student mental health.
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51 The influence of debt on specialty choice has been investigated much more extensively,
52 although the majority of these studies have been conducted in the USA. These studies have
53 produced conflicting results, and the generalizability of these findings to other countries with
54 different socioeconomic structures may be limited. Another significant finding evident in
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3 multiple studies was differences between urban and rural students. Students from urban
4
5 backgrounds were more likely to report debt as influencing their specialty choice and
6
7 increasing the likelihood of them choosing higher paying specialties. Conversely, those from
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9 rural backgrounds were less likely to report an effect despite commonly having greater debt
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11 levels and/or coming from lower socioeconomic backgrounds.^{16,34} Together these findings
12
13 illustrate the need to more clearly assess (and control for) whether one's socioeconomic
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15 background/financial liquidity in itself is a determinant of preferred practice area, with incurred
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17 debt being simply a consequence thereof – for example, do individuals of greater or lesser
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19 financial means gravitate toward higher or lower paying practice areas, and for what reasons –
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21 or are one's socioeconomic background and educational debt burden separate and independent
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23 predictors of specialty choice? Future studies in this area would help answer these key
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25 questions.
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31 The vast majority of studies identified were cross-sectional in nature. Of the 52 articles
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33 included, there were only 6 prospective studies^{27,35,39,40,47,57}, which primarily focused on the
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35 effects of debt on influencing specialty choice. The lack of longitudinal studies is important to
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37 consider, given the dynamic nature of debt and its capacity to compound. The majority of
38
39 studies employed self-report questionnaires. Likert scale-type responses were commonly used.
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41 Few studies were identified that used alternative methodologies such as interviews or focus
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43 groups, although at least one study used a prompted-essay response design.⁵⁴
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48 Furthermore, no qualifying studies could be located that examined the effects of
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50 interventions targeting debt on medical student mental health, academic performance, or
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52 specialty choice. Given debt's influence on these parameters as has been identified by the
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54 observational studies in this review, it may be reasonable to hypothesize that such interventions
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56 could influence these outcomes. Some possible debt-targeting interventions worth exploring
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58 for their effects on these outcomes, perhaps even in a prospective study, are loan forgiveness
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3 programs. Along a similar theme, one report compared the impact of unsubsidized versus
4 subsidized loans (a form of debt forgiveness) on speciality choice, and found those with greater
5 unsubsidized loan burdens were more likely to pursue higher paying specialties.³⁰ Further
6 research yielded additional information on loan forgiveness. The US Public Service Loan
7 Forgiveness program, established in 2007, advertises complete (remaining) loan forgiveness
8 for public-sector/non-profit employees after they have made 120 qualifying monthly payments.
9 One study found more future primary care physicians intended to use this program, compared
10 to programs expressly designed to promote primary care.⁶³ A survey on physician recruiting
11 incentives reported that for 31% of respondents, whether or not a potential employer (e.g. a
12 hospital) offered educational loan forgiveness as a job incentive would have a great effect on
13 selecting an offer.⁶⁴ More studies are needed in these areas, to determine whether loan
14 forgiveness or similar programs can obviate some the negative impacts that debt burden has on
15 medical student mental health, academic performance, and speciality choice.

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33 The majority of articles assessed whole-year level cohorts and were anonymous, which
34 helped to minimize any selective reporting bias. However, many studies had small sample
35 sizes, the smallest being twenty seven,³¹ while some sample sizes were not specified.³⁹ This
36 raises the issue of possible non-response bias, which could have influenced results in studies
37 with smaller sample sizes. There was also concern of differing stress levels depending on the
38 time of the year the survey was administered. Ross et al.²² acknowledged this, with their survey
39 being released just before the examination period, which may have contributed to general stress
40 levels as well as low response rate.

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51 We acknowledge the exclusion of non-English language publications as a potential
52 limitation of this review. Additionally, there is the possibility of selective outcome reporting
53 or publication bias that may have influenced the conclusions formed.

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3 Additional prospective studies investigating the effects of debt on all three areas
4 examined in this review are likely to be beneficial, especially as regards the influence of debt
5 on medical student mental health. Furthermore, the international generalizability of studies
6 conducted in other countries may be limited, due to a range of often significant cultural,
7 socioeconomic, socio-political, and structural differences regarding the costs and financial
8 responsibilities for medical education. Many countries around the world, for example, have far
9 greater opportunities for tuition-free medical education than others, thus making medical
10 education debt a non-issue for some students. Accordingly, studies examining these issues may
11 be warranted in countries in which it has not yet been examined. Future interventional studies
12 may be useful, for example in regard to addressing shortages of primary care physicians.
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29 **Conclusions**

30 Medical student debt is negatively associated with mental well-being, academic
31 outcomes and may drive physicians to practice in higher paying specialty areas rather than
32 primary care. Further prospective studies are warranted, and student debt may be a suitable
33 target for interventional studies aiming to improve or influence these outcomes in future.
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43
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Table 1: Articles investigating the effect on Mental Health

Study	Year	Sample Size	Study design	Significant Findings	Oxford level of evidence
USA Studies					
Hafferty, Boulger ⁵	1986	96	Cross-sectional survey	High levels of debt associated with concern about practise climate	4
Jackson, Shanafelt, Hasan, Satele, Dyrbye ¹⁵	2016	4402	Cross-sectional survey	32.4% met criteria for alcohol abuse/dependence. 80% had burnout, alcohol abuse/dependence or depressive symptoms at time of survey	4
Marci, Roberts ¹⁷	1998	100	Longitudinal Survey	Increasing debt levels positively correlated with worry and negatively correlated with comfort, specifically in those with debt greater than \$75000	3
Rohlfing, Navarro, Maniya, Hughes, Rogalsky ²¹	2014	3032	Cross-sectional survey	Each \$50,000 increase in medical Student loan debt was associated with increased stress, mainly financial.	4
Phillips, Wilbanks, Salinas, Doberneck ⁵⁴	2016	132	Cross sectional qualitative study	There were many themes on how students emotionally perceive debt including: debt symbolises lack of social investment, debt reinforces a sense of entitlement.	4
Canadian Studies					
Kwong, Dhalla, Streiner, Baddour, Waddell, Johnson ¹⁶	2005	2994	Cross-sectional Survey	Compared to non-rural, rural students reported more debt at both entry to medical school and upon graduation. They were also more likely to report fair-extreme levels of financial stress compared to non-rural (61.7% V 55.4%, p=0.03).	4
Merani, Abdulla, Kwong, Rosella, Streiner, Johnson, Dhalla ¹⁸	2010	7795	Longitudinal Survey	More students in 2007 than 2001 expected to graduate with debt (89.7% compared to 75.7%). Rose from \$14500 to \$30000 in Quebec but \$50K to \$90K outside Quebec (P<0.0001). Quebec students anticipated less debt and less likely to report financial stress than those outside Quebec.	3

Morra, Regehr, Ginsburg ¹⁹	2008	549	cross sectional survey	Perceived financial stress correlated significantly with both current debt (r=0.303) and anticipated debt (r=0.455). The anticipated debt was also able to account for an additional 11.5% of the variance in reported stress over that predicted by current debt alone.	4
Kwong, Dhalla, Streiner, Baddour, Waddell, Johnson ²⁴	2002	2994	Cross-sectional survey	Students reported that their financial situation was 'very' or 'extremely' stressful (21.4% V 26%), opposite result was found in control groups.	4
New Zealand Study					
Gill, Palmer, Mulder, Wilkinson ¹⁴	2001	179	Cross-sectional survey	Worrying about debt increased in 6th year students with levels of debt: those who never worried (14%) had debts of \$2500, those with always worried (7%) has \$86750. Frequency of worrying for all students was never (20%), rarely (10%), sometimes (34%), often (30%), always (5%)	4
Perry, Wilkinson ²⁵	2010	372	cross sectional survey	32% of students always or often worry about debt, 34% sometimes. The amount of worry was positively correlated with amount of debt.	4
Scottish Study					
Ross, Cleland, Macleod ²²	2006	352	Cross-sectional survey	42% reported stress about money contributed to up to 1/4 of their stress, nearly 16% stated stress about money made up >50% of their overall stress. 37.4% thought worrying about money affected their studies. Money came in has the 2nd most common cause of stress after coursework at 78.1%.	4
Australian Study					
Rogers, Creed, Searle ²³	2012	755	Cross-sectional survey	Barriers (including medical specialty choice, family and lifestyle conditions, male domination, hrs of work), concern about debt, academic stress accounted for 12.7% of variance on well-being.	4

Table 2: Articles investigating the effect on Academic Performance

Study	Year	Sample Size	Study design	Significant Findings	Oxford level of evidence
Gill, Palmer, Mulder, Wilkinson ¹⁴	2001	179	Cross sectional survey	Impact of debt: 46% said debt never impacted full participation in course, impaired rarely for 31%, sometimes for 21% and often for	4

				2%	
Ross, Cleland, Macleod ²²	2006	352	Cross sectional survey	No significant relationship between total debt and performance (as measured using class rank). Students who reported worrying about money affected their performance generally had lower ranks and higher outstanding debt, those who already had a degree were more likely to say that money affects their performance.	4
Andriole, Jeffe ²⁶	2010	86114	Retrospective longitudinal study	There was a progressive decrease in the percent of students graduating with optimal/passing scores with increasing debt levels: No debt-90.1%; 100-9999-86.8%; 10000-24999-87%; 25000-49999-83.6%; >/50000-76.4%	3
Jeffe, Andriole, Wathington, Tai ²⁷	2014	89948	Retrospective longitudinal study	Premedical debt was associated with MD-only graduation but not with withdrawal/dismissal compared with MD-PhD graduation. Higher premedical debt (>20K) was not independently associated with MD-PhD program attrition.	3

Table 3: Articles investigating the effect on Specialty Choice

Study	Year	Sample Size	Study design	Significant Findings	Oxford level of evidence
USA Studies Associating Debt with High Paying Specialties					
Hafferty, Boulger ⁵	1986	96	Cross sectional survey	Higher debt led to specialist medical fields over generalist	4
Colquitt, Zeh, Killian, Cultice ¹⁰	1996	N/A	Cross sectional (AAMC, HEAL)	High debt led to high paying specialties	4
Schwartz, Durning, Linzer, Hauer ¹¹	2011	2421	Longitudinal survey	Greater debt in 2007 compared to 1990 and students in 2007 were more likely to report that debt repayments pushed them away from primary care careers like internal medicine.	3
Andriole, Whelan, Jeffe ²⁸	2008	1833	Cross sectional survey (AAMC)	Lower debt led to high paying specialties	4
Azizzadeh, McCollum, Miller, Holliday, Shilstone, Lucci ²⁹	2003	111	Cross sectional survey	Lower concern about debt led to high paying specialties	4

Bazzoli ³⁰	1985	3855	Cross sectional survey	Higher subsidized debt led to primary care specialties (\$10000 increase in debt increases PC by 5.3%) Higher HEAL debt led to high paying specialties (\$10000 increase decreased PC by 7.5%)	4
Curran, Black, Depp, Iglewicz, Reichstadt, Palinkas, Jeste ³¹	2015	27	Cross sectional survey	In those not pursuing academic careers due to financial issues, the cited a need for adequate compensation due to debt.	4
Grayson, Newton, Thompson ³⁵	2012	4916	Longitudinal survey	High debt led to high paying specialties. Placed more value on anticipated higher income.	3
Hauer, Durning, Kernan, Fagan, Mintz, O'Sullivan, Battistone, DeFer, Elnicki, Harrell, Reddy, Boscardin, Schwartz ³⁷	2008	1177	Cross sectional survey	26.1% stated debt led to less attracted to internal medicine careers (generalist specialties)	4
Andriole, Jeffe ²⁶⁶	2010	N/A	Longitudinal survey (AAMC)	Higher debt led to less generalist/primary care specialty choices, but not associated with family medicine specialty choices.	3
Kassebaum, Szenas ⁴²	1993	12131	Cross sectional survey (AAMC)	Debt had a greater influence in those choosing surgical and support specialties compared to generalist and medical specialties. There was also a higher number of students citing an influence in the 1993 graduate class compared to the 1992 class. However, interest in generalist specialties increased during this time compared to the other specialties.	4
Kassebaum, Szenas ⁴³	1994	8128	Cross sectional survey (AAMC)	Limited influence but slightly higher for surgical (0.93) compared to generalist (0.54).	4
Kassebaum, Szenas, Caldwell ⁴⁴	1993	12096	Cross sectional survey (AAMC)	Underrepresented minority students were more likely to have debt than white and other non-underrepresented minorities (majority students). Minority cited debt as a strong or major influence more frequently, particularly in those wanting to pursue medical/surgical/support	4

				specialties compared to generalist certifications.	
Park ⁵³	1990	33499	Longitudinal survey (AAMC)	Highest mean debt in those who chose emergency medicine and surgical subspecialties in 1986 and 1989.	3
Rosenblatt, Andrilla ⁵⁵	2005	14240	Cross sectional survey (AAMC)	Increasing debt inversely correlated with choosing a PC specialty, greatest effect in debt exceeding \$150,000. However, only modest relationship after controlling for other characteristics. Factors like demographic (race, age, gender) has a more significant effect.	4
Rosenthal, Marquette, Diamond ⁵⁷	1996	326	Longitudinal survey	Higher debt associated with not choosing family practise specialties.	3

USA Studies Associating Debt with Low Paying Specialties

Phillips, Weismantel, Gold, Schwenk ²⁰	2010	983	Cross sectional survey	Those with any level of debt were two-times as likely to choose PC compared to no debt, but those with no debt were less likely to be underrepresented minorities and their families had higher incomes. Also, those from middle income families were less likely to choose primary care as their debt levels increased.	4
Rohlfing, Navarro, Maniya, Hughes, Rogalsky ²¹	2014	3032	Cross sectional survey	Each decrease in relative debt decreased salary of desired specialty by \$21,000, there was not a statistically significant relationship with an increase in relative debt. An increase in pre-medical student loan debt by \$20,000 increased chance of choosing a PC specialty. Contrarily, a decrease in relative debt as measured by an increased PECOAS (proportion of estimated cost of attendance saved) was also associated with choosing PC.	4
Bazzoli ³⁰	1985	3855	Cross sectional survey	Higher subsidized debt led to primary care specialties (\$10000 increase in debt increases PC by 5.3%) Higher HEAL debt led to high paying specialties (\$10000 increase decreased PC by 7.5%)	4
Greenberg, Ziegler, Borges, Elam, Stratton, Woods ³⁶	2013	239	Cross sectional survey	Higher debt led to academic medicine	4

Henderson, Hunt, Williams ³⁸	1996	144	Longitudinal survey (pre and post clerkship survey)	High debt led to primary care specialties	3
Jeffe, Andriole, Hageman, Whelan ⁴⁰	2008	87763	Retrospective longitudinal (AAMC)	Lower debt led to more likely to stay with academic medicine if considered initially. But doesn't increase chance of changing to academic medicine if didn't initially consider it.	3
Kassebaum, Szenas ⁴²	1994	8128	Cross sectional survey	Higher debt led to more generalist/primary care specialty choices. Increased citing debt as minor or moderate influence from 1992-1993 (23.6% → 28.5%) and strong/major (6.2% → 11.9%). However, increased interest in generalist specialties and decline in medical and support specialties. Declined interest in surgical specialties from public schools' graduates but increase from private school graduates.	4
McLaughlin, Daugherty, Rose, Goodman ⁶¹	1991	983	Longitudinal survey	Mean debt rising correlated with effect on 'choice of specialty', but weak relationship. Ratings of effect of debt greater in lower pay specialties compared to higher paying.	3
USA Studies which found no or minimal association between debt and specialty choice					
Diamond, Ruth, Markham, Rabinowitz, Rosenthal ³²	1994	104	Cross sectional survey (conjoint analysis)	Out of 6 factors asked for influencing specialty choice, loan repayment contributed 5% and debt 4% of variance in specialty choice. The other factors were more influential.	4
Gil, Waryasz, Liu, Daniels ³³	2016	415	Cross sectional survey (12 centres)	No significant influence	4
Kahn, Markert, Lopez, Specter, Randall, Krane ⁴¹	2006	2022	Retrospective longitudinal study	No significant influence	3
Kassebaum, Szenas, Schuchert ⁴⁵	1996	7848	Cross sectional study (AAMC)	No significant influence	3
Kassler, Wartman, Silliman ⁴⁶	1991	293	Cross sectional survey (8 medical schools)	No significant influence	4

Mutha, Takayama, O'Neil ⁵⁰	1997	52	Cross sectional study (group discussion)	No significant influence	4
Paiva, Vu, Verhulst ⁵²	1982	144	Cross Sectional Study	Level of education debt did not have a significant influence on career choices: 1.7% rating it as very important compared to approx. 73% rating it as none.	4
Wilbanks, Spollen, Messias ⁶⁰	2016	29227	Cross sectional study (AAMC 11-13)	Educational debt was ranked as the least influential factor in choosing a specialty out of the factors listed.	4
Rosenthal, Diamond, Rabinowitz, Bauer, Jones, Kearl, Kelly, Sheets, Jaffe, Jonas, et al. ⁵⁶	1994	688	Cross sectional study	Little difference in mean debt between those selecting PC and NPC. However, 10% of NPC students said they would change to PC if medical school loans were repaid.	4
USA Studies finding an association between debt and specialty choice but did not specify direction					
Marci, Roberts ¹⁷	1998	400	Longitudinal survey	At debt less than US\$75000 debt and influence on specialty choice not correlated. At debt US\$25000-\$75000 increasing debt correlated with increasing influence. At debt greater than US\$75000 had more influence on specialty choice.	3
Mader, Roseamelia, Morley ⁴⁷	2014	500	Longitudinal survey	Influence on specialty choice for 'amount of educational debt I have' rose in importance from the beginning of 1 st year to 3 rd year, while interest in content declined.	3
Phillips, Wilbanks, Salinas, Doberneck ⁵⁴	2016	132	Cross sectional qualitative (essays)	48% said debt limited career choice preferences.	4
Teitelbaum, Ehrlich, Travis ⁵⁸	2009	2345	Cross sectional survey (21 colleges of osteopathic medicine and 2 branch campuses)	As average debt increased, students were more likely to say it had an impact on specialty choice. However, 62.8% said debt had no impact.	4
Studies outside the USA finding an association between debt and specialty choice					
Canadian Studies					

Kwong, Dhalla, Streiner, Baddour, Waddell, Johnson ¹⁶	2005	2994	Cross Sectional Survey	More urban students reported that financial considerations around debt would be a major influence on specialty choice However, more rural students than urban students enter with debt and among those with debt have greater debt at both entry and completion of medical school.	4
Kwong, Dhalla, Streiner, Baddour, Waddell, Johnson ²⁴	2002	2994	Longitudinal Survey	Students reported debt being a major influence on choice of specialty and was higher in 1 st year students compared to 4 th year students. More students in 2000 (28.5%) compared to 1997 (21.2%) stated financial considerations would be a major influence on chosen practice location.	3
Gill, McLeod, Duerksen, Szafran ³⁴	2012	280	Cross Sectional Survey	Medical students with urban background: specialty choice influenced by current debt load	4
Morra, Regehr, Ginsburg ⁴⁹	2009	560	Cross Sectional Survey	Higher debt → higher paying specialty: 54-64% of students agreed with the statement that "it is better to do a specialty as you will make more money and be able to pay off your debt faster", with remainder agreeing that a student should "Do family medicine as the residency is shorter so you can start paying off your debt faster".	4
Vanasse, Orzanco, Courteau, Scott ⁵⁹	2011	1776	Cross Sectional Descriptive Survey	In the pre-clinical years, 30% of those intending to practise FM said doing a shorter residency is better to start paying off debt sooner while 28.8% of those intending to practise other specialties said it is better to do a specialty to make more money and pay off the debt. Similar results were found in the clinical years with 39.4% and 35.2% respectively.	4
New Zealand					
Gill, Palmer, Mulder, Wilkinson ⁴	2001	179	Cross Sectional Survey	In 6 th year students, there was a slight trend those with higher debt to exclude GP from their top 3 preferences, however this was not statistically significant. 16% stated level of debt as a very important and strong influence on career choice.	4
Perry, Wilkinson ²⁵	2010	372	Cross Sectional Survey	36% said debt influence specialty choice to at least a moderate amount or more. 13% said less debt would change specialty decision, location of work or doing locum work. Those with greater debt were more likely to say having less debt would affect their career choice	4

McHardy, Janssen, Poole ⁴⁸	2008	115	Cross Sectional Survey	11% reported degree of debt would have a significant influence on their career choice.	4
O'Grady, Fitzjohn ⁵¹	2001	407	Cross Sectional Survey	No significant influence, association between debt and likelihood of practising overseas: 31.3% of students with debt >60K planning to mainly or only practise overseas, compared to 20.3% of those with debts <60K	4

References

1. Licinio J, Wong ML. The pharmacogenomics of depression. *Pharmacogenomics J*. 2001;1(3):175-177.
2. Youngclaus J, Fresne JA. *Physician education debt and the cost to attend medical school: 2012 update*. Association of American Medical Colleges; 2013.
3. Steinbrook R. Medical Student Debt — Is There a Limit? *New England Journal of Medicine*. 2008;359(25):2629-2632.
4. Gill D, Palmer C, Mulder R, Wilkinson T. Medical student career intentions at the Christchurch School of Medicine. The New Zealand Wellbeing, Intentions, Debt and Experiences (WIDE) survey of medical students pilot study. Results Part II. *New Zealand Medical Journal*. 2001;114(1142):465-476.
5. Hafferty FW, Boulger JG. A look by medical students at medical practice in the future. *J Med Educ*. 1986;61(5):359-367.
6. Jorm AF. Why hasn't the mental health of Australians improved? The need for a national prevention strategy. *The Australian and New Zealand journal of psychiatry*. 2014;48(9):795-801.
7. Rotenstein LS, Ramos MA, Torre M, et al. Prevalence of Depression, Depressive Symptoms, and Suicidal Ideation Among Medical Students: A Systematic Review and Meta-Analysis. *JAMA*. 2016;316(21):2214-2236.

- 1
2
3 8. Hiroi N, Wong ML, Licinio J, et al. Expression of corticotropin releasing hormone
4 receptors type I and type II mRNA in suicide victims and controls. *Mol Psychiatry*.
5
6 2001;6(5):540-546.
7
- 8
9
10 9. Wong ML, Kling MA, Munson PJ, et al. Pronounced and sustained central
11
12 hypernoradrenergic function in major depression with melancholic features: relation
13
14 to hypercortisolism and corticotropin-releasing hormone. *Proc Natl Acad Sci U S A*.
15
16 2000;97(1):325-330.
17
- 18
19 10. Colquitt WL, Zeh MC, Killian CD, Cultice JM. Effect of debt on U.S. medical school
20
21 graduates' preferences for family medicine, general internal medicine, and general
22
23 pediatrics. *Acad Med*. 1996;71(4):399-411.
24
- 25
26 11. Schwartz MD, Durning S, Linzer M, Hauer KE. Changes in medical students' views
27
28 of internal medicine careers from 1990 to 2007. *Arch Intern Med*. 2011;171(8):744-
29
30 749.
31
- 32
33 12. JAMA Psychiatry JN. Instructions for Authors 2019;
34
35 <https://jamanetwork.com/journals/jamapsychiatry/pages/instructions-for-authors>.
36
- 37
38 13. CEBM. OCEBM Levels of Evidence - CEBM. 2019.
39
- 40
41 14. Gill D, Palmer C, Mulder R, Wilkinson T. Medical student debt at the Christchurch
42
43 School of Medicine. The New Zealand Wellbeing, Intentions, Debt and Experiences
44
45 (WIDE) survey of medical students pilot study. Results part I. *The New Zealand*
46
47 *medical journal*. 2001;114(1142):461-464.
48
- 49
50 15. Jackson ER, Shanafelt TD, Hasan O, Satele DV, Dyrbye LN. Burnout and Alcohol
51
52 Abuse/Dependence Among U.S. Medical Students. *Acad Med*. 2016;91(9):1251-
53
54 1256.
55
56
57
58
59
60

16. Kwong JC, Dhalla IA, Streiner DL, Baddour RE, Waddell AE, Johnson IL. A comparison of Canadian medical students from rural and non-rural backgrounds. *Canadian Journal of Rural Medicine*. 2005;10(1).
17. Marci CD, Roberts TG. The Increasing Debt of Medical Students: How Much Is Too Much? *JAMA*. 1998;280(21):1879-1880.
18. Merani S, Abdulla S, Kwong JC, et al. Increasing tuition fees in a country with two different models of medical education. *Med Educ*. 2010;44(6):577-586.
19. Morra DJ, Regehr G, Ginsburg S. Anticipated debt and financial stress in medical students. *Med Teach*. 2008;30(3):313-315.
20. Phillips JP, Weismantel DP, Gold KJ, Schwenk TL. Medical Student Debt and Primary Care Specialty Intentions. *Family medicine*. 2010;42(9):616-622.
21. Rohlfing J, Navarro R, Maniya OZ, Hughes BD, Rogalsky DK. Medical student debt and major life choices other than specialty. *Med Educ Online*. 2014;19:25603.
22. Ross S, Cleland J, Macleod MJ. Stress, debt and undergraduate medical student performance. *Med Educ*. 2006;40(6):584-589.
23. Rogers ME, Creed PA, Searle J. Person and environmental factors associated with well-being in medical students. *Personality and Individual Differences*. 2012;52(4):472-477.
24. Kwong JC, Dhalla IA, Streiner DL, Baddour RE, Waddell AE, Johnson IL. Effects of rising tuition fees on medical school class composition and financial outlook. *CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne*. 2002;166(8):1023-1028.
25. Perry WR, Wilkinson TJ. Taking the pulse: medical student workforce intentions and the impact of debt. *The New Zealand medical journal*. 2010;123(1318):15-23.

- 1
2
3 26. Andriole DA, Jeffe DB. Prematriculation variables associated with suboptimal
4 outcomes for the 1994-1999 cohort of US medical school matriculants. *JAMA*.
5
6 2010;304(11):1212-1219.
7
8
9
10 27. Jeffe DB, Andriole DA, Wathington HD, Tai RH. Educational outcomes for students
11 enrolled in MD-PhD programs at medical school matriculation, 1995-2000: a national
12 cohort study. *Acad Med*. 2014;89(1):84-93.
13
14
15
16 28. Andriole DA, Whelan AJ, Jeffe DB. Characteristics and career intentions of the
17 emerging MD/PhD workforce. *JAMA*. 2008;300(10):1165-1173.
18
19
20
21 29. Azizzadeh A, McCollum CH, Miller CC, Holliday KM, Shilstone HC, Lucci A.
22 Factors influencing career choice among medical students interested in surgery.
23
24 *Current Surgery*. 2003;60(2):210-213.
25
26
27
28 30. Bazzoli GJ. Does educational indebtedness affect physician specialty choice? *Journal*
29 *of Health Economics*. 1985;4(1):1-19.
30
31
32
33 31. Curran MA, Black M, Depp CA, et al. Perceived barriers and facilitators for an
34 academic career in geriatrics: medical students' perspectives. *Acad Psychiatry*.
35
36 2015;39(3):253-258.
37
38
39
40 32. Diamond JJ, Ruth DH, Markham FW, Rabinowitz HK, Rosenthal MP. Specialty
41 Selections of Jefferson Medical College Students. *Evaluation & the Health*
42 *Professions*. 2016;17(3):322-328.
43
44
45
46 33. Gil JA, Waryasz GR, Liu D, Daniels AH. Influence of Medical Student Debt on the
47 Decision to Pursue Careers in Primary Care. *Rhode Island medical journal* (2013).
48
49 2016;99(7):19-21.
50
51
52
53 34. Gill H, McLeod S, Duerksen K, Szafran O. Factors influencing medical students'
54 choice of family medicine: Effects of rural versus urban background. *Canadian*
55 *Family Physician*. 2012;58(11):e649-e657.
56
57
58
59
60

- 1
2
3 35. Grayson MS, Newton DA, Thompson LF. Payback time: the associations of debt and
4 income with medical student career choice. *Med Educ.* 2012;46(10):983-991.
5
6
7
- 8 36. Greenberg RB, Ziegler CH, Borges NJ, Elam CL, Stratton TD, Woods S. Medical
9 student interest in academic medical careers: a multi-institutional study. *Perspect Med*
10 *Educ.* 2013;2(5-6):298-316.
11
12
13
- 14 37. Hauer KE, Durning SJ, Kernan WN, et al. Factors associated with medical students'
15 career choices regarding internal medicine. *JAMA.* 2008;300(10):1154-1164.
16
17
18
- 19 38. Henderson MC, Hunt DK, Williams JW. General internists influence students to
20 choose primary care careers: The power of role modeling. *The American Journal of*
21 *Medicine.* 1996;101(6):648-653.
22
23
24
- 25 39. Jeffe DB, Whelan AJ, Andriole DA. Primary care specialty choices of United States
26 medical graduates, 1997-2006. *Acad Med.* 2010;85(6):947-958.
27
28
29
- 30 40. Jeffe DB, Andriole DA, Hageman HL, Whelan AJ. Reaping What We Sow: The
31 Emerging Academic Medicine Workforce. *Journal of the National Medical*
32 *Association.* 2008;100(9):1026-1035.
33
34
35
- 36 41. Kahn MJ, Markert RJ, Lopez FA, Specter S, Randall H, Krane NK. Is medical student
37 choice of a primary care residency influenced by debt? *MedGenMed : Medscape*
38 *general medicine.* 2006;8(4):18.
39
40
41
42
43
- 44 42. Kassebaum DG, Szenas PL. Relationship between indebtedness and the specialty
45 choices of graduating medical students: 1993 update. *Academic Medicine.*
46
47
48
49
50
51
- 52 43. Kassebaum DG, Szenas PL. Factors influencing the specialty choices of 1993 medical
53 school graduates. *Acad Med.* 1994;69(2):163-170.
54
55
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60

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- 2
- 3 44. Kassebaum DG, Szenas PL, Caldwell K. Educational debt, specialty choices, and
- 4
- 5 practice intentions of underrepresented-minority medical school graduates. *Academic*
- 6
- 7 *Medicine*. 1993;68(6):506-511.
- 8
- 9
- 10 45. Kassebaum DG, Szenas PL, Schuchert MK. Determinants of the generalist career
- 11
- 12 intentions of 1995 graduating medical students. *Acad Med*. 1996;71(2):198-209.
- 13
- 14 46. Kassler WJ, Wartman SA, Silliman RA. Why medical students choose primary care
- 15
- 16 careers. *Acad Med*. 1991;66(1):41-43.
- 17
- 18 47. Mader EM, Roseamelia C, Morley CP. The temporal decline of idealism in two
- 19
- 20 cohorts of medical students at one institution. *BMC Med Educ*. 2014;14:58.
- 21
- 22 48. McHardy KM, Janssen A, Poole PJ. Female medical students may accrue less student
- 23
- 24 loan debt than their male colleagues in New Zealand. *The New Zealand medical*
- 25
- 26 *journal*. 2008;121(1273):37-44.
- 27
- 28 49. Morra DJ, Regehr G, Ginsburg S. Medical students, money, and career selection:
- 29
- 30 students' perception of financial factors and remuneration in family medicine. *Family*
- 31
- 32 *medicine*. 2009;41(2):105-110.
- 33
- 34 50. Mutha S, Takayama JI, O'Neil EH. Insights into medical students' career choices
- 35
- 36 based on third- and fourth-year students' focus-group discussions. *Acad Med*.
- 37
- 38 1997;72(7):635-640.
- 39
- 40 51. O'Grady G, Fitzjohn J. Debt on graduation, expected place of practice, and career
- 41
- 42 aspirations of Auckland Medical School students. *The New Zealand medical journal*.
- 43
- 44 2001;114 1142:468 - 470.
- 45
- 46 52. Paiva RE, Vu NV, Verhulst SJ. The effect of clinical experiences in medical school
- 47
- 48 on specialty choice decisions. *Academic Medicine*. 1982;57(9):666-674.
- 49
- 50 53. Park R. Graduating medical students' debt and specialty choices. *Academic Medicine*.
- 51
- 52 1990;65(7):485-486.
- 53
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- 55
- 56
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2
3 54. Phillips JP, Wilbanks DM, Salinas DF, Doberneck DM. Educational Debt in the
4 Context of Career Planning: A Qualitative Exploration of Medical Student
5 Perceptions. *Teach Learn Med.* 2016;28(3):243-251.
6
7
8
9
10 55. Rosenblatt RA, Andrilla CH. The impact of U.S. medical students' debt on their
11 choice of primary care careers: an analysis of data from the 2002 medical school
12 graduation questionnaire. *Acad Med.* 2005;80(9):815-819.
13
14
15
16
17 56. Rosenthal MP, Diamond JJ, Rabinowitz HK, et al. Influence of income, hours
18 worked, and loan repayment on medical students' decision to pursue a primary care
19 career. *Jama.* 1994;271(12):914-917.
20
21
22
23
24 57. Rosenthal MP, Marquette PA, Diamond JJ. Trends along the debt-income axis.
25 *Academic Medicine.* 1996;71(6):675-677.
26
27
28
29 58. Teitelbaum HS, Ehrlich N, Travis L. Factors affecting specialty choice among
30 osteopathic medical students. *Acad Med.* 2009;84(6):718-723.
31
32
33 59. Vanasse A, Orzanco MG, Courteau J, Scott S. Attractiveness of family medicine for
34 medical students: influence of research and debt. *Canadian family physician Medecin*
35 *de famille canadien.* 2011;57(6):e216-227.
36
37
38
39
40 60. Wilbanks L, Spollen J, Messias E. Factors Influencing Medical School Graduates
41 Toward a Career in Psychiatry: Analysis from the 2011-2013 Association of
42 American Medical Colleges Graduation Questionnaire. *Acad Psychiatry.*
43
44
45
46
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48
49 61. McLaughlin MA, Daugherty SR, Rose W, H. , Goodman KJ. The Impact of Medical
50 School Debt on postgraduate Career and Lifestyle *Academic Medicine.*
51
52
53
54
55
56 62. Watt CD, Greeley SA, Shea JA, Ahn J. Educational views and attitudes, and career
57 goals of MD-PhD students at the University of Pennsylvania School of Medicine.
58
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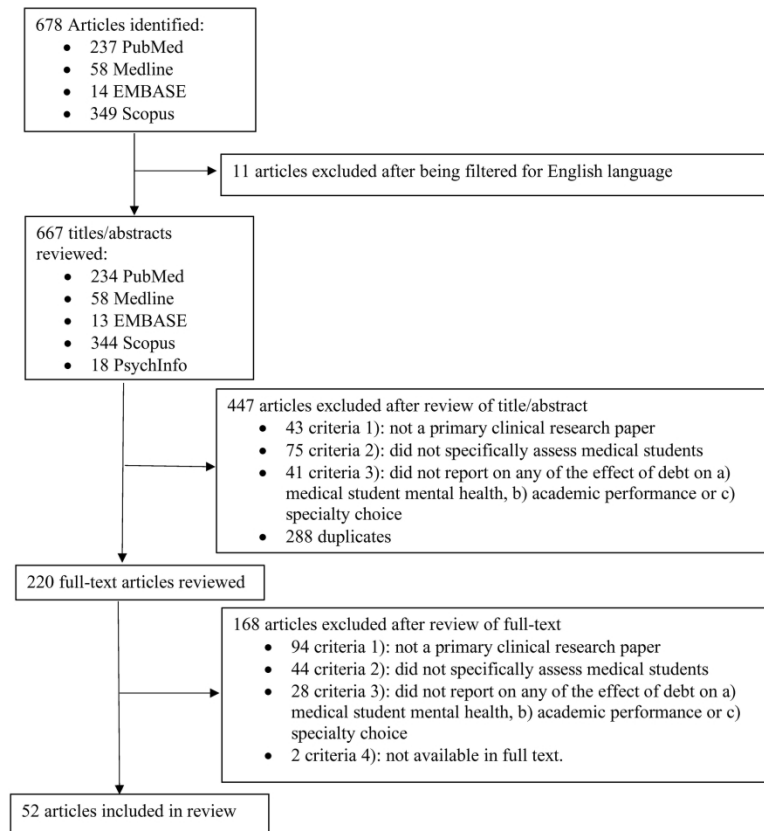
1
2
3 *Academic medicine : journal of the Association of American Medical Colleges.*

4
5 2005;80(2):193-198.

- 6
7
8 63. Friedman AB, Grischkan JA, Dorsey ER, George BP. Forgiven but not Relieved: US
9
10 Physician Workforce Consequences of Changes to Public Service Loan Forgiveness.
11
12 *J Gen Intern Med.* 2016;31(10):1237-1241.

- 13
14
15 64. Merritt-Hawkins. *2017 Survey of Final-Year Medical Residents.*

16
17 https://www.merritthawkins.com/uploadedfiles/mha_2017_resident_survey.pdf2017.



45 Figure 1: Flowchart detailing results of the search strategy and application of the eligibility criteria for a
46 review of articles investigating the effects of medical student debt on mental health, academic performance,
47 or specialty choice.

48 215x279mm (300 x 300 DPI)

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Full Search String

Databases Searched: PubMed, Medline, Embase, Scopus, and PsychInfo

Search string: PubMed

("students, medical"[MeSH Terms] OR ("students"[All Fields] AND "medical"[All Fields]) OR "medical students"[All Fields] OR ("medical"[All Fields] AND "student"[All Fields]) OR "medical student"[All Fields]) AND Debt[All Fields]

For peer review only



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	5, 6
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	6
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	N/A
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	7
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	7
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	7, 8
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	N/A
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	N/A



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	15
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7, 8
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	N/A
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	N/A
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	N/A
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	N/A
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	15, 16
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	17-23
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	15
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	15, 16
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	16, 17

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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BMJ Open

The effect of medical student debt on mental health, academic performance, and specialty choice: A systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-029980.R1
Article Type:	Research
Date Submitted by the Author:	30-Apr-2019
Complete List of Authors:	Pisaniello, Monique; The University of Adelaide, Adelaide, South Australia, Asahina, Adon; The University of Adelaide, Adelaide, South Australia Bacchi, Stephen; Royal Adelaide Hospital Wagner, Morganne; State University of New York Upstate Medical University Perry, Seth; State University of New York Upstate Medical University, Department of Psychiatry Wong, Ma-Li; State University of New York Upstate Medical University Licinio, Julio; State University of New York Upstate Medical University, Department of Psychiatry
Primary Subject Heading:	Mental health
Secondary Subject Heading:	Communication
Keywords:	medical student, debt, stress, MENTAL HEALTH, academic performance, specialty choice

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8 **specialty choice: A systematic review**
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14 Monique Pisaniello,* Adon Toru Asahina, Stephen Bacchi, Morganne Wagner, Seth W.
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55 **Word Count:** ~ 4000 (without citations)

56
57 **Key Words:** medical student, debt, stress, mental health, academic performance, specialty
58 choice, physician, well-being, vocation, loans, financial
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Key Points:

Question: What are the effects of medical student debt on mental health, academic performance, and specialty choice?

Findings: Medical student debt was associated with the pursuit of higher paying specialties in the majority of studies. Debt was also associated with financial stress surrounding managing and repaying debt, and with worse academic outcomes.

Meaning: Medical student debt has multiple effects on medical students' and physicians' career choices, stress levels, and academic performance. Further work is warranted to better understand and mitigate the impact of medical student debt on the well-being of physicians and by extension, the quality of care delivered to their patients.

Abstract:

Objectives: With the high and rising total cost of medical school, medical student debt is an increasing concern for medical students and graduates, with significant potential to impact the well-being of physicians and their patients. We hypothesized that medical student debt levels would be negatively correlated with mental health and academic performance, and would influence career direction (i.e. medical specialty choice).

Design: We performed a systematic literature review to identify articles that assessed associations between medical student mental health, academic performance, specialty choice, and debt. The Databases PubMed, Medline, Embase, Scopus, and PsychInfo were searched on April 12, 2017, for combinations of the Medical Subject Headings *Medical Student* and *Debt*. Updates were incorporated April 24, 2019.

Results: 678 articles were identified, of which 52 met the inclusion criteria after being reviewed in full-text. The majority of studies were conducted in the United States of America (USA) with some from Canada, New Zealand, Scotland, and Australia. The most heavily researched aspect was the association between medical student debt and specialty choice, with the majority of studies finding that medical student debt was associated with pursuit of higher paying specialties. In addition, reported levels of financial stress were high among medical students, and correlated with debt. Finally, debt was also shown to be associated with poorer academic performance.

Conclusions: Medical student debt levels are negatively associated with mental well-being and academic outcomes, and high debt is likely to drive students toward choosing higher paying specialties. Additional prospective studies may be warranted, to better understand how educational debt loads are affecting the well-being, career preparation, and career choices of physicians-in-training, which may in turn impact the quality of care provided to their current and future patients.

Article Summary

Strengths and limitations of this study:

Strengths:

- A unique systematic review that evaluates and integrates the strength of the evidence for the effects of medical education debt on medical students' and future physicians' mental health, academic performance, and area of specialization.
- 52 articles were included in the initial systematic review, with 7 added April 24, 2019.

Limitations:

- Does not assess evidence from primary literature that was not available in English.
- Articles from only 6 countries met criteria for the systematic review.

Introduction

As medical students' debt burdens rise along with the cost of education, the potential for this debt to significantly impact their well-being, career preparation, and career choices, and thus the quality of care that they can provide to their current and future patients, also grows. This debt has long been a concern for current and prospective medical students, as well as graduates. Education-related costs incurred by medical students may include, at minimum, housing and living expenses, health insurance, and tuition/fees, and most medical students incur significant debt to cover these costs, usually in the form of government or private loans. In the USA, median indebtedness at graduation was \$192,000 in 2017 compared to \$50,000 in 1992,^{1,2} which is an approximately 220% increase even after accounting for the rate of inflation. Increases in these costs have outpaced the relative compensation of primary care physicians and specialists, as well as grants and scholarships.³ The effects of this debt are significant and myriad; it can negatively impact mental health and academic performance, and influence specialty choice.^{4,5} This issue is of great importance with the recent focus on mental health concerns in medical students and physicians.^{6,7}

Background

Medical student debt is commonly accrued as a result of borrowing to cover the costs of medical school tuition fees, housing and living expenses. For many, this debt may be additive with pre-existing educational debt, the levels of which are already considered to constitute a "student debt crisis" in many parts of the world, particularly the USA. Australia has Commonwealth supported places (CSP) – i.e. subsidized university education, available to all Australian Citizen university students through the Higher Education Contribution Scheme – Higher Education Loan Programme (HECS-HELP), that does not incur interest and is repaid once an income threshold is reached (\$51,957 for the 2018-2019 financial year).⁸ New Zealand

1
2
3 has a similar loan system to Australia, with Government Student Loan (GSL) schemes
4 available to all students. America offers 3 main types of loans: (1) Federal Loans, available to
5 all students studying at least half-time, the accumulating interest on which may be subsidized
6 (i.e. paid) or unsubsidized (not paid) by the government during the student's time in school, (2)
7 Stafford or Perkins loans that accrue interest but do not require repayment until 6 months after
8 graduation; and (3) private (unsubsidized) loans from third parties like banks or state loans,
9 sometimes offered directly from the student's college or state⁹. Canada offers grants and
10 student loans to those with financial need studying at least part-time, which vary by province
11 and with stated lifetime limits up to 400 weeks (or 520 weeks for those with a permanent
12 disability).¹⁰ Typically these loans do not incur interest until the lifetime limit is reached, and
13 repayments are not commenced until 6 months after the student leaves or completes their
14 studies.¹⁰

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There is contrasting evidence regarding the extent to which debt influences choice of medical specialty.¹¹ Results have varied between studies, with high and low debt being associated with desire for both high paying specialties and practice in primary care. The income gap between primary care and subspecialist physicians has risen to nearly 3-fold in some countries.¹² This wage gap may contribute to the role debt plays in specialty choice. It is important to elucidate the extent to which debt affects these choices, particularly in regards to high levels of physician burnout associated with unsatisfying career choices, and insufficient numbers of primary care doctors in many countries.

Despite these concerning statistics, few studies have explored how medical students' debt affects their mental health and academic performance. It is important to investigate the links between debt and these outcomes in order to inform interventions aimed at alleviating student stressors, and to guide specialty planning. This review was conducted to appraise the

1
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3 available evidence regarding the extent to which medical student debt impacts mental health,
4
5 academic performance, and specialty choice.
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7 8 **Methods**

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10 Search Strategy: We searched the databases PubMed, Medline, Embase, Scopus, and
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12 PsychInfo on April 12, 2017 for combinations of the Medical Subject Headings *Medical*
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14 *Student* and *Debt* as search terms. A full string of search terms for PubMed is provided online
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16 as a supplementary file (Figure S1). A language filter was then applied to exclude articles not
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18 published in English. The databases were searched from inception: PubMed 1996, Medline
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20 1946, Embase 1974, Scopus 2004, and PsychInfo 1967. Updates were incorporated April 24,
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22 2019.
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26 Eligibility Criteria: After the application of this filter, articles were included if they
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28 fulfilled the following criteria: 1) a primary clinical research paper; 2) specifically assessed
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30 medical students (i.e. not mixed with other student groups); 3) reported on the effect of debt
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32 on a) medical student mental health, b) academic performance, or c) specialty choice, and
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34 finally; 4) available in full text.
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38 Selection of studies: The titles and abstracts of the included publications were examined
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40 by one author (MP), and consensus achieved in cases of uncertainty through discussion with a
41
42 second author (SB), to determine if they met inclusion criteria. Those publications that were
43
44 likely to meet the eligibility criteria were reviewed in full-text before being included or
45
46 excluded by one author (MP). To further reduce any possible selection bias, the suggested
47
48 included studies were then reviewed again by a second author (AA) with respect to eligibility.
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50 Those for which likely eligibility could not be determined from the title and abstract were also
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52 retrieved in full text and analyzed for inclusion or exclusion. Inter-library requests were sent
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54 for any full texts that could not be accessed through the online databases. Reference lists of the
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56 included articles were searched for other studies that might be eligible.
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3 Data extraction and quality assessment: Extraction of the following data and quality
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5 assessment for each of the included articles was completed using a standardized form in
6
7 Microsoft Excel® (Microsoft Corporation, Redmond, Washington, USA): study characteristics
8
9 (description of study protocol, how results were assessed); characteristics of the study
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11 population (sample size, stage of medical training, undergraduate or postgraduate degree,
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13 country of study); information to evaluate risk of bias (anonymity of surveys, selection bias,
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15 presence of control group, selective reporting bias, quality assessment as seen below); and
16
17 finally, outcomes relevant to one of the three areas of interest (mental health, academic
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19 performance or specialty choice).
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24 Quality of evidence: The quality of evidence of the included articles was assessed using
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26 the Oxford 2011 Level of Evidence, “Quality Rating Scheme for Studies and Other Evidence,”
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28 a commonly accepted tool for rating evidence. It rates trials from 1-5 as follows: systematic
29
30 review with meta-analysis, prospective comparative cohort trial, retrospective cohort study,
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32 cross-section study, and case reports^{13,14}. The articles’ level of evidence assessment and
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34 significant data points are summarized in Tables 1-3.
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38 Role of funding source: The University of Adelaide provided institutional funds for
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40 retrieval of inter-library requests.
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43 Patient and Public involvement: Patients and the public were not involved in this
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45 systematic review.
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48 49 **Results**

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51 On the initial database searches, 678 potential articles were identified. 667 of these were
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53 in English, and after reviewing these titles and abstracts, 220 were reviewed in full text. 52
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55 articles met the inclusion criteria and were included in this review (see Figure 1). A further 7
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57 articles were added in the April 2019 review.
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4 **Figure 1:** Flowchart detailing results of the search strategy and application of the eligibility
5 criteria for a review of articles investigating the effects of medical student debt on mental
6 health, academic performance, or specialty choice.
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11 The majority of the identified (included) studies examined the influence of debt on
12 specialty choice. Only fourteen articles assessed the influence of debt on (A) medical student
13 mental health ^{5,15-27}. Four studies assessed debt in relation to (B) academic performance
14 ^{15,23,28,29}. Fifty articles assessed the relationship between debt and (C) specialty choice
15 ^{4,5,11,12,17,18,21,22,25,26,30-69}. Several articles fell under one or more of these categories. All but one
16 ²⁷ of the additional articles from the 2019 review examined the effect on (C) specialty choice
17 ⁶⁴⁻⁶⁹.

27 **A) Effect on mental health (see Table 1)**

28
29 The 14 studies identified that assessed the impact of debt on different aspects of medical
30 student mental health included results from several countries: USA ^{5,16,18,22,56},
31 Canada^{17,19,20,25,27}, New Zealand ^{15,26}, Scotland ²³, and Australia ²⁴ (Table 1). These studies
32 mainly focused on the effect of debt on stress levels, rather than on symptoms of anxiety or
33 depression. Reported levels of financial stress were typically high and correlated with debt
34 levels at a statistically significant level ($p < 0.05$).
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43 The publications with data collected from medical students in the USA found clear
44 correlation between higher levels of debt and stress levels. In a study of 3032 postgraduate
45 medical students, Rohlfing, et al. ²² found that each \$50,000 increase in medical student loan
46 debt was associated with increased self-reported stress. This stress was mainly financial, i.e.
47 related to concerns over repaying or managing debt. Another study found increasing debt levels
48 to be positively correlated with worry and negatively correlated with comfort when rated on a
49 Likert scale.¹⁸
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3 Canadian studies demonstrated that junior students were more likely to report
4 significant stress associated with finances. For example, one study found first-year medical
5 students were more likely to report that their financial situation was very or extremely stressful
6 (20.5%) compared to fourth year students (17.5%).²⁵ Those earlier in their education were
7 found to have higher anticipated debt levels, which accounted for an additional 11.5% variance
8 in reported stress levels when added to current debt, over that predicted by current debt alone.²⁰
9
10 It was also found that rural students had higher levels of financial stress compared to non-rural
11 students.¹⁷ These results were consistent with those seen in a large study by Merani, et al. ¹⁹
12 that examined the financial stress levels of 7795 medical students from across Canada, lower
13 stress levels were experienced by students in Quebec (where medical school tuition had
14 remained stable), compared to those outside Quebec (where medical student tuition had risen
15 dramatically).¹⁹ A more recent 2018 study found that one of the predictors for burnout and
16 psychological distress was feeling psychologically/emotionally unsupported at their university,
17 which increased through the years of medical
18 training.²⁷ [file:///Users/moniquepisaniello/Dropbox/mental_health_research
19 project/final/revision_1/revision_2/72](file:///Users/moniquepisaniello/Dropbox/mental_health_research_project/final/revision_1/revision_2/72)
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40 In contrast, a study of 170 New Zealand undergraduate students found that concern
41 about debt was higher in more senior (6th year) students, and predictably, in those who had
42 higher levels of debt.¹⁵ In this study, those who reported that they never worried about debt
43 (14%) had average debts of \$2500 (New Zealand Dollars; NZD), whereas those reporting that
44 they always worried about debt (7%) had on average \$86750 (NZD) in debt. These results were
45 supported by another New Zealand-based study, which showed a positive correlation between
46 worry and indebtedness, with 32% of all students reporting worrying about debt “often” or
47 “always.”²⁶ Studies from Scotland and Australia reported similar findings.^{23,24}
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Another study used a prompted-essay type format to examine how medical students in the USA emotionally perceived debt in the context of career planning.⁵⁶ Common themes highlighted by the authors suggested that the responding students felt their debt burdens reflected a lack of societal investment in medical education; that their sacrifices related to that debt were underappreciated by most outside of their profession; and that these debt burdens and consequent sacrifices appeared to leave them feeling entitled to certain income and lifestyle expectations going forward. Also concerning, Jackson, et al.¹⁶ measured alcohol dependence in medical students using the Alcohol Use Disorders Identification Test (AUDIT-C) screening tool, and found alcohol abuse/dependence was significantly more common in those with greater than \$100,000 (USD) in educational debt ($P < 0.01$).¹⁶ Nonetheless, the majority of students considered their debt in a positive manner: 45% sought ways to avoid accumulating more, 22% managed debt proactively, and only 2% deliberately avoided thinking about debt's consequences and ways to manage it.⁵⁶

B) Effect on academic performance (see Table 2)

The correlation between academic performance and debt was only investigated in 4 articles^{4,23,28,29}, shown in Table 2. Debt was negatively correlated with academic performance in three of these reports^{4,23,28}, while one study showed no correlation between debt and attrition rates²⁹.

One group found suboptimal academic outcomes in those with debts over \$10,000 (USD), and a progressive decrease in the percentage of students graduating with optimal outcomes as debt rose. 90.1% of students with no debt achieved a passing score on their first attempt at a high stakes examination, while only 76.4% of those with debt $>$ \$50,000 passed on their first-attempt.²⁸ Ross, et al.²³ found that although there was no significant relationship between total debt and class rank, the students who reported that financial worries affected their performance had lower class ranks and higher debt.²³ Those who had a previous degree

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3 were also more likely to state that money affects their academic performance.²³ Similarly, Gill,
4 et al.¹⁵ analyzed students' opinions of the effect of debt on their participation in the degree,
5 and 21% of respondents stated that debt "sometimes" impacted their ability to fully participate
6 in their course of study.¹⁵ However, 46% stated debt never impacted them, and 31% said it
7 rarely impacted them.¹⁵ Other studies have suggested that higher debt levels,⁷⁰ or matriculation
8 in MD-PhD programs that are not "fully funded" (i.e. not supported by federal MSTP
9 funding),²⁹ may increase likelihood of attrition from MD-PhD programs.

20 21 **C) Effect on specialty choice (see Table 3)**

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23 The association between debt and specialty choice was assessed in a large number of
24 studies^{4,5,11,12,17,18,21,22,25,26,30-69}, each of which are listed individually in Table 3. There were
25 more longitudinal studies in this area than there were studies that assessed the impact of debt
26 on mental health or academic performance. The studies typically divided specialty choices into
27 high paying specialties versus low paying areas (most commonly family practice/primary care).
28 Higher paying specialties typically included surgery, dermatology, neurology, ophthalmology,
29 radiology, and other surgical and medical subspecialties. The results were varied. Overall, the
30 majority (21) of the articles found that the presence of debt was associated with the choice of
31 higher paying specialties^{5,11,12,22,30-33,37,39,41,44-46,51,55,57,59,64-67}. 9 articles found that the presence
32 of debt was associated with lower paying specialty choices^{17,22,32,38,40,42,44,56,63}. A further 10
33 articles said there was no or minimal effect,^{34,35,43,47,48,52-54,62} and 13 articles found there was
34 an association but did not further explore the nature of this relationship
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54 **i) Studies conducted in the USA examining the effect of debt on specialty choice**

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Twenty articles from the USA^{5,11,12,22,30-33,37,39,41,44-46,51,55,57,59,64-67} found that the
presence of significant debt was associated with higher paying specialty choice. Eight articles

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3 17,22,32,38,40,42,44,56,63 found debt was associated to a greater degree with lower paying specialties
4 like primary care/family practice and academic medicine, compared to other medical and
5 surgical specialties. Nine USA publications found that debt did not significantly influence
6 specialty choice^{34,35,43,47,48,52-54,62}. Four studies^{18,49,56,60} found that debt levels had an effect on
7 specialty choice, but did not clarify in which direction.

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15 One of the most authoritative studies in this area was a longitudinal study of 4916 US
16 medical students, conducted by Grayson, et al.³⁷ from 1992-2012. This study found that first-
17 and fourth-year medical students wanting to pursue high paying non-primary care careers
18 anticipated a greater debt burden, placed higher importance on income, and anticipated greater
19 incomes, compared to their same-year peers seeking a career in primary care. Moreover, 31%
20 of those reporting intending to pursue primary care at Year 1 had decided to switch to a higher
21 paying specialty by Year 4, with debt and income appearing to be driving factors.³⁷ Another
22 longitudinal study by Jeffe, et al.⁴¹ found that from 1997-2006, the proportion of medical
23 students with at least \$150,000 total debt at graduation rose from 6.7% to 35.9%, in conjunction
24 with a decline in the number of physicians pursuing generalized primary care. Similarly,
25 Schwartz, et al.¹² found greater debt in 2007 compared to 1990, and students in 2007 were
26 more likely to report that debt repayments pushed them away from primary care careers. More
27 recently, high debt levels (\$150,000-\$249,999) of family medicine residents were associated
28 with decreased odds of working in a government organization, and very high debt levels (>
29 \$250,000) associated with decreased odds of academic practice or geriatric fellowships.⁶⁴

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49 Although less frequently examined, loan types were also found to play a role in
50 specialty choice. For example, Bazzoli³² examined both subsidized loans with lower interest
51 rates that only accrue after graduation/residency, and Health Education Assistance Loans
52 (HEAL) which had comparatively higher interest rates with accrual beginning from the date of
53 taking the loan (i.e. unsubsidized). Higher relative debt accrued from subsidized loan programs
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3 seemed to predict primary care as a specialty choice, whereas higher (unsubsidized) HEAL
4 debt was associated with higher paying specialties.³² These findings were consistent with more
5 recent studies of osteopathic medical students,^{65,66}. Conversely, Nguyen, et al. ⁶⁷ found that
6 only 24% chose primary care despite having no student debt.
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13 **ii) Studies conducted outside of the USA examining the effect of debt on specialty choice**

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16 There were five Canadian studies ^{17,25,36,51,61} that looked at the effect of debt on specialty
17 choice. Three articles found there was an affect but did not specify the influence ^{17,25,36}, one
18 found higher debt was associated with a preference for family medicine ⁶¹, and the remaining
19 publication found debt to be associated with higher paying specialties ⁵¹. Two reports found
20 that current debt load affected urban students' preference for specialty choice, but had no
21 statistically significant influence for rural students.^{17,36} Vanasse, et al. ⁶¹ found that higher
22 expected debt upon completion of medical school was a strong predictor of desire to do family
23 medicine. Morra, et al. ⁵¹ provided an interesting possible insight into this pattern. This study
24 found that a large number of students agreed with the rationale that they should "Do family
25 medicine as the residency is shorter and you can start paying off debt faster."⁵¹
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39 Several studies were identified that studied the influence of debt on specialty choice in
40 New Zealand. ^{4,26,50,68} In these studies, debt was found to influence specialty choice, but
41 generally it was not specified whether the directionality was toward higher paying specialties
42 or primary care. McHardy, et al. ⁵⁰ found that 11% of students reported debt would have a
43 significant influence on their career choice. Likewise, Gill, et al. ⁴ found 16% of students stated
44 level of debt as an important and strong influence on their career choice. They also noted that
45 in 6th year students there was a slight trend for those with higher debt to exclude general practice
46 from their top 3 preferences but not to a statistically significant level. A more recent study from
47 New Zealand found complex relationships that varied with one's medical profession, and
48 preference for rural versus urban practice.⁶⁸
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3 One 2018 Singaporean study investigated the associations between economic factors
4 and residency choices. It found 40.5% of the 1241 students studied were to graduate with debt,
5 and these students were more likely to rank an economic factor as significantly influencing
6 their postgraduate training.⁶⁹
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10 11 12 **Discussion:** 13

14 The majority of studies meeting the eligibility criteria and examined in this review
15 support the notion that educational debt burden has a profound and often negative impact on
16 medical students. Many studies reported debt as having adverse effects on student stress levels,
17 and in some cases being associated with troubling patterns of alcohol use.¹⁶ Other reports
18 strongly suggested that debt may also adversely affect academic performance.
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26 Although few studies explored other aspects of students' mental health, one example
27 that did assess other aspects of their mental health was an Australian study by Rogers and
28 colleagues.²⁴ This study identified personality traits that accounted for variances in levels of
29 psychological stress: students with higher levels of extraversion, conscientiousness,
30 professional expectations, and lifestyle expectations, and lower levels of neuroticism, reported
31 better well-being. In addition, future work could aim to prospectively investigate the
32 interactions between resilience, debt, and psychological distress in medical students. Results
33 from such studies could underpin future targeted interventional strategies to maximize medical
34 student mental health.
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46 The influence of debt on specialty choice has been investigated much more extensively,
47 although the majority of these studies have been conducted in the USA. These studies have
48 produced conflicting results, and the generalizability of these findings to other countries with
49 different socioeconomic structures may be limited. Another significant finding evident in
50 multiple studies was differences between urban and rural students. Students from urban
51 backgrounds were more likely to report debt as influencing their specialty choice and
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3 increasing the likelihood of them choosing higher paying specialties. Conversely, those from
4 rural backgrounds were less likely to report an effect despite commonly having greater debt
5 levels and/or coming from lower socioeconomic backgrounds.^{17,36} Together these findings
6 illustrate the need to more clearly assess (and control for) whether one's socioeconomic
7 background/financial liquidity in itself is a determinant of preferred practice area, with incurred
8 debt being simply a consequence thereof – for example, do individuals of greater or lesser
9 financial means gravitate toward higher or lower paying practice areas, and for what reasons –
10 or are one's socioeconomic background and educational debt burden separate and independent
11 predictors of specialty choice? Future studies in this area would help answer these key
12 questions.
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26 The vast majority of studies identified were cross-sectional in nature. Of the 52 articles
27 included, there were only 6 prospective studies^{29,37,41,42,49,59}, which primarily focused on the
28 effects of debt on influencing specialty choice. The lack of longitudinal studies is important to
29 consider, given the dynamic nature of debt and its capacity to compound. The majority of
30 studies employed self-report questionnaires. Likert scale-type responses were commonly used.
31 Few studies were identified that used alternative methodologies such as interviews or focus
32 groups, although at least one study used a prompted-essay response design.⁵⁶
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42 Furthermore, no qualifying studies could be located that examined the effects of
43 interventions targeting debt on medical student mental health, academic performance, or
44 specialty choice. Given debt's influence on these parameters as has been identified by the
45 observational studies in this review, it may be reasonable to hypothesize that such interventions
46 could influence these outcomes. Some possible debt-targeting interventions worth exploring
47 for their effects on these outcomes, perhaps even in a prospective study, are loan forgiveness
48 programs. Along a similar theme, one report compared the impact of unsubsidized versus
49 subsidized loans (a form of debt forgiveness) on specialty choice, and found those with greater
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3 unsubsidized loan burdens were more likely to pursue higher paying specialties.³² Further
4 research yielded additional information on loan forgiveness. The US Public Service Loan
5 Forgiveness program, established in 2007, advertises complete (remaining) loan forgiveness
6 for public-sector/non-profit employees after they have made 120 qualifying monthly payments.
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8 One study found more future primary care physicians intended to use this program, compared
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10 to programs expressly designed to promote primary care.⁷¹ A survey on physician recruiting
11 incentives reported that for 31% of respondents, whether or not a potential employer (e.g. a
12 hospital) offered educational loan forgiveness as a job incentive would have a great effect on
13 selecting an offer.⁷² Findings from a very recent study of osteopathic medical graduates
14 "consistently showed that graduates with a loan forgiveness/repayment program were more
15 likely to choose primary care over graduates without such a program."⁶⁵ Another similar recent
16 study reported that osteopathic "graduates with the most debt intended to practice in
17 underserved areas at a higher percentage than those with the least amount of debt, and they
18 also planned on using loan-repayment programs at a higher rate."⁶⁶ More studies are needed
19 in these areas, to determine whether loan forgiveness or similar programs can obviate some the
20 negative impacts that debt burden has on medical student mental health, academic
21 performance, and specialty choice.
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42 Interestingly, while many studies supported the notion that significant medical school
43 debt may drive some graduates away from primary care or other lower paying practice areas,
44 particularly in the absence of loan repayment programs, the converse may not necessarily be
45 true: that is, at least one recent study suggests that the absence of medical student debt alone
46 does not appear to drive more graduates into primary care.⁶⁷
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54 The majority of articles assessed whole-year level cohorts and were anonymous, which
55 helped to minimize any selective reporting bias. However, many studies had small sample
56 sizes, the smallest being twenty seven,³³ while some sample sizes were not specified.⁴¹ This
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3 raises the issue of possible non-response bias, which could have influenced results in studies
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5 with smaller sample sizes. There was also concern of differing stress levels depending on the
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7 time of the year the survey was administered. Ross, et al.²³ acknowledged this, with their
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9 survey being released just before the examination period, which may have contributed to
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11 general stress levels as well as low response rate.
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15 Because our initial full search and meta-analysis was performed in April 2017, which
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17 is a potential limitation of this study for publication in 2019, we incorporated key search
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19 updates in April 24, 2019. This more recent search revealed similar findings to those already
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21 concluded, in particular the majority of articles being related to specialty choice. Examples of
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23 the most recent studies⁶⁴⁻⁶⁹ are included throughout the Results and Discussion above.
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27 We also recognize the exclusion of non-English language publications as a potential
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29 limitation of this review. Additionally, there is the possibility of selective outcome reporting
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31 or publication bias that may have influenced the conclusions formed.
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34 Additional prospective studies investigating the effects of debt on all three areas
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36 examined in this review are likely to be beneficial, especially as regards the influence of debt
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38 on medical student mental health. Furthermore, the international generalizability of studies
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40 conducted in other countries may be limited, due to a range of often significant cultural,
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42 socioeconomic, socio-political, and structural differences regarding the costs and financial
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44 responsibilities for medical education. Many countries around the world, for example, have far
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46 greater opportunities for tuition-free medical education than others, thus making medical
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48 education debt a non-issue for some students. Accordingly, studies examining these issues may
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50 be warranted in countries in which it has not yet been examined. Future interventional studies
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52 may be useful, for example in regard to addressing shortages of primary care physicians.
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58 **Conclusions**

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Medical student debt is negatively associated with mental well-being, academic outcomes and may drive physicians to practice in higher paying specialty areas rather than primary care. Further prospective studies are warranted, and student debt may be a suitable target for interventional studies aiming to improve or influence these outcomes in future.

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Table 1: Articles investigating the effect on Mental Health

Study	Year	Sample Size	Study design	Significant Findings	Oxford level of evidence
USA Studies					
Hafferty, et al. ⁵	1986	96	Cross sectional survey	High levels of debt associated with concern about practise climate	4
Jackson, et al. ¹⁶	2016	4402	Cross sectional survey	32.4% met criteria for alcohol abuse/dependence. 80% had burnout, alcohol abuse/dependence or depressive symptoms at time of survey	4
Marci, et al. ¹⁸	1998	100	Longitudinal Survey	Increasing debt levels positively correlated with worry and negatively correlated with comfort in a linear manner. Comfort with debt was rated from -3 (not comfortable) to +3 (very	3

				comfortable) on a Likert scale. For 1997 graduates with debt projections over \$75000, comfort level was rated significantly lower (-1.86 vs 0.89, P<0.001)	
Rohlfing, et al. ²²	2014	3032	Cross sectional survey	Each \$50,000 increase in medical Student loan debt was associated with increased stress, mainly financial. (Crude OR 1.54, 95% CI: 1.43, 1.67, Adjusted OR 1.55, 95% CI:1.34, 1.81).	4
Phillips, et al. ⁵⁶	2016	132	Cross sectional qualitative study	There were many themes on how students emotionally perceive debt including: debt symbolizes lack of social investment; debt reinforces a sense of entitlement.	4
Canadian Studies					
Kwong, et al. ¹⁷	2005	2994	Cross sectional Survey	Compared to non-rural, rural students reported more debt at both entry to medical school and upon graduation. They were also more likely to report fair-extreme levels of financial stress compared to non-rural (61.7% V 55.4%, p=0.03).	4
Merani, et al. ¹⁹	2010	7795	Longitudinal Survey	More students in 2007 than 2001 expected to graduate with debt (89.7% compared to 75.7%). Rose from \$14500 to \$30000 in Quebec but \$50K to \$90K outside Quebec (P<0.0001). Quebec students anticipated less debt and less likely to report financial stress than those outside Quebec.	3
Morra, et al. ²⁰	2008	549	Cross sectional survey	Perceived financial stress correlated significantly with both current debt (r=0.303) and anticipated debt (r=0.455). The anticipated debt was also able to account for an additional 11.5% of the variance in reported stress over that predicted by current debt alone.	4
Kwong, et al. ²⁵	2002	2994	Cross sectional survey	Students reported that their financial situation was 'very' or 'extremely' stressful (21.4% V 26%), opposite result was found in control groups.	4
McLuckie, et al. ²⁷	2017	381	Cross sectional survey	Feeling psychologically/emotionally unsupported at their university, which increased through the years of medical training, was a predictor of psychological distress and burnout. This risk was reduced in those who felt supported.	4
New Zealand Study					
Gill, et al. ¹⁵	2001	179	Cross-sectional survey	Worrying about debt increased in 6th year students with levels of debt: those who never worried (14%) had debts of \$2500, those with always worried (7%) has \$86750. Frequency of worrying for all	4

				students was never (20%), rarely (10%), sometimes (34%), often (30%), always (5%)	
Perry, et al. ²⁶	2010	372	Cross sectional survey	32% of students always or often worry about debt, 34% sometimes. The amount of worry was positively correlated with amount of debt.	4
Scottish Study					
Ross, et al. ²³	2006	352	Cross sectional survey	42% reported stress about money contributed to up to 1/4 of their stress, nearly 16% stated stress about money made up >50% of their overall stress. 37.4% thought worrying about money affected their studies. Money came in has the 2nd most common cause of stress after coursework at 78.1%.	4
Australian Study					
Rogers, et al. ²⁴	2012	755	Cross sectional survey	Barriers (including medical specialty choice, family and lifestyle conditions, male domination, hrs of work), concern about debt, academic stress accounted for 12.7% of variance on well-being.	4

Table 2: Articles investigating the effect on Academic Performance

Study	Year	Sample Size	Study design	Significant Findings	Oxford level of evidence
Gill, et al. ¹⁵	2001	179	Cross sectional survey	Impact of debt: 46% said debt never impacted full participation in course, impaired rarely for 31%, sometimes for 21% and often for 2%	4
Ross, et al. ²³	2006	352	Cross sectional survey	No significant relationship between total debt and performance (as measured using class rank). Students who reported worrying about money affected their performance generally had lower ranks and higher outstanding debt, those who already had a degree were more likely to say that money affects their performance.	4
Andriole, et al. ²⁸	2010	86114	Retrospective longitudinal study	There was a progressive decrease in the percent of students graduating with optimal/passing scores with increasing debt levels: No debt-90.1%; 100-9999-86.8%; 10000-24999-87%; 25000-49999-83.6%; >50000-76.4%	3
Jeffe, et al. ²⁹	2014	89948	Retrospective longitudinal study	Premedical debt was associated with MD-only graduation but not with withdrawal/dismissal	3

				compared with MD-PhD graduation. Higher premedical debt (>20K) was not independently associated with MD-PhD program attrition.	
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Table 3: Articles investigating the effect on Specialty Choice

Study	Year	Sample Size	Study design	Significant Findings	Oxford level of evidence
USA Studies Associating Debt with High Paying Specialties					
Hafferty, et al. ⁵	1986	96	Cross sectional survey	Higher debt led to specialist medical fields over generalist	4
Colquitt, et al. ¹¹	1996	N/A	Cross sectional (AAMC, HEAL)	High debt led to high paying specialties	4
Schwartz, et al. ¹²	2011	2421	Longitudinal survey	Greater debt in 2007 compared to 1990 and students in 2007 were more likely to report that debt repayments pushed them away from primary care careers like internal medicine.	3
Andriole, et al. ³⁰	2008	1833	Cross sectional survey (AAMC)	Lower debt led to high paying specialties	4
Azizzadeh, et al. ³¹	2003	111	Cross sectional survey	Lower concern about debt led to high paying specialties	4
Bazzoli ³²	1985	3855	Cross sectional survey	Higher subsidized debt led to primary care specialties (\$10000 increase in debt increases PC by 5.3%) Higher HEAL debt led to high paying specialties (\$10000 increase decreased PC by 7.5%)	4
Curran, et al. ³³	2015	27	Cross sectional survey	In those not pursuing academic careers due to financial issues, the cited a need for adequate compensation due to debt.	4
Grayson, et al. ³⁷	2012	4916	Longitudinal survey	High debt led to high paying specialties. Placed more value on anticipated higher income.	3
Hauer, et al. ³⁹	2008	1177	Cross sectional survey	26.1% stated debt led to less attracted to internal medicine careers (generalist specialties)	4
Andriole, et al. ²⁸⁶	2010	N/A	Longitudinal survey (AAMC)	Higher debt led to less generalist/primary care specialty choices, but not associated with family medicine specialty choices.	3
Kassebaum, et al. ⁴⁴	1993	12131	Cross sectional survey (AAMC)	Debt had a greater influence in those choosing surgical and support specialties compared to generalist and medical specialties. There was also a higher number of students citing an influence in the 1993 graduate class compared to the	4

				1992 class. However, interest in generalist specialties increased during this time compared to the other specialties.	
Kassebaum, et al. ⁴⁵	1994	8128	Cross sectional survey (AAMC)	Limited influence but slightly higher for surgical (0.93) compared to generalist (0.54).	4
Kassebaum, et al. ⁴⁶	1993	12096	Cross sectional survey (AAMC)	Underrepresented minority students were more likely to have debt than white and other non-underrepresented minorities (majority students). Minority cited debt as a strong or major influence more frequently, particularly in those wanting to pursue medical/surgical/support specialties compared to generalist certifications.	4
Nguyen, et al. ⁶⁷	2019	74	Cross sectional survey	Physicians who received full tuition and fee scholarships for college and medical school were surveyed for their specialty choice. Of the 74 respondents (54% response rate) only 18 went into primary care despite having no student debt.	4
Park ⁵⁵	1990	33499	Longitudinal survey (AAMC)	Highest mean debt in those who chose emergency medicine and surgical subspecialties in 1986 and 1989.	3
Phillips, et al. ⁶⁴	2019	6229	Cross sectional survey	High debt (\$150,000-\$249,999) was associated with lower odds of intention to work for government organizations in family medicine residents. Those with high debt or very high debt (> \$250,000) had lower odds of intention to pursue academic practice or a geriatrics fellowship.	4
Richards, et al. ⁶⁶	2018	6594	Longitudinal Survey	The proportion of students intending to practice in underserved areas from between 2007 and 2016 (27.5% to 35.3% and those with more debt were more likely to practice in underserved areas. These students also intended on using loan-repayment programs at a higher rate.	3
Rosenblatt, et al. ⁵⁷	2005	14240	Cross sectional survey (AAMC)	Increasing debt inversely correlated with choosing a PC specialty, greatest effect in debt exceeding \$150,000. However, only modest relationship after controlling for other characteristics. Factors like demographic (race, age, gender) has a more significant effect.	4
Rosenthal, et al. ⁵⁹	1996	326	Longitudinal survey	Higher debt associated with not choosing family practice specialties.	3
Scheckel, et al. ⁶⁵	2019	13097	Longitudinal Survey	Graduates who were above the 75 th percentile of debt moved more towards non-primary care positions, with an increase from 74.4% to 79.9% from 2007 to 2016. Over the same time period, there was greater interest in primary care positions in those below the 25 th percentile of debt, increasing from 24.6% to 29.4%. Graduates with a loan forgiveness/repayment program were more likely to choose primary care over graduates without such a program.	3

USA Studies Associating Debt with Low Paying Specialties					
Phillips, et al. ²¹	2010	983	Cross sectional survey	Those with any level of debt were two-times as likely to choose PC compared to no debt, but those with no debt were less likely to be underrepresented minorities and their families had higher incomes. Also, those from middle income families were less likely to choose primary care as their debt levels increased.	4
Rohlfing, et al. ²²	2014	3032	Cross sectional survey	Each decrease in relative debt decreased salary of desired specialty by \$21,000, there was not a statistically significant relationship with an increase in relative debt. An increase in pre-medical student loan debt by \$20,000 increased chance of choosing a PC specialty. Contrarily, a decrease in relative debt as measured by an increased PECOAS (proportion of estimated cost of attendance saved) was also associated with choosing PC.	4
Bazzoli ³²	1985	3855	Cross sectional survey	Higher subsidized debt led to primary care specialties (\$10000 increase in debt increases PC by 5.3%) Higher HEAL debt led to high paying specialties (\$10000 increase decreased PC by 7.5%)	4
Greenberg, et al. ³⁸	2013	239	Cross sectional survey	Higher debt led to academic medicine	4
Henderson, et al. ⁴⁰	1996	144	Longitudinal survey (pre and post clerkship survey)	High debt led to primary care specialties	3
Jeffe, et al. ⁴²	2008	87763	Retrospective longitudinal (AAMC)	Lower debt led to more likely to stay with academic medicine if considered initially. But doesn't increase chance of changing to academic medicine if didn't initially consider it.	3
Kassebaum, et al. ⁴⁴	1994	8128	Cross sectional survey	Higher debt led to more generalist/primary care specialty choices. Increased citing debt as minor or moderate influence from 1992-1993 (23.6% → 28.5%) and strong/major (6.2% → 11.9%). However, increased interest in generalist specialties and decline in medical and support specialties. Declined interest in surgical specialties from public schools' graduates but increase from private school graduates.	4
McLaughlin, et al. ⁶³	1991	983	Longitudinal survey	Mean debt rising correlated with effect on 'choice of specialty', but weak relationship. Ratings of effect of debt	3

				greater in lower pay specialties compared to higher paying.	
USA Studies which found no or minimal association between debt and specialty choice					
Diamond, et al. ³⁴	1994	104	Cross sectional survey (conjoint analysis)	Out of 6 factors asked for influencing specialty choice, loan repayment contributed 5% and debt 4% of variance in specialty choice. The other factors were more influential.	4
Gil, et al. ³⁵	2016	415	Cross sectional survey (12 centers)	No significant influence	4
Kahn, et al. ⁴³	2006	2022	Retrospective longitudinal study	No significant influence	3
Kassebaum, et al. ⁴⁷	1996	7848	Cross sectional study (AAMC)	No significant influence	3
Kassler, et al. ⁴⁸	1991	293	Cross sectional survey (8 medical schools)	No significant influence	4
Mutha, et al. ⁵²	1997	52	Cross sectional study (group discussion)	No significant influence	4
Paiva, et al. ⁵⁴	1982	144	Cross Sectional Study	Level of education debt did not have a significant influence on career choices: 1.7% rating it as very important compared to approx. 73% rating it as none.	4
	2016	29227	Cross sectional study (AAMC 11-13)	Educational debt was ranked as the least influential factor in choosing a specialty out of the factors listed.	4
Rosenthal, et al. ⁵⁸	1994	688	Cross sectional study	Little difference in mean debt between those selecting PC and NPC. However, 10% of NPC students said they would change to PC if medical school loans were repaid.	4
USA Studies finding an association between debt and specialty choice but did not specify direction					
Marci, et al. ¹⁸	1998	400	Longitudinal survey	At debt less than US\$75000 debt and influence on specialty choice not correlated. At debt US\$25000-\$75000 increasing debt correlated with increasing influence. At debt greater than US\$75000 had more influence on specialty choice.	3
Mader, et al. ⁴⁹	2014	500	Longitudinal survey	Influence on specialty choice for 'amount of educational debt I have' rose in importance from the beginning of 1 st year to 3 rd year, while interest in content declined.	3

1	Phillips, et al. ⁵⁶	2016	132	Cross sectional qualitative (essays)	48% said debt limited career choice preferences.	4
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3	Teitelbaum, et al. ⁶⁰	2009	2345	Cross sectional survey (21 colleges of osteopathic medicine and 2 branch campuses)	As average debt increased, students were more likely to say it had an impact on specialty choice. However, 62.8% said debt had no impact.	4
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20	Studies outside the USA finding an association between debt and specialty choice					
21	Canada					
22	Kwong, et al. ¹⁷	2005	2994	Cross Sectional Survey	More urban students reported that financial considerations around debt would be a major influence on specialty choice. However, more rural students than urban students enter with debt and among those with debt have greater debt at both entry and completion of medical school.	4
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28	Kwong, et al. ²⁵	2002	2994	Longitudinal Survey	Students reported debt being a major influence on choice of specialty and was higher in 1 st year students compared to 4 th year students. More students in 2000 (28.5%) compared to 1997 (21.2%) stated financial considerations would be a major influence on chosen practice location.	3
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36	Gill, et al. ³⁶	2012	280	Cross Sectional Survey	Medical students with urban background: specialty choice influenced by current debt load	4
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39	Morra, et al. ⁵¹	2009	560	Cross Sectional Survey	Higher debt → higher paying specialty: 54-64% of students agreed with the statement that "it is better to do a specialty as you will make more money and be able to pay off your debt faster", with remainder agreeing that a student should "Do family medicine as the residency is shorter so you can start paying off your debt faster".	4
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46	Vanasse, et al. ⁶¹	2011	1776	Cross Sectional Descriptive Survey	In the pre-clinical years, 30% of those intending to practise FM said doing a shorter residency is better to start paying off debt sooner while 28.8% of those intending to practise other specialties said it is better to do a specialty to make more money and pay off the debt. Similar results were found in the clinical years with 39.4% and 35.2% respectively.	4
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55	New Zealand					
56	Gill, et al. ⁴	2001	179	Cross Sectional Survey	In 6 th year students, there was a slight trend those with higher debt to exclude GP from their top 3 preferences, however this was not statistically significant.	4
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				16% stated level of debt as a very important and strong influence on career choice.	
Ling, et al. ⁶⁸	2018	3121	Cross sectional survey	Medical and pharmacy students with higher debt were more likely to prefer rural practice. Medical students exhibited little influence of debt on career choice, and those with higher levels of debt were less concerned over career financial prospects. There was no correlation between debt level and interest in a primary care specialty	4
Perry, et al. ²⁶	2010	372	Cross Sectional Survey	36% said debt influence specialty choice to at least a moderate amount or more. 13% said less debt would change specialty decision, location of work or doing locum work. Those with greater debt were more likely to say having less debt would affect their career choice	4
McHardy, et al. ⁵⁰	2008	115	Cross Sectional Survey	11% reported degree of debt would have a significant influence on their career choice.	4
O'Grady, et al. ⁵³	2001	407	Cross Sectional Survey	No significant influence, association between debt and likelihood of practicing overseas: 31.3% of students with debt >60K planning to mainly or only practise overseas, compared to 20.3% of those with debts <60K	4
Singapore					
Fong, et al. ⁶⁹	2018		Cross Sectional Survey	40.5% of the 1241 students studied were to graduate with debt. Those with debt (unadjusted OR 1.623, 95% CI 1.261-2.090, p<0.001; adjusted OR 1.393, 95% CI 1.048-1.851, p=0.022) were more likely to have an economic factor very significantly influencing postgraduate training choices.	4

References

1. Medical student education: Debt, costs, and loan repayment fact card. *Association of American Medical Colleges*.
2. Youngclaus J, Fresne JA. *Physician education debt and the cost to attend medical school: 2012 update*. Association of American Medical Colleges; 2013.
3. Steinbrook R. Medical Student Debt — Is There a Limit? *New England Journal of Medicine*. 2008;359(25):2629-2632.
4. Gill D, Palmer C, Mulder R, Wilkinson T. Medical student career intentions at the Christchurch School of Medicine. *The New Zealand Wellbeing, Intentions, Debt and*

- 1
2
3 Experiences (WIDE) survey of medical students pilot study. Results Part II. *New*
4 *Zealand Medical Journal*. 2001;114(1142):465-476.
5
6
7
8 5. Hafferty FW, Boulger JG. A look by medical students at medical practice in the
9 future. *J Med Educ*. 1986;61(5):359-367.
10
11
12 6. Jorm AF. Why hasn't the mental health of Australians improved? The need for a
13 national prevention strategy. *The Australian and New Zealand journal of psychiatry*.
14 2014;48(9):795-801.
15
16
17 7. Rotenstein LS, Ramos MA, Torre M, et al. Prevalence of Depression, Depressive
18 Symptoms, and Suicidal Ideation Among Medical Students: A Systematic Review
19 and Meta-Analysis. *JAMA*. 2016;316(21):2214-2236.
20
21
22 8. Study Assist - Loan repayment. [https://www.studyassist.gov.au/paying-back-my-](https://www.studyassist.gov.au/paying-back-my-loan/loan-repayment)
23 [loan/loan-repayment](https://www.studyassist.gov.au/paying-back-my-loan/loan-repayment). Accessed 27/08/2018.
24
25
26 9. Norwood A. The 3 Main Categories Of Financial Aid.
27 [https://www.saltmoney.org/content/media/Article/the-three-main-categories-of-](https://www.saltmoney.org/content/media/Article/the-three-main-categories-of-financial-aid/_R-101-18405?WT.mc_id=ME-ASAORG&unblocked=true)
28 [financial-aid/_R-101-18405?WT.mc_id=ME-ASAORG&unblocked=true](https://www.saltmoney.org/content/media/Article/the-three-main-categories-of-financial-aid/_R-101-18405?WT.mc_id=ME-ASAORG&unblocked=true). Accessed
29 27/08/2018.
30
31
32 10. Student Financial Assistance.
33 <https://www.canada.ca/en/services/jobs/education/student-financial-aid.html>.
34 Accessed 27/08/2018.
35
36
37 11. Colquitt WL, Zeh MC, Killian CD, Cultice JM. Effect of debt on U.S. medical school
38 graduates' preferences for family medicine, general internal medicine, and general
39 pediatrics. *Acad Med*. 1996;71(4):399-411.
40
41
42 12. Schwartz MD, Durning S, Linzer M, Hauer KE. Changes in medical students' views
43 of internal medicine careers from 1990 to 2007. *Arch Intern Med*. 2011;171(8):744-
44 749.
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 13. JAMA Psychiatry JN. Instructions for Authors 2019;
4
5 <https://jamanetwork.com/journals/jamapsychiatry/pages/instructions-for-authors>.
6
7
- 8 14. CEBM. OCEBM Levels of Evidence - CEBM. 2019.
9
- 10 15. Gill D, Palmer C, Mulder R, Wilkinson T. Medical student debt at the Christchurch
11 School of Medicine. The New Zealand Wellbeing, Intentions, Debt and Experiences
12 (WIDE) survey of medical students pilot study. Results part I. *The New Zealand*
13 *medical journal*. 2001;114(1142):461-464.
14
15
- 16 16. Jackson ER, Shanafelt TD, Hasan O, Satele DV, Dyrbye LN. Burnout and Alcohol
17 Abuse/Dependence Among U.S. Medical Students. *Acad Med*. 2016;91(9):1251-
18 1256.
19
- 20 17. Kwong JC, Dhalla IA, Streiner DL, Baddour RE, Waddell AE, Johnson IL. A
21 comparison of Canadian medical students from rural and non-rural backgrounds.
22 *Canadian Journal of Rural Medicine*. 2005;10(1).
23
24
- 25 18. Marci CD, Roberts TG. The Increasing Debt of Medical Students: How Much Is Too
26 Much? *JAMA*. 1998;280(21):1879-1880.
27
28
- 29 19. Merani S, Abdulla S, Kwong JC, et al. Increasing tuition fees in a country with two
30 different models of medical education. *Med Educ*. 2010;44(6):577-586.
31
32
- 33 20. Morra DJ, Regehr G, Ginsburg S. Anticipated debt and financial stress in medical
34 students. *Med Teach*. 2008;30(3):313-315.
35
36
- 37 21. Phillips JP, Weismantel DP, Gold KJ, Schwenk TL. Medical Student Debt and
38 Primary Care Specialty Intentions. *Family medicine*. 2010;42(9):616-622.
39
40
- 41 22. Rohlfing J, Navarro R, Maniya OZ, Hughes BD, Rogalsky DK. Medical student debt
42 and major life choices other than specialty. *Med Educ Online*. 2014;19:25603.
43
44
- 45 23. Ross S, Cleland J, Macleod MJ. Stress, debt and undergraduate medical student
46 performance. *Med Educ*. 2006;40(6):584-589.
47
48
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 24. Rogers ME, Creed PA, Searle J. Person and environmental factors associated with
4 well-being in medical students. *Personality and Individual Differences*.
5
6 2012;52(4):472-477.
7
8
9
10 25. Kwong JC, Dhalla IA, Streiner DL, Baddour RE, Waddell AE, Johnson IL. Effects of
11 rising tuition fees on medical school class composition and financial outlook. *CMAJ :
12 Canadian Medical Association journal = journal de l'Association medicale
13 canadienne*. 2002;166(8):1023-1028.
14
15
16
17
18 26. Perry WR, Wilkinson TJ. Taking the pulse: medical student workforce intentions and
19 the impact of debt. *The New Zealand medical journal*. 2010;123(1318):15-23.
20
21
22
23 27. McLuckie A, Matheson KM, Landers AL, et al. The Relationship Between
24 Psychological Distress and Perception of Emotional Support in Medical Students and
25 Residents and Implications for Educational Institutions. *Acad Psychiatry*.
26
27 2018;42(1):41-47.
28
29
30
31
32 28. Andriole DA, Jeffe DB. Prematriculation variables associated with suboptimal
33 outcomes for the 1994-1999 cohort of US medical school matriculants. *JAMA*.
34
35 2010;304(11):1212-1219.
36
37
38
39 29. Jeffe DB, Andriole DA, Wathington HD, Tai RH. Educational outcomes for students
40 enrolled in MD-PhD programs at medical school matriculation, 1995-2000: a national
41 cohort study. *Acad Med*. 2014;89(1):84-93.
42
43
44
45
46 30. Andriole DA, Whelan AJ, Jeffe DB. Characteristics and career intentions of the
47 emerging MD/PhD workforce. *JAMA*. 2008;300(10):1165-1173.
48
49
50
51 31. Azizzadeh A, McCollum CH, Miller CC, Holliday KM, Shilstone HC, Lucci A.
52 Factors influencing career choice among medical students interested in surgery.
53
54 *Current Surgery*. 2003;60(2):210-213.
55
56
57
58
59
60

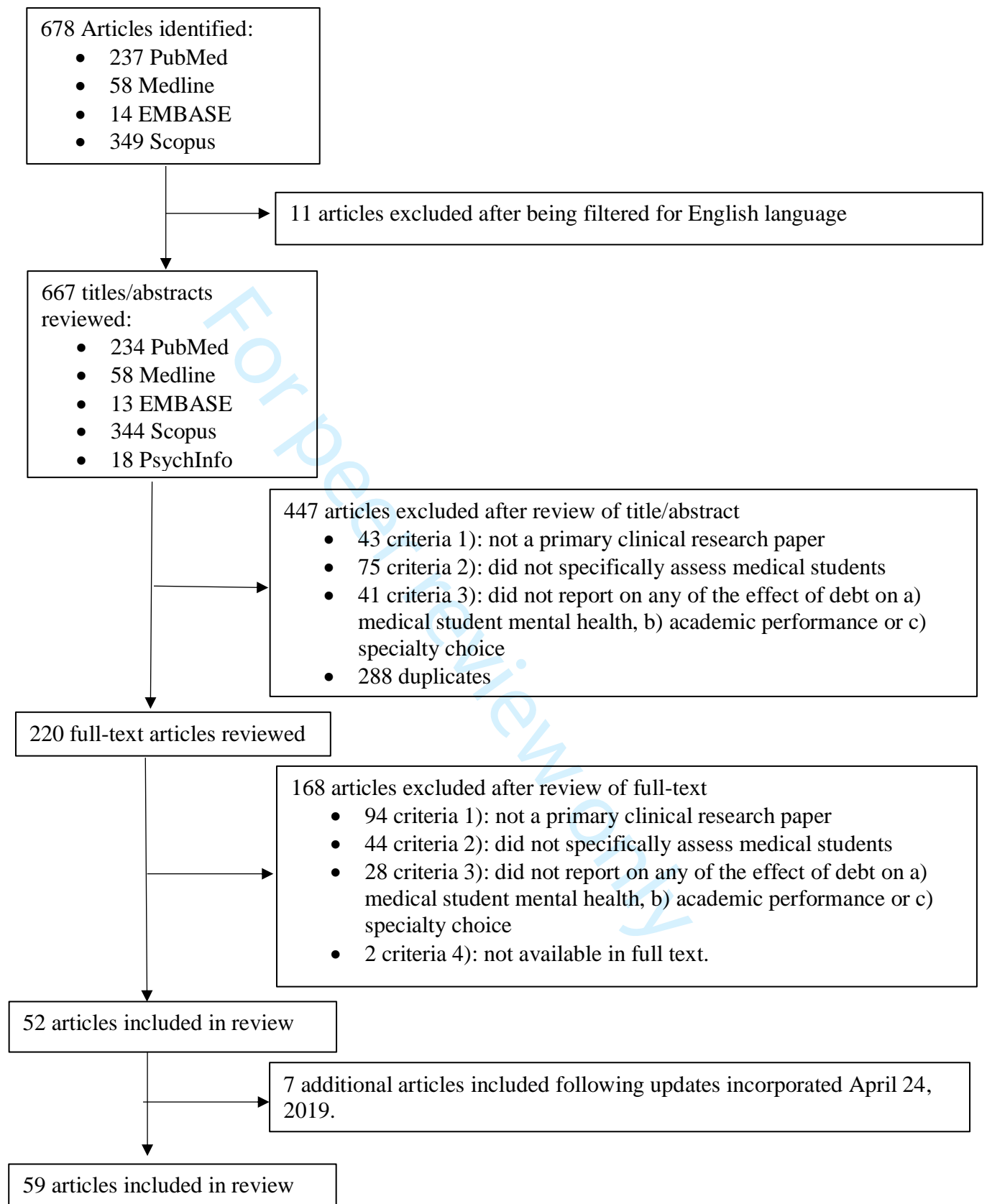
- 1
2
3 32. Bazzoli GJ. Does educational indebtedness affect physician specialty choice? *Journal*
4 *of Health Economics*. 1985;4(1):1-19.
5
6
7
8 33. Curran MA, Black M, Depp CA, et al. Perceived barriers and facilitators for an
9 academic career in geriatrics: medical students' perspectives. *Acad Psychiatry*.
10 2015;39(3):253-258.
11
12
13
14 34. Diamond JJ, Ruth DH, Markham FW, Rabinowitz HK, Rosenthal MP. Specialty
15 Selections of Jefferson Medical College Students. *Evaluation & the Health*
16 *Professions*. 2016;17(3):322-328.
17
18
19
20
21 35. Gil JA, Waryasz GR, Liu D, Daniels AH. Influence of Medical Student Debt on the
22 Decision to Pursue Careers in Primary Care. *Rhode Island medical journal (2013)*.
23 2016;99(7):19-21.
24
25
26
27
28 36. Gill H, McLeod S, Duerksen K, Szafran O. Factors influencing medical students'
29 choice of family medicine: Effects of rural versus urban background. *Canadian*
30 *Family Physician*. 2012;58(11):e649-e657.
31
32
33
34
35 37. Grayson MS, Newton DA, Thompson LF. Payback time: the associations of debt and
36 income with medical student career choice. *Med Educ*. 2012;46(10):983-991.
37
38
39
40 38. Greenberg RB, Ziegler CH, Borges NJ, Elam CL, Stratton TD, Woods S. Medical
41 student interest in academic medical careers: a multi-institutional study. *Perspect Med*
42 *Educ*. 2013;2(5-6):298-316.
43
44
45
46 39. Hauer KE, Durning SJ, Kernan WN, et al. Factors associated with medical students'
47 career choices regarding internal medicine. *JAMA*. 2008;300(10):1154-1164.
48
49
50
51 40. Henderson MC, Hunt DK, Williams JW. General internists influence students to
52 choose primary care careers: The power of role modeling. *The American Journal of*
53 *Medicine*. 1996;101(6):648-653.
54
55
56
57
58
59
60

- 1
2
3 41. Jeffe DB, Whelan AJ, Andriole DA. Primary care specialty choices of United States
4
5 medical graduates, 1997-2006. *Acad Med.* 2010;85(6):947-958.
6
7
- 8 42. Jeffe DB, Andriole DA, Hageman HL, Whelan AJ. Reaping What We Sow: The
9
10 Emerging Academic Medicine Workforce. *Journal of the National Medical*
11
12 *Association.* 2008;100(9):1026-1035.
13
- 14 43. Kahn MJ, Markert RJ, Lopez FA, Specter S, Randall H, Krane NK. Is medical student
15
16 choice of a primary care residency influenced by debt? *MedGenMed : Medscape*
17
18 *general medicine.* 2006;8(4):18.
19
- 20 44. Kassebaum DG, Szenas PL. Relationship between indebtedness and the specialty
21
22 choices of graduating medical students: 1993 update. *Academic Medicine.*
23
24 1993;68(12):934-937.
25
- 26 45. Kassebaum DG, Szenas PL. Factors influencing the specialty choices of 1993 medical
27
28 school graduates. *Acad Med.* 1994;69(2):163-170.
29
- 30 46. Kassebaum DG, Szenas PL, Caldwell K. Educational debt, specialty choices, and
31
32 practice intentions of underrepresented-minority medical school graduates. *Academic*
33
34 *Medicine.* 1993;68(6):506-511.
35
- 36 47. Kassebaum DG, Szenas PL, Schuchert MK. Determinants of the generalist career
37
38 intentions of 1995 graduating medical students. *Acad Med.* 1996;71(2):198-209.
39
- 40 48. Kassler WJ, Wartman SA, Silliman RA. Why medical students choose primary care
41
42 careers. *Acad Med.* 1991;66(1):41-43.
43
- 44 49. Mader EM, Roseamelia C, Morley CP. The temporal decline of idealism in two
45
46 cohorts of medical students at one institution. *BMC Med Educ.* 2014;14:58.
47
- 48 50. McHardy KM, Janssen A, Poole PJ. Female medical students may accrue less student
49
50 loan debt than their male colleagues in New Zealand. *The New Zealand medical*
51
52 *journal.* 2008;121(1273):37-44.
53
54
55
56
57
58
59
60

- 1
2
3 51. Morra DJ, Regehr G, Ginsburg S. Medical students, money, and career selection:
4 students' perception of financial factors and remuneration in family medicine. *Family*
5 *medicine*. 2009;41(2):105-110.
6
7
8
9
10 52. Mutha S, Takayama JI, O'Neil EH. Insights into medical students' career choices
11 based on third- and fourth-year students' focus-group discussions. *Acad Med*.
12 1997;72(7):635-640.
13
14
15
16
17 53. O'Grady G, Fitzjohn J. Debt on graduation, expected place of practice, and career
18 aspirations of Auckland Medical School students. *The New Zealand medical journal*.
19 2001;114 1142:468 - 470.
20
21
22
23
24 54. Paiva RE, Vu NV, Verhulst SJ. The effect of clinical experiences in medical school
25 on specialty choice decisions. *Academic Medicine*. 1982;57(9):666-674.
26
27
28
29 55. Park R. Graduating medical students' debt and specialty choices. *Academic Medicine*.
30 1990;65(7):485-486.
31
32
33 56. Phillips JP, Wilbanks DM, Salinas DF, Doberneck DM. Educational Debt in the
34 Context of Career Planning: A Qualitative Exploration of Medical Student
35 Perceptions. *Teach Learn Med*. 2016;28(3):243-251.
36
37
38
39 57. Rosenblatt RA, Andrilla CH. The impact of U.S. medical students' debt on their
40 choice of primary care careers: an analysis of data from the 2002 medical school
41 graduation questionnaire. *Acad Med*. 2005;80(9):815-819.
42
43
44
45
46 58. Rosenthal MP, Diamond JJ, Rabinowitz HK, et al. Influence of income, hours
47 worked, and loan repayment on medical students' decision to pursue a primary care
48 career. *Jama*. 1994;271(12):914-917.
49
50
51
52
53 59. Rosenthal MP, Marquette PA, Diamond JJ. Trends along the debt-income axis.
54 *Academic Medicine*. 1996;71(6):675-677.
55
56
57
58
59
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47
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54
55
56
57
58
59
60
60. Teitelbaum HS, Ehrlich N, Travis L. Factors affecting specialty choice among osteopathic medical students. *Acad Med.* 2009;84(6):718-723.
 61. Vanasse A, Orzanco MG, Courteau J, Scott S. Attractiveness of family medicine for medical students: influence of research and debt. *Canadian family physician Medecin de famille canadien.* 2011;57(6):e216-227.
 62. Wilbanks L, Spollen J, Messias E. Factors Influencing Medical School Graduates Toward a Career in Psychiatry: Analysis from the 2011-2013 Association of American Medical Colleges Graduation Questionnaire. *Acad Psychiatry.* 2016;40(2):255-260.
 63. McLaughlin MA, Daugherty SR, Rose W, H. , Goodman KJ. The Impact of Medical School Debt on postgraduate Career and Lifestyle *Academic Medicine.* 1991;66(9):43-45.
 64. Phillips JP, Peterson LE, Fang B, Kovar-Gough I, Phillips RL, Jr. Debt and the Emerging Physician Workforce: The Relationship Between Educational Debt and Family Medicine Residents' Practice and Fellowship Intentions. *Acad Med.* 2019;94(2):267-273.
 65. Scheckel CJ, Richards J, Newman JR, et al. Role of Debt and Loan Forgiveness/Repayment Programs in Osteopathic Medical Graduates' Plans to Enter Primary Care. *The Journal of the American Osteopathic Association.* 2019;119(4):227-235.
 66. Richards JR, Scheckel CJ, Kunz M, Newman JR, Poole KG, Jr., Mi L. Practice Area Intentions of Graduates of Colleges of Osteopathic Medicine: What Role Does Debt Play? *The Journal of the American Osteopathic Association.* 2018;118(6):384-388.
 67. Nguyen BM, Bounds G. Factors Affecting Specialty Choice Among Doctors Who Received Tuition Scholarships. *Family medicine.* 2019;51(3):276-281.

- 1
2
3 68. Ling S, Jacobs R, Ponton R, et al. Influence of student debt on health career location
4 and specialty. *Journal of primary health care*. 2018;10(1):54-61.
5
6
7
8 69. Fong JMN, Tan YTW, Sayampanathan AA, et al. Impact of financial background and
9 student debt on postgraduate residency choices of medical students in Singapore.
10
11
12 *Singapore medical journal*. 2018;59(12):647-651.
13
14
15 70. Watt CD, Greeley SA, Shea JA, Ahn J. Educational views and attitudes, and career
16 goals of MD-PhD students at the University of Pennsylvania School of Medicine.
17
18
19 *Academic medicine : journal of the Association of American Medical Colleges*.
20
21
22 2005;80(2):193-198.
23
24 71. Friedman AB, Grischkan JA, Dorsey ER, George BP. Forgiven but not Relieved: US
25 Physician Workforce Consequences of Changes to Public Service Loan Forgiveness.
26
27
28 *J Gen Intern Med*. 2016;31(10):1237-1241.
29
30
31 72. Merritt-Hawkins. *2017 Survey of Final-Year Medical Residents*.
32
33 https://www.merritthawkins.com/uploadedfiles/mha_2017_resident_survey.pdf2017.
34
35
36
37
38
39
40
41
42
43
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Full Search String

Databases Searched: PubMed, Medline, Embase, Scopus, and PsychInfo

Search string: PubMed

("students, medical"[MeSH Terms] OR ("students"[All Fields] AND "medical"[All Fields]) OR "medical students"[All Fields] OR ("medical"[All Fields] AND "student"[All Fields]) OR "medical student"[All Fields]) AND Debt[All Fields]

For peer review only

MOOSE Checklist for Meta-analyses of Observational Studies

Item No	Recommendation	Reported on Page No
Reporting of background should include:		
1	Problem definition	5,6
2	Hypothesis statement	N/A
3	Description of study outcome(s)	7
4	Type of exposure or intervention used	N/A
5	Type of study designs used	1
6	Study population	5
Reporting of search strategy should include:		
7	Qualifications of searchers (eg, librarians and investigators)	1 (credentials in the title page)
8	Search strategy, including time period included in the synthesis and key words	7
9	Effort to include all available studies, including contact with authors	7-8 (inter library requests made for any unavailable full text studies)
10	Databases and registries searched	7 (PubMed, Medline, Embase, Scopus, PsychInfo)
11	Search software used, name and version, including special features used (eg, explosion)	8
12	Use of hand searching (eg, reference lists of obtained articles)	N/A
13	List of citations located and those excluded, including justification	See Prisma flow-chart – citation list is available upon request
14	Method of addressing articles published in languages other than English	7
15	Method of handling abstracts and unpublished studies	7, 8
16	Description of any contact with authors	Contact with authors was planned if any data was missing – was not needed
Reporting of methods should include:		
17	Description of relevance or appropriateness of studies assembled for assessing the hypothesis to be tested	7-8
18	Rationale for the selection and coding of data (eg, sound clinical principles or convenience)	N/A
19	Documentation of how data were classified and coded (eg, multiple raters, blinding and interrater reliability)	N/A
20	Assessment of confounding (eg, comparability of cases and controls in studies where appropriate)	N/A
21	Assessment of study quality, including blinding of quality assessors, stratification or regression on possible predictors of study results	8
22	Assessment of heterogeneity	N/A
23	Description of statistical methods (eg, complete description of fixed or random effects models,	N/A

	justification of whether the chosen models account for predictors of study results, dose-response models, or cumulative meta-analysis) in sufficient detail to be replicated	
24	Provision of appropriate tables and graphics	19-25
Reporting of results should include:		
25	Graphic summarizing individual study estimates and overall estimate	N/A
26	Table giving descriptive information for each study included	19-25
27	Results of sensitivity testing (eg, subgroup analysis)	N/A
28	Indication of statistical uncertainty of findings	NA
Reporting of discussion should include:		
29	Quantitative assessment of bias (eg, publication bias)	N/A (descriptive assessment pg. 17-18)
30	Justification for exclusion (eg, exclusion of non-English language citations)	18
31	Assessment of quality of included studies	19-25
Reporting of conclusions should include:		
32	Consideration of alternative explanations for observed results	N/A
33	Generalization of the conclusions (ie, appropriate for the data presented and within the domain of the literature review)	18-19
34	Guidelines for future research	18
35	Disclosure of funding source	19

From: Stroup DF, Berlin JA, Morton SC, et al, for the Meta-analysis Of Observational Studies in Epidemiology (MOOSE) Group. Meta-analysis of Observational Studies in Epidemiology. A Proposal for Reporting. *JAMA*. 2000;283(15):2008-2012. doi: 10.1001/jama.283.15.2008.