

BMJ Open Effect of medical student debt on mental health, academic performance and specialty choice: a systematic review

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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 hypothesised that medical student debt levels would be negatively correlated with mental health and academic performance, and would influence career direction (ie, 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 PsycINFO were searched on 12 April 2017, for combinations of the medical subject headings *Medical Student* and *Debt* as search terms. Updates were incorporated on 24 April 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 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 towards 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.

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

Strengths and limitations of this study

- 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 specialisation.
- Fifty-two articles were included in the initial systematic review, with seven added on 24 April 2019.
- This review does not assess evidence from primary literature that was not available in English.
- Articles from only six countries met criteria for the systematic review.

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 US\$192 000 in 2017 compared with US\$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, that is, subsidised university education, available to all Australian citizen university students through the Higher Education Contribution Scheme—Higher Education Loan Programme, which does not incur interest and is repaid once an income threshold is reached (US\$51 957 for the 2018–2019 financial year).⁸ New Zealand has a similar loan system to Australia, with Government Student Loan schemes available to all students. America offers three main types of loans: (1) federal loans, available to all students studying at least half-time, the accumulating interest on which may be subsidised (ie, paid) or unsubsidised (not paid) by the government during the student's time in school, (2) Stafford or Perkins loans that accrue interest but do not require repayment until 6 months after graduation and (3) private (unsubsidised) loans from third parties like banks or state loans, sometimes offered directly from the student's college or state.⁹ Canada offers grants and student loans to those with financial need studying at least part-time, which vary by province and with stated lifetime limits up to 400 weeks (or 520 weeks for those with a permanent disability).¹⁰ Typically, these loans do not incur interest until the lifetime limit is reached, and repayments are not commenced until 6 months after the student leaves or completes his/her studies.¹⁰

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 threefold 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 regard 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 available evidence regarding the extent to which medical student debt impacts mental health, academic performance and specialty choice.

METHODS

Search strategy

We searched the databases PubMed, Medline, Embase, Scopus and PsycINFO on 12 April 2017 for combinations of the medical subject headings *Medical Student* and *Debt* as search terms. A full string of search terms for PubMed

is provided in the online supplementary figure S1. A language filter was then applied to exclude articles not published in English. The databases were searched from inception: PubMed 1996, Medline 1946, Embase 1974, Scopus 2004, and PsycINFO 1967. Updates were incorporated on 24 April 2019.

Eligibility criteria

After the application of this filter, articles were included if they fulfilled the following criteria: (1) a primary clinical research paper; (2) specifically assessed medical students (ie, not mixed with other student groups); (3) reported on the effect of debt on (a) medical student mental health, (b) academic performance or (c) specialty choice and finally (4) available in full text.

Selection of studies

The titles and abstracts of the included publications were examined by one author (MSP), and consensus achieved in cases of uncertainty through discussion with a second author (SB), to determine if they met inclusion criteria. Those publications that were likely to meet the eligibility criteria were reviewed in full text before being included or excluded by one author (MSP). To further reduce any possible selection bias, the suggested included studies were then reviewed again by a second author (ATA) with respect to eligibility. Those for which likely eligibility could not be determined from the title and abstract were also retrieved in full text and analysed for inclusion or exclusion. Interlibrary requests were sent for any full texts that could not be accessed through the online databases. Reference lists of the included articles were searched for other studies that might be eligible.

Data extraction and quality assessment

Extraction of the following data and quality assessment for each of the included articles was completed using a standardised form in Microsoft Excel (Microsoft, Redmond, Washington, USA): study characteristics (description of study protocol, how results were assessed); characteristics of the study population (sample size, stage of medical training, undergraduate or postgraduate degree, country of study); information to evaluate risk of bias (anonymity of surveys, selection bias, presence of control group, selective reporting bias, quality assessment as seen below) and finally outcomes relevant to one of the three areas of interest (mental health, academic performance or specialty choice).

Quality of evidence

The quality of evidence of the included articles was assessed using the Oxford 2011 level of evidence, 'quality rating scheme for studies and other evidence', a commonly accepted tool for rating evidence. It rates trials from 1 to 5 as follows: systematic review with meta-analysis, prospective comparative cohort trial, retrospective cohort study, cross-section study and case reports.^{13 14} The articles' level of evidence assessment and significant data points are summarised in [tables 1-3](#).

Table 1 Articles investigating the effect on Mental Health

Study	Year	Sample size	Study design	Significant findings	Oxford level of evidence
USA studies					
Hafferty <i>et al</i> ⁵	1986	96	Cross-sectional survey	Higher levels of debt associated with greater concern about practise climate.	4
Jackson <i>et al</i> 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 and Roberts 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 comfortable) on a Likert scale. For 1997 graduates with debt projections over US\$75 000, comfort level was rated significantly lower (-1.86 vs 0.89, p<0.001).	3
Rohlfing <i>et al</i> ²²	2014	3032	Cross-sectional survey	Each US\$50 000 increase in medical student loan debt was associated with increased stress, mainly financial (crude OR 1.54, 95% CI 1.43 to 1.67, adjusted OR 1.55, 95% CI 1.34 to 1.81).	4
Phillips <i>et al</i> ⁵⁶	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 <i>et al</i> ¹⁷	2005	2994	Cross-sectional survey	Compared with non-rural, rural students reported more debt at both entry to medical school and on graduation. They were also more likely to report fair-to-extreme levels of financial stress compared with non-rural (61.7% vs 55.4%, p=0.03).	4
Merani <i>et al</i> ¹⁹	2010	7795	Longitudinal survey	More students in 2007 than 2001 expected to graduate with debt (89.7% vs 75.7%). Rose from US\$14 500 to US\$30 000 in Quebec but US\$50 000 to US\$90 000 outside Quebec (p<0.0001). Quebec students anticipated less debt and less likely to report financial stress than those outside Quebec.	3
Morra <i>et al</i> 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 <i>et al</i> ²⁵	2002	2994	Cross-sectional survey	Students reported that their financial situation was 'very' or 'extremely' stressful (21.4% vs 26%), opposite result was found in control groups.	4
McLuckie <i>et al</i> 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 studies					
Gill <i>et al</i> ¹⁵	2001	179	Cross-sectional survey	Worrying about debt increased in sixth year students with levels of debt: those who never worried (14%) had debts of US\$2500, those who always worried (7%) had debts of US\$86 750. Frequency of worrying for all students was never (20%), rarely (10%), sometimes (34%), often (30%), always (5%).	4

Continued

Table 1 Continued

Study	Year	Sample size	Study design	Significant findings	Oxford level of evidence
Perry and Wilkinson 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 <i>et al</i> ²³	2006	352	Cross-sectional survey	42% reported stress about money contributed to up to one-fourth 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 as the second most common cause of stress after coursework at 78.1%.	4
Australian study					
Rogers <i>et al</i> ²⁴	2012	755	Cross-sectional survey	Barriers (including medical specialty choice, family and 4 lifestyle conditions, male domination, hours of work), concern about debt, academic stress accounted for 12.7% of variance on well-being.	

Role of funding source

The University of Adelaide provided institutional funds for retrieval of interlibrary requests.

Patient and public involvement

Patients and the public were not involved in this systematic review.

RESULTS

On the initial database searches, 678 potential articles were identified. Six hundred and sixty-seven of these were in English, and after reviewing these titles and abstracts, two hundred and twenty were reviewed in full

text. Fifty-two articles met the inclusion criteria and were included in this review (figure 1). A further seven articles were added in the 24th of April 2019 review.

The majority of the identified (included) studies examined the influence of debt on specialty choice. Only 14 articles assessed the influence of debt on (a) medical student mental health.^{5 15–27} Four studies assessed debt in relation to (b) academic performance.^{15 23 28 29} Fifty articles assessed the relationship between debt and (C) specialty choice.^{4 5 11 12 17 18 21 22 25 26 30–69} Several articles fell under one or more of these categories. All but one²⁷ of the additional articles from the 2019 review examined the effect on (c) specialty choice.^{64–69}

Table 2 Articles investigating the effect on academic performance

Study	Year	Sample size	Study design	Significant findings	Oxford level of evidence
Gill <i>et al</i> 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 <i>et al</i> 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 and Jeffe ²⁸	2010	86 114	Retrospective longitudinal study	There was a progressive decrease in the per cent of students graduating with optimal/passing scores with increasing debt levels: no debt—90.1%; 100%—9999%—86.8%; 10 000%—24 999%—87%; 25 000—49 999%—83.6%; >50 000%—76.4%.	3
Jeffe <i>et al</i> ²⁹	2014	89 948	Retrospective longitudinal study	Premedical debt was associated with MD-only graduation but not with withdrawal/dismissal compared with MD-PhD graduation. Higher premedical debt (>20 000) was not independently associated with MD-PhD programme 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 and Boulger ⁵	1986	96	Cross-sectional survey	Higher debt led to specialist medical fields over generalist.	4
Colquitt <i>et al</i> ¹¹	1996	N/A	Cross-sectional (American Medical Colleges' (AAMC) Medical Student Graduation Questionnaire (GQ) and Matriculating Student Questionnaire (MSQ))	High debt led to high paying specialties.	4
Schwartz <i>et al</i> ¹²	2011	2421	Longitudinal survey	Greater debt in 2007 compared with 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 <i>et al</i> ³⁰	2008	1833	Cross-sectional survey (AAMC)	Lower debt led to high paying specialties.	4
Azizzadeh <i>et al</i> ³¹	2003	111	Cross-sectional survey	Lower concern about debt led to high paying specialties.	4
Bazzoli ³²	1985	3855	Cross-sectional survey	Higher subsidised debt led to primary care (PC) specialties (US\$10 000 increase in debt increases PC by 5.3%). Higher HEAL debt led to high paying specialties (US\$10 000 increase decreased PC by 7.5%).	4
Curran <i>et al</i> 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 <i>et al</i> ³⁷	2012	4916	Longitudinal survey	High debt led to high paying specialties. Placed more value on anticipated higher income.	3
Hauer <i>et al</i> ³⁹	2008	1177	Cross-sectional survey	26.1% stated debt led to less attracted to internal medicine careers (generalist specialties).	4
Andriole and Jaffe ²⁸	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 and Szenas ⁴⁴	1993	12 131	Cross-sectional survey (AAMC)	Debt had a greater influence in those choosing surgical and support specialties compared with generalist and medical specialties. There was also a higher number of students citing an influence in the 1993 graduate class compared with the 1992 class. However, interest in generalist specialties increased during this time compared with the other specialties.	4
Kassebaum and Szenas ⁴⁵	1994	8128	Cross-sectional survey (AAMC)	Limited influence but slightly higher for surgical (0.93) compared with generalist (0.54).	4
Kassebaum and Szenas ⁴⁶	1993	12 096	Cross-sectional survey (AAMC)	Under-represented minority students were more likely to have debt than white and other non-under-represented 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 with generalist certifications.	4

Continued

Table 3 Continued

Study	Year	Sample size	Study design	Significant Findings	Oxford level of evidence
Nguyen and Bounds 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	33 499	Longitudinal survey (AAMC)	Highest mean debt in those who chose emergency medicine and surgical subspecialties in 1986 and 1989.	3
Phillips <i>et al</i> ⁶⁴	2019	6229	Cross-sectional survey	High debt (US\$150 000–US\$249 999) was associated with lower odds of intention to work for government organisations in family medicine residents. Those with high debt or very high debt (>US\$250 000) had lower odds of intention to pursue academic practice or a geriatrics fellowship.	4
Richards <i>et al</i> ⁶⁶	2018	6594	Longitudinal survey	The proportion of students intending to practice in underserved areas from between 2007 and 2016 (27.5%–35.3% and those with more debt were more likely to practice in underserved areas. These students also intended on using loan-repayment programmes at a higher rate.	3
Rosenblatt and Andrilla ⁵⁷	2005	14 240	Cross-sectional survey (AAMC)	Increasing debt inversely correlated with choosing a PC specialty, greatest effect in debt exceeding US\$150 000. However, only modest relationship after controlling for other characteristics. Factors like demographic (race, age, gender) has a more significant effect.	4
Rosenthal <i>et al</i> ⁵⁹	1996	326	Longitudinal survey	Higher debt associated with not choosing family practice specialties.	3
Scheckel <i>et al</i> ⁶⁵	2019	13 097	Longitudinal survey	Graduates who were above the 75th percentile of debt moved more towards non-primary care (NPC) 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 25th percentile of debt, increasing from 24.6% to 29.4%. Graduates with a loan forgiveness/repayment programme were more likely to choose primary care over graduates without such a programme.	3
USA studies associating debt with low paying specialties					
Phillips <i>et al</i> ²¹	2010	983	Cross-sectional survey	Those with any level of debt were two-times as likely to choose PC compared with no debt, but those with no debt were less likely to be under-represented 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 <i>et al</i> ²²	2014	3032	Cross-sectional survey	Each decrease in relative debt decreased salary of desired specialty by US\$21 000, there was not a statistically significant relationship with an increase in relative debt. An increase in premedical student loan debt by US\$20 000 increased chance of choosing a PC specialty. Contrarily, a decrease in relative debt as measured by an increased proportion of estimated cost of attendance saved was also associated with choosing PC.	4

Continued

Table 3 Continued

Study	Year	Sample size	Study design	Significant Findings	Oxford level of evidence
Bazzoli ³²	1985	3855	Cross-sectional survey	Higher subsidised debt led to primary care specialties (US\$10 000 increase in debt increases PC by 5.3%). Higher HEAL debt led to high paying specialties (US\$10 000 increase decreased PC by 7.5%).	4
Greenberg <i>et al</i> ³⁸	2013	239	Cross-sectional survey	Higher debt led to academic medicine.	4
Henderson <i>et al</i> ⁴⁰	1996	144	Longitudinal survey (preclerkship and postclerkship survey)	High debt led to primary care specialties.	3
Jeffe <i>et al</i> ⁴²	2008	87 763	Retrospective longitudinal (AAMC)	Lower debt led to more likely to stay with academic medicine if considered initially. But does not increase chance of changing to academic medicine if did not initially consider it.	3
Kassebaum and Szenas 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 to 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 school graduates but increase from private school graduates.	4
McLaughlin <i>et al</i> ⁶³	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 with higher paying.	3
USA studies which found no or minimal association between debt and specialty choice					
Diamond <i>et al</i> 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 <i>et al</i> ³⁵	2016	415	Cross-sectional survey (12 centres)	No significant influence.	4
Kahn <i>et al</i> ⁴³	2006	2022	Retrospective longitudinal study	No significant influence.	3
Kassebaum <i>et al</i> ⁴⁷	1996	7848	Cross-sectional study (AAMC)	No significant influence.	3
Kassler <i>et al</i> ⁴⁸	1991	293	Cross-sectional survey (eight medical schools)	No significant influence.	4
Mutha <i>et al</i> ⁵²	1997	52	Cross-sectional study (group discussion)	No significant influence.	4
Paiva <i>et al</i> 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 with approximately 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

Continued

Table 3 Continued

Study	Year	Sample size	Study design	Significant Findings	Oxford level of evidence
Rosenthal <i>et al</i> 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 and Roberts ¹⁸	1998	400	Longitudinal survey	At debt <US\$75 000 and influence on specialty choice not correlated. At debt US\$25 000–US\$75 000 increasing debt correlated with increasing influence. At debt >US\$75 000 had more influence on specialty choice.	3
Mader <i>et al</i> ⁴⁹	2014	500	Longitudinal survey	Influence on specialty choice for “amount of educational debt I have” rose in importance from the beginning of first year to third year, while interest in content declined.	3
Phillips <i>et al</i> ⁵⁶	2016	132	Cross-sectional qualitative (essays)	48% said debt limited career choice preferences.	4
Teitelbaum <i>et al</i> 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
Studies outside the USA finding an association between debt and specialty choice					
Canada					
Kwong <i>et al</i> 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
Kwong <i>et al</i> ²⁵	2002	2994	Longitudinal survey	Students reported debt being a major influence on choice of specialty and was higher in first-year students compared with fourth-year students. More students in 2000 (28.5%) compared with 1997 (21.2%) stated financial considerations would be a major influence on chosen practice location.	3
Gill <i>et al</i> ³⁶	2012	280	Cross-sectional survey	Medical students with urban background: specialty choice influenced by current debt load.	4
Morra <i>et al</i> 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
Vanasse <i>et al</i> ⁶¹	2011	1776	Cross-sectional descriptive survey	In the preclinical years, 30% of those intending to practise family medicine 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

Continued

Table 3 Continued

Study	Year	Sample size	Study design	Significant Findings	Oxford level of evidence
New Zealand					
Gill <i>et al</i> ⁴	2001	179	Cross-sectional survey	In sixth-year students, there was a slight trend those with higher debt to exclude GP from their top three preferences, however this was not statistically significant. 16% stated level of debt as a very important and strong influence on career choice.	4
Ling <i>et al</i> 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 and Wilkinson 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 <i>et al</i> ⁵⁰	2008	115	Cross-sectional survey	11% reported degree of debt would have a significant influence on their career choice.	4
O'Grady and Fitzjohn ⁵³	2001	407	Cross-sectional survey	No significant influence, association between debt and likelihood of practising overseas: 31.3% of students with debt >60 000 planning to mainly or only practise overseas, compared with 20.3% of those with debts <60 000.	4
Singapore					
Fong, <i>et al</i> 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 to 2.090, p<0.001; adjusted OR 1.393, 95% CI 1.048 to 1.851, p=0.022) were more likely to have an economic factor very significantly influencing postgraduate training choices.	4

HEAL, health education assistance loans; N/A, not available.

Effect on mental health

The 14 studies identified that assessed the impact of debt on different aspects of medical student mental health included results from several countries: the USA,^{5 16 18 22 56} Canada,^{17 19 20 25 27} New Zealand,^{15 26} Scotland²³ and Australia²⁴ (table 1). These studies mainly focused on the effect of debt on stress levels, rather than on symptoms of anxiety or depression. Reported levels of financial stress were typically high and correlated with debt levels at a statistically significant level ($p<0.05$) (table 1).

The publications with data collected from medical students in the USA found clear correlation between higher levels of debt and stress levels. In a study of 3032 postgraduate medical students, Rohlfing *et al*²² found that each US\$50 000 increase in medical student loan debt was associated with increased self-reported stress. This

stress was mainly financial, that is, related to concerns over repaying or managing debt. Another study found increasing debt levels to be positively correlated with worry and negatively correlated with comfort when rated on a Likert scale.¹⁸

Canadian studies demonstrated that junior students were more likely to report significant stress associated with finances. For example, one study found first-year medical students were more likely to report that their financial situation was very or extremely stressful (20.5%) compared with fourth-year students (17.5%).²⁵ Those earlier in their education were found to have higher anticipated debt levels, which accounted for an additional 11.5% variance in reported stress levels when added to current debt, over that predicted by current debt alone.²⁰ It was also found that rural students had higher levels of financial stress compared with non-rural

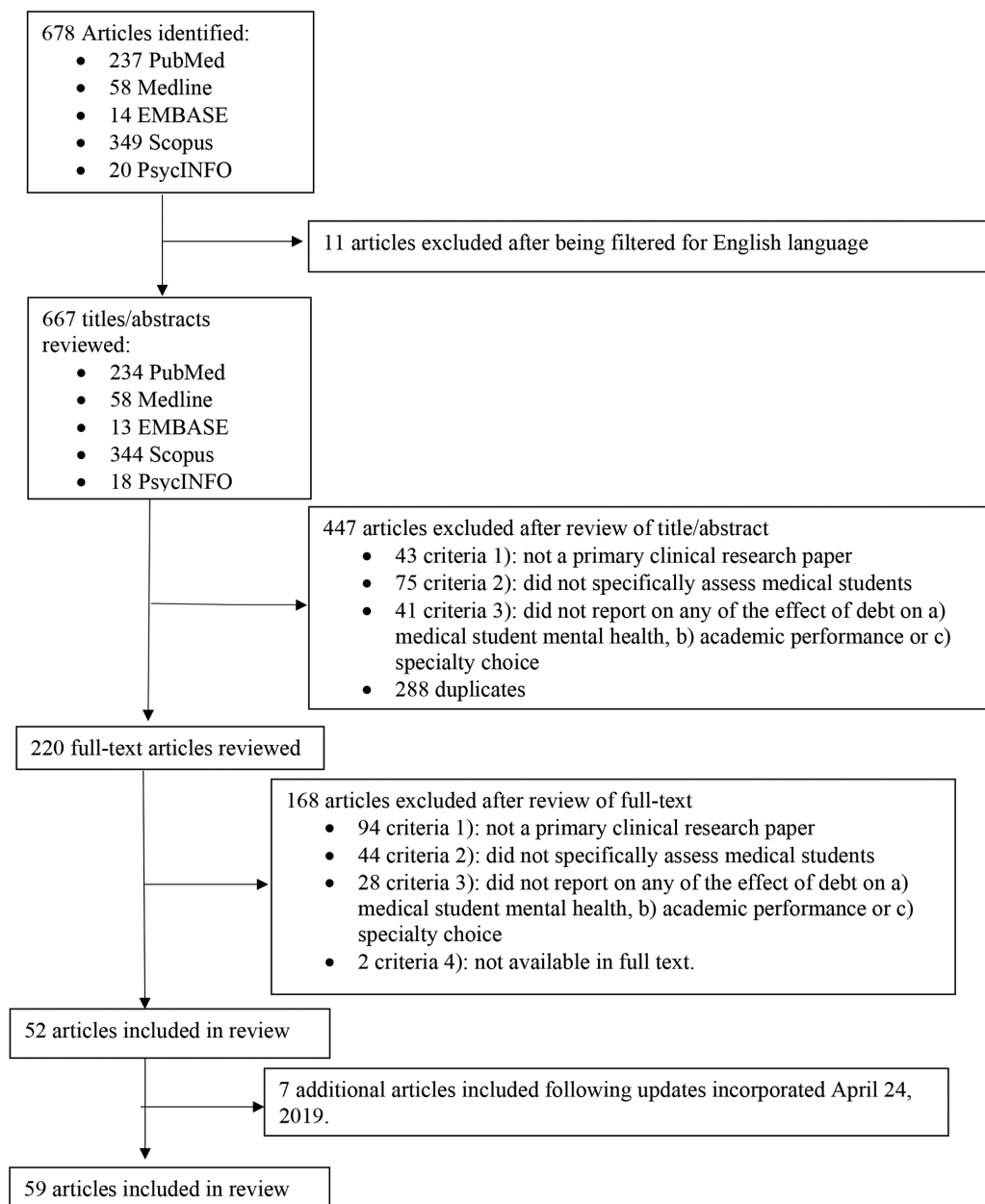


Figure 1 Flow chart detailing results of the search strategy and application of the eligibility criteria for a review of articles investigating the effects of medical student debt on mental health, academic performance or specialty choice.

students.¹⁷ These results were consistent with those seen in a large study by Merani *et al*¹⁹ that examined the financial stress levels of 7795 medical students from across Canada, lower stress levels were experienced by students in Quebec (where medical school tuition had remained stable), compared with those outside Quebec (where medical student tuition had risen dramatically).¹⁹ A more recent 2018 study found that one of the predictors for burnout and psychological distress was feeling psychologically/emotionally unsupported at their university, which increased through the years of medical training.²⁷

In contrast, a study of 170 New Zealand undergraduate students found that concern about debt was higher in more senior (sixth-year) students, and predictably, in those who had higher levels of debt.¹⁵ In this study, those

who reported that they never worried about debt (14%) had average debts of \$2500 (New Zealand Dollars (NZD)), whereas those reporting that they always worried about debt (7%) had on average \$NZD86750 in debt. These results were supported by another New Zealand-based study, which showed a positive correlation between worry and indebtedness, with 32% of all students reporting worrying about debt 'often' or 'always'.²⁶ Studies from Scotland and Australia reported similar findings.^{23 24}

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 screening tool, and found alcohol abuse/dependence was significantly more common in those with >US\$100 000 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

Effect on academic performance

The correlation between academic performance and debt was only investigated in four 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 rates (table 2).²⁹

One group found suboptimal academic outcomes in those with debts over US\$10 000, 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 >US\$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 were also more likely to state that money affects their academic performance.²³ Similarly, Gill *et al*¹⁵ analysed students' opinions of the effect of debt on their participation in the degree, and 21% of respondents stated that debt 'sometimes' impacted their ability to fully participate in their course of study.¹⁵ However, 46% stated debt never impacted them, and 31% said it rarely impacted them.¹⁵ Other studies have suggested that higher debt levels,⁷⁰ or matriculation in MD-PhD programmes that are not 'fully funded' (ie, not supported by federal Medical Scientist Training Program (MSTP) funding),²⁹ may increase likelihood of attrition from MD-PhD programmes.

Effect on specialty choice

The association between debt and specialty choice was assessed in a large number of studies,^{4 5 11 12 17 18 21 22 25 26 30–69} each of which are listed individually in table 3. There were more longitudinal studies in this area than there were studies that assessed the impact of debt on mental health or academic performance. The studies typically divided specialty choices into high paying specialties versus low paying areas (most commonly family practice/primary care). Higher paying specialties typically

included surgery, dermatology, neurology, ophthalmology, radiology and other surgical and medical subspecialties. The results were varied. Overall, the majority (21) of the articles found that the presence of debt was associated with the choice of higher paying specialties.^{5 11 12 22 30–33 37 39 41 44–46 51 55 57 59 64–67} Nine articles found that the presence of debt was associated with lower paying specialty choices.^{17 22 32 38 40 42 44 56 63} A further 10 articles said there was no or minimal effect,^{34 35 43 47 48 52–54 62} and 13 articles found there was an association but did not further explore the nature of this relationship.^{4 17 18 25 26 36 49 50 56 60 68 69} The majority of these studies were conducted in the USA (table 3).

Studies conducted in the USA examining the effect of debt on specialty choice

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

One of the most authoritative studies in this area was a longitudinal study of 4916 US medical students, conducted by Grayson *et al*³⁷ from 1992 to 2012. This study found that first-year and fourth-year medical students wanting to pursue high paying non-primary care careers anticipated a greater debt burden, placed higher importance on income and anticipated greater incomes, compared with their same-year peers seeking a career in primary care. Moreover, 31% of those reporting intending to pursue primary care at year 1 had decided to switch to a higher paying specialty by year 4, with debt and income appearing to be driving factors.³⁷ Another longitudinal study by Jeffe *et al*⁴¹ found that from 1997 to 2006, the proportion of medical students with at least US\$150 000 total debt at graduation rose from 6.7% to 35.9%, in conjunction with a decline in the number of physicians pursuing generalised primary care. Similarly, Schwartz *et al*⁴² found greater debt in 2007 compared with 1990, and students in 2007 were more likely to report that debt repayments pushed them away from primary care careers. More recently, high debt levels (US\$150 000–US\$249 999) of family medicine residents were associated with decreased odds of working in a government organisation, and very high debt levels (>US\$250 000) associated with decreased odds of academic practice or geriatric fellowships.⁶⁴

Although less frequently examined, loan types were also found to play a role in specialty choice. For example, Bazzoli³² examined both subsidised loans with lower interest rates that only accrue after graduation/residency, and health education assistance loans (HEAL) which

had comparatively higher interest rates with accrual beginning from the date of taking the loan (ie, unsubsidised). Higher relative debt accrued from subsidised loan programmes seemed to predict primary care as a specialty choice, whereas higher (unsubsidised) HEAL debt was associated with higher paying specialties.³² These findings were consistent with more recent studies of osteopathic medical students.^{65 66} Conversely, Nguyen and Bounds⁶⁷ found that only 24% chose primary care despite having no student debt.

Studies conducted outside the USA examining the effect of debt on specialty choice

There were five Canadian studies^{17 25 36 51 61} that looked at the effect of debt on specialty choice. Three articles found there was an affect but did not specify the influence,^{17 25 36} one found higher debt was associated with a preference for family medicine,⁶¹ and the remaining publication found debt to be associated with higher paying specialties.⁵¹ Two reports found that current debt load affected urban students' preference for specialty choice, but had no statistically significant influence for rural students.^{17 36} Vanasse *et al*⁶¹ found that higher expected debt on completion of medical school was a strong predictor of desire to do family medicine. Morra *et al*⁵¹ provided an interesting possible insight into this pattern. This study found that a large number of students agreed with the rationale of doing family medicine to start paying off their debt faster, as the residency is shorter.⁵¹

Several studies were identified that studied the influence of debt on specialty choice in New Zealand.^{4 26 50 68} In these studies, debt was found to influence specialty choice, but generally it was not specified whether the directionality was towards higher paying specialties or primary care. McHardy *et al*⁵⁰ found that 11% of students reported debt would have a significant influence on their career choice. Likewise, Gill *et al*⁴ found 16% of students stated level of debt as an important and strong influence on their career choice. They also noted that in sixth-year students there was a slight trend for those with higher debt to exclude general practice from their top three preferences but not to a statistically significant level. A more recent study from New Zealand found complex relationships that varied with one's medical profession, and preference for rural versus urban practice.⁶⁸

One 2018 Singaporean study investigated the associations between economic factors and residency choices. It found 40.5% of the 1241 students studied were to graduate with debt, and these students were more likely to rank an economic factor as significantly influencing their postgraduate training.⁶⁹

DISCUSSION

The majority of studies meeting the eligibility criteria and examined in this review support the notion that educational debt burden has a profound and often negative impact on medical students. Many studies reported debt

as having adverse effects on student stress levels, and in some cases being associated with troubling patterns of alcohol use.¹⁶ Other reports strongly suggested that debt may also adversely affect academic performance.

Although few studies explored other aspects of students' mental health, one example that did assess other aspects of their mental health was an Australian study by Rogers *et al*.²⁴ This study identified personality traits that accounted for variances in levels of psychological stress: students with higher levels of extraversion, conscientiousness, professional expectations and lifestyle expectations, and lower levels of neuroticism, reported better well-being. In addition, future work could aim to prospectively investigate the interactions between resilience, debt and psychological distress in medical students. Results from such studies could underpin future targeted interventional strategies to maximise medical student mental health.

The influence of debt on specialty choice has been investigated much more extensively, although the majority of these studies have been conducted in the USA. These studies have produced conflicting results, and the generalisability of these findings to other countries with different socioeconomic structures may be limited. Another significant finding evident in multiple studies was differences between urban and rural students. Students from urban backgrounds were more likely to report debt as influencing their specialty choice and increasing the likelihood of them choosing higher paying specialties. Conversely, those from rural backgrounds were less likely to report an effect despite commonly having greater debt levels and/or coming from lower socioeconomic backgrounds.^{17 36} Together these findings illustrate the need to more clearly assess (and control for) whether one's socioeconomic background/financial liquidity in itself is a determinant of preferred practice area, with incurred debt being simply a consequence thereof, for example, do individuals of greater or lesser financial means gravitate towards higher or lower paying practice areas, and for what reasons—or are one's socioeconomic background and educational debt burden separate and independent predictors of specialty choice? Future studies in this area would help answer these key questions.

The vast majority of studies identified were cross-sectional in nature. Of the 52 articles included, there were only 6 prospective studies,^{29 37 41 42 49 59} which primarily focused on the effects of debt on influencing specialty choice. The lack of longitudinal studies is important to consider, given the dynamic nature of debt and its capacity to compound. The majority of studies employed self-report questionnaires. Likert scale-type responses were commonly used. Few studies were identified that used alternative methodologies such as interviews or focus groups, although at least one study used a prompted-essay response design.⁵⁶

Furthermore, no qualifying studies could be located that examined the effects of interventions targeting debt on medical student mental health, academic performance or

specialty choice. Given debt's influence on these parameters has been identified by the observational studies in this review, it may be reasonable to hypothesise that such interventions could influence these outcomes. Some possible debt-targeting interventions worth exploring for their effects on these outcomes, perhaps even in a prospective study, are loan forgiveness programmes. Along a similar theme, one report compared the impact of unsubsidised versus subsidised loans (a form of debt forgiveness) on specialty choice, and found those with greater unsubsidised loan burdens were more likely to pursue higher paying specialties.³² Further research yielded additional information on loan forgiveness. The US Public Service Loan Forgiveness programme, established in 2007, advertises complete (remaining) loan forgiveness for public-sector/non-profit employees after they have made 120 qualifying monthly payments. One study found more future primary care physicians intended to use this programme compared with programmes expressly designed to promote primary care.⁷¹ A survey on physician recruiting incentives reported that for 31% of respondents, whether or not a potential employer (eg, a hospital) offered educational loan forgiveness as a job incentive would have a great effect on selecting an offer.⁷² Findings from a very recent study of osteopathic medical graduates 'consistently showed that graduates with a loan forgiveness/repayment programme were more likely to choose primary care over graduates without such a programme'.⁶⁵ Another similar recent study reported that osteopathic 'graduates with the most debt intended to practice in underserved areas at a higher percentage than those with the least amount of debt, and they also planned on using loan-repayment programmes at a higher rate'.⁶⁶ More studies are needed in these areas, to determine whether loan forgiveness or similar programmes can obviate some the negative impacts that debt burden has on medical student mental health, academic performance and specialty choice.

Interestingly, while many studies supported the notion that significant medical school debt may drive some graduates away from primary care or other lower paying practice areas, particularly in the absence of loan repayment programmes, the converse may not necessarily be true, that is, at least one recent study suggests that the absence of medical student debt alone does not appear to drive more graduates into primary care.⁶⁷

The majority of articles assessed whole-year level cohorts and were anonymous, which helped to minimise any selective reporting bias. However, many studies had small sample sizes, the smallest being 27,³³ while some sample sizes were not specified.⁴¹ This raises the issue of possible non-response bias, which could have influenced results in studies with smaller sample sizes. There was also concern of differing stress levels depending on the time of the year the survey was administered. Ross *et al*²³ acknowledged this, with their survey being released just before the examination period, which may have contributed to general stress levels as well as low response rate.

Because our initial full search and meta-analysis was performed in April 2017, which is a potential limitation of this study for publication in 2019, we incorporated key search updates on 24 April 2019. This more recent search revealed similar findings to those already concluded, in particular the majority of articles being related to specialty choice. Examples of the most recent studies⁶⁴⁻⁶⁹ are included throughout the 'Results' and 'Discussion' sections.

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

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

CONCLUSIONS

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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