

# Anxiety and depression in surgeons: A systematic review

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## ABSTRACT

**Introduction:** The unique pressures of a surgical career put surgeons at particular risk of mental health conditions, including anxiety and depression. Surgeons have previously been shown to have a high prevalence of psychological distress. This study aimed to systematically review the prevalence of anxiety and depression amongst surgeons, and to identify factors that can modify the risk of anxiety and depression in surgeons.

**Methods:** A 10-year systematic review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) guidelines to identify citations related to the keywords “anxiety” OR “depression” AND “surgeon” in PubMed/Medline and ScienceDirect databases. Inclusion and exclusion criteria were applied to produce a final list of citations.

**Results:** Thirty-one citations were included with a total of 11,399 participants. The median percentage of anxiety in surgeons was 20 with a range of 54.6%. While the median percentage of depression was 24 with a range of 59%. Risk factors associated with a higher risk of anxiety and depression include female gender, younger age, concurrent burnout, and occupational concerns regarding the COVID-19 pandemic. Protective factors include institutional support and a sense of social belonging.

**Conclusions:** There was a high prevalence of anxiety and depression amongst surgeons over the past decade. It is imperative to develop strategies to mitigate the effect of anxiety and depression in surgeons.

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## Background

Medical practitioners have long been known to be at risk of developing a range of psychological conditions, such as burnout, stress, anxiety and depression.<sup>1</sup> The unique pressures of a surgical career, including long, unpredictable hours, the expectation of significant personal sacrifice, and dealing with life-or-death decisions on a daily basis, put surgeons at risk for psychological distress.<sup>2</sup> Whilst surgeons may be at particular risk of developing mental health conditions such as depression and anxiety, there is evidence that they may be less likely to seek professional help for these problems due to concerns about their career.<sup>3</sup> A previous study evaluated the range of the non-physical effects of a surgical career including

psychological distress showing a prevalence of psychiatric morbidity amongst surgeons to be between 16 and 37%, with a rate of suicidal ideation higher than that of the general population.<sup>4</sup>

Psychological distress in surgeons can potentially have wide-ranging negative impacts on the individual, their colleagues, their loved ones, and their patients. Burnout has been shown to be strongly associated with a desire to retire early, and lower career satisfaction, suicidal ideation, and harmful use of alcohol.<sup>2</sup> Previous reports among surgeons found that psychiatric morbidity and burnout had a negative effect on family relationships and teamwork, as well as negatively impacting the surgeon-patient relationship, and increasing the risk of errors.<sup>5</sup> Furthermore, a previous review has shown that surgical trainees experienced a significant level of

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psychological distress and burnout during the COVID-19 pandemic.<sup>5</sup>

This study aimed to systematically review the prevalence of anxiety and depression amongst surgeons over the past 10 years, to identify factors associated with anxiety and depression in surgeons, and to discuss potential methods to address their impact.

## Methods

The PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) checklist was followed for identifying and evaluating the data.<sup>7</sup> A literature search was performed on the PubMed/Medline and ScienceDirect databases from 1st January 2013 to 14th March 2023 (Fig. 1). Two more relevant citations from other sources were included. We only included articles published in the English language. The search was performed using the search terms: “anxiety” OR “depression” AND “surgeon. In the PubMed/Medline database, a further

search using the same search terms including MeSH terms was performed.

We only included citations about anxiety and depression specifically in surgeons. We excluded narrative reviews, conference abstracts, letters to editors and studies that did not study anxiety and depression in surgeons. We excluded qualitative studies, those that did not use a validated tool for identification of anxiety and depression, and citations that studied performance anxiety during surgery to decrease the risk of bias.

After the detailed literature search was performed, by inspecting titles, abstracts, and reading the full text of the papers, the citations were reviewed against the inclusion and exclusion criteria. A final list of citations was made, and two reviewers independently conducted the assessments for risk of bias and certainty of evidence. In case of any disagreements, they were resolved through discussion between the two reviewers. The inclusion and exclusion criteria were clearly pre-determined, and citations were read in full text for further assessment for eligibility and to decrease the risk of bias across studies.

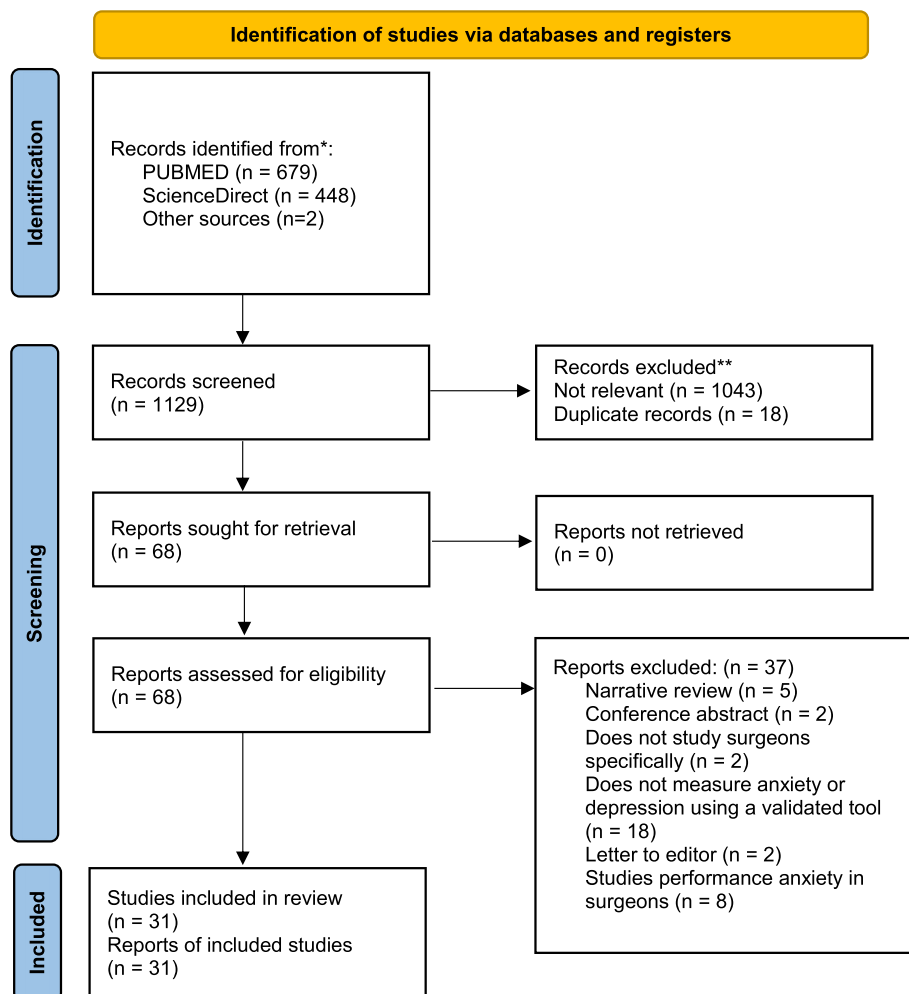


Fig. 1 – The PRISMA flow diagram illustrating the screening process.

Data were extracted and recorded using Excel 2016 (Microsoft Corporation, Redmond, California, USA). Information collected for each citation included citations description (title, authors, year of publication, Journal, country of origin), study design, methods, characteristics, and the tools used for assessment of anxiety and depression in surgeons, and basic information about the findings of the studies.

## Results

After careful review of search results according to the PRISMA guidelines, a final 31 citations were included in this systematic review. All included citations were cross sectional studies. A total of 11,399 surgeon participants were included across all citations. Tabular analysis of the included citations was performed (Table 1).<sup>8–38</sup>

The surgical speciality of the study participants was stated in 30 citations. Ten studies included surgeons across multiple specialities, 6 citations studied trauma and orthopaedic surgeons, 4 studied neurosurgeons, 3 studied general surgeons, 3 studied vascular surgeons. There was 1 citation each studying cardiac surgeons, paediatric surgeons, otorhinolaryngology surgeons, and maxillofacial surgeons.

Sixteen citations included consultant surgeons, 23 included surgical trainees, and 13 included both consultants and trainees. Sixteen citations studied anxiety in surgeons, 23 studied depression in surgeons, and 9 studied both anxiety and depression in surgeons. Fifteen studies were conducted during the COVID-19 pandemic.

A wide range of validated tools were used to measure anxiety and depression. For anxiety, the commonest tool used was the Generalised Anxiety Disorder Assessment (GAD-7), with 5 citations using this tool. 3 citations used the Depression, Anxiety and Stress Scale (DASS-21) to measure anxiety, and 3 citations used the Hospital Anxiety and Depression Scale (HADS) to measure anxiety.

For depression, the commonest tool was the Patient Health Questionnaire-9 (PHQ-9), with 5 citations using this tool. 3 citations used the Depression, Anxiety and Stress Scale (DASS-21), 3 citations used the Hospital Anxiety and Depression Scale (HADS), two citations used the Patient Health Questionnaire-2 (PHQ-2), and two citations used the Self-Reporting Questionnaire-20. Two citations used the Beck Depression Inventory, and two citations used the General Health Questionnaire (GHQ-12).

The median percentage of anxiety in surgeons was 20 with a range of 54.6%. While the median of depression percentage in surgeons was 24% with a range of 59%. Table 2 demonstrates the prevalence of anxiety and depression by surgical speciality.

The risk factors associated with anxiety and depression in surgeons were identified in Table 3 and Table 4. Only factors identified in more than one citation have been included, as there were over 30 risk factors identified across all citations, however, the majority were identified only in one citation. Factors associated with an increased risk of anxiety included female gender, younger age, and occupational concerns regarding the COVID-19 pandemic (Table 3). Factors associated with an increased risk of depression included female

gender, burnout, younger age, exposure to individuals infected with COVID-19, and concerns regarding personal protective equipment (PPE) during the COVID-19 pandemic (Table 4).

There were some protective factors identified in the citations which were associated with a reduced risk of anxiety and depression in surgeons. Protective factors for anxiety include increased years of practice,<sup>19</sup> feeling well-protected from the pandemic,<sup>22</sup> hospital support, and using positive reframing strategies.<sup>32</sup> Protective factors for depression included feeling of social belonging,<sup>13</sup> adequate access to PPE,<sup>25</sup> and being vaccinated against COVID-19.<sup>34</sup>

## Discussion

Our findings demonstrated a high prevalence of anxiety and depression in surgeons.

Surgeons can be at high risk, but also less likely to seek help for mental health conditions.<sup>3</sup> A study of surgeons in the United States found the rate of suicidal thoughts to be 1.5 to 3 times higher than the national average, but only 26% of those with suicidal thoughts had sought help, and 60% of those with suicidal ideation were hesitant to seek help due to concerns about their career.<sup>3</sup>

Similarly, in the United Kingdom (UK), the Practitioner Health Programme is a confidential service for doctors suffering with psychological conditions.<sup>39</sup> Only 4.3% of those presenting to the service are surgeons, however surgeons make up 14% of medical practitioners on the specialist register in the UK.<sup>40</sup> Given the evidence that surgeons do in fact experience a high prevalence of psychological distress, it is hypothesised that this underrepresentation stems from a reluctance of surgeons to seek help for psychological conditions.<sup>40</sup> The findings of our review bring the reality of anxiety and depression amongst surgeons into the open and will hopefully encourage surgeons to feel more able to seek help, when needed.

There is a wealth of existing evidence demonstrating the wide-reaching negative consequences of mental health conditions in medical professionals: not just on the individual, but also on their patients, and their workplace.<sup>5</sup> Doctors suffering with psychiatric conditions such as depression and anxiety have been shown to report lower productivity at work and reduced work satisfaction.<sup>41</sup> Psychological distress is known to reduce physicians' ability to work full-time, potentially leading to a workforce shortage within an institution or healthcare system.<sup>42</sup> Mental health conditions amongst surgeons also have a direct impact on patient care, as depression is associated with a significantly increased risk of making serious medical errors.<sup>43</sup> Therefore, it is important to recognise and address the results of this study, as a high prevalence of anxiety and depression in surgeons can result in harmful consequences for patients, and staff shortages within healthcare systems.

The COVID-19 pandemic was declared a public health emergency of international concern by the World Health Organisation from 20th January 2020 until 5th May 2023.<sup>44</sup> With the inclusion of citations published between January 2013 and March 2023, this study covered a period before, and during the pandemic. Almost half of the included studies took

**Table 1 – Tabular analysis of included citations.**

First author (Year)	Journal	Country	Participants and assessment tool	Aims	Summary of findings
Wall M (2014)	BMC Psychology	Italy and Sweden	Surgeons (n = 421) Consultants only Specialty not stated Depression General Health Questionnaire (GHQ-12)	To investigate the extent to which surgeons in Italy and Sweden are affected by suicidal ideation and identify work-related factors associated with suicidal ideation	A high percentage of surgeons reported suicidal ideation. Work-related factors, such as harassment, can contribute to suicidal ideation in surgeons. Depression, as defined by the GHQ-12 questionnaire, was not associated with increased risk of suicidal ideation.
Havron WS (2017)	The Journal of Surgical Education	USA	Surgical trainees at the closest hospital to a mass casualty shooting (n = 24) Major depression PHQ-2	To evaluate the psychological impact of a mass casualty event on surgical trainees, comparing trainees on-call at the time of the event, to those not on-call	Three months following the event, the rate of major depression in the on-call group compared to the off-call group was not statistically significant. Seven months after the event, there continued to be no significance difference in the rate of major depression between the two groups.
Faivre G (2018)	Orthopaedics & Traumatology: Surgery & Research	France	Trainees in trauma and orthopaedic surgery (n = 107) Depression General Health Questionnaire (GHQ-12)	To assess the prevalence of burnout and factors associated with a modified risk of burnout syndrome in orthopaedic trainees	The study showed a high prevalence of burnout syndrome amongst trauma and orthopaedic trainees in France with a high level of psychological distress in this population. 40.1% of respondents had an abnormal GHQ-12 score, indicative of depression, and this was found to be a risk factor for burnout.
Muskens IS (2018)	Journal of Clinical Neuroscience	Europe	Neurosurgeons including trainees and consultants (n = 279) Anxiety Modified Aviation Safety Attitude Scale	To investigate the prevalence of potentially hazardous attitudes amongst neurosurgeons	There was a low prevalence of potentially hazardous attitudes amongst neurosurgeons, such as anxiety, impulsiveness, overconfidence, and resignation. 3.7% of neurosurgeons demonstrated a potentially hazardous level of anxiety.
Janko MR (2019)	Journal of Vascular Surgery	USA	Vascular surgery trainees (n = 177) Depression PHQ-4	To identify the factors associated with burnout in vascular surgery trainees	There was a significant association between trainees in the highest quartile for burnout and scoring consistent with moderate to severe depression. Other factors associated with burnout in vascular surgery trainees were perceived stress, reduced self-efficacy and low social support.
Salles A (2019)	Journal of Surgical Education	USA	Surgical trainees at 2 hospitals (n = 169) Depression Beck Depression Inventory Short Form	To assess the relationship between social belonging and mental wellbeing in surgical trainees	The study found that social belonging had a positive correlation with overall wellbeing and a negative correlation with intention to leave surgical training. There was a significant negative correlation between feeling of belonging and depression in surgical trainees.
Aljehani YM (2020)	Saudi Medical Journal	Saudi Arabia and Bahrain	General surgery trainees (n = 234) Anxiety 4 question screening tool for GAD formulated by the Anxiety and depression association of America	To evaluate the impact of the COVID-19 pandemic and its consequences on general surgery trainees	The pandemic has had a serious impact on surgical trainees. 50.4% of respondents had been redeployed to intensive care units or emergency departments, 50% of participants screened positive for GAD and 56.4% described themselves as having excessive anxiety.

**Table 1 – (continued)**

First author (Year)	Journal	Country	Participants and assessment tool	Aims	Summary of findings
Bui A (2020)	The American Journal of Surgery	USA	Trainees and fellows in surgical specialties (n = 161) Depression Modified PHQ-2	To assess the prevalence of burnout and depressive symptoms in surgical trainees and identify program factors associated with poor trainee wellbeing	63.2% of participants screened positive for burnout and 59% of participants screened positive for depression. There were no factors that were significantly associated with depression after adjustment.
Civantos AM (2020)	American Journal of Otolaryngology	Brazil	Head and neck surgeons (n = 163) Depression and anxiety GAD-7 PHQ-2	To assess mental health outcomes in Brazilian head and neck surgeons approaching the height of the COVID-19 pandemic	There was a high prevalence of burnout, anxiety, distress, and depression in the study cohort. 45.5% of participants had symptoms of anxiety and 16% of participants screened positive for depression.
Commander SJ (2020)	Journal of Surgical Research	Sub-Saharan Africa	Surgeons across specialities working in Africa (n = 131) Depression PHQ-9	To assess the prevalence and sources of depression and burnout in surgeons working in Africa	There was a substantial incidence of burnout and depression in the study cohort. 24.4% had mild depressive symptoms, 16.5% had moderate depression, 18.1% had moderately severe depression, and 12.6% had severe depression. Predictors of depression included difficulty accessing childcare, professional conflict, and racial discrimination.
Khurshied S (2020)	Pakistan Journal of Medical Sciences	Pakistan	Surgeons (consultants and trainees) across specialities (n = 68) Depression + anxiety DASS-21	To compare the rates of anxiety, stress, and depression between consultant surgeons and surgical trainees	There was a significantly higher prevalence of both anxiety and depression in trainees compared to consultants. 35% of trainees had depression, compared to 10% of consultants. 48% of trainees had anxiety, compared to 20% of consultants. Overall, the prevalence of depression was 26% and the prevalence of anxiety was 35%. There was no significant difference in the prevalence of stress between consultants and trainees.
Scheepstra KWF (2020)	BMJ Open	Netherlands	Dutch paediatricians, gynaecologists and orthopaedic surgeons (total n = 1374) Orthopaedic surgeons (n = 292) Depression + anxiety HADS Hospital Anxiety and Depression Scale	To compare the prevalence of potentially traumatic events and related mental health disorders between clinicians of different specialities	20% of respondents had experienced a potentially traumatic event at work within the past four weeks. The prevalence of depression was 4.8% in orthopaedic surgeons. The prevalence of anxiety was 8.2% in orthopaedic surgeons. The lack of a support protocol for potentially traumatic events was associated with increased post-traumatic stress.
Sharif S (2020)	World Neurosurgery	International	Neurosurgery trainees and consultants (n = 375) Depression Self-Reporting Questionnaire-20	To assess the frequency of depression amongst neurosurgeons during the pandemic and identify any modifiable factors influencing the incidence of depression	14% of participants had a score consistent with depression. There were multiple risk factors relating to the COVID-19 pandemic that were associated with an increased risk of depression.

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Table 1 – (continued)

First author (Year)	Journal	Country	Participants and assessment tool	Aims	Summary of findings
Sligter LM (2020)	Acta Orthopaedica Belgica	Netherlands	Orthopaedic surgeons, including retired (n = 292) Depression + anxiety HADS Hospital Anxiety and Depression Scale	To explore which events have a high emotional impact on orthopaedic surgeons, including the impact on mental health	The events with the highest emotional impact were missing a diagnosis, a patient becoming handicapped, and doubting one's own decision-making. 4.8% of respondents scored above the cut-off for depression, and 8.3% of respondents scored above the cut-off for anxiety.
Yilmaz A (2020)	Turkish Neurosurgery	Turkey	Neurosurgeons (n = 240) Anxiety Beck Anxiety Inventory	To understand the anxiety levels of neurosurgeons during the COVID-19 pandemic, as well as to record changes in clinical practice during the pandemic	62.9% of respondents had no anxiety, 13.8% had mild anxiety, 12.1% had moderate anxiety. The pandemic caused disruption to the clinical practice of neurosurgery, with postponement of elective surgery.
Al-Humadi SM (2021)	Geriatric Orthopaedic Surgery and Rehabilitation	USA	Trainees, fellows and consultants in surgery and other specialities (n = 26 orthopaedic surgeons, n = 33 other surgeons) Depression PHQ-9	To investigate rates of burnout, depression and suicidal thoughts in trainees/fellows and consultants in orthopaedic surgery compared to other specialities	Orthopaedic surgeons demonstrated lower levels of depression, suicidal ideation and burnout compared to physicians of other specialities. The rate of a tentative diagnosis of major depression was 0% in orthopaedic surgeons and 3.2% in other surgeons.
Burhamah W (2021)	Annals of Medicine and Surgery	Kuwait	Trainees in multiple surgical specialities (n = 85) Depression PHQ-9	To assess the prevalence of depression and burnout in surgical trainees	55.3% of respondents had depression (PHQ-9 $\geq$ 10). 36.5% had moderate depression, 15.3% had moderately severe depression, 3.5% had severe depression. 51.8% of respondents had an overall high score for burnout.
Coleman JR (2021)	Journal of the American College of Surgeons	USA	Trainees, fellows and early career surgeons across surgical specialties (n = 1160) Depression PHQ-9	To analyse the effects of the COVID-19 pandemic on the lives and experiences of surgical trainees and early career surgeons	The COVID-19 pandemic had a negative impact on the educational, clinical and personal experiences of surgeons. 34% of all respondents reported a high level of symptoms of depression, and 42.5% of respondents reported a high level of symptoms of burnout.
Collins C (2021)	The Journal of Surgical Education	USA	Surgical trainees across specialties (n = 73) Anxiety GAD-7	To evaluate the impact of the COVID-19 pandemic on the surgical residency training	Surgical trainees experienced a substantial reduction in operative volume during the pandemic. 14% of respondents (n = 10) met the criteria for moderate or severe generalised anxiety.
Guiroy A (2021)	Global Spine Journal	Latin America	Spinal surgeons including orthopaedics and neurosurgery (n = 204) Depression PHQ-9	To investigate the impact of the COVID-19 pandemic amongst spinal surgeons	The pandemic had an occupation, financial and psychological impact on the respondents. Overall, 48.5% reported some level of depressive symptoms. 26.5% of respondents had mild depressive symptoms, 12.3% had moderate depressive symptoms, 7.4% had moderately severe symptoms and 2.45% had severe symptoms of depression.



**Table 1 – (continued)**

First author (Year)	Journal	Country	Participants and assessment tool	Aims	Summary of findings
Johnson AP (2021)	Annals of Vascular Surgery	USA	Vascular surgery trainees (n = 145) Anxiety GAD-7	To examine the impact of COVID-19 on vascular surgery trainees	The pandemic had a substantial impact on the study population, due to changes in clinical activity, exposure to COVID-19, and psychological stressors. 31.7% of trainees reported mild anxiety, 12.2% had moderate anxiety, 5.8% reported severe anxiety.
Mahat N (2021)	The Medical Journal of Malaysia	Malaysia	Surgeons, surgical trainees and medical officers in paediatric surgery (n = 62) Depression + anxiety DASS-21	To determine the response of healthcare workers in paediatric surgery to the COVID-19 pandemic, which overwhelmingly affected adults	The pandemic had a significant impact on the respondents, especially for trainees. The prevalence of depression was 10.7% in senior surgeons and 29.4% in surgical trainees. The prevalence of anxiety was 10.7% in senior surgeons and 23.5% in surgical trainees.
Milder MJ (2021)	Journal of Oral and Maxillofacial Surgery	USA	OMFS fellows (n = 108) Depression + anxiety Expanded Physician Well-Being Index	To identify factors which may place academic OMFS fellows at higher risk of burnout	Risk factors for burnout included age, gender, working hours and teaching responsibilities. 58.3% of respondents reported feeling anxious or irritable in the past month. 38.9% of respondents reported feeling depressed or hopeless in the past month.
Rocha EAV (2021)	Brazilian Journal of Cardiovascular Surgery	Brazil	Cardiovascular surgeons (n = 37) Depression + anxiety Validated questionnaires from the DSM-5	To identify the prevalence of mental health disorders amongst Brazilian cardiovascular surgeons	This study found a high level of mental health disorders including anxiety, depression, drug abuse and burnout. The prevalence of each of these conditions in the study population was higher than that of the general population in Brazil. 43.2% of respondents had anxiety, and 32.6% of respondents had depression.
Shalhub S (2021)	Journal of Vascular Surgery	International	Vascular surgeons (n = 1609) Anxiety GAD-7	To evaluate the effects of COVID-19 on vascular surgeons by examining the level of pandemic-related anxiety	54.5% of respondents reported some level of anxiety, and 23.3% reported moderate or severe anxiety. There were multiple pandemic-related risk factors that were associated with increased anxiety.
Sharma V (2021)	Journal of Orthopaedic Surgery	India	Orthopaedic surgeons (n = 100) Anxiety GAD-7	To assess the burden of anxiety amongst orthopaedic surgeons in India during the COVID-19 pandemic	53% had minimal-no anxiety, 27% had mild anxiety, 12% had moderate anxiety and 8% had severe anxiety. Risk factors for anxiety were related to age and type of working facility.
Sharif S (2022)	World Neurosurgery	International	Neurosurgery trainees and consultants (n = 534) Depression Self-Reporting Questionnaire-20	To reassess the prevalence and factors associated with depression in neurosurgeons after the advent of the COVID-19 vaccination	The overall prevalence of depression among respondents was 16.3%. There were multiple pandemic-related risk factors associated with depression. Vaccination against COVID-19 was identified as a protective factor against depression.

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**Table 1 – (continued)**

First author (Year)	Journal	Country	Participants and assessment tool	Aims	Summary of findings
Stein MK (2022)	The Journal of Bone & Joint Surgery	USA	Orthopaedic surgeons (n = 661) Depression Beck Depression Inventory	To identify factors that may be associated with depression and suicidal ideation amongst orthopaedic surgeons	20.3% of respondents had mild depression, 4.1% had moderate depression, 0.8% had severe depression. The rate of lifetime suicidal ideation was 5%. There were lower rates of depression and suicidal ideation in those who were married or had children, and higher rates in those who were divorced.
Suraci A (2022)	The Journal of Arthroplasty	Canada	Orthopaedic surgeons (n = 80) Depression Center for Epidemiological Studies Depression Scale	To determine the prevalence of psychological distress experienced by arthroplasty surgeons in Canada during the first wave of the COVID-19 pandemic	The prevalence of depression amongst respondents was 29%, and the prevalence of emotional distress was 28%. Safety concerns, emotional conflict, and loss of income and operating time were common causes of psychological distress.
Hariri N (2023)	Cureus	Saudi Arabia	Surgeons (including trainees) across specialties (n = 153) Depression + anxiety HADS Hospital Anxiety and Depression Scale	To assess the prevalence of anxiety and depression amongst surgeons and identify risk factors for developing anxiety and depression	The prevalence of anxiety was 30.7% and the prevalence of depression was 27.5%. Risk factors for anxiety were long working hours, work related stress and dissatisfaction with income. Risk factors for depression were age 50–59 and work-related stress.
Tan YQ (2023)	Annals of Surgery	International	Surgeons, surgical trainees + nurse specialists (n = 3391) Surgeons (n = 3196) Depression + anxiety Depression, anxiety, and stress scale (DASS-21)	To investigate the psychological impact of the COVID-19 pandemic on surgical staff	There was a considerable prevalence of depression, anxiety, stress and post-traumatic stress disorder during the pandemic in this population. 33.9% of surgical trainees and 31.2% of consultant surgeons screened positive for depression. 33% of surgical trainees and 28.1% of consultant surgeons screened positive for anxiety.

**Table 2 – Prevalence of anxiety and depression by surgical speciality.**

Specialty (total number of participants)	Citations and number of participants	Anxiety prevalence	Depression prevalence	Assessment tool
Vascular surgery (n = 1754)	Johnson et al. (2021) n = 145	18%	N/A	GAD-7
	Shalhub et al. (2021) n = 1609	23.3%	N/A	GAD-7
Trauma and orthopaedic surgery (n = 1532)	Faivre et al. (2018) n = 107	N/A	40.1%	GHQ-12
	Scheepstra et al. (2020) n = 292	8.2%	4.8%	HADS
	Sligter et al. (2020) n = 292	8.3%	4.8%	HADS
	Sharma et al. (2021) n = 100	20%	N/A	GAD-7
	Stein et al. (2022) n = 661	N/A	4.9%	Beck Depression Inventory
Neurosurgery (n = 1428)	Suraci et al. (2022) n = 80	N/A	29%	Center for Epidemiological Studies Depression (CES-D) scale
	Muskens et al. (2018) n = 279	3.7%	N/A	Modified Aviation Safety Attitude Scale
	Sharif et al. (2020) n = 375	N/A	14%	Self-Reporting Questionnaire-20
	Yilmaz et al. (2020) n = 240	12.1%	N/A	Beck anxiety inventory
General surgery (n = 258)	Sharif et al. (2022) n = 534	N/A	16.3%	Self-Reporting Questionnaire-20
	Havron et al. (2017) n = 24	N/A	7–30%	PHQ-2
	Aljehani et al. (2020) n = 234	50%	N/A	4-question screening tool formulated by the Anxiety and depression association of America



**Table 3 – Factors associated with increased risk of anxiety in surgeons.**

Factor	Citations	Comments
Female gender	Civantos et al. (2020) Scheepstra et al. (2020)	Female surgeons reported significantly higher symptoms of anxiety Higher rates of anxiety were seen in female consultants, but there was no difference in rates of anxiety by gender in trainees
Younger age	Tan et al. (2023) Civantos et al. (2020) Mahat et al. (2021) Tan et al. (2023)	Female surgeons were 1.4 times more likely to screen positive for anxiety The 25–44 years age group reported significantly higher anxiety scores Age under 30 years was significantly associated with anxiety Younger respondents were significantly more likely to screen positive for anxiety
Occupational concerns regarding the COVID-19 pandemic	Yilmaz et al. (2020) Shalhub et al. (2021)	Surgeons who felt less protected from the pandemic experienced higher levels of anxiety Anxiety was associated with a range of occupational concerns during the COVID-19 pandemic, including lack of personal protective equipment (PPE), donning and doffing PPE, being away from home and family, concerns about delays to patient care, and financial concerns

**Table 4 – Factors associated with an increased risk of depression in surgeons.**

Factor	Citations	Comments
Female gender	Civantos et al. (2020) Coleman et al. (2021) Tan et al. (2023) Scheepstra et al. (2020)	Female respondents had significantly higher PHQ-2 scores, indicating a higher probability of depression Female gender significantly increased the odds of depression Female respondents were 1.3 times more likely to screen positive for depression There was a higher prevalence of depression in female consultants compared to male consultants
Burnout	Faivre et al. (2018) Janko et al. (2018) Burhamah et al. (2021)	There was a significant association between symptoms of depression and burnout syndrome Burnout was associated with significantly higher levels of depression There was a significant association between depression and a high score on the emotional exhaustion subscale of the Maslach Burnout Inventory
Younger age	Civantos et al. (2020) Guiroy et al. (2021) Tan et al. (2023)	Younger surgeons had significantly higher PHQ-2 scores, indicating a higher probability of depression There was a significant negative correlation between age and PHQ-9 score, indicating a higher probability of depression in younger surgeons Younger surgeons were significantly more likely to report symptoms of depression
Exposure to individuals infected with COVID-19	Sharif et al. (2020) Sharif et al. (2022) Tan et al. (2023)	There was a significant association between depression and being exposed to a COVID positive colleague There was a significant association between depression and being redeployed to work in a COVID-19 area There was a significant association between depression and knowing somebody who was infected with, or died from COVID-19
Concerns regarding personal protective equipment (PPE) during the COVID-19 pandemic	Sharif et al. (2020) Sharif et al. (2022) Coleman et al. (2021)	There was a significant correlation between depression and feeling unsafe with the PPE provided at the workplace There was a significant association between depression and being asked to provide one's own PPE during the pandemic

place during the pandemic, despite the pandemic only lasting for one third of the time period included in this review. There was a far higher number of participants in the studies conducted during the pandemic than before the pandemic, with 8234 participants in studies during the pandemic, compared to 3165 participants before the pandemic. This likely reflects the level of newfound attention to physician wellbeing that developed during the pandemic. In this systematic review, although COVID-19 did have an impact on surgeons; anxiety and depression in surgeons existed before the pandemic and is expected to continue existing after the pandemic. Therefore, we cannot be reassured that the end of the pandemic will

result in an improvement in surgeons' mental health. This demonstrates the importance of continuing and expanding the initiatives around surgeon wellbeing that gained traction during the pandemic.<sup>45</sup>

A limitation of this review was the heterogeneous methods in the included citations and the inclusion of different assessment tools. However, we only included validated tools in detecting anxiety and depression in a 10-year period to decrease the risk of bias. This review described the issue of the possible existence of poor mental health in surgeons, and its potential deleterious consequences, which raises the obvious question of what can be done to manage or

mitigate the effects of anxiety and depression in surgeons. It is important to normalise discussions around mental health in surgery.<sup>46</sup> Surgeons are less likely to seek psychological help compared to other medical professionals; therefore, creating an open and honest environment around mental health is an essential first step.<sup>40</sup> Specialised mental health services may also be useful in addressing anxiety and depression in surgeons. Whilst surgeons do have a low level of utilisation of the UK Practitioner Health Programme, it is an example of an effective service with great potential, due to the ability to self-refer to the service in a completely confidential manner.<sup>47</sup> Confidentially designed services may be key in enabling surgeons to seek help when mental health support is needed.

Institutional support must be also strengthened in order to address anxiety and depression in surgeons. There are multiple examples of the relationship between institutional support and mental wellbeing in surgeons. Evidence shows a significant negative correlation between depression in surgical trainees and a feeling of belonging towards their institution.<sup>13</sup> This was also seen during the COVID-19 pandemic, as multiple studies in this review cited institutional support around the pandemic as a protective factor associated with a decreased risk of anxiety or depression.<sup>29,32</sup> Institutional support can take the form of transparency from leadership figures and provision of access to psychological support.<sup>22,28</sup> Surgical colleges can also play a role in offering tailored psychological support on a wider scale.<sup>48</sup> As such, it is clear that there is much work to be done to improve the mental health of surgeons and address the impact of anxiety and depression amongst them.

## Conclusion

There was a high prevalence of anxiety and depression amongst surgeons over the past decade. Risk factors associated with a higher risk of anxiety and depression include female gender, younger age, concurrent burnout, and occupational concerns regarding the COVID-19 pandemic. Protective factors include institutional support and a sense of social belonging. These findings are significant as surgeons have been demonstrated to be less likely to seek help for mental health concerns, and psychological distress in surgeons can have a devastating impact on individuals, employers, and patients. This study highlighted the urgent need for action to address anxiety and depression in surgeons.

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## List of abbreviations

COVID-19	Coronavirus disease 2019
PRISMA	Preferred Reporting Items for Systematic Review and Meta-Analysis
MeSH	Medical Subject Headings
GHQ-12	General Health Questionnaire
USA	United States of America
PHQ-2	Patient Health Questionnaire-2
PHQ-4	Patient Health Questionnaire-4
GAD	Generalised Anxiety Disorder
GAD-7	Generalised Anxiety Disorder Assessment
PHQ-9	Patient Health Questionnaire-9
DASS-21	Depression, Anxiety and Stress Scale
HADS	Hospital Anxiety and Depression Scale
PPE	Personal protective equipment
OMFS	Oral and Maxillofacial Surgery
DSM-5	The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
UK	United Kingdom

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