Original Article

Clin Shoulder Elbow 2024;27(3):295-308
https://doi.org/10.5397/cise.2024.00178

CiSE
Clinics in Shoulder and Elbow

eISSN 2288-8721

The impact of mental health on shoulder arthroplasty and rotator cuff repair: a meta-analysis

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Background: The aim of this study was to evaluate the impact of mental health attributes, such as the presence of psychiatric comorbidities or psychological comorbidities (low resilience), on outcomes after rotator cuff repair (RCR) and total shoulder arthroplasty (TSA).
Methods: PubMed, Cochrane, and Google Scholar (results pages 1–20) were searched up to November 2023. Mental health problems of interest included the presence of psychiatric comorbidities (depression, anxiety) or indicators of poor psychological functioning, such as low resilience or the presence of distress. Patients were assigned to poor or good mental health groups in this study based on their grouping in the original study.
Results: Fourteen studies were included in the meta-analysis. Patients with good mental health had greater improvements in postoperative American Shoulder and Elbow Surgeons and Simple Shoulder Test scores in the TSA cohort (P=0.003 and P=0.01), RCR cohort (P<0.001), and the combined TSA and RCR cohort (P<0.001). No difference was found in visual analog scale score, satisfaction, external rotation, or flexion between the two mental health groups. Patients with poor mental health undergoing RCR experienced higher rates of adverse events and transfusions (P<0.001). Patients with poor mental health also had greater rates of revision and emergency department visits in the TSA cohort (P<0.001), RCR cohort (P=0.05 and P=0.03), and combined cohort (P<0.001). Patients with poor mental health undergoing TSA had a higher rate of re-admission (P<0.001).
Conclusions: Patients with poor preoperative mental health showed inferior patient-reported outcome scores and increased rates of adverse events, revisions, and re-admissions.
Level of evidence: III.

Keywords: Mental health; Rotator cuff repair; Total shoulder arthroplasty; Patient reported outcomes; Adverse events

INTRODUCTION

The prevalence of mental health disorders is alarmingly high, surpassing 15%–20% globally according to the most recent estimates from the World Health Organization [1]. Particularly in the context of the coronavirus disease 2019 pandemic, which was found to have exacerbated mental health burdens, it is imperative to explore how psychiatric comorbidities may influence patient outcomes after elective surgery [2]. In fact, mental health disorders impact the lives of roughly one billion individuals worldwide [1]. With advancing age, there is a notable increase in the susceptibility to mental health disorders, especially in mood and substance use disorders, which exhibit a pronounced age-related escalation in risk [3]. Orthopedic surgeons often encounter postoperative experiences that elude clear explanation, and these situations can frequently be explained by patient-related factors [4-

Received: February 26, 2024 Revised: May 22, 2024 Accepted: June 1, 2024
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7]. A growing body of literature has emerged to shed light on the effects of mental health on outcomes after elective orthopedic surgery. Many studies indicate preoperative mental health diagnosis and/or lower preoperative scores on validated mental health surveys as predictors for increased postoperative opioid usage and worse patient-reported outcomes (PROs) [8-17].

Recent research has also sought to clarify the relationship between resilience and surgical outcomes. Multiple studies have shown that higher levels of preoperative and early postoperative resilience, as calculated using validated questionnaires like the Pain Self-efficacy Questionnaire, correlate with improved postoperative functional outcomes and PROs [18-22]. In addition, highly resilient patients have been shown to achieve greater success in same-day discharge programs following total joint arthroplasty and to require shorter hospital stays [19,20]. In fact, resilience is often referred to as a part of mental health; as such, for the purpose of this study, it will be examined alongside other mental health entities [23].

In line with the broader orthopedic surgery literature, there is a growing body of evidence in the field of shoulder surgery that suggests similar effects. Several studies of patients undergoing various surgical treatments of the shoulder have reported lower PROs among patients with mental health conditions compared to patients without such conditions [24-28]. Furthermore, other studies have shown that higher preoperative mental health survey scores may correlate with a faster return to work following rotator cuff repair (RCR) and reduced rates of complications and re-admissions following total shoulder arthroplasty (TSA) [29,30]. Thus, the objective of this meta-analysis was to assess the impact of mental health on RCR and TSA outcomes. For the sake of consistency, patients with a psychiatric comorbidity or poor psychological function will be referred to as having poor mental health; otherwise, they will be referred to as having good mental health. We hypothesize that patients with poor mental health will have worse outcomes postoperatively compared to patients with good mental health preoperatively undergoing the same surgeries.

METHODS

Search Strategy

Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, PubMed, Cochrane, and Google Scholar (results pages 1–20) were searched up to November 2023. The following keywords and Boolean terms were used to find studies assessing the impact of preoperative mental health on the outcomes of shoulder replacement and RCR: "mental health," "psych," "resilience," "shoulder," "replacement," "arthroplasty," and "rotator cuff." Additional studies were identified by manually searching through the reference lists of identified papers and by Internet searches. One author extracted the data and another confirmed the choice of articles. The process is summarized in Fig. 1.

Comparative studies of patients who had either a TSA or RCR and were separated into two groups based on mental health were included. Mental health problems of interest were psychiatric comorbidities (depression, anxiety) or indicators of poor psychological functioning, such as low resilience or distress. We excluded case reports, narrative or systematic reviews, theoretical research, conference reports, meta-analyses, expert comments, economic analyses, and studies reporting non-relevant outcomes or incomplete outcomes (such as the absence of standard deviations).

Data Extraction

Study eligibility was determined by two reviewers independently. Extracted data consisted of complications, re-admissions, emergency department (ED) visits, revision surgeries, discharge location, transfusions, tendon healing, range of motion (ROM) (external rotation [ER] and flexion), and PROs (American Shoulder and Elbow Surgeons [ASES] score, Simple Shoulder Test [SST] score, visual analog scale [VAS] score, and satisfaction). Any differences between the investigators were resolved by discussion.

Risk-of-Bias Assessment

The ROBINS-I tool was used by the authors to independently assess the risk of bias in the included studies [31]. Studies were excluded if they had a critical risk of bias.

Statistical Analysis

Review Manager 5.4 (Cochrane) was used to perform all statisti-

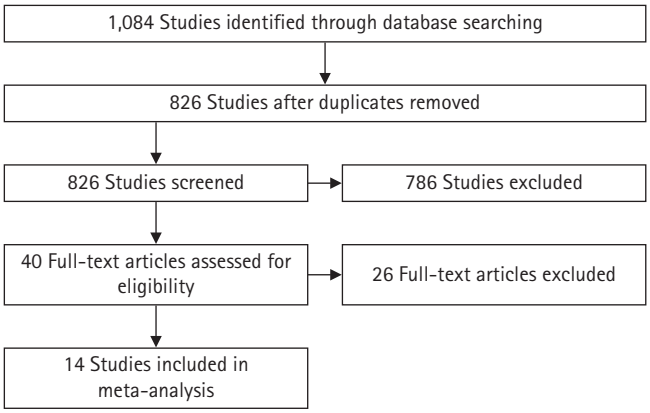

Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart of article selection.

https://doi.org/10.5397/cise.2024.00178

cal analysis. For dichotomous data, the risk ratio and 95% confidence interval were used. For continuous data, mean differences (MDs) with 95% CI values were used. Heterogeneity was evaluated by Q tests and I^2 statistics. If considerable heterogeneity was present, as indicated by $P \leq 0.10$ or $I^2 > 50\%$, a random-effects model was used; otherwise, a fixed-effects model was chosen ($P > 0.10$ or $I^2 < 50\%$). The threshold for statistical significance was set a priori at $P \leq 0.05$.

RESULTS

Characteristics of the Included Studies

Fourteen studies [28,30,32-43], including 13 retrospective studies and one prospective study, met the inclusion criteria and were included in the meta-analysis. Seven studies enrolled patients undergoing RCR, including 68,107 patients with good preoperative mental health and 68,547 with poor preoperative mental health. Of these seven studies, three identified patients with a preoperative mood/anxiety disorder, three focused on psychological functioning (resilience, distress), and one studied mental health in general. Another seven studies enrolled patients undergoing TSA, including 560,778 patients with good preoperative mental health and 60,043 with poor preoperative mental health. Of these seven studies, five analyzed patients had a preoperative mood/anxiety disorder and two addressed psychiatric comorbidities in general. The characteristics of the 14 included studies are summarized in Table 1 [25,27,29,32-42].

Patient-Reported Outcomes

American Shoulder and Elbow Surgeons score

Three studies enrolling 988 subjects undergoing TSA [28,40,41] (368 with poor and 620 with good mental health) and four studies enrolling 362 subjects undergoing RCR [32-35] (112 with poor and 250 with good mental health) reported postoperative ASES scores. Higher postoperative ASES scores were recorded

Table 1. Main characteristics of the included studies

Surgery	Study	Methods	Database	Year of data collection	Participant		Mental health assessment
					Poor mental health	Good mental health	
Shoulder replacement	Bot et al. (2014) [36]	Retrospective	National hospital discharge survey	1990–2007	24,418	324,406	The presence of a psychiatric comorbidity
	Colasanti et al. (2023) [28]	Retrospective	Author's institution	2011–2020	218	378	The presence of anxiety or depression
	Diamond et al. (2023) [37]	Retrospective	Pearldiver	2010–2020	4,084	20,242	The presence of depression
	Lunati et al. (2021) [38]	Retrospective	Truven MarketScan database	2009–2017	3,209	19,414	The presence of depression
	Mollon et al. (2016) [39]	Retrospective	The United States Nationwide Inpatient Sample	2002–2012	27,964	196,096	The presence of depression
	Porter et al. (2021) [33]	Retrospective	Author's institution	2010–2017	62	66	The presence of a psychiatric disorder
	Werner et al. (2017) [41]	Retrospective	Author's institution	2007–2013	88	176	The presence of depression
Rotator cuff repair	Dujeux et al. (2023) [42]	Retrospective	Author's institution	2012–2018	38	181	The presence of mood and anxiety disorder
	Freshman et al. (2023) [30]	Retrospective	Pearldiver	2010–2020	68,397	67,092	The presence of a mental health disorder
	Johnson et al. (2022) [43]	Retrospective	Author's institution	2014–2020	232	584	The presence of depression or anxiety
	Park et al. (2021) [32]	Retrospective	Author's institution	Jun–Dec 2017	41	103	The presence of depression or anxiety
	Porter et al. (2021) [40]	Retrospective	Author's institution	Jan–Dec 2014	5	19	Mild vs. High resilience
	Potter et al. (2015) [34]	Retrospective	Author's institution	2011–2014	26	44	Whether or not the patient is distressed
	Thorpe et al. (2018) [35]	Prospective	Author's institution	2014–2015	40	84	The presence of a poor psychological function

for patients with good mental health undergoing TSA (MD, −9.73; 95% CI, −16.18 to −3.27; P = 0.003) (Fig. 2A) and RCR (MD, −10.42; 95% CI, −15.98 to −4.85; P = 0.0002) (Fig. 2A). Greater postoperative ASES scores in patients with good mental health were also observed when the cohorts were combined (MD, −9.82; 95% CI, −13.36 to −6.27; P < 0.00001) (Fig. 2A).

When assessing the improvement in ASES (postoperative score−preoperative score), two studies enrolling 860 subjects undergoing TSA [28,41] (306 with poor and 554 with good mental health) and three studies enrolling 338 subjects undergoing RCR [32,34,35] (107 with poor and 231 with good mental health) were included. Greater improvement was seen in the patients with good mental health undergoing TSA (MD, −10.93; 95% CI, −14.46 to −7.40; P < 0.00001) (Fig. 2B), while no significant difference was seen in patients undergoing RCR (MD, 2.44; 95% CI, −4.10 to 8.98; P = 0.46) (Fig. 2B) or when the cohorts were combined (MD, −2.34; 95% CI, −7.98 to 3.31; P = 0.42) (Fig. 2B).

Simple Shoulder Test score

One study of 128 subjects undergoing TSA [40] (62 with poor and 66 with good mental health) and three studies enrolling 238 subjects undergoing RCR [32-34] (72 with poor and 166 with good mental health) reported data on postoperative SST scores. The results showed a greater postoperative improvement in SST scores in patients with good mental health undergoing TSA (MD, −1.20; 95% CI, −2.12 to −0.28; P = 0.01; Fig. 2C), RCR (MD,

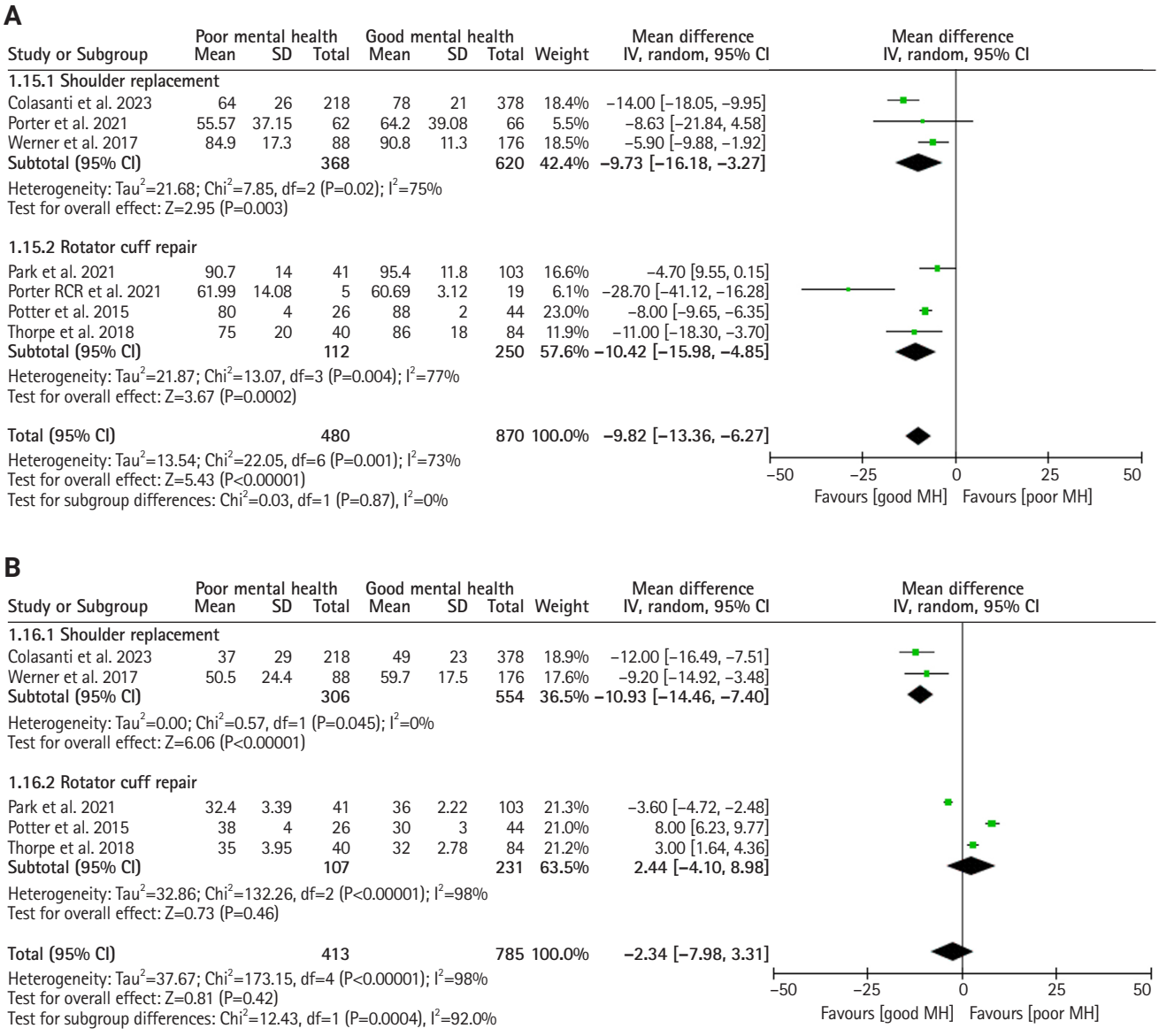

Fig. 2. Continued.

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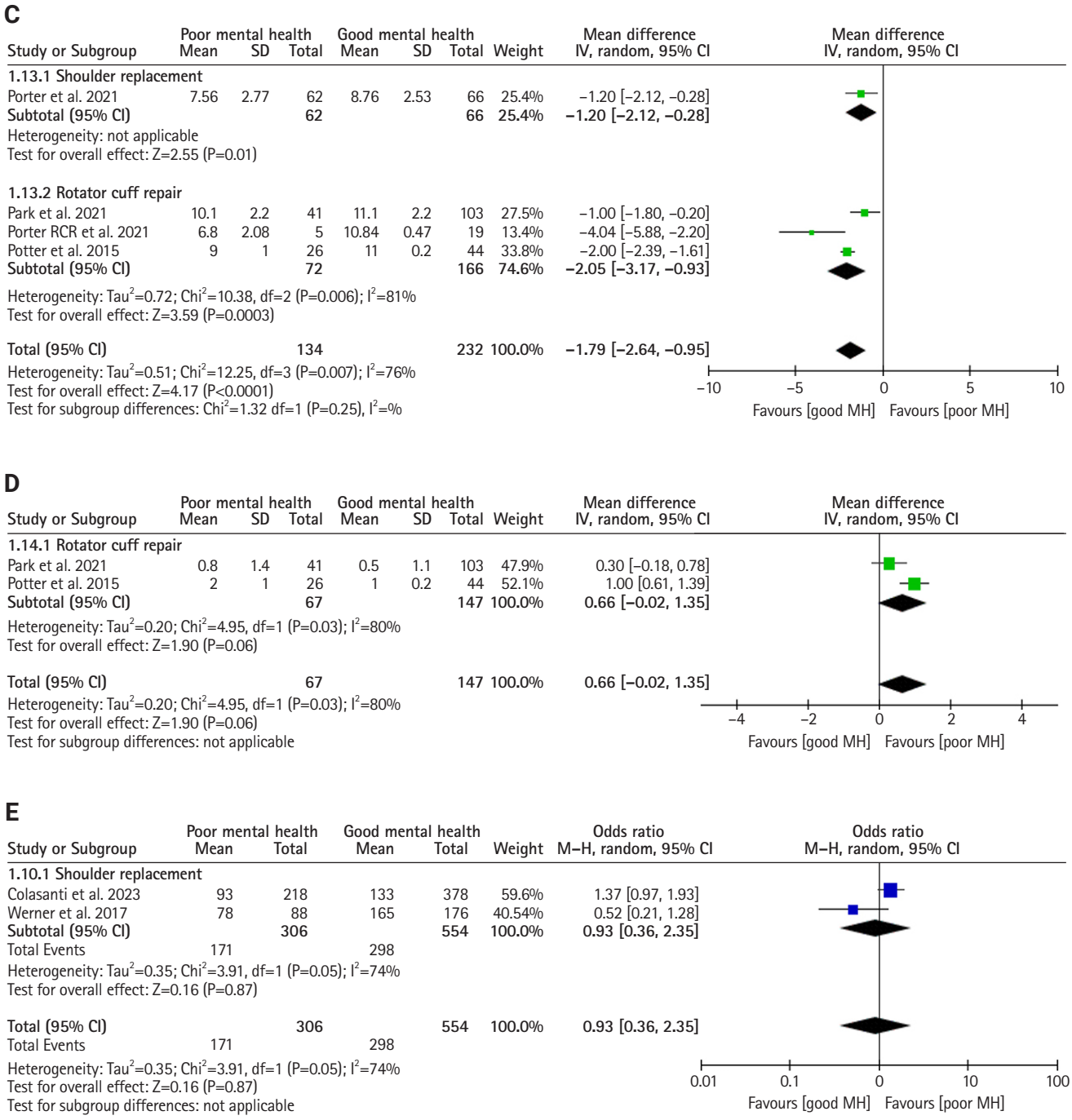

Fig. 2. Forest plots showing the difference in postoperative American Shoulder and Elbow Surgeons (ASES) score (A), ASES score improvement (B), postoperative Simple Shoulder Test score (C), postoperative visual analog scale (D), and postoperative satisfaction (E). SD: standard deviation, IV: inverse variance; CI: confidence interval, M-H: Mantel-Haenszel.

−2.05; 95% CI, −3.17 to −0.93; P = 0.0003) (Fig. 2C), and when the cohorts were combined (MD, −1.79; 95% CI, −2.64 to −0.95; P < 0.0001) (Fig. 2C).

Visual analog scale

Two studies enrolling 214 subjects undergoing RCR [32,34] (67 with poor and 147 with good mental health) reported data on postoperative VAS scores. The results showed no significant difference between the two groups (MD, 0.66; 95% CI, −0.02 to 1.35; P = 0.06) (Fig. 2D).

Satisfaction

Two studies enrolling 860 subjects undergoing TSA [28,41] (306 with poor and 554 with good mental health) reported data on postoperative satisfaction. The results showed no significant difference between the two groups (odds ratio [OR], 0.93; 95% CI, 0.36–2.35; P = 0.87) (Fig. 2E).

Range of Motion

Two studies enrolling 724 subjects undergoing TSA [28,40] (280 with poor and 444 with good mental health) and one study enrolling 144 subjects undergoing RCR [32] (41 with poor and 103 with good mental health) reported data on postoperative ROM. The results showed no significant difference in ER or flexion within the TSA cohort (MD, −2.12; 95% CI, −16.81 to 12.58; P = 0.78; Fig. 3A) (MD, − 2.83; 95% CI,−8.01 to 2.34; P = 0.28; Fig. 3B) or the RCR cohort (MD, −0.50; 95% CI, −5.59 to 4.59; P = 0.85; Fig. 3A) (MD, − 0.30; 95% CI,−4.72 to 4.12; P = 0.89; Fig. 3B). In addition, no significant differences were observed when the cohorts were combined (MD, −1.22; 95% CI, −9.01 to 6.57; P = 0.84; Fig. 3A) (MD, −1.37; 95% CI, −4.73 to 1.99; P = 0.47; Fig. 3B).

Complications

Adverse events

Six studies enrolling 620,557 subjects undergoing TSA [28,36-40] (59,955 with poor and 560,602 with good mental health) and three studies enrolling 136,524 subjects undergoing RCR [30,42,43] (68,667 with poor and 67,857 with good mental health) reported data on postoperative adverse events (medical and surgical complications). There was no significant difference in the rate of complications in patients undergoing TSA (OR, 1.82; 95% CI, 0.86–3.87; P = 0.12) (Fig. 4A). However, a higher rate of adverse events was recorded for patients with poor mental health undergoing RCR (OR, 2.25; 95% CI, 1.84–2.74; P < 0.00001) (Fig. 4A)

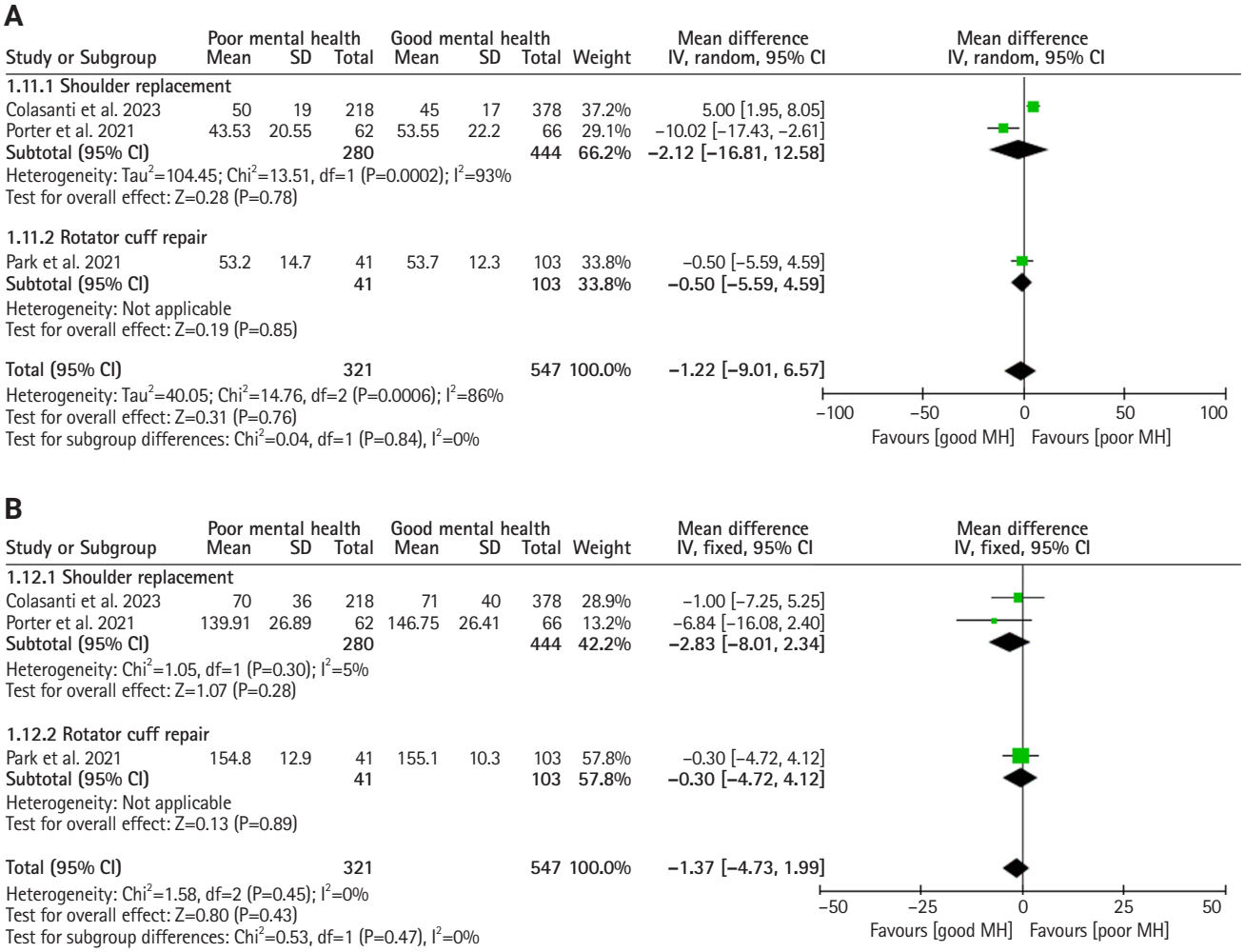

Fig. 3. Forest plots showing the difference in postoperative external rotation (A) and postoperative flexion (B). SD: standard deviation, IV: inverse variance; CI: confidence interval, M-H: Mantel-Haenszel.

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and when the cohorts were combined (OR, 1.84; 95% CI, 1.16–2.94; P = 0.01) (Fig. 4A).

When assessing medical and surgical complications separately, four studies on 619,833 subjects undergoing TSA [36-39] (59,675 with poor and 560,158 with good mental health) and one study on 135,489 subjects undergoing RCR [30] (68,397 with poor and 67,092 with good mental health) were included. No significant difference in medical or surgical complications was seen in the TSA cohort (OR, 2.24; 95% CI, 0.26–19.64; P = 0.47) (Fig. 4B) (OR, 1.10; 95% CI, 0.47–2.56; P = 0.83) (Fig. 4C) or when the cohorts were combined (OR, 2.11; 95% CI, 0.52–8.54; P = 0.29) (Fig. 4B) (OR, 1.21; 95% CI, 0.61–2.38; P = 0.59) (Fig. 4C). However, a higher rate of medical and surgical complications was identified in patients with poor mental health undergoing RCR (OR, 1.67; 95% CI, 1.63–1.71; P < 0.00001) (Fig. 4B) (OR, 1.60; 95% CI, 1.54–1.66; P < 0.00001) (Fig. 4C).

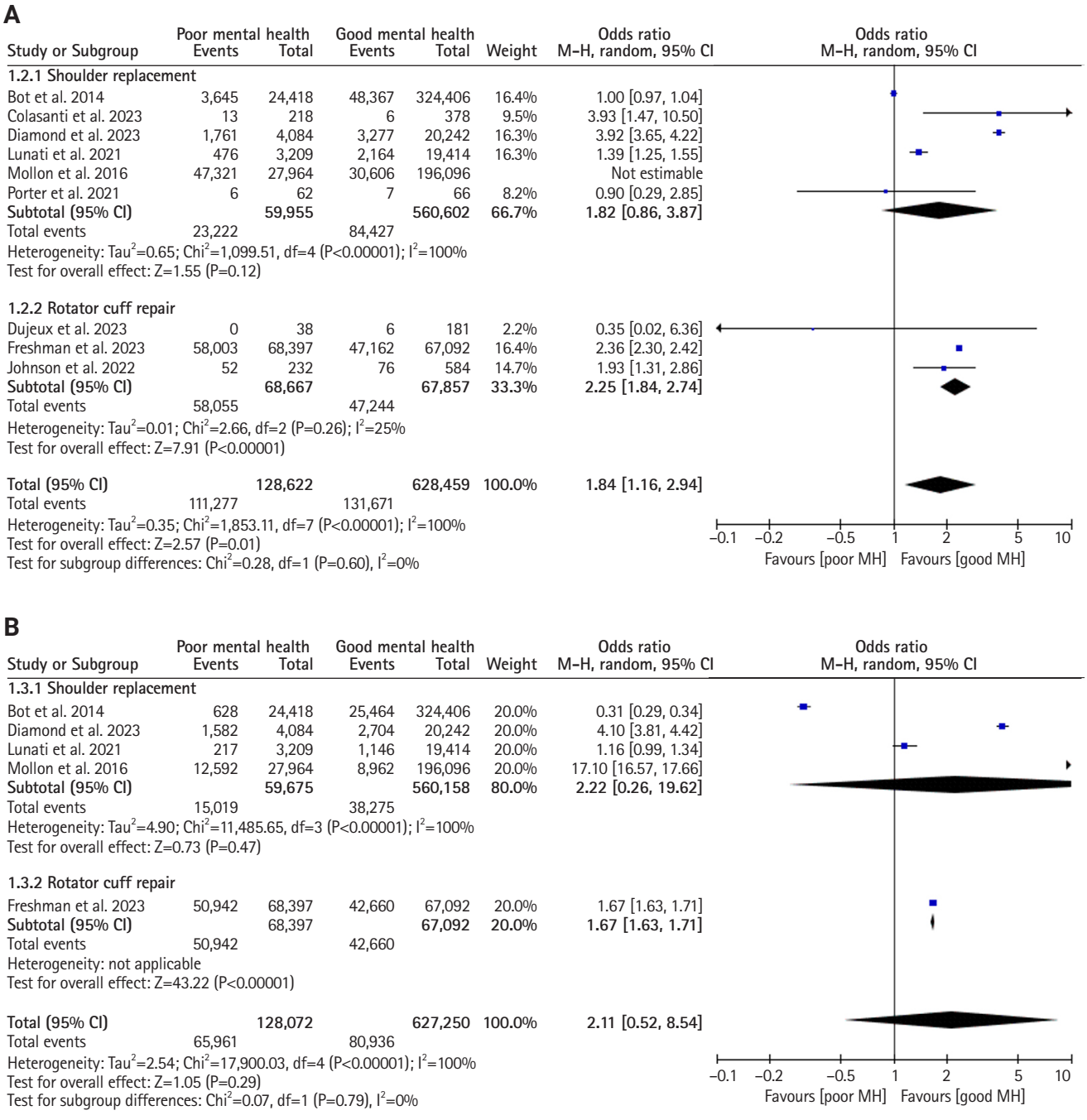
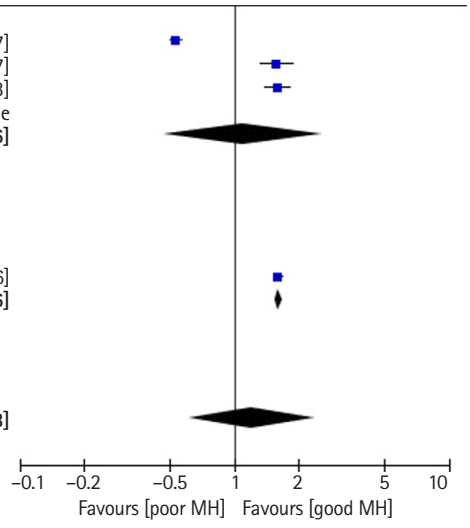


Fig. 4. Continued.

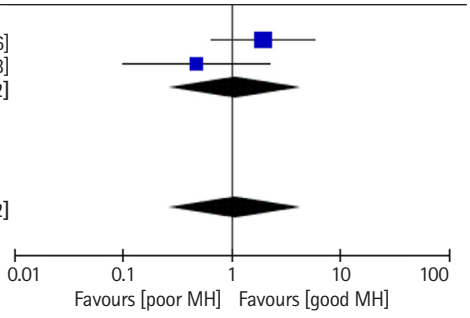
C

Study or Subgroup	Poor mental health Events	Total	Good mental health Events	Total	Weight	Odds ratio M-H, random, 95% CI
1.4.1 Shoulder replacement						
Bot et al. 2014	1,186	24,418	28,254	324,406	25.1%	0.54 [0.50, 0.57]
Diamond et al. 2023	179	4,084	573	20,242	24.8%	1.57 [1.33, 1.87]
Lunati et al. 2021	259	3,209	1,018	19,414	24.9%	1.59 [1.38, 1.83]
Mollon et al. 2016	34,729	27,964	21,644	196,096		Not estimable
Subtotal (95% CI)		**59,675**		**560,158**	**74.8%**	**1.10 [0.47, 2.56]**
Total events	36,353		51,489			
Heterogeneity: Tau^2=0.55; Chi^2=296.09, df=2 (P<0.00001); I^2=99%						
Test for overall effect: Z=0.22 (P=0.83)						
1.4.2 Rotator cuff repair						
Freshman et al. 2023	7,061	68,397	4,502	67,092	25.2%	1.60 [1.54, 1.66]
Subtotal (95% CI)		**68,397**		**67,092**	**25.2%**	**1.60 [1.54, 1.66]**
Total events	7,061		4,502			
Heterogeneity: Tau^2=not applicable						
Test for overall effect: Z=0.22 (P=0.83)						
Total (95% CI)		**128,072**		**627,250**	**100.0%**	**1.21 [0.61, 2.38]**
Total events	43,414		55,991			
Heterogeneity: Tau^2=0.48; Chi^2=951.58, df=3 (P<0.00001); I^2=100%						
Test for overall effect: Z=0.54 (P=0.59)						
Test for subgroup differences: Chi^2=0.76, df=1 (P=0.38), I^2=0%						



D

Study or Subgroup	Poor mental health Events	Total	Good mental health Events	Total	Weight	Odds ratio M-H, random, 95% CI
1.9.1 Rotator cuff repair						
Dujeux et al. 2023	5	38	13	181	57.9%	1.96 [0.65, 5.86]
Park et al. 2021	2	41	10	103	42.1%	0.48 [0.10, 2.28]
Subtotal (95% CI)		**79**		**284**	**100.0%**	**1.08 [0.27, 4.32]**
Total events	7		23			
Heterogeneity: Tau^2=0.55; Chi^2=2.16, df=1 (P=0.14); I^2=54%						
Test for overall effect: Z=0.11 (P=0.91)						
Total (95% CI)		**79**		**284**	**100.0%**	**1.08 [0.27, 4.32]**
Total events	7		23			
Heterogeneity: Tau^2=0.55; Chi^2=2.16, df=1 (P=0.14); I^2=54%						
Test for overall effect: Z=0.11 (P=0.91)						
Test for subgroup differences: not applicable						



E

Study or Subgroup	Poor mental health Events	Total	Good mental health Events	Total	Weight	Odds ratio M-H, random, 95% CI
1.5.1 Shoulder replacement						
Bot et al. 2014	2,459	24,418	20,113	324,406	25.0%	1.69 [1.62, 1.77]
Diamond et al. 2023	179	4,084	292	20,242	25.0%	3.13 [2.59, 3.78]
Mollon et al. 2016	17,925	27,964	12,996	196,096	25.0%	25.16 [24.41, 25.93]
Subtotal (95% CI)		**56,466**		**540,44**	**75.0%**	**5.11 [0.61, 42.94]**
Total events	20,563		33,401			
Heterogeneity: Tau^2=3.53; Chi^2=10,095.65, df=2 (P<0.00001); I^2=100%						
Test for overall effect: Z=1.50 (P=0.13)						
1.5.2 Rotator cuff repair						
Freshman et al. 2023	2,099	68,397	1,728	67,092	25.0%	1.20 [1.12, 1.28]
Subtotal (95% CI)		**68,397**		**67,092**	**25.0%**	**1.20 [1.12, 1.28]**
Total events	2,099		1,728			
Heterogeneity: not applicable						
Test for overall effect: Z=5.47 (P<0.00001)						
Total (95% CI)		**124,863**		**607,836**	**100.0%**	**3.56 [0.58, 21.70]**
Total events	22,662		35,129			
Heterogeneity: Tau^2=3.40; Chi^2=13,952.01, df=3 (P=0.18); I^2=44.0%						
Test for overall effect: Z=0.37 (P=0.17)						
Test for subgroup differences: Chi^2=1.79, df=1 (P=0.18), I^2=44.0%						

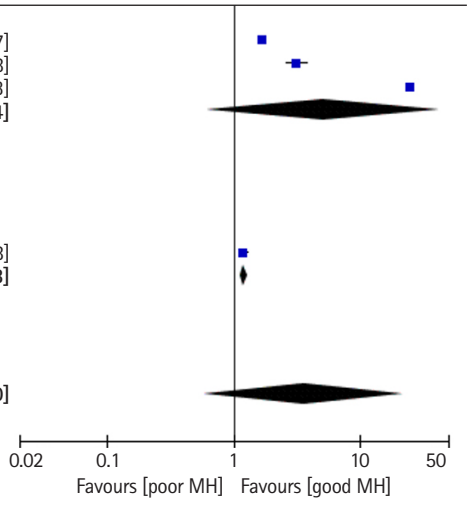


Fig. 4. Continued.

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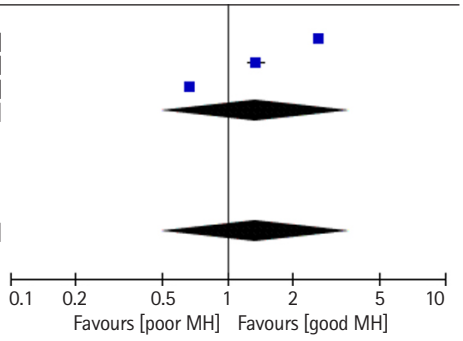
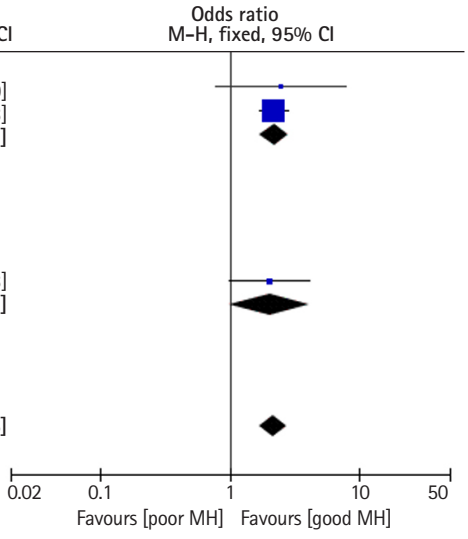
F

Study or Subgroup	Poor mental health Events	Total	Good mental health Events	Total	Weight	Odds ratio M-H, random, 95% CI
1.1.1 Shoulder replacement						
Bot et al. 2014	7,822	24,418	49,309	324,406	33.4%	2.63 [2.56, 2.71]
Lunati et al. 2021	846	3,209	4,064	19,414	33.3%	1.35 [1.24, 1.47]
Mollon et al. 2016	3,300	27,964	32,552	196,096	33.4%	0.67 [0.65, 0.70]
Subtotal (95% CI)		**55,591**		**539,916**	**100.0%**	**1.34 [0.49, 3.64]**
Total events	11,968		85,925			
Heterogeneity: Tau^2=0.78; Chi^2=3,237.53, df=2 (P<0.00001); I^2=100%						
Test for overall effect: Z=0.57 (P=0.57)						
Total (95% CI)		**55,591**		**539,916**	**100.0%**	**1.34 [0.49, 3.64]**
Total events	11,968		85,925			
Heterogeneity: Tau^2=0.78; Chi^2=3,237.53, df=2 (P<0.00001); I^2=100%						
Test for overall effect: Z=0.57 (P=0.57)						
Test for subgroup differences: not applicable						



G

Study or Subgroup	Poor mental health Events	Total	Good mental health Events	Total	Weight	Odds ratio M-H, fixed, 95% CI
1.6.1 Shoulder replacement						
Colasanti et al. 2023	7	218	5	378	4.7%	2.47 [0.78, 7.89]
Lunati et al. 2021	79	3,209	222	19,414	82.4%	2.18 [1.68, 2.83]
Subtotal (95% CI)		**3,427**		**19,792**	**87.1%**	**2.20 [1.71, 2.83]**
Total events	86		227			
Heterogeneity: Chi^2=3,237.53, df=1 (P=0.84); I^2=0%						
Test for overall effect: Z=6.09 (P<0.00001)						
1.6.2 Rotator cuff repair						
Johnson et al. 2022	14	232	18	584	12.9%	2.02 [0.99, 4.13]
Subtotal (95% CI)		**232**		**584**	**12.9%**	**2.02 [0.99, 4.13]**
Total events	14		18			
Heterogeneity: not applicable						
Test for overall effect: Z=1.92 (P=0.05)						
Total (95% CI)		**3,659**		**20,376**	**100.0%**	**2.17 [1.71, 2.76]**
Total events	100		245			
Heterogeneity: Chi^2=0.09, df=2 (P=0.96); I^2=0%						
Test for overall effect: Z=6.37 (P<0.00001)						
Test for subgroup differences: Chi^2=0.05, df=1 (P=0.83), I^2=0%						



H

Study or Subgroup	Poor mental health Events	Total	Good mental health Events	Total	Weight	Odds ratio M-H, random, 95% CI
1.8.1 Shoulder replacement						
Lunati et al. 2021	186	3,209	680	19,414	33.9%	1.70 [1.43, 2.00]
Subtotal (95% CI)		**3,209**		**19,414**	**33.9%**	**1.70 [1.43, 2.00]**
Total events	186		680			
Heterogeneity: Chi^2=not applicable						
Test for overall effect: Z=6.21 (P<0.00001)						
1.8.2 Rotator cuff repair						
Freshman et al. 2023	1,306	68,397	0	67,092	32.3%	2,613.04 [163.35, 41,799.00]
Johnson et al. 2022	7	232	15	584	33.8%	1.18 [0.47, 2.93]
Subtotal (95% CI)		**68,629**		**67,676**	**66.1%**	**54.02 [0.00, 284,425,501.51]**
Total events	1,313		15			
Heterogeneity: Tau^2=123.60; Chi^2=112.53, df=1 (P<0.00001); I^2=99%						
Test for overall effect: Z=0.51 (P=0.61)						
Total (95% CI)		**71,838**		**87,090**	**100.0%**	**16.06 [0.01, 20529.86]**
Total events	1,499		695			
Heterogeneity: Chi^2=0.09, df=2 (P=0.96); I^2=0%						
Test for overall effect: Z=0.76 (P=0.45)						
Test for subgroup differences: Chi^2=0.19, df=1 (P=0.66), I^2=0%						

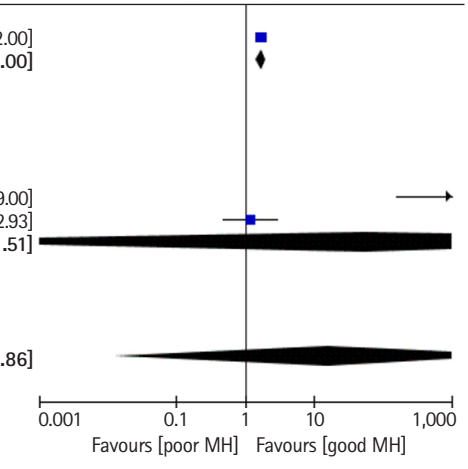


Fig. 4. Continued.

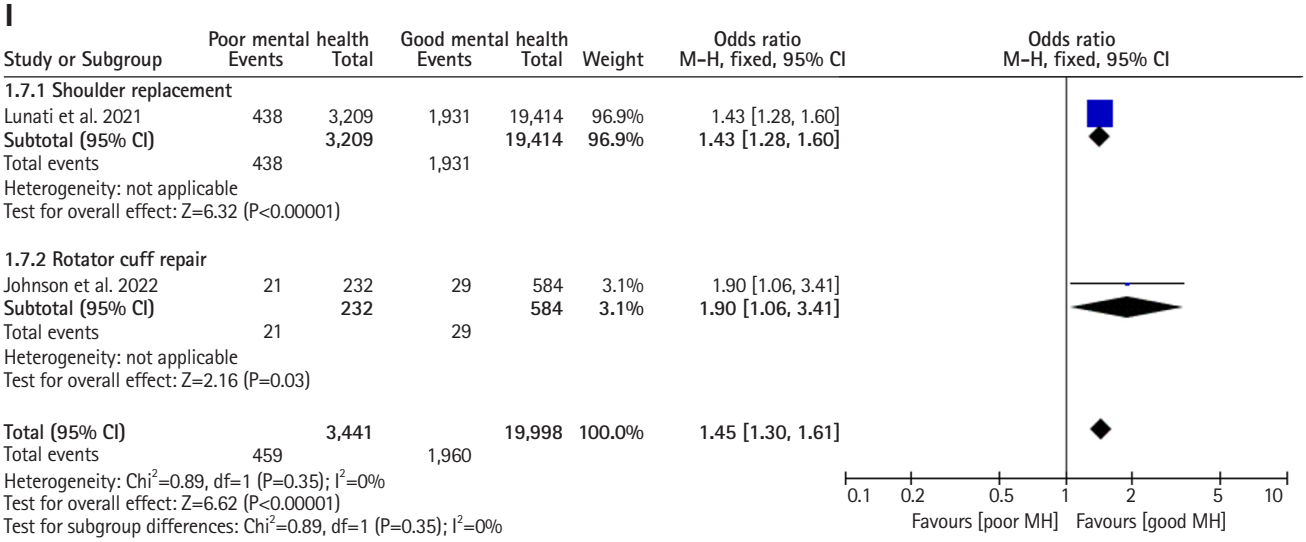


Fig. 4. Forest plots showing the difference in postoperative overall adverse events (A), postoperative medical complications (B), postoperative surgical complications (C), postoperative tendon healing failure (D), postoperative transfusion rate (E), postoperative discharge location (F), postoperative revision rate (G), postoperative re-admission rate within 90 days (H), and postoperative emergency department visit rate within 90 days (I). M-H: Mantel-Haenszel, CI: confidence interval.

Tendon healing failure

Two studies enrolling 363 subjects undergoing RCR [32,42] (79 with poor and 284 with good mental health) reported data on postoperative tendon healing failure. Ultimately, no significant difference was observed (OR, 1.08; 95% CI, 0.27–4.32; P = 0.91) (Fig. 4D).

Transfusions

Three studies enrolling 597,210 subjects undergoing TSA [36,37,39] (56,466 with poor and 540,744 with good mental health) and one study of 135,489 subjects undergoing RCR [30] (68,397 with poor and 67,092 with good mental health) reported data on postoperative transfusions. There was no significant difference in the rate of transfusions in patients undergoing TSA (OR, 5.11; 95% CI, 0.61–42.94; P = 0.13) (Fig. 4E) and when both cohorts were combined (OR, 3.56; 95% CI, 0.58–21.70; P = 0.17) (Fig. 4E). However, a higher rate of transfusions was documented in patients with poor mental health undergoing RCR (OR, 1.2; 95% CI, 1.12–1.28; P < 0.00001) (Fig. 4E).

Non-homebound discharge

Three studies enrolling 595,507 subjects undergoing TSA [36,38,39] (55,591 with poor and 539,916 with good mental health) reported data on postoperative discharge location. There was no significant difference between the two groups (OR, 1.34; 95% CI, 0.49–4364; P = 0.57) (Fig. 4F).

Revision

Two studies enrolling 23,219 subjects undergoing TSA [28,38] (3,427 with poor and 19,792 with good mental health) and one study of 816 subjects undergoing RCR [43] (232 with poor and 584 with good mental health) reported data on rates of revision surgery. A higher rate of revision was seen in patients with poor mental health undergoing TSA (OR, 2.20; 95% CI, 1.71–2.83; P < 0.00001) (Fig. 4G), RCR (OR, 2.02; 95% CI, 0.99–4.13; P = 0.05) (Fig. 4G), and when the cohorts were combined (OR, 2.17; 95% CI, 1.71–2.76; P < 0.00001) (Fig. 4G).

Re-admission (90 days)

One study of 22,623 subjects undergoing TSA [38] (3,209 with poor and 19,414 with good mental health) and two studies enrolling 136,305 subjects undergoing RCR [30,43] (68,629 with poor and 67,676 with good mental health) reported data on the postoperative rate of re-admissions within 90 days. A higher rate of re-admissions was seen in patients with poor mental health undergoing TSA (OR, 1.70; 95% CI, 1.43–2.00; P < 0.00001) (Fig. 4H). Meanwhile, the difference in rates was not significant in patients undergoing RCR (OR, 54.02; 95% CI, 0.00–284,425,501; P = 0.61) (Fig. 4H) or when the cohorts were combined (OR, 16.06; 95% CI, 0.01–20529; P = 0.66) (Fig. 4H).

ED visits (90 days)

One study of 22,623 subjects undergoing TSA [38] (3,209 with poor and 19,414 with good mental health) and one study of 816

https://doi.org/10.5397/cise.2024.00178

subjects undergoing RCR [43] (232 with poor and 584 with good mental health) reported data on the postoperative rate of ED visits within 90 days. A higher rate of ED visits was recorded in patients with poor mental health undergoing TSA (OR, 1.43; 95% CI, 1.28–1.60; P < 0.00001) (Fig. 4I), RCR (OR, 1.90; 95% CI, 1.06–3.41; P = 0.03) (Fig. 4I), and when the cohorts were combined (OR, 1.45; 95% CI, 1.30–1.61; P < 0.00001) (Fig. 4I).

DISCUSSION

Contradictory results on the impact of preoperative mental health on outcomes after shoulder surgery have been reported. Thus, a meta-analysis was necessary to examine this relationship and produce robust conclusions. Our results revealed better PROs, including ASES and SST scores; fewer adverse events, including reduced numbers of both medical and surgical complications; and lower rates of transfusions, revision surgery, 90-day re-admissions, and ED visits in patients with good preoperative mental health.

Although the postoperative ASES score was statistically better in patients with good preoperative mental health, the difference did not reach clinical significance in the TSA, RCR, or combined cohort. The MDs observed in our cohorts were 9.73 for TSA and 10.42 for RCR, both of which are below the ASES minimal clinically important differences (MCIDs) for patients undergoing TSA (20.9) and RCR (27.1) [44,45]. Furthermore, when assessing the improvement in ASES, only patients with good mental health in the TSA cohort showed significantly better scores, and this finding was not clinically significant. The same pattern of results was seen in SST in that the difference was significant but did not reach the MCID in the TSA (2.4) or RCR (4.3) group [44,45]. No difference in VAS, satisfaction, or ROM between patients with poor and good mental health was seen in either cohort. Thus, although mental health might impact the PROs of RCR and TSA patients, this impact was not of clinical significance, supporting some of the included studies [40,41].

A higher rate of overall complications (both medical and surgical combined) was seen in the group with poor preoperative mental health; however, there was no significant difference in complications when they were divided into medical and surgical complication subgroups. Furthermore, the difference in transfusion rate was not significant when the two cohorts were combined. This discrepancy between the rate of overall complications and the rates of surgical and medical complications separately may be explained by the inclusion of four studies reporting data on overall rather than specific adverse events [28,40,42,43]. Despite these findings, the correlation between psychiatric comorbidities and postoperative complications has not been fully characterized. Additionally, the influence of commonly prescribed psychiatric medications like selective-serotonin re-uptake inhibitors (SSRIs) may influence outcomes after shoulder surgery. Studies have demonstrated that side effects of SSRIs can mimic some of the known adverse events or the negative impact of psychological distress on the immune system [28,38,39]. Furthermore, both overall revisions and ED department visits within 90 days were significantly more common in the poor mental health group. As for the re-admission rate and discharge location, the difference was not significant. This increased rate of revision surgeries could also be well explained by the same reasons justifying the higher rate of complications as well as by the number of adverse events themselves [28,38,39]. Another explanation for the higher revision rate could be the impact of poor mental health on compliance with the postoperative protocol and rehabilitation [46,47]. However, a more in-depth analysis of the underlying mechanisms driving the association between poor mental health and higher adverse events and revision rates is needed to confirm our proposed relationships as these were not explored in our study nor in the literature.

Strengths and Limitations

The main limitation of this study is the high heterogeneity observed among studies, which could be partially explained by the different ways in which preoperative mental health was characterized in the included studies and therefore by the pooling of patients with different psychiatric comorbidities (depression, anxiety) or signs of poor psychological functioning, such as low resilience or distress) into the same group of poor mental health. Furthermore, studies using national databases were included, which could have potentially led to duplicate/overlapping patients. One last limitation is the low number of studies with data for some of the studied parameters.

This study also has several strengths. To our knowledge, it is the first meta-analysis to study the impact of preoperative mental health on the outcomes of shoulder surgery, including TSA and RCR. Moreover, only comparative studies were included, reducing the risk of operative and matching biases, and the selection process was stricter.

CONCLUSIONS

Patients with poor preoperative mental health demonstrated statistically lower ASES and SST scores in the TSA cohort, RCR cohort, and combined cohort, although these findings were not clinically significant. VAS score, satisfaction, ER, and flexion did

not differ between the two mental health groups. Increased rates of adverse events and transfusions were observed in RCR patients, while increased re-admission rates were observed in TSA patients. Finally, higher rates of revision surgery and ED visits were observed in both RCR and TSA patients with poor preoperative mental health. Additional research using standardized definitions for good and poor mental health is needed to characterize the relationship between mental health and adverse events. Examining the effects of preoperative screening and treatment of mental health disorders on orthopedic surgical outcomes may also be beneficial.

NOTES

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Investigation: all authors. Writing – original draft: all authors. Writing Writing – review & editing: all authors.

Conflict of interest

JAA would like to disclose royalties from: DJO Global, Zimmer-Biomet, Smith and Nephew, Stryker, Globus Medical, Inc.; research support as a PI from: Lima Corporation - Italy, Orthofix, Arthrex, OREF; royalties, financial or material support from: Wolters Kluwer; and board member/committee appointments for: American Shoulder and Elbow Society, Pacira. No other potential conflict of interest relevant to this article was reported.

Funding

None.

Data availability

None.

Acknowledgments

None.

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