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Mental health disorders and pain modulation in orthopedic shoulder patients

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Background: Various studies have examined the relationship between preoperative mental health diagnoses (MHDs) and postoperative outcomes in orthopedic shoulder patients. However, few investigations delve into the relationship between a preoperative MHD and postoperative opioid pain control regimens in patients who have undergone rotator cuff repair (RCR), total shoulder arthroplasty (TSA), and reverse TSA (rTSA). We hypothesize that orthopedic shoulder patients with a preoperative MHD will be prescribed more opioids (ie, request more refills) postoperatively than those without a MHD.

Methods: An institutional review board-approved retrospective chart review was performed on 438 patients, 18 years or older, who underwent RCR, TSA, or rTSA. Patients were divided into two groups: those diagnosed with depression, anxiety, bipolar disorder, and/or schizophrenia (n = 193), and those with no previous MHD (n = 245). Statistical outcomes were analyzed with the independent *t*-test, Mann-Whitney U test, one-way Analysis of Variance, and Kruskal-Wallis test.

Results: Univariate analysis demonstrated significant differences between the MHD group and non-MHD group in average 90-day postoperative opioid scripts (2.10 vs. 1.55, respectively, $P < .001$) and median 90-day postoperative morphine milligram equivalents (MMEs) prescribed (225 MME vs. 185.25 MME, respectively, $P < .001$). Among patients who were opioid naive 90 days preoperatively, significant differences were found in MMEs prescribed between the MHD and non-MHD group (225 MME vs. 150 MME, respectively, $P < .001$). Further analysis of opioid naive patients with specifically depression compared to patients with an alternate or no MHD diagnosis yielded significant differences in scripts (1.78 vs. 1.33, respectively, $P = .031$) and MMEs prescribed (225 MME vs. 150 MME, respectively, $P < .001$).

Conclusion: This study found that RCR, TSA, or rTSA patients with a preoperative MHD were prescribed significantly more postoperative MMEs and more opioid scripts (ie, requested more refills) than those without MHD. This is despite preoperative education on postoperative pain expectations and limiting opioid use. Our findings support our hypothesis and emphasize the clinical importance of recognizing mental health disease while navigating postoperative pain control expectations. Given the rising prevalence of mental health disorders nationwide, considering the effect of these comorbidities on postoperative pain in RCR, TSA, and rTSA patients will be essential to enhance preoperative and postoperative counseling and management by orthopedic surgeons. We further recommend a multidisciplinary approach to help manage pain in these patients.

The prevalence of mental health diagnoses (MHDs) such as anxiety and depression in our nation continues to increase and affect various areas of healthcare.[22] Depression has been associated with increased morbidity and mortality[11] and is predicted to be ranked the leading cause of disease burden by 2030 by the World Health Organization.[21] Mental health disorders have been associated with worse postoperative outcomes following orthopedic

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surgery such as anemia, pulmonary embolism, infection, increased hospital length of stay, and lower patient-reported outcomes.[3,16,19] MHD has also been shown to lead to worse patient-reported outcomes after shoulder procedures, especially rotator cuff repair (RCR) and shoulder arthroplasty.[4,9,15,17,20]

MHDs have also been correlated to differences in pain perception. Etcheson et al[7] found that total knee and total hip arthroplasty patients suffering from depression experienced increased perception of pain and higher mean intensity pain scores following surgery when compared to their healthy counterparts. Furthermore, two previous database studies have evaluated the effect of MHD on opioid use after shoulder surgery.[2,5] After primary elective total shoulder arthroplasty (TSA), patients with depression or anxiety diagnosed preoperatively had increased odds of long-term (>180 days) postoperative opioid use.[2] This study did not specifically look at opioid naive patients and found that preoperative opioid use was a strong predictor of postoperative opioid use as well. Similar findings have been reported in orthopedic shoulder patients undergoing RCR, where patients with preoperative MHD in an insurance claims database who underwent RCR filled more prescriptions > 90 days and 180 days after surgery and had overall higher costs of care.[5]

Many efforts have been made throughout the orthopedic community to increase education on the potential adverse effects and risks of opioid use after surgery. Given the current opioid epidemic, the Centers for Disease Control and Prevention produced guidelines for treating chronic pain to try to educate both patients and providers on the risk of opioids and encourage to use of other non-opioid modalities for pain control.[6] The American Academy of Orthopaedic Surgeons also collaborated with the American Society of Anesthesiologists to produce a website for resources for providers and patients on pain management after orthopedic procedures. The website has many educational resources for patients on what to expect for pain after surgery and how to manage it with non-opioid medications, as well as screening tools to identify patients at risk of long-term opioid use, misuse, and abuse. The goal of this website was to help providers have educated conversations with their patients preoperatively about pain postoperatively and to encourage multimodal pain control while limiting the use of narcotics.[1] Even with all these interventions, we still encounter patients who require higher doses of narcotics to treat their pain postoperatively. The tools proposed on the website also have not been fully validated in shoulder surgery.[12] Understanding what patients are at increased risk of requiring more opioid prescriptions postoperatively can help to identify them preoperatively to better educate them on the expectations for pain control.

To our knowledge, there are limited studies that have investigated the effect of preoperative MHD on the quantity of opioid prescriptions given postoperatively following RCR, TSA, or reverse TSA (rTSA). There are also limited data on the association between preoperative MHD and preoperative opioid use in orthopedic shoulder patients. The primary aim of this study is to investigate the effect of MHDs on postoperative opioid prescriptions in patients undergoing RCR, TSA, or rTSA. We hypothesize that patients undergoing RCR, TSA, or rTSA with a preoperative diagnosis of depression, anxiety, bipolar disorder, or schizophrenia will be prescribed more opioids postoperatively than their counterparts with no preoperative MHD. A secondary aim of this study is to identify any association between preoperative MHD and preoperative opioid use.

Materials and methods

An institutional review board-approved retrospective study was conducted in which our institution's orthopedic shoulder database was queried from January 1, 2020, to January 1, 2022, to identify patients who underwent RCR, TSA, or rTSA. A total of 438 patients, 18 years or older, who underwent a RCR, TSA, or rTSA met the inclusion criteria. Patients were divided into two groups: those diagnosed with depression, anxiety, bipolar disorder, and/or schizophrenia (n = 193); and those with no previous MHD (n = 245). Patients were included in the MHD group based on documentation in their electronic medical record of a MHD. Within the MHD group, patients were subdivided by their specific diagnosis of depression (n = 152), anxiety (n = 161), bipolar, and/or schizophrenia (n = 21) to examine the impact of these disorders on the measured outcomes.

The procedures were performed by one of four fellowship-trained (three sports medicine and one shoulder and elbow) surgeons at an urban tertiary referral center. Patients who presented on preoperative opioids continued to receive their prescriptions postoperatively by the outside provider managing their preoperative pain. Patients on preoperative opioid medications were encouraged to wean off of their medications if possible. Opioid naive patients were prescribed either oxycodone 5 mg or oxycodone 5 mg/acetaminophen 325 mg for no more than an initial five-day supply (20 to 45 tablets depending on the provider). Each surgeon had a standard postoperative prescription they wrote that did not vary based on any preoperative diagnosis. All patients were educated on the risks of opioid medication including misuse, abuse, and addiction. Patients who were deemed to be higher risk for long-term opioid use (self-identified, patients with a history of substance abuse/addiction, patients on buprenorphine-naloxone or methadone, or via risk assessment tools) were recommended to see our addiction medicine colleagues preoperatively to develop a postoperative plan for pain control to try to prevent long-term narcotic use. Finally, all patients received an interscalene block preoperatively by anesthesia.

A review of the 438 patients' electronic medical records was performed to collect patient demographic data (gender, race, age, body mass index, sex, Charlson comorbidity index) and clinical characteristics (type of surgery). The prescription monitoring program database was utilized to obtain the 30-/90-day preoperative and postoperative opioid scripts and the total 90-day postoperative morphine milligram equivalents (MMEs) prescribed. Primary outcome variables included preoperative and postoperative opioid prescriptions (measured in 30-/90-day preoperative and postoperative opioid scripts and 90-day postoperative MMEs).

Statistical analysis was performed utilizing the independent *t*-test for continuous parametric variables, Mann-Whitney U test and Kruskal-Wallis test for nonparametric data, chi-squared test for categorical variables, and one-way Analysis of Variance for single independent variables. Significant primary and secondary outcomes were further analyzed with multivariate linear regression. Statistical significance was defined as P value <.05.

Results

Out of the 438 patients, 193 (44%) had comorbid anxiety, depression, bipolar, and/or schizophrenia (MHD = yes), and 245 (56%) had no previous mental health comorbidities (MHD = no). Demographic analysis demonstrated no significant difference in body mass index and Charlson comorbidity index. Significant differences were observed between the MHD group and the control group in race, sex, and surgery type. There were more females in the MHD group than males (67.4% vs. 32.6%, respectively, $P < .001$), more white patients in the MHD group than in the control group (68.4% vs. 62%, respectively, $P = .019$), and a greater percent of the control group had rotator cuff tear repair when compared to the MHD group (77.1% vs. 65.8%, respectively, $P = .018$) (Table I).

Table I
Demographics.

Variable	No MHD (N = 245)	Yes MHD (N = 193)	*P* value
Age (y)	60.95 ± 11.4	60.11 ± 10.2	.424
Sex			
Male	147 (60.0%)	63 (32.6%)	<.001
Female	98 (40.0%)	130 (67.4%)	
BMI (kg/m^2)	30.21 ± 6.4	31.04 ± 7.0	.195
Charlson comorbidity index (CCI)	2.8 ± 2.0	2.98 ± 2.1	.353
Race			
White	152 (62.0%)	132 (68.4%)	.019
Black	41 (16.7%)	32 (16.6%)	
Asian	8 (3.3%)	1 (0.5%)	
Hispanic	23 (9.4%)	23 (11.9%)	
Other races	21 (8.6%)	5 (2.6%)	
Surgery type			
Rotator cuff repair	189 (77.1%)	127 (65.8%)	.018
TSA	27 (11.0%)	38 (19.7%)	
RTSA	29 (11.8%)	28 (14.5%)	

BMI, body mass index; *MHD*, mental health diagnoses; *TSA*, total shoulder arthroplasty; *RTSA*, reverse total shoulder arthroplasty.

Univariate analysis demonstrated significant differences between the MHD and control groups in average 90-day postoperative opioid scripts (2.10 vs. 1.55, respectively, $P = .001$). There was also a significant difference in median 90-day postoperative MMEs prescribed between the MHD group and the control group (225 MME vs. 185.25 MME, respectively, $P < .001$) (Table II). When the data were stratified by patients who did not receive opioids preoperatively (opioid naive) and those who had a documented prescription of preoperative opioids (non-opioid naive), pairwise analysis only found a significant difference in median 90-day postoperative MMEs among opioid naive patients; that is, opioid naive patients with a MHD were prescribed more MMEs than those without a MHD (225 vs. 150, respectively, $P < .001$) (Tables III and IV).

The data were further stratified by specific mental health disorders. Among opioid naive patients who had a preoperative diagnosis of depression, a significant difference in average 90-day postoperative opioid scripts (1.78 vs. 1.33, $P = .031$) and median 90-day postoperative MMEs (225 vs. 150, $P < .001$) was observed when compared to opioid naive patients who either (1) carry an alternate MHD or (2) no MHD. Analysis of the opioid naive patients with an anxiety diagnosis compared to those without a diagnosis of anxiety yielded a significant difference in median 90-day postoperative MMEs (225 vs. 150, respectively, $P < .001$). In patients with a preoperative diagnosis of bipolar disorder and/or schizophrenia, we found no significant differences in primary outcome variables. All other outcomes were not significantly different. Lastly, we examined whether patients with a preoperative MHD were more likely to be on preoperative opioids, and we found a significant difference in preoperative opioid prescription between the MHD group and the control group (n = 62 (32.1%) vs. n = 38, (15.15%), $P < .001$).

Discussion

Mental health disorders are a highly prevalent comorbidity among patients seeking care for musculoskeletal complaints.[7,20] It has been shown that a MHD can impact a patient's perception of pain and lead to decreased functional status and less improvement in postoperative scores.[2,5,7,8,14] In consideration of this literature, the goal of this study was to investigate the relationship between orthopedic shoulder patients' preoperative mental health status and the amount of opioids prescribed postoperatively. Additionally, we aimed to uncover an association between preoperative mental health status and preoperative opioid use. The hypothesis of this study had two parts: (1) orthopedic shoulder patients undergoing RCR, TSA, or rTSA with a preoperative MHD would be prescribed a greater number of postoperative opioid scripts and MMEs compared to those without a mental health disorder, and (2) a preoperative MHD would be associated with preoperative opioid use within 90 days of surgery. Both hypotheses were confirmed by our statistical analyses.

Our retrospective analysis found that comorbid MHDs are associated with increased postoperative opioid prescriptions (ie, refills) and total MMEs prescribed in patients undergoing RCR, TSA, or rTSA even with procedures in place to educate the patient preoperatively about postoperative pain expectations and risks of opioid use. Subgroup analysis based on preoperative opioid status revealed that opioid naive patients with a preoperative MHD were prescribed a greater number of MMEs (ie, refills) within 90 days postoperatively when compared to their opioid naive non-MHD counterparts. Additional subgroup analysis of the MHD group found that both depression and anxiety, specifically, were associated with a greater number of postoperative opioid prescriptions (ie, refills) in opioid naive patients. It has been reported that depression and anxiety increase the risk of persistent pain and dissatisfaction after arthroplasty.[13,18] Furthermore, Etcheson et al[7] mentioned that total knee and total hip arthroplasty patients suffering from depression experienced an increased perception of pain after surgery and higher mean intensity scores when compared to their healthy counterparts. This could result in fear of and/or delay in physical therapy and more follow-up appointments with reports of pain requiring additional management. Furthermore, in patients with a mental illness, anticipatory pain resulting from routine postoperative physical therapy may also contribute to increased MMEs and opioid prescriptions.

When subgroup analysis was performed to determine whether the same association was observed when stratifying based on preoperative opioid status, only opioid naive patients demonstrated a difference in the number of postoperative scripts and total MMEs. Patients who had been on preoperative opioids did not demonstrate a significant difference in postoperative scripts and MMEs regardless of mental health status. This could be explained by the fact that patients with chronic opioid use are followed by pain specialists who design a preoperative and postoperative pain regimen for them regardless of whether or not they have a preexisting MHD. As a result, the postoperative pain regimen is strictly followed so that their preexisting pain needs are met in addition to their acute postoperative pain concerns. Preoperative education about their expected level of pain following surgery should be a multidisciplinary process so these patients are adequately

Table II
Univariate analysis of primary outcome variables.

Variable	N	Mean	Standard deviation	Minimum	Maximum	25th percentile	Median	75th percentile	*P* value
Number of scripts postoperatively 90 days									
MHD No	245	1.55	1.255						<.001
MHD Yes	193	2.1	1.766						
MME 90 postop									
MHD No	242			7.5	13410	150	185.25	294.3	<.001
MHD Yes	189			30	13595	150	225	525	

MHD, mental health diagnoses; *MME*, morphine milligram equivalent.

Table III
Univariate analysis of primary outcome variables in patients stratified by preoperative opioid status.

Variable	N	Mean	Standard deviation	Minimum	Maximum	25th percentile	Median	75th percentile	*P* value
90-d postoperative number of scripts									
Group 1	62.00	2.98	2.10						
Group 2	131.00	1.68	1.40						
Group 3	38.00	2.68	2.00						
Group 4	207.00	1.34	0.90						
90-d postoperative MMEs									
Group 1	60.00			112.50	13595.00	225.00	656.25	3215.63	<.001
Group 2	129.00			30.00	9000.00	150.00	225.00	325.00	
Group 3	37.00			150.00	13410.00	225.00	405.00	1800.00	
Group 4	205.00			7.50	1965.00	150.00	150.00	225.00	

MMEs, morphine milligram equivalents; *MHD*, mental health diagnoses.
Group 1 = MHD on preoperative opioids, Group 2 = MDH not on preoperative opioids, Group 3 = no MHD on preoperative opioids, Group 4 = no MHD not on preoperative opioids.

Table IV
Pairwise analysis of patients stratified by preoperative opioid status.

Variable	Group 1	Group 2	Group 3	Group 4
90-d postoperative number of scripts				
Group 1		<0.001	0.728	<0.001
Group 2	<0.001		<0.001	0.14
Group 3	0.728	<0.001		<0.001
Group 4	<0.001	0.14	<0.001	
90-d postoperative MMEs				
Group 1		<0.001	0.811	<0.001
Group 2	<0.001		<0.001	<0.001
Group 3	0.811	<0.001		<0.001
Group 4	<0.001	<0.001	<0.001	

MMEs, morphine milligram equivalents; *MHD*, mental health diagnoses.
Group 1 = MHD on preoperative opioids, Group 2 = MDH not on preoperative opioids, Group 3 = no MHD on preoperative opioids, Group 4 = no MHD not on preoperative opioids.

informed. At our institution, many of these patients are evaluated by our Center for Healing addiction medicine specialists to help determine the best plan for postoperative pain control.

The third major finding of this study was that orthopedic shoulder patients who had a MHD preoperatively were more likely to be on preoperative opioids than patients who did not have a previous diagnosis. This result is consistent with the findings of Hooten et al[10] which showed that a bidirectional relationship exists between individuals who have a MHD and are experiencing chronic pain. Mental health can significantly influence pain perception leading to higher preoperative opioid consumption to manage pain as a result of an injury. It is of utmost importance for orthopedic surgeons to be aware of this phenomenon as more extensive education regarding their pain and the postoperative surgical course could alter patients' perception of pain postoperatively. In turn, this could diminish the anxiety provoked by the impact these injuries have on patients' quality of life and lead to reduced preoperative and postoperative opioid consumption. The authors also believe that providers should encourage patients to attempt to wean down or off of their opioid medications, if possible, preoperatively. This should be guided by a pain management or addiction medicine specialist.

The present study has several limitations. First, it was a retrospective review which is subject to common biases of retrospective studies. Additionally, we could not quantify the severity of mental health disease preoperatively. We defined a MHD of depression, anxiety, bipolar disorder, and schizophrenia as a categorical diagnosis; however, mood can be a continuous variable with fluctuations throughout different time periods. Furthermore, we could not record or consider whether patients with an MHD were adequately treated for their illness (or treated at all). Finally, due to its retrospective nature, we could not record, or consider, whether patients were actually taking all of their prescribed opioids postoperatively for pain. We could only consider what had been prescribed and cannot equate that to those medications being consumed by the patient. Follow-up studies should focus on prospectively collecting data on the severity of mental illness, potential treatment or nontreatment, quantity of pain medication consumed postoperatively, and outcome scores.

Conclusion

Our study found that RCR, TSA, and rTSA patients with a preoperative MHD were prescribed significantly more postoperative MMEs and more opioid prescriptions than those without a MHD. Given the rising prevalence of mental health disorders nationwide, our findings emphasize the importance of considering preexisting MHDs in RCR, TSA, and rTSA patients to enhance perioperative counseling and pain management. The authors encourage a multidisciplinary approach to managing these patients to try to limit the amount of narcotics required postoperatively.

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References

1. Asa-Aaos pain alleviation toolkit. Available at: https://www.asahq.org/advocacy-and-asapac/advocacy-topics/pain-medicine-talking-points/the-pain-toolkit. Accessed May 10, 2023.
2. Best MJ, Harris AB, Bansal A, Huish E, Srikumaran U. Predictors of long-term opioid use after elective primary total shoulder arthroplasty. Orthopedics 2021;44:58-63. https://doi.org/10.3928/01477447-20201007-06.
3. Browne JA, Sandberg BF, D'Apuzzo MR, Novicoff WM. Depression is associated with early postoperative outcomes following total joint arthroplasty: a nationwide database study. J Arthroplasty 2014;29:481-3. https://doi.org/10.1016/j.arth.2013.08.025.
4. Colasanti CA, Lin CC, Anil U, Simovitch RW, Virk MS, Zuckerman JD. Impact of mental health on outcomes after total shoulder arthroplasty. J Shoulder Elbow Surg 2023;32:980-90. https://doi.org/10.1016/j.jse.2022.10.028.
5. Cronin KJ, Mair SD, Hawk GS, Thompson KL, Hettrich CM, Jacobs CA. Increased health care costs and opioid use in patients with anxiety and depression undergoing rotator cuff repair. Arthroscopy 2020;36:2655-60. https://doi.org/10.1016/j.arthro.2020.05.038.
6. Dowell D, Haegerich TM, Chou R. CDC guideline for prescribing opioids for chronic pain–United States, 2016. JAMA 2016;315:1624-45. https://doi.org/10.1001/jama.2016.1464.
7. Etcheson JI, Gwam CU, George NE, Virani S, Mont MA, Delanois RE. Patients with major depressive disorder experience increased perception of pain and opioid consumption following total joint arthroplasty. J Arthroplasty 2018;33:997-1002. https://doi.org/10.1016/j.arth.2017.10.020.
8. Henn RF 3rd, Kang L, Tashjian RZ, Green A. Patients' preoperative expectations predict the outcome of rotator cuff repair. J Bone Joint Surg Am 2007;89:1913-9. https://doi.org/10.2106/JBJS.F.00358.
9. Hines AC, Pill SG, Boes N, Reuschel B, Lutz A, Thigpen CA, et al. Mental health status, not resilience, influences functional recovery after arthroscopic rotator cuff repairs. J Shoulder Elbow Surg 2022;31:S117-22. https://doi.org/10.1016/j.jse.2022.02.005.
10. Hooten WM. Chronic pain and mental health disorders: shared neural mechanisms, epidemiology, and treatment. Mayo Clin Proc 2016;91:955-70. https://doi.org/10.1016/j.mayocp.2016.04.029.
11. Kessler RC, Bromet EJ. The epidemiology of depression across cultures. Annu Rev Public Health 2013;34:119-38. https://doi.org/10.1146/annurev-publhealth-031912-114409.
12. Khoury LH, Stephens J, Brown S, Chatha K, Girshfeld S, Lozano Leon JM, Lavin A, Sabesan VJ. Application of risk assessment tools to predict opioid usage after shoulder surgery. JSES Int 2022;6:833-42. https://doi.org/10.1016/j.jseint.2022.06.001.
13. O'Connor JP, Holden P, Gagnier JJ. "Systematic review: preoperative psychological factors and total hip arthroplasty outcomes." J Orthop Surg Res 2022;17:457. https://doi.org/10.1186/s13018-022-03355-3.
14. Park JH, Rhee SM, Kim HS, Oh JH. Effects of anxiety and depression measured via the hospital anxiety and depression scale on early pain and range of motion after rotator cuff repair. Am J Sports Med 2021;49:314-20. https://doi.org/10.1177/0363546520976574.
15. Sahoo S, Ricchetti ET, Zajichek A, Cleveland Clinic Shoulder Group, Evans PJ, Farrow LD, et al. Associations of preoperative patient mental health and sociodemographic and clinical characteristics with baseline pain, function, and satisfaction in patients undergoing rotator cuff repairs. Am J Sports Med 2020;48:432-43. https://doi.org/10.1177/0363546519892570.
16. Schwartz S, Bazargan-Hejazi S, Pan D, Ruiz D, Shirazi A, Washington E. Association of psychiatric diagnostic conditions with hospital care outcomes of patients with orthopedic injuries. Perm J 2018;22:17-120. https://doi.org/10.7812/TPP/17-120.
17. Vajapey SP, Cvetanovich GL, Bishop JY, Neviaser AS. Psychosocial factors affecting outcomes after shoulder arthroplasty: a systematic review. J Shoulder Elbow Surg 2020;29:e175-84. https://doi.org/10.1016/j.jse.2019.09.043.
18. Vajapey SP, McKeon JF, Krueger CA, Spitzer AI. "Outcomes of total joint arthroplasty in patients with depression: a systematic review." J Clin Orthop Trauma 2021;18:187-98. https://doi.org/10.1016/j.jcot.2021.04.028.
19. Visser MA, Howard KJ, Ellis HB. The influence of major depressive disorder at both the preoperative and postoperative evaluations for total knee arthroplasty outcomes. Pain Med 2019;20:826-33. https://doi.org/10.1093/pm/pny107.
20. Werner BC, Wong AC, Chang B, Craig EV, Dines DM, Warren RF, et al. Depression and patient-reported outcomes following total shoulder arthroplasty. J Bone Joint Surg Am 2017;99:688-95. https://doi.org/10.2106/JBJS.16.00541.
21. WHO. The global burden of disease: 2004 update. Geneva: World Health Organization; 2008.
22. Zhdanava M, Pilon D, Ghelerter I, Chow W, Joshi K, Lefebvre P, et al. The prevalence and national burden of treatment-resistant depression and major depressive disorder in the United States. J Clin Psychiatry 2021;82:20m13699. https://doi.org/10.4088/JCP.20m13699.