Research

Characteristics and Hospital Outcomes of 1403 Patients Hospitalized at Community Hospitals With Ankylosing Spondylitis

Se Won Lee, MD[1]; Carol Elsakr, MD[1]; Jonathan Holt, MD[1]; Napatkamon Ayutyanont, PhD[2]

Author affiliations are listed at the end of this article.

Correspondence to:
Se Won Lee, MD
(sewon.lee@hcahealthcare.com)

Abstract

Background
In this study, we aimed to assess the hospital course, outcomes after hospitalization, and predictors of outcomes in patients with ankylosing spondylitis (AS).

Methods
We included 1403 patients with AS between 2016 and 2021 who were identified using International Classification of Disease (ICD) codes from a large for-profit healthcare system database. Demographics and clinical characteristics were compared between those who had a favorable outcome, defined as being discharged to home without readmission within 3 months of discharge, versus those who had an unfavorable outcome. A stepwise logistic regression was used to identify demographic and clinical characteristics associated with home discharge and readmission.

Results
The mean age for all AS patients was 56.06 ± 17.01 years, which was younger in the favorable outcome group, and 82.47% of patients were discharged to home after the average length of stay of 3.72 ± 4.09 days, also shorter in the favorable outcome group. Of 1403 patients, 37.56% were readmitted within 3 months of discharge, at a lower rate in the group with home discharge. Opioids were the most commonly used medication during hospitalization (67.07%), prescribed at a lower rate in the favorable outcome group. Medical coverage by Medicare and Medicaid, fall at admission, hospital-acquired anemia, steroid, acetaminophen, muscle relaxant use, and an increased dose of morphine milligram equivalent at discharge were significantly associated with decreased odds of home discharge. Surgical procedures during admission, gastrointestinal complications, discharge to inpatient rehabilitation units, and use of benzodiazepine were associated with an increased risk of readmission within 3 months.

Conclusion
Recognizing factors that put patients with AS at risk of unfavorable outcomes is useful information to improve patient care during hospitalization.

Keywords
ankylosing spondylitis; opioids; patient discharge; patient readmission; patient outcome assessment

Introduction
Ankylosing spondylitis (AS) is a seronegative spondyloarthropathy that primarily affects axial joints but can also affect peripheral joints.[1,2] The presentation of AS can vary from intermittent back pain with stiffness to devastating disability due to spinal cord injury secondary to vertebral fractures.[3]

Inflammation in the axial skeleton with spondyloarthritis, structural changes due to osteo-proliferation, and low bone density are

common underlying causes of musculoskeletal-manifestations in patients with AS.[4] Regarding the involvement of peripheral joints, large joints such as the hips and knees are most commonly involved, which often correlates with functional decline.[5] Extraarticular manifestations of AS include anterior uveitis, inflammatory bowel disease, aortic incompetence, conduction defects, restrictive lung disease, pulmonary fibrosis, and renal disease.[6,7] Disease burden from the painful musculoskeletal and extraarticular manifestations of AS, which impact physical activity, morbidity, and mortality, can complicate the hospital course and discharge plan, often leading to the need for facility-based post-acute care or an increased rate of readmission.[8-10] However, there are few reports of clinical characteristics of patients hospitalized with AS and the factors associated with hospital outcomes such as destination at discharge or readmission.

Nonsteroidal anti-inflammatory drugs (NSAIDs) are used as the first-line treatment for pain and stiffness in patients with AS.[2] Tumor necrosis factor alpha (TNF-α) inhibitor agents are used in patients with inadequate response to NSAIDs or conventional disease-modifying antirheumatic drugs for peripheral arthritis.[11] Corticosteroids and opioids are also frequently used but without clear guidelines.[11] Previously, opioids were reported to be used intermittently in 21.7% to 27.3% of patients in the community.[11,12] Although different pain medications are used during acute hospitalization compared to the community setting due to acute medical problems and medical comorbidities, there is limited information on the usage pattern of analgesics, including opioids, among hospitalized patients with AS.

In this study, we aim to describe the demographics, clinical characteristics, hospital course, and the outcomes after hospitalization among patients admitted with the primary diagnosis of AS. In addition, we further investigated the factors associated with unfavorable outcomes, such as non-home discharge and readmission within 3 months of discharge.

Methods

The de-identified electronic health data were collected from the electronic data warehouse of 158 for-profit community hospitals in the HCA Healthcare system in the United States. The inclusion criteria for this study were as follows: adult patients, age greater than 18 years, and an initial admission with the primary diagnosis of AS from January 1, 2016, to December 31, 2021. Patients who were discharged home from the emergency room were excluded from the analysis.

Variables

The demographic and clinical variables included age, sex, ethnicity, race, medical coverage, length of stay, and discharge disposition. The Charlson Comorbidity Index (CCI), a validated, weighted scoring system, was used to determine the severity of medical illness based on 17 comorbid conditions.[13] In addition, other admitting diagnoses including vertebral fracture, spinal cord injury, and other spine disorders were analyzed. The 5 most common diagnosis-related groups (DRGs) found among the study population were also included for analysis.[14]

Opioids with calculated morphine milligram equivalent (MME) doses and NSAIDs were included for analysis. Other analgesics investigated in this study included acetaminophen, muscle relaxants, anticonvulsants, corticosteroids, and benzodiazepines. The 10 most commonly used medication classes were also examined.

Main Outcome Variables

Outcome variables included in-hospital mortality and destination at discharge (home discharge vs other than home discharge). Readmission to the same healthcare system within 3 months of discharge was investigated. A favorable outcome was defined as home discharge without readmission within 3 months after discharge.

Statistics

Descriptive statistics were performed via a t-test, Kruskal-Wallis test, and chi-square test. Data tests were selected based on the types of variables included and normal distribution patterns.

A stepwise logistic regression analysis was used to evaluate the relationships between independent variables (demographic and clinical variables) and outcome variables (home

discharge vs other than home discharge and readmission within 3 months).

A *P* value of less than .05 was considered significant. Analyses were performed using Stata, version 17 (College Station, TX).

Ethics Approval

This study was reviewed and ethical approval was waived by the Intuitional Review Board (IRB) of HCA Healthcare Graduate Medical Education (IRB exempt number 2022-146) as this study used a de-identified dataset and all the procedures being performed were part of routine care.

Results

There were 1403 unique patient admissions that met the inclusion criteria between January 1, 2016, to December 31, 2021. The mean age ± standard deviation of all patients was 56.06 ± 17.01 years with 56.81% being male, and 82.47% of patients (n = 1157) discharged home (**Table 1**). The most common DRG was hip or knee joint replacement, followed by back problems without major medical complications, and spinal fusion (**Table 1**). Among the 246 patients who were not discharged home, 102 patients (7.27%) were discharged to skilled nursing facilities, 84 patients (5.99%) went to inpatient rehabilitation units, 27 patients (1.92%) left against medical advice, and 2 patients (0.14%) died. Among patients discharged home, 35.26% (n = 408) patients were readmitted to the same hospital within three months, while 48.37% (n = 119) of patients who were discharged to places other than home were readmitted within 3 months (*P* < .0001). The readmission rate was highest among patients discharged to inpatient rehabilitation units (66.67%).

The group with unfavorable outcomes after hospitalization, compared to the favorable outcome group, was overall older (58.23 ± 17.47 years vs 54.17 ± 16.37 years, *P* < .0001, **Table 1**) and also had a higher proportion of non-Hispanic/Latino patients (94.19% vs 90.12%, *P* = .005), as well as patients with public health insurance (ie, Medicare and Medicaid [60.24% vs 47.53%, *P* < .0001]). More medical comorbidities (higher CCI) were noted among the unfavorable outcome group (2.65 ± 2.23 vs 2.05 ± 2.10, *P* < .0001, **Table 1**).

The average length of stay was significantly shorter in the favorable outcome group compared to that of the unfavorable outcome group (3.11 ± 3.22 vs 4.42 ± 4.80 days, *P* < .0001) with a lower percentage of patients requiring admission to the intensive care unit (ICU) during hospitalization (8.56% vs 14.92%, *P* < .0001, **Table 1**). Hospital-acquired complications were reported in 327 patients (23.31%) and were less common in the favorable outcome group (21.23% vs 25.69%, *P* = .049). The most common complication was genitourinary complication (n = 139, 9.91%), followed by acute posthemorrhagic anemia (n = 53, 3.78%) and implant complication (n = 42, 2.99%).

Opioid analgesics were the most commonly used medication (71.42%, n = 1002) with a higher rate of use among the unfavorable outcome group (74.31% vs 68.89%; *P* = .025, **Table 1**). Daily MME was high (329.00 ± 3141.81 at admission vs 286.06 ± 2860.96 at discharge). Benzodiazepines were more frequently used in the unfavorable outcome group (29.66% vs 23.10%, *P* = .005). NSAIDs were used in 38.7% (n = 543) of patients and a higher proportion of the favorable outcome group when compared to the unfavorable outcome group (41.66% vs 35.22%, *P* = .015, **Table 1**).

Stepwise regression analysis of clinical characteristic variables for home discharge is summarized in **Table 2**. Fall diagnosis at admission, coverage by Medicare and Medicaid, and posthemorrhagic anemia were associated with decreased odds of home discharge (odds ratio [OR] 0.24, confidence interval [CI] 0.11-0.54; OR 0.10, CI 0.03-0.33; and OR 0.10, CI 0.01-0.82, respectively). An increased dose of MME at discharge was associated with decreased odds of home discharge (OR 0.998 per 1 MME for a favorable outcome, CI 0.996-1) in addition to the use of acetaminophen, steroid, and muscle relaxants (OR 0.44, CI 0.20-0.98; OR 0.14, CI 0.02- 0.91; OR 0.33, CI 0.15-0.73, respectively) were each associated with decreased odds of home discharge. Use of NSAIDs was associated with increased odds of home discharge (OR 3.87, CI 1.58-9.45). The pseudo R^2 of this model was 0.3612. Regarding readmission within 3 months, increased odds were associated with the presence of surgery during hospitalization (OR 1.68, CI 1.03-2.74), in-hospital gastrointestinal complications (OR 6.02, CI 1.16-31.36), the

Table 1. Demographic and Clinical Information Based on the Discharge Outcome

	Total, N = 1,403	Home discharge without readmission, n = 749 (53.38%) (Favorable outcome)	Discharge-other than home or readmission, n = 654 (46.61%) (Unfavorable outcome)	*P* value
Age, mean ± SD	56.06 ± 17.01	54.17 ± 16.37	58.23 ± 17.47	**<.0001**
Body mass index (n = 1397)	29.50 ± 7.07	29.72 ± 6.74	29.24 ± 7.42	.21
Male sex	797 (56.81%)	412 (55.01%)	385 (58.87%)	.145
Race **Black** **Other** **White**	101 (7.20%) 75 (5.35%) 1,227 (87.46%)	52 (6.94%) 40 (5.34%) 657 (87.72%)	49 (7.49%) 35 (5.35%) 570 (87.16%)	.92
Ethnicity Hispanic	112 (7.98%)	74 (9.88%)	38 (5.81%)	**.005**
Insurance **Medicare & Medicaid** **Private** **Other** **No insurance**	 423 (31.15%) 750 (53.46%0 75 (5.35%) 155 (11.05%)	 356 (47.53%) 257 (34.31%) 91 (12.15%) 45 (6.01%)	 394 (60.24%) 166 (25.38%) 64 (9.79%) 30 (4.59%)	**< .0001**
Length of stay, mean ± SD	3.72 ± 4.09	3.11 ± 3.22	4.42 ± 4.80	**< .0001**
Number of subjects who stayed in the ICU during hospitalization	162 (11.55%)	63 (8.41%)	99 (15.14%)	**< .0001**
Top 5 diagnostic-related groups	Hip or knee joint replacement (n = 109, 7.77%) Back problem without MMC (n = 74, 5.27%) Spinal fusion without MMC (n = 64, 4.56%) Psychoses (n = 62, 4.42%) Connective tissue disease with CC (n = 52, 3.71%)	Joint replacement (n = 73, 9.75%) Psychoses (n = 37, 4.94%) Spinal fusion without MCC (n = 26, 3.47%) Back problem without MMC (n = 24, 3.20%) Connective tissue disease with CC (n = 20, 2.67%)	Back problem without MMC (n = 50, 7.65%) Spinal fusion without MMC (n = 38, 5.81%) Joint replacement (n = 36, 5.50%) Connective tissue disease with CC (n = 32, 4.89%) Psychoses (n = 25, 3.82%)	
Charleston Comorbidity Index (for medical comorbidities)	2.33 ± 2.10	2.05 ± 1.94	2.65 ± 2.23	**< .0001**
Spine fracture	127 (9.05%)	35 (4.67%)	92 (14.07%)	**< .0001**
Fracture in extremities	102 (7.27%)	42 (5.61%)	102 (7.27%)	**.034**
Fall as admitting diagnosis	176 (11.89%)	48 (6.13%)	128 (18.36%)	**< .0001**
Nontraumatic spinal disorders	127 (9.05%)	35 (4.67%)	92 (14.07%)	**< .0001**

Abbreviations: SD = standard deviation; ICU = intensive care unit; MMC = major complication or comorbidity; CC = complication or comorbidity; NSAIDs = nonsteroidal anti-inflammatory drugs

P value < .05 are shown in bold type

Table 1. Demographic and Clinical Information Based on the Discharge Outcome (Continued)

	Total, N = 1,403	Home discharge without readmission, n = 749 (53.38%) (Favorable outcome)	Discharge-other than home or readmission, n = 654 (46.61%) (Unfavorable outcome)	*P* value
Severity of pain at admission (numeric rating scale, n = 405)	3.72 ± 3.11	3.43 ± 3.14	4.02 ± 3.06	**.042**
Severity of pain at discharge (n = 479)	2.74 ± 2.79	2.52 ± 2.67	2.98 ± 2.91	.075
Presence of surgical procedures during hospitalization	686 (48.9%)	373 (49.8%)	313 (47.85%)	.468
Analgesics used during hospitalization				
NSAIDs	543 (38.70%)	312 (41.66%)	231 (35.32%)	**.015**
Acetaminophen	597 (42.55%)	322.00 (42.99%)	275 (42.05%)	.772
Opioids	941 (67.07%)	481 (64.22%)	460 (70.34%)	**.015**
Muscle relaxants	374 (26.66%)	187.00 (24.97%)	187 (28.59%)	.125
Benzodiazepine	367 (26.16%)	173.00 (23.10%)	194 (29.66%)	**.005**
Steroids	98 (6.99%)	55.00 (7.34%)	43 (6.57 %)	.573
Anticonvulsants	259 (18.46%)	151.00 (20.16%)	108 (16.51%)	.079

Abbreviations: SD = standard deviation; ICU = intensive care unit; MMC = major complication or comorbidity; CC = complication or comorbidity; NSAIDs = nonsteroidal anti-inflammatory drugs

P value < .05 are shown in bold type

use of benzodiazepine (OR 2.06, CI 1.20-3.54), and discharge to inpatient rehabilitation units (OR 10.55, CI 2.27- 49.07) (**Table 3**).

Discussion

This study provides a snapshot of the hospital course for patients with the primary admitting diagnosis of AS. The 3 most common major medical reasons for admissions indicated by DRG in patients with AS were all related to axial and large peripheral joint lesions requiring surgical procedures, such as joint replacement or spinal fusion. The group with hip or knee joint replacement largely had a favorable outcome (home discharge without readmission), contrary to a prior report that implied hip arthroplasty indicated poor functional outcomes.[5] This finding from our study should, therefore, be interpreted with caution. Despite the high rate of discharge to home (84.53%) and a low rate of in-hospital mortality in this study population compared to the previous literature, our readmission rate was higher than that of a previous report (27.3% in a study performed in Demark).[15-17] Recognizing patients at risk using information from the present study (patients undergoing surgical procedures, gastrointestinal complications, requiring inpatient rehabilitation, and use of benzodiazepine and/or muscle relaxants) could be an initial step to prevent readmission, a vital accountability measure for the quality of hospital care by the public payer.[18]

A vertebral fracture was noted as an admitting diagnosis for axial lesions in 127 patients (9.05%), which were more frequent in the unfavorable outcome group. The most common fracture location was at the thoracic spine level, and falls were reported in 65.47% of patients with vertebral fractures. Interestingly, only 9 patients (6.47% of patients with spine fracture) in this study had a known diagnosis of osteoporosis. Considering the older age of patients in the spine fracture group in this study than in a previously reported study (72.78 years vs 50 years), aggressive screening for and treatment of osteoporosis as well as fall prevention strategies, should be seen as a crucial part of the management of AS, as fractures in this population often occur with minimal trauma such as ground-level falls.[19-20]

Opioid analgesics were commonly used among patients with AS at a much higher rate during

Table 2. Stepwise Logistic Regression Analysis of the Relationship Between Home Discharge and Contributing Factors (Odds ratio for home discharge, pseudo R^2 = .3612)

Independent variables	Odds ratio	*P* value	95% confidence interval
Demographic and comorbidities			
Medicare and Medicaid	0.10	< .0001	0.03 - 0.33
Fall at admission	0.24	< .0001	0.11 - 0.54
Hospital-acquired complications			
Posthemorrhagic anemia	0.10	.032	.032 - 0.82
Medications			
One morphine milligram equivalents (MMEs) at discharge	0.998	.041	0.996 - 1.000
Nonsteroidal anti-inflammatory	3.87	< .0001	1.58 - 9.45
Steroid medications	0.14	.039	0.02 - 0.91
Acetaminophen	0.44	.04	0.20 - 0.98
Muscle relaxant	0.33	.006	0.15 - 0.73

hospitalization than what had previously been reported in the community.[11,12] This higher rate can be explained by the need for increased pain management after surgical procedures and the adverse effects of non-opioid analgesics, such as NSAIDs and TNF-α antagonists.[21] However, increased opioid and benzodiazepine use among the unfavorable outcome group is concerning. Furthermore, MME dose on the last day of the hospitalization was independently associated with decreased odds of home discharge while benzodiazepine use was associated with increased odds of readmission. Benzodiazepine use was more frequent in the group using opioids (27.84% vs 22.73%, *P* = .04) in a post-hoc analysis. Our result was similar to a previous study of the combined use of opioids and benzodiazepines associated with poor outcomes in the outpatient setting.[22]

NSAIDs, the first-line treatment for AS, were used more frequently in the favorable outcome group (41.6% vs 35.32%, *P* = .015) and associated independently with home discharge.[2] Considering higher CCI in the unfavorable outcome group, medical comorbidities likely limited NSAID use due to their adverse effects. Prudent use of NSAIDs can be encouraged to decrease MME in patients without contraindications. In this study's cohort, TNF-α inhibitor agents were used in only 4 patients (therefore, not included in the analysis) and other biologics such as interleukin-17A antibody agents were not used during acute care hospitalization, in part due to the concern for increased risk of infection at the surgical site and to cost.[23]

This study has several additional limitations. First, the study population does not include patients from non-profit healthcare systems, such as academic centers or the Veterans Health Administration. Second, this was a retrospective analysis of hospital discharge-based data including ICD-10-CM codes, and was therefore fundamentally limited by potential coding errors, which are often based on clini-

Table 3. Stepwise Logistic Regression Analysis of the Relationship Between Readmission Within 3 Months and Contributing Factors (Odds ratio for favorable outcome, pseudo R^2 = .0726)

Independent variables	Odds ratio	*P* value	95% confidence interval
Hospital course and hospital-acquired condition			
Surgical procedures	1.68	.04	1.03 - 2.74
Gastrointestinal complications	6.02	.03	1.16 - 31.36
Destination at discharge			
Acute inpatient rehabilitation unit	10.55	.00	2.27 - 49.07
Medications			
Benzodiazepine	2.06	.009	1.20 - 3.54
Muscle relaxant	0.58	.05	0.34 - 1.00

cal documentation. Third, this study could not determine the disease severity or duration of AS, both of which can impact outcome variables. Lastly, there was a lack of home medication information for our study population, including TNF-α inhibitor, biologics, and MME dose, which can limit the interpretation of this study's results regarding pain medications.

Conclusion

Patients with AS were admitted for advanced axial and peripheral joint pathologies and had favorable hospital courses but frequent readmissions. This study indicates that discharge MME dose and benzodiazepine use are associated with poor hospitalization outcomes.

Conflicts of Interest

The authors declare they have no conflicts of interest.

Drs Elsakr, Holt, and Lee are employees of MountainView Hospital, a hospital affiliated with the journal's publisher.

Dr Ayutyanont is an employee of HCA Healthcare Graduate Medical Education, an organization affiliated with the journal's publisher.

This research was supported (in whole or in part) by HCA Healthcare and/or an HCA Healthcare-affiliated entity. The views expressed in this publication represent those of the author(s) and do not necessarily represent the official views of HCA Healthcare or any of its affiliated entities.

Author Affiliations

1. MountainView Hospital, Las Vegas, NV
2. HCA Healthcare Graduate Medical Education, Far West Division, Las Vegas, NV

References

1. Zochling J, Braun J. Assessments in ankylosing spondylitis. *Best Pract Res Clin Rheumatol*. 2007;21(4):699-712. doi:10.1016/j.berh.2007.02.010
2. Taurog JD, Chhabra A, Colbert RA. Ankylosing spondylitis and axial spondyloarthritis. *N Engl J Med*. 2016;374(26):2563-2574. doi:10.1056/NEJMra1406182
3. Rustagi T, Drazin D, Oner C, et al. Fractures in spinal ankylosing disorders: a narrative review of disease and injury types, treatment techniques, and outcomes. *J Orthop Trauma*. 2017;31 Suppl 4:S57-S74. doi:10.1097/BOT.0000000000000953
4. Braun J, Sieper J. Ankylosing spondylitis. *Lancet*. 2007;369(9570):1379-1390. doi:10.1016/S0140-6736(07)60635-7
5. Gran JT, Skomsvoll JF. The outcome of ankylosing spondylitis: a study of 100 patients. *Br J Rheumatol*. 1997;36(7):766-771. doi:10.1093/rheumatology/36.7.766
6. Mahmood F, Helliwell P. Ankylosing spondylitis: a review. *EMJ*. 2017;2(4):134-139. doi: 10.33590/emj/10314487.
7. Ozkan Y. Cardiac Involvement in ankylosing spondylitis. *J Clin Med Res*. 2016;8(6):427-430. doi:10.14740/jocmr2488w
8. Bernstein DN, McCalla DJ, Molinari RW, Rubery PT, Menga EN, Mesfin A. An analysis of patient and fracture characteristics and clinical outcomes in patients with hyperostotic spine fractures. *Global Spine J*. 2020;10(8):964-972. doi:10.1177/2192568219887157
9. Olivieri I, D'Angelo S, Palazzi C, Padula A, Mader R, Khan MA. Diffuse idiopathic skeletal hyperostosis: differentiation from ankylosing spondylitis. *Curr Rheumatol Rep*. 2009;11(5):321-328. doi:10.1007/s11926-009-0046-9
10. Mrabet D, Alaya Z, Mizouni H, et al. Spine fracture in patient with ankylosing spondylitis: a case report. *Ann Phys Rehabil Med*. 2010;53(10):643-649. doi:10.1016/j.rehab.2010.09.008
11. Sloan VS, Sheahan A, Stark JL, Suruki RY. Opioid use in patients with ankylosing spondylitis is common in the United States: outcomes of a retrospective cohort study. *J Rheumatol*. 2019;46(11):1450-1457. doi:10.3899/jrheum.180972
12. Dau JD, Lee M, Ward MM, et al. Opioid analgesic use in patients with ankylosing spondylitis: an analysis of the prospective study of outcomes in an ankylosing spondylitis cohort. *J Rheumatol*. 2018;45(2):188-194. doi:10.3899/jrheum.170630
13. Ofori-Asenso R, Zomer E, Chin KL, et al. Effect of comorbidity assessed by the Charlson Comorbidity Index on the length of stay, costs and mortality among older adults Hospitalised for Acute Stroke. *Int J Environ Res Public Health*. 2018;15(11):2532. doi:10.3390/ijerph15112532

14. Welton JM, Halloran EJ. Nursing diagnoses, diagnosis-related group, and hospital outcomes. *J Nurs Adm*. 2005;35(12):541-549. doi:10.1097/00005110-200512000-00008
15. Dhital R, Oke I, Donato A, et al. Trends in hospitalizations for vertebral compression fracture in ankylosing spondylitis: data from the National Inpatient Sample 2000-2014. *Clin Rheumatol*. 2021;40(12):4927-4932. doi:10.1007/s10067-021-05842-0
16. Exarchou S, Lie E, Lindström U, et al. Mortality in ankylosing spondylitis: results from a nationwide population-based study. *Ann Rheum Dis*. 2016;75(8):1466-1472. doi:10.1136/annrheumdis-2015-207688
17. Holland-Fischer M, Thomsen RW, Tarp U, Nørgaard M. Ankylosing spondylitis and mortality following hospitalised pneumonia: a population-based cohort study. *RMD Open*. 2020;6(1):e001140. doi:10.1136/rmdopen-2019-001140
18. Axon RN, Williams MV. Hospital readmission as an accountability measure. *JAMA*. 2011;305(5):504-505. doi:10.1001/jama.2011.72
19. Vosse D, Feldtkeller E, Erlendsson J, Geusens P, van der Linden S. Clinical vertebral fractures in patients with ankylosing spondylitis. *J Rheumatol*. 2004;31(10):1981-1985.
20. van der Weijden MA, van der Horst-Bruinsma IE, van Denderen JC, Dijkmans BA, Heymans MW, Lems WF. High frequency of vertebral fractures in early spondylarthropathies. *Osteoporos Int*. 2012;23(6):1683-1690. doi:10.1007/s00198-011-1766-z
21. Fisher N, Hooper J, Bess S, Konda S, Leucht P, Egol KA. Ninety-day postoperative narcotic use after hospitalization for orthopaedic trauma. *J Am Acad Orthop Surg*. 2020;28(13):e560-e565. doi:10.5435/JAAOS-D-17-00825
22. Hirschtritt ME, Delucchi KL, Olfson M. Outpatient, combined use of opioid and benzodiazepine medications in the United States, 1993-2014. *Prev Med Rep*. 2017;9:49-54. doi:10.1016/j.pmedr.2017.12.010
23. Clay M, Mazouyes A, Gilson M, Gaudin P, Baillet A. Risk of postoperative infections and the discontinuation of TNF inhibitors in patients with rheumatoid arthritis: a meta-analysis. *Joint Bone Spine*. 2016;83(6):701-705. doi:10.1016/j.jbspin.2015.10.019