Title

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Journal

Arthritis Care & Research, 75(8)

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Publication Date

2023-08-01

DOI

10.1002/acr.25081

Peer reviewed

HHS Public Access

Author manuscript

Arthritis Care Res (Hoboken). Author manuscript; available in PMC 2023 September 28.

Published in final edited form as:

Arthritis Care Res (Hoboken). 2023 August ; 75(8): 1830–1837. doi:10.1002/acr.25081.

Burden, Causes, and Outcomes of Hospitalization in Patients With Giant Cell Arteritis: A US National Cohort Study

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Abstract

Objective.—Giant cell arteritis (GCA) has a relapsing–remitting course and is associated with a high burden of comorbidities, leading to repeated hospitalizations. This study was undertaken to investigate the burden, risk factors, causes, and outcomes of hospitalization and readmission in GCA patients in a US national cohort.

Methods.—Using the 2017 US National Readmission Database, we identified adults ≥50 years of age hospitalized with GCA between January and June 2017, with at least 6 months of follow-up. We estimated the burden of hospitalization including 6-month risk of readmission, total days spent in hospital, and costs, annually. We examined patient-, hospital-, and index hospitalization–related factors for 6-month readmission and total days of hospitalization using binomial logistic regression.

Results.—Our study included 1,206 patients hospitalized with GCA (70% women, median age 77 years), with 13% of patients experiencing GCA-related ophthalmologic complications at index hospital admission. On follow-up, 3% died, and 34% of patients were readmitted within 6 months, primarily for infections (23%) and cardiovascular diseases (CVDs) (15%). Charlson comorbidity index (CCI) of ≥1, smoking, and obesity were associated with readmission. GCA patients spent a

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AUTHOR CONTRIBUTIONS

All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version to be submitted for publication. Dr. Goulabchand had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Author disclosures are available at https://onlinelibrary.wiley.com/action/downloadSupplement?doi=10.1002%2Facr.25081&file=acr25081-sup-0001-Disclosureform.pdf.

Study conception and design. Goulabchand, Qian, Nguyen, N. Singh, S. Singh.

Acquisition of data. Goulabchand, Qian, S. Singh.

Analysis and interpretation of data. Goulabchand, Qian, Nguyen, A. Singh, Roubille, Parreau, N. Singh, S. Singh.

median of 5 days/year in hospital (interquartile range [IQR] 3–11), with those in the top quartile spending 19 days/year in hospital (IQR 14–26).

Conclusion.—GCA patients frequently experience unplanned health care utilization, with 1 in 3 patients experiencing readmission within 6 months, and 3% dying within the follow-up period. Infection and CVDs are common causes of readmission and may be related to glucocorticoid exposure. Population health management strategies are required in these vulnerable GCA patients.

INTRODUCTION

Giant cell arteritis (GCA) is a systemic vasculitis targeting large vessels, mainly affecting women and elderly patients (1). Approximately 1 in 1,900 adults over the age of 50 have GCA, with an annual incidence of 10 per 100,000 adults in this population (2). The disease follows a relapsing–remitting course, with ~15% of patients experiencing major relapse annually (3). Even though GCA may not be associated with an increased risk of death (4), it is associated with increased risk of ophthalmologic complications, cerebrovascular accidents, prolonged glucocorticoid exposure, and a high burden of comorbidities (2,5–7). These factors result in a high burden of hospitalization, unplanned health care utilization, and costs (8,9).

There is limited information regarding outcomes in patients hospitalized with GCA. Identifying characteristics of patients at high risk of frequent hospitalizations and long hospital stays could help tailor risks and reduce health care costs in elderly patients. Hence, we used the 2017 Nationwide Readmissions Database (NRD), an all-payer database of hospital inpatient stays, developed as part of the Healthcare Cost and Utilization Project (HCUP), to describe the characteristics of hospitalized GCA patients, readmission rates, causes and risk factors for hospitalizations, and costs.

PATIENTS AND METHODS

Data source.

The 2017 NRD is a population-wide longitudinal database developed by the HCUP, sponsored by the Agency for Healthcare Research and Quality (AHRQ). The NRD contains a unique patient identifier that allows linkage of individual patients across hospitalizations within all participating states over the course of a year. It contains demographic, clinical, and nonclinical variables from all community hospitals, public hospitals, and academic medical centers, enabling study of readmission. This database accounts for 49.3% of the US population and contains ~85% of discharges from the State Inpatient Databases (obtained from 21 US states). Although primarily designed to examine encounter-level 30-day risk of readmission metrics, we transformed this data set to create a patient-level longitudinal, nationally representative cohort of hospitalized adults in the US (10).

Study population.

From the 2017 NRD, we identified adults ≥50 years old hospitalized between January 1, 2017 and June 30, 2017, with ≥1 code of GCA (with or without associated polymyalgia rheumatica [PMR]) as a primary or secondary discharge diagnosis, based on International

Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) codes (see Figure 1 and Supplementary Table 1, available on the *Arthritis Care & Research* website at http://onlinelibrary.wiley.com/doi/10.1002/acr.25081) (6,11,12). The positive predictive value of this approach to GCA diagnosis was >90% in a French study (12). First hospitalization was defined as the index hospitalization. To estimate annual burden and readmission risk, the "at-risk" period for readmission was defined as the period from discharge following index hospitalization to the end of the study year, December 31, 2017, or death. We excluded patients whose index hospitalization was between July and December 2017 (to ensure a minimum 6-month follow-up period for all patients); patients hospitalized with other concomitant autoimmune diseases including rheumatoid arthritis, systemic lupus erythematosus, or vasculitis (to avoid misclassification of attribution); patients who were transferred from another hospital; or those with missing data for the lengths of hospital stays.

Baseline characteristics.

We selected data on relevant patient characteristics during index hospitalization, including age, sex, primary expected payment source (Medicare/Medicaid or other payment, combining private insurances and self-pay), income quartile based on the median household income at the patient's zip code, and relevant comorbidities (diabetes, cardiovascular diseases [CVDs], kidney and lung diseases, gastrointestinal [GI] and liver diseases). From these comorbidities and specific medical conditions, along with the ages of the patient, we derived Charlson comorbidity index (CCI) (see Supplementary Table 2, at http://onlinelibrary.wiley.com/doi/10.1002/acr.25081), which was designed to predict 1-year mortality in patients with a range of comorbid conditions. We also calculated the prevalence of frailty using the Hospital Frailty Risk Score, which was developed and validated in 1.04 million hospitalized patients ≥75 years old (13). The Hospital Frailty Risk Score is used to screen for frailty and identify a group of patients who are at greater risk of adverse outcomes (e.g., mortality, readmission, length of stay). This score is based on ICD-10 codes and can be readily implemented in hospital information systems. Detailed calculation of this score is shown in Supplementary Table 3 (at http://onlinelibrary.wiley.com/doi/10.1002/acr.25081). We classified the patients as normal (score <5) or pre-frail/frail (score ≥5).

We also selected data regarding hospital characteristics including location (urban area = >1 million residents), teaching status, and bed size (small, medium, or large, based on the number of short-term acute care hospital beds, obtained from the American Hospital Association's annual survey of hospitals). NRD does not include data on outpatient/office visits, medication use, or biologic tests and pathologic results. In addition, we recorded GCA-specific variables, including procedure codes for temporal artery biopsy (TAB). Because GCA-related ophthalmologic complications deeply impact prognosis in GCA patients, we described highly suspected GCA-related ophthalmologic conditions, combining blindness, ischemic optic neuropathy, and retinal artery occlusion occurring 31 days before the index date to the end of the follow-up period (see ICD-10–related codes in Supplementary Table 1 at http://onlinelibrary.wiley.com/doi/10.1002/acr.25081). Additional specific comorbidities of interest (CVDs and risk factors, obesity, dementia, smoking status,

and cancers) were recorded based on ICD-10 codes before or around index hospitalization (details regarding codes are shown in Supplementary Table 1).

Outcomes.

To examine unplanned health care utilization, we calculated 1) risk of all-cause readmission at 1 month, 3 months, and 6 months after index hospitalization; 2) annual burden and cost of hospitalization, using total days spent in the hospital in a calendar year as the primary metric including index hospitalization (divided into quartiles) (cost of hospitalizations was computed by multiplying charges for each hospitalization with the cost-to-charge ratios for each hospital for a given year, with inflation adjusted to the year 2017); and 3) percentage of inpatient mortality.

Among patients who were readmitted within 6 months, we classified causes of readmission based on the primary discharge diagnosis as 1) CVDs (combining ischemic heart disease, hypertension and its complications, heart failure, arrythmias, arterial diseases); 2) cerebrovascular diseases (combining stroke, stenosis of precerebral arteries, and seizures); 3) all infections (including respiratory infections, bacteremia and other sepsis, urinary tract infection, or intestinal infections); 4) metabolic diseases (diabetes, kidney diseases, electrolyte disorders); 5) venous thromboembolic events, including pulmonary embolisms; 6) noninfectious respiratory diseases (combining chronic obstructive pulmonary disease, acute and chronic respiratory failure, hypoxemia); 7) GI diseases (gastric and duodenal ulcers, gastroesophageal reflux, GI hemorrhages, ileus, constipation, unspecified colitis); 8) musculoskeletal disorders (combining osteoarthritis, gout, chondrocalcinosis, osteoporosis, trauma, and myopathy); 9) and cancers (solid neoplasms and blood malignancies) (see Supplementary Table 1, at http://onlinelibrary.wiley.com/doi/10.1002/acr.25081). Other discharge codes were classified into “miscellaneous diagnoses.”

We evaluated risk factors at index hospitalization associated with 6-month readmission and a high burden of health care utilization (days spent in hospital from the date of index hospitalization). We also evaluated factors associated with GCA-related ophthalmologic complications.

Statistical analysis.

Descriptive statistics were used to describe baseline demographic characteristics, hospital characteristics, and index hospitalization characteristics in GCA patients. Categorical variables are expressed as percentages, and continuous variables are expressed as the median (interquartile range [IQR]). Patients were followed up from date of discharge from index hospitalization until outcome of interest (readmission) or end of the year. Patients who died as inpatients during index hospitalization (no possibility of readmission) were excluded from the analysis. To evaluate the independent impact of baseline factors on 6-month readmission, we performed binomial logistic regression accounting for patient factors (age, sex, annual income level, Medicare/Medicaid status, frailty risk score, CCI), disease factors (GCA with or without PMR, GCA-related ophthalmologic complications), and hospital factors (location, bed size, teaching status, and length of hospital stay for index hospitalization).

Similarly, we examined risk factors associated with the annual burden of hospitalization (total days spent in hospitalization, inclusive of index hospitalization) using conditional linear regression models. We performed multivariate binomial logistic regression analysis to study the risk factors associated with GCA-related ophthalmologic complications, including age, sex, income level, insurance status, hospital characteristics, and main comorbidities (CCI, frailty, or ischemic heart disease). When one of the composite scores of comorbidities (CCI or frailty) was significantly associated with the outcome of interest, we conducted a secondary analysis focusing on specific components relevant in elderly patients: smoking, obesity, diabetes, ischemic heart disease, and dementia. All results from the regression models were represented by the odds ratio (OR) with accompanying 95% confidence interval (95% CI). Statistical analysis was conducted using RStudio version 1.4.1717.

Ethics.

This study was exempt from institutional review board approval because the NRD is a publicly available database containing deidentified patient information. The present study was performed in accordance with the AHRQ's data use agreement.

RESULTS

We identified 2,477 inpatients with ≥1 diagnosis code of GCA in the 2017 NRD database. After excluding patients <50 years old, with index hospitalization after June 30, or with concomitant exclusionary autoimmune diseases, our cohort included 1,206 patients hospitalized with GCA (Figure 1).

Patient characteristics.

Characteristics of the 1,206 GCA patients are shown in Table 1. The median (IQR) age was 77 years (68–84 years); 70% were female. Approximately 13% of patients had a concomitant diagnosis of PMR. Approximately 43% were classified as frail, and 35% had CCI ≥1, most commonly hypertension or related complications (61%), ischemic heart disease (27%), and diabetes (27%); 10% were obese and 20% were smokers. TABs were performed in 34% of patients during the year, and these patients were younger and were more likely to have been admitted to a large and/or a teaching hospital.

The median follow-up period after index hospitalization was 8 months (IQR 7–10). Approximately 13% of patients (n = 156) experienced ophthalmologic events (including blindness in 130 patients); 83% of these events occurred during index hospitalization. GCA- related ophthalmologic complications were more likely to occur in GCA patients without PMR compared with patients with concomitant PMR (OR 3.46 [95% CI 1.69–8.36]), whereas the presence of ischemic heart disease was associated with a lower risk of GCA-related ophthalmologic complications (OR 0.58 [95% CI 0.36–0.88]) (independent of age, sex, income level, Medicare/Medicaid, CCI, frailty score).

Risk and risk factors for readmission.

Of 1,202 patients alive after index hospitalization, we identified 484 patients (40%) with at least one readmission, with a median delay of 54 days (IQR 18–120) (Table 2); 243 (20%)

were readmitted ≥2 times. Overall, 1-month, 3-month and 6-month risk of readmission was 13%, 26% and 34%, respectively. Among the 412 patients who were readmitted within 6 months, infections (23%) and CVDs (15%) were the two leading causes of readmission. Only 4% of patients were readmitted with GCA ± PMR as the primary discharge diagnosis, and there was no 6-month readmission for GCA-related ophthalmologic complications (Figure 2). Among hospitalizations for infections, bacteremia/sepsis (10%) was more numerous than respiratory infections (5%) or intestinal infections (3%). Twenty-five patients (6%) were readmitted for GI diseases, and 7% for musculoskeletal disorders (Figure 2).

On binomial logistic regression analysis, independent risk factors for 6-month readmission were CCI ≥1 (OR 2.13 [95% CI 1.65–2.77]) and the presence of GCA-related ophthalmologic complications (OR 1.46 [95% CI 1.02–2.09]) (Table 3). When testing subcomponents of CCI in the model, smoking (OR 1.92 [95% CI 1.41–2.61]), obesity (OR 1.78 [95% CI 1.17–2.70]), diabetes (OR 1.45 [95% CI 1.09–1.93]), ischemic heart disease (OR 1.56 [95% CI 1.18–2.06]), and dementia (OR 2.72 [95% CI 1.81–4.13]) were independently associated with 6-month readmission risk.

Annual burden of hospitalization.

GCA patients spent a median of 5 days (IQR 3–11) in the hospital, inclusive of index hospitalization (Table 2). Patients in the highest quartile for length of hospitalization spent a median of 19 days (IQR 14–26) in the hospital versus 2 days (2–3 days) in the lowest quartile. The median overall cost for hospital stays, inclusive of index hospitalization, was $112,000 (IQR $59,000–194,000); median costs were $181,000 (IQR $143,000–271,000) in the highest quartile compared with $15,000 (IQR $11,000–20,000) in the lowest quartile. The total number of days spent in hospitalization, inclusive of index hospitalization, was higher in men, patients with Medicare/Medicaid, pre-frail or frail patients, patients with high CCI, and patients with index hospitalization in a large hospital (Table 3).

Inpatient mortality.

Thirty-six patients (3%) died as inpatients within the year, of whom 4 died during index hospitalization.

DISCUSSION

GCA is associated with a significant burden of morbidity in older patients, who are at high risk of unplanned health care utilization. In this nationally representative cohort study using the NRD, which includes >85% of all hospital discharges in 21 states, we made several key observations regarding burden, risk factors, and outcomes in patients hospitalized with GCA. First, we observed that ~1 in 3 patients hospitalized with GCA are readmitted within 6 months, and ~20% are readmitted twice. On average, GCA patients spend 5 days in the hospital annually, with wide variability; patients in the highest quartile of total time spent in hospital spend almost 3 weeks in the hospital annually. Second, we observed that serious infections and CVDs are the leading causes of readmission in GCA patients, with only a small fraction readmitted primarily for GCA or direct complications from GCA. Third, we identified CCI ≥1, in particular obesity, smoking, and dementia, were novel risk

factors associated with readmission. Overall, these findings regarding patterns and drivers of unplanned health care utilization in patients hospitalized with GCA may inform population health management strategies in these vulnerable patients.

There have been few population-based studies examining the burden of unplanned health care utilization in GCA patients. In a population-based cohort study in Olmsted County, Michet et al observed that GCA patients were at higher risk of all-cause hospitalization compared with those without GCA (14). In their cohort, hospitalization due to neurologic events including transient ischemic attack and syncope occurred at a higher frequency in GCA patients. In our cohort, cerebrovascular diseases accounted for readmission in ~6% of patients, while infections and CVDs were the leading causes of readmission. In another cohort study using the NRD published only in abstract form, 13% of patients primarily admitted for GCA were readmitted within 30 days, similar to the rate in our cohort (15). However, as opposed to encounter-level analysis, we created a longitudinal cohort of patients to estimate annual burden and costs of hospitalization in GCA patients.

The first step in population health management is identifying patients with highest health care utilization and sources of variability in outcomes. We observed that CCI ≥1, particularly smoking, diabetes, ischemic heart disease, and dementia were associated with an increased risk of readmission. We also observed that obesity was a novel risk factor for readmission. This may be related to a higher burden of cardiovascular risk, potential risk of serious infections (16), or potentially a reflection of higher glucocorticoid use leading to weight gain. These risk factors for higher rates of unplanned health care utilization may help identify a subgroup of GCA patients at high risk of readmission who may benefit from a proactive post-discharge monitoring strategy.

In our cohort, ~13% of GCA patients experienced ophthalmologic complications, the vast majority of which were present at time of initial hospitalization. This rate is consistent with other cohorts (6,17,18). Interestingly, GCA-related ophthalmologic complications negatively correlated with history of ischemic heart disease. This may be related to the use of antiplatelet agents in patients with ischemic heart disease, which may be associated with a lower risk of GCA-related ophthalmologic complications and other ischemic events (19). However, related data mainly involve retrospective studies, and data are heterogenous (20,21). In our cohort, data regarding medication use were not available. Aside from this impact of medication, there is a small competing risk of death, wherein patients with ischemic heart disease may be more likely to die prior to the development of GCA-related ophthalmologic complications.

Infections and CVDs were the leading causes of readmission in GCA patients. A high prevalence of serious infections was observed in GCA patients. In the Medicare database, serious infections were observed in 28% of GCA patients, with an incidence rate of 10.7 per 100 person-years (22). In this cohort, 85% of patients had received treatment with high-dose prednisone. In another cohort study in the Health Improvement Research Network, Durand et al observed that 48% of GCA patients developed systemic infections, with most infections occurring within 6 months of GCA diagnosis (23); the risk of serious infection was 55% higher in GCA patients compared with age- and sex-matched non-GCA controls. In another

multicenter cohort study, Schmidt et al observed that use of glucocorticoids at a dose of >10 mg/day 12 months after diagnosis was associated with serious infections and death (24). We also observed that CVDs were an important cause of readmission in GCA patients. While this risk may be high in older patients, several studies have demonstrated that GCA patients may have 1.5–2.5-fold higher risk of myocardial infarction and stroke (25–28).

Other than old age, long-term, high cumulative use of glucocorticoids may be a major factor contributing to this increased risk of serious infections and cardiovascular events (7,29–31). Glucocorticoid-sparing treatment strategies, such as tocilizumab or JAK inhibitors (32–35) are attractive and may decrease the risk of glucocorticoid complications and unplanned health care utilization in GCA patients. Further studies examining the comparative safety and impact on hospitalization and readmission with alternative treatment approaches in GCA patients is warranted. In addition to vaccination campaigns and monitoring cardiovascular risk and diseases, the observed proportion of GI and musculoskeletal diseases among the 6-month readmission causes in this fragile population of GCA patients could lead to specific preventive measures.

The strengths of our study include 1) use of a nationally representative database to study rehospitalization burden, 2) a novel, patient-centered metric of burden of hospitalization in “total days spent in hospital,” and 3) assessment of causes of readmissions. Our study has several limitations. First, the analyses are based on administrative codes and only focus on inpatient use, without details of outpatient clinic visits, medication use, and laboratory variables. Indeed, patients diagnosed as having GCA as outpatients were not selected in our study: the prevalence rate of hospitalization and characteristics in these patients could be interesting to study in order to report “low-risk” patients for hospitalizations. Second, causes of readmissions were identified using primary discharge diagnoses, which were grouped by disease system to allow for interpretation. Third, since the NRD uses data from state inpatient databases, it does not track patients across state boundaries. However, in validation studies performed by the HCUP, the rate of cross-state hospitalizations was found to be <5% of all admissions, thereby unlikely to substantially affect our estimates. Moreover, the NRD does not capture out-of-hospital mortality, which may bias the “at risk of hospitalization” time period. Finally, the comparison of the outcomes concerning our hospitalized GCA patients to a matched control group could provide details regarding the specific risk factors associated with readmission rates.

In conclusion, in this nationally representative study of patients hospitalized with GCA, we observed high rates of unplanned health care utilization and considerable variability in the burden of hospitalization, with a small fraction of patients disproportionately contributing to total hospitalization burden and costs. Infections and CVDs, potentially related to prolonged glucocorticoid exposure, contribute as leading causes of readmission. Population health management strategies directed toward identifying high-need, high-cost GCA patients and implementing multicomponent chronic care models may improve quality of care and reduce costs of care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Dr. Goulabchand's work was partially supported by the Philippe Foundation and the CHU de Nimes. Dr. N. Singh's work was supported by the National Institute of Arthritis and Musculoskeletal and Skin Diseases (grant K23-AR-079588), the Rheumatology Research Foundation, and the American Heart Association. Dr. S. Singh's work was supported by the National Institute of Diabetes and Digestive Kidney Diseases (grants K23-DK-117058 and R03-DK-129631), the American College of Gastroenterology Junior Faculty Development Award, and the Crohn's and Colitis Foundation Career Development Award (grant 404614).

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SIGNIFICANCE & INNOVATIONS

- There is a need to identify factors associated with readmission in patients with giant cell arteritis (GCA) in the US.
- Of 1,206 GCA patients hospitalized, 34% were readmitted within 6 months.
- Infections (23%) and cardiovascular diseases (15%) are the main causes of readmissions.
- Charlson comorbidity index, frailty score, and obesity screening may help to identify GCA patients with increased risk of readmission and health care utilization.

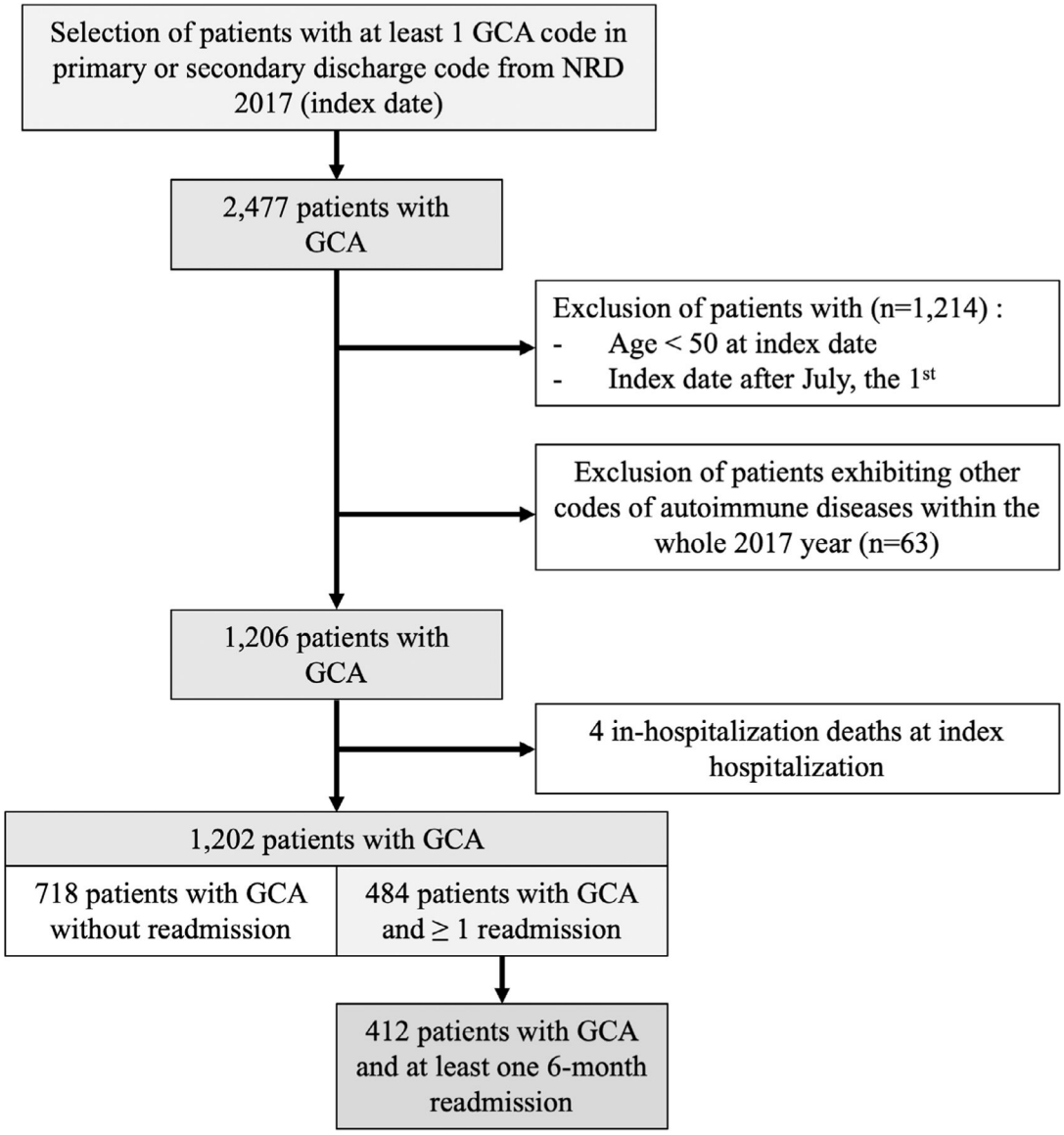

Figure 1.
Selection of the population of patients with giant cell arteritis (GCA) from the 2017 National Readmission Database (NRD).

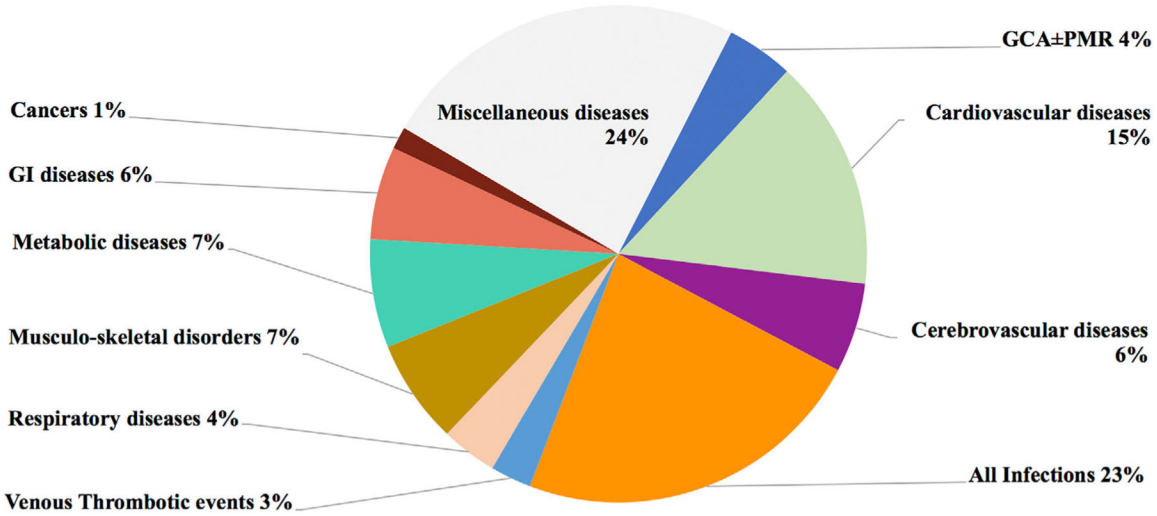

Figure 2.

Causes of 6-month readmissions in 412 patients with giant cell arteritis (GCA) from the 2017 National Readmission Database. Cardiovascular diseases include ischemic heart disease, hypertension and its complications, heart failure, arrythmias, and arterial diseases; cerebrovascular diseases include strokes, stenosis of precerebral arteries, and seizures; respiratory diseases include chronic obstructive pulmonary disease, acute and chronic respiratory failure, and hypoxemia; musculoskeletal disorders include osteoarthritis, gout, chondrocalcinosis, osteoporosis, trauma, myopathy; metabolic disorders include diabetes, kidney diseases, and electrolyte disorders; and gastrointestinal (GI) diseases include gastric and duodenal ulcers, gastroesophageal reflux, GI hemorrhages, ileus, constipation, and unspecified colitis. PMR = polymyalgia rheumatica.

Table 1.

Baseline characteristics in 1,206 GCA inpatients, selected from the 2017 National Readmission Database *

Characteristics	Values
General characteristics, no.	1,206
Female sex	849 (70)
Age at index date, median (IQR) years	77 (68–84)
Age at index date, years	
50–59	89 (7)
60–69	239 (20)
70–79	400 (33)
80–89	383 (32)
≥90	95 (8)
Follow-up time after index date, median (IQR) months	8 (7–10)
GCA characteristics	
GCA	1,054 (87)
GCA plus PMR	152 (13)
TAB procedure within the year	410 (34)
Ophthalmologic conditions complicating GCA †	
Combination of blindness and/or GCA-related ophthalmologic complications	156 (13)
Blindness	130 (11)
GCA-related ophthalmologic complications	41 (3)
Sociodemographic characteristics	
Medicare/Medicaid	1,038 (86)
Annual income level	
1st quartile (<$44,000)	253 (21)
2nd quartile ($44,000–55,999)	294 (24)
3rd quartile ($56,000–73,999)	319 (26)
4th quartile (≥$74,000)	323 (27)
Hospital characteristics (index hospitalization)	
Hospital bed size	
Small	185 (15)
Medium	302 (25)
Large	719 (60)
Teaching hospital	855 (71)
Hospital location (urban area = >1 million residents)	676 (56)
Comorbidity scores at index hospitalization	
Pre-frail or frail patients (frailty score ≥5)	518 (43)
CCI ≥1	423 (35)
CCI ≥2	164 (14)
Reported ICD-10 code diagnoses for hospitalization before or near the index date	
Cardiovascular diseases and factors	
Hypertension and its complications	738 (61)

Characteristics	Values
Diabetes	324 (27)
Chronic kidney disease	173 (14)
Ischemic heart disease	326 (27)
Heart failure	106 (9)
Stroke	171 (14)
Obesity	117 (10)
Dementia	118 (10)
Smoking	244 (20)
All solid neoplasms	57 (5)
All blood malignancies	33 (3)

*Unless otherwise specified, values are the number (%) of patients. CCI = Charlson comorbidity index; GCA = giant cell arteritis; ICD-10 = International Statistical Classification of Diseases and Related Health Problems, Tenth Revision; IQR = interquartile range; PMR = polymyalgia rheumatica; TAB = temporal artery biopsy.

†GCA-related ophthalmologic complications include ischemic optic neuropathy and/or retinal artery occlusion.

Table 2.

Readmission rates and annual burden of hospitalization in 1,202 GCA patients *

	Values
Readmission rates at month 1, 3, and 6, n	1,202
Patients with ≥1 readmission within the entire follow-up period, no. (%)	484 (40)
1-month readmission rate, no. (%) of patients	157 (13)
3-month readmission rate, no. (%) of patients	308 (26)
6-month readmission rate, no. (%) of patients	412 (34)
Patients with ≥2 readmissions, no. (%)	243 (20)
Patients with ≥3 readmissions, no. (%)	119 (10)
Time to the first readmission, median (IQR) days (n = 484)	54 (18–120)
Annual burden of hospitalization	
Total length of hospitalization, inclusive of index hospitalization, median (IQR)	
Days of hospitalization	5 (3–11)
Days of hospitalization for GCA patients in the highest quartile	19 (14–26)
Days of hospitalization for GCA patients in the lowest quartile	2 (2–3)
Cost of hospitalization, inclusive of index hospitalization, median (IQR)	
Total cost of hospitalization stays	$112,000 ($59,000–194,000)
Cost of hospital stays for GCA patients in the highest quartile	$181,000 ($143,000–271,000)
Cost of hospital stays for GCA patients in the lowest quartile	$15,000 ($11,000–20,000)
Total inpatients deaths during the follow-up period, no. (%)	36 (3)
Time to death after the index date, median (IQR) days	51.5 (21.3–113.8)

* GCA = giant cell arteritis; IQR = interquartile range.

Table 3.

Risk factors for 6-month readmission and burden of hospitalization in 412 patients with giant cell arteritis [*]

	Values
Factors associated with 6-month readmission [†]	
Male sex	1.13 (0.86–1.48)
Income level (lowest quartile)	1.00 (0.74–1.36)
Medicare/Medicaid	1.22 (0.81–1.86)
Pre-frail or frail patients	1.08 (0.83–1.40)
CCI ≥1	2.13 (1.65–2.77)
GCA plus PMR	1.12 (0.77–1.65)
GCA-related ophthalmologic complications	1.46 (1.02–2.09)
Hospital bed size	
Medium vs. small	0.89 (0.60–1.33)
Large vs. small	0.92 (0.64–1.31)
Teaching hospital	0.94 (0.71–1.25)
Hospital in urban area (population ≥1 million residents)	1.12 (0.86–1.45)
Length of stay of index hospitalization	1.02 (0.99–1.06)
Factors associated with total days spent in hospital [‡]	
Male sex	1.20 (1.01–1.42)
Income level (lowest quartile)	1.09 (0.90–1.32)
Medicare/Medicaid	1.37 (1.08–1.75)
Pre-frail or frail patients	1.35 (1.15–1.58)
CCI ≥1	1.96 (1.66–2.30)
GCA plus PMR	0.95 (0.75–1.19)
GCA-related ophthalmologic complications	1.17 (0.94–1.47)
Hospital bed size	
Medium vs. small	1.24 (0.97–1.59)
Large vs. small	1.45 (1.16–1.80)
Teaching hospital	1.08 (0.91–1.29)
Hospital in urban area (population ≥1 million residents)	1.16 (0.99–1.36)

[*] Values are the odds ratio (95% confidence interval). Also included age ranks, not significantly associated with 6-month readmission risk or burden of hospitalization. CCI = Charlson comorbidity index; GCA = giant cell arteritis; PMR = polymyalgia rheumatica.

[†] By binomial logistic regression.

[‡] By conditional linear regression.