

# There and back again: analyzing the effect of outpatient readmission on the quality of life of patients attending a rheumatology clinic

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## Abstract

**Aims:** The aim of this study was to assess the effect of “outpatient readmissions” on the health-related quality of life (HR-QoL) of outpatients from a rheumatology clinic, meaning the effect of the patient’s return to the outpatient clinic after having received care and been discharged.

**Methods:** We conducted an observational longitudinal retrospective study, with patients selected from the Hospital Clínico San Carlos Musculoskeletal cohort, based on having received at least one discharge from the outpatient clinic and having returned (readmission) at least once after the discharge. The main outcomes were the patients’ baseline HR-QoL (measured on the first visit of each episode) and the  $\Delta$ HR-QoL (difference between the HR-QoL in the last and the first visit of each episode). Successive episodes of admission and readmission were chronologically ordered, paired and analyzed using nested linear mixed models, nested by patients and by admission–readmission tandem. We carried out bivariable and multivariable analyses to assess the effect of demographic, clinical, treatment and comorbidity-related variables in both main outcomes.

**Results:** For the first main outcome, 5887 patients (13,772 episodes) were analyzed. Based on the multivariable level, readmission showed no significant marginal effect on the baseline HR-QoL ( $p$ -value = 0.17). Conversely, when analyzing the  $\Delta$ HR-QoL, we did observe a negative and significant marginal effect ( $p$ -value = 0.028), meaning that readmission was associated with a lower gain in the HR-QoL during the follow-up, compared with the previous episode.

**Conclusion:** In the outpatient setting, readmission exerts a deleterious effect in patients undergoing this process. Identification of outpatients more likely to be readmitted could increase the value of the care provided.

**Keywords:** axial neuropathy, chronic polyarthritis, quality of life, readmission, Rosser classification system

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## Introduction

Readmission is defined as the return of a patient to a healthcare setting after receiving care and being discharged. Attention has been mainly focused on the inpatient setting, where 10–20% of patients are readmitted in the 30 days following discharge,<sup>1–3</sup> and where this process imposes an overwhelming burden at multiple levels<sup>4–11</sup> and

has been identified as a major driver of patients’ poor outcomes, such as increased hospital mortality,<sup>5,11</sup> length of stay,<sup>3</sup> and healthcare costs.<sup>12,13</sup>

In the outpatient setting, there is no formal definition of what can be interpreted as an “outpatient readmission”; neither has it received the same level of attention as the inpatient readmission. In

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this work, we defined “outpatient readmission” as the return of a non-hospitalized patient to an outpatient clinic after having received care and been discharged. The return may be motivated by the same initial condition that was previously attended or by a different one.

As seen with inpatient readmissions, outpatient readmissions could also negatively affect both patients and the healthcare system, impairing the patient’s continuity of care, if returning patients are not attended by the same physician; also, readmissions could increase the healthcare resources’ consumption, as these patients could use appointment slots intended for new, previously unattended, patients, which are usually longer. However, the negative impact of readmissions on the patient’s health has not been yet analyzed. Therefore, our aim is to assess the effect of outpatient readmission, in a rheumatology outpatient clinic, on the patient’s health-related quality of life (HR-QoL).

## Patients and methods

### Study design

Observational longitudinal retrospective study, including patients from 1 April 2007 to 30 November 2016, and followed up until 30 November 2017.

Study approval was obtained as a retrospective study from the Hospital Clínico San Carlos Ethics Committee (approval number 20/040-E\_TFG), and waiver of informed consent was obtained for use of de-identified clinical information. The study was conducted in accordance with the Declaration of Helsinki, the Spanish law and applicable regulations.

### Patients

The study population was selected from the Hospital Clínico San Carlos Musculoskeletal Cohort (HCSC-MSKC),<sup>14</sup> a routine clinical practice cohort that includes subjects seen at the rheumatology outpatient clinic of our center whose clinical information and management was carried out using a departmental electronic health record (EHR). The HCSC-MSKC contains information from more than 35,000 patients attending our clinic from 1 April 2007 until 30 November 2017 and comprising more than 117,000 clinical visits.

Patients seen at the rheumatology outpatient clinic are mostly referred from primary care (90%), followed by the Emergency Department (7%) and other specialties (3%) from the same center.

Patients and follow-up episodes included in the present study were selected based on several criteria: first, we defined follow-up episodes (referred to as episodes) as the time intervals during which a patient is being followed-up in the rheumatology outpatient clinic. The first episode starts with the patient’s first visit to the clinic and ends when he/she is discharged, is lost to follow-up or when the study ends (30 November 2017). In the case of the patient returning after being discharged, a new episode begins and it is defined as the elapsed time from that new visit after the previous discharge until the patient is again discharged, lost to follow-up, or the end of the study. Therefore, new episodes begin when the patient is discharged and returns to the clinic.

Second, based on that definition, we selected the patients and episodes that fulfilled the following criteria:

1. Episodes with all its visits spaced less than 365 days.
2. Episodes with a “valid ending”, meaning that both sections of the patient’s follow-up plan from the last visit of the episode (which is fulfilled by the rheumatologist at the end of each contact with the patient) are consistent. The follow-up plan comprises a mandatory section “discharge status” (codified as “continue follow-up in our clinic”, “discharge”, “inpatient admission” or “transfer to another center”), and a non-mandatory section “elaboration of the discharge status” (e.g. in the case the patient is discharged, she/he can be referred to primary care; or the rheumatologist can indicate that a scheduled telephone contact to assess the patient’s clinical evolution and response to medication was planned; or that section can be left blank, as it is not a mandatory variable to complete during the contact with the patient. See further details in Madrid-García *et al.*<sup>14</sup>). Therefore, by consistent we mean that the information provided by both sections cannot be contradictory: for example, a patient with a discharge status of “continue follow-up in our clinic” and an elaboration of the discharge status of “referral to primary care” would not

be considered consistent. In the present study, all patients with a “valid ending” were included in the description of the baseline characteristics of patients who returned after the first discharge, who did not return after the first discharge and who were never discharged were described (see the Statistical analysis section below); for the analysis of the impact of readmission in the HR-QoL, only episodes with a “discharge status” codified by the rheumatologist as “discharge” and an “elaboration on the discharge status” with a consistent patient referral were included.

3. Patients with a “valid first episode” defined as those with a first episode that fulfills criteria 1 and 2.
4. Patients that had at least a second episode, this is, that returned at least once to the rheumatology clinic once they were discharged.
5. Patients with a “valid second episode”, defined as a second episode that fulfills criteria 1 and 2.
6. Episodes preceded by an episode that fulfilled criteria 1 and 2.

In addition, for the analysis of the HR-QoL difference between the last and the first visit of each episode (see further details below) we also required that:

7. Episodes had at least two visits.
8. Same as criterion 6.
9. Same as criterion 5.

### Variables

Two dependent variables based on the HR-QoL [measured using the Rosser classification index (RCI)<sup>15</sup>] were defined:

- HR-QoL in the first visit of each episode (baseline HR-QoL);
- HR-QoL difference between the last and the first visit of each episode ( $\Delta$ HR-QoL).

As independent variables, demographic (e.g. sex, age at first visit, occupation), clinical (diagnoses, treatments and comorbidities) and episode-related variables (e.g. episode number, discharge-readmission elapsed time, common diagnoses between episodes) were analyzed.

International Classification of Diseases version 9/10 codes given by the rheumatologists were grouped in 64 categories. Drugs prescribed by the

rheumatologist in each patient’s visit and codified using the Spanish Drug and Medical Products Agency drug codes were combined according to their active principle into 73 categories. Finally, comorbidities and concomitant treatments prescribed by other physicians outside the rheumatology clinic were grouped into 204 categories. Variables were included in the analysis if the percentage of events for that particular variable was  $\geq 1\%$ , in order to avoid misinterpretations of the results due to a low and non-representative number of events. If the frequency was lower, those categories were grouped in already pre-existing categories or combined into new categories, based on affinity. Supplemental material File S1 online shows this combination process. After applying this 1% rule, the number of diagnosis, treatments and comorbidities variables was reduced to 25, 19 and 110, respectively.

Regarding the diagnoses given in the outpatient clinic, they were analyzed as a four-level categorical variable: (a) no diagnosis of that particular process was given in any of the paired episodes; (b) the diagnosis was given in the admission episode but not in the readmission episode; (c) the diagnosis was given in the readmission episode but not in the admission one; and (d) the diagnoses was given in both episodes.

A list with all the studied variables can be found in Supplemental Table S1. In addition, the episode-related variables “order of Admission–Readmission pair”, “elapsed time from discharge to readmission” and “number of common diagnoses between episodes” were included.

### Statistical analysis

Baseline characteristics (first visit of the first episode) of the patients included in the HCSC-MSKC who returned after the first discharge, who did not return after the first discharge and who were never discharged were described (median and first and third quartiles for continuous variables; number and proportions for categorical variables). Differences among the three groups were assessed using the analysis of variance test for continuous variables and  $\chi^2$  for categorical variables.

The impact of readmission on the HR-QoL was assessed: episodes were chronologically ordered and paired (in each pair, the first or the earlier episode was considered as the “admission” and the

second or the latest episode was considered as the “readmission” episode). This way, the effect of each episode and the effect of the admission–readmission tandem on the HR-QoL could be analyzed. The same episode could be considered at the same time a readmission episode (regarding the previous episode) and an admission episode (regarding the following episode). The HR-QoL was analyzed as the RCI value in the first visit of each episode (baseline HR-QoL) as well as the RCI difference between the last and the first visit of each episode ( $\Delta$ HR-QoL). Lineal mixed regression models nested by patient and admission–readmission tandem were developed. These models consider the variability between and within subjects and pairs of episodes.<sup>16</sup>

First, bivariable models were used to analyze the effect of demographic, clinical and episode-related variables on the HR-QoL (both baseline and  $\Delta$ HR-QoL). When the baseline HR-QoL was analyzed, all independent variables included in the analysis took their values based only on the first visit of each episode (i.e. an episode would be considered to have a diagnosis of “knee osteoarthritis” if the patient received this diagnosis in the first visit of the episode). When the  $\Delta$ HR-QoL was analyzed, all independent variables included in the analysis took their value considering all visits of each episode (i.e. an episode would be considered to have a diagnosis of “knee osteoarthritis” if the patient received this diagnosis in any visit of the episode).

For diagnoses, treatments and readmission-related variables, interactions with the “admission–readmission” variable were introduced to study whether the effect of readmission on the HR-QoL was different depending on the values of those independent variables. Multivariable linear mixed regression models including sex, age and variables with a  $p$ -value < 0.10 in the bivariate analyses were carried out. The multivariate models were compared using the Akaike Information Criteria.

STATA 13 (Stata Corp) was used to perform the statistical analyses.

## Results

### *Baseline characteristics of patients*

Inclusion criteria and number of included patients and episodes can be found in Figure 1.

After applying inclusion criteria 1–3, we defined three different groups of patients: patients who

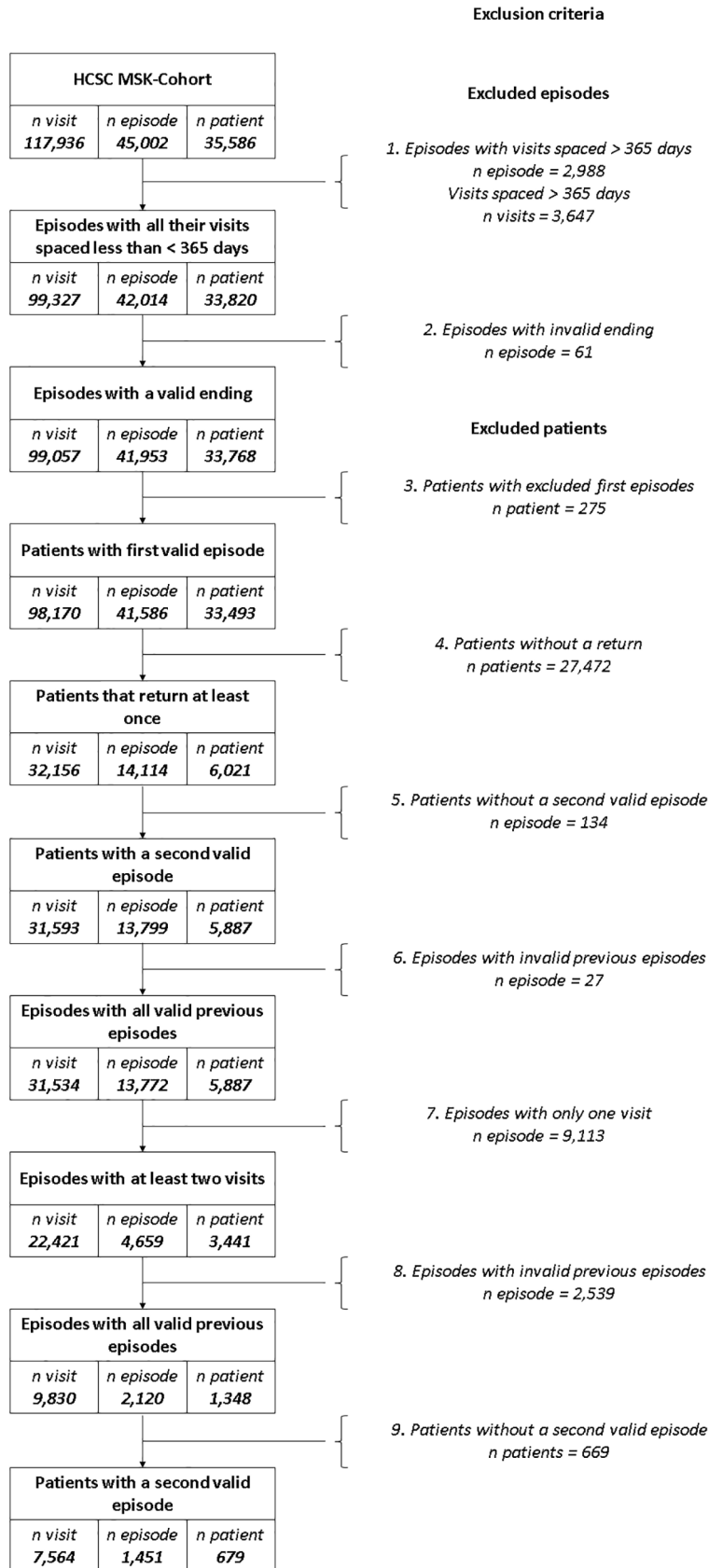
returned after a first discharge, patients who did not return after a first discharge and patients who were never discharged. Supplemental Table S1 shows their baseline demographic, clinical and HR-QoL characteristics. Those returning after a discharge were older, more likely women, had received a diagnosis of tendinitis of upper extremities or knee osteoarthritis, and had been prescribed with first-level analgesia, non-steroidal anti-inflammatory drugs, and gastric protectors. In addition, dyslipidemia and depression were also more frequent in this group, as well as being retired or doing housework as the main occupation.

### *Readmission's impact on the baseline HR-QoL*

After applying inclusion criteria 1–6 (Figure 1), 5887 patients (13,772 episodes) were eligible for studying the impact of readmission on the HR-QoL of first visit of the episode. Bivariate analyses results are shown in Supplemental Table S2. Table 1 shows the most important results of the multivariable analysis (complete results can be found in Supplemental Table S3).

Figures 2 and 3 offer a visual representation of the effects of chronic polyarthritis (which grouped the diagnoses: rheumatoid arthritis, polyarthritis, polymyalgia rheumatica, adult-onset Still's disease, and amyloidosis) and axial neuropathy (grouping the diagnoses of lumbago with sciatica, sciatica, spinal stenosis, lesion of sciatic nerve, radiculopathy, lumbar and other intervertebral disc disorders with radiculopathy, and cervicobrachial syndrome) on the baseline HR-QoL, depending on whether these diagnosis were given in neither episode, in the “admission”, in the “readmission” or in both episodes. We want to highlight that for several diagnosis, including knee osteoarthritis, crystal arthropathies, chronic polyarthritis and axial neuropathies, when the patient returns with the same diagnosis, baseline HR-QoL improves regarding that of the previous episode.

Based on this multivariable model, we estimated the marginal effect of readmission, assuming that categorical variables were balanced and that continuous variables took the mean value of the studied sample. Based on these assumptions, no significant differences were observed [coefficient:  $-0.94$  (95% confidence interval (CI):  $-2.29$  to  $0.41$ ),  $p$ -value =  $0.17$ ], meaning that after adjusting for different demographic and clinical variables, readmission had no effect on the baseline HR-QoL.



**Figure 1.** Flow chart of patients and episodes included in the study after applying inclusion criteria. HCSC-MSKC, Hospital Clínico San Carlos Musculoskeletal Cohort.

**Table 1.** Multivariable linear regression mixed model to assess the influence of diagnosis and the most important comorbidities in the health-related quality of life of the first visit of each episode, in patients attending a rheumatology outpatient clinic.

Variable	Main effect		Interaction	
	Coef. (95% CI)	<i>p</i> -value	Coef. (95% CI)*	<i>p</i> -value*
(Dx) Hip osteoarthritis				
No diagnosis	Ref.		Ref.	
In the first episode	-2.38 (-3.38 to -1.37)	3.50E-06	2.35 (1.17 to 3.52)	8.90E-05
In the second episode	-0.33 (-1.16 to 0.50)	0.43	-1.28 (-2.25 to -0.31)	0.010
In both episodes	-1.11 (-2.10 to -0.12)	0.029	0.63 (-0.43 to 1.68)	0.24
(Dx) Knee osteoarthritis				
No diagnosis	Ref.		Ref.	
In the first episode	-0.002 (-0.51 to 0.51)	1.00	-0.36 (-0.95 to 0.23)	0.23
In the second episode	0.14 (-0.27 to 0.56)	0.50	-0.44 (-0.92 to 0.05)	0.076
In both episodes	-1.10 (-1.47 to -0.72)	7.60E-09	0.56 (0.18 to 0.95)	0.004
(Dx) Hands osteoarthritis				
No diagnosis	Ref.			
In the first episode	0.52 (-0.05 to 1.08)	0.072		
In the second episode	0.45 (-0.12 to 1.02)	0.12		
In both episodes	0.60 (0.10 to 1.10)	0.018		
(Dx) Peripheral joints osteoarthritis				
No diagnosis	Ref.			
In the first episode	-0.40 (-0.84 to 0.03)	0.070		
In the second episode	-0.26 (-0.69 to 0.17)	0.24		
In both episodes	-0.49 (-0.89 to -0.08)	0.018		
(Dx) Fibromyalgia				
No diagnosis	Ref.		Ref.	
In the first episode	-2.04 (-3.54 to -0.54)	0.008	1.86 (0.11-3.62)	0.037
In the second episode	-1.16 (-2.14 to -0.19)	0.020	-1.10 (-2.20 to 0.00)	0.050
In both episodes	-1.57 (-2.48 to -0.66)	6.90E-04	-0.05 (-0.97 to 0.86)	0.91
(Dx) Gout				
No diagnosis	Ref.		Ref.	
In the first episode	0.46 (-0.78 to 1.71)	0.47	-0.99 (-2.40 to 0.43)	0.17
In the second episode	0.19 (-0.95 to 1.33)	0.74	-1.73 (-3.02 to -0.45)	0.008

*(Continued)*

**Table 1.** (Continued)

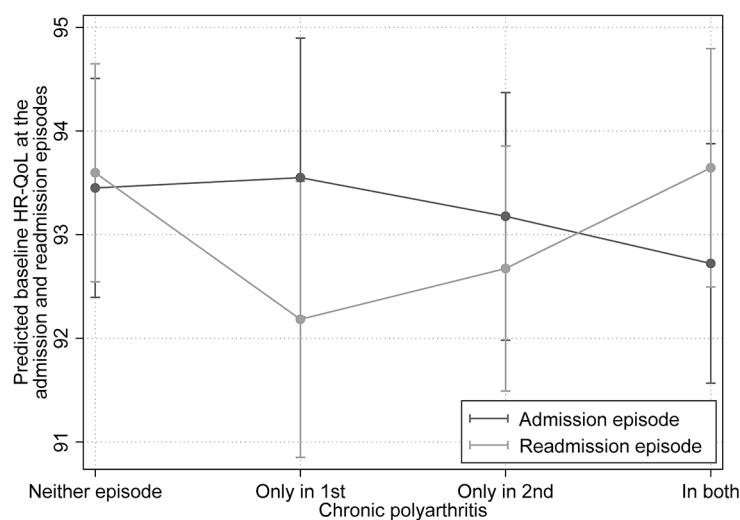
Variable	Main effect		Interaction	
	Coef. (95% CI)	<i>p</i> -value	Coef. (95% CI)*	<i>p</i> -value*
In both episodes	0.22 [-0.56 to 1.00]	0.58	-0.14 [-0.92 to 0.63]	0.72
(Dx) Crystal arthropathies				
No diagnosis	Ref.		Ref.	
In the first episode	-0.29 [-0.94 to 0.35]	0.37	0.10 [-0.65 to 0.84]	0.80
In the second episode	0.01 [-0.63 to 0.65]	0.97	-0.86 [-1.60 to -0.11]	0.024
In both episodes	-1.12 [-1.70 to -0.55]	1.20E-04	0.74 [0.15 to 1.34]	0.015
(Dx) Other non-inflammatory diseases				
No diagnosis	Ref.		Ref.	
In the first episode	-1.75 [-3.10 to -0.41]	0.010	-0.09 [-1.63 to 1.45]	0.91
In the second episode	-0.34 [-1.36 to 0.69]	0.52	-2.11 [-3.29 to -0.94]	4.00E-04
In both episodes	-1.85 [-3.16 to -0.55]	0.005	0.94 [-0.49 to 2.37]	0.20
(Dx) Chronic polyarthritis				
No diagnosis	Ref.		Ref.	
In the first episode	0.10 [-0.74 to 0.94]	0.82	-1.51 [-2.48 to -0.55]	0.002
In the second episode	-0.27 [-0.85 to 0.30]	0.35	-0.65 [-1.30 to 0.00]	0.050
In both episodes	-0.73 [-1.20 to -0.26]	0.002	0.78 [0.33 to 1.23]	7.20E-04
(Dx) Axial neuropathy				
No diagnosis	Ref.		Ref.	
In the first episode	-0.73 [-1.50 to 0.05]	0.065	0.54 [-0.36 to 1.44]	0.24
In the second episode	-0.13 [-0.78 to 0.52]	0.70	-0.74 [-1.50 to 0.02]	0.055
In both episodes	-1.75 [-2.42 to -1.08]	2.80E-07	0.80 [0.11 to 1.49]	0.023
(Dx) No diagnoses				
No diagnosis	Ref.			
In the first episode	0.39 [0.10 to 0.68]	0.009		
In the second episode	0.22 [-0.21 to 0.66]	0.32		
In both episodes	0.40 [0.01 to 0.78]	0.044		
(Dx) Osteoporosis				
No diagnosis	Ref.		Ref.	
In the first episode	1.11 [0.00 to 2.22]	0.050	-1.66 [-2.95 to -0.36]	0.012
In the second episode	-0.91 [-1.80 to -0.02]	0.044	1.73 [0.71 to 2.74]	8.50E-04

*(Continued)*

**Table 1.** (Continued)

Variable	Main effect		Interaction	
	Coef. (95% CI)	<i>p</i> -value	Coef. (95% CI)*	<i>p</i> -value*
In both episodes	0.89 (0.10 to 1.67)	0.026	-0.17 [-0.99 to 0.65]	0.69
[Dx] Tendinitis, lower extremities				
No diagnosis	Ref.		Ref.	
In the first episode	0.42 [-0.03 to 0.87]	0.065	-0.61 [-1.13 to -0.08]	0.024
In the second episode	0.26 [-0.16 to 0.69]	0.23	0.13 [-0.36 to 0.62]	0.60
In both episodes	0.21 [-0.20 to 0.61]	0.32	-0.02 [-0.44 to 0.41]	0.94
[XM] Diabetes mellitus	-0.33 [-0.63 to -0.03]	0.030		
[XM] Cerebrovascular disease	-1.07 [-1.73 to -0.41]	0.002		
[XM] Kidney failure	-1.50 [-2.21 to -0.80]	2.80E-05		

CI, confidence interval; Coef., coefficient; Dx, diagnosis variable; Ref., reference category; XM, comorbidity.

**Figure 2.** Predicted baseline health-related quality of life (HR-QoL) in the “admission” and “readmission” episodes, according to the diagnosis of chronic polyarthritis given in the first visit of those episodes.

### Readmission's impact on the $\Delta$ HR-QoL

After applying criteria 7–9, 679 patients (1451 episodes) were eligible for studying the difference in HR-QoL between the last and the first visit of each episode. Bivariable analyses results can be found in Supplemental Table S4. In Table 2, results of the multivariable analysis are shown.

As with the multivariable model from the previous subsection, some variables had a major

impact on the  $\Delta$ HR-QoL regardless of whether it corresponded to an “admission” or to a “readmission” episode (meaning that no significant interaction between that variable and readmission was observed). On the other hand, other variables showed a significant interaction, meaning that their influence in the  $\Delta$ HR-QoL was different in the admission and the readmission episodes, and *vice versa*, the influence of readmission in the  $\Delta$ HR-QoL was different depending on the diagnoses given in the “admission” and “readmission” episodes: some variables affected the  $\Delta$ HR-QoL when present in the first but not in the subsequent episode; some when present in the readmission episode, but not in the previous (such as axial neuropathy; Supplemental Figure S1). Finally, others exert their influence when given in both admission and readmission episodes (such as chronic polyarthritis). When studying the direction of the effect of the interactions, we observed that for the latter, negative interaction coefficients indicated that when the same diagnosis was given in both episodes, the  $\Delta$ HR-QoL was lower in the second episode (Figure 4).

We observed a statistically significant difference when estimating the marginal effect of readmission using the multivariable model: coefficient -1.61 (CI 95%: -3.04 to -0.18), *p*-value = 0.028. The negative coefficient indicated a lower gain in HR-QoL during follow-up compared with the previous episode. We assumed that categorical



variables were balanced and continuous variables took the mean value of the studied sample.

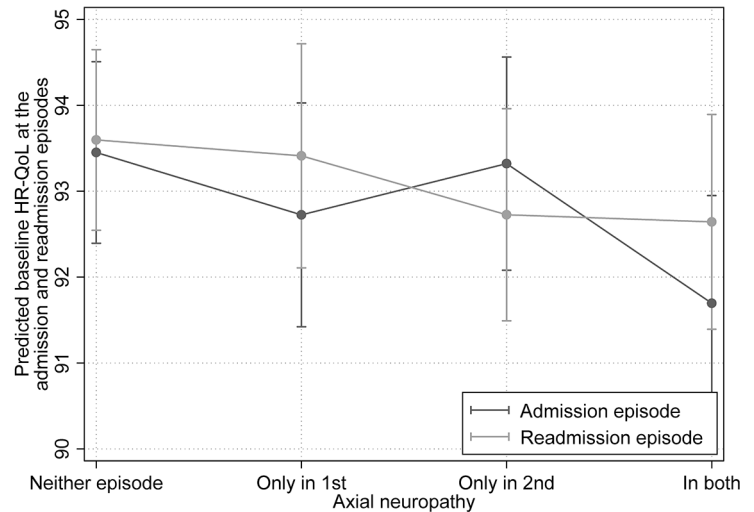
## Discussion

In the present work we analyzed the influence that outpatient readmission may have on the patients' health. To achieve this objective, we used data from a cohort of patients attending an outpatient rheumatology clinic from a tertiary care center in Madrid (Spain). Our results suggest that this process could be associated with a deleterious outcome, when measured as the evolution of the HR-QoL of the patient during readmission.

We hypothesized that if readmission influences the patients' health, it could manifest as a difference in the baseline health situation when the patient is first seen in each episode (admission *versus* readmission) and/or a difference in the evolution of the patient's health while being assisted at the outpatient clinic during each episode.

In the first case, we would expect a lower HR-QoL assessed in the first visit of the readmission episode compared with the previous episode. The results from our study do not support this hypothesis, as the marginal effect of readmission on the baseline HR-QoL is not significant, even after adjusting by several variables influencing this outcome. We did observe that when particular diagnoses were given, baseline HR-QoL was different in the admission and remission episodes. We want to bring attention to the situation when the patients returned with the same condition that motivated the first admission. In these cases, the baseline HR-QoL was better in the readmission episode, which could be related to a milder relapse of the disease or that the intervention carried out in the previous episode has empowered the patient, providing them with tools (such as education and self-care) to alleviate part of the negative consequences of a new episode of the disease.

In the second case, we would expect that the HR-QoL gained during the readmission episode would be smaller compared with the one gained during the previous episode. The results from our study do support this hypothesis, showing a statistically significant marginal effect of readmission in the  $\Delta$ HR-QoL, even after adjusting by several demographic and clinical variables. These results suggest that repeated episodes of the same condition could be associated with a lower improvement



**Figure 3.** Predicted baseline health-related quality of life (HR-QoL) in the “admission” and “readmission” episodes, according to the diagnosis of axial neuropathy given in the first visit of those episodes.

capability, which would translate into a lower HR-QoL gain during the patient's care.

As pointed out, in addition to analyzing the role of readmission, the impact of numerous variables on the baseline and  $\Delta$ HR-QoL was also analyzed. Several have shown a similar influence in the HR-QoL regardless of the episode (admission or readmission), while others have shown a significantly different effect depending on the episode. Regarding the effect of musculoskeletal diseases on quality of life, our findings are in line with the described deleterious effect.<sup>17</sup>

Few studies have analyzed the negative consequences of readmission in an outpatient setting. In the inpatient setting, most of the research is centered on estimating the readmission ratio and identifying factors associated with the readmission risk.<sup>18</sup> The studies aimed at identifying factors associated with a worse prognosis during readmission are scarce and have been mainly focused on the analysis of the impact of being readmitted in a different center from the one in which the patient was originally admitted.

## Limitations

The limitations of this study include:

1. Its retrospective design: patients' data that were already stored in our EHR was used and, therefore, it is likely that not all risk factors

**Table 2.** Multivariable linear regression mixed model to assess the influence of demographic, diagnoses, medication and comorbidities-related variables in the difference in health-related quality of life between the last and the first visit of an episode, in patients attending a rheumatology outpatient clinic.

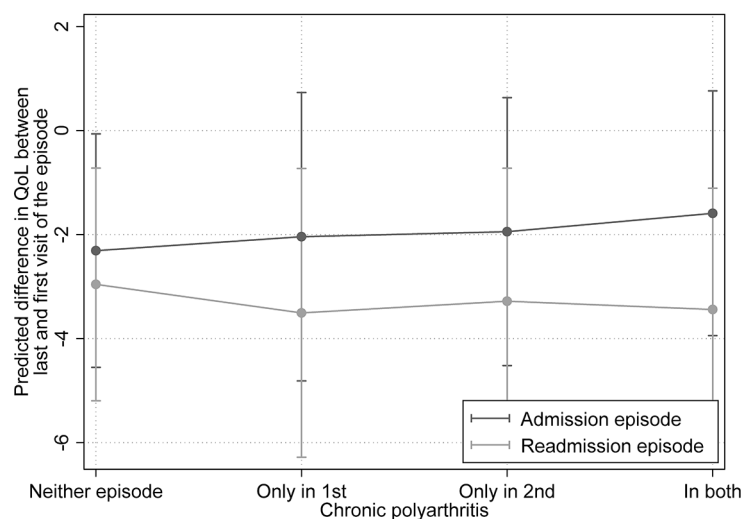
Variable	Main effect		Interaction	
	Coef. (95% CI)	p-value	Coef. (95% CI)*	p-value
(DM) Women	-0.11 (-0.60 to 0.38)	0.66		
(DM) Age at first visit at the clinic	0.01 (-0.01 to 0.02)	0.25		
Readmission episode	-0.65 (-1.48 to 0.18)	0.12		
Admission-readmission pair				
First	Ref.			
Second	-0.75 (-1.38 to -0.11)	0.021		
≥3rd	-2.25 (-3.89 to -0.62)	0.007		
Time for previous discharge				
0-2 months	Ref.		Ref.	
2-12 months	0.35 (-0.32 to 1.03)	0.3	-0.01 (-0.86 to 0.84)	0.98
>12 months	0.04 (-0.71 to 0.79)	0.92	0.83 (-0.12 to 1.78)	0.086
HR-QoL at the first visit of the episode	-0.52 (-0.56 to -0.48)	2.00E-150		
(T) Colchicine				
No diagnosis	Ref.			
In the first episode	0.08 (-1.64 to 1.80)	0.93		
In the second episode	-0.59 (-1.90 to 0.71)	0.37		
In both episodes	1.50 (0.42 to 2.58)	0.007		
(T) Other osteoporotics				
No diagnosis	Ref.			
In the first episode	-0.66 (-2.41 to 1.09)	0.46		
In the second episode	-1.09 (-2.06 to -0.12)	0.027		
In both episodes	-1.22 (-2.09 to -0.34)	0.006		
(XM) Articular prosthesis	-2.23 (-3.13 to -1.32)	1.40E-06		
(XM) Biphosphonates	-1.96 (-3.20 to -0.72)	0.002		
(Dx) Chronic polyarthritis				
No diagnosis	Ref.		Ref.	
In the first episode	0.27 (-1.40 to 1.94)	0.75	-0.81 (-2.92 to 1.29)	0.45
In the second episode	0.36 (-0.91 to 1.64)	0.58	-0.69 (-2.31 to 0.93)	0.41
In both episodes	0.72 (-0.11 to 1.55)	0.09	-1.20 (-2.22 to -0.18)	0.022
(T) NSAIDs				
No diagnosis	Ref.		Ref.	

(Continued)

**Table 2.** (Continued)

Variable	Main effect		Interaction	
	Coef. (95% CI)	<i>p</i> -value	Coef. (95% CI)*	<i>p</i> -value
In the first episode	-0.65 [-1.53 to 0.23]	0.15	0.34 [-0.77 to 1.45]	0.55
In the second episode	-0.07 [-0.93 to 0.78]	0.87	0.67 [-0.40 to 1.74]	0.22
In both episodes	-0.50 [-1.16 to 0.17]	0.14	1.03 [0.23 to 1.82]	0.012
(T) Analgesic second and third level				
No diagnosis	Ref.		Ref.	
In the first episode	-0.68 [-2.09 to 0.73]	0.35	0.91 [-0.85 to 2.67]	0.31
In the second episode	0.36 [-0.51 to 1.23]	0.42	-0.54 [-1.65 to 0.57]	0.34
In both episodes	-0.12 [-1.03 to 0.80]	0.8	-2.01 [-3.14 to -0.87]	5.20E-04
(T) Other drugs				
No diagnosis	Ref.		Ref.	
In the first episode	2.32 [0.87 to 3.77]	0.002	-2.04 [-3.87 to -0.21]	0.029
In the second episode	0.05 [-0.92 to 1.01]	0.93	-0.35 [-1.56 to 0.87]	0.58
In both episodes	-0.34 [-1.56 to 0.87]	0.58	-1.64 [-3.17 to -0.10]	0.036
(Dx) Axial neuropathy				
No diagnosis	Ref.		Ref.	
In the first episode	0.16 [-1.90 to 2.22]	0.88	0.11 [-2.52 to 2.74]	0.93
In the second episode	-0.99 [-2.42 to 0.43]	0.17	1.94 [0.13 to 3.75]	0.036
In both episodes	0.65 [-1.02 to 2.31]	0.45	-1.91 [-4.00 to 0.18]	0.073
(Dx) Tendinitis				
No diagnosis	Ref.		Ref.	
In the first episode	-0.02 [-1.55 to 1.52]	0.98	1.84 [-0.11 to 3.78]	0.065
In the second episode	0.21 [-1.33 to 1.75]	0.79	-0.46 [-2.42 to 1.50]	0.64
In both episodes	0.41 [-0.98 to 1.80]	0.57	-0.13 [-1.88 to 1.62]	0.89
(XM) Biliary diseases	1.05 [0.11 to 1.99]	0.029		
(XM) Other colon diseases	1.06 [-0.04 to 2.17]	0.06		
(XM) Angiotensin-converting-enzyme inhibitor	-1.02 [-1.74 to -0.30]	0.005		
(XM) Other ovary diseases	2.71 [0.89 to 4.54]	0.004		
(XM) Other virus infection	-2.17 [-3.32 to -1.01]	2.50E-04		
(XM) Peripheral venous insufficiency	2.01 [0.72 to 3.30]	0.002		
(XM) Cerebrovascular disease	-3.90 [-5.57 to -2.23]	4.90E-06		
(XM) Thyroid others	-2.41 [-4.07 to -0.75]	0.004		
(XM) Thyroidectomy	2.62 [0.81 to 4.43]	0.005		

CI, confidence interval; Coef., coefficient; DM, demographic variable; Dx, diagnosis variable; HR-QoL, health-related quality of life; NSAID, non-steroidal anti-inflammatory drug; Ref., reference category; T, treatment variable; XM, comorbidity.



**Figure 4.** Predicted difference in the health-related quality of life (HR-QoL) between the last and the first visit of “admission” and “readmission” episodes, according to the diagnosis of chronic polyarthritis given in those episodes.

have been identified and collected. Furthermore, codification errors could exist, since the data were gathered in routine clinical practice with a high workload. To overcome this limitation, we have used only patients with high integrity and consistency data.

- Due to prolonged patients’ inclusion time, different physicians have participated in the patient care, which could have influenced the measurement of risk factors and main outcomes, making them less accurate and consistent than with a shorter inclusion period or with a prospective study design.
- Despite analyzing the main risk factors that could have influenced the patients’ HR-QoL during the follow-up at the outpatient clinic, we do not have any data from the periods between episodes. Therefore, it is not possible to identify and analyze factors external to the clinic that could have affected the HR-QoL.
- Only patients from a rheumatology outpatient clinic were included. To demonstrate the deleterious effect of readmissions, it will be necessary to analyze its effects in other specialties. In addition, this study was carried out in a single tertiary hospital of the Madrid Region that covers only a concrete health area. To obtain robust data that can be extrapolated to other populations, the study should be extended to other centers in other locations.

- Finally, additional research on the factors that affect the HR-QoL of patients that are readmitted should be carried out to measure their impact on the HR-QoL of patients who did not return after discharge or who were never discharged. This analysis would be motivated due to the different distribution of several musculoskeletal diseases and comorbidities among these three groups of patients. Also, repeating this study with other HR-QoL scales would be reasonable, since assessing the HR-QoL of a patient with only one index could vastly simplify the measurements obtained regarding their health status.<sup>17</sup>

Several of these limitations could be overcome with a prospective design, which would allow us to validate the results from this study, to assess those variables that could not be analyzed or diminish the risk of coding errors.

### Conclusions

Two main conclusions can be extracted from our work: first, in a rheumatology setting, baseline HR-QoL seemed to improve when the patient returned with the same diagnosis, at least for particular conditions. On the other hand, outpatient readmission was associated with a lower gain in HR-QoL, even after adjusting by several demographic and clinical variables. Our work provides the first evidences of a deleterious impact of this process on the patient’s health, when measured as how the HR-QoL evolved during follow-up. If further evidences support our claim, outpatient readmission could become an indicator of the quality of care in outpatients, as well as an outcome to identify and prevent, which in turn would increase the value of the care provided by the Healthcare system.

### Author contributions

LRR and LAA conceived and designed the study. JFU, LLM, EP, JAJ and BFG collected data. AMG, IMF and LRR performed the data analysis and interpreted the data. All of the authors were involved in the drafting and/or revising of the manuscript; all authors gave the final approval of the version to be published and have participated sufficiently in the work to take public responsibility for appropriate portions of the content.

### Conflict of interest statement

The authors declare that there is no conflict of interest.

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## Data availability statement

Data are available upon reasonable request.

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## Supplemental material

Supplemental material for this article is available online.

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