

Patient-Reported Outcomes Following Inpatient Multimodal Treatment Approach in Chronic Pain-Related Rheumatic Diseases

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Abstract

Introduction: Musculoskeletal disorders may cause chronic pain, which is associated with deterioration in physical well-being, functions, and quality of life. There are worldwide shortfalls in the care that is provided to the affected patients. Holistic, interdisciplinary care is rare. Monomodal therapeutic approaches dominate when health-care resources are scarce. In this study, we test the patient-relevant outcomes of multimodal treatment for rheumatic diseases that are associated with pain and check for remuneration.

Methods: We performed a retrospective data analysis of an inpatient multimodal treatment. The target parameter was the patient perspective, which we assessed by means of Patient-Reported Outcomes (PRO). We applied the Visual Analogue Scale (mental and physical condition), the Heidelberg Short Early Risk Assessment Questionnaire, the Pain Disability Index, and the pain grading according to Kohlmann/Raspe (N = 375 patients). We also investigated compensation for inpatient treatments with and without multimodal treatments. Moreover, we compared Diagnosis-Related Group remuneration with and without complex treatment.

Results: After implementing a multimodal treatment, improved mental (mood) status was significantly better (Wilcoxon signed-rank test, $P < .001$), despite high levels of pain (Kohlmann/Raspe) reported on admission. Apart from the underlying rheumatic disease, 111 patients also reported chronic back pain, which was improved following the treatment (t test, $P < .001$). Subjective impairments associated with pain were significantly lower at the end of the hospital stay (Wilcoxon signed-rank test, $P < .001$). Compensation for inpatient treatments with multimodal treatments increased noticeably in German hospitals in 2016 to 2019, while remunerations for monomodal treatments show mixed results.

Conclusion: PROs regarding mood, pain, and perceived impairments improved following the multimodal complex treatment. Compensation of hospitals should take into account additional performance requirements of holistic treatments, whereby the promotion and further studies of PROs are recommended.

Keywords

pain, patient satisfaction, holistic care, health policy, multimodal, patient-reported outcome

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Background

Chronic pain is a multidimensional problem worldwide. Pain impairs the quality of life of the affected patients who are then looking for treatments to alleviate their symptoms. Hospitals, outpatient care providers, and the pharmaceutical industry seek to develop therapies, while cost bearers aim to save costs and reduce treatment offers. Often, health policy makers create inflexible compensation systems that offer little performance incentive

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to providers. At the same time, due to pressure from cost bearers, policy makers create barriers to innovative treatment concepts.

In Germany, the care of patients with complex chronic pain disorders has been inadequate for many years, both in outpatient and inpatient settings.¹ Surgical interventions also dominate the international health-care services, though multimodal conservative treatments have yielded good results.² A study on the care situation of pain patients in 15 European countries draws attention to patient dissatisfaction with regular monomodal treatments.³ The number of people with chronic pain is constantly rising and, given the current state of affairs, the condition is likely to affect well over 23 million people in Germany alone.⁴ Considering this number together with the discussion of effectiveness of multimodal treatments, an evaluation of these is required. This study aims to help close this research gap by analyzing patient-reported outcomes (PROs) of multimodal conservative treatments for rheumatic diagnoses.

Rheumatic diseases are of particular importance due to their increasing prevalence.⁵ The number of people affected by osteoporosis in the European Union is estimated at 22 million women and 5.5 million men.⁶ According to the German Society for Rheumatology, approximately 1.5 million people in Germany suffer from inflammatory rheumatic diseases, and 3.5% of the population suffers from fibromyalgia (chronic musculoskeletal pain over the entire body).⁷ More than 200 rheumatic and musculoskeletal disorders have been classified so far,⁸ which often occur in a combined fashion or together with other (chronic) illnesses, calling for targeted and comprehensive treatments. What is required is holistic and patient-centered care,⁹ which is geared toward the individual and his or her complaints.¹⁰ In addition to effectively treating the ailments, this can contribute to increasing patient satisfaction.¹¹ Health policy makers should, therefore, aim to develop adequate care concepts that take full account of the needs of pain patients and also financially cover the necessary resources for service providers.

Multimodal treatments, aimed at effective and efficient care for patients with acutely exacerbated chronic pain, are among the range of available options¹² and are also reported to increase patient satisfaction.¹¹ Four medical conditions that are treated with multimodal complex treatment are presented below. They were selected because they are associated with pain, impaired physical functions, and worsening quality of life, a combination that covers all aspects requiring complex treatment.

Medical Conditions Associated With Pain

Rheumatoid Arthritis

Rheumatoid arthritis (RA) can be diagnosed based on the presence of a swollen joint, if other potential causes

have been ruled out. The type and number of painful and/or swollen joints also play a role. To establish a diagnosis, specific laboratory tests (rheumatoid factor, anti citrullinated protein antibodies [ACPA], and C-reactive protein [CRP]) are also performed, and the duration of symptoms is taken into account.¹³ RA is often accompanied by depression and anxiety,^{14,15} especially in cases of persistent pain, impaired physical functions, and inadequate treatment results. Treating depression in patients with RA should, therefore, also be considered in the context of a multimodal treatment.¹⁶

Polymyalgia Rheumatica

Polymyalgia rheumatic (PMR) is an inflammatory rheumatic disease that affects primarily the elderly.¹⁷ Several diagnostic criteria have been developed over the years^{18,19} with particular reference to the presence of shoulder pain, neck pain, or pain in the pelvic girdle.²⁰ Joints in hands, knees, shoulders, or hips are often inflamed. General symptoms such as fever, loss of appetite, weakness, and/or weight loss may also be present.²¹ Laboratory tests often detect elevated CRP values.²² PMR may also cause fatigue, stiffness, fever, and weight loss.²³

Ankylosing Spondylitis

Ankylosing spondylitis (AS) is an inflammatory disease of the spine and involves inflammation of tendon insertion sites.²⁴ In advanced stages, the spine becomes rigid, causing loss of mobility. Joints become inflamed. The eyes, kidneys, heart, and lungs are also frequently affected. Many patients diagnosed with AS suffer from severe functional impairments, cardiovascular diseases, diarrhea²⁵, depression, and anxiety, which have a lasting impact on their quality of life.²⁶

The New York diagnostic criteria can be used to establish a diagnosis for investigational studies.^{27,28} The related clinical criteria are as follows: severe back pain and stiffness, which can be relieved by exercise, for over 3 months. AS can also be associated with limitation of lumbar spine motion in sagittal and frontal planes and decreased chest expansion. Grades 2 to 4 bilateral sacroiliitis or Grades 3 to 4 unilateral sacroiliitis can be used as radiographic criteria. A definite diagnosis of AS is established if all clinical criteria or 1 clinical criterion with 1 radiographic criterion are met.²⁸

Apart from pharmacological treatment,²⁹ physiotherapy and exercise programs^{30–32} have proven to be of great benefit in the treatment of AS.

Fibromyalgia

Fibromyalgia (FM) can be diagnosed using the classification criteria of the American College of Rheumatology 1990.³³ It is defined as chronic pain in multiple body regions and tenderness to pressure of at least 11/18 tender points.

Patients report pain in the axial skeleton, the right and left sides of the body, and above and below the waist, lasting for at least 3 months. FM presents with a large number of accompanying symptoms: headaches, irritable bowel syndrome, cognitive dysfunction, depression, and other impairments are common.³⁴ The origin and etiology of FM are still largely unexplained; however, genetic predispositions are thought to play a role.³⁵ It often takes a long time to diagnose the disease. Many patients do not receive adequate treatment³⁶ and may use multiple medicines (polypharmacy).³⁷ Scientific studies and guidelines focus on the evidence for specific therapeutic procedures, while therapeutic effects of several therapies used simultaneously in a close temporal context have not been adequately examined so far, even though they may bring positive outcomes.³⁸

Multimodal Treatment Concepts

Rheumatic diseases are often associated with a large number of comorbidities,^{39,40} which are not always treated alongside the main disease.⁴¹ These comorbidities may vary widely and include gastrointestinal problems, headaches, cardiovascular diseases, depression, or other diseases of the musculoskeletal system, and so on.^{42–45} Many multimodal treatment programs described in the literature consist of successive therapeutic interventions.⁴⁶ However, there are structural requirements for providing a multidisciplinary team comprising various specialists, specialized therapists, and nurses. Moreover, multimodal treatments should consist of therapy procedures that are frequent, performed in a close temporal context, and covering complex disorders.⁴⁷

Physiotherapeutic measures are important in the treatment of rheumatic diseases. They serve to address the increasing weakness and functional limitations. In multimodal treatment programs, physical therapy should be used in series and in combination. This is to ensure that stimulus-response regulation therapy can influence pain and dysfunction, and that physiological adaptation mechanisms are activated.⁴⁸ Active movement therapy is significant in this context.⁴⁹ For example, physiotherapy at close intervals may help address the progression of damage to the musculoskeletal system and functional impairment. Integrating psychotherapeutic measures into multimodal concepts is also recommended.⁵⁰ Heat therapy, which has been known

for millennia, is increasingly being integrated into multimodal treatment concepts for rheumatic diseases. Its integration has been a success.⁵¹ In addition, multimodal treatment programs that include guideline-based pharmacotherapy promise good therapeutic results for rheumatic diseases.⁵²

Multimodal Complex Treatments in the German Health-Care System

These treatments were developed in order to offer complex and specialist inpatient treatments, which are provided under the “German Diagnosis-Related Groups System” (G-DRG) to chronically ill patients with acute exacerbation of the disease. As a rule, an interdisciplinary team provides a number of patient-oriented therapeutic procedures in a close temporal context, based on interdisciplinary assessments discussed in team meetings. Within the German health-care system, multimodal inpatient treatments are specified in the German procedure classification (Operationen- und Prozedurenschlüssel or Operations- and Procedures-Classifications, translation by the authors [OPS]), an adaptation of the International Classification of Procedures in Medicine (ICPM) of the World Health Organization. The German version of the ICPM is based on a translation of the extended Dutch version ICPM-DE (Dutch extension). Two officially classified multimodal complex treatments, which can be offered in specialized clinics in Germany, are presented below.

Multimodal Nonoperative Complex Treatment of the Movement System

The focus of this complex treatment is an interdisciplinary diagnosis and treatment of complex (multifactorial) diseases of the movement system. A minimum treatment time of 12 days is required, and 5 diagnostic procedures must be used. These can be chosen from the following: neuro-orthopedic structural diagnostics, manual medical functional diagnostics, pain diagnostics and apparatus diagnostics under functional pathological aspects (eg, X-ray, posturography, magnetic resonance imaging, computed tomography [CT], video-based motion analysis, computer-aided motion or force measurement, optometry), and psychodiagnostics. Three of the following methods must be used as therapy methods: manual medicine, reflex therapy, infiltration therapy/interventional pain therapy, psychotherapy. Furthermore, at least 3 procedures from the therapeutic areas of manual therapy and physiotherapy based on neurophysiology, medical training therapy of physical therapy and relaxation procedures are to be integrated.

In total, a therapy density of at least 30 active and passive individual services from the 2 service groups

must be guaranteed, and a therapeutic assessment with interdisciplinary team discussion must take place.

Multimodal Rheumatological Complex Therapy

The team is led by a specialist in internal medicine with a focus on rheumatology, a specialist in orthopedics and trauma surgery with additional training in orthopedic rheumatology, or a specialist in orthopedics with a focus on rheumatology.

Of the therapy areas mentioned below, physiotherapy/physical therapy, occupational therapy, pain therapy, cognitive behavior therapy, and conversation psychotherapy, 3 areas must be applied. The complex treatment is patient-related in different combinations with a therapy density of at least 11 hours per week.

Process-oriented treatment management with standardized findings is to be ensured and disease activity, functional restrictions, and the extent of pain assessed at the beginning and at the end of the inpatient stay. The immediate start of pain therapy, physiotherapy, or physical therapy must be guaranteed

Methods

A retrospective data analysis (N = 375) examines patient-relevant outcomes of multimodal treatment for rheumatic diseases that are associated with pain. To receive this treatment, the main diagnose has to be part of the Major Diagnostic Category (MDC) 8, which covers diseases of the musculoskeletal system and connective tissues.

In order to create a homogenous sample, only patients with a similar degree of chronification (assessed based on patient career, medication and duration of pain) and the following diagnoses were chosen, which all belong to MDC 8: FM, PMR, Morbus Bechterew, RA. The diagnoses of the patients included in the sample were assessed before and at admission, thus confirmed by several specialists, including rheumatologists. Each diagnosis is encoded using the International Statistical Classification of Diseases and Related Health Problems, 10th revision, German modification. This is the official classification for encoding diagnoses in outpatient and inpatient care in Germany.

All patients gave written consent regarding data analysis and could resign from being part of the study at any time. For ethical reasons, no sociodemographic data were asked for. The analysis uses PROs (scales listed below) taken at admission and discharge and is done with SPSS Statistics 25.0 (IBM, 2017). *T* tests are used for paired samples wherever there is a normal distribution. For nonnormally distributed data, the Wilcoxon test is used to check whether there are significant differences between the 2 measurements. The application for

the implementation of the empirical research project was approved by the Research Committee for Scientific Ethical Questions on July 02, 2019, under the reference number 2528. The following scales and scores were used for the project:

Visual Analogue Scale

The Visual Analogue Scale (VAS) is a 1-dimensional measurement tool. It can be used to measure not only pain intensity but also sleep quality and well-being of patients.^{53–55} It consists of a 100-mm horizontal line on which the patients mark their pain intensity⁵⁶ with “0” for no pain up to “100” for unbearable pain.

The VAS is in widespread use globally and can be used for patients with rheumatic diseases.⁵⁷ The instrument fulfills the quality criteria regarding validity, reproducibility, reliability, construct validity, and interpretability^{58,59} plus is very quick and easy to use.⁵⁷

Pain Disability Index

The Pain Disability Index (PDI) has been used extensively for many years to assess impairments experienced by patients due to pain. It is suitable for use in various pain-related chronic diseases.⁶⁰ The instrument is a pain-specific assessment catalogue of 7 items covering the following areas: Family/Home Responsibilities, Recreation, Social Activity, Occupation, Sexual Behavior, Self Care, and Life Support Activities. As a generic instrument, it meets all criteria of validity and reliability.^{61,62}

Pain Grading According to Kohlmann/Raspe

This instrument is based on the patient’s pain assessment via VAS and the Hanover Functional Questionnaire (FFbH), making it a multidimensional instrument. The FFbH is used to identify impairments when performing everyday activities and consists of 18 questions.⁶³ The result is reported on a scale between 0% and 100%. The FFbH is reliable, valid, and sensitive to change. It was shown to be a viable and economical instrument in clinical and epidemiological studies.⁶⁴ The VAS measuring subjective pain validly and reliably⁶⁵ has been described above. Combining both values allows calculating the pain grade. Grade 3 stands for high pain intensity and significantly limited physical functions. Grade 1 indicates low pain intensity and adequate physical functions (Figure 1).

Heidelberg Short Early Risk Assessment Questionnaire

The validated questionnaire is used for predicting the risk of transition from acute to chronic back pain.⁶⁶ It

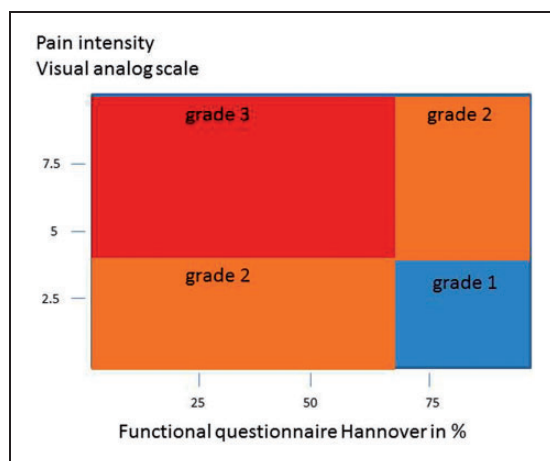


Figure 1. Pain-Grading According to Kohlmann/Raspe.

consists of 10 core questions with 27 items and covers duration and intensity of pain.

Compensation for Providing Inpatient Care

The German health-care system uses Diagnosis-Related Groups (DRG). These are diagnosis-related flat rates per case paid by health insurance funds for inpatient treatment. DRGs are based on a classification of diagnoses to ensure that similar diseases receive comparable high-standard treatment from a medical point of view, resulting in equal cost. The categorization also takes into account secondary diagnoses, age, and type of discharge from the hospital, as well as other aspects. Every DRG has cost weights, also called relative cost weights, which are used for calculating a price, which ideally is covered by the insurances' flat rate. Since it is a case-based system, all operating costs for inpatient treatment need to be financed with the revenue that is generated by the DRG(s) treated. This includes all salaries, medicinal products, pharmaceuticals, and the costs of the entire medical and nonmedical infrastructure.¹¹ This scientific investigation analyses the average hospital compensation, with and without complex treatment, for the medical conditions mentioned above, and the developments.

Results

Pain Disability Index

PDI shows a reduction in pain (median on admission = 43.00) on discharge (median = 33.30, asymptotic Wilcoxon test: $z = -10.854$, $P < .001$, $n = 371$) (Table 1). The effect size is $r = .56$ and corresponds to a strong effect.

On admission, there was a deviation from the normal distribution (negative skew). With regard to the severity level, there is, in general, a shift to the left, which

Table 1. PDI Admission and Discharge.

| | PDI Admission | PDI Discharge |
|---------|---------------|---------------|
| N | | |
| Valid | 371 | 371 |
| Missing | 4 | 4 |
| M | 42.314 | 34.280 |
| Median | 43.000 | 33.300 |
| SD | 13.1646 | 13.9700 |
| Minimum | 3.0 | .0 |
| Maximum | 68.5 | 70.0 |

| | | N | Middle rank | Rank sum |
|---------------------------------|----------------|------------------|-------------|----------|
| PDI admission– PDI discharge | Negative ranks | 284 ^a | 197.58 | 56113.00 |
| | Positive ranks | 84 ^b | 140.27 | 11783.00 |
| | Bonds | 3 ^c | | |
| | Total | 371 | | |

Abbreviations: SD, standard deviation; PDI, Pain Disability Index.

^aPDI discharge < PDI admission.

^bPDI discharge > PDI admission.

^cPDI discharge = PDI admission.

indicates improvement in the impairments that are associated with pain (Figure 2).

VAS Well-Being

The VAS data “well-being” was assessed comprehensively on admission and on discharge. There was a deviation from the normal distribution when VAS assessments were performed (Figure 3). Both show a shift to the left, which suggests a general improvement in the well-being of patients.

According to the Wilcoxon test, the negative ranks clearly outweigh the positive ones. This means that the VAS values went down. The central tendencies of the 2 times of measurement “VAS well-being” differ (asymptotic Wilcoxon test: $z = -14.794$, $P < .001$, $n = 375$). The effect size is $r = .76$ and corresponds to a very strong effect (Table 2).

Pain-Grading According to Kohlmann/Raspe

The central tendencies of the measurement on admission and upon discharge differ (asymptotic Wilcoxon test: $z = -6.600$, $P < .001$, $n = 374$) (Table 3). The effect size is $r = .34$ and corresponds to a low effect.

Heidelberg Short Early Risk Assessment Questionnaire

There is a shift to the left, that is, the values decreased, indicating improvement in back pain. The average Heidelberg Short Early Risk Assessment Questionnaire

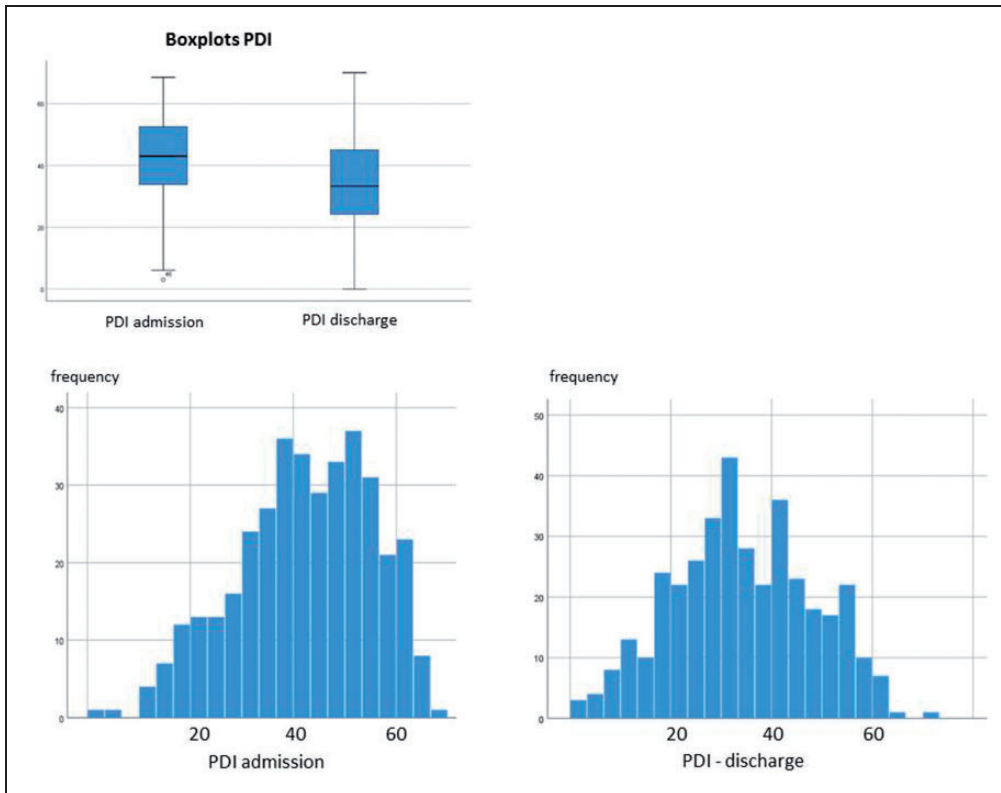


Figure 2. PDI. PDI, Pain Disability Index.

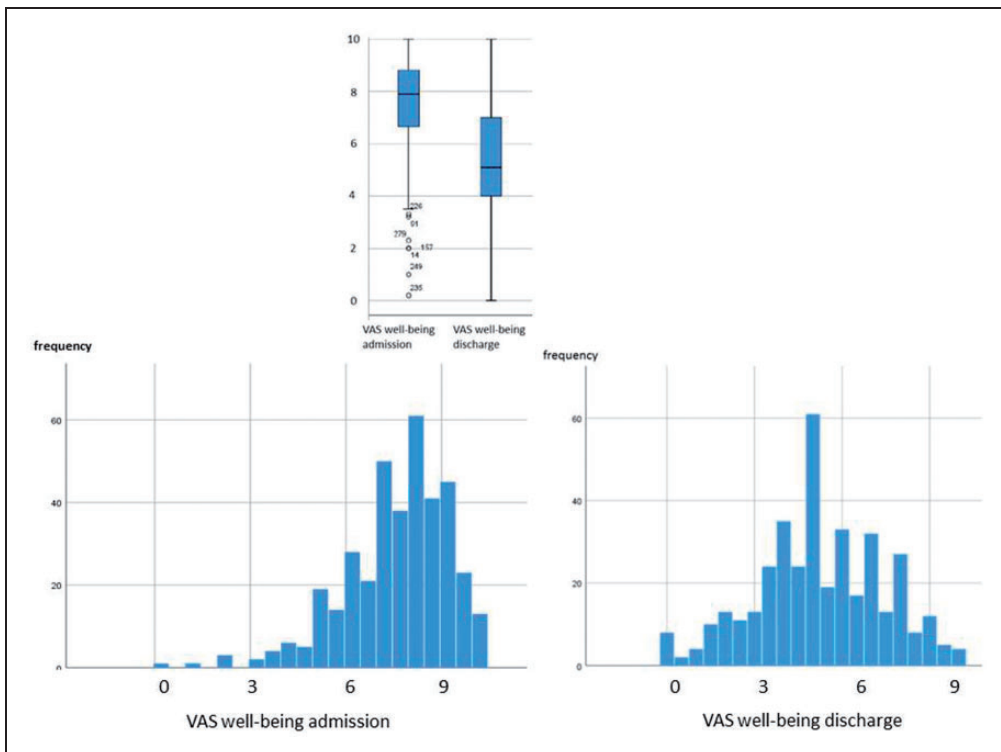


Figure 3. VAS Well-Being. VAS, Visual Analogue Scale.

Table 2. VAS Well-Being Admission and Discharge.

| Ränge | | N | Middle Rank | Rank Sum |
|---------------------------|----------------|------------------|-------------|----------|
| VAS well-being discharge— | Negative ranks | 322 ^a | 198.29 | 63849.00 |
| VAS well-being admission | Positive ranks | 45 ^b | 81.76 | 3679.00 |
| | Bonds | 8 ^c | | |
| | Total | 375 | | |

Abbreviation: VAS, Visual Analogue Scale.

^aVAS well-being discharge < VAS well-being admission.

^bVAS well-being discharge > VAS well-being admission.

^cVAS well-being discharge = VAS well-being admission.

Table 3. Pain-Grading According to Kohlmann/Raspe.

| | Kohlmann/Raspe Admission | Kohlmann/Raspe Discharge |
|---------|--------------------------|--------------------------|
| N | | |
| Valid | 374 | 375 |
| Missing | 1 | 0 |
| M | 2.83 | 2.66 |
| Median | 3.00 | 3.00 |
| SD | .418 | .528 |
| Minimum | 1 | 1 |
| Maximum | 3 | 3 |

| | | N | Middle rank | Rank sum |
|---------------------------|----------------|------------------|-------------|----------|
| Kohlmann/Raspe discharge— | Negative ranks | 75 ^a | 44.67 | 3350.50 |
| Kohlmann/Raspe admission | Positive ranks | 13 ^b | 43.50 | 565.50 |
| | Bonds | 286 ^c | | |
| | Total | 374 | | |

Abbreviation: SD, standard deviation.

^aKohlmann/Raspe discharge < Kohlmann/Raspe admission.

^bKohlmann/Raspe discharge > Kohlmann/Raspe admission.

^cKohlmann/Raspe discharge = Kohlmann/Raspe admission.

Table 4. HKF-R.

| | M | N | SD | Standard Error of M |
|--------------------|--------|-----|---------|---------------------|
| HKF R-10 admission | 83.792 | 111 | 27.0945 | 2.5717 |
| HKF-R discharge | 69.391 | 111 | 25.2952 | 2.4009 |

| Paired differences | | | | | | | | |
|--|---------|---------------------|--------|---|---------|-------|-----|----------------|
| | | | | 95% confidence interval of the difference | | T | df | Sig. (2-sided) |
| M | SD | Standard error of M | lower | upper | | | | |
| HKF R-10 admission— HKF-R discharge | 14.4009 | 23.4129 | 2.2223 | 9.9969 | 18.8049 | 6.480 | 110 | .000 |

Abbreviations: SD, standard deviation; HKF R, Heidelberg Short Early Risk Assessment Questionnaire.

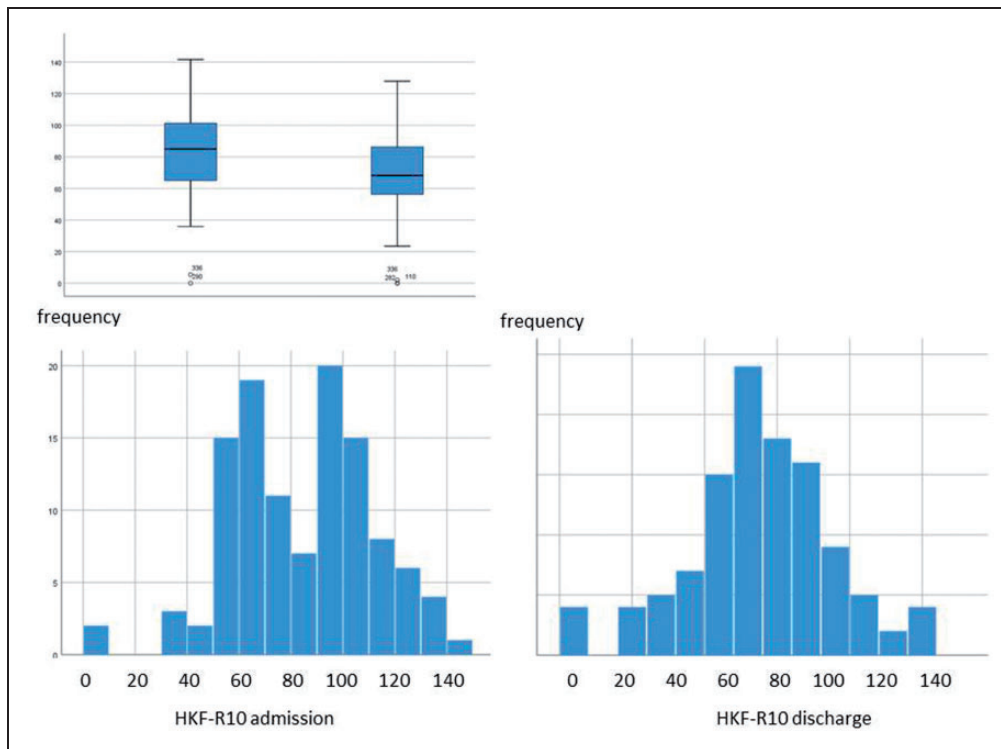


Figure 4. HKF-R10 Admission. HKF-R10, Heidelberg Short Early Risk Assessment Questionnaire.

Table 5. Remuneration Aspects of Fibromyalgia, Polymyalgia Rheumatic, Ankylosing Spondylitis and Rheumatoid Arthritis Versus Complex Treatment.

| Disease | Year | Conventional Treatment | Complex Treatment |
|------------------------|------|------------------------|-------------------|
| Fibromyalgia | 2019 | 3350 | 5364 |
| Fibromyalgia | 2018 | 3081 | 5275 |
| Fibromyalgia | 2017 | 3148 | 5123 |
| Fibromyalgia | 2016 | 3152 | 5010 |
| Polymyalgia rheumatic | 2019 | 2445 | 5364 |
| Polymyalgia rheumatic | 2018 | 2523 | 5275 |
| Polymyalgia rheumatic | 2017 | 2632 | 5123 |
| Polymyalgia rheumatic | 2016 | 2774 | 5010 |
| Ankylosing spondylitis | 2019 | 2445 | 5364 |
| Ankylosing spondylitis | 2018 | 2523 | 5275 |
| Ankylosing spondylitis | 2017 | 2632 | 5123 |
| Ankylosing spondylitis | 2016 | 2774 | 5010 |
| Rheumatoid arthritis | 2019 | 2594 | 5364 |
| Rheumatoid arthritis | 2018 | 2936 | 5275 |
| Rheumatoid arthritis | 2017 | 3063 | 5123 |
| Rheumatoid arthritis | 2016 | 3056 | 5010 |

(HKF-R10) was reduced from 83.792 to 69.391 until the patient was discharged and the P value is highly significant (t test, $P < .000$), equaling a statistically detectable change over time (Table 4; Figure 4).

Remuneration Aspects

Analysis of compensation data for approximately 1600 hospitals in Germany from 2016 to 2019 demonstrated, in general, that revenues were lower when conventional unimodal treatment without CT was offered. We have

found that revenues were lower especially in relation to the treatment of RA (€3056 in 2016 vs €2594 in 2019). Compensation for the treatment of AS and PMR was somewhat less reduced, but the reduction was still evident. Compensation for FM treatment has improved compared to 2018. When CT was performed, hospital revenues increased noticeably in all years examined (Table 5).

Outliers in the data do not distort any of the result of the tests performed.

Discussion

The trend toward surgical interventions without a prior attempt to apply conservative treatment has been criticized in recent years.⁶⁷ The current state of research demonstrates that multimodal treatment programs are effective. However, they are also associated with higher costs for service providers.^{48,68} This is due to the requirement of providing an interdisciplinary team with specialists from various disciplines but also due to the logistically complex treatment processes, high-intensity therapies, and longer hospital stay. Due to the increase in surgical treatment methods, there is a need for outcomes research to evaluate conservative multimodal treatment concepts,⁶⁹ which is done in this study.

A high PDI value, as found in this study in patients prior to their admission, suggests a more severe psychological distress, higher pain burden, and greater restrictions when performing everyday activities.⁶⁰ Subjective patient assessments indicate that the multimodal treatment seems to have had a positive influence on the extent of impairments associated with pain, plus physical and mental well-being. Pain grading according to Kohlmann/Raspe, a multidimensional instrument that takes into account both pain intensity and physical functions of the patient, shows a significant decrease of pain. This result matters because studies demonstrate that also factors other than pain relief, such as improvement in physical functions, are important for the affected patients.^{70,71}

The outcomes of the HKF-R10 indicate that approximately 30% of the patients surveyed also suffer from chronic low back pain. So far, this fact has been given little attention in scientific studies.⁷² Here, too, the use of CT may have a positive impact.

There are several limitations in this study that future investigations might consider to analyze in more detail. First, we cannot exclude an effect of the setting on the health status, and it is possible that complex cases receive additional attention of the nursing and medical staff, which might improve satisfaction and health conditions. Second, we could not assess sociodemographic data but only controlled for similar degree of chronification and medication.

This results of this study shed light on medical care under everyday conditions using scientific, interdisciplinary methods and examines the outcome changes following routine care⁷³ using PROs. These can be used to assess the therapeutic benefit since they take into account patient-relevant endpoints, which means disease-related changes, and changes due to treatment. Patients in multimodal programs can benefit substantially from the variety of therapies and the frequent procedures that are carried out in quick succession, which can also contribute to high patient satisfaction.⁷⁴ Studies demonstrate that holistic, multimodal treatment programs may in addition have a positive influence on doctor-patient communication and the patient's trust in doctors and nurses.^{75,76}

Conclusions

The aim of this study was to test the patient-relevant outcomes of multimodal treatment for rheumatic diseases that are associated with pain and check for remuneration. The results show that PROs regarding mood, pain, and perceived impairments improved following the multimodal complex treatment.

The DRG system established in Germany provides specialized hospitals with the option to offer multimodal treatments in the form of complex treatments. The system takes into account the added value that is created by complex treatments as indicated in the PROs and provides for higher compensation to cover the additional costs. Multimodal complex treatments and the associated financial incentives that are required for quality care of patients with acute exacerbation of chronic conditions thus seem to be a successful model of innovation. Further research including randomized controlled trials testing the clinical effectiveness of such models are warranted.

Declaration of Conflicting Interests

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