OPEN ACCESS

EPIDEMIOLOGICAL SCIENCE

Rheuma-VOR study: optimising healthcare of rheumatic diseases by multiprofessional coordinating centres

Matthias Dreher ,[1] Torsten Witte,[2] Kirsten Hoeper ,[2,3] Gunter Assmann ,[4] Fabian Proft ,[5] Denis Poddubnyy ,[5] Niels Murawski,[6] Konstantinos Triantafyllias ,[1,7] Marlon Grodd,[8] Erika Graf ,[8] Urs A Fichtner ,[9] Harald Binder,[8] Jan Zeidler ,[10] Juliana Rachel Hoeper,[10] Johanna Callhoff ,[11,12] Kirsten Karberg ,[13] Anna Trautwein,[1] Dativa Tibyampansha,[14] Leszek Wojnowski,[14] Reinhold E Schmidt,[2] Andreas Schwarting [1,7]

Handling editor Josef S Smolen

► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/ard-2023-224205).

For numbered affiliations see end of article.

Correspondence to
Professor Andreas Schwarting, Department of Internal Medicine I, Division of Rheumatology and Clinical Immunology, University Medical Center of the Johannes Gutenberg University Mainz, Mainz 55131, Germany; schwarting@uni-mainz.de

Received 25 March 2023
Accepted 4 September 2023
Published Online First 27 October 2023

To cite: Dreher M, Witte T, Hoeper K, *et al*. *Ann Rheum Dis* 2024;**83**:184–193.

ABSTRACT

Objectives Early diagnosis of inflammatory arthritis is critical to prevent joint damage and functional incapacities. However, the discrepancy between recommendations of early diagnosis and reality is remarkable. The Rheuma-VOR study aimed to improve the time to diagnosis of patients with early arthritis by coordinating cooperation between primary care physicians, specialists and patients in Germany.

Methods This prospective non-randomised multicentre study involved 2340 primary care physicians, 72 rheumatologists, 4 university hospitals and 4 rheumatology centres in 4 German Federal States. The two coprimary endpoints (time to diagnosis and screening performance of primary care physicians) were evaluated for early versus late implementation phase. Additionally, time to diagnosis and secondary endpoints (decrease of disease activity, increase in quality of life and overall well-being, improvement of fatigue, depression, functional ability, and work ability, reduction in drug and medical costs and hospitalisation) were compared with a reference cohort of the German Rheumatism Research Centre (DRFZ) reflecting standard care.

Results A total of 7049 patients were enrolled in the coordination centres and 1537 patients were diagnosed with a rheumatic disease and consented to further participation. A follow-up consultation after 1 year was realised in 592 patients. The time to diagnosis endpoint and the secondary endpoints were met. In addition, the calculation of cost-effectiveness shows that Rheuma-VOR has a dominant cost–benefit ratio compared with standard care.

Discussion Rheuma-VOR has shown an improvement in rheumatological care, patient-reported outcome parameters and cost savings by coordinating the cooperation of primary care physicians, rheumatologists and patients, in a nationwide approach.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ It is essential to initiate therapy within 12 weeks to reduce the irreversible damage to cartilage and bone and increase the probability of a sustained remission. Delayed diagnosis is also associated with higher costs of care and socioeconomic disadvantages.

⇒ In Germany, about 1.2 million suffer from the most common inflammatory rheumatic diseases rheumatoid arthritis, psoriatic arthritis and axial spondyloarthritis. Especially in rural regions, approximately only 60% of the rheumatology care needs are met. Thus, time to diagnosis is far too long and initiation of treatment begins too late for many patients.

WHAT THIS STUDY ADDS

⇒ The novel approach of 'coordinated cooperation' between the caregivers of patients with rheumatic diseases enables a significant reduction of the duration of symptoms in comparison to standard care and improves patient care, from a medical therapeutic, social, physical, psychological and economic perspective.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our study provides evidence that the 'coordinated cooperation' between primary care physicians and rheumatologists is beneficial for patients and the health insurance systems. This process is not restricted to rheumatic and musculoskeletal diseases but can also be transferred to other disease entities with bottlenecks in care (eg, neurology, psychiatry). Rheuma-VOR represents a general and easy to use model for the comprehensive care of diseases when the time to diagnosis and initial treatment is crucial for the overall outcome.

INTRODUCTION

The time to diagnosis and thus the start of therapy has an impact on the progression of chronic inflammatory rheumatic diseases including rheumatoid arthritis (RA), psoriatic arthritis (PsA) and axial spondyloarthritis (axSpA). In Germany, approximately 1.2 million patients are affected by one of these three diseases.[1 2] According to the European League Against Rheumatism (EULAR)

recommendations for the management of early arthritis, symptomatic patients should be seen by a rheumatologist within 6 weeks after the onset of complaints and treatment with disease-modifying antirheumatic drugs (DMARDs) should be commenced within 12 weeks.[3 4] Prompt diagnosis and initiation of therapy can prevent irreversible joint damage and guide patients into a long-lasting remission. Thus, economic benefits are generated due to the reduction of direct and indirect disease costs, such as incapacity to work costs.[4–9] From a health economic point of view, initiating treatment within the first 12 weeks reduces the likelihood of cost-intensive therapy with biological drugs and targeted-synthetic DMARDS.[10] Implementing these theoretical goals is challenged by the lack of rheumatologists in many countries.

This is also reflected in a 2020 EULAR survey in which 52% of 1873 patients and 59% of 1131 rheumatologists from 35 European countries described specialist consultation within 6 weeks as the biggest challenge.[11] Therefore, EULAR calls for a feasible and valid approach to support especially general practitioners in the diagnosis and referral of patients with early RA since a standardised procedure for transferring patients with musculoskeletal problems from primary care physicians to rheumatologists does not exist.[3]

Approximately 100 million people in Europe are diagnosed with a rheumatic and musculoskeletal disease (RMD). It is speculated that at least 100 million more people live without a diagnosis. In 2017, the EULAR launched the Europe-wide campaign entitled 'Don't Delay, Connect Today' to highlight RMDs as a public health concern of pandemic proportions and that early diagnosis and timely access to treatment can prevent further damage and burden on the individual and society (www.EULAR.org). While this campaign endeavoured to raise awareness, our study aimed to address a reason for the delay-the lack of rheumatologists prevents timely treatment of time-critical diseases.[2 3] Additionally, the shortage of rheumatologists is exacerbated by geographic distribution. While the average distance in Germany to a rheumatologist for patients with RA in urban areas with >500 000 inhabitants is 12 km, patients from rural areas (<5000 inhabitants) have to travel an average of 32 km to a rheumatologist.[12] Thus, the Rheuma-VOR study investigated a novel approach of 'coordinated cooperation' between the caregivers of patients with rheumatic diseases to improve the early diagnosis of inflammatory arthritis.

METHODS

Study design

Rheuma-VOR was a prospective non-randomised multicentre study aiming to establish a network to optimise rheumatological care and diagnostic processes.

From 1 July 2017 to 31 December 2020, patients were included in the study to pass a baseline data collection and a 1-year follow-up appointment. The inclusion criteria for the study were as follows:

- Age at inclusion ≥18 years.
- (Suspected) inflammatory rheumatic disease with International Classification of Diseases codes (ICD) M05, M06, M06.9, M13.0, M45, M46.1, M46.8, M07, M09.0 or L40.5.
- Sufficient language skills and signed informed consent form.

Four university medical centres, three rheumatology centres, local rheumatological specialists, the associations of statutory health insurance physicians and primary care physicians, and the regional associations of the patient advocacy groups from four federal states with a population of about 14 million adults (approximately 20% of the German adult population), participated in the study. Two scientific institutes evaluated the results of the study with different focus. One evaluating institute was responsible for clinical effect evaluation and the other was responsible for health economic evaluation.

Primary care physicians such as general practitioners, internists, dermatologists and orthopaedists used screening questionnaires to document potential early cases of RA, PsA and axSpA, based on the characteristic symptoms of the classification criteria.

Additionally, the primary care physicians had the opportunity to join interactive training courses in basic rheumatology. The interactive training is based on a lecture on early symptoms, diagnostic criteria and examination procedures. During the study period, 20 open access courses were performed.

Primary care physicians sent the questionnaires by fax or a newly developed app for mobile devices to the federal state specific coordination centres. Multiprofessional teams in the specific coordinating centre assessed the likelihood of early arthritis. The teams consisted of a specialist in rheumatology, a clinical nurse specialist and a secretary.

The clinical nurse specialists processed, completed and prepared the screening questionnaires for the rheumatology specialists. The specialist evaluated and triaged the available data for the presence of one of these three conditions. If the criteria for referral were met (characteristic symptoms with elevated C reactive protein or erythrocyte sedimentation rate), the patient was assigned to obtain an appointment with a cooperating rheumatologist within 6 weeks. Appointments were coordinated by the secretaries with one of the 72 in the network participating rheumatologists. When the criteria for referral were not met, patients were returned to standard medical care without a rheumatological examination (figure 2).

When the participating rheumatologists confirmed a rheumatic disease, physicians and patients received questionnaires on sociodemographic data, diagnosis, disease activity, medication, health-related quality of life, well-being and activities of daily living. After 12 months, the questionnaires were issued a second time.

Additionally, from October 2018 to the end of the survey, a 15 min screening consultation was integrated at the Rhineland-Palatinate coordination office. All patients meeting the appropriate criteria but with a scheduled appointment later than 4 weeks were examined by rheumatologists within the coordination centre without further diagnostics (no lab, no X-ray) (figure 1).

The intervention of the study is the implementation of the coordination centres in a way of a professional triage and schedule office, which can be used by all physicians in order to speed up time to diagnosis and a relief for rheumatologists. This is in contrast to the standard German care in which the general practitioner assesses the symptoms, and refers the patient, for example, one after another to a dermatologist, orthopaedist and rheumatologist until the diagnosis is made. Figure 2 shows the common referral process for rheumatic diseases in German standard care versus the Rheuma-VOR process with the focus on the coordination centre.

Data collection and quality control

Based on the study design, the screening questionnaires were derived from strict classification criteria: the disease-specific ACR classification criteria for RA, the slightly adapted CASPAR criteria combined with the 'Psoriasis Epidemiology Screening

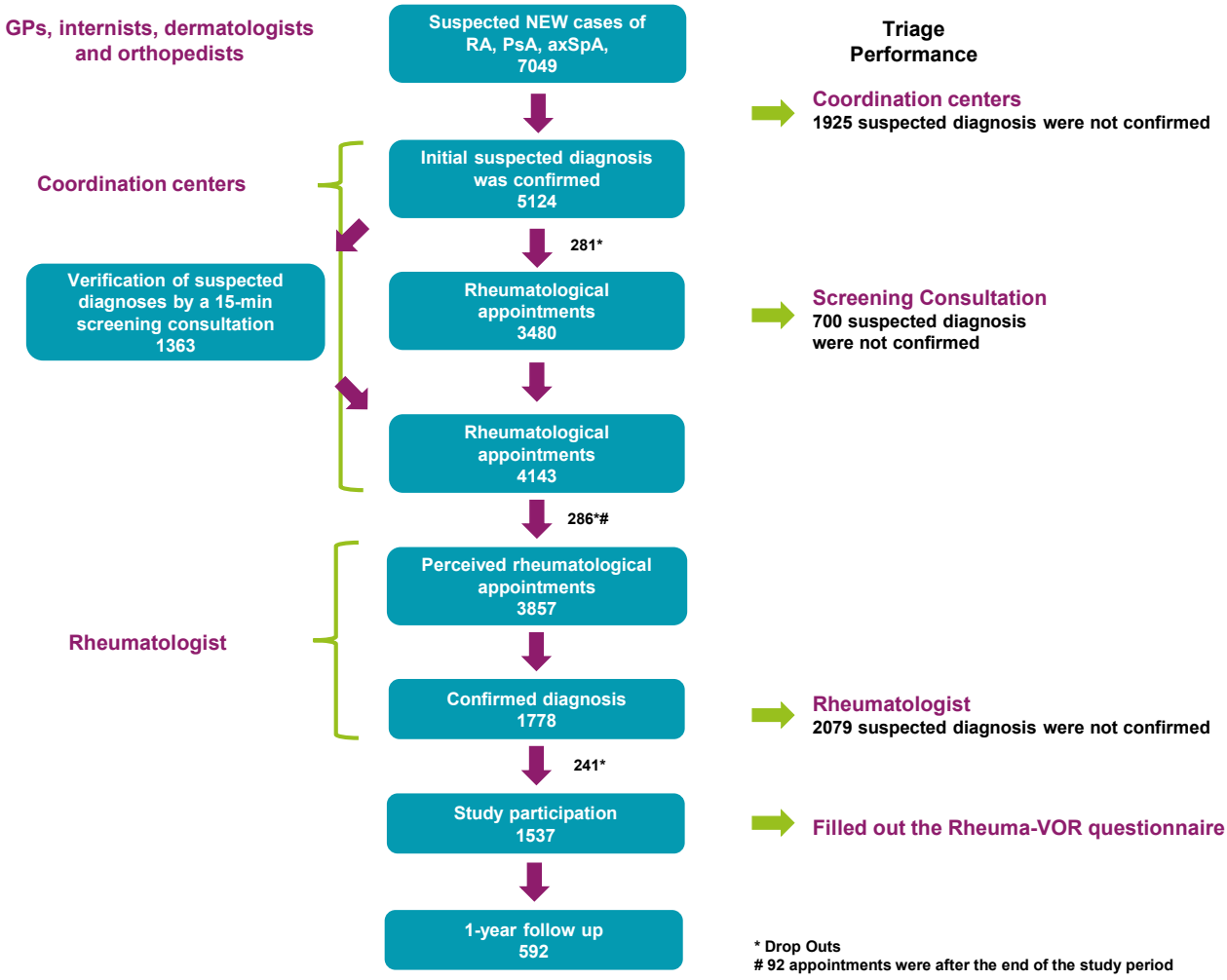

Figure 1 Flow chart Rheuma-VOR. GP, general practitioner.

Tool', and the 'Early Arthritis for Psoriatic Patients' questionnaire for PsA.[13–16] Slightly adapted ASAS classification criteria were used for axSpA.[17 18]

If a rheumatic disease was diagnosed, further assessments were performed to collect disease-specific and patient-related outcome parameters (table 1). Disease-specific remission was specified by the Disease Activity Score 28 for RA and PsA (<2.6) and Ankylosing Spondylitis Disease Activity Score score (<2.1) for axSpA.[19 20]

The Rheuma-VOR data were compared with a weighted cohort for effect evaluation (n=2139) and a matched reference cohort for economic evaluation (n=806) from the DRFZ, reflecting the standard of care. Since 1993, the DRFZ prospectively collects annual epidemiological cross-sectional and longitudinal data from rheumatic centres, such as university hospitals, acute care hospitals and rheumatologists across Germany.[21] The data provided from the DRFZ cover the time period from 1 January 2015 to 31 June 2017 to ensure that patients are not included in both cohorts, as some of the rheumatologists participating in Rheuma-VOR also support the DRFZ's annual documentation.

Time to first rheumatologist contact was documented retrospectively. Inclusion criteria were as follows:

- Age at inclusion ≥18 years.
- Signed informed consent form.
- (Suspicion of) inflammatory rheumatic disease
- Sufficient language skills to complete the questionnaire.

For comparisons with Rheuma-VOR, only persons affected by one of the three inflammatory rheumatic diseases for the first time and recorded in the National Database were selected.

Outcome measures

In addition to a qualitative process evaluation, Rheuma-VOR was evaluated on two aspects within the first year following diagnosis.

1. Disease-specific effects.
2. Health economic effects.

The reduction of the time to diagnosis is the focus in this study. Time from first medical contact to diagnosis between the early (1 July 2017–31 December 2018) and late (1 January 2019–31 December 2020) phases was the first coprimary endpoint. This was further evaluated by comparing time from symptom onset to diagnosis between Rheuma-VOR and standard care. The screening performance of the primary care physicians was the second coprimary endpoint (proportion of confirmed diagnoses).

The reduction of the disease activity, an increase in quality of life and overall well-being, improvement in fatigue, depression, functional ability, work ability, and reduction in drug and medical costs were analysed as secondary endpoints. Costs were determined by weighting the resource use with information from public cost databases. Drug costs were calculated using the current prices from the German Lauer-Taxe 4.0. Cost data were

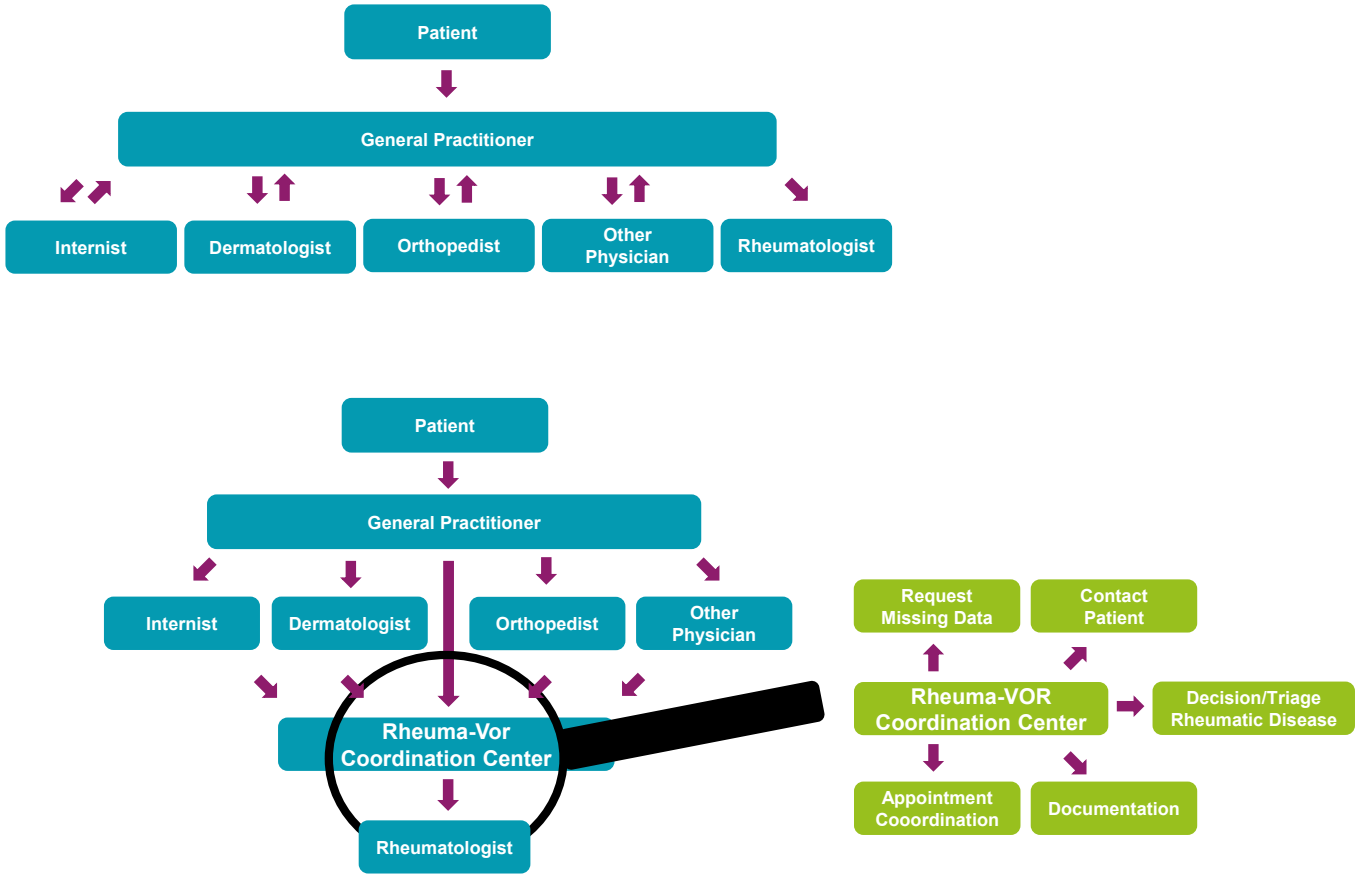

Figure 2 Common referral process for rheumatic diseases in German standard care versus Rheuma-VOR.

Table 1 Disease activity parameters, functional assessment and quality of life questionnaires

Disease-specific activity index		
RA	**PsA**	**axSpA**
DAS28[32 33]	DAS28[32 33]	ASDAS[34]
SDAI[35]	SDAI[35]	BASDAI[36]
RAID[37]	KOF[38]	BASFI[39]
RADAI[40]	LEI[41]	BASMI[42]
	DLQI[43]	
Functional assessment		
FFbH[44]		
Quality of Life Questionnaire		
EQ-5D-3L[45 46]		
WHO-5[47]		
PHQ-9[48]		
FACIT-Fatigue[49]		

ASDAS, Ankylosing Spondylitis Disease Activity Score; axSpA, axial spondyloarthritis; BASDAI, Bath Ankylosing Spondylitis Disease Activity Index; BASFI, Bath Ankylosing Spondylitis Functional Index; BASMI, Bath AS Metrology Index; DAS28, Disease Activity Score 28; DLQI, Dermatology Life Quality Index; EQ-5D-3L, European Quality of Life 5 Dimensions 3 Level Questionnaire; FACIT, Functional Assessment of Chronic Illness Therapy ; FFBH, Hannover Functional Ability Questionnaire; KOF, body surface area; LEI, Leeds Enthesitis Index; PHQ-9, Patient Health Questionnaire-9; PsA, psoriatic arthritis; RA, rheumatoid arthritis; RADAI, Rheumatoid Arthritis Disease Activity Index; RAID, Rheumatoid Arthritis Impact of Disease; SDAI, Simple Disease Activity Index; SpA, spondyloarthritis.

discounted in accordance with the recommendations for health economic evaluations.[22]

Only patients with both baseline and 1-year follow-up data were considered for the follow-up analysis.

Statistical analysis

All analyses were performed using R software version 4.0.3 and SPSS 26 . The first coprimary endpoint time to diagnosis was analysed using a Cox proportional hazards model with a random intercept to account for correlations within different regional coordinating centres. The second coprimary endpoint screening performance (percentage of patients with a suspected diagnosis confirmed by the rheumatologist) was evaluated using a logistic regression model considering site-specific effects by a random intercept model. Both models compare patients from the early with those from the late phase. We postulated an initial screening performance of 50% of the primary care physicians and an increase by 5% during the course of the study.

For the effect evaluation, the two cohorts were weighted. In this way, a probability of belonging to the introduction or consolidation phase was estimated for each patient and calculated with stabilised weights according to Robins *et al*.[23]

For the secondary endpoints, univariate and multivariable linear regression models with a random intercept to account for correlations within different regional coordinating centres and patients were performed comparing consultation 1 with consultation 2.

Two-sided 95% CIs and p values were calculated. The confirmatory significance level was $p<0.025$ for the two primary and

descriptively set to $p<0.05$ for the secondary endpoints (no correction for multiple testing). Independent variables were imputed with multiple imputation algorithms using the mice-package in R.[24]

No alpha error correction was used to counteract multiple comparison problems of secondary endpoints.

To compare the health economic effects between the Rheuma-VOR and standard of care cohort, a case–control matching based on age (±5 years), gender, primary diagnosis and the number of consultations were conducted. Data for cost structure analysis are based on Huscher *et al*.[7] χ^2 tests and Mann-Whitney-U tests were used for the analysis. The significance level was set to $p<0.05$.

Power analysis

Sample size calculations were based on the coprimary endpoint describing the proportion of suspected diagnoses confirmed by rheumatologists. Due to lack of prior data, we adopted an initial worst-case scenario of 50% for the early phase and an improvement to 55% in the study's late phase. Using a χ^2 test with a two-sided significance level of 2.5%, a power of 90%, a ratio for patient inclusion of 1:1.25 (early to late phase), and a drop-out rate of 28% resulted in a minimum sample size of 6875 needed patients.

RESULTS

Study population

During the study period, 7049 screening questionnaires were referred to the coordination centres. Following assessment by the multiprofessional team, the suspected diagnosis was upheld for 5124, of which 1363 patients were seen at the 15 min consultation in Rhineland-Palatine. Based on the information provided by the primary care physicians by fax, by app or the specialist assessment during the screening consultation, 4143 patients with a suspected diagnosis were referred to the rheumatology specialist level. Of the 3857 patients which were seen by a rheumatologist, the diagnosis of RA, PsA or axSpA was confirmed in 1778 patients. Finally, 1537 patients were included in the study (consultation 1), of which 592 had a follow-up after 1 year (consultation 2) (figure 1). Summarised, 37% of the primary suspected cases (n=2625) could be excluded from a consultation with the rheumatologist. Diagnostic performance was also significantly increased by the implementation of the screening consultation (OR 0.553, 95% CI: 0.453; 0.677, $p<0.001$). The drop-out rate was 10.2% (figure 1).

Nationwide geographical distribution of Rheuma-VOR across the four federal states is presented in figure 3.

Due to the study design, and study inclusion until the the end of the study (31 December 2020), a total of 404 patients which were included in Rheuma-VOR after the 1 January 2020 could not be considered for the follow-up analysis.

Based on the 1537 included patients, the main referring physicians were general practitioners (47%), followed by internists (16%), orthopaedists (16%) and dermatologists (9%). The remaining 12% were neurologists, surgeons, ophthalmologists, geriatricians or even rheumatologists who made an initial diagnosis and included patients in the study.

Additionally, the 700 excluded patients from the screening consultation level were used as the basis for a review of false-negative diagnoses. A total of 532 patients were eligible for follow-up. The difference of 168 patients resulted from definite rejections of the suspected diagnoses due to the presence of osteoarthritis, an orthopaedic or other rheumatic condition (eg, gout or systemic lupus erythematosus), an already existing rheumatic diagnosis, or from revocation of further participation in Rheuma-VOR. The period from the rejection of the diagnosis to the contact was at least 3 months and three attempts were made to contact the patient. Finally, 445 people were contacted, 30 of whom stated that they had been diagnosed with RA, PsA or axSpA. This corresponds to a share of just under 7%.

Patient characteristics

The most common diagnosis was RA (58%), followed by PsA (27%) and axSpA (15%).

The mean age of participants corresponded with the age of manifestation of the diseases (54±16 years); 57% of participants were female and 31% reported being smokers. The mean body mass index was 28 kg/m^2, and 29% of the patients were already

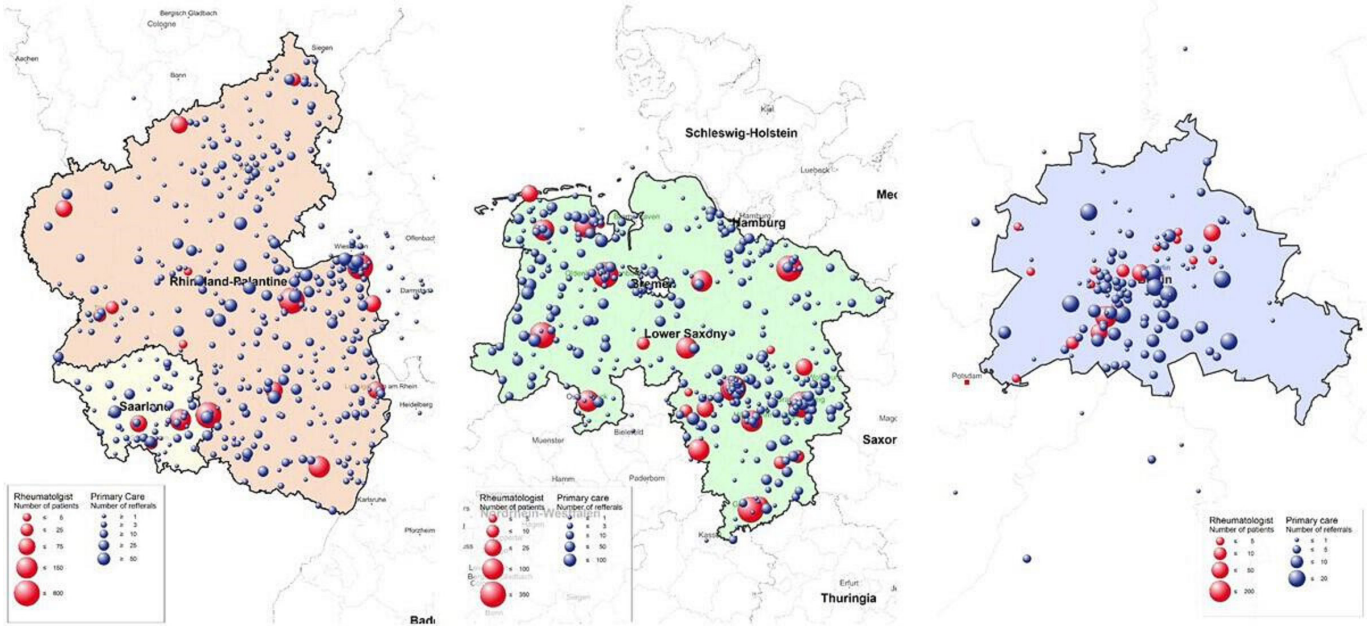

Figure 3 Nationwide geographical distribution of Rheuma-VOR primary care physicians and rheumatologists.

Table 2 Baseline characteristics and development in the first year after diagnosis

	Rheuma-VOR Baseline (consultation 1)	Rheuma-VOR 1-year follow-up (consultation 2)	Effect (slope of lin. Reg.)	95% CI	P value
Baseline characteristics					
n	1537	592			
Female (%, n missing)	870 (57.2, 15)	328 (55.6, 2)			
Diagnosis RA (%, n missing)	889 (57.8, 0)	340 (57.4, 0)			
Diagnosis: PsA (%, n missing)	409 (26.6, 0)	176 (29.7, 0)			
Diagnosis axSpA (%, n missing)	239 (15.5, 0)	76 (12.8, 0)			
Age (years). mean (SD, min, max, n missing)	53.6 (15.89, 18, 91, 0)	53.56 (14.97, 18, 87, 0)			
BMI (mean, min, max, n missing)	27.69 (5.38, 14.5, 55.25, 23)	27.85 (5.29, 15.79, 46.65, 3)			
Smoking (%, n missing)	468 (30.6, 6)	168 (28.5, 3)			
Pensioners (%, n missing)	440 (28.7, 6)	179 (30.4, 3)			
Comorbidities mean (SD, min, max, n missing)	2.15 (2.22, 0, 15, 0)	2.61 (2.56, 0, 19, 0)			
Rf+ (%, n missing)	482 (31.4, 0)				
Anti-CCP+ (%, n missing)	378 (24.6, 0)				
HLA-B27+ (%, n missing)	268 (17.4, 0)				
Duration of complaints (years) mean (SD, min, max, n missing)	1.58 (4.41, 0, 45, 24)				
Registration until appointment (days) mean (SD, min, max, n missing)	29.87 (37.24, 0, 812, 0)				
Registration until 15 min screening consultation in Rhineland-Palantine (days) mean (SD, min, max, n missing)	16.28 (15.11, 0, 140, 1279)				
Residence size ≤5000 to 20 000 (%, n missing)	924 (61.6, 37)				
Distance to the rheumatologists (in km) mean (SD, min, max, n missing)	42.4 (41.14, 0, 538, 0)				
Disease-specific activity index, Functional Assessment, Quality of life questionnaire					
RA DAS28 mean (SD, min, max, n missing)	4.45 (1.46, 0.49, 8.55, 39)	2.84 (1.13, 0.28, 6.6, 51)	1.631	1.802 to −1.46	<0.01*
RA DAS28<2.6 (%, n missing)	103 (12.1, 39)	133 (46, 51)			
RA SDAI mean (SD, min, max, n missing)	26.76 (18.57, 0.03, 98.5, 26)	11.39 (11.25, 0.06, 96, 22)	14.951	17.163 to −12.739	<0.01*
RA SDAI<3.3 (%, n missing)	20 (2.3, 26	55 (17.3, 22)			
PsA DAS28 mean (SD, min, max, n missing)	3.48 (1.29, 0.56, 6.99, 42)	2.7 (1.13, 0.28, 6.79, 40)	0.765	0.995 to −0.534	<0.01*
PsA DAS28<2.6 (%, n missing)	110 (30, 42)	72 (52.9, 40)			
PsA SDAI mean (SD, min, max, n missing)	17.91 (11.8, 1.05, 82, 29)	10.26 (8.63, 0.1, 50.5, 20)	6.88	9.479 to −4.281	<0.01*
PsA SDAI<3.3 (%, n missing)	12 (3.2%, 29)	23 (14.7%, 20)			
ASDAS mean (SD, min, max, n missing)	2.61 (0.9, 0.66, 5.45, 36)	2.33 (0.9, 0.41, 3.98, 16)	0.293	0.555 to −0.032	0.03*
ASDAS<2.1 (%, n missing)	62 (30.5, 36)	23 (38.3, 16)			
FFBH mean (SD, min, max, n missing)	76.91 (20.1, 0, 100, 19)	82.98 (18.13, 14, 100, 6)	5.896	4.572 to 7.22	<0.01*
EQ-5D mean (SD, min, max, n missing)	0.7 (0.28, −0.2, 1, 44)	0.81 (0.21, 0.02, 1, 18)	0.125	0.1 to 0.149	<0.01*
FACIT-Fatigue mean (SD, min, max, n missing)	34.44 (11.27, 1.3, 52, 22)	37.5 (10.45, 5, 52, 6)	3.065	2.251 to 3.879	<0.01*
WHO-5 mean (SD, min, max, n missing)	45.98 (26.45, 0, 100, 23)	56.37 (27.35, 0, 100, 5)	10.176	8.028 to 12.324	<0.01*
PHQ-9 mean (SD, min, max, n missing)	7.66 (5.34, 0, 27, 39)	6.11 (4.9, 0, 23, 12)	1.611	2.017 to 1.205	<0.01*
RADAI mean (SD, min, max, n missing)	4.46 (1.87, 0, 9.36, 46)	2.77 (1.81, 0, 9.17, 12)	1.719	1.941 to −1.497	<0.01*
RAID mean (SD, min, max, n missing)	4.92 (2.34, 0, 10, 19)	3.16 (2.2, 0, 9.03, 5)	1.7	1.961 to −1.439	<0.01*
KOF mean (SD, min, max, n missing)	3.11 (5.26, 0, 46, 32)	1.73 (3.36, 0, 29, 7)	1.388	2.044 to −0.731	<0.01*
DLQI mean (SD, min, max, n missing)	7.2 (6.7, 0, 29, 30)	4.75 (5.83, 0, 26, 5)	2.769	3.693 to 1.845	<0.01*
LEI mean (SD, min, max, n missing)	0.76 (1.3, 0, 6, 32)	0.28 (0.9, 0, 6, 6)	0.456	0.652 to −0.259	<0.01*
BASFI mean (SD, min, max, n missing)	3.1 (2.39, 0, 10, 20)	2.55 (2.31, 0, 8.5, 1)	0.734	1.259 to −0.209	<0.01*
BASMI mean (SD, min, max, n missing)	1.16 (1.73, 0, 8, 41)	0.9 (1.87, 0, 10, 14)	0.518	1.05 to 0.014	0.06
BASDAI mean (SD, min, max, n missing)	4.63 (2.01, 0, 9.18, 16)	3.8 (2.1, 0, 8.6, 1)	1.077	1.535 to −0.619	<0.01*

*Significant at p<0.05.

ASDAS, Ankylosing Spondylitis Disease Activity Score; axSpA, axial spondyloarthritis; BASDAI, Bath Ankylosing Spondylitis Disease Activity Index; BASFI, Bath Ankylosing Spondylitis Functional Index; BASMI, Bath AS Metrology Index; BMI, body mass index; DAS28, Disease Activity Score 28; DLQI, Dermatology Life Quality Index; EQ-5D, European Quality of Life 5 Dimensions; FACIT, Functional Assessment of Chronic Illness Therapy; FFBH, Hannover Functional Ability Questionnaire; KOF, body surface area; LEI, Leeds Enthesitis Index; PHQ-9, Patient Health Questionnaire-9; PsA, psoriatic arthritis; RA, rheumatoid arthritis; RADAI, Rheumatoid Arthritis Disease Activity Index; RAID, Rheumatoid Arthritis Impact of Disease; SDAI, Simple Disease Activity Index.

retired at consultation 1. On average, two comorbidities were present at diagnosis (table 2).

The average waiting time from registration at the Rheuma-VOR coordination centres until the rheumatological appointment was 30±37 days. In addition, 16±15 days of waiting time have to be added in Rhineland-Palatinate due to the 15 min screening consultation.

A main aim of the project was to support patients from rural regions, with 62% of included patients residing in towns with <5000 to 20 000 inhabitants (figure 3, table 2). Average distance to the rheumatologist was about 42 km.

Coprimary endpoints

The first coprimary endpoint time from first medical contact to diagnosis was significantly reduced between the two phases of the study (HR 1.27; (95% CI 1.17 to 1.37); p<0.001) and, similarly, from onset of symptoms to diagnosis in comparison to standard care (figure 4): RA: 0.55 years (mean) vs 2.31 years (p<0.001), PsA: 2.43 years vs 4.41 years (p<0.001) and axSpA: 3.92 years vs 8.41 years (p<0.001) (table 3).

The second coprimary endpoint screening performance did not show a significant difference between early and late phase. However, in the early phase the screening performance was already much higher than originally assumed (75% vs 50%) (online supplemental file 1).

Secondary endpoints

Disease activity

Patients in the Rheuma-VOR cohort had moderate to high disease activity at inclusion, which improved significantly at the follow-up consultation; 47% (n=228) of all patients achieved remission at consultation 2 (p<0.01) (table 2).

Detailed analysis revealed a comparable, uniform picture during the project: disease activity, measured with the respective RA-specific, PsA-specific and axSpA specific objective and subjective parameters decreased significantly (p<0.01). Functional impairment in the axSpA patients was minimal at consultation 1, reflecting early diagnosis. During the study, there was a numerical improvement to 0.9 at consultation 2 (p<0.06) (table 2).

Health-related quality of life, well-being and activities of daily living

Parallel with the decrease in disease activity, all patients reported significantly improved outcome parameters concerning functional ability, patient well-being, quality of life, fatigue and depression (p<0.01) (table 2).

Resource use analysis

Health economic evaluation revealed that optimising patient management with a reduction in the time to diagnosis resulted in considerable savings in resource use. Patients in the Rheuma-VOR cohort had fewer hospitalisations than standard care at consultation 1 (7.2% vs 15.7%) and consultation 2 (9.3% vs 12.7%). Regarding the ability to work, 6.1% of the Rheuma-VOR cohort patients were on sick leave at consultation 2, compared with 9.3% in the control group. The major part of the costs arose from drug therapy. In the Rheuma-VOR cohort, 2.4% (n=34) received biologics therapy at consultation 1, in contrast to 11.8% (n=165) in standard care (online supplemental file 1).

Incremental cost-effectiveness ratio

Cost-effectiveness of Rheuma-VOR was analysed by comparing the cost–utility ratio for both cohorts. At lower care costs

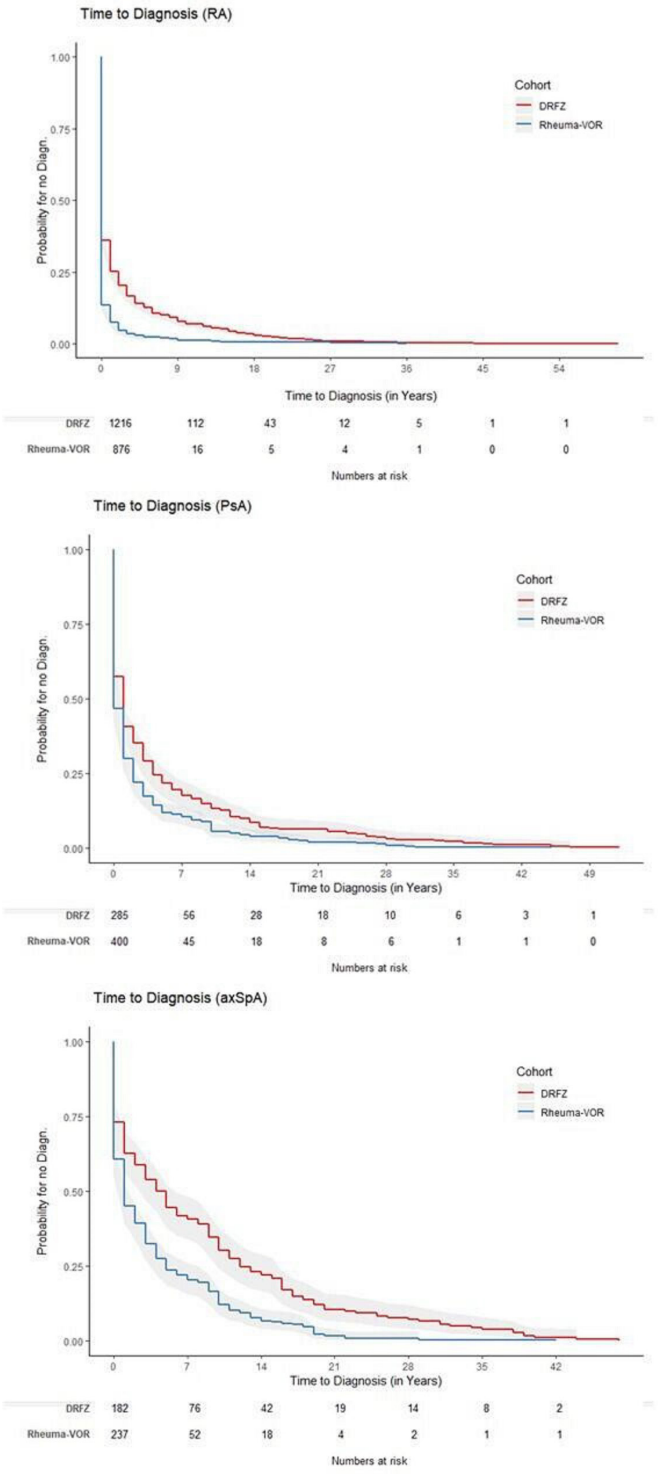

Figure 4 Symptom onset until time to diagnose of Rheuma-VOR and standard care. DRFZ, German Rheumatism Research Centre; PsA, psoriatic arthritis; RA, rheumatoid arthritis; SpA, spondyloarthritis.

(including the costs for the coordination centres), a higher benefit is achieved at consultation 2.

Further calculations were conducted for patients with data available for both consultations. Costs necessary to increase the quality of life by 0.1 points, that is, by 10%, (consultation 1 to consultation 2) were calculated. In the Rheuma-VOR cohort, on average, €2445, 95% CI (€1955.79 to €3041.50) per patient was spent compared with €3107, 95% CI (€1958.28 to €3997.62) for the standard cohort.

Table 3 Symptom onset until time (years) to diagnosis of Rheuma-VOR and standard care

	Rheuma-VOR	DRFZ	HR	95% CI	P value
RA md. (min, 25%-qant, 75%-quant, max, n missing) mean (SD)	0 (0, 0, 0, 36, 13) 0.55 (2.76)	0 (0, 0, 0, 61, 315) 2.31 (5.68)	1.57	1.43 to 1.719	<0.001*
PsA md. (min, 25%-qant, 75%-quant, max, n missing) mean (SD)	0 (0, 0, 2, 45, 9) 2.43 (5.41)	0, (0, 0, 2, 52, 85) 4.41 (8.44)	1.26	1.07 to 1.47	<0.001*
axSpA md. (min, 25%-qant, 75%-quant, max, n missing) mean (SD)	1 (0, 0, 5, 42, 2) 3.92 (6.02)	1 (0, 0, 5, 48, 49) 8.41 (10.45)	1.67	1.35 to 2.07	<0.001*

*Significant at p<0.05.
axSpA, axial spondyloarthritis; DRFZ, German Rheumatism Research Centre; PsA, psoriatic arthritis; RA, rheumatoid arthritis.

Thus, the cost–benefit ratio in the Rheuma-VOR cohort showed higher effectiveness than the standard cohort since improvement in quality of life is associated with lower costs.

DISCUSSION

The Rheuma-VOR study has highlighted that coordination between rheumatic healthcare providers significantly improved time to diagnosis, especially from symptom onset until diagnosis. The provided DRFZ data show comparable results to general and former published DRFZ-data.[21] Patients suffering from the first symptoms of a chronic rheumatic disease immediately benefited from earlier diagnosis with improved health-related quality of life and increased daily activities and work ability. The benefit and relevance of early diagnosis and early medication were already shown and are included in current guidelines.[2 3 5 8 25]

Contrary to our assumptions, 73% of the initially referred suspected patients were confirmed by the coordination centres. The screening questionnaires may have contributed to this unexpected high rate. It has to be mentioned that only <5% of all participating GPs received training during the Rheuma-VOR study due to pandemic reasons. All primary care physicians received a feedback for their screening questionnaires to improve the accuracy of the screening. Yet, the accuracy of the screening questionnaire was much better than expected. Only 15% of screening questionnaires needed to be revised by the primary care physician.

In 2017, the Interdisciplinary Commission on Healthcare Quality of the German Society for Rheumatology (DGRh) updated the 2008 memorandum on rheumatological healthcare in Germany.[2] The update examined the need for rheumatologists and determined the gap between needs and supply. According to the analysis, at least two rheumatologists are required for the outpatient care of 100 000 adult inhabitants. This is equivalent to 1350 rheumatologists in Germany, which currently has only 812 rheumatologists.[2 26] While some larger cities (eg, Hamburg or Hannover) meet these criteria, many rheumatologically underserved areas, especially in rural regions such as Rhineland-Palatinate and Saarland, do not. Therefore, an additional bottleneck is caused by a ruralurban gap.[2 27] The Rheuma-VOR study allowed referral to rheumatologists only by urgency and not by place of residence, and therefore, balanced the existing rural–urban gap in care since 62% of the included patients lived in cities with up to 20 000 inhabitants. In addition, the involvement of primary care physicians in therapy decisions, immediate support via consultation with the coordinating centres, and continuous training will strengthen the competence of the primary care physicians and consequently further relieve specialist resources.

The Rheuma-VOR study was quickly communicated among GPs via the Association of Statutory Health Insurance Physicians. The fact that there was a way to quickly send a patient with rheumatic complaints to a coordination centre that takes care of this patient is another explanation for the success of Rheuma-VOR, given regular waiting times of 1 year and longer for an appointment with a rheumatologist. It can be noted that all patients were seen by a rheumatologists within an average waiting time of about 4 weeks (29.87±37.24), respective approximately 2 weeks (16.28±15.11 days) considering the 15 min screening consultation in Rhineland-Palantine.

Optimising coordination by reducing waiting time until diagnosis leads to significant savings in resource use and favourable cost-effectiveness compared with standard care. Studies revealed a positive correlation between the rising severity of the disease and increasing costs.[28] Regarding the number and duration of hospital stays, the periods of incapacity to work, and the medication used, further positive effects could occur in the long term due to the early and close-meshed initiation and control of therapy. It has to be mentioned that the Rheuma-VOR does not consider the time from symptom onset until the visit to the primary care physicians and initial referral to the rheumatologists which can extend the time to rheumatologist significantly. Some of the National Health Service data published in 2019 showed an average of four visits at the general practitioner/primary care physicians with a median waiting time of 6.9 weeks (IQR 2.3–20.3) for referral to a rheumatologist in patients suffering from RA. Patients who purchased over-the-counter medications took longer to seek help.[29] Thus, an additional focus should be on rising awareness in different sectors of the healthcare systems.

Defining the DRFZ cohort as the standard of care is not entirely accurate, since the National Database of the DRFZ is not a registry, and the aim is not to achieve full coverage. Participating facilities are encouraged to enrol persons in the National Database on an unselected basis. However, within Germany, the National Database currently represents the best possible data collection in the field of rheumatology to reflect the standard of rheumatological care.

Additionally, due to data protection reasons, it was possible to control potential false-negative diagnosis only at the level of the screening consultation following the triage level ‘coordination centre’. As a result, the actual proportion could be higher due to this bias.

In Lower Saxony and Rhineland-Palatine screening questionnaire for collagenosis and vasculitides were developed and implemented. Follow-up time was extended in Rhineland-Palatinate for additional 2 years to obtain further data and optimisation approaches.

Although Rheuma-VOR has significantly improved care and rheumatologists were relieved of 37% of patients, the problem of the insufficient number of rheumatologists still exists. Therefore, we envision Rheuma-VOR as the core of an optimisation

strategy around which further initiatives must be established, for example, such as the effect of nurse-led care, an independent study in Rheuma-VOR.[30] Several campaigns are ongoing to increase interest in rheumatology.[31]

This novel concept has shown an improvement in rheumatological care, patient-reported outcome parameters, and cost savings by coordinating the cooperation of general practitioners, rheumatologists and patients in a nationwide approach. Additionally, the study shows effectiveness to decrease inappropriate rheumatological referrals by 37% as well as an approach to reduce the time to diagnosis. The Rheuma-VOR concept of 'coordinated cooperation' is not restricted to RMDs but can also be transferred to other clinical critical courses and bottlenecks in care (eg, neurology, psychiatry). Rheuma-VOR represents a general model for action and structure for the comprehensive care of diseases if the time factor for the response to therapy and the overall outcome is critical.

Author affiliations
[1]Division of Rheumatology and Clinical Immunology, Department of Internal Medicine I, University Medical Center of the Johannes Gutenberg University, Mainz, Germany
[2]Department of Rheumatology and Immunology, Hannover Medical School, Hannover, Germany
[3]Center for Rheumatology Lower Saxony, Hannover, Germany
[4]Center of Rheumatology and Clinical Immunology, RUB-University Hospital Minden JWK, Minden, Germany
[5]Department of Gastroenterology, Infectiology and Rheumatology (including Nutrition Medicine), Charite Universitatsmedizin Berlin, Berlin, Germany
[6]Internal Medicine I Oncology, Haematology, Clinical Immunology and Clinical Rheumatology, Saarland University Hospital and Saarland University Faculty of Medicine, Homburg, Germany
[7]Center for Rheumatology Rhineland-Palatinate, Bad Kreuznach, Germany
[8]Institute of Medical Biometry and Statistics, Faculty of Medicine and Medical Center, University of Freiburg, Freiburg, Germany
[9]Institute of Medical Biometry and Statistics, Section of Healthcare Research and Rehabilitation Research, Faculty of Medicine and Medical Center, University of Freiburg, Freiburg, Germany
[10]Center for Health Economics Research Hannover (CHERH), Leibniz Universitat Hannover, Hannover, Germany
[11]Epidemiology and Health Services Research, German Rheumatism Research Centre, Berlin, Germany
[12]Institute for Social Medicine, Epidemiology and Health Economics, Charite Universitatsmedizin Berlin, Berlin, Germany
[13]Center for Rheumatology Berlin, Berlin, Germany
[14]Department of Pharmacolgy, University Medical Center of the Johannes Gutenberg University, Mainz, Germany

Correction notice This article has been corrected since it published Online First. Figure 2 has been updated.

Twitter Fabian Proft @ProftDr and Johanna Callhoff @callhoffj

Acknowledgements We dedicate this article to our beloved colleague Prof. Reinhold E. Schmidt, who was one of the driving forces behind the project and who sadly passed away unexpectedly two years ago. Rheuma-VOR was funded by the Innovation Fund at the Federal Joint Committee (G-BA) from 2017 to 2021. The funding has no influence on the study. Funding code: 01NVF16029. Preliminary results of the different Rheuma-VOR substudies were presented at national (DGRh) and international (EULAR) conferences. The authors would like to thank the participating rheumatological practices, the Deutsche Rheumaliga, the Rheumaliga Landesverband of the federal states, the Deutsche Vereinigung Morbus Bechterew e.V., and the participants for the excellent cooperation.

Contributors MD was the project manager of the study and responsible for data collection. He was involved in data analysis and wrote the final manuscript together with AS. TW, KH, GA, FP, DP, MN, KT, KK and RES were responsible for patient recruitment and the coordination centres in the participating federal states. JC was responsible for the control group from the DRFZ. MG, EG and HB were responsible for data anylasis with the focus on effect evaluation. UAF analysed the qualitative data. JZ and JRH were responsible for economic data evaluation. DT and LW programmed and set up the Rheuma-VOR App. AT was responsible for financial implementation and administrative project coordination. AS the principal investigator and guarantor of this study. He is responsible for the overall content, initiated the idea, contributed to the study design and wrote the manuscript.

Funding Rheuma-VOR was funded by the Innovation Fund at the Federal Joint Committee (G-BA) from 2017 to 2021. Funding code: 01NVF16029.

Map disclaimer The inclusion of any map (including the depiction of any boundaries therein), or of any geographic or locational reference, does not imply the expression of any opinion whatsoever on the part of BMJ concerning the legal status of any country, territory, jurisdiction or area or of its authorities. Any such expression remains solely that of the relevant source and is not endorsed by BMJ. Maps are provided without any warranty of any kind, either express or implied.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study involves human participants and the study design was reviewed by the ethics committees of the state medical association of Rhineland-Palatinate (837.260.17), (11094), and the ethics committees of the university medical centres in Hannover (Lower Saxony), Homburg (Saarland), Berlin (Berlin), and Freiburg (Baden-Wuerttemberg). For evaluation, an additional data protection concept was obtained. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Not applicable, additional data uploaded as online supplemental material.

ORCID iDs
Matthias Dreher http://orcid.org/0000-0002-9171-3780
Kirsten Hoeper http://orcid.org/0000-0002-4327-9836
Gunter Assmann http://orcid.org/0000-0002-3216-9340
Fabian Proft http://orcid.org/0000-0003-4306-033X
Denis Poddubnyy http://orcid.org/0000-0002-4537-6015
Konstantinos Triantafyllias http://orcid.org/0000-0001-8765-2636
Erika Graf http://orcid.org/0000-0002-6831-0756
Urs A Fichtner http://orcid.org/0000-0002-4190-8969
Jan Zeidler http://orcid.org/0000-0002-0104-2267
Johanna Callhoff http://orcid.org/0000-0002-3923-2728
Kirsten Karberg http://orcid.org/0000-0002-1362-7326
Andreas Schwarting http://orcid.org/0000-0002-0566-598X

REFERENCES

1 Zink A, Albrecht K. Wie Häufig sind Muskuloskeletale Erkrankungen in Deutschland? *Z Rheumatol* 2016;75:346–53.
2 Zink A, Braun J, Gromnica-Ihle E, *et al*. Memorandum of the German Society for Rheumatology on the quality of treatment in rheumatology - update 2016. *Z Rheumatol* 2017;76:195–207.
3 Combe B, Landewe R, Daien CI, *et al*. 2016 update of the EULAR recommendations for the management of early arthritis. *Ann Rheum Dis* 2017;76:948–59.
4 Gossec L, Smolen JS, Ramiro S, *et al*. European League Against Rheumatism (EULAR) recommendations for the management of psoriatic arthritis with pharmacological therapies: 2015 update. *Ann Rheum Dis* 2016;75:499–510.
5 Smolen JS, Landewé RBM, Bijlsma JWJ, *et al*. EULAR recommendations for the management of rheumatoid arthritis with synthetic and biological disease-modifying antirheumatic drugs: 2019 update. *Ann Rheum Dis* 2020;79:685–99.
6 Fautrel B, Verstappen SMM, Boonen A. Economic consequences and potential benefits. *Best Pract Res Clin Rheumatol* 2011;25:607–24.
7 Huscher D, Mittendorf T, von Hinüber U, *et al*. Evolution of cost structures in rheumatoid arthritis over the past decade. *Ann Rheum Dis* 2015;74:738–45.

8 van der Heijde D, Ramiro S, Landewé R, *et al*. 2016 update of the ASAS-EULAR management recommendations for axial spondyloarthritis. *Ann Rheum Dis* 2017;76:978–91.
9 Zink A. Healthcare research in rheumatology: current state. *Z Rheumatol* 2014;73:115–22.
10 Gremese E, Salaffi F, Bosello SL, *et al*. Very early rheumatoid arthritis as a predictor of remission: a multicentre real life prospective study. *Ann Rheum Dis* 2013;72:858–62.
11 Meisters R, Putrik P, Ramiro S, *et al*. EULAR/Eumusc.Net standards of care for rheumatoid arthritis: cross-sectional analyses of importance, level of implementation and care gaps experienced by patients and Rheumatologists across 35 European countries. *Ann Rheum Dis* 2020;79:1423–31.
12 Albrecht K, Luque Ramos A, Callhoff J, *et al*. Outpatient care and disease burden of rheumatoid arthritis: results of a linkage of claims data and a survey of insured persons. *Z Rheumatol* 2018;77:102–12.
13 Aletaha D, Neogi T, Silman AJ, *et al*. 2010 rheumatoid arthritis classification criteria: an American college of rheumatology/European League against rheumatism collaborative initiative. *Ann Rheum Dis* 2010;69:1580–8.
14 Helliwell PS. Psoriasis epidemiology screening tool (PEST): a report from the GRAPPA 2009 annual meeting. *J Rheumatol* 2011;38:551–2.
15 Taylor W, Gladman D, Helliwell P, *et al*. Classification criteria for psoriatic arthritis: development of new criteria from a large international study. *Arthritis Rheum* 2006;54:2665–73.
16 Tinazzi I, Adami S, Zanolin EM, *et al*. The early psoriatic arthritis screening questionnaire: a simple and fast method for the identification of arthritis in patients with psoriasis. *Rheumatology (Oxford)* 2012;51:2058–63.
17 Rudwaleit M, van der Heijde D, Landewé R, *et al*. The assessment of SpondyloArthritis International Society classification criteria for peripheral spondyloarthritis and for spondyloarthritis in general. *Ann Rheum Dis* 2011;70:25–31.
18 Rudwaleit M, van der Heijde D, Landewé R, *et al*. The development of assessment of SpondyloArthritis International Society classification criteria for axial spondyloarthritis (part II): validation and final selection. *Ann Rheum Dis* 2009;68:777–83.
19 Aletaha D, Smolen JS. Joint damage in rheumatoid arthritis progresses in remission according to the disease activity score in 28 joints and is driven by residual swollen joints. *Arthritis Rheum* 2011;63:3702–11.
20 Machado P, Landewé R, Lie E, *et al*. Ankylosing Spondylitis Disease Activity Score (ASDAS): defining cut-off values for disease activity States and improvement scores. *Ann Rheum Dis* 2011;70:47–53.
21 Albrecht K, Callhoff J, Zink A. Long-term trends in rheumatology care: achievements and deficits in 25 years of the German national rheumatology database. *Z Rheumatol* 2019;78:65–72.
22 Zentner A, Busse R. Internationale standards der Kosten-Nutzen-Bewertung. *Gesundh Ökon Qual Manag* 2006;11:368–73.
23 Robins JM, Hernán MA, Brumback B. Marginal structural models and causal inference in epidemiology. *Epidemiology* 2000;11:550–60.
24 van Buuren S, Groothuis-Oudshoorn K. mice: multivariate imputation by chained equations in R. *J Stat Softw* 2011;45:1–67.
25 Gossec L, Baraliakos X, Kerschbaumer A, *et al*. EULAR recommendations for the management of psoriatic arthritis with pharmacological therapies: 2019 update. *Ann Rheum Dis* 2020;79:700–12.
26 Fiehn C, Baraliakos X, Edelmann E, *et al*. Current state, goals and quality standards of outpatient care in rheumatology: position paper of the professional Association of German Rheumatologists (Bdrh). *Z Rheumatol* 2020;79:770–9.
27 Edelmann E. Outpatient rheumatologic treatment in Germany. *Z Rheumatol* 2014;73:123–34.
28 Huscher D, Merkesdal S, Thiele K, *et al*. Cost of illness in rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis and systemic lupus erythematosus in Germany. *Ann Rheum Dis* 2006;65:1175–83.
29 Stack RJ, Nightingale P, Jinks C, *et al*. Delays between the onset of symptoms and first rheumatology consultation in patients with rheumatoid arthritis in the UK: an observational study. *BMJ Open* 2019;9:e024361.
30 Hoeper JR, Zeidler J, Meyer SE, *et al*. Effect of nurse-led care on outcomes in patients with ACPA/RF-positive rheumatoid arthritis with active disease undergoing treat-to-target: a multicentre randomised controlled trial. *RMD Open* 2021;7:e001627.
31 Benesova K, Lorenz H-M, Lion V, *et al*. Early recognition and screening consultation: a necessary way to improve early detection and treatment in rheumatology?: overview of the early recognition and screening consultation models for rheumatic and musculoskeletal diseases in Germany. *Z Rheumatol* 2019;78:722–42.
32 Prevoo ML, van 't Hof MA, Kuper HH, *et al*. Modified disease activity scores that include twenty-eight-joint counts. development and validation in a prospective longitudinal study of patients with rheumatoid arthritis. *Arthritis Rheum* 1995;38:44–8.
33 Leeb BF, Andel I, Sautner J, *et al*. The disease activity score in 28 joints in rheumatoid arthritis and psoriatic arthritis patients. *Arthritis Rheum* 2007;57:256–60.
34 Lukas C, Landewé R, Sieper J, *et al*. Development of an ASAS-endorsed disease activity score (ASDAS) in patients with ankylosing spondylitis. *Ann Rheum Dis* 2009;68:18–24.
35 Aletaha D, Smolen J. The simplified disease activity index (SDAI) and the clinical disease activity index (CDAI): a review of their usefulness and validity in rheumatoid arthritis. *Clin Exp Rheumatol* 2005;23:S100–8.
36 Garrett S, Jenkinson T, Kennedy LG, *et al*. A new approach to defining disease status in ankylosing spondylitis: the Bath Ankylosing Spondylitis disease activity index. *J Rheumatol* 1994;21:2286–91.
37 Gossec L, Paternotte S, Aanerud GJ, *et al*. Finalisation and validation of the rheumatoid arthritis impact of disease score, a patient-derived composite measure of impact of rheumatoid arthritis: a EULAR initiative. *Ann Rheum Dis* 2011;70:935–42.
38 Ramsay B, Lawrence CM. Measurement of involved surface area in patients with psoriasis. *Br J Dermatol* 1991;124:565–70.
39 Calin A, Garrett S, Whitelock H, *et al*. A new approach to defining functional ability in ankylosing spondylitis: the development of the bath ankylosing spondylitis functional index. *J Rheumatol* 1994;21:2281–5.
40 Fransen J, Langenegger T, Michel BA, *et al*. Feasibility and validity of the RADAI, a self-administered rheumatoid arthritis disease activity index. *Rheumatology (Oxford)* 2000;39:321–7.
41 Healy PJ, Helliwell PS. Measuring clinical enthesitis in psoriatic arthritis: assessment of existing measures and development of an instrument specific to psoriatic arthritis. *Arthritis Rheum* 2008;59:686–91.
42 Jenkinson TR, Mallorie PA, Whitelock HC, *et al*. Defining spinal mobility in Ankylosing Spondylitis (AS). The Bath AS Metrology index. *J Rheumatol* 1994;21:1694–8.
43 Finlay AY, Khan GK. Dermatology life quality index (DLQI)--a simple practical measure for routine clinical use. *Clin Exp Dermatol* 1994;19:210–6.
44 Kohlmann T, Raspe H. Hannover functional questionnaire in ambulatory diagnosis of functional disability caused by backache. *Rehabilitation (Stuttg)* 1996;35:I–VIII.
45 Herdman M, Gudex C, Lloyd A, *et al*. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Qual Life Res* 2011;20:1727–36.
46 Brooks R. Euroqol: the current state of play. *Health Policy* 1996;37:53–72.
47 Topp CW, Østergaard SD, Søndergaard S, *et al*. The WHO-5 well-being index: a systematic review of the literature. *Psychother Psychosom* 2015;84:167–76.
48 Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001;16:606–13.
49 Webster K, Cella D, Yost K. The functional assessment of chronic illness therapy (FACIT) measurement system: properties, applications, and interpretation. *Health Qual Life Outcomes* 2003;1:79.

Primary Endpoints

Table 1: Time from first medical contact to diagnosis

	HR	97.5%-CI	95%-CI	p-Value
Phase (late to early)	1.265	(1.165; 1.373)	(1.177; 1.359)	< 0.001
Age (years)	0.999	(0.997; 1.002)	(0.997; 1.001)	0.44
Sex (female to male)	0.996	(0.926; 1.071)	(0.935; 1.062)	0.9
Suspected diagnosis (SpA to RA)	0.906	(0.814; 1.008)	(0.825; 0.995)	0.038
Suspected diagnosis (PsA to RA)	0.841	(0.771; 0.916)	(0.779; 0.907)	< 0.001
Suspected diagnosis (Other to to RA)	0.651	(0.406; 1.044)	(0.43; 0.984)	0.042
examined by a specialist in rheumatology (Yes to No)	0.485	(0.43; 0.548)	(0.436; 0.539)	< 0.001

Random-Effect Cox-Proportional-Hazard-Model for time-to-event analysis while accounting for site-specific effects. HR = Hazard Ratio, CI = Confidence interval

Table 2: Screening performance

	OR	97.5%-CI	CI (95%)	p-Value
Intercept	0.33	(0.189; 0.576)	(0.203; 0.537)	< 0.001
Phase (late to early)	0.93	(0.807; 1.073)	(0.821; 1.054)	0.256
Age (years)	1.002	(0.997; 1.006)	(0.998; 1.006)	0.396
Sex (female to male)	0.631	(0.553; 0.719)	(0.562; 0.707)	< 0.001
Suspected diagnosis (SpA to RA)	1.226	(1.005; 1.494)	(1.03; 1.458)	0.022
Suspected diagnosis (PsA to RA)	1.663	(1.383; 1.998)	(1.416; 1.952)	< 0.001
Suspected diagnosis (Other to to RA)	0.044	(0.005; 0.427)	(0.006; 0.321)	0.002
examined by a specialist in rheumatology (Yes to No)	0.553	(0.453; 0.677)	(0.464; 0.66)	< 0.001
Medical specialist primary caregiver: Dermatologist to general practitioner	0.973	(0.736; 1.287)	(0.762; 1.243)	0.827
Medical specialist primary caregiver: Internist to general practitioner	1.042	(0.869; 1.25)	(0.889; 1.222)	0.608
Medical specialist primary caregiver: Orthopedist to general practitioner	1.088	(0.901; 1.313)	(0.923; 1.282)	0.317
Medical specialist primary caregiver: rheumatism-bus-tour to general practitioner	0.734	(0.458; 1.176)	(0.486; 1.108)	0.141
Medical specialist primary caregiver: Rheumatologist to general practitioner	2.804	(2.141; 3.67)	(2.215; 3.548)	< 0.001
Medical specialist primary caregiver: Other to general practitioner	0.784	(0.465; 1.322)	(0.497; 1.238)	0.296

Random-Effect logistic regression model for analysing dichotomous endpoints while accounting for site-specific effects. OR = Odds Ratio, CI = Confidence interval

Secondary Endpoints

Table 3: Time from begin of afflictions to diagnosis for RA, Rheuma-VOR vs. DRFZ

	HR	95%-CI	p-Value
Rheuma-VOR to DRFZ	1.568	(1.43; 1.719)	< 0.001
Age at begin of afflictions (years)	1.017	(1.014; 1.02)	< 0.001
Sex (female to male)	0.907	(0.828; 0.994)	0.036
Distance to rheumatologist (km)	1.001	(1; 1.003)	0.009

Cox-Proportional-Hazard-Model weighted by affiliation to the Rheuma-VOR/DRFZ-Cohortfor time-to-event analysis while accounting for site-specific effects. HR = Hazard Ratio, CI = Confidence interval

Table 4: Time from begin of afflictions to diagnosis for SpA, Rheuma-VOR vs. DRFZ

	HR	95%-CI	p-Value
Rheuma-VOR to DRFZ	1.669	(1.346; 2.068)	< 0.001
Age at begin of afflictions (years)	1.024	(1.016; 1.032)	< 0.001
Sex (female to male)	1.089	(0.894; 1.326)	0.4
Distance to rheumatologist (km)	0.999	(0.996; 1.001)	0.3

Cox-Proportional-Hazard-Model weighted by affiliation to the Rheuma-VOR/DRFZ-Cohortfor time-to-event analysis while accounting for site-specific effects. HR = Hazard Ratio, CI = Confidence interval

Table 5: Time from begin of afflictions to diagnosis for PsA, Rheuma-VOR vs. DRFZ

	HR	95%-CI	p-Value
Rheuma-VOR to DRFZ	1.255	(1.074; 1.468)	0.004
Age at begin of afflictions (years)	1.026	(1.02; 1.032)	< 0.001
Sex (female to male)	0.929	(0.799; 1.081)	0.34
Distance to rheumatologist (km)	1.003	(1.001; 1.004)	0.008

Cox-Proportional-Hazard-Model weighted by affiliation to the Rheuma-VOR/DRFZ-Cohortfor time-to-event analysis while accounting for site-specific effects. HR = Hazard Ratio, CI = Confidence interval

Table 6: Disease activity RA, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	3.518	(2.567; 4.468)	< 0.001
Consultation (2 to 1)	-1.631	(-1.802; -1.46)	< 0.001
Sex (female to male)	0.265	(0.044; 0.487)	0.019
Distance to rheumatologist (km)	0.002	(-0.001; 0.004)	0.177
Age (years)	0.019	(0.011; 0.027)	< 0.001
Smoker (yes to no)	0.11	(-0.132; 0.351)	0.373
BMI	0.047	(0.026; 0.069)	< 0.001

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 7: Disease activity SDAI for RA, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	26.624	(10.345; 42.904)	0.001
Consultation (2 to 1)	-14.951	(-17.163; -12.739)	< 0.001
Sex (female to male)	2.733	(-0.107; 5.572)	0.059
Principal diagnosis (PsA to RA)	-0.017	(-0.049; 0.015)	0.306
Distance to rheumatologist (km)	0.138	(0.033; 0.242)	0.01
Age (years)	2.053	(-1.021; 5.128)	0.191
Smoker (yes to no)	0.424	(0.151; 0.697)	0.002
BMI	26.624	(10.345; 42.904)	0.001

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 8: Disease activity PsA, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	2.645	(1.42; 3.869)	< 0.001
Consultation (2 to 1)	-0.765	(-0.995; -0.534)	< 0.001
Sex (female to male)	0.052	(-0.242; 0.345)	0.731
Distance to rheumatologist (km)	0.002	(-0.002; 0.005)	0.339
Age (years)	0.013	(0.001; 0.024)	0.034
Smoker (yes to no)	-0.202	(-0.536; 0.132)	0.236
BMI	0.04	(0.011; 0.069)	0.007

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 9: Disease activity SDAI for PsA, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	20.472	(6.639; 34.304)	0.004
Consultation (2 to 1)	-6.88	(-9.479; -4.281)	< 0.001
Sex (female to male)	-1.175	(-4.173; 1.823)	0.443
Principal diagnosis (PsA to RA)	0.007	(-0.03; 0.043)	0.722
Distance to rheumatologist (km)	0.025	(-0.094; 0.145)	0.677
Age (years)	1.399	(-2.057; 4.855)	0.428
Smoker (yes to no)	0.267	(-0.024; 0.558)	0.072
BMI	20.472	(6.639; 34.304)	0.004

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 10: Disease activity SpA, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	2.308	(1.333; 3.283)	< 0.001
Consultation (2 to 1)	-0.293	(-0.555; -0.032)	0.028
Sex (female to male)	0.109	(-0.243; 0.46)	0.544
Distance to rheumatologist (km)	-0.001	(-0.006; 0.004)	0.81
Age (years)	-0.002	(-0.016; 0.012)	0.782
Smoker (yes to no)	-0.151	(-0.512; 0.211)	0.414
BMI	0.025	(-0.005; 0.055)	0.1

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 11: FFBH, Consultation 1 vs. Consultation 2

	Effect	CI (95%)	p
Intercept	108.102	(95.549; 120.655)	< 0.001
Consultation (2 to 1)	5.896	(4.572; 7.22)	< 0.001
Sex (female to male)	-3.783	(-6.435; -1.131)	0.005
Principal diagnosis (SpA to RA)	-3.782	(-8.378; 0.815)	0.107
Principal diagnosis (PsA to RA)	-0.059	(-3.257; 3.139)	0.971
Distance to rheumatologist (km)	-0.013	(-0.044; 0.019)	0.434
Age (years)	-0.267	(-0.397; -0.137)	< 0.001
Smoker (yes to no)	-1.177	(-3.77; 1.415)	0.373
BMI	-2.96	(-6.435; 0.516)	0.095
duration of complaints (years)	-0.71	(-0.948; -0.473)	< 0.001
Size of residence: > 100.000 to 1 Mio vs. > 1 Mio.	0.123	(-0.2; 0.447)	0.455
Size of residence: > 20.000 to 100.000 vs. > 1 Mio.	-0.143	(-7.844; 7.557)	0.971
Size of residence: > 5.000 to 20.000 vs. > 1 Mio.	-1.721	(-9.04; 5.599)	0.645
Size of residence: <= 5.000 vs. > 1 Mio.	-0.847	(-8.12; 6.425)	0.819
Living situation: Nursing home vs. alone	0.151	(-6.879; 7.181)	0.966
Living situation: Children vs. alone	-17.727	(-45.977; 10.523)	0.219
Living situation: life partners vs. alone	-1.021	(-6.939; 4.897)	0.735
Living situation: Others vs. alone	1.81	(-1.41; 5.03)	0.271
Living situation: life partners and Nursing home vs. alone	0.171	(-6.118; 6.461)	0.957
Living situation: Others and Nursing home vs. alone	17.99	(-10.274; 46.255)	0.212
Living situation: life partners and Children vs. alone	20.636	(-7.654; 48.926)	0.153
Living situation: Others and Children vs. alone	3.389	(-0.438; 7.215)	0.083
Living situation: Others and life partners vs. alone	-2.054	(-18.597; 14.489)	0.808
Living situation: Others, life partners and Children vs. alone	11.73	(-3.275; 26.735)	0.125

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 12: EQ-5D, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	0.847	(0.682; 1.013)	< 0.001
Consultation (2 to 1)	0.125	(0.1; 0.149)	< 0.001
Sex (female to male)	-0.026	(-0.058; 0.007)	0.127
Principal diagnosis (SpA to RA)	-0.037	(-0.094; 0.02)	0.206
Principal diagnosis (PsA to RA)	-0.006	(-0.046; 0.034)	0.773
Distance to rheumatologist (km)	0	(-0.001; 0)	0.061
Age (years)	-0.001	(-0.003; 0)	0.113
Smoker (yes to no)	-0.041	(-0.077; -0.006)	0.022
retired (yes to no)	-0.041	(-0.088; 0.007)	0.092
BMI	-0.006	(-0.009; -0.003)	< 0.001
duration of complaints (years)	-0.004	(-0.008; 0)	0.072
Size of residence: > 100.000 to 1 Mio vs. > 1 Mio.	0.01	(-0.086; 0.105)	0.843
Size of residence: > 20.000 to 100.000 vs. > 1 Mio.	-0.033	(-0.124; 0.058)	0.475
Size of residence: > 5.000 to 20.000 vs. > 1 Mio.	-0.039	(-0.129; 0.052)	0.402
Size of residence: <= 5.000 vs. > 1 Mio.	-0.038	(-0.125; 0.049)	0.393
Living situation: Nursing home vs. alone	0.019	(-0.443; 0.48)	0.937
Living situation: Children vs. alone	0.034	(-0.048; 0.116)	0.415
Living situation: life partners vs. alone	0.032	(-0.011; 0.075)	0.14
Living situation: Others vs. alone	-0.036	(-0.122; 0.051)	0.42
Living situation: life partners and Nursing home vs. alone	0.152	(-0.312; 0.616)	0.521
Living situation: Others and Nursing home vs. alone	0.145	(-0.316; 0.606)	0.538
Living situation: life partners and Children vs. alone	0.037	(-0.013; 0.088)	0.149
Living situation: Others and Children vs. alone	-0.047	(-0.316; 0.222)	0.732
Living situation: Others and life partners vs. alone	0.168	(-0.057; 0.394)	0.144
Living situation: Others, life partners and Children vs. alone	-0.013	(-0.154; 0.128)	0.86

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 13: FACIT Fatique, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	38.647	(30.46; 46.835)	< 0.001
Consultation (2 to 1)	3.065	(2.251; 3.879)	< 0.001
Sex (female to male)	-1.538	(-3.092; 0.017)	0.052
Principal diagnosis (SpA to RA)	-2.554	(-5.252; 0.144)	0.064
Principal diagnosis (PsA to RA)	-0.464	(-2.343; 1.416)	0.629
Distance to rheumatologist (km)	-0.011	(-0.03; 0.007)	0.234
Age (years)	-0.006	(-0.082; 0.071)	0.88
Smoker (yes to no)	-1.206	(-2.754; 0.342)	0.127
retired (yes to no)	-0.034	(-2.112; 2.045)	0.975
BMI	-0.282	(-0.422; -0.142)	< 0.001
duration of complaints (years)	-0.095	(-0.286; 0.097)	0.332
Size of residence: > 100.000 to 1 Mio vs. > 1 Mio.	-0.98	(-5.501; 3.541)	0.671
Size of residence: > 20.000 to 100.000 vs. > 1 Mio.	-0.902	(-5.199; 3.394)	0.681
Size of residence: > 5.000 to 20.000 vs. > 1 Mio.	-0.147	(-4.422; 4.127)	0.946
Size of residence: <= 5.000 vs. > 1 Mio.	-0.015	(-4.149; 4.119)	0.994
Living situation: Nursing home vs. alone	1.026	(-16.227; 18.279)	0.907
Living situation: Children vs. alone	-0.461	(-3.975; 3.052)	0.797
Living situation: life partners vs. alone	2.909	(1.001; 4.817)	0.003
Living situation: Others vs. alone	1.399	(-2.339; 5.138)	0.463
Living situation: life partners and Nursing home vs. alone	2.752	(-14.516; 20.02)	0.755
Living situation: Others and Nursing home vs. alone	-5.232	(-22.423; 11.958)	0.551
Living situation: life partners and Children vs. alone	1.915	(-0.342; 4.172)	0.096
Living situation: Others and Children vs. alone	-3.08	(-13.134; 6.973)	0.548
Living situation: Others and life partners vs. alone	9.413	(0.389; 18.438)	0.041
Living situation: Others, life partners and Children vs. alone	2.774	(-3.139; 8.686)	0.358

Random-Effect linear regression model for analyzing continuous endpoints with consideration of site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 14: WHO-5, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	57.399	(37.525; 77.274)	< 0.001
Consultation (2 to 1)	10.176	(8.028; 12.324)	< 0.001
Sex (female to male)	-2.217	(-6.023; 1.589)	0.254
Principal diagnosis (SpA to RA)	-6.529	(-13.158; 0.1)	0.054
Principal diagnosis (PsA to RA)	-2.977	(-7.574; 1.62)	0.204
Distance to rheumatologist (km)	-0.019	(-0.064; 0.027)	0.415
Age (years)	-0.092	(-0.283; 0.098)	0.342
Smoker (yes to no)	-4.857	(-8.725; -0.989)	0.014
retired (yes to no)	5.994	(0.754; 11.235)	0.025
BMI	-0.686	(-1.031; -0.34)	< 0.001
duration of complaints (years)	-0.017	(-0.486; 0.451)	0.942
Size of residence: > 100.000 to 1 Mio vs. > 1 Mio.	-2.897	(-13.947; 8.154)	0.607
Size of residence: > 20.000 to 100.000 vs. > 1 Mio.	-4.626	(-15.127; 5.876)	0.388
Size of residence: > 5.000 to 20.000 vs. > 1 Mio.	0.707	(-9.737; 11.151)	0.894
Size of residence: <= 5.000 vs. > 1 Mio.	-0.139	(-10.244; 9.965)	0.978
Living situation: Nursing home vs. alone	-3.186	(-47.717; 41.346)	0.888
Living situation: Children vs. alone	-0.739	(-9.7; 8.221)	0.872
Living situation: life partners vs. alone	5.412	(0.645; 10.18)	0.026
Living situation: Others vs. alone	-2.278	(-11.661; 7.105)	0.634
Living situation: life partners and Nursing home vs. alone	-13.617	(-58.352; 31.119)	0.551
Living situation: Others and Nursing home vs. alone	-0.684	(-45.213; 43.844)	0.976
Living situation: life partners and Children vs. alone	4.848	(-0.78; 10.476)	0.091
Living situation: Others and Children vs. alone	-11.91	(-37.96; 14.139)	0.37
Living situation: Others and life partners vs. alone	26.207	(3.146; 49.268)	0.026
Living situation: Others, life partners and Children vs. alone	11.333	(-3.61; 26.277)	0.137

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 15: PHQ-9, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	4.826	(1.002; 8.649)	0.013
Consultation (2 to 1)	-1.611	(-2.017; -1.205)	< 0.001
Sex (female to male)	0.651	(-0.095; 1.398)	0.087
Principal diagnosis (SpA to RA)	1.49	(0.196; 2.783)	0.024
Principal diagnosis (PsA to RA)	0.1	(-0.804; 1.005)	0.828
Distance to rheumatologist (km)	0.004	(-0.005; 0.012)	0.439
Age (years)	0.024	(-0.013; 0.061)	0.2
Smoker (yes to no)	0.439	(-0.313; 1.191)	0.253
retired (yes to no)	-0.762	(-1.771; 0.246)	0.138
BMI	0.117	(0.049; 0.185)	< 0.001
duration of complaints (years)	0.015	(-0.078; 0.107)	0.756
Size of residence: > 100.000 to 1 Mio vs. > 1 Mio.	1.263	(-0.902; 3.428)	0.253
Size of residence: > 20.000 to 100.000 vs. > 1 Mio.	1.138	(-0.923; 3.198)	0.279
Size of residence: > 5.000 to 20.000 vs. > 1 Mio.	0.642	(-1.405; 2.688)	0.539
Size of residence: <= 5.000 vs. > 1 Mio.	0.251	(-1.727; 2.23)	0.803
Living situation: Nursing home vs. alone	1.831	(-6.653; 10.315)	0.672
Living situation: Children vs. alone	-0.299	(-2.041; 1.443)	0.736
Living situation: life partners vs. alone	-1.074	(-1.998; -0.151)	0.023
Living situation: Others vs. alone	0.108	(-1.725; 1.94)	0.908
Living situation: life partners and Nursing home vs. alone	6.093	(-2.388; 14.574)	0.159
Living situation: Others and Nursing home vs. alone	-3.55	(-11.989; 4.889)	0.41
Living situation: life partners and Children vs. alone	-1.043	(-2.143; 0.056)	0.063
Living situation: Others and Children vs. alone	0.687	(-4.251; 5.624)	0.785
Living situation: Others and life partners vs. alone	-2.835	(-7.247; 1.577)	0.208
Living situation: Others, life partners and Children vs. alone	-1.309	(-4.224; 1.606)	0.379

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 16: RADAI, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	4.656	(3.182; 6.129)	< 0.001
Consultation (2 to 1)	-1.719	(-1.941; -1.497)	< 0.001
Sex (female to male)	0.255	(-0.08; 0.589)	0.136
Distance to rheumatologist (km)	0.004	(0; 0.007)	0.046
Age (years)	0.004	(-0.008; 0.017)	0.483
Smoker (yes to no)	0.166	(-0.187; 0.519)	0.357
BMI	0.045	(0.013; 0.077)	0.005
duration of complaints (years)	-0.007	(-0.069; 0.054)	0.818

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 17: RAID, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	4.113	(2.366; 5.861)	< 0.001
Consultation (2 to 1)	-1.7	(-1.961; -1.439)	< 0.001
Sex (female to male)	0.404	(0; 0.809)	0.05
Distance to rheumatologist (km)	0.004	(0; 0.009)	0.065
Age (years)	0.006	(-0.009; 0.021)	0.423
Smoker (yes to no)	0.364	(-0.062; 0.789)	0.094
BMI	0.07	(0.032; 0.108)	< 0.001
duration of complaints (years)	-0.025	(-0.1; 0.049)	0.509

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 18: KOF, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	4.721	(1.228; 8.213)	0.008
Consultation (2 to 1)	-1.388	(-2.044; -0.731)	< 0.001
Sex (female to male)	-0.658	(-1.642; 0.326)	0.19
Distance to rheumatologist (km)	0.002	(-0.009; 0.014)	0.697
Age (years)	-0.021	(-0.06; 0.018)	0.287
Smoker (yes to no)	0.019	(-1.059; 1.097)	0.972
BMI	0.037	(-0.056; 0.13)	0.433
duration of complaints (years)	0.029	(-0.056; 0.115)	0.502

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 19: DLQI, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	6.922	(-0.709; 14.554)	0.075
Consultation (2 to 1)	-2.769	(-3.693; -1.845)	< 0.001
Sex (female to male)	-0.931	(-2.544; 0.681)	0.258
Distance to rheumatologist (km)	0.001	(-0.019; 0.021)	0.929
Age (years)	-0.026	(-0.105; 0.053)	0.517
Smoker (yes to no)	0.636	(-1.082; 2.354)	0.468
retired (yes to no)	-0.54	(-2.88; 1.8)	0.651
BMI	0.129	(-0.025; 0.283)	0.102
duration of complaints (years)	-0.023	(-0.182; 0.136)	0.776
Size of residence: > 100.000 to 1 Mio vs. > 1 Mio.	3.277	(-2.241; 8.795)	0.244
Size of residence: > 20.000 to 100.000 vs. > 1 Mio.	2.143	(-3.359; 7.644)	0.445
Size of residence: > 5.000 to 20.000 vs. > 1 Mio.	3.404	(-2.046; 8.854)	0.221
Size of residence: <= 5.000 vs. > 1 Mio.	3.067	(-2.314; 8.449)	0.264
Living situation: Children vs. alone	-1.617	(-6.895; 3.66)	0.548
Living situation: life partners vs. alone	-2.3	(-4.452; -0.148)	0.036
Living situation: Others vs. alone	-3.29	(-6.944; 0.365)	0.078
Living situation: life partners and Children vs. alone	-0.535	(-2.882; 1.811)	0.655
Living situation: Others and Children vs. alone	-1.747	(-7.906; 4.411)	0.578
Living situation: Others and life partners vs. alone	-3.401	(-16.159; 9.356)	0.601
Living situation: Others, life partners and Children vs. alone	3.165	(-4.392; 10.723)	0.412

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 20: LEI, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	0.907	(-0.189; 2.003)	0.105
Consultation (2 to 1)	-0.456	(-0.652; -0.259)	< 0.001
Sex (female to male)	0.121	(-0.154; 0.396)	0.387
Distance to rheumatologist (km)	-0.003	(-0.006; 0)	0.088
Age (years)	0.001	(-0.01; 0.013)	0.808
Smoker (yes to no)	-0.218	(-0.525; 0.088)	0.162
BMI	0.018	(-0.008; 0.045)	0.175
duration of complaints (years)	0.004	(-0.021; 0.028)	0.772

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 21: BASFI, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	0.633	(-1.749; 3.015)	0.602
Consultation (2 to 1)	-0.734	(-1.259; -0.209)	0.006
Sex (female to male)	0.052	(-0.817; 0.921)	0.907
Distance to rheumatologist (km)	-0.009	(-0.022; 0.003)	0.148
Age (years)	0.011	(-0.027; 0.049)	0.566
Smoker (yes to no)	-0.052	(-0.9; 0.796)	0.905
BMI	0.111	(0.035; 0.187)	0.004
duration of complaints (years)	0.062	(-0.033; 0.158)	0.2

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 22: BASMI, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	-0.511	(-2.304; 1.281)	0.576
Consultation (2 to 1)	-0.518	(-1.05; 0.014)	0.057
Sex (female to male)	-0.774	(-1.394; -0.154)	0.014
Distance to rheumatologist (km)	-0.007	(-0.017; 0.003)	0.166
Age (years)	0.023	(-0.004; 0.05)	0.094
Smoker (yes to no)	0.579	(-0.089; 1.246)	0.089
BMI	0.065	(0.01; 0.119)	0.02
duration of complaints (years)	0.042	(-0.023; 0.106)	0.208

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 23: BASDAI, Consultation 1 vs. Consultation 2

	Effect	95%-CI	p-Value
Intercept	4.273	(2.133; 6.413)	< 0.001
Consultation (2 to 1)	-1.077	(-1.535; -0.619)	< 0.001
Sex (female to male)	0.291	(-0.49; 1.071)	0.466
Distance to rheumatologist (km)	-0.008	(-0.02; 0.003)	0.149
Age (years)	-0.01	(-0.043; 0.024)	0.575
Smoker (yes to no)	-0.058	(-0.816; 0.7)	0.881
BMI	0.076	(0.008; 0.145)	0.029
duration of complaints (years)	0.037	(-0.047; 0.121)	0.386

Random-Effect linear regression model for analyzing continuous endpoints while accounting for site-specific effects. Effect = Influence of this factor, CI = Confidence interval

Table 24: Comparison of health economic variables

	Rheuma-VOR n (%)	DRFZn (%)	Significance
Hospitalisation Consultation 1	101 (7.2)	219 (15.7)	$X^{2*} = (1) = 81.824$; $p < .001$
Days of hospitalisation, Mean (SD) Median	14.32 (29.64) 10	14.04 (18.60) 10	U** = 9126.000; Z = -1.724; p = 0.085
Hospitalisation Consultation 2	55 (9.3)	75 (12.7)	$X^2 = (1)$ 9.623; p = .002
Days of hospitalisation, Mean (SD) Median	13.98 (7.57) 14	11.31 (6.69) 10	U = 1410.500; Z = -2.349; p = 0.019
Workabilty Consultation 1			
Currently incapacitated	215 (15.4)	155 (11.1)	$X^2 = (1) = 0.007$; p = 0.954
Last 12 months incapacitated	367 (26.3)	337 (24.2)	$X^2 = (1) = 33.175$; $p < 0.001$
Number of days of incapacity Mean (SD) Median	38.15 (64.96) 15	50.08 (77.15) 21	U = 45460.000; Z = -2.275; p = 0.023
Workabilty Consultation 2			
Currently incapacitated	36 (6.1)	55 (9.3)	$X^2 = (1) = 14.474$; $p < 0.001$
Last 12 months incapacitated	130 (22.1)	122 (20.7)	$X^2 = (1) = 33.175$; $p < 0.001$
Number of days of incapacity Mean (SD) Median	78.48 (123.39) 20	84.68 (117.02) 24	U = 5568.500; Z = -.762; p = 0.446
Rehabilitation Consultation 1	73 (5.2)	120 (8.6)	$X^2 = (4) = 2193.628$; p = .000
Number of weeks inpatient rehabilitation MW (SD) Mean	4.20 (2.76) 3	3.44 (1.35) 3	U = 1409.500; Z = -1.062; p = 0.288
Rehabilitation Consultation	90 (15.2)	65 (11.0)	$X^2 = (4) = 902.591$; $p < .001$
Number of weeks inpatient rehabilitation	4.56 (4.40) 3	3.45 (1.89) 3	U = 1230.000; Z = -2.208; p = 0.027
Biologics Consultation 1	34 (2.4)	178 (11.8)	U= 881470.000; Z=-9.651; $p < 0.001$
Biologics Consultation 2	86 (14.60)	94 (15.96)	U= 172282.500; Z= -0.328; p = 0.743

*** X^2 = Chi-Quadrat** **** U= Mann-Whitney-U Test**

Tabelle 25: Sensitivity Analaysis, Time from first medical contact to diagnosis

	HR	97.5%-KI	95%-KI	p-Wert
Phase (late to early)	1.151	(1.069; 1.24)	(1.079; 1.229)	< 0.001

Cox-Proportional-Hazard-Model for time-to-event analysis. HR = Hazard Ratio, CI = Confidence interval

Tabelle 26: Sensitivity Analaysis, Time from first medical contact to diagnosis

	HR	KI (97.5%)	KI (95%)	p-Wert
Phase (late to early)	1.265	(1.177; 1.359)	(1.177; 1.359)	< 0.001
Suspected diagnosis (SpA to RA)	0.917	(0.84; 1.002)	(0.825; 0.994)	0.054
Suspected diagnosis (PsA to RA)	0.844	(0.783; 0.909)	(0.779; 0.906)	< 0.001
Suspected diagnosis (Other to to RA)	0.659	(0.436; 0.995)	(0.43; 0.984)	0.047
examined by a specialist in rheumatology (Yes to No)	0.486	(0.437; 0.54)	(0.436; 0.539)	< 0.001

Random-Effect Cox-Proportional-Hazard-Model for time-to-event analysis while accounting for site-specific effects. HR = Hazard Ratio, CI = Confidence interval