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# Healing beyond the joint: Addressing mental health in periprosthetic joint infection in a prospective longitudinal study

Nike Walter<sup>a,b</sup>, Melvin Mohokum<sup>c</sup>, Thomas Loew<sup>a</sup>, Markus Rupp<sup>b,\*</sup>, Volker Alt<sup>b</sup>

<sup>a</sup> Department for Psychosomatic Medicine, University Hospital Regensburg, Franz-Josef-Strauß-Allee 11, 93053 Regensburg, Germany

<sup>b</sup> Department for Trauma Surgery, University Hospital Regensburg, Franz-Josef-Strauß-Allee 11, 93053 Regensburg, Germany

<sup>c</sup> Faculty of Health, Safety, Society, Furtwangen University, Konrad-Goldmann-Str. 5c, 79100 Freiburg, Germany

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## ABSTRACT

**Objective:** Periprosthetic joint infection (PJI) is a devastating complication following joint replacement surgeries. While the somatic impacts of PJI have been extensively explored, the influence on mental health remains understudied. This study aimed to longitudinally assess the psychological burden, quality of life, and expectations in individuals undergoing treatment for PJI.

**Methods:** A prospective study was conducted at a German trauma center between January 2020 and December 2022. Patients diagnosed with PJI ( $n = 29$ , mean age  $71.4 \pm 8.8$  years) were assessed at five timepoints, within one week before revision surgery, one month, three, six, and twelve months postoperatively. Outcomes included the ICD-10 symptom-rating (ISR), German Short-Form 36 (SF-36), European Quality of Life 5 Dimensions (EQ-5D), and an expectation questionnaire.

**Results:** Psychological scores exhibited significant upward trends over time. The ISR score increased from 0.55 preoperatively to 0.87 at the 12-month follow-up ( $p = 0.002$ ), surpassing the clinically relevant threshold. Depression and anxiety scores peaked at 6 months ( $1.6$ ,  $p = 0.005$ ) and 12 months ( $1.12$ ,  $p = 0.001$ ), respectively. Quality of life, measured by SF-36, showed stable physical component summary scores but declining mental component summary scores. Patients' expectations of returning to normal health consistently decreased ( $p = 0.009$ ).

**Conclusion:** Patients undergoing treatment for PJI experience significant psychological burden, with implications for quality of life and expectations of recovery. The findings underscore the importance of addressing psychological well-being in the management of PJI and emphasize the need for comprehensive care strategies that encompass both somatic and psychological dimensions.

## 1. Introduction

Periprosthetic joint infection (PJI), a devastating complication following joint replacement surgery, poses a significant challenge to patients, orthopedic surgeons, and the healthcare system as a whole. As joint arthroplasty procedures continue to gain traction as a successful intervention for relieving pain and restoring function, the prevalence of PJI has surged, underscoring the importance of understanding its multifaceted impact (1). PJI not only impairs joint function but also engenders systemic repercussions, leading to prolonged hospitalization, repeated surgeries, increased healthcare costs, and the potential for long-term disability (2).

Clinical parameters play a pivotal role in gauging the severity and

extent of infection. These parameters encompass inflammatory markers, identified pathogens, imaging studies, and diagnostic criteria, which collectively aid in establishing a definitive diagnosis and informing treatment strategies (3). However, while these clinical parameters are indispensable for the management of PJI, they predominantly capture the physiological manifestations of the infection.

Amid the emphasis on somatic parameters, an often-underappreciated facet is the profound impact of PJI on mental health and overall well-being. The emotional toll of PJI extends beyond the physical realm, affecting psychological and social dimensions of patients' lives (4). Symptoms on the continuum of anxiety and depression as well as uncertainty, and frustration are just a few of the emotional challenges that individuals grappling with PJI may encounter (5,6). The

\* Corresponding author at: Department of Trauma Surgery, University Hospital Regensburg, Franz-Josef-Strauß-Allee 11, 93053 Regensburg, Germany.

E-mail address: [markus.rupp@ukr.de](mailto:markus.rupp@ukr.de) (M. Rupp).

journey from diagnosis to treatment and recovery is fraught with uncertainty, engendering feelings of helplessness and distress (7). Moreover, the disruption of daily activities, functional limitations, and the specter of recurrent infections can lead to a deterioration in mental health.

Despite the profound ramifications of PJI on both somatic and psychological well-being, the exploration of its mental health implications remains relatively uncharted territory. The existing body of literature predominantly centers on clinical parameters and functional outcomes, often overlooking the intricate interplay between PJI and mental health (7). Although, there has been a burst of interest in mental health among orthopedic surgical patients in general, studies that comprehensively examine the full spectrum of challenges faced by affected individual with PJI are notably scarce (8,9).

Therefore, the aim of this study was a longitudinal evaluation of patients' (i) psychological wellbeing, (ii) quality of life, and (iii) improvement expectations.

## 2. Methods

### 2.1. Design, setting and participants

A prospective, longitudinal study of patients treated for PJI was conducted in a level 1 trauma center in Germany. The inclusion period was defined from January 2020 to December 2022. PJI was verified in all cases according to the European Bone and Joint Infection Society consensus for diagnosis (3).

The exclusion criteria included patients with a known comorbid psychological disorder according to chapter F of the ICD-10, malignancy, an additional periprosthetic fractures or antibiotic therapy due to any other infectious disease. Additionally, to address missing values, only patients who had completed all questionnaires in full were considered. Eligible patients aged 18 years or older were consecutively enrolled. Patients were enrolled regardless of whether they presented with primary infection or reinfection. A total of  $n = 38$  patients were initially enrolled in the study, however,  $n = 2$  patients died during the follow-up period,  $n = 4$  were not willing to continue the study and dropped out, and  $n = 3$  were excluded due to incomplete questionnaires.

Informed consent was obtained from all individual participants included. The study was approved by the institutional ethics committee of the University Hospital Regensburg according to the Helsinki Convention (file number 20-1680-101). This study was registered at the German Clinical Trials Register (DRKS, file number: 00025492).

### 2.2. Outcome measures

The following patient-reported outcome measures (PROMs) were assessed at five different timepoints, specifically within one week before revision surgery, one month postoperatively, after three, six, and twelve months, respectively. The questionnaires were administered by the study team in person during inpatient treatment and ambulatory visits.

ICD-10- symptom-rating (ISR): The ISR is an inventory for symptom rating based on the ICD-10 classification system. It serves as a license-free alternative to the well-known international SCL90 (Symptom Checklist 90). In a comparative study, the total scales of ISR and SCL-90 showed a strong correlation of  $r = 0.833$  (10). The ISR comprises 29 items, and respondents rate each item on a 5-point scale ranging from "does not apply", "applies barely", "applies somewhat", "applies significantly", "applies extremely". The inventory assesses various factors, including depression, anxiety, obsession, somatic symptoms, eating disorders, as well as additional supplementary factors related to suicide, sleep problems, memory issues, sexuality, and traumatic experiences (11). The overall internal consistency of the ISR is high, with a Cronbach's alpha of 0.92 for the total score, and the syndrome scales show good internal consistency as well, ranging between 0.78 and 0.86 (12).

German Short-Form 36 (SF-36): The extensively employed SF-36

health survey assesses overall health status through 36 questions across eight functional domains, which include physical function, role physical, bodily pain, general health, vitality, social function, emotional role, and mental health (13). Summary scores for the physical and mental components were derived utilizing normative data from a 1998 German national health interview and examination survey involving 7124 participants (14). The overall Cronbach  $\alpha$  was reported to be above 0.70 in multiple studies (15).

European Quality of Life 5 Dimensions (EQ-5D): The EQ-5D stands as a widely recognized and extensively utilized generic quality of life assessment tool, developed by the EuroQol group (16). This instrument encompasses five distinct dimensions that probe into various functional domains: mobility, self-care, everyday life activities, pain/discomfort, and anxiety/depression. Furthermore, the efficacy of the EQ-5D was gauged through the implementation of the visual analogue scale (VAS) methodology (17). For the EQ-5D an acceptable internal consistency reliability (Cronbach's alpha = 0.77), and a good test-retest reliability (intra-class correlation coefficient = 0.77) has been calculated (18).

Expectation Questionnaire: To assess patients' expectations, the German version of the HSS expectation questionnaire, originally developed for hip joint replacement was used (19,20). The instrument consists of 18 items assessing the four dimensions "everyday activity," "pain relief and functional improvement," "medication and social participation," and "gait improvement". The items are rated on a 4-point- Likert scale ranging from "Back to normal state or complete improvement" to "Not back to normal state, but a slight improvement". The internal consistency was determined with a Cronbach's alpha of 0.89 (19).

### 2.3. Statistics

The analysis of the data was conducted using SPSS Statistics version 28.0 (IBM, USA). Descriptive measures were computed for all the variables. Mean and standard deviation (SD) were used to express continuous variables. To compare continuous variables a repeated measures ANOVA with a Bonferroni-adjusted post-hoc analysis was calculated, following confirmation of suitable distribution for parametric testing through Levene's test. There were no violations of sphericity. Pearson correlation was used to test for associations between the ISR, quality of life scores and the expectation scores. Significance was set at  $p < 0.05$ .

## 3. Results

In total, 29 patients were included in the study. The gender distribution was nearly equal, with 14 patients (48%) being male and 15 patients (52%) female. The average age of the patients was 71.4 years (SD 8.8). Anatomically, the infections were localized in the hip for 14 patients (48%) and in the knee for the remaining 15 patients (52%). The majority of the patients was treated with a two-stage exchange (66%). Of the total cases, 9 (31%) presented with a reinfection (Table 1).

Over various time intervals, participants' psychological scores demonstrated significant upward trends. Preoperatively, the total ISR score was 0.55. After one month, it increased to 0.61, followed by a rise to 0.64 at three months. The six-month assessment showed a further increase to 0.76, and the 12-month follow-up displayed the highest total score of 0.87, which was statistically significantly higher compared to the preoperative score ( $p = 0.002$ ). Notably, the clinically relevant threshold for symptom burden, set at 0.60, was exceeded one month after surgery. In terms of the depression subscale, the threshold for symptom burden (1.0) was crossed at each evaluation timepoint. After surgery, the score increased and reached a maximum of 1.6 at 6 months ( $p = 0.005$ ). Similarly, the anxiety score displayed a consistent upward trajectory over time. With a preoperative value of 0.37, it rose to 1.12 at the 12-month follow-up ( $p = 0.001$ ), surpassing the defined threshold for symptom burden of 1.0 (Fig. 1).

In addition, participants' quality of life was assessed using the SF-36

**Table 1**  
Patient characteristics.

Patients	n = 29
Sex	
Male	14 (48%)
Female	15 (52%)
Age	71.4 (8.8) years
Anatomical localization	
Hip	14 (48%)
Knee	15 (52%)
Previous reinfection cases	9 (31%)
Type of prosthesis	
Standard	17 (59%)
Revision	12 (41%)
Revision rate	1.9 (range 1–5)
Surgical procedure	
DAIR	7 (24%)
One-stage exchange	1 (4%)
Two-stage exchange	19 (66%)
Amputation	2 (7%)
Infection eradication	25 (86%)

DAIR = debridement, antibiotics and implant retention.

questionnaire, from which the Physical Component Summary (PCS) and Mental Component Summary (MCS) scores were calculated. The preoperative PCS score was 28.91. At one month postoperatively, the PCS score decreased to 25.08, followed by a modest increase to 26.18 at three months. Notably, the six-month evaluation demonstrated a further decline in PCS score to 24.59, which stabilized at 26.90 at the 12-month follow-up. On the other hand, the preoperative MCS score was 44.58. Postoperatively, the MCS score decreased to 40.93 at one month and slightly further to 38.93 at three months. This trend continued, with the MCS score decreasing to 34.78 at the six-month assessment. While the 12-month follow-up showed a slight improvement to 35.24, it remained lower compared to the preoperative value ( $p = 0.023$ ) (Fig. 2).

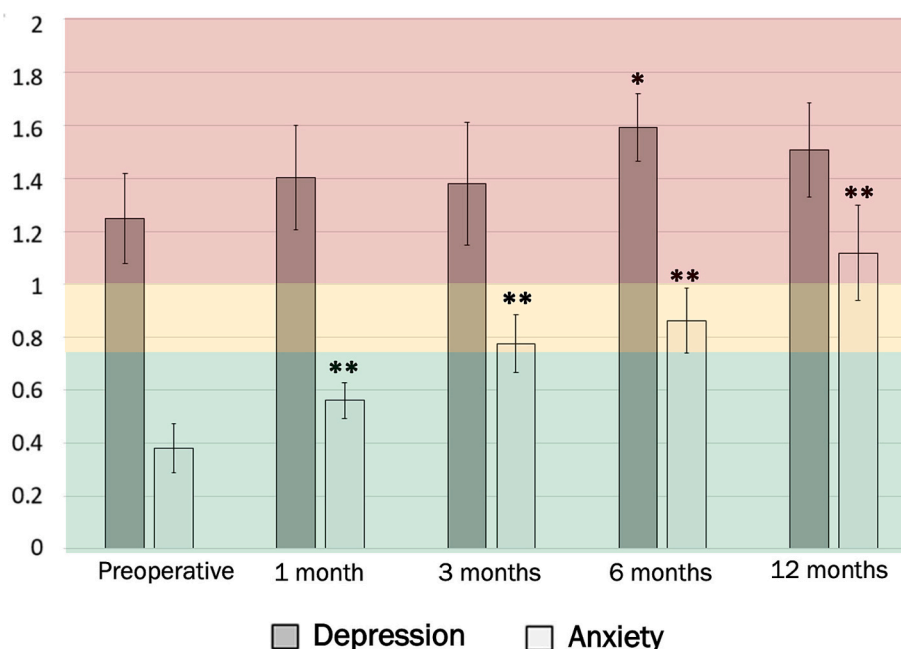
Regarding, the EQ-5D subdimension, a positive outcome was observed. For mobility, participants showed an initial mild limitation

(50%) preoperatively, which notably improved by the 12-month assessment, with only 5% reporting severe limitations. A decreasing trend in limitations was observed in self-care, as mild limitations decreased from 59% preoperatively to 10% at 12 months. The trend in usual activities demonstrated a reduction in severe limitations from 33% preoperatively to 29% at 12 months. Additionally, the percentage of participants reporting no problems increased from 11% to 24%, indicating a gradual improvement in performing everyday activities. While pain and discomfort limitations fluctuated, a trend of decreasing severe limitations was evident. Severe limitations decreased from 56% preoperatively to 33% at 12 months. Anxiety/depression limitations showed fluctuations with mild limitations reaching their peak at 63% at three months before decreasing to 48% at 12 months. The EQ-5D VAS score was relatively stable over time without statistically significant differences (Supplementary fig. 1).

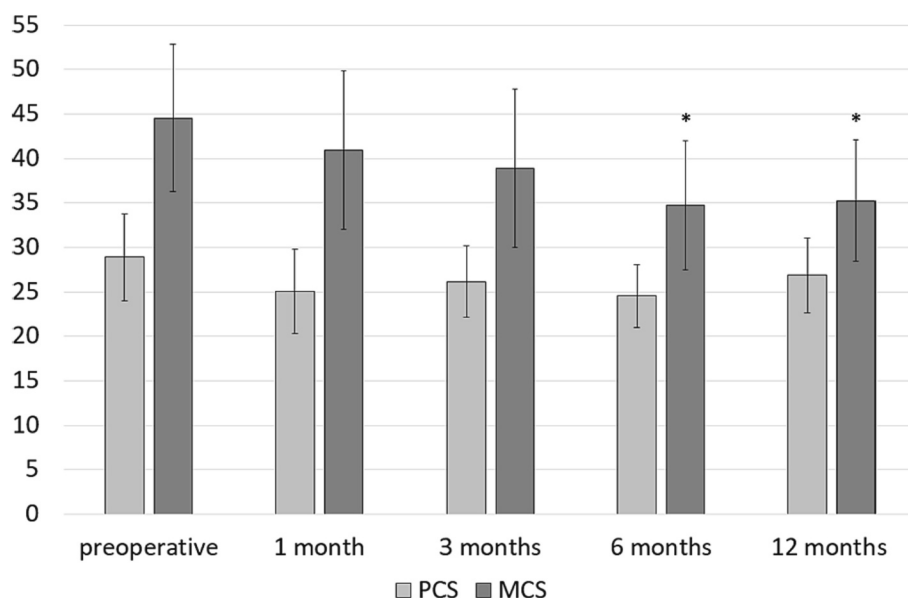
Participants' expectations of returning to a state of normal health exhibited a consistent declining trend over the study period. Preoperatively, the expectation score was 1.6, indicating relatively higher expectations for returning to normal health. However, this score gradually decreased at subsequent time intervals, reaching 1.8 at one month, 2.1 at three months ( $p = 0.0223$ ), 2.4 at six months ( $p \leq 0.001$ ), and finally, 2.4 at the 12-month follow-up ( $p = 0.009$ ) (Fig. 3). The Pearson correlation did not reveal any statistically significant association between the ISR, the quality-of-life scores and the expectation scores.

#### 4. Discussion

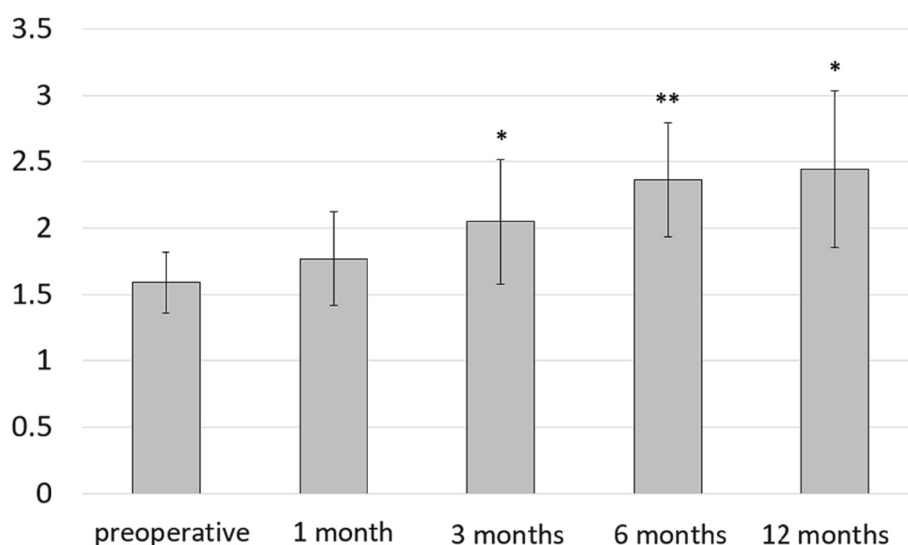
The study explored the psychological burden, quality of life, and improvement expectations of patients undergoing treatment for PJI. The findings revealed that patients experienced increasing psychological symptoms over time, as evidenced by rising ISR scores, particularly in depression and anxiety subscales. Quality of life assessments using the SF-36 questionnaire demonstrated a temporary decline in physical well-being postoperatively, along with a gradual decrease in mental well-being. Whereas functional improvement was observed across various dimensions. Notably, patients' expectations of returning to normal health declined consistently over the study period, paralleling the trends in psychological symptoms.



**Fig. 1.** Mean values of the ISR responses shown for the subscale depression and the subscale anxiety. Higher scores stand for higher symptom burden. The threshold for clinically relevant symptom burden is and 1.0 for depression and anxiety, respectively. \* $p \leq 0.05$ , \*\* $p \leq 0.001$ .



**Fig. 2.** Mean physical health component score (PCS) shown in light grey and mean mental health component score (MCS) shown in dark grey assessed with the SF-36. Lower scores are interpreted as declining quality of life. \* $p \leq 0.05$ , \*\* $p \leq 0.001$ .



**Fig. 3.** Mean expectation scores. Higher scores depict lower expectation to return to a state of normal health. \* $p \leq 0.05$ , \*\* $p \leq 0.001$ .

#### 4.1. Psychological burden

The evaluation of the ISR revealed that patients surpassed the clinically relevant threshold for symptom burden one months after surgery, which gradually increased over time, also concerning the subscales depression and anxiety. In line with this findings, Knebel et al. showed that the value for depression of the Patient Health Questionnaire (PHQ) was above the cut-off in 58.1% of PJI patients (4). Another study also revealed that 58.3% of the PJI patients reported scores crossing the cut-off value for depression of the ISR, even up to more than four years after successful surgery (21). Despite clear indications from PJI patients about their requirement for psychological assistance (5,22), there has been a noticeable absence of research investigating supportive interventions. For instance, Kunutsor and colleagues screened 4213 articles on the treatment of PJI and could not identify even one evaluation adjunct psychological therapies (9). This underscores the inadequacy of effective approaches in tackling the mental challenges associated with musculoskeletal infections, although research has demonstrated that the

presence of concurrent depression or anxiety prior to surgery serves as an indicator of heightened postoperative complications, such as infections, following total joint arthroplasty, as well as notably elevated hospitalization expenses (23–25). Already the decision to seek care and accept an offer of arthroplasty surgery can be influenced by individual mindsets. Notably, it has been shown that pain intensity before primary total knee arthroplasty could serve as a significant factor in determining the need for revision surgery in cases of unresolved symptoms, particularly in the absence of clear pathology or technical issues, suggesting a strong relationship between mental health and reasons for revision surgeries (26). Thus, mental health should be considered in musculoskeletal care at all times. In addition, a nationwide analysis for Germany showed that a quarter of all PJI patients (4043/16,174) exhibited comorbidities in the realm of mental and behavioral disorders, with the number of patients with psychological comorbidities doubling in the last decade (27). Besides, previous diagnoses, also the prevalence of depressive symptoms is elevated up to four times in patients undergoing two-staged exchange compared to patients undergoing aseptic revisions

(40.5% vs 10.8%,  $p < 0.01$ ) (28).

As a result, it becomes crucial to direct future research efforts towards comprehending the psychological welfare of orthopedic patient groups (29). It is well known that a multidisciplinary approach is beneficial for PJI patients, and psychologists should not be missed in the treatment team (30–32). Neglecting to recognize the impact of these burdensome conditions could potentially influence the allocation of resources, the prioritization of preventive measures, and even impede the integration of counseling as an integral component of standard care in the field of trauma surgery.

#### 4.2. Quality of life

Aligned with our own findings, Helwig and colleagues' research presents comparable results. They conducted a study comparing the quality of life among two sets of patients – 29 with hip periprosthetic joint infection (PJI) and 29 with knee PJI. The investigation examined the impact of various treatment outcomes, including both successful and unsuccessful interventions. The study reveals that in the knee PJI subgroup, the mean Physical Component Summary (PCS) score was 35.84, while the mean Mental Component Summary (MCS) score was 51.73. (33) Also, Lueck et al., have shown that during two-stage exchange patients report reduced quality of life (7). Another study has further looked into the long-term effects of PJI treatment finding a significantly diminished quality of life compared to normative data even 4.9 years after successful management with achieved infection eradication (21). Such findings suggest that our finding of diminishing quality of life in the mental domain over time is not transiently, highlighting the potential and need of restoring patients' quality of life with additional psychological therapeutic offerings (34).

#### 4.3. Expectations

Participants' expectations of returning to a state of normal health exhibited a consistent declining trend over the study period. Here, no correlations between the preoperative expectation scores and the ISR and quality of life scores were found for any time point of assessment. However, in contrast, a longitudinal study of patients undergoing total knee arthroplasty has demonstrated that anticipating a poorer result was indicative of dissatisfaction with the surgery, diminished clinical progress, and failure to resume desired activities. Conversely, patients envisioning a more optimistic outcome compared to their preoperative status attained more favorable surgical results (35). On the other hand, it has been reported that patients do not realize the severity of PJI, which poses a major problem in terms of non-compliance (36). Thus, one of the challenges is matching patient expectations with the reality of the PJI treatment process. In this stance, a previous study indicated that surgeons who sets a clear expectation in terms of length of hospitalization could achieve a reduction in this parameter (37).

#### 4.4. Limitations

Several limitations must be acknowledged when interpreting the findings of this study. First, study is constrained by a relatively small sample size ( $n = 29$ ). This limited cohort size is primarily attributed to the specific nature of the study population, consisting of patients with PJI, and the comprehensive longitudinal design we employed. The mean age of the study cohort was 71.4 years, indicating that a majority of the participants are elderly individuals. This age composition is an important sample limitation to consider. While it reflects the demographic characteristics of the specific patient group with PJI under investigation (38), the unique age distribution in our study cohort may limit the extent to which these findings can be extrapolated to younger or more diverse patient groups. Second, the patient cohort demonstrated heterogeneity in treatment procedures, reflecting the diverse and evolving approaches to managing PJI in clinical practice. While this heterogeneity mirrors the

real-world variability in PJI treatment strategy, the disease severity among the participants in our study was comparable. Also, the single-center design may limit the generalizability of the findings. Moreover, the absence of a control group hinders the ability to draw definitive causal conclusions regarding the observed trends in psychological burden, quality of life, and expectations. The lack of a control group also limits the ability to account for potential confounding factors that may influence the outcomes over time. However, during the study's design, we gave this flaw a lot of consideration. For this, primary arthroplasty or a control group of unsuccessful treatments were discussed. However, primary arthroplasty is fundamentally different from a PJI therapy group, and a therapy failure group could not be followed up with a minimum follow-up of 12 months for ethical and therapeutic reasons, so an uncontrolled case series was preferred. Furthermore, the longitudinal design of the study, while enabling insights into temporal changes, does not establish causality or address potential fluctuations in patients' psychological and physical well-being due to factors unrelated to PJI treatment. Additionally, the reliance PROMs introduce the possibility of response bias and subjectivity. Moreover, it's important to note that this study commenced during the COVID-19 pandemic, which could have added to the psychological stress and potentially impacted the collected scores (39).

### 5. Conclusion

The findings underscore the significant psychological burden experienced by individuals undergoing treatment for PJI, as reflected by the increasing ISR scores including depression and anxiety over time. Notably, the thresholds for symptom burden were crossed post-operatively, indicating the need for vigilant attention to the mental well-being of PJI patients. The decline in quality of life, especially the mental domain, further highlights the comprehensive nature of the challenges faced by these patients indicating the need for targeted interventions to address mental health struggles throughout the treatment journey.

#### Statement of ethics

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

#### Study approval statement

This study protocol was reviewed and approved by the institutional ethics committee of the University Hospital Regensburg (file number 20–1680-101).

#### Consent to participate statement

Written informed consent was obtained from participants to participate in the study.

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#### Declaration of Competing Interest

The authors have no competing interests to report.

#### Data availability statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.



## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychores.2023.111559>.

## References

- [1] M. Rupp, E. Lau, S.M. Kurtz, V. Alt, Projections of primary TKA and THA in Germany from 2016 through 2040, *Clin. Orthop. Relat. Res.* 478 (7) (2020) 1622–1633.
- [2] P. Izakovicova, O. Borens, A. Trampuz, Periprosthetic joint infection: current concepts and outlook, *EFORT Open Rev.* 4 (7) (2019) 482–494.
- [3] M. McNally, R. Sousa, M. Wouthuyzen-Bakker, A.F. Chen, A. Soriano, H.C. Vogely, et al., The EBJIS definition of periprosthetic joint infection, *Bone Joint J.* 103-B (1) (2021) 18–25.
- [4] C. Knebel, J. Menzemer, F. Pohl, P. Herschbach, R. Burgkart, A. Obermeier, et al., Peri-prosthetic joint infection of the knee causes high levels of psychosocial distress: a prospective cohort study, *Surg. Infect.* 21 (10) (2020) 877–883.
- [5] A.J. Moore, A.W. Blom, M.R. Whitehouse, R. Gooberman-Hill, Deep prosthetic joint infection: a qualitative study of the impact on patients and their experiences of revision surgery, *BMJ Open* 5 (12) (2015), e009495.
- [6] C.K. Palmer, R. Gooberman-Hill, A.W. Blom, M.R. Whitehouse, A.J. Moore, Post-surgery and recovery experiences following one- and two-stage revision for prosthetic joint infection—a qualitative study of patients’ experiences, *PLoS One* 15 (8) (2020), e0237047.
- [7] E. Lueck, T.E. Schlaepfer, F.A. Schildberg, T.M. Randau, G.T. Hischebeth, M. Jaenisch, et al., The psychological burden of a two-stage exchange of infected total hip and knee arthroplasties, *J. Health Psychol.* 27 (2) (2022) 470–480.
- [8] J. Schmerler, L. Solon, A.B. Harris, M.J. Best, D. LaPorte, Publication trends in research on mental health and mental illness in Orthopaedic surgery: a systematic review, *JBJS Rev.* 11 (6) (2023).
- [9] S.K. Kunutsor, A.D. Beswick, T.J. Peters, R. Gooberman-Hill, M.R. Whitehouse, A. W. Blom, et al., Health care needs and support for patients undergoing treatment for prosthetic joint infection following hip or knee arthroplasty: a systematic review, *PLoS One* 12 (1) (2017), e0169068.
- [10] E. Gangl, Vergleich des ICD-10-Symptom-Rating (ISR) Selbstbeurteilungsfragebogens mit der SCL-90-R an 319 ambulanten Patienten, Universität Regensburg, 2011.
- [11] K. Tritt, F. von Heymann, M. Zaudig, I. Zacharias, W. Söllner, T. Loew, Entwicklung des Fragebogens “ICD-10-Symptom-Rating” (ISR), *Z. Psychosom. Med. Psychother.* 54 (4) (2008) 409–418.
- [12] H.F. Fischer, K. Tritt, B.F. Klapp, H. Fliege, Faktorstruktur und psychometrische Eigenschaften des ICD-10-Symptom-Rating (ISR) an Stichproben psychosomatischer Patienten, *Psychother. Psychosom. Med. Psychol.* 60 (8) (2010) 307–315.
- [13] M. Bullinger, I. Kirchberger, J. Ware, Der deutsche SF-36 Health Survey Übersetzung und psychometrische Testung eines krankheitsübergreifenden Instruments zur Erfassung der gesundheitsbezogenen Lebensqualität, *J. Public Health* 3 (1) (1995) 21–36.
- [14] U. Ellert, B.-M. Kurth, Methodische Betrachtungen zu den Summenscores des SF-36 anhand der erwachsenen bundesdeutschen Bevölkerung, *Bundesgesundheitsbl. Gesundheitsforsch. Gesundheitsschutz* 47 (11) (2004) 1027–1032.
- [15] M. Bullinger, German translation and psychometric testing of the SF-36 health survey: preliminary results from the IQOLA project. International quality of life assessment, *Soc. Sci. Med.* 41 (10) (1995) 1359–1366.
- [16] N.J. Devlin, R. Brooks, EQ-5D and the EuroQol group: past, present and future, *Appl. Health Econ. Health Policy* 15 (2) (2017) 127–137.
- [17] R. Brooks, EuroQol: the current state of play, *Health Policy* 37 (1) (1996) 53–72.
- [18] R.H. Xu, A.D. Keetharuth, L.-L. Wang, A.W.-L. Cheung, E.L.-Y. Wong, Measuring health-related quality of life and well-being: a head-to-head psychometric comparison of the EQ-5D-5L, ReQoL-UI and ICECAP-A, *Eur. J. Health Econ.* 23 (2) (2022) 165–176.
- [19] F. Balck, S. Kirschner, C. Jeszenszky, M. Lippmann, K.-P. Günther, Validität und Reliabilität der deutschen Version des HSS-Erwartungsfragebogens zum Hüftgelenkersatz, *Z. Orthop. Unfall.* 154 (6) (2016) 606–611.
- [20] C.A. Mancuso, E.A. Salvati, N.A. Johanson, M.G. Peterson, M.E. Charlson, Patients’ expectations and satisfaction with total hip arthroplasty, *J. Arthroplast.* 12 (4) (1997) 387–396.
- [21] N. Walter, M. Rupp, K. Hierl, M. Koch, M. Kerschbaum, M. Worlicek, et al., Long-term patient-related quality of life after knee Periprosthetic joint infection, *J. Clin. Med.* 10 (5) (2021).
- [22] C. Mallon, R. Gooberman-Hill, A. Blom, M. Whitehouse, A. Moore, Surgeons are deeply affected when patients are diagnosed with prosthetic joint infection, *PLoS One* 13 (11) (2018), e0207260.
- [23] M.R. Rasouli, M.E. Menendez, A. Sayadipour, J.J. Purtill, J. Parvizi, Direct cost and complications associated with Total joint arthroplasty in patients with preoperative anxiety and depression, *J. Arthroplast.* 31 (2) (2016) 533–536.
- [24] J.R. Harmer, C.C. Wyles, S.Q. Duong, R.J. Morgan III, H. Maradit-Kremers, M. P. Abdel, Depression and anxiety are associated with an increased risk of infection, revision, and reoperation following total hip or knee arthroplasty, *Bone Joint J.* 105-B (5) (2023) 526–533.
- [25] J.M. Wilson, K.X. Farley, G.A. Erens, T.L. Bradbury, G.N. Guild, Preoperative depression is associated with increased risk following revision Total joint arthroplasty, *J. Arthroplast.* 35 (4) (2020) 1048–1053.
- [26] J.C. Sorel, J.H.F. Oosterhoff, B.F.P. Broekman, R.L. Jaarsma, J.N. Doornberg, Ijpm FFA, et al., Do symptoms of anxiety and/or depression and pain intensity before primary Total knee arthroplasty influence reason for revision? Results of an observational study from the Dutch arthroplasty register in 56,233 patients, *Gen. Hosp. Psychiatry* 78 (2022) 42–49.
- [27] N. Walter, M. Rupp, T. Hinterberger, Protheseninfektionen und die zunehmende Bedeutung psychologischer Komorbiditäten : Eine epidemiologische Analyse für Deutschland von 2009 bis 2019, *Orthopäde* 50 (10) (2021) 859–865.
- [28] V. Hegde, D.N. Bracey, R.M. Johnson, D.A. Dennis, J.M. Jennings, Increased prevalence of depressive symptoms in patients undergoing revision for Periprosthetic joint infection, *Arthropl. Today* 13 (2022) 69–75.
- [29] D. Ring, Editorial comment: comprehensive Orthopaedic care, *Clin. Orthop. Relat. Res.* 476 (4) (2018) 694–695.
- [30] N. Walter, M. Rupp, S. Baertl, T.P. Ziarko, F. Hitznibichler, S. Geis, et al., Periprosthetic joint infection : patients benefit from a multidisciplinary team approach, *Bone Joint Res.* 11 (1) (2022) 8–9.
- [31] N. Walter, M. Rupp, S. Baertl, V. Alt, The role of multidisciplinary teams in musculoskeletal infection, *Bone Joint Res.* 11 (1) (2022) 6–7.
- [32] M. Biddle, J.W. Kennedy, P.M. Wright, N.D. Ritchie, R.M.D. Meek, B.P. Rooney, Improving outcomes in acute and chronic periprosthetic hip and knee joint infection with a multidisciplinary approach, *Bone Jt. Open* 2 (7) (2021) 509–514.
- [33] P. Helwig, J. Morlock, M. Oberst, O. Hauschild, J. Hübner, J. Borde, et al., Periprosthetic joint infection—effect on quality of life, *Int. Orthop.* 38 (5) (2014) 1077–1081.
- [34] N. Walter, T. Loew, V. Alt, M. Rupp, Effect of functional relaxation on the quality of life in patients with periprosthetic joint infection: protocol for a randomised controlled trial, *BMJ Open* 12 (10) (2022), e066066.
- [35] S.R. Filbay, A. Judge, A. Delmestri, N.K. Arden, Evaluating Patients’ expectations from a novel patient-centered perspective predicts knee arthroplasty outcome, *J. Arthroplast.* 33 (7) (2018) 2146–2152.e4.
- [36] N. Walter, B. Wimalan, S. Baertl, S. Lang, T. Hinterberger, V. Alt, et al., Managing periprosthetic joint infection—a qualitative analysis of nursing staffs’ experiences, *BMC Nurs.* 21 (1) (2022) 190.
- [37] D. Tanzer, K. Smith, M. Tanzer, Changing patient expectations decreases length of stay in an enhanced recovery program for THA, *Clin. Orthop. Relat. Res.* 476 (2) (2018) 372–378.
- [38] N. Walter, M. Rupp, S. Bärtl, C. Uecker, V. Alt, The definition of the term “Orthogeriatric infection” for Periprosthetic joint infections, *Geriatr. Orthop. Surg. Rehabil.* 13 (2022), 2151459322111649.
- [39] S. Wang, Y. Zhang, W. Ding, Y. Meng, H. Hu, Z. Liu, et al., Psychological distress and sleep problems when people are under interpersonal isolation during an epidemic: a nationwide multicenter cross-sectional study, *Eur. Psychiatry* 63 (1) (2020), e77.