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# Pain cognition versus pain intensity in patients with endometriosis: toward personalized treatment

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**Objective:** To explore how pain intensity and pain cognition are related to health-related quality of life (HRQoL) in women with endometriosis.

**Design:** Cross-sectional questionnaire-based survey.

**Setting:** Multidisciplinary referral center.

**Patient(s):** Women with laparoscopically and/or magnetic resonance imaging–proven endometriosis (n = 50) and healthy control women (n = 42).

**Intervention(s):** For HRQoL, two questionnaires: the generic Short Form Health Survey (SF-36) and the Endometriosis Health Profile 30 (EHP-30). For pain cognition, three questionnaires: the Pain Catastrophizing Scale (PCS), the Pain Vigilance and Awareness Questionnaire (PVAQ), and the Pain Anxiety Symptoms Scale (PASS). For pain intensity, the verbal Numeric Rating Scale (NRS).

**Main Outcome Measure(s):** Association between pain intensity and pain cognition with HRQoL in women with endometriosis, and the differences in HRQoL and pain cognition between women with endometriosis and healthy controls.

**Result(s):** Health-related quality of life was statistically significantly impaired in women with endometriosis as compared with healthy control women. The variables of pain intensity and pain cognition were independent factors influencing the HRQoL of women with endometriosis. Patients with endometriosis had statistically significantly more negative pain cognition as compared with controls. They reported more pain anxiety and catastrophizing, and they were hypervigilant toward pain.

**Conclusion(s):** Pain cognition is independently associated with the HRQoL in endometriosis patients. Clinicians should be aware of this phenomenon and may consider treating pain symptoms in a multidimensional, individualized way in which the psychological aspects are taken into account. In international guidelines on management of women with endometriosis more attention should be paid to the psychological aspects of care. (Fertil Steril® 2017;■:■–■. ©2017 by American Society for Reproductive Medicine.)

**Key Words:** Endometriosis, health-related quality of life, pain cognition, pain intensity

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Chronic pain is associated with an impairment of health-related quality of life (HRQoL) (1–3). It interferes with many aspects of a person's life and causes high levels of physical and emotional stress (1–9). Chronic pelvic pain is defined as the presence of continuous or intermittent pain symptoms perceived in the pelvic area that last for at least 3 to 6 months (10, 11). Endometriosis, considered the most frequent reproductive tract–related cause of chronic pelvic pain (12), affects approximately 5% to 10% of women of reproductive age and up to 50% of women with subfertility (9, 13, 14). The presence of functional endometrial-like tissue outside the uterine cavity may result in formation of adhesions and chronic inflammation (13, 14). This provokes a variety of symptoms of which pain is the primary (12, 13, 15, 16). The negative

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impact on a woman's life of chronic pain caused by endometriosis is often substantial (16–19).

A purely physiologic approach to pain assumes that pain intensity relates to the degree of tissue damage, but this often cannot explain the wide range of reactions in humans in response to a painful stimulus (10, 20). The experience of pain is influenced by a complex interplay between physical, psychological, environmental, and social variables (1, 4, 21, 22). In past years it has become clear that psychological factors such as pain catastrophizing, pain anxiety, and pain vigilance are important determinants contributing to pain perception (1,20,21,23–25). These aspects refer to a negative appraisal of pain, in which a person is anxious of pain and has a constant awareness for pain sensations. As soon as these sensations appear, this person is not able to engage attention away from it, and consequently suffers from exaggerated feelings of helplessness and pessimism. This results in an inability to deal with the pain experience, disability, and distress (20, 23, 26). Moreover, these aspects are shown to negatively influence the effect of medical therapy in chronic pain patients (25,27–29). Psychological aspects of pain perception are referred to as pain cognition by Lame et al. (25), and our study uses this term for the psychological aspects pain catastrophizing, pain anxiety, and pain vigilance.

In the international guidelines on management of endometriosis from the European Society of Human Reproduction and Embryology (ESHRE) and American Society for Reproductive Medicine (ASRM), psychological aspects of care are not integrated in the recommendations about care for patients, indicating that treatment of endometriosis is still mainly pharmacologically and surgically targeted (14, 30).

We hypothesize that pain cognition plays an important role in the quality of life of women with endometriosis. We therefore explored the relationship between pain cognition and quality of life in endometriosis patients as well as in healthy control women. This relationship provides important information about whether patients with endometriosis indeed show distinct pain cognitions from controls. In addition, we explore to what extent pain intensity and pain cognition scores are independently associated with HRQoL. Based on the results of this study variables can be identified, which may help to improve HRQoL by introducing personalized pain treatment.

## MATERIALS AND METHODS
### Study Population

Fifty women with endometriosis confirmed by laparoscopy or magnetic resonance imaging (MRI) were included. All patients were treated in the multidisciplinary endometriosis referral center Rijnstate Hospital, the Netherlands. Healthy controls were recruited by advertisement on social media, the hospital's Web site, and a poster inside the hospital. All participating women (50 patients and 42 control women) were of fertile age (18–49 years) and used hormone treatment or hormone contraception, which suppresses the menstrual cycle, to rule out the influence of hormone cycles on the results of our study. The exclusion criteria were postmenopausal status, treatment

of current psychologic disorders, and chronic pain other than endometriosis.

General characteristics of the participants were collected. Education level was rated with an ordinal scale (31), ranging from 1, less than primary education, to 7, university degree. The endometriosis disease severity was staged using the revised American Society for Reproductive Medicine (revised ASRM) classification (32).

### Questionnaires

Participants were asked to complete five validated questionnaires in Dutch: two questionnaires addressing HRQoL and three questionnaires addressing pain cognition (33–40). The answers to the questionnaires were self-reported.

### Health-related Quality of Life Questionnaires

To measure general HRQoL, we used the standardized Short Form Health Survey (SF-36), version 2.0. The SF-36 is a multipurpose health survey which is applied to measure HRQoL on nine different health concepts (33). It consists of 36 questions concerning physical and mental health, covering in total the following nine domains: physical functioning, social functioning, role limitations due to physical health, role limitations due to emotional problems, emotional well-being, vitality, pain, general health, and health change. The scores on the subscales are transformed to a range of 0 to 100 (total SF-36 score 0–900) in which a high score corresponds to a high quality of life on the specific domain.

All participants also filled in the Endometriosis Health Profile 30 (EHP-30) (41). This disease-specific quality of life questionnaire is commonly used in endometriosis research (42). It measures the impact of the disease on physical, mental, and social aspects of life. The questionnaire is divided into two parts. The core questionnaire consists of five subscales: pain, control and powerlessness, emotional well-being, social support, and self-image. The second, modular part of the questionnaire is not always applicable. It consists of six subscales: work, relationship with children, sexual intercourse, infertility, medical profession and treatment. The scores are transformed in a range of 0 to 100 (total score EHP-30 core questionnaire 0–500), in which a higher score corresponds with a lower disease-specific quality of life. If an item in a subscale was not answered, no score could be calculated for that subscale. In the control participants, the standard question "Because of your endometriosis, how often did you …" was adjusted into "How often did you …," as suggested by van de Burgt et al. (35).

### Pain Cognition Questionnaires

Three questionnaires addressed pain cognition: the Pain Catastrophizing Scale (PCS), the Pain Vigilance and Awareness Questionnaire (PVAQ), and the Pain Anxiety Symptoms Scale (PASS). These questionnaires have been shown to be valid and reliable in the measurement of the variables assessed (36, 38, 43, 44).

The PCS measures the degree of pain catastrophizing of the participant (44, 45) by measuring elements of

helplessness and pessimism in relation to the ability to deal with the pain experience. The participants were asked to fill in 13 items in which they reflected on their thoughts and feelings during a painful experience on a 5-point scale. The scores can range from 0 (not at all) to 4 (always), with a maximum score of 52. A high score on the PCS reflects a high degree of pain catastrophizing.

The PVAQ measures the degree of pain vigilance (36, 43). Participants were asked to complete a 16-item list in which they had to reflect on their focus on pain during the last two weeks. A 6-point scale is used ranging from 0 (never) to 5 (always), with a maximum score of 80. A high score on the PVAQ indicates more pain hypervigilance.

The final pain cognition questionnaire measures anxiety caused by pain, the PASS (38). Questions are asked about feelings of fear of pain, cognitive anxiety, avoidance behavior, and physiological anxiety symptoms. A 6-point scale is used, ranging from 0 (never) to 5 (always), with a maximum score of 100. A high score on the PASS corresponds with a high degree of pain-associated anxiety.

## Pain Intensity Scores

Endometriosis patients were asked to indicate the severity of pain during the last month using the verbal Numerical Rating Scale (NRS). The NRS scale ranges from 0 (no pain) to 10 (unbearable pain), and it is the most commonly used subjective measure to score pain intensity in patients (46). Patients were asked to score their average pain symptoms during the month before inclusion in one total NRS score. An average pain intensity score of <4 is considered as a none-to-mild pain intensity and a score ≥4 as a moderate-to-severe pain intensity (47–49). These scores are based on earlier reports in which scores <4 and ≥4 reliably reflected mild or severe pain in chronic pain patients and mild or severe limitations in daily physical and emotional functioning (49, 50).

## Ethics Approval

Ethical approval was obtained from the Ethics Committee Social Sciences of the Radboud University Faculty of Social Sciences (file number: ECSW2014–2411–275). Participants were asked to sign an informed consent form before participation in the study. Data collection and analysis were performed anonymously.

## Statistical Methods

Statistical analysis was performed using SPSS version 22.0 (IBM Inc.). $P<.05$ was considered statistically significant unless specified otherwise. Scale and subscale scores on the questionnaires were calculated according to their manuals (51, 52). Missing data were not imputed in the analyses.

With regard to the participant's characteristics, an independent samples $t$-test or nonparametric Mann-Whitney $U$ test was performed to test for differences in age, body mass index, and education level between the two study groups (31).

To determine the effect of endometriosis on the HRQoL we calculated mean scores on all subscales as well as a total score of both HRQoL questionnaires. Because of the high amount of missing values due to the disease-specific aspect of the questionnaire, a total score to the entire EHP-30 could not be computed. Therefore, a total score on the core-questionnaire part of the EHP-30 questionnaire was computed as a total EHP-30 score.

To study pain cognition, we calculated mean total scores on the three corresponding questionnaires. Differences between study groups were calculated using an independent samples $t$-test or nonparametric Mann-Whitney $U$, depending on the normality of the data. Differences on the EHP-30 modular part of the questionnaire were not compared between the two study groups as these subscales were not applicable to the control participants. Effect sizes were calculated as the standardized mean difference between the patient and control groups (Cohen's $d$). An effect size of 0.2 was considered a low effect size. Effect sizes of 0.5 were considered a moderate effect size and 0.8 a strong effect size, according to the guidelines of Cohen (53). In case of nonparametric data, Cohen's $d$ was estimated based on a previously validated method (54).

Correlations between pain intensity, HRQoL (SF-36 total score), and pain cognition were calculated using either Pearson correlation coefficients or Spearman's rho correlation coefficient, depending on the normality of the data. Correlations were only calculated for the patient group to identify how the pain intensity and pain cognition scores related to the HRQoL in patients. A correlation coefficient $r$ of 0.1 was considered a low correlation, $r$ of 0.3 a mediate correlation, and $r$ of 0.5 a high correlation (53).

Finally, multivariate linear regression analysis using a stepwise method was used to explore to what extent pain intensity and pain cognition independently contributed to the HRQoL score. In this analysis pain intensity and pain cognition were the independent variables. The total score on the SF-36 as well as the total score on the EHP-30 core questionnaire were used as dependent variables.

The PCS, PVAQ, and PASS all measure different psychological aspects of pain perception. Together, they reflect an individual's pain cognition. A joint pain cognition score was calculated using $z$ scores by calculating each individual's standardized difference to the mean score of the study sample for each of the three questionnaires. The average $z$ scores of the three questionnaires reflected one pain cognition score. For pain intensity the average NRS score of the month before inclusion was used.

## RESULTS
### Demographics

A total of 92 participants were invited to participate in the study (50 patients and 42 controls). A total of 83 participants (48 patients and 35 controls; 90% in total) returned the questionnaires. Table 1 shows the sociodemographic and clinical characteristics of the participants. The study group consisted of women with variety in their disease severity. The majority of patients (74%) were classified as having a moderate-to-severe stage of endometriosis according to the

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## TABLE 1

Characteristics of participating women (N = 92).

| Characteristic | Patients (n = 50) | Controls (n = 42) | *P* value |
|---|---|---|---|
| Age (y), mean ± SD | 34.5 ± 7.0 | 34.1 ± 6.7 | .802[a] |
| BMI (kg/m²), mean ± SD | 24.4 ± 4.1 | 25.2 ± 5.1 | .655[b] |
| Education level (Verhage [31]) | | | .024[b] |
| 5 | 25 (50.0) | 15 (35.7) | |
| 6 | 18 (36.0) | 10 (23.8) | |
| 7 | 7 (14.0) | 17 (40.5) | |
| Current marital status | | | |
| Single | 12 (24.0) | 9 (21.4) | |
| Living with partner | 38 (76.0) | 33 (78.6) | |
| Occupation | | | |
| Student | 3 (6.0) | 0 (0) | |
| Employee | 40 (80.0) | 41 (97.6) | |
| Housewife | 2 (4.0) | 1 (2.4) | |
| Unable to work | 5 (10.0) | 0 (0) | |
| Parity | | | |
| 0 | 30 (60.0) | 22 (52.4) | |
| 1 | 7 (14.0) | 2 (4.8) | |
| 2 | 11 (22.0) | 12 (28.6) | |
| ≥3 | 2 (4.0) | 6 (14.3) | |
| Subfertility | | | |
| Yes | 20 (40.0) | 1 (2.4) | |
| No | 30 (60.0) | 41 (97.6) | |
| Hormone use | | | |
| Oral contraceptives or progestogens | 30 (62) | 41 (97.6) | |
| Leuprorelin acetate (Lucrin) | 12 (24) | 0 (0) | |
| Ovariectomy | 6 (12) | 0 (0) | |
| Lactation amenorrhea | 0 (0) | 1 (2.4) | |
| Ulipristal acetate | 1 (2) | 0 (0) | |
| Endometriosis confirmed | | | |
| MRI | 7 (14.0) | | |
| Surgery | 43 (86.0) | | |
| Years since diagnosis of endometriosis, mean ± SD | 5.2 ± 6.1 | | |
| No. of surgical therapies in history | | | |
| No surgical treatment | 22 (44.0) | | |
| 1 | 19 (38.0) | | |
| 2 | 5 (10.0) | | |
| 3 | 2 (4.0) | | |
| 4 | 1 (2.0) | | |
| 5 | 1 (2.0) | | |
| Average NRS score last month | | | |
| <4 | 23 (46.0) | | |
| ≥4 | 21 (42.0) | | |
| Missing | 6 (12.0) | | |
| Revised ASRM classification | | | |
| I | 2 (4.0) | | |
| II | 4(8.0) | | |
| III | 7 (14) | | |
| IV | 30 (60.0) | | |
| Missing (no surgery performed) | 7 (14.0) | | |
| Type of endometriosis | | | |
| Adenomyosis | 1 (2.0) | | |
| Peritoneal | 6 (12.0) | | |
| Ovarian | 9 (18.0) | | |
| Deep endometriosis | 34 (68.0) | | |

*Note:* Data presented as n (%), unless noted otherwise. BMI = body mass index; NRS = Numeric Rating Scale; ASRM = American Society for Reproductive; SD = standard deviation.
[a] Independent *t*-test.
[b] Mann-Whitney *U* test.

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revised ASRM classification. Two-thirds of the patients suffered from deep endometriosis. Half the patients (56%) had a history of one or more therapeutic surgical interventions. Of these, 10 patients (35%) had had major surgery: hysterectomy, ovariectomy, bowel or bladder procedures, extended adhesiolysis, or a combination of procedures.

## Health-related Quality of Life

The generic HRQoL questionnaire (SF-36) showed a strong statistically significant reduction in quality of life for the endometriosis patients compared with the healthy control women in eight out of nine domains as well as on the total

## TABLE 2

**Results of questionnaires.**

| Questionnaire | Patients (n = 48) | Controls (n = 35) | *P* value | Effect size (Cohen's *d*) |
|---|---|---|---|---|
| Quality of life | | | | |
| SF-36[a] | 521.31 ± 174.85 | 743.11 ± 103.50 | <.001[c] | 1.48 |
| EHP-30[b] | 189.41 ± 102.52 | 57.85 ± 65.55 | <.001[c] | −1.53 |
| Pain cognition | | | | |
| PCS | 16.88 ± 10.40 | 7.26 ± 6.32 | <.001[c] | −1.08 |
| PVAQ | 35.73 ± 14.32 | 24.94 ± 12.21 | .001[c] | −0.80 |
| PASS | 31.00 ± 17.98 | 14.74 ± 11.15 | <.001[d] | −1.05 |

*Note:* Data presented as mean ± standard deviation. EPH-30 = Endometriosis Health Profile 30; PASS = Pain Anxiety Symptoms Scale; PCS = Pain Catastrophizing Scale; PVAQ = Pain Vigilance and Awareness Questionnaire; SF-36 = Short Form Health Survey.
[a] SF-36 total score.
[b] Total score on EHP-30 core questionnaire.
[c] Independent samples *t*-test.
[d] Mann-Whitney *U* test.

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score (Table 2; Supplemental Table 1, available online). Only the domain "health change" did not statistically significantly differ between the two study groups. Based on the calculated effect sizes, the effect of endometriosis on HRQoL was considered large for almost all subscales (Supplemental Table 1).

With regard to the disease-specific EHP-30 questionnaire, the women with endometriosis scored higher on the core questionnaire corresponding with a lower quality of life (Table 2; Supplemental Table 2, available online). Based on the calculated effect sizes, the effect of endometriosis on HRQoL as measured by the EHP-30 was considered large for almost all items on the core questionnaire.

### Pain Cognition

Table 2 displays the scores on the three pain cognition questionnaires (PCS, PVAQ, and PASS). There is a statistically significant difference in pain cognition between the patients and controls on all three questionnaires. Women with endometriosis scored higher on all three questionnaires, corresponding with a more negative pain cognition compared with the control group. Based on the calculated effect sizes (Cohen's *d*), the effect of endometriosis on pain cognition was considered large.

### Pain Intensity

The pain intensity scores are displayed in Table 1. Despite the fact that the majority of patients had severe endometriosis, fewer than half of them reported a pain intensity score of ≥4.

### Health-related Quality of Life Correlations

All correlations between the HRQoL (measured with the SF-36 and EHP-30), pain intensity, and pain cognitions are displayed in Table 3 and Supplemental Table 3, available online. A negative correlation was found between pain intensity and the self-reported HRQoL as measured with the SF-36, indicating that with an increasing pain intensity the SF-36 score decreases.

A similar negative correlation was found between the patients' pain cognition score and the HRQoL as measured with the SF-36, indicating that with an increasing pain

cognition score the SF-36 score decreases. A decrease in the SF-36 score corresponds with a reduction in HRQoL. A similar effect was observed regarding the EHP-30 core questionnaire. A strong positive correlation was found between pain intensity and pain cognition and the total score on the EHP-30 core questionnaire. This indicates that with an increasing pain intensity and more negative pain cognition, the total score on het EHP-30 core questionnaire increases, reflecting a reduction in HRQoL.

### Health-related Quality of Life Regression Analysis

Multiple linear regression analysis was conducted to explore to what extent the pain intensity and pain cognition independently contributed to the HRQoL score. The pain intensity score and pain cognition score were included in the analysis as independent variables, using the SF-36 total score and the EHP-30 core questionnaire total score as dependent variables (Table 4).

The analyses showed a statistically significant negative association of both the pain intensity and the pain cognition score on the patients' self-reported HRQoL as measured with the SF-36 and the EHP-30. Pain intensity entered the model first as the strongest predictor of HRQoL. However, pain cognition shows a

## TABLE 3

**Correlations between health-related quality of life and pain intensity and pain cognition.**

| Scale | Pain intensity | Pain cognition |
|---|---|---|
| SF-36 total score[a] | −0.62[b] | −0.58[b] |
| EHP-30 total core questionnaire score[a] | 0.66[b] | 0.58[b] |

*Note:* Pain intensity was measured using an average pain score on a numerical rating scale (0–10). Pain cognition was measured using a joint score on the three pain cognition questionnaires (PCS, PVAQ, PASS). A higher score on the questionnaires reflects a more negative pain cognition. EPH-30 = Endometriosis Health Profile 30; PASS = Pain Anxiety Symptoms Scale; PCS = Pain Catastrophizing Scale; PVAQ = Pain Vigilance and Awareness Questionnaire; SF-36 = Short Form Health Survey.
[a] Pearson's *r*.
[b] *P*< .001.

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## TABLE 4

**Multivariate regression analyses for health-related quality of life, pain intensity, and pain cognition.**

| Variable | Model summary | Predictor | β | P value |
|---|---|---|---|---|
| SF-36[a] | $R^2 = 0.39$ ($F$ 1,40) = 24.562, $P<.001$ | Pain intensity | −0.59 | <.001 |
| | $R^2 = 0.61$ ($F$ 2,40) = 29.395, $P<.001$ | Pain cognition | −0.47 | <.001 |
| EHP-30[b] | $R^2 = 0.43$ ($F$ 1,40) = 29.781, $P<.001$ | Pain intensity | 0.64 | <.001 |
| | $R^2 = 0.61$ ($F$ 2,40) = 29.898, $P<.001$ | Pain cognition | 0.42 | <.001 |

*Note*: EPH-30 = Endometriosis Health Profile 30; SF-36 = Short Form Health Survey.
[a] SF-36 total score.
[b] Total score on EHP-30 core questionnaire.

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unique, independent contribution to the variance in reported HRQoL, with an additive effect up to 20% of the SF-36 total score and 17% of the EHP-30 total score.

All analyses were repeated for the subscales of the HRQoL questionnaires when both pain factors contributed the HRQoL score (Supplemental Table 4, available online). The results of these analyses showed comparable effects, in which both pain intensity and pain cognition were independently associated with the quality of life scores.

## DISCUSSION

Our study explored how pain intensity and pain cognition are related to HRQoL in women with endometriosis. Both HRQoL questionnaires have proven to be suitable for measuring HRQoL in women with endometriosis (33, 40). Our data confirm that women with endometriosis have a significantly impaired HRQoL compared with healthy controls, as has been shown elsewhere (16–19). Despite the fact that our study population was relatively small, the effect sizes were large. However, it is important to stress that because all women included in the study had relatively severe endometriosis and were treated in a referral center for endometriosis, the effects may be overestimated due to selection bias. Therefore, care must be taken to extrapolate our study results to all women diagnosed with endometriosis.

We are not aware of other studies focusing on pain cognition aspects in women with endometriosis. It is already known, however, that HRQoL can be negatively affected by pain intensity as well as pain cognition, as was shown in patients with other chronic pain conditions, predominantly musculoskeletal pain (3, 25, 26, 36, 37, 55). In our study a higher level of catastrophizing, fear of pain, and hypervigilance to pain was observed in women with endometriosis as compared with controls.

The theoretical perspective on the relationship between this negative pain cognition and the experienced pain intensity can be explained by the Fear Avoidance Model (21). This model addresses how "fear of pain" is crucial in explaining different responses toward pain in different individuals. For example, some individuals generate a strategy of avoidance whereas others will confront the pain (21). Catastrophizing is a cognitive strategy that leads to avoidance of pain: individuals who tend to catastrophize interpret pain as extremely threatening, causing an exaggerated negative orientation toward pain and making it impossible to shift

attention away from painful signals (20, 24, 26, 36, 37, 56). The phenomenon in which it seems impossible to shift attention away from possible painful signals is known as "pain hypervigilance" (26, 36, 56). A hypervigilant person is constantly scanning the body for somatic sensations, in particular pain sensations (36). The Fear Avoidance Model suggests that a hypervigilant person who tends to catastrophize experiences more intense pain and increased emotional distress. These individuals show a tendency to avoid any activity that may induce pain, which leads to disengagement from social activities and higher levels of distress, disability, and depression (8, 20, 24, 26, 36, 56). This consequently negatively harms the persons' HRQoL (26, 37).

We aimed to find specific correlations between pain cognition and HRQoL in women with endometriosis. Previous research by Roelofs et al. (43) showed a high correlation between scores on the three pain cognition questionnaires that were used in this study, resulting in a strong convergent validity. This makes a joint score feasible. We used this joint score on pain cognition and found a strong negative correlation between both pain intensity and pain cognition scores with the total SF-36 score in women with endometriosis. This finding that pain intensity and pain cognition both uniquely and independently contribute to the HRQoL provides new insight and should be used in the clinical treatment of women with endometriosis.

A negative pain cognition not only impairs the HRQoL but is a risk factor in the development of increased postoperative pain as well as chronic pain after surgery (24, 25, 27–29, 57). Moreover, negative pain cognitions are associated with an increase in illness behavior, resulting in an increased use of analgesics and over-the-counter medication, and more frequent visits to the clinic. As a reaction to this behavior, clinicians tend to pursue more intensive and invasive approaches to treat the pain (20). Our results indicate that additional treatment aimed at influencing patients' cognitions may be more useful to improve patients' quality of life. Samwel et al. (27) hypothesized that psychological intervention aimed at improving pain cognition before treatment could contribute to a positive treatment effect.

In conclusion, we report that pain cognition is an important, independent factor influencing the HRQoL of endometriosis patients. We suggest that medical professionals aim for a multidimensional approach to treating endometriosis-related pain and that they consider adding cognitive behavioral

therapy for women who tend to experience a negative pain cognition. An adequate screening for pain cognition in patients with poor treatment outcomes could help to identify the patients who might benefit from cognitive behavioral therapy. Identifying positive strategies to treat fear avoidance behavior may help patients to cope with pain and decrease their feelings of disability (55, 56, 58–60). In endometriosis, this aspect of multidimensional and personalized pain treatment has been underexposed so far. Further multicenter studies with larger sample sizes are needed to address the efficacy of this treatment approach in endometriosis patients.

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