

Supplementary I

A multi-Y partial least squares (PLS) model with 13 X-variables

Pain tolerance in the leg (PTTleg) was added as an additional Y-variable (i.e. this model is a multi-Y model) using both PTTarm and PTTleg as

Y-variables. The model had 13 X-variables, 2 principal component, $R^2=0.38$, $Q^2=0.14$, $p < 0.001$ by cross-validated analysis of variance (CV-ANOVA). Here, we show 2 versions of the loading plot of the model, Fig. SII showing an additional axis to interpret PTTarm, in accordance with the standards of how to interpret PLS.

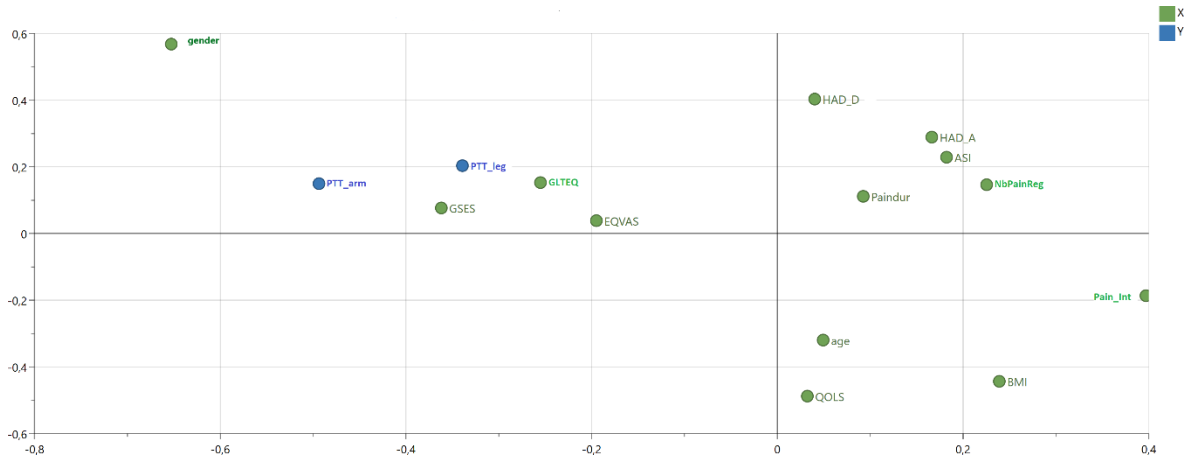


Fig. S1. Loading plot of the Y partial least squares (PLS) model. The loading plot summarizes how the X-variables relate to each other as well as to the Y-variables. The model had 13 X-variables, 2 principal component, $R^2=0.38$, $Q^2=0.14$, $p < 0.001$ by cross-validated analysis of variance (CV-ANOVA). For sex, 1=males and 0=females. ASI: Anxiety Sensitivity Index; BMI: body mass index; EQVAS: second part of the European Quality of Life instrument, which captures a person's perceived health status; GLTEQ: Godin Leisure-Time Exercise Questionnaire; GSES: General Self-Efficacy Scale; HAD_A and HAD_D: Anxiety and Depression subscale of Hospital Anxiety and Depression scale; NbPainReg: number of painful regions; Paindur: pain duration, Pain_Int: pain Intensity; PTT: pain tolerance threshold; QOLS: Quality Of Life Scale.

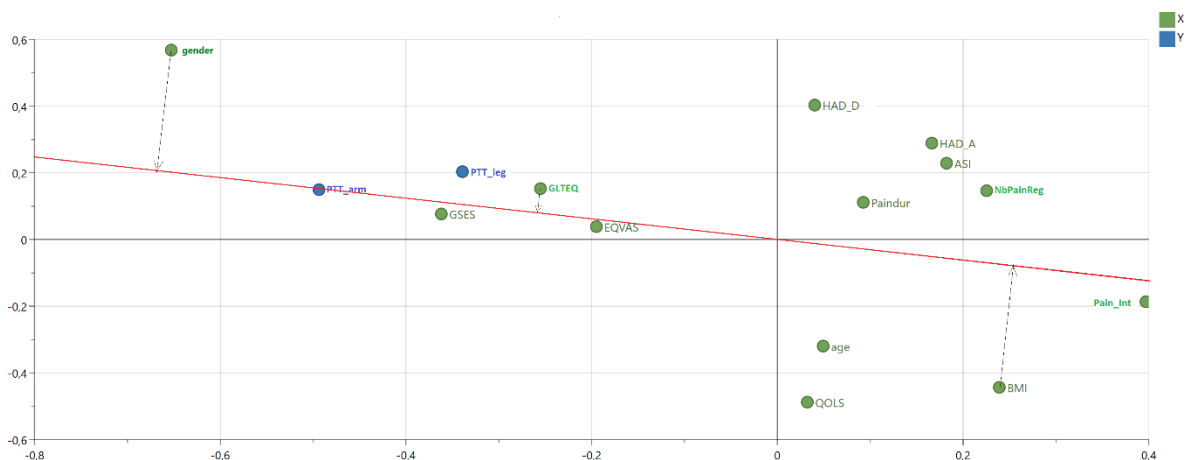


Fig. SII. Loading plot of the same Y partial least squares (PLS) model presented in Fig. S1 showing an additional red interpretative axis in the loading plot. The importance of the X-variables can be assessed by projection of the X-variables on the new axis, as exemplified for sex, body mass index (BMI) and Godin Leisure-Time Exercise Questionnaire (GLTEQ). The most important predictors of pain tolerance threshold (PTT)arm (when taking PTTleg into consideration) were sex (higher PTTarm in males), pain intensity, General Self-Efficacy Scale (GSES), BMI and GLTEQ (positive correlation with PTTarm for GSES and GLTEQ, and negative correlation with PTTarm for pain intensity and BMI). Hence, compared with the original single-Y model, BMI emerged as an important predictor of PTTarm; BMI was as important as GLTEQ (same distance to the origin of the plot on the new interpretative axis).

Supplementary II

A multi-Y partial least squares (PLS) model with 20 X-variables.

A new multi-Y PLS model was computed using both PTTarm and PTTleg as Y-variables. Previously we had used the 3 pain characteristic variables only available in patients. In this model we have also added 7 more patient-reported outcome measures (PROMs) only available in patients as X-variables. The pain characteristics and the PROMs are presented below and in Table SI.

Description of patient-reported outcome measures only available in patients

Chronic Pain Acceptance Questionnaire. CPAQ consists of 20 questions that measure acceptance of pain. Acceptance of pain is considered to reduce failed attempts to avoid or control pain and, consequently, instead focus on engaging in valuable activities and sticking to meaningful goals. The questions are graded on a 7-point scale from 0 (never true) to 6 (always true). CPAQ has 2 subscales that give 2 indices: (a) acceptance, activity to engage (Activity engagement), (b) together with the pain/symptoms (Pain willingness). The points for the subscales are added separately to determine the respective index. To determine the total score, the scores for the subscales are added. The higher the values, the more the patient has accepted their symptoms. In this study only the total score (1–3) is used.

Pain Anxiety Symptoms Scale-20 (PASS-20) is a short version of PASS-40 that contains 40 questions that measure fear and anxiety response specifically to pain. PASS-20 has 4 subscales, each with 5 questions, which meet avoidant, anxious thinking, cognitive anxiety and physiological response to pain. The subject rates each question on a 6-point scale, from never (0) to always (5). Higher scores on PASS-20 indicate a higher degree of physical and mental

anxiety associated with pain. To get the total score, the score for the subscales are added together. This study only used the total score. The instrument has good psychometric properties (4, 5).

Pain characteristics: *Pain intensity* before assessment (11-graded numerical rating scale; with endpoints: 0=no pain and 10=worst possible pain). Patients also denoted the anatomical extent of pain on a pain drawing encompassing 36 anatomical regions; the *number of painful regions* was thereby registered (painful regions, possible range: 0–36). *Pain duration*, in months, was also reported by the patients.

Arthritis Self-Efficacy Scale (ASES) is a standardized self-assessment form with 20 questions that measures an individual's perceived belief in their own ability to cope with the consequences of chronic arthritis. This study uses a validated Swedish version. The only modification made is to change the words "joint pain" and "arthritis" to "pain". The first subscale (5 questions) measures confidence in one's own self-efficacy to control pain (SE pain). The second subscale (9 questions) measures confidence in one's own self-efficacy to function in daily life (SE function). The third subscale (6 questions) measures confidence in one's own self-efficacy to control other symptoms related to chronic pain (SE symptoms). Each question is answered by marking on a scale of 10–100. Each subscale is calculated separately by taking the mean value for the included questions. A higher score indicates a higher level of self-sufficiency (6, 7).

The **Pain Catastrophizing Scale (PCS)** is a self-assessment form with 13 questions that assess catastrophizing thoughts and feelings that accompany pain experience. Subjects are asked to reflect on past pain experiences and to indicate how much of each of the 13 thoughts or feelings they experienced when in pain. The questionnaire uses a 5-point scale, from not at all (0) to all the time (4). A total is calculated and high values indicate very catastrophic (8).

The **Pain Disability Index (PDI)** is a self-assessment form with 7 questions based on a 10-point scale that measures perceptions of the specific influence of pain on disability that can prevent the desired implementation of a number of functions, such as family and social activities, sex, work, life support (sleep, breathing, eating) and other daily activities. A total is added and a higher value indicates greater disability due to pain. PDI has shown good reliability and validity in several studies (9, 10).

Results of the new multi-Y model

The model had 20 X-variables, 2 principal component, $R^2=0.38$, $Q^2=0.15$, $p<0.001$ by CV-ANOVA. Below, we show 2 versions of the loading plot of

Table SI. Patient-reported outcome measures (PROMs) only available in patients

Patient-reported outcome measures	Patients ($n=78$)
CPAQ	58 (45.5–71)
PCS	21 (12–32)
PASS-20	44 (36–58)
Pain duration, months	33.5 (24–120)
Pain intensity (0–10)	6 (5–7)
Painful regions (0–36)	13 (7–18)
PDI	39 (29.3–45)
SE function	80 (67.8–96.7)
SE pain	45 (30.5–60)
SE symptoms	51.7 (42.5–66.7)

Data are expressed as median (25th–75th percentiles).

CPAQ: Chronic Pain Acceptance Questionnaire; PASS-20: Pain Anxiety Symptoms Scale-20; PCS: Pain Catastrophizing Scale; PDI: Pain Disability Index; SE: self-efficacy.

the model, Fig. SIV showing an additional red axis to interpret PTTarm when taking PTTleg into

consideration, in accordance with the standards of how to interpret PLS.

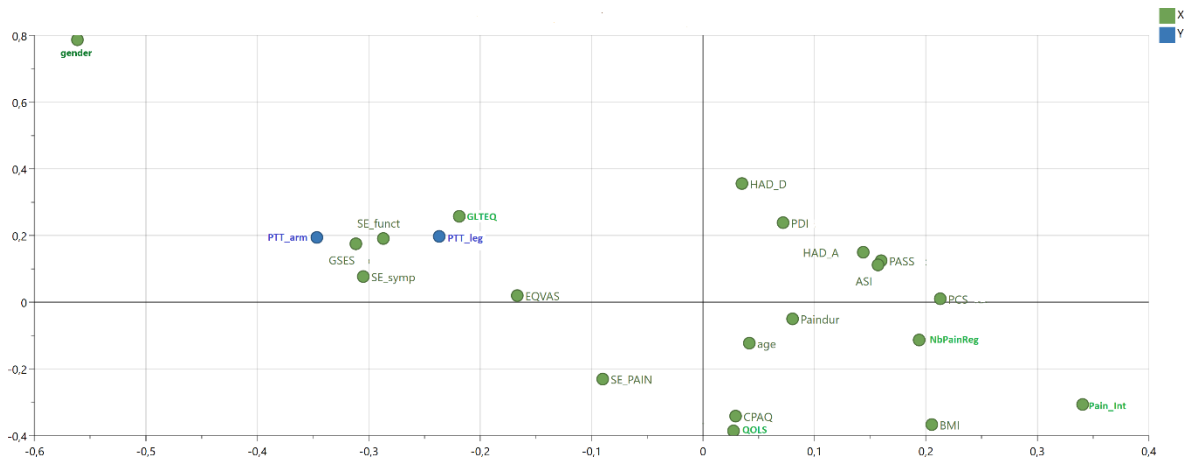


Fig. SIII. Loading plot of the Y Partial Least Squares (PLS) model. The model had 20X-variables, 2 principal component, $R^2=0.38$, $Q^2=0.15$, $p < 0.001$ by CV-ANOVA. The loading plot summarizes how the X-variables relate to each other as well as to the Y-variables. For Sex, 1=males and 0=females. ASI: Anxiety Sensitivity Index; BMI: body mass index; CPAQ: Chronic Pain Acceptance Questionnaire; EQVAS: second part of the European Quality of Life instrument, which captures a person's perceived health status; GLTEQ: Godin Leisure-Time Exercise Questionnaire; GSES: General Self-Efficacy Scale; HAD_A and HAD_D: Anxiety and Depression subscale of Hospital Anxiety and Depression scale; NbPainReg: Number of Painful Regions; PASS-20: Pain Anxiety Symptoms Scale-20; Paindur: pain duration; Pain_Int: pain intensity; PCS: Pain Catastrophizing Scale; PDI: Pain Disability Index; PTT: pain tolerance threshold; QOLS: Quality Of Life Scale; SE_funct: Self-Efficacy function; SE_pain: Self-Efficacy pain; SE_symp: Self-Efficacy symptoms.

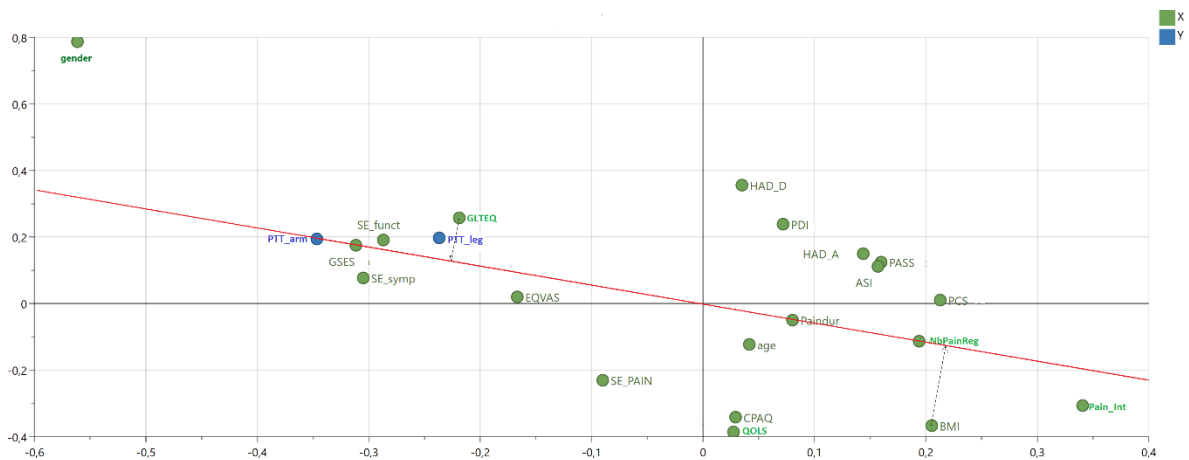


Fig. SIV. Loading plot of the same Y Partial Least Squares (PLS) model presented in Fig. SIII, now with an additional red interpretative axis in the loading plot. The importance of the X-variables can be assessed by projection of the X-variables on the new axis. For instance Godin Leisure-Time Exercise Questionnaire (GLTEQ) is strongly positively associated with pain tolerance threshold (PTT) arm and body mass index (BMI) is strongly negatively associated with PTTarm. One can see that GLTEQ and BMI are equally important by measuring the distance between the origin and the point they project on the red line; this distance is approximately equal. Compared with the model of Appendix SI, BMI remained as important as GLTEQ. Note also a high positive inter-correlation between GSES, Self-Efficacy function (SE-function) and Self-Efficacy symptoms (SE-symptom), which were all more important than GLTEQ. Pain Catastrophizing Scale (PCS) was also important and negatively correlated with PTTarm. Sex and pain intensity remained the most important variables in the model. The importance of BMI is well in line with accumulating evidence that strongly suggests that pain and obesity are significantly related to each other, but research evaluating the relationship between obesity and pain sensitivity has yielded conflicting results (11). Dong et al. have shown that the prevalence of physical inactivity among patients with chronic pain referred to pain rehabilitation clinics is 47% (12) compared with global estimates of physical inactivity among adults 27.5% (13). Dong's study also indicates that mildly obese patients had an elevated risk of 65% and severely obese patients had an elevated risk of 96% for insufficient physical activity (PA).

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