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# Psychosocial and behavioural characteristics in women with pregnancy-related lumbopelvic pain 12 years postpartum

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## Abstract

**Background:** There is insufficient evidence regarding psychosocial factors and its long-term association with persistent pregnancy-related lumbopelvic pain. The overall aim of this study was to investigate women with persistent pregnancy-related lumbopelvic pain 12 years postpartum based on psychosocial and behavioural characteristics using the Swedish version of the Multidimensional Pain Inventory (MPI-S) classification system.

**Material and methods:** This is a cross-sectional study based on a previous cohort. Data collection took place through a questionnaire. A total of 295 women from the initial cohort ($n = 639$) responded to the questionnaire giving a response rate of 47.3%. To determine the relative risk (RR) of reporting pain 12 years postpartum, a robust modified Poisson regression was used. This is the first study using the MPI-S as a predictive variable on women with persistent pregnancy-related lumbopelvic pain.

**Results:** The MPI-S classification procedure was carried out on a total of $n = 226$ women, where 53 women were classified as interpersonally distressed (ID), 82 as dysfunctional (DYS), and 91 as adaptive copers (AC). Women in the ID and DYS subgroups had a relative risk (RR) of reporting persistent pregnancy-related lumbopelvic pain 12 years postpartum that was more than twice as high compared to the AC subgroup (95% confidence interval (CI) in parenthesis): RR 2.57 (CI 1.76 - 3.75), $p<0.0001$ and RR 2.23 (CI 1.53 - 3.25), $p<0.0001$ respectively. Women in the DYS subgroup had more than 5 times increased risk of reporting sick leave the past 12 months compared to the AC subgroup (RR 5.44; CI 1.70 - 17.38, $p=0.004$).

**Conclusions:** The present study demonstrates that it is possible to classify women with persistent pregnancy-related lumbopelvic pain 12 years postpartum into relevant clinical subgroups based on psychosocial and behavioural characteristics using the MPI-S questionnaire.

**Keywords:** Pregnancy-related lumbopelvic pain, Postpartum, Psychosocial characteristics, MPI, Cross-sectional questionnaire study

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## Introduction

Pregnancy-related lumbopelvic pain is not limited to pregnancy. Though most women recover within 6 months postpartum [1, 2], we as well as other researchers have demonstrated in several studies that symptoms can persist from a couple of years up to 12 years postpartum [3–8]. It has been shown that individuals with low back pain (LBP) who transition into a more chronic state take up the majority of the allocated resources [9]. The majority of the societal costs associated with chronicity are indirect cost such as disability, production loss, sickness absence and disability pension [10].

Psychosocial factors have long been associated with chronic pain and the bio-psycho-social model has become the leading theory of the development and management of chronic pain [11]. Psychosocial factors have also been demonstrated to play a crucial role in the transition from acute and sub-acute pain to chronicity [12–14]. In patients with musculoskeletal pain, psychosocial factors appear to exacerbate the clinical component of pain [15, 16] and have shown to influence future disability, pain, self-reported improvement after treatment in patients with LBP [17–21]. Even though pregnancy itself negatively influences health related quality of life lumbopelvic pain increases this influence [22]. Pregnancy-related lumbopelvic pain has also been shown to have great negative emotional and psychological impact on women [23]. Daily stress has been demonstrated to be a risk factor for pregnancy-related lumbopelvic pain [24] and women with postpartum depressive symptom are three times more likely to report lumbopelvic pain compared to those without [25].

The West Haven Multidimensional Pain Inventory (MPI) [26] is commonly used in studies concerned with chronic pain and was designed to capture the multidimensionality of chronic pain. Three clinically relevant subgroups are derived from the MPI instrument [27]; Interpersonally Distressed (ID), Dysfunctional (DYS), and Adaptive Copers (AC). Individuals in the ID subgroup is characterised by inadequate social support, and individuals in the DYS subgroup is characterised by high disability, affective distress, and pain intensity, while the AC group demonstrates a more successful adjustment to chronic pain.

There is a paucity of evidence in regard to psychosocial factors and its long-term association with pregnancy-related lumbopelvic pain. Therefore, the overall aim of this study was to investigate women with persistent pregnancy-related lumbopelvic pain 12 years postpartum based on psychosocial and behavioural characteristics using the MPI-S classification system. More specifically, we wanted to determine if women classified as ID or DYS, were more likely to report pain 12 years postpartum compared to women in the AC subgroup.

Secondly, we wanted to investigate if women assigned to the ID and DYS subgroup were more likely to report widespread pain, higher pain intensity, more days with pain, sick leave and disability pension compared to women in the AC subgroup. In addition, we also wanted to explore the use of prescription/non-prescription drugs and treatment sought among women with pregnancy-related lumbopelvic pain based on psychosocial and behavioural characteristics using the MPI-S. To the best of our knowledge the MPI has not been used for this condition previously.

## Methods

### Study design

This study is a cross-sectional study based on a previous cohort consisting of newly delivered women reporting lumbopelvic pain during their pregnancy in 2002. All women who had delivered from 1 January 2002 to 30 April 2002 at Departments of Obstetrics and Gynaecology at Umeå University Hospital (UUH), and Sunderby Hospital (SH), in northern Sweden were invited to fill out the first questionnaire (Q1).
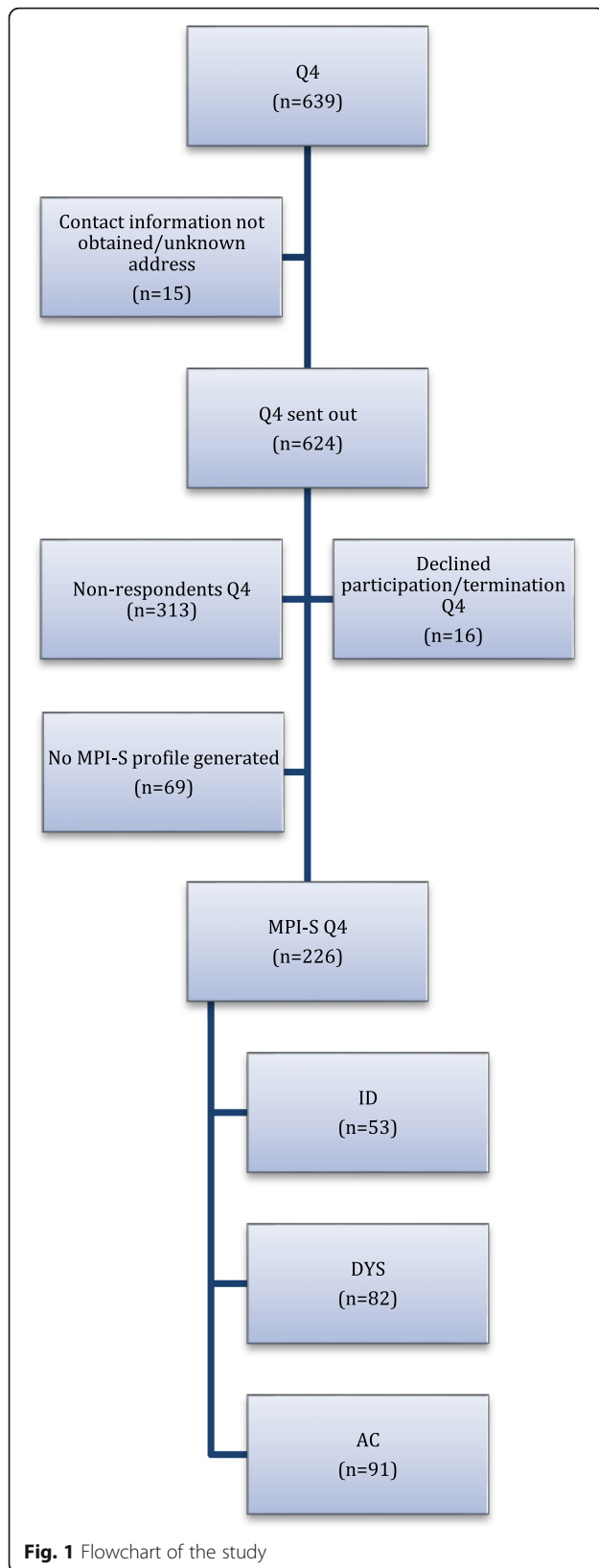
### Data collection

Collection of data took place through four questionnaires; distributed right after delivery (Q1), 6 months after delivery (Q2), 14 months postpartum (Q3), and 12 years postpartum (Q4). To enable comparisons over time, similar questions were posed throughout the questionnaires. Additionally, instruments that have been shown to work well with patients with chronic musculoskeletal pain such as the EQ-5D [28, 29], Roland Morris Disability Questionnaire (RMDQ) [30], and the Swedish version of the Multidimensional Pain Inventory (MPI-S) [31], were included in Q4. Data collection of Q4 took place between May and June 2014. More detailed information regarding the data collection has been presented in previous publications [6, 32].

### Study participants

The fourth questionnaires (Q4) were sent out to 624 women from the initial cohort ($n = 639$). A total of $n = 295$ women responded to the questionnaire giving response rate of 47.3% (Fig. 1).

### Dependent variables

The primary outcome measure was self-reported persistent pregnancy-related lumbopelvic pain 12 years postpartum using the previous definition in questionnaire Q1-Q3, where persistent pregnancy-related lumbopelvic pain was defined as 'continuous' or 'recurrent' pain in the lumbopelvic area over the past 12 months. The response alternative were 'yes, continuous pain', 'yes, recurrent pain', 'yes, pain on a few occasions', and 'no pain'. Women reporting 'continuous' or 'recurrent' pain the

**Fig. 1** Flowchart of the study

past 12 months were also asked to mark the area of pain on a schematic pain drawing [32]. The outcome variable was dichotomized into 'pain' and 'no pain' where women reporting pain on a few occasions were considered not to be in pain at Q4.

As secondary outcomes, neck pain (NP) and/or thoracic spinal pain (TSP) were dichotomized the same way as pain in the lumbopelvic area. Sciatica was defined as pain in one or both legs in relation to lumbopelvic pain the past 12 months. Pain intensity the past week and the past 12 months was reported through a visual analogue scale (VAS) of 100 mm (mm), where 0 indicated 'no pain' and 100 'worst imaginable pain'. Pain intensity was dichotomized into scores above and below 70 mm on the VAS where women scoring ≥70 mm were considered to be in severe pain [33, 34]. This cut-off score has previously been used for the same study group [4, 32, 35]. The participants were asked to estimate how many days the past 12 months they have had lumbopelvic pain with the response alternatives 'less than 30 days' and 'more than 30 days'. The same classification was done for days with NP/TSP the past 12 months. Participants were asked if they had been on sick leave due to lumbopelvic pain the past 12 months (response alternative 'yes' or 'no') and if so, how many days with the options '1-7 days in total', '8-14 in total', and 'more than 15 days in total' (dichotomized to < or ≥ 15 days the past 12 months), and to what degree they had been on sick leave ('full-time' and 'part-time' including to what degree in percentage). To investigate granted disability pension, the question 'have you been granted disability pension due to lumbopelvic pain' was used with response alternatives 'yes' and 'no'.

To explore the use of prescription/non-prescription drugs the question 'do you take any prescription and/or non-prescription drugs on a regular basis' was used with the response alternatives 'yes' or 'no'. The participants were also asked to write the names of the prescription/non-prescription drug/drugs they took on a regular basis. Furthermore, participants were asked if they had sought any healthcare/treatment due to lumbopelvic pain after their last pregnancy with the response alternatives 'yes' or 'no'.

### Independent variables

Data regarding the participants' psychological and behavioural profile were collected at Q4 through the MPI-S instrument. The MPI is a psychometric tool developed to categorize chronic pain patients into more homogenous subgroups of patients [26, 27]. The MPI has been used in a variety of chronic pain condition such as NP and LBP [27, 36–39], headaches [40], temporomandibular disorders [41], fibromyalgia [42], and cancer pain [43]. The MPI classification strategy has been

Bergström *et al. Chiropractic & Manual Therapies* (2019) 27:34

Page 4 of 12

shown to be independent of age, pain duration, pathology, and has been replicated in several studies [44].

The Swedish version of the MPI (MPI-S) has shown acceptable reliability and validity across gender [45]. The MPI-S is comprised of 34 items, 8-scale inventory divided into one psychosocial and one behavioural section. The psychosocial section consists of five scales: pain severity (PS), pain-related interference of everyday life (I), perceived life control (LC), affective distress (AD), and perceived support from significant other (S). The behavioural part entails three scales measuring individual's perception of responses of significant others to display of pain and suffering. The three scales are: punishing responses (PR), solicitous responses (SR), and distracting responses (DR). All scales include a 7 numerical interval between 0 and 6, where high scores indicate more of the characteristic in question.

Three different groups have empirically been derived from the MPI scales through cluster analysis and have been labelled: interpersonally distressed (ID), dysfunctional (DYS), and adaptive copers (AC) [27]. Individuals in the ID subgroup are characterised by inadequate social support, low solicitous response from significant other, and lower distracting response while individual in the DYS subgroup is characterised by high disability, affective distress, and pain intensity. Furthermore, individuals in the DYS subgroup are found to be more depressed, have more catastrophizing thoughts, low physical functioning, poor sleep quality and poor lifting capacity. The AC subgroup consists of individuals reporting a more successful adjustment to chronic pain compared both to ID and DYS individuals. AC individuals generally report low pain severity, low emotional distress, less catastrophizing thoughts, and better quality of sleep and physical functioning. The AC subgroup is considered to have the most favourable prognosis and less reported sick leave than both ID and DYS [37].

As not all responders had dated their questionnaire, mean age was calculated by subtracting the date of birth from January 1, 2015. Physical activity was investigated by asking the participants if they had exercised/done sports on a regular basis since their last pregnancy, with the response alternatives 'yes' or 'no'. Body Mass Index (BMI) at Q4 was calculated by kilograms (kg)/height$^2$ (meters). Self-rated health status (SRH) was investigated by asking the study participant to assess their current overall health status with the options: 'very good', 'quite good', 'fair', 'quite poor', and 'poor'. The options for relationship satisfaction were: 'very good', 'good', 'neither good or bad', 'bad', and 'very bad'.

## Statistical methods

The method used to derive the three different MPI-S subgroups was a non-hierarchical cluster procedure

(K-Means algorithm). Computations started with a standardisation of the MPI-S scales using the mean value and standard deviation to form Z-scores and then T-scores. The MPI-S subgroups were formed from the eight original scales using centroid vectors from a previously validated sample [31].

Descriptive statistics were used for all background variables of the three different MPI-S groups through the calculation of means and standard deviation (SD) for parametric data using one-way ANOVA. To test for differences between the MPI-S subgroups the independent t-test and Pearson's chi-square test was used as appropriate.

The dichotomized primary outcome of persistent pregnancy-related lumbopelvic pain 12 years postpartum was analysed using a robust modified Poisson regression [46] to determine the relative risk (RR) of reporting pain 12 years postpartum. The MPI-S subgroups were used as the predictive variable in the model. The same procedure was used for the secondary outcomes: pain intensity, days with pain, and sick leave as well as for the use of prescription/non-prescription drugs and treatment sought the past 12 months. The final model of the robust modified Poisson adjusted for LBP prior to pregnancy in 2002 improved the Akaike's Information Criterion (AIC) and the Bayesian Information Criterion (BIC). Due to violation of the normality assumption, pain intensity the past week as well as the past 12 months were also analysed by Kruskal-Wallis 1-way ANOVA on ranks; a suitable alternative for comparisons of three groups or more [47]. Additionally, the Mann-Whitney $U$ test was used to compare difference between two independent variables. As individuals belonging to the AC subgroup are considered better copers, the AC subgroup was used as the predefined reference group in all statistical analyses. All data was analysed using the SPSS v 24.0 software package. Statistical significance was set at $p < 0.05$ when comparing differences among the three MPI-S subgroups.

## Ethics, consent and permission

This study was approved by the Ethics Committee at the Umeå University (Dnr 2014–4-32 M supplement to Dnr 2012–404-31 M) and was performed in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants. No collection of details, images, or videos related to an individual person took place in this study.

## Results

### The Swedish version of the MPI (MPI-S)

The MPI-S classification procedure was carried on a total of $n = 226$ women. Table 1 describes the MPI-S study population at Q4, where 53 women were classified as interpersonally distressed (ID), 82 as dysfunctional

**Table 1** Descriptive information on MPI-S subgroups

| | MPI-S subgroups | | | Total | P-value[e] | |
|---|---|---|---|---|---|---|
| | ID[a] | DYS[b] | AC[c] | $n = 226$ | $X^2$ | F |
| | $n = 53$ | $n = 82$ | $n = 91$ | | | |
| Age, mean (SD) | 43.8 (5.1) | 42.8 (4.5) | 43.6 (4.6) | 43.4 (4.7) | | 0.38 |
| Marital status | | | | | | |
|   Married/cohabiting | 42 (85.7) | 65 (92.2) | 65 (91.5) | 172 (90.5) | 0.27 | |
|   Relationship but not cohabiting | 2 (4.1) | 4 (5.7) | 2 (2.8) | 8 (4.2) | | |
|   Single | 5 (10.2) | 1 (1.4) | 4 (5.6) | 10 (5.3) | | |
| Education in 2002 | | | | | | |
|   Up to high school/folk school | 29 (54.7) | 43 (53.8) | 47 (52.8) | 119 (53.6) | 0.96 | |
|   University or higher | 24 (45.3) | 37 (46.3) | 42 (47.2) | 103 (46.4) | | |
| Total number of children | | | | | | |
|   1 | 14 (26.4) | 16 (19.5) | 23 (25.3) | 53 (27.0) | 0.72 | |
|   2 | 16 (30.2) | 21 (25.6) | 28 (30.8) | 65 (33.2) | | |
|   3 | 12 (22.6) | 26 (31.7) | 26 (28.6) | 64 (32.7) | | |
|   ≥ 4 | 11 (20.8) | 19 (23.2) | 14 (15.4) | 44 (22.4) | | |
| Physical activity | | | | | | |
|   Yes | 33 (62.3) | 53 (66.3) | 66 (73.3) | 152 (68.2) | 0.35 | |
|   No | 20 (37.7) | 27 (33.8) | 24 (26.7) | 71 (31.8) | | |
| Body Mass Index (BMI), mean (SD) | 25.0 (5.3) | 24.9 (4.3) | 25.9 (4.1) | 25.2 (4.4) | | 0.67 |
| Relationship satisfaction | | | | | | |
|   Very good | 18 (37.5) | 47 (58) | 54 (62.8) | 119 (55.3) | 0.13 | |
|   Good | 18 (37.5) | 23 (28.4) | 24 (27.9) | 65 (30.2) | | |
|   Neither good or bad | 9 (18.8) | 9 (11) | 7 (8.1) | 25 (11.6) | | |
|   Bad | 2 (4.2) | 2 (2.4) | 1 (1.2) | 5 (2.3) | | |
|   Very bad | 1 (2.1) | – | – | 1 (0.5) | | |
| Low back pain before pregnancy in 2002 | | | | | | |
|   No | 5 (27.8) | 21 (48.8) | 18 (69.2) | 44 (50.6) | 0.025 | |
|   Yes | 13 (72.2) | 22 (51.2) | 8 (30.8) | 43 (49.2) | | |
| Pain status | | | | | | |
|   No pain | 14 (26.9) | 30 (36.6) | 65 (72.2) | 109 (48.7) | < 0.0001 | |
|   Pain | 38 (73.1) | 52 (63.4) | 25 (27.8) | 115 (51.3) | | |
| Pain intensity the past week (VAS[d]), mean (SD) | 38.0 (28.6) | 41.4 (31.9) | 15.2 (19.7) | 31.68 (29.8) | | < 0.0001 |
| Pain intensity the past 12 months (VAS[d]), mean (SD) | 58.7 (23.4) | 52.2 (23.9) | 40.4 (20.0) | 52.3 (23.9) | | < 0.0001 |
| Self-reported health (SRH) | | | | | | |
|   Very good | 3 (5.7) | 2 (2.5) | 24 (26.4) | 29 (12.9) | < 0.0001 | |
|   Quite good | 19 (35.8) | 29 (35.8) | 52 (57.1) | 100 (44.4) | | |
|   Fair | 18 (34.0) | 28 (34.6) | 13 (14.3) | 59 (26.2) | | |
|   Quite poor | 12 (22.6) | 17 (21.0) | 1 (1.1) | 30 (13.3) | | |
|   Poor | 1 (1.9) | 5 (6.2) | 1 (1.1) | 7 (3.1) | | |

Numbers in parenthesis are percentage unless otherwise specified
[a]Interpersonally distressed
[b]Dysfunctional
[c]Adapative copers
[d]Visual Analogue Scale
[e]Significance test $p < 0.05$

(DYS), and 91 as adaptive copers (AC). The mean age across the MPI-S group was 43.4 years (SD 4.7). The vast majority of women were either married or cohabiting and 53.6% had a high school/folk school education. Most women reported having a total of 2 or 3 children and almost 70% of the women reported to participate in physical activity on a regular basis. Mean BMI across the study population was 25.2 (SD 4.4) kg/m$^2$ and most women reported to be satisfied with their relationship. No statistically significant difference was found between the MPI-S subgroups regarding the above-mentioned variables in Table 1. Women in both the ID and DYS subgroup reported LBP before pregnancy in 2002 to a statistically significantly higher degree compared to the AC subgroup ($p = 0.025$). Additionally, a statistically significant difference were found between women in the ID and DYS subgroups compared to the AC subgroup in regard to pain status (pain versus no pain) at Q4 ($p < 0.0001$), pain intensity the past week ($p < 0.0001$) and the past 12 months ($p < 0.0001$), and SRH ($p < 0.0001$), where women in the AC subgroup reported pain at Q4 to a lesser degree, lower pain intensity both the past week (Fig. 2a) as well as the past 12 months (Fig. 2b). Women in the AC subgroup also reported better SRH at Q4 compared both to both the ID and DYS subgroups.

Table 2 gives an overview of descriptive data for the three individual subgroups (ID, DYS and AC). As expected, the descriptive data could differentiate between the individual subgroups and statistically significant differences were observed in all variables with the exception of NP/TSP the past 12 months, degree of sick leave and days of sick leave the past 12 months.

### Primary and secondary outcomes

Women belonging to the ID and DYS subgroup had a RR of reporting pain 12 years postpartum (95% confidence interval (CI) in parenthesis) of 2.57 (CI 1.76–3.75), $p < 0.0001$ and 2.23 (CI 1.53–3.25), $p < 0.0001$ respectively, compared to the AC subgroup (adjusting for LBP before pregnancy in 2002). Moreover, additional analyses demonstrated that women in the ID subgroup had a statistically significant increased RR in all variables with the exception of NP/TSP, sick leave and treatment sought the past 12 months compared to the AC subgroup. The DYS subgroups had a statistically significant increased RR in all variables, except NP/TSP, compared to the AC subgroup. Notable is that the DYS subgroup had more than 5 times increased RR of reporting sick leave the past 12 months compared to the AC subgroup at Q4 (RR 5.44; CI 1.70–17.38, $p = 0.004$) (Table 3). In addition, both the ID and DYS subgroup had an 8 to 11 times increased RR in reporting pain intensity of ≥70 mm both the past week and the past 12 months. Women in the ID and DYS subgroups also used antidepressants ($\chi^2$ (2, $N = 226$) = 6.92, $p = 0.031$),

paracetamol ($\chi^2$ (2, $N = 226$) = 17.99, $p > 0.0001$), opiates ($\chi^2$ (2, $N = 226$) = 7.04, $p = 0.03$), and other drugs ($\chi^2$ (2, $N = 226$) = 8.70, $p = 0.031$) to a statistically significant higher extent compared to the AC subgroup with the exception of Non-Steroid Anti-Inflammatory Drugs (NSAID) ($\chi^2$ (2, $N = 226$) = 2.70, $p = 0.26$) (Fig. 3).

Table 4 show that there was a statistically significant effect on the overall pain intensity the past week as well as pain intensity the past 12 months between the MPI-S subgroups ($p < 0.0001$). A statistically significant difference was also demonstrated regarding pain intensity the past week and the past 12 months between ID and AC and between DYS and AC, where women in the ID and DYS subgroup reported higher pain intensity in both variables compared to the AC subgroup (Table 4).

## Discussion

This study aimed to investigate psychosocial and behavioural characteristics in women with persistent pregnancy-related lumbopelvic pain 12 years postpartum using the MPI-S. In this study we have demonstrated that it is possible to classify this group of women into clinically relevant subgroups using the MPI-S questionnaire. As hypothesized, women with more pronounced psychosocial difficulties (ID or DYS) were more than twice as likely to report pain 12 years postpartum compared to women belonging to the AC subgroup. Women in the ID and DYS subgroups also reported widespread pain to a higher extent, higher pain intensity, and more sick leave and disability pension compared to women in the AC subgroup. They also reported that they used prescription/non-prescriptions drugs to a higher degree and sought more treatment compared to women in the AC subgroup.

Together with previous episodes of LBP, psychological risk factors have been suggested to be of particular importance in the course of LBP [15, 16, 48–50]. Congruent with the findings in this study, emotional distress during pregnancy has been shown to be positively associated with severe persistent pregnancy-related lumbopelvic pain [51] and postpartum depressive symptoms has been demonstrated to be three times more prevalent in women with lumbopelvic pain compared to those not afflicted [25]. More extensive rehabilitation programs including counselling with focus on coping strategies may be more beneficial for patients with more pronounced psychosocial factors. A multidisciplinary approach is probably the most appropriate and effective intervention for patients with a variety of chronic musculoskeletal problem as it may help patients to lessens pain and disability, reduce number of sick days, and help the individual to faster return to work compared to physical treatment or usual care [52]. Consequently, it appears necessary to timely address psychosocial factors in women with persistent pregnancy-related lumbopelvic

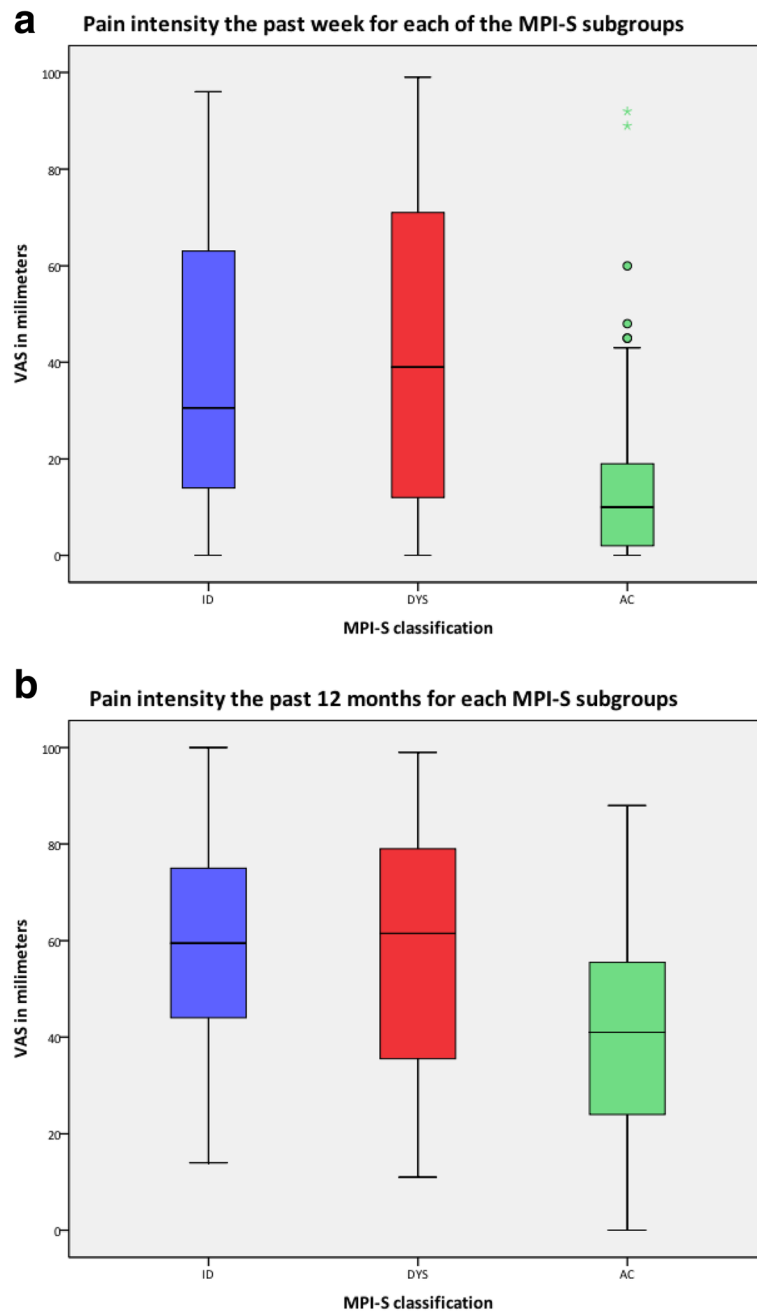**Fig. 2 a** Pain intensity the past week for each of the MPI-S subgroups. **b** Pain intensity the past 12 months for each of the MPI-S subgroups

pain in an attempt to prevent symptoms to become chronic in nature.

Poor health-related qualities of life, kinesiophobia, high degree of disability and pain intensity, have been demonstrated to be linked to pregnancy-related lumbo-pelvic pain [53]. Persistent symptoms seem to negatively affect the ability to perform daily activities and women with persistent symptoms postpartum are often concerned about the possible progression of symptom [54]. As expected, women classified as ID and DYS

demonstrated statistically increased risk in almost all secondary outcome variables compared to the AC subgroup. It is noteworthy that there were more than 5 times increased risk of women in the DYS subgroup to report sick leave the past 12 months compared to the AC subgroup (Table 3). These findings are similar to results in previous studies using the MPI questionnaire on populations with chronic LBP [37, 38]. Another study found that individuals with high levels of fear-avoidance were twice as likely to believe that sick leave is a good

**Table 2** Test for difference between MPI-S groups 12 years postpartum using Pearson's chi-square test

| | ID[a]<br>n = 53 | DYS[b]<br>n = 82 | AC[c]<br>n = 91 | p-value[e] |
|---|---|---|---|---|
| Pain intensity the past week (VAS[d]) | | | | |
| < 70 mm | 43 (81.1) | 62 (75.6) | 89 (97.8) | < 0.0001 |
| ≥ 70 mm | 10 (18.9) | 20 (24.4) | 2 (2.2) | |
| Pain intensity the past 12 months (VAS[d]) | | | | |
| < 70 mm | 37 (69.8) | 55 (67.1) | 88 (96.7) | < 0.0001 |
| ≥ 70 mm | 16 (30.2) | 27 (32.9) | 3 (3.3) | |
| Days with persistent LBP/PGP the past 12 months | | | | |
| < 30 days | 11 (23.9) | 24 (31.6) | 45 (71.4) | < 0.0001 |
| ≥ 30 days | 35 (76.1) | 52 (68.4) | 18 (28.6) | |
| Sciatica | | | | |
| No | 13 (28.3) | 22 (29.3) | 37 (58.7) | < 0.0001 |
| Yes | 33 (71.7) | 53 (70.7) | 26 (41.3) | |
| Neck or thoracic pain the past 12 months | | | | |
| No | 16 (51.6) | 26 (59.1) | 21 (77.8) | 0.11 |
| Yes | 15 (48.4) | 18 (40.9) | 6 (22.2) | |
| Days with neck or thoracic pain the past 12 months | | | | |
| < 30 days | 11 (26.2) | 21 (32.3) | 25 (53.2) | 0.018 |
| ≥ 30 days | 31 (73.8) | 44 (67.7) | 22 (46.8) | |
| Sick leave the past 12 months | | | | |
| No | 41 (91.1) | 56 (75.7) | 58 (95.1) | 0.003 |
| Yes | 4 (8.9) | 18 (24.3) | 3 (4.9) | |
| Degree of sick leave | | | | |
| Full-time | 6 (100) | 15 (88.2) | 2 (66.7) | 0.34 |
| Part-time | – | 2 (11.8) | 1 (33.3) | |
| Days of sick leave the past 12 months | | | | |
| < 15 days | 2 (50.0) | 8 (44.4) | 2 (50.0) | 0.97 |
| ≥ 15 days | 2 (50.0) | 10 (55.6) | 2 (50.0) | |
| Granted disability pension | | | | |
| No | 39 (88.6) | 68 (90.7) | 57 (100) | 0.042 |
| Yes | 5 (11.4) | 7 (9.3) | – | |
| Prescription and/or non-prescription drugs | | | | |
| No | 22 (41.5) | 33 (40.7) | 58 (65.2) | 0.002 |
| Yes | 31 (58.5) | 48 (59.3) | 31 (34.8) | |
| Treatment sought since last delivery due to persistent LBP/PGP | | | | |
| No | 26 (56.5) | 26 (34.2) | 43 (70.5) | < 0.0001 |
| Yes | 20 (43.5) | 50 (65.8) | 18 (29.5) | |

Numbers in parenthesis are percentage unless otherwise specified
[a]Interpersonally distressed
[b]Dysfunctional
[c]Adaptative copers
[d]Visual Analogue Scale
[e]Significance test p < 0.05

treatment for LBP compared to individuals with low levels of fear-avoidance [55]. The individual beliefs about LBP, comorbidities, and coping abilities appear to be the most important reasons for sick leave due to LBP [56]. This could possibly explain why women belonging to the AC subgroup reported statistically significant less sick leave compared to the DYS subgroup, as the AC subgroup is characterized by less pain intensity and co-morbidities, better coping abilities, and have a more positive outlook on LBP.

Patients on analgesics medications incur higher cost to society [10] and the World Health Organisation (WHO) has ranked depression as the single largest contributor to global disability [57]. In this study, prescription/non-prescription drugs were used to a significant lesser extent in the AC subgroup compared to both the ID and DYS subgroup. Women in the ID subgroup reported use of antidepressants drugs to a statistically significant higher extent compared to women in the DYS and AC subgroup. Even though individuals belonging to the DYS subgroup have been found to be significantly more depressed compared to individuals in the ID subgroup [44], there may be different factors contributing to symptoms of depression in the two subgroups. Depressive symptoms in ID individuals may be more contributed to marital and interpersonally difficulties, lack of support from significant other compared to individuals in the DYS subgroup [31, 44]. ID individuals rated the quality of their interpersonal relationship as lower compared to both DYS and AC subgroups [44] and this was also true in this study, though not to a statistically significant degree. Worrisome is the high use of opiates among women in the DYS subgroup, especially considering the unknown long-term effectiveness and safety of opioids [58] as well as the emerging evidence that long-term opioid use increases the risk of abnormal menstruation and of menopausal symptoms in women [59].

### Methodological considerations
This study has some limitations that need to be discussed. Failure to respond to parts of the MPI questionnaire renders an unclassifiable profile [60, 61]. A total of 69 women did not respond to sufficient numbers of questions of the MPI-S questionnaire and had to be excluded due to missing data in the two different section of the MPI-S. This negatively impacted the number of women in each of the MPI-S subgroups, hence, reducing statistical power and increased the risk of Type II error in the analysis of the data. The MPI-S was only distributed at Q4 and may infer that the women in this study could have changed MPI-S groups over the course of the study. Even though classification changes can occur over time (mostly in the AC subgroup) several studies have confirmed the MPI classification system internal

**Table 3** Risk ratios for the MPI-S groups using AC[c] as reference of the explantory variable, estimated by modified Poisson regression and adjusted for low back pain prior to pregnancy in 2002

| | ID[a] | | | | DYS[b] | | | |
|---|---|---|---|---|---|---|---|---|
| | n (%) | RR | CI (95%) | *p*-value[e] | n (%) | RR | CI (95%) | *p*-value[e] |
| Pain status 12 years post partum | 49 (22.5) | | | | 79 (36.2) | | | |
| No pain | | 1 | | | | 1 | | |
| Pain | | 2.57 | 1.76–3.75 | < 0.0001 | | 2.23 | 1.53–3.25 | < 0.0001 |
| Days with lumbopelvic pain the past 12 months | 43 (24.2) | | | | 73 (41.0) | | | |
| <30 days | | 1 | | | | 1 | | |
| ≥30 days | | 2.63 | 1.72–4.03 | < 0.0001 | | 2.35 | 1.55–3.57 | < 0.0001 |
| Pain intensity the past week (VAS[d]) | 50 (22.8) | | | | 79 (36.1) | | | |
| <70 mm | | 1 | | | | 1 | | |
| ≥70 mm | | 8.38 | 1.90–37.00 | 0.005 | | 11.00 | 2.66–45.48 | 0.001 |
| Pain intensity the past 12 months (VAS[d]) | 50 (22.8) | | | | 79 (36.1) | | | |
| <70 mm | | 1 | | | | 1 | | |
| ≥70 mm | | 9.43 | 2.89–30.72 | < 0.0001 | | 9.32 | 2.94–29.57 | < 0.0001 |
| Sciatica | 43 (24.3) | | | | 72 (40.7) | | | |
| No | | 1 | | | | 1 | | |
| Yes | | 1.81 | 1.27–2.58 | 0.001 | | 1.77 | 1.26–2.48 | 0.001 |
| Neck and/or thoracic pain | 28 (29.5) | | | | 41 (43.2) | | | |
| No | | 1 | | | | 1 | | |
| Yes | | 2.09 | 0.94–4.62 | 0.07 | | 1.98 | 0.92–4.26 | 0.08 |
| Days with neck or thoracic pain the past 12 months | 39 (26.5) | | | | 62 (42.2) | | | |
| <30 days | | 1 | | | | 1 | | |
| ≥30 days | | 1.62 | 1.12–2.34 | 0.01 | | 1.51 | 1.05–2.16 | 0.03 |
| Sick leave the past 12 months | 42 (24.3) | | | | 71 (41.0) | | | |
| No | | 1 | | | | 1 | | |
| Yes | | 2.13 | 0.51–8.82 | 0.30 | | 5.44 | 1.70–17.38 | 0.004 |
| Treatment sought the past 12 months | 43 (24.4) | | | | 73 (41.5) | | | |
| No | | 1 | | | | 1 | | |
| Yes | | 1.51 | 0.91–2.52 | 0.11 | | 2.28 | 1.50–3.46 | < 0.0001 |
| Prescription and/or non-prescription drugs | 50 (23.1) | | | | 78 (36.1) | | | |
| No | | 1 | | | | 1 | | |
| Yes | | 1.66 | 1.13–2.43 | 0.009 | | 1.70 | 1.20–2.41 | 0.003 |

Numbers in parenthesis are percentage unless otherwise specified
[a]Interpersonally distressed
[b]Dysfunctional
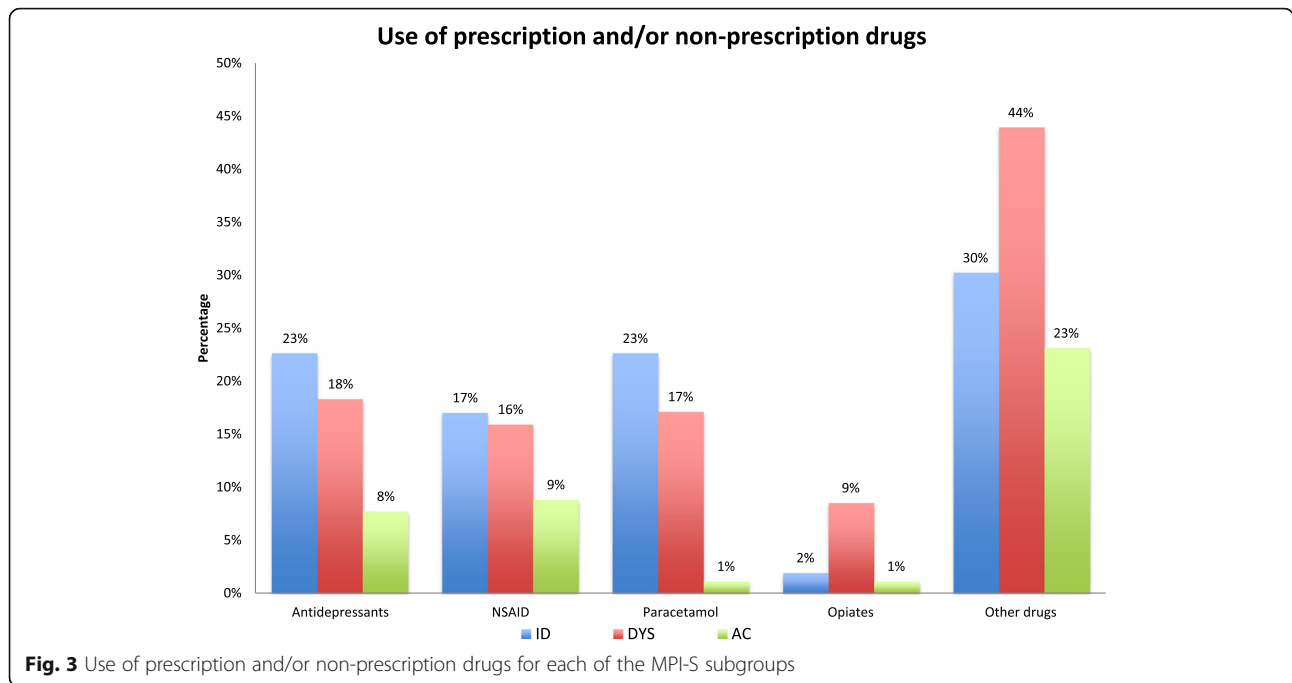[c]Adapative copers
[d]Visual Analogue Scale
[e]Significance test *p* < 0.05

reliability, validity and generalizability both in interventional and observational studies in patients with chronic musculoskeletal pain [31, 62–64]. In addition, the Swedish version of the MPI (MPI-S) has shown good reliability and validity across gender [45] and no difference in pain duration or medical variables [31].

Conversely to studies where we investigated individuals with chronic musculoskeletal pain using the MPI-S [38, 65], the number of individuals in the AC subgroup is high. This seems reasonable, as approximately 60% of women responding to the Q4 reported no pain 12 years postpartum [6]. Moreover, studies investigating NP and LBP in a gainfully employed population have demonstrated that the AC subgroup is commonly larger than both the ID and the DYS subgroup [36, 37].

This cross-sectional study is part of a cohort of women that commenced in 2002. At that point, today's

**Fig. 3** Use of prescription and/or non-prescription drugs for each of the MPI-S subgroups

definition of PGP based on positive diagnostic tests as well as pain upon palpation of the ligaments and joints of the pelvis was not available. Instead pain drawings were used in this study to describe pain location [6, 32]. However, it is impossible to exclude pain from the lumbar area or a combination of PGP and LBP, as it strongly correlates to the same anatomical location as non-specific LBP. Yet, it has been demonstrated that there is an increased risk of persistent pregnancy-related lumbopelvic pain if a woman is diagnosed with both LBP and PGP during pregnancy [66]. Swedish women under the age of 65 are overrepresented in the statistics regarding chronic LBP [67] and the estimated prevalence of LBP in women in the age group 40–49 years is 35% [68]. LBP is commonly regarded as stable over time, while pelvic pain increases during pregnancy [69]; hence factors and outcomes in this study are probably mostly related to pregnancy-related pelvic pain.

Baseline data (Q1) was complete on all subjects and analysis of the data collected through Q4 showed that non-responders did not differ significantly in the majority of variables compared to responders [6].

Convenience sampling of doublet questionnaires (Q4) were able to show that most questions showed adequate to excellent agreement [6] and questions in Q4 were very similar to those in Q1-Q3. Data collected after delivery (Q2-Q3) has been regarded to be representative of Swedish women with persistent PGP [32]. About 19% of women responding to Q4 reported pain to various degree 12 years postpartum, which is in line with other long-term follow-up studies of women with persistent pregnancy-related lumbopelvic pain [3, 8].

## Conclusions

This study is unique as it is the first study attempting to classify women with persistent pregnancy-related lumbopelvic pain into psychosocial derived subgroups. We were able to demonstrate that a multidimensional approach to classification of women with persistent pregnancy-related lumbopelvic pain based on psychosocial and behavioural characteristics, can further distinguish different clinically relevant subgroups in women with persistent symptoms 12 years postpartum. The

**Table 4** Comparing highest level of pain at Q4 using the AC group as the reference group

| Highest level of pain | ID | | | | DYS | | | | *p*-value[c] KW-test |
|---|---|---|---|---|---|---|---|---|---|
| | n | Median[a] | IR[b] | *p*-value MW-test | n | Median[a] | IR[b] | *p*-value MW-test | |
| Past week | 46 | 30.5 | 51 | < 0.0001 | 75 | 39 | 59 | < 0.0001 | < 0.0001 |
| Past 12 months | 46 | 59.5 | 34 | < 0.0001 | 76 | 61.5 | 44 | < 0.0001 | < 0.0001 |

[a]Median Mann-Whitney U test. [b]*IR* Interquartile Range. [c]Kruskal-Wallis *p*-value
Significant result *p* < 0.05 using Mann-Whitney *U* test
Significant result *p* < 0.05 using Kruskal-Wallis test

MPI-S classification system together with clinical data, early and customized interventions with a multidisciplinary approach could thus improve clinical outcomes for women with persistent pregnancy-related lumbopelvic pain and reduce the economic burden on the social security and healthcare systems. Future research concerning women with pregnancy-related lumbopelvic pain needs to take psychosocial and behavioural characteristics into consideration.

### Abbreviations
AC: Adaptive copers; BMI: Body mass index; CI: Confidence interval; DYS: Dysfunctional; ID: Interpersonally distressed; LBP: Low back pain; MPI-S: Multidimensional Pain Inventory – Swedish version; NP: Neck pain; NSAID: Non-Steroid Anti-Inflammatory Drugs; PPGP: Persistent pelvic girdle pain; RMDQ: Roland Morris Disability Questionnaire; RR: relative risk; TSP: Thoracic spinal pain; VAS: Visual analogue scale

### Availability of data and materials
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### Authors' contributions
All authors have read and approved the final manuscript. CB was involved in the study design, data collection, analysis and interpretation of the data, drafting and revising of the manuscript and has given final approval. MP was involved in the study design, data collection, interpretation of data, and revision of the manuscript and gave final approval. IM was involved in study design, interpretation of data, and revision of the manuscript, and gave final approval.

### Ethics approval and consent to participate
This study was approved by the Ethics Committee at the Umeå University (Dnr 2014–4-32 M supplement to Dnr 2012–404-31 M) and was performed in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants. No collection of details, images, or videos related to an individual person took place in this study.

### Consent for publication
Not applicable in this study.

### Competing interests
The authors declare that they have no competing interests.

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