





Cut-off scores of the Depression Anxiety Stress Scale-8: Implications for improving the management of chronic pain

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Abstract

Aim: Mental distress, non-specific symptoms of depression and anxiety, is common in chronic pelvic pain (CPP). It contributes to poor recovery. Women's health nurses operate in multidisciplinary teams to facilitate the assessment and treatment of CPP. However, valid cut-off points for identifying highly distressed patients are lacking, entailing a gap in CPP management.

Design: This instrumental cross-sectional study identified a statistically derived cut-off score for the Depression Anxiety Stress Scale-8 (DASS-8) among 214 Australian women with CPP (mean age = 33.3, SD = 12.4, range = 13–71 years).

Methods: Receiver operator characteristic curve, decision trees and K-means clustering techniques were used to examine the predictive capacity of the DASS-8 for psychiatric comorbidity, pain severity, any medication intake, analgesic intake and sexual abuse. The study is prepared according to the STROBE checklist.

Results: Cut-off points resulting from the analysis were ordered ascendingly. The median (13.0) was chosen as an optimal cut-off score for predicting key outcomes. Women with DASS-8 scores below 15.5 had higher analgesic intake.

Conclusion: CPP women with a DASS-8 score above 13.0 express greater pain severity, psychiatric comorbidity and polypharmacy. Thus, they may be a specific target for nursing interventions dedicated to alleviating pain through the management of associated co-morbidities.

Implications for patient care: At a cut-off point of 13.0, the DASS-8 may be a practical instrument for recommending a thorough clinician-based examination for psychiatric comorbidity to facilitate adequate CPP management. It may be useful for evaluating patients' response to nursing pain management efforts. Replications of the study in different populations/countries are warranted.

KEYWORDS

chronic pelvic pain, cut-off score*/cut-off point*, pain severity/polypharmacy/the intake of any medication/analgesics/pain medication, psychological distress/psychiatric comorbidity, receiver operator curve (ROC)/decision trees/K-means clustering, sexual abuse/sexual assault/post-traumatic stress, short form of the Depression Anxiety Stress Scale 21/Depression Anxiety Stress Scale 8-items

1 | INTRODUCTION

Chronic pelvic pain (CPP) is pain in the pelvis, which persists for more than three consecutive months, and it is unrelated to cancer, intercourse or menstruation (Ali, Hendawy, et al., 2022; Bruckenthal, 2011). CPP prevails globally in up to 26.6% of reproductive-age women (Tewhaiti-Smith et al., 2022). It has a lifetime occurrence of 33% (Bruckenthal, 2011). It is frequently associated with debilitating conditions: gastrointestinal (e.g. Crohn's disease and irritable bowel), urogenital (e.g. endometriosis and polycystic ovarian syndrome), neurological (central pain sensitization and low pressure-pain thresholds due to dysregulation in neurotransmitters, e.g. nerve growth factor), musculoskeletal (e.g. abdominal myofascial dysfunction) and endocrine (e.g. induced by endocrine-disrupting chemicals such as phthalates) (Huntington & Gilmour, 2005; Phan et al., 2021; Terzoni et al., 2023; Tewhaiti-Smith et al., 2022; Yang et al., 2017). It takes a relatively long time (up to 10 years) to get these conditions reported and diagnosed (Huntington & Gilmour, 2005; Tewhaiti-Smith et al., 2022).

Despite its high prevalence, only 1% of CPP women seek help from a pain specialist. Alternatively, they seek assistance from gynaecologists, primary care physicians and urologists (Bruckenthal, 2011). Both CPP and related conditions exert significant negative impact on social, academic and sexual/romantic relationships (Armour et al., 2020; Tewhaiti-Smith et al., 2022). Different aspects of patients' health can be seriously affected, with more than 52% of women expressing poor sleep and limited ability to move or do simple daily activities (Dysvik et al., 2013; Gökyıldız & Beji, 2012). The economic burden of CPP is high. However, it relatively varies across countries with estimated total annual costs of \$2.8 billion, ¥191,680 to ¥246,488, and \$16,970 to \$20,898 per woman in the United States, Japan and Australia, respectively (Armour et al., 2019; Huang et al., 2022). Productivity loss accounts for 75%–84% of the cost of CPP, regardless of having a diagnosis of endometriosis (Armour et al., 2019).

Anxiety and mood disorders are more prevalent among patients with CPP (Bruckenthal, 2011; Delanerolle et al., 2021; Dunbar et al., 2021; Lopes et al., 2021; Siqueira-Campos et al., 2019). They represent key causes of distress, altered functioning and poor quality of life (Dunbar et al., 2021; Lopes et al., 2021; Siqueira-Campos et al., 2019). Multiple overlapping mechanisms such as alterations in neurotrophins and inflammatory mediators operate simultaneously to drive pain, anxiety and depression (Arango-Dávila & Rincón-Hoyos, 2018; Consonni et al., 2021; Dunbar et al., 2021; Lopes et al., 2021). CPP in many instances is difficult-to-treat, rendering

What does this paper contribute to the wider global clinical community?

It emphasises integrating distress assessment in chronic pelvic pain (CPP) management pathways. CPP management outcomes may improve by allocating highly distressed patients (DASS-8 score above 13.0) to comprehensive interventional programs.

patients at risk for psychological frailty. Painful manifestations may contribute to mood dysfunction, especially when pain is persistent rather than intermittent (Arango-Dávila & Rincón-Hoyos, 2018; Consonni et al., 2021; Dunbar et al., 2021; Lopes et al., 2021). In addition, CPP may exacerbate depressive mood by promoting constant patterns of cognitive biases (e.g. pain catastrophism), sleep disturbance, emotion dysregulation, behavioural inactivation and loneliness (Consonni et al., 2021; Soltani et al., 2019). Despite the noted bidirectional relations between CPP and depressive/anxiety comorbidity (Consonni et al., 2021; Huang et al., 2020; Soltani et al., 2019), longitudinal studies, which are quite few, report significant contribution of depression and anxiety to pain and related disability (Dybowski et al., 2018; Lerman et al., 2015). However, pain and pain-related disability failed to predict depression/anxiety (Lerman et al., 2015) or quality of life (Dybowski et al., 2018).

CPP patients frequently experience a wide range of collateral physical symptoms beyond their primary pain complaint itself. In addition, pain-related distress (anxiety and depression) directly contribute to psychosocial disability and greater reporting of other noxious physical complaints (Dunbar et al., 2021; McCracken et al., 1998). Apart from the influence of the biopsychosocial factors, the high degree of CPP overlap or co-prevalence with other common pain conditions (e.g. irritable bowel syndrome) accounts for the disappointing rates of response to treatment (Bruckenthal, 2011; Terzoni et al., 2023). Because it is not easy to define a clear organic injury or disease in CPP, it is commonly addressed as a multifactorial condition (Gökyıldız & Beji, 2012). Application of the whole-person model in understanding the experiences of people with persistent pain is reported to increase the use of personalised pain management plans, reduce procedural interventions, and increase attendance and clinically significant gains from shorter and more flexible group programs (Hayes & Hodson, 2011). Therefore, biopsychosocially oriented approaches for CPP treatment are directed towards early detection and management of clinically significant distress

symptomatology for alleviating pain intensity and related physical complaints (Dybowski et al., 2018).

Being involved in the assessment, documentation, referral and treatment of CPP, rehabilitation and women's health nurses focus on understanding and addressing the complexity of the physiological, cognitive, social, behavioural, neurological, sexual and emotional aspects of this neglected common health problem (Bruckenthal, 2011; Huntington & Gilmour, 2005; Terzoni et al., 2023). They operate in multidisciplinary teams to alleviate the painful symptoms in CPP women through the application of conventional medicine and complementary/alternative modalities, which also serve to minimise psychological suffering and improve physical functioning such as breathing retraining, biofeedback, evidence-based dietary regimens and noninvasive neuromodulation (Terzoni et al., 2023; Yang et al., 2017). Deriving from the holistic nursing approach, nurses have been investing effort in the development of cognitive behavioural therapy (CBT) group (Dysvik et al., 2013) as well as exercise combined with direct vagina low voltage low frequency electric stimulation-based CPP management (Yang et al., 2017). This inter-professional CBT work provides frequent multi-dimensional monitoring, ongoing support (both by clinicians and peers) and education about disease self-management. As a result, patients receiving this intervention express improvements in pain severity, pain interference, physical functioning and health-related quality of life (Dysvik et al., 2013). This approach is intended to overcome time and resource constraints in the ordinary brief office visits—a reason for under service or inconsistent access to health care in CPP women. Likewise, exercise on top of electric stimulation improved the strength of type I and type II pelvic floor muscles in primiparous women with episiotomy or second-degree episiotomy tear, indicating that this modality may defeat the neuro-muscular origins of CPP (Yang et al., 2017).

Psychological distress is referred to as non-specific symptoms of depression and anxiety (Ali, Hendawy, et al., 2022; Ali, Hori, et al., 2022). Several continuous measures of distress may be initially used for the detection of individuals who require more comprehensive symptom assessment: Patient Health Questionnaire-4, Kessler-10/Kessler-6, Distress Questionnaire-5, Mental Health Inventory-5, Hopkins Symptom Checklist-25, Self-Report Questionnaire-20, Distress Thermometer and Depression Anxiety Stress Scale-21 (DASS-21) (Ali et al., 2021; Batterham et al., 2018). However, practical decisions on who should be referred to further clinical workout and psychological treatment require evidence on clear cut-off points. In a couple of former investigations, the Depression Anxiety Stress Scale-8 (DASS-8), the shortest form of the DASS-21, expressed more robust psychometric properties (e.g. construct validity, measurement invariance, convergent validity, criterion validity and discriminant validity) among healthy and diseased groups compared with the DASS-21 and the DASS-12. This scale has the merit of capturing the symptoms of overall distress as well as the specific symptoms of depression, anxiety, and stress (Ali et al., 2021; Ali, Alameri, et al., 2022; Ali, Hendawy, et al., 2022; Ali, Hori, et al., 2022). Among Australian women with CPP, the DASS-8 correlated more strongly with measures of pain and history of sexual abuse than

other versions of the DASS (Ali, Hendawy, et al., 2022). Therefore, the present study aimed to determine an optimal cut-off point for the DASS-8, which may help nurses to decide whether patients' distress scores represent a clinically relevant burden through the interference with other symptom-related measures.

2 | METHODS

2.1 | Study design and participants

In this instrumental cross-sectional study, we analysed data derived from a convenience sample of women with CPP ($N = 214$), which was obtained from a specialist pelvic pain clinic in South Australia during the period between January 2015 and July 2016. Women reporting CPP were included in the study if they completed a pretreatment questionnaire, and they or their guardian (for those less 18 years) signed an informed consent. Women reporting only sex pain or period pain were not eligible to participate. Ethical approval of the study was obtained from the Human Research Ethics Committee of the University of South Australia (Application ID: 0000036598; 26/05/2017). See Data S1 for the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) checklist (Von Elm et al., 2014) used in reporting this research.

2.2 | Measures

The pretreatment questionnaire comprised a set of questions about pain (type, frequency, severity), collateral physical symptoms (e.g. headache and nausea), history of sexual trauma, psychiatric comorbidity, as well as history of large set of gynaecological and medical conditions (e.g. endometriosis, celiac disease, etc.). Pain severity was rated on a numerical scale (0 = no pain at all to 10 = extremely severe pain) (Brooks et al., 2020). The DASS-21 was used as a measure of distress, and the DASS-8 was nested within that is, only eight items of the DASS-21, which comprise the DASS-8, were included in the present analysis. The DASS-8 consists of three subscales. The depression subscale comprises three items (10, 13 and 16 on the DASS-21: had nothing to look forward to, felt down hearted and blue, was unable to become enthusiastic about anything). The anxiety subscale comprises three items (9, 15 and 20 on the DASS-21: was worried about the situations in which I might panic and make a fool of myself, felt close to panic, felt scared without reason). The stress subscale comprises two items (8 and 12 on the DASS-21: was using a lot of my mental energy, found it difficult to relax) (Ali et al., 2021; Ali, Hori, et al., 2022). Same as the DASS-21, the items of the DASS-8 are rated on a four-point scale (0 = did not apply to me at all to 3 = applied to me very much or most of the time). The minimum and maximum total scores of the DASS-8 and its depression, anxiety and stress subscales range between 0–24, 0–9, 0–9 and 0–6, respectively. Higher scores reflect higher distress and vice versa. The internal consistency of the DASS-8 in the current sample is excellent (coefficient alpha = 0.90).

2.3 | Statistical analysis

Non-normal quantitative variables (e.g. DASS-8) were reported as median (Q1–Q3) while normally distributed variables (e.g. age and pain severity) were reported as mean \pm SD. Categorical variables were reported as frequency and percentage.

To determine cut-off points of the DASS-8, three methods were used. Receiver-operating characteristic (ROC) method was used to define the cut-off score, which might differentiate those self-reporting current psychiatric comorbidity from those without comorbidity. ROC is a reliable technique, which represents the sensitivity over all possible values of specificity. The overall diagnostic utility independent of a specific cut point can be determined based on the value of the area under curve (AUC), along with the sensitivity and specificity for all possible cut points. The Youden index for an optimal cut-off was calculated as the sum of sensitivity and specificity minus one.

K-means clustering was used to group the respondents into non-overlapping clusters based on the scores of the DASS-8 and its subscales. Clustering techniques employ characteristics uncovered in the sample to allocate individuals/variables into distinct groups (Ali, Hori, et al., 2022). High degree of similarity within each group and a low degree of similarity between groups is considered a key feature, which promotes the development of classifications and cut-off scores.

Decision trees were designed using the DASS-8 and its subscales as independent continuous variables to predict self-reported current psychiatric diagnosis, daily intake of medication, stabbing pain severity, current pain severity (on the day of data collection), sex pain and history of sexual abuse. All predicted variables were dichotomous (yes, no), except for stabbing pain severity and current pain severity, which were categorised into normal-mild (1–5) and moderate to severe (>5). Because of missing data, we used classification and regression (CRT) growing method. Complete case analysis or imputing the missing values through multiple imputation is possible, but it implies a risk of bias. Alternatively, CRT employs the surrogate splitting method: when a value for a variable used to determine a split is missing, an alternative independent variable that is highly correlated with the missing variable is used to determine the direction of the split (Doggett et al., 2023; Tierney et al., 2015). Accordingly, CART can effectively highlight missingness structures in the data, the presence of extreme values, as well as variables and values responsible for predicting missingness (Tierney et al., 2015). Random assignment of cases into training and test samples (70% and 30% of cases, respectively) was used as a validation method, that is the data are split into two datasets: the training dataset is used to fit the tree, while the testing dataset is used to evaluate the prediction accuracy of the training tree (Doggett et al., 2023). While setting the models, target groups/categories of the dependent variables were defined as ' >5 ' for pain variables and 'yes' for the rest of the variables. This is because we were primarily interested in identifying those women most likely to experience mental comorbidity, severe pain, sexual abuse, or have daily medication intake or daily intake of pain medication. Prior probabilities of group membership were obtained from

the test sample. Prior probabilities are estimates of the overall relative frequency for each category of the dependent variable prior to knowing anything about the values of the independent (predictor) variables. They help to correct any tree growth caused by data in the sample, which is not representative of the entire population (https://www.ibm.com/docs/en/SSLVMB_28.0.0/pdf/IBM_SPSS_Decision_Trees.pdf). All the analyses were performed in SPSS V.28, with 0.05 as a level of significance in two-tailed tests.

3 | RESULTS

Women in this sample had mean age of 33.1 ± 12.4 years (range = 13–71 years). Most women reported stabbing pelvic pain (87.7%), sex pain (82.8%), and a wide range of collateral symptoms including bloating (88.6%), headache (87.9), bowel pain (78.7%), fatigue (77.7%), sleep disturbance (59.4%), dizziness (58.9%) and nausea (52.9%). Women reported mean severity of 3.5 ± 2.8 , 7.6 ± 1.8 , 6.0 ± 2.0 and 7.0 ± 1.8 for pain on the day of the survey, stabbing pelvic pain, sex pain and headache, respectively. More than half the respondents (55.2%) reported frequent intake of occasional pain medications. Sexual abuse history and current psychiatric comorbidity were reported by 16.1% and 29.3% of women, respectively. The respondents displayed a median DASS-8 score (Q1–Q3) of 4.0 (1.0–8.0). The characteristics of the subjects are described in detail elsewhere (Ali, Hendawy, et al., 2022; Brooks et al., 2020).

The ROC-curve criteria (AUC = 0.77, SE = 0.04, $p = 0.001$, 95% CI: 0.70–0.84, sensitivity = 0.48, specificity = 0.89, Youden index = 0.42) show that a DASS-8 cut-off score of 9.5 can be used to fairly discriminate CPP women with self-reported psychiatric comorbidity from those without comorbidity (Figure 1).

K-means clustering assigned women into two clusters of high and low distress ($n = 47$ and 167 , respectively). These clusters were distinguished based on the cut-off scores (final cluster centers) of the DASS-8, depression, anxiety and stress subscales of 14.2, 5.5, 5.1 and 4.2, respectively (Figure 2). ANOVA test shows that the differences between clusters have been significantly maximised ($F(569) = 1638.53, 800.73, 1710.85$ and 561.15 ; all $p < 0.001$).

Consistent with ROC analysis, decision tree analysis suggested that a cut-off score of 9.5 on the DASS-8 may predict psychiatric comorbidity. A score of 10.5 may predict the severity of sex pain while higher scores predicted the severity of current pelvic pain as well as daily intake of medication and the intake of occasional pain medications (Table 1). A cut-off score of 15.5 could classify women without a history of sexual abuse; however, that score could weakly distinguish those with a history of abuse. See Data S2 for decision trees of all the outcomes.

To determine a single optimal cut-off score of the DASS-8, we ascendingly ordered cut-off scores suggested by ROC curve, k-means clustering and decision tree analyses as follows: 9.5, 9.5, 10.5, 12.5, 13.5, 14.5, 15.5, 15.5. Choosing the value in the middle indicated that 13.0 may represent an optimal cut-off score of the DASS-8 in the current sample.

4 | DISCUSSION

CPP is a hard-to-manage chronic condition, which involves a complex interplay of multifactorial origins (psychological, physiological, neurological, inflammatory, etc.). It puts its victims at risk for analgesic abuse, mood dysfunction, altered sexuality and reproductivity, poor quality of life and defective social relationships. Recent treatment approaches emphasise the importance of managing emotional negativity for obtaining better CPP treatment outcomes (Dybowski et al., 2018; Hayes & Hodson, 2011; Lerman et al., 2015). A valid

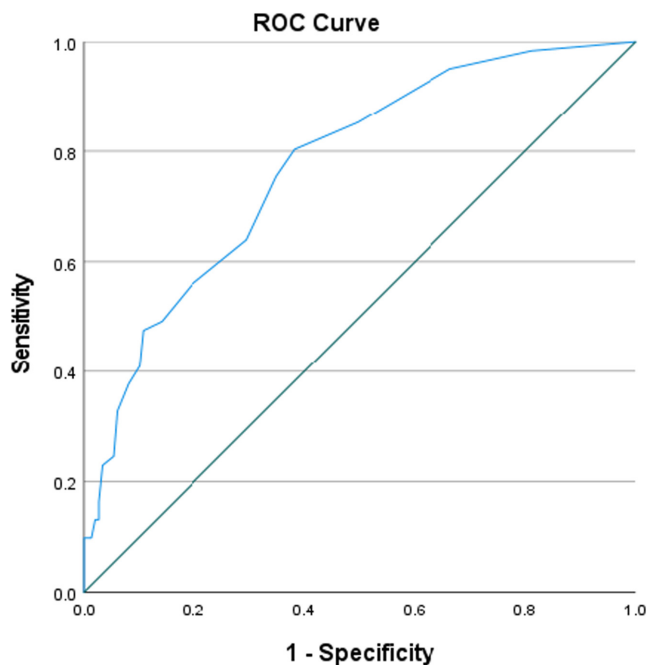


FIGURE 1 Receiver-operating characteristic (ROC) curve using the scores of the Depression Anxiety Stress Scale 8 (DASS-8) to classify women according to self-reported current psychiatric comorbidity.

cut-off score of a brief measure of mental distress symptoms such as the DASS-8 may help nurses allocate highly distressed CPP clients to the most pertinent pain management interventions. Brief measures are appealing in busy patientcare practices as they offer an expeditious opportunity to evaluate current status and treatment progress; they save the time and effort of patients and clinicians because they are completed in a few minutes and can be used on the phone in large-scale surveys (Mansfield et al., 2019). Thus, the DASS-8 as a brief multidimensional scale can be widely used to screen for mental distress in patients with CPP, and those exceeding its cut-off may be referred to specific CPP programs that address emotional negativity such as CBT (Yang et al., 2017). The DASS-8 is a relatively new version of the DASS-21. It has expressed adequate psychometric properties relative to the parent scale and other longer versions (e.g. DASS-12). However, it has been only used as a continuous variable with no cut-off point proposed. This study used three robust methods to determine the optimal cut-off score of the DASS-8 among women with CPP. The ROC curve indicated a cut-off score of 9.5 for the DASS-8 for determining women who self-reported a current mental disorder. However, a score of 14.2 was reported by clustering analysis as a cut-off for determining women with higher levels of distress. Using decision tree analysis to predict several outcomes revealed five cut-off scores, which ranged from 9.5 to 15.5. Ordering all the cut-off scores ascendingly, 13.0 was chosen as a median value to denote an optimal cut-off score of the DASS-8 in the current sample as per the existing literature (Mansfield et al., 2019). This single optimal cut-off is close to 14.0—the cut-off determined based on the scores of loneliness and caregiving burden in a sample of European dementia family caregivers during the COVID-19 pandemic (unpublished data).

AUC (0.77) and Youden Index (0.42) produced by ROC analysis show that the DASS-8 at a cut-off score of 9.5 can fairly identify those with psychiatric co-morbidity. The ability of the DASS-8 to discriminate psychiatric patients may be limited by self-reported psychiatric diagnosis rather than clinician-based diagnosis of a

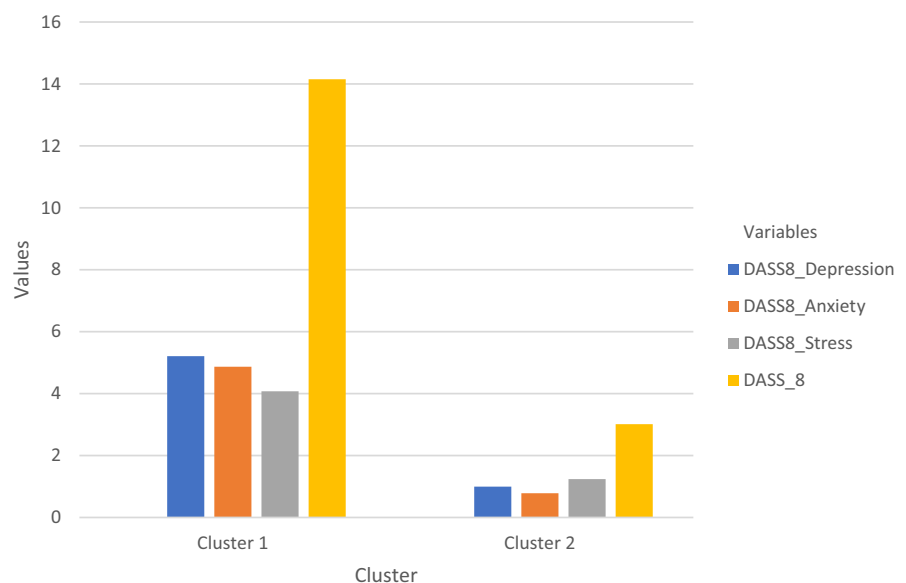


FIGURE 2 K-means clusters of women with chronic pelvic pain based on the scores of the Depression Anxiety Stress Scale 8 (DASS-8) and its subscales.

TABLE 1 Decision tree analysis calculating cut-off scores of the Depression Anxiety Stress Scale 8 (DASS-8) based on the prediction of reference characteristics.

Predicted reference characteristics	Samples	Cut-off	Overall correctly predicted %	% predicted > cut-off	% predicted < cut-off	Prediction probability for the target group	Risk (SE)
Current pain severity (1–5, >5)	Training	13.5	83.3	41.9	94.1	0.65	16.6 (3.0)
	Test		87.5	38.5	100.0		12.7 (4.2)
Sex pain severity (1–5, >5)	Training	6.5	60.9	47.2	72.6	0.62	39.1 (3.9)
	Test		63.8	47.8	74.3		36.2 (6.3)
Mental health problems (yes, no)	Training	9.5	77.3	47.9	90.6	0.70	22.7 (3.4)
	Test		77.8	46.2	87.8		22.2 (5.7)
Intake of daily medication (yes, no)	Training	12.5	66.7	64.7	68.3	0.95	33.3 (3.8)
	Test		54.8	51.3	60.9		45.2 (6.3)
Intake of occasional pain medication (yes, no)	Training	15.5	55.9	10.1	97.4	0.77	44.1 (4.1)
	Test		55.2	3.8	87.8		44.8 (6.1)
Sexual abuse (yes, no)	Training	13.5	84.7	42.9	93.8	0.60	15.3 (3.3)
	Test		86.0	16.7	95.5		14.0 (4.9)

psychiatric disorder. In other words, it is possible that some respondents in the non-psychiatric group suffered from a mental disorder, but they did not report a diagnosis or seek treatment, probably for fear of stigmatisation. Reported mental disorders were primarily anxiety disorders, major depression and mixed anxiety depression disorder (Ali, Hendawy, et al., 2022). Moreover, some of the participants in the psychiatric group were on treatment (10.7% reported daily intake of amitriptyline), which may have caused symptom remission in some patients, that is the symptoms expressed by treated psychiatric patients may be similar to those who do not suffer a mental disorder. In support of these arguments, 42.2% of 3563 unselected depression patients in German primary care settings reported only pain and poor sleep to their doctors and completely ignored their mental symptoms because of stigma (Heinz et al., 2021). Additionally, clustering analysis revealed a greater cut-off score (14.2) for distinguishing the subjects in low and high distress groups. Around one fifth of the respondents in the low distress cluster (19.3%) self-reported psychiatric comorbidity and 9.3% of them were on amitriptyline, indicating that symptom remission and psychiatric treatments may buffer distress level. On the other hand, 37.7% of the patients in the high distress cluster reported no psychiatric comorbidity, suggesting a possibility of missed psychiatric diagnosis in the distress.

Cut-off scores of 13.5 and 9.5 of the DASS-8 correctly identified 40.2% and 47.5% of cases with a severity of current pain and sex pain above five (based on the average of the true and test samples). Consistent with former studies (Antunes et al., 2021; Möckel et al., 2021), this finding indicates that higher distress scores are more common among women witnessing greater pain severity. Interestingly, the intake of any daily medication was higher among those with DASS-8 scores above 12.5. Meanwhile, the intake of occasional analgesics was less common among those with DASS-8 scores above 15.5. The model yielding this result entails a high risk as shown in Table 1. Nonetheless, anxious and depressed patients commonly experience pain symptoms, usually at a greater

severity (Albrecht et al., 2021; Heinz et al., 2021). In fact, longitudinal data suggest a causative effect of anxiety/depression symptoms and pain catastrophizing on the severity of CPP (Dybowski et al., 2018). However, emotional negativity (e.g. depression) may interfere with the adherence to analgesic therapy in chronic conditions (e.g. cancer). Research relates this to hypervigilance, which entails lack of engagement of perceptual and cognitive filtering related to a deficiency of the inhibitory system, which may dampen the response to aversive stimuli (Davydov et al., 2021). In the meantime, depression is recurrent and self-remitting. Therefore, pain intensity and duration in depressed/distressed individuals may frequently vary, which may affect their propensity to take analgesics. In support of this argument, analgesic intake is more frequent in people with acute pain than chronic and recurrent pain (76.9% vs. 69.9% and 47.9%, respectively) (Möckel et al., 2021). Moreover, severe pain may persist despite the intake of analgesics. Indeed, one third patients experiencing chronic pain in primary care settings consider their pain management as inefficient, and as a result, they report higher anxiety/depression and lower quality of life (Antunes et al., 2021). A possible reason for analgesic failure in people with negative affect (moderate not low depression) and comorbid chronic pain is neuroinflammation, which is noted by glial activation (increased glial marker 18kDa translocator protein) and changes in functional connectivity in the anterior middle and pregenual anterior cingulate cortices to the dorsolateral prefrontal cortex (Albrecht et al., 2021). As a result, patients with higher distress may give up the use of analgesics and try other alternatives. Incidentally, out of 50.0% of our subjects who reported daily intake of medication, 26.2% reported the intake of dietary supplements (e.g. cod liver oil, probiotics, vitamins, minerals (e.g. calcium and zinc), etc.). Natural products containing such elements exert antioxidant and anti-inflammatory properties. Integrating foods rich in these nutrients in patients' diet is suggested to reduce the release of inflammatory biomarkers and related central

sensitization (Terzoni et al., 2023). In fact, women with CPP account for lack of support and formal pain management activities by seeking information and making major lifestyle changes (e.g. physical exercise and dietary modifications) to regulate their mood and alleviate their pain (Huntington & Gilmour, 2005).

Although the DASS-8 and its subscales correlated with history of sexual abuse more strongly than the DASS-12 and even the subscales of the DASS-21 (Ali, Hendawy, et al., 2022), scores below the cut-off point of 15.5 were more likely to predict absence of sexual abuse. However, a DASS-8 score greater than 15.5, along with scores of the depression, anxiety and stress subscales above 5.5 could predict history of abuse at a probability of 60%. Research indicates that 50% or more of CPP patients experience a history of physical and/or sexual abuse (Bruckenthal, 2011). However, sexual assault victims are less likely to report their traumatic experiences because of stigma (expecting negative reactions from others), concerns about the evidence, fear of the perpetrator, etc. (Reich et al., 2022). In this study, some preferred not to talk about it all, some noted that they would discuss it with the doctor in person (3.3% in total) while 17.7% did not answer this question. This indicates that sexual abuse is less likely to be discussed even within the therapeutic context, giving more chance for the flaring of post-traumatic symptoms (e.g. rumination and emotional negativity) and maladaptive/violent or reckless behaviours such as self-harm and suicidality (Reich et al., 2022). Because of the contribution of depression, coping, and history of abuse to pain intensity in CPP, their assessment has been integrated in the Pain Inventory—a comprehensive and widely used CPP assessment tool developed by the International Pelvic Pain Society (Bruckenthal, 2011; Terzoni et al., 2023). However, this tool does not offer cut-offs for determining patients in intense need for integrated treatments. Thus, in routine CPP treatment protocols, those scoring high on the DASS-8 may be prompted to discuss the possibility of exposure to traumatic events, including sexual abuse.

Our results offer important implications for policy and practice: it is pivotal that the assessment of mental distress among women with CPP is integrated in routine CPP management pathways. Women with higher distress scores express greater pain intensity; they are also prone to psychiatric comorbidities, polypharmacy, and sexual abuse. Thus, these women require thorough investigations and tailored interventions. This study has the merit of providing a cut-off score for distinguishing CPP women with higher mental distress, which may be referred to further diagnostic workup and treatment. It employed three robust techniques to predict various outcomes via the DASS-8. For decision-based modelling, we used validation groups (training and test) to ensure the credibility of the findings as noted by the degree of discrepancies between the results of both groups. However, given the small sample size of the test group (30%) as well as the relatively small size of the entire sample, replication of the analyses in bigger samples may be more helpful. A range of cut-off scores were indicated for the DASS-8. However, it is not uncommon to have varying cut-off scores for a single scale when many symptoms are included in the prediction models (Oldenmenger et al., 2013). Moreover, our choice of an optimal cut-off is based on

an evidence targeting the median cut-off score (Yu et al., 2019). In this sense, the determined cut-off score may serve only as a guideline for nurses and other health professionals to encourage CPP women to seek further clinician-based assessment for psychiatric comorbidity, and consequently receive needed psychosocial interventions. Self-reporting of all the outcomes, which is associated with reporting biases (social desirability, recall, etc.), along with the convenience sample and cross-sectional design represent major pitfalls, which may limit the generalizability of results of the current study. Because of limited resources, we used an already existing dataset. This approach saves different types of cost, which may be invested in data collection as well as the effort of the respondents. However, crucial outcomes could not be confirmed in reference to reliable sources. For example, current psychiatric comorbidity and treatment were not obtained from a medical record. Additionally, the data were collected approximately 8 years ago, which may be another potential limitation. This is because great distressing events have affected the world after that such as the COVID-19 pandemic, which has resulted in lockdowns/isolation as well as health-related and economic burdens that have increased mental/behavioural dysfunctions in different groups—women with CPP are not an exception. Missed psychiatric diagnosis, which could be ensured via clinical assessments, may threaten the credibility of our findings (e.g. AUC was relatively low). More investigations of the cut-off of the DASS-8 in women with CPP from other countries as well as in other physical and mental conditions are warranted. Further studies validating the cut-off scores of DASS-8 should avoid the limitations that we have encountered in the present study.

5 | CONCLUSION

Among Australian women with CPP, 13.0 represents a statistically derived optimal cut-off score of the DASS-8. It expresses an adequate predictive validity for current self-reported psychiatric comorbidity, pain severity, and daily intake of any medication. Thus, women with this score may be a target for specific pain management interventions. Higher scores may be considered for distinguishing who experienced sexual abuse. Because of the limitations of this study, it is necessary to test the cut-off point of the DASS-8 in more representative and soundly investigated CPP samples as well as in other populations from other countries for further validation of the findings.

AUTHOR CONTRIBUTIONS

Amira Mohammed Ali, Annamaria Pakai and Tiffany Brooks conceptualised the study and designed the methodology. Tiffany Brooks collected the data. Rana Ali Alameri and Haitham Khatatbeh cleaned the data. Abdulmajeed A. Alkhamees, Saeed A. Al-Dossary and Rana Ali Alameri analysed and interpreted the data. Nashwa Ibrahim, Tazeen Saeed Ali and Haitham Khatatbeh wrote the initial draft of the manuscript. Amira Mohammed Ali, Tiffany Brooks, Annamaria Pakai and Saeed A. Al-Dossary edited and revised the final draft. All

authors have critically revised and approved the final draft of the manuscript.

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None.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The dataset supporting the conclusions of this article is available in Zenodo repository, [<https://zenodo.org/record/1307252#YckoVWhBw2w>].

ETHICS STATEMENT

The protocol of data collection was approved by the Human Research Ethics Committee of the University of South Australia (Application ID: 0000036598; 26/05/2017). The present study was conducted according to the Declaration of Helsinki.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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