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# Validation of the Croatian Pain Catastrophizing Scale through a study on the influence of medical education on pain catastrophizing

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## Abstract

***Background and Purpose:*** *Pain catastrophizing is an important risk factor for pain and pain-related outcomes. There is no validated Croatian version of the Pain Catastrophizing Scale (PCS), the most commonly used questionnaire for assessment of pain catastrophizing. The aims of this study were to validate the Croatian version of the PCS and to study whether formal medical education has correlation with pain catastrophizing.*

***Participants and Methods:*** *Translation and back-translation of the original English version of the PCS to Croatian language was made. The Croatian Pain Catastrophizing Scale (Cro-PCS) was given to 521 healthy students from first and last year of medicine and economics.*

***Results:*** *The Cro-PCS showed the same 3-factor structure (rumination, magnification and helplessness) as the original study. It also showed appropriate internal consistency (Cronbach alpha = 0.88). When compared to students of economics, last-year medical students had significantly lower rumination score, which accounts for the largest proportion of pain catastrophizing variance.*

***Conclusions:*** *The Croatian version of PCS shows appropriate psychometric properties, similar to the English original scale. Therefore, Cro-PCS could be useful for clinical practice and research in Croatian patients. We also found that medical education may be linked with reduction in pain catastrophizing, which contributes to our understanding of effectiveness of educational interventions.*

## INTRODUCTION

Educational interventions have been shown to be effective for different types of pain and able to improve outcome measures such as pain intensity, global measure of improvement, functional status, return-to-work, anxiety and self-efficacy *(1, 2)*. The mechanism by which the educational intervention affects experiences of pain is uncertain. Several rationales for effectiveness of such interventions have been suggested, including reduction of recognized barriers to pain management and increased medication adherence, increased knowledge about pain, effective interaction with physicians and greater sense of self-efficacy *(2, 3)*. Recent systematic reviews and research reports have recommended pain education as a key strategy for decreasing patients' misconceptions about pain and enhancing pain control *(4-7)*. However, it

is likely that there are other mechanisms that mediate improved pain outcomes following educational intervention.

Lai *et al*. found that patients who had received structured pain education had significantly lower pain intensity and pain catastrophizing than patients in the control group, even though their pain education program was not specifically directed at changing patients' negative cognition about their overall pain experience *(7)*. Pain catastrophizing is conceptualized as a negative cognitive-affective response to anticipated or actual pain, and has been associated with a number of pain-related outcomes *(8)*. It has been shown that education may be linked with pain catastrophizing *(7, 9)*. Therefore, pain catastrophizing could be one of the mechanisms to explain improvement of pain outcomes after educational intervention. Educational achievement has already been linked with pain-related cognitions, but not in the context of pain catastrophizing *(10)*.

Pain catastrophizing is a set of exaggerated and negative cognitive and emotional schema brought to bear during actual or anticipated painful stimuli *(8)*. It is a tendency to magnify or exaggerate the threat value or seriousness of pain sensations, and pain-related worry and fear coupled with inability to divert attention away from pain *(8)*. In the early studies of pain catastrophizing, researchers used nonstandardized interview methods to identify pain catastrophizing, which was a serious impediment to its measurement *(8)*.

A major step forward in the research on pain catastrophizing was development of the Pain Catastrophizing Scale (PCS), which incorporates items explicitly designed to assess elements of pain catastrophizing phenomenon *(11)*. The goal of the PCS authors was to develop and validate a self-report measure of pain catastrophizing.The authors reported that the PCS scale is a reliable and valid measure of catastrophizing and that PCS scores were significant predictors of the intensity of physical and emotional distress experienced by participants experiencing pain. The study also revealed that the PCS has a three component solution comprising rumination, magnification, and helplessness *(11)*.

The PCS is not the only instrument for measurement of pain catastrophizing, but it is widely used and well studied. There are no validated Croatian versions of any of the questionnaires developed to assess pain catastrophizing, and therefore the primary goal of this study was to validate Croatian version of the PCS (Cro-PCS). Additionally, since it was suggested that knowledge about pain management decreases pain intensity and pain catastrophizing, we wanted to test this assumption in healthy volunteers. Our second aim was to assess whether formal medical education has a significant correlation with pain catastrophizing. In our study medical curriculum itself was an educational intervention. We hypothesized that level of pain catastrophizing will be lower in medical students at the end of their studies than at the beginning. In a control group there were first- and last-year students of economics. We expected that there will be no difference in pain catastrophizing scores between first- and last-year students of economics.

## METHODS

### Participants

This was cross-sectional study with a consecutive sampling design. Subjects were 521 healthy undergraduate students, recruited by invitation during lectures at participating schools. Participants were first- and last-year students of medicine and economics from University of Split, Croatia, and University of Mostar, Bosnia and Herzegovina. Medical school has 6-year curriculum in these universities, while economy schools have 3+2 curriculum based on Bologna accord. Therefore, our last-year medical students came from the 6$^{th}$ year of studies, while last-year economics students were from the 5$^{th}$ study year. Participants were told that the study was concerned with individuals' thoughts and feelings related to pain and distress. In order to be eligible for participation in the study, students had to be healthy and pain-free. All participants completed informed consent form and a 13-item Pain Catastrophizing Scale. Participants were guaranteed anonymity. The study was approved by Ethics Committee of School of Medicine in Split.

### Measure

The Pain Catastrophizing Scale (PCS) is a 13-item self-report inventory that measures the extent to which people catastrophize in response to pain. Participants rate how frequently they experience each of 13 thoughts or feelings when they are in pain. Ratings are made on a 5-point scale with the end points (0) *not at all* and (4) *all the time*. Items are summed to create a total score. The PCS has been shown to have high internal consistency; Cronbach alpha=0.87 *(11)*.

Scores on PCS subscales were also evaluated. Rumination score (items 8–11), Magnification score (items 6, 7, and 13), and Helplessness score (items 1–5 and 12). The PCS was translated into Croatian language (Cro-PCS) using back-translation method with no modification needed. Each questionnaire was coded with a number and then entered into a spreadsheet. Participants were additionally asked to indicate their study year, gender and age at the PCS form.

### Statistics

Psychometric and socio-demographic variables were studied using analytical software SPSS 15.0 (SPSS Inc., Chicago, IL, USA). Items on the PCS were summed to derive each subscale score. Kolmogorov-Smirnov test was conducted to analyze normality of distribution. Reliability analysis with Cronbach's alpha coefficients for the PCS total and subscale scores was computed. Since Kolmogorov-Smirnov test proved asymmetric data distribution, differences between groups were studied using Mann-Whitney test and Kruskal-Wallis, followed by Dunn's

post-hoc test. Pain catastrophizing scale was psychometrically analysed. Descriptive statistics for participant subgroups was also provided. Statistical significance was set at $p<0.05$.

## RESULTS

### Psychometric properties of Cro-PCS

In order to test psychometric properties of Croatian version of PCS, principal component analysis was performed and resulted with three-component solution. Rumination, the first component, accounted for 40.8% of the total variance and contained 6 items describing ruminative thoughts, anxiety and inability to inhibit pain-related thoughts. Helplessness, the second component, accounted for 10.3% of the total variance and contained 4 items reflecting inability to deal with painful situations. Magnification, the third component, accounted for 7.9% of total variance and contained 3 items reflecting exaggerating unpleasantness related to aversive situations. Rumination and helplessness were moderately correlated ($r=-0.49$), as well as rumination and magnification ($r=0.41$), and magnification and helplessness ($r=-0.304$). Cronbach's reliability coefficients were $\alpha_{help}=0.80$ $\alpha_{rum}=0.81$, $\alpha_{mag}=0.64$, while for the total PCS it was $\alpha=0.88$.

### Medical education and pain catastrophizing

A total of 521 healthy undergraduate students consented to participate in the study. Among them, there were 165 men and 356 women, with a mean age of 20 ± 2.3 years (Table 1). No gender differences were found on PCS total score or any of the subscales.

Kruskal-Wallis test was performed to test differences in total PCS score between educational level (freshmen/senior) and school (medicine/economics), and no significant differences were found ($\chi^2_{PCS}=3.97$, $p<0.05$). The same analysis was performed for each of the PCS subscales and there were no significant differences observed between these four groups of students ($\chi^2_{rum}=7,38$, $p<0.05$; $\chi^2_{help}=4,94$, $p<0.05$; $\chi^2_{mag}=6,45$, $p<0.05$). Post-hoc analysis with Dunn's test did not reveal any significant differences within groups.

Further analysis was performed using Mann-Whitney test for independent samples. Although all catastrophizing indicators were lower in senior medical students, rumination subscale was the only one that was significantly lower in last-year medical students, comparing to first-year medical students ($U=2859.50$, $p<0.01$) (Table 1).

When the same analyses were applied for first- and last-year economics students, we did not find significant differences in pain catastrophizing total score ($U=10209$, $p<0.05$) (Table 1). Significant differences were found only on magnification subscale ($u=9000.5$, $p<0.05$).

## DISCUSSION

We found that the Croatian version of PCS shows appropriate psychometric properties, similar to the English original scale. The Cro-PCS has shown a high internal consistency in the subscales rumination, magnification and helplessness, as well as in the total PCS score and these figures were very similar as reported in the original report about validation of the PCS *(11)*. The direction of correlations between three sub-scales in the Cro-PCS was the same like in the original English version of the PCS, and correlation coefficients of the Cro-PCS and PCS were also very similar *(11)*.

When analyzing Cro-PCS we found moderate correlations between three components, which suggest that rumination, magnification and helplessness can be viewed as different dimensions of the same underlying construct. Results from this preliminary psychometric analysis indicate that Croatian version of PCS has acceptable metric characteristics. All PCS scales showed positive asymmetry of score distributions. However, there were several deviations from the original factor structure of the PCS. Several items have primary factor loadings on other factors. Possible explanations include slight changes of

**TABLE 1**

Age, gender and pain catastrophizing indicators of study participants.

| Characteristic | 1st year medical students (n=137) | 6th year medical students (n=53) | 1st year economics students (n=245) | 5th year economics students (n=86) |
|---|---|---|---|---|
| Age (years, mean ± SD) | 18.6 ± 1.7 | 24 ± 1.8 | 18.8 ± 1.7 | 22.9 ± 1.7 |
| Gender | | | | |
| M (n, %) | 47 (34.3) | 10 (18.9) | 86 (35.1) | 22 (25.6) |
| F (n, %) | 90 (65.7) | 43 (81.1) | 159 (64.9) | 64 (74.4) |
| Pain catastrophizing indicators | | | | |
| PCS total score | 19.2 ± 7.9 | 16.8 ± 9.9 | 19.7 ± 9.1 | 19.8 ± 10.1 |
| Rumination | 7.9 ± 3.3* | 6.3 ± 4 | 7.9 ± 4 | 7.1 ± 4.8 |
| Helplessness | 7.6 ± 4.4 | 6.9 ± 4.6 | 7.9 ± 4.4 | 8.1 ± 3.9 |
| Magnification | 3.7 ± 2 | 3.7 ± 2.3 | 3.9 ±2.4* | 4.7 ± 2.7 |

*Significant difference between first- and last-year students

meaning caused by translation from English to Croatian language.

Besides validating Croatian version of the instrument for measurement of pain catastrophizing, in this study we hypothesized that formal medical education may be associated with lower pain catastrophizing, which could partly explain effectiveness of educational interventions for improving pain outcomes. Our results showed certain trends in line with our hypothesis, as we found that at the end of medical school students have lower pain catastrophizing scores, comparing to freshmen, while the opposite was found for students of economics, but these results were not statistically significant.

Considering the three different subscales, significant differences were found on a rumination subscale between first- and last-year medical students. Rumination is a subscale that accounted for the largest proportion of variance in the PCS. The items that compose this subscale imply an inability to suppress or divert attention away from pain-related thoughts *(11)*. This result may be particularly interesting because it possibly indicates that senior medical students developed successful distraction strategies due to increase in formal medical knowledge.

It has been reported that there is an interrelationship between educational level and pain-related catastrophizing in patients with scleroderma *(9)*. We did not find statistical difference in pain-catastrophizing at the end of both medical school and school of economics, compared to students at the beginning of those studies. Therefore, level of formal education may become important when a person is in pain.

Previous study in clinical research sample reported findings suggesting that short pain education protocol was relatively powerful intervention for helping cancer patients control their pain intensity *(7)*. The authors propose that their results strongly suggest that the more skills and knowledge a patient has about pain management and the use of analgesics, the greater is his or her sense of control *(7)*. According to that study, education could be an effective intervention for reducing pain catastrophizing among patients in pain. In the case of healthy students it could be that, although they possess knowledge about human body, pain physiology and pain management, medical students do not yet have a sense of control over their knowledge because of the lack of clinical experience. Perhaps these results would be different in experienced physicians. Furthermore, education of patients is inherently different than education of healthcare practitioners.

Patient education has been defined as 'a systematic learning experience in which a combination of methods is generally used, such as the provision of information and advice and behaviour modification techniques, which influences the way the patient experiences his illness and/or his knowledge and health behavior, aimed at improving or maintaining or learning to cope with a condition, usually a chronic one' *(12)*. It is possible that effectiveness of education as an intervention for pain-related outcomes depends on a theoretical model on which education is based. As patient education is complex and aims at behavioural changes, it is important that interventions are developed that are based on a theoretical model. This will have implications for the content of the intervention and will increase its effectiveness *(1)*. Since it has been noticed that pain education may decrease negative thoughts about pain, i.e. catastrophizing, it is worth studying this intervention further, for standardizing the intervention. Since pain catastrophizing is related to a number of important pain-related outcomes, interventions aimed towards its reduction are of great clinical importance.

Limitation of this study, regarding our hypothesis about link between medical education and pain catastrophizing, is a choice of young, healthy participants, whose results may not be generalizable to people experiencing pain. Our sample was relatively homogeneous including only university population, people who are generally more educated and especially medical students who in general have a better understanding of human body funcions than the general population, so it is possible that no significant differences were found due to homogeneity of our sample. An argument that favors definition of catastrophizing as a situation-specific cognitive style is a body of research performed with asymptomatic volunteers, who have lower catastrophizing scores than patients with chronic pain *(11, 13)*.

Secondly, this study has cross-sectional design, which is not appropriate for studying developmental patterns within cohorts. Although it has been suggested that catastrophizing is a relatively enduring mode of responding to painful experiences, the bulk of research examining the relation between catastrophizing and pain has been cross-sectional *(14)*. That kind of study design does not allow the key requirement of causality – a temporal relationship. We are lacking long-term prospective cohort studies of pain catastrophizing that would provide insight into possible changes of pain catastrophizing throughout the life of an individual.

Thirdly, we measured pain catastrophizing in senior medical students, and not in experienced physicians who certainly have more experience in pain management and sense of control over their knowledge. We could also speculate that the absence of actual aversive stimuli influenced reduced results on pain catastrophizing. It is important to emphasize that PCS requires participants to remember some of the past painful experiences to answer items and relies on assumption that cognitive-affective reactions to pain are consistent across different pain situations. Pain catastrophizing in this research was tested in a non-clinical sample of healthy undergraduate students in a non-threatening experimental situation that did not require exposure to actual pain. It is possible that participants in a clinical sample would show a different response to PCS. Despite these limitations, the present results may serve to guide future studies. Additionally, it would be useful to test Croatian version of PCS in other student, non student and clinical samples.

In conclusion, the Croatian version of PCS shows appropriate psychometric properties, similar to the English original scale. Therefore, Cro-PCS could be useful for clinical practice and research in Croatian patients. We also found that formal medical education did not significantly reduce total pain catastrophizing score in healthy undergraduate students, but it did significantly reduce rumination, a subscale that accounted for the largest proportion of pain catastrophizing variance. Our results suggest that the success of educational interventions may be partly mitigated with reduction of pain catastrophizing.

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