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## Moderators of the Negative Effects of Catastrophizing in Arthritis

Robert R. Edwards, Ph.D.<sup>1</sup>, Jon Giles, M.D.<sup>2</sup>, Clifton O. Bingham III, M.D.<sup>2,3</sup>, Claudia Campbell, Ph.D.<sup>4</sup>, Jennifer A. Haythornthwaite, Ph.D.<sup>4</sup>, and Joan Bathon, M.D.<sup>2</sup>

<sup>1</sup>Department of Anesthesiology, Perioperative and Pain Medicine, Harvard Medical School, Brigham & Women's Hospital

<sup>2</sup>Division of Rheumatology, Department of Medicine, Johns Hopkins

<sup>3</sup>Division of Allergy & Clinical Immunology, Department of Medicine, Johns Hopkins

<sup>4</sup>Department of Psychiatry and Behavioral Sciences, Johns Hopkins

### Abstract

**Objectives**—Pain is among the most frequently-reported, bothersome, and disabling symptoms described by patients with rheumatoid arthritis, and the experience of pain is partially shaped by catastrophizing, a set of cognitive and emotional pain-related processes. However, other variables may moderate catastrophizing's influence on the experience of pain. In this study, we investigated a variety of factors that might buffer or magnify catastrophizing's deleterious consequences among patients with RA.

**Methods**—A total of 185 RA patients were surveyed to determine levels of catastrophizing, pain, general psychological distress, and physical functioning.

**Results**—Catastrophizing was associated with increased pain severity and psychological distress, and with poorer physical functioning. Some of these relationships were significantly moderated by education and social functioning; among RA patients with above-average social functioning and a college education, minimal relationships of catastrophizing with pain and distress symptoms were observed, while these associations were highly significant ( $p < .001$ ) among patients with lower levels of education or social functioning.

**Conclusions**—Collectively, educational achievement and positive social interactions may protect against some of the deleterious effects of catastrophizing. The design of future interventions to reduce catastrophizing, or ameliorate its impact on pain outcomes, may benefit from further study of these subgroups of patients.

### Keywords

Pain; Coping; Catastrophizing; Rheumatoid Arthritis; Education

### Introduction

Catastrophizing, a set of negative emotional and cognitive processes incorporating rumination about pain, magnification of pain-related symptoms, and feelings of helplessness 1, is increasingly implicated as a critical factor shaping individual differences in the pain

Address correspondence to: Robert R. Edwards, Ph.D., Pain Management Center, Brigham & Women's Hospital, 850 Boylston St, Suite 302, Chestnut Hill, MA 02467, Phone: 617-732-9486, Fax: 617-732-9050, RREdwards@partners.org.

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experience among patients with rheumatic disease. While some research suggests that catastrophizing is most prominent in idiopathic pain syndromes such as fibromyalgia 2, studies in other painful inflammatory diseases in which the origins of pain are more clear, such as rheumatoid arthritis (RA), also highlight the important role of catastrophizing 3. Indeed, some of the earliest catastrophizing studies were conducted in RA patients nearly two decades ago 4·5. In a handful of RA studies since that time, positive associations have been described between catastrophizing, negative mood, and daily pain severity 6–8. In addition, catastrophizing and other indices of maladaptive pain coping are prospectively associated with enhanced inflammatory disease activity 3, and with long-term reductions in objectively-measured mobility and muscle strength 9·10. Such findings suggest that catastrophizing may have important effects on disease-related pain and functional outcomes in RA patients.

It is important to note that the links between catastrophizing and RA pain-related outcomes are not uniformly strong, and some negative studies have appeared 2. In general, recent lines of catastrophizing research have suggested that other variables may moderate catastrophizing's effects on pain-related outcomes. Such moderational effects can be framed as identifying “protective factors”, or “buffers”, which act to inhibit the deleterious impact of catastrophizing. Alternatively, such analyses can be conceptualized as identifying factors which confer increased risk for the negative effects of catastrophizing. Two such variables highlighted in the past several years are educational attainment 11·12 and social support 8·13·14. In our previous study of scleroderma patients, for example, catastrophizing's relationship with pain was dependent on the educational level of patients 11. However, fairly little research to date has evaluated a broad set of potential moderators in patients with persistent pain. It is important to identify subgroups of patients for whom catastrophizing's effects are either diminished or magnified so that we can design interventions to reduce the deleterious consequences of catastrophizing, and then target those interventions at those who need them most.

In the present study, we evaluated the association between catastrophizing and important pain-related outcome variables such as pain severity, psychological distress, and physical functioning in RA patients. Moreover, we focused on identifying potential demographic and disease-related moderators of these relationships, including education and social function, as well as other factors that have been associated with pain and catastrophizing, including sex 15, and disease severity 3.

## Materials & Methods

### Participants

Participants in this study were patients with RA who were enrolled in ESCAPE RA trial (Evaluation of Subclinical Cardiovascular Disease and Predictors of Events in Rheumatoid Arthritis), a cohort study of risk factors for subclinical cardiovascular disease. Subjects were included if they met the American College of Rheumatology 1987 criteria for RA and were 45–84 years of age. In general, participants were recruited from among patients being followed up at the Johns Hopkins Arthritis Center, and by referral from local rheumatologists. The study was approved by the Institutional Review Board of the Johns Hopkins Hospital, with all subjects providing written informed consent prior to enrollment. Enrollment began in October 2004 and concluded in May 2006. Several reports describing participants in the ESCAPE RA trial have recently been published 16·17. A total of 197 RA patients enrolled in the ESCAPE RA trial; in the present analyses, we include the 185 participants who enrolled and then returned for visit 2, at which the data described below were collected.

## Measures

**Basic Demographics**—Standard demographic information was collected by self-report.

**Education**—Patients responded to a single question about the amount of formal education they had completed. Response options ranged from “no schooling” (assigned a value of zero) to “graduate degree” (assigned a value of 8). Formal educational attainment has shown itself to be an important determinant of long-term outcomes such as mortality in RA patients 18·19.

**RA Disease Variables**—Multiple variables were utilized as indicators of RA disease status. The duration of RA (i.e., measured in years since an RA diagnosis was made) was assessed by self-report. We used the DAS28 (with CRP measurement) as an index of RA disease activity. The CRP level was determined with a high-sensitivity nephelometry method (Dade Behring, Deerfield, IL), and joints were examined by a single trained assessor for swelling and tenderness. In addition, serostatus for RF or anti-CCP antibodies was documented, with seropositivity defined as  $\geq 40$  units for RF and  $\geq 60$  units for anti-CCP antibodies. Finally, Sharp radiographic scores were calculated using x-ray evidence of erosions and joint space narrowing in 44 joints.

**Catastrophizing**—Participants completed the Pain Catastrophizing Scale (PCS 20, a well-validated, widely-used, self-report measure of catastrophic thinking associated with pain 3. The PCS has good psychometric properties in pain patients and controls 21. The construct of catastrophizing incorporates: magnification of pain-related symptoms, rumination about pain, feelings of helplessness, and pessimism about pain-related outcomes. Individuals rate the extent to which they experience (when they are in pain) the thought or feeling described by each item; scores on this 13-item measure can range from 0–52 (each item is scored 0–4). In this study, Cronbach’s  $\alpha$  for the PCS was .93, indicating very high levels of internal item consistency.

**Short-Form 36**—Subscales of the Medical Outcomes Study Short Form 36-item questionnaire (SF-36; 22) were utilized to assess pain, physical functioning, and social functioning. The SF-36 subscales of Bodily Pain, Mental Health, Physical Function, and Social Function provide scores from 0 (severe pain, poor function) to 100 (no pain, excellent function), which characterize pain, distress, and functional status over the past 4 weeks. The SF-36 is the most widely-used quality of life instrument in the world; it possesses excellent psychometric properties across a wide variety of patient samples, as well as the general population 23·24.

## Data Analysis

We evaluated catastrophizing’s associations with pain, distress, and physical functioning, and potential moderators of those associations, using hierarchical regression analyses as suggested 11. First, we evaluated zero-order relationships between catastrophizing and predictor or moderator variables using Pearson correlations or Analysis of Variance. Next, the hierarchical regression analyses included three steps: on the first step, demographic variables were entered, on the second step, RA disease variables were entered, and on the third step, catastrophizing and potential moderator variables were entered. On the fourth and final step, to examine moderation, interactions between catastrophizing and each potential moderator were entered. If the interaction term was significant, follow-up analyses were performed as recommended 25. All analyses were conducted using SPSS software.

## Results

Consistent with the demographics of RA, of the 185 patients included in this study, 60.5% were women. Most subjects (86.5%) reported their race as “white”, with a mean sample age of 61.5 years old ( $SD= 8.5$ ). Educational attainment was variable; 25% of the sample had a high school degree, GED, or less, 27% had some college education but never completed a degree, 28% had completed an associate’s or bachelor’s degree, and 20% had a graduate degree. In terms of disease-related variables, the mean reported duration of RA was 14.0 years (range: 2 years to 50 years,  $SD= 10.4$  years), most patients (78.2%) were seropositive for RF or anti-CCP antibodies, mean Sharp scores were  $76.1 \pm 82.9$ , and mean DAS28 scores were  $3.2 \pm 1.0$ . See Table 1.

Correlations between PCS scores and other study variables are detailed in Table 1. Higher PCS scores were associated with higher levels of distress (i.e., lower SF-36 Mental Health scores), more pain (i.e., lower scores on the SF-36 Bodily Pain subscale), and reduced physical and social function. ( $p's < .01$ ). Catastrophizing was unrelated to age, Sharp scores, or RA duration, though it was positively correlated with DAS28 disease activity scores. Catastrophizing also showed some significant, though very modest, correlations with educational achievement. No significant sex or racial differences in PCS scores were evident ( $p's > .2$ ).

A series of hierarchical regression analyses were undertaken to examine potential moderators of catastrophizing’s relationships with symptoms of distress, pain severity, and physical function. Three demographic factors (age, sex, and education), four disease-related variables (RA duration, Sharp scores, serological status, and DAS28 scores), and one additional parameter (social functioning, included because we had previously found it to be a moderating factor in scleroderma patients 11) were investigated. Only the education and social functioning variables emerged as moderators; interactions between catastrophizing and the other potential moderator variables (i.e., age, sex, RA duration, Sharp scores, serological status, and DAS28 scores) were all non-significant ( $p's > .05$ ).

### Prediction of SF-36 MH Scores

In the model predicting SF-36 Mental Health scores, education and social functioning both emerged as significant moderators of catastrophizing’s effects. Demographic factors explained 4% of the variance in MH scores in the initial step of the regression, with women reporting more distress than men. In the second step, disease factors (in particular, the DAS28) explained 9% of the variance; higher DAS28 scores were related to higher levels of psychological distress. In the third step, catastrophizing and social functioning explained 31% of the variance in SF-36 mental health scores (higher catastrophizing and worse social function were associated with greater distress scores). In the final step, the two interaction terms explained 6% of the variance. In each case, the interactions suggested that the association of catastrophizing with distress would be strongest in subjects reporting lower levels of education or social functioning. Table 2 lists the results of the hierarchical regression analysis, and Table 3 includes findings from follow-up analyses assessing these relationships within categories of education and social functioning. As shown in Table 3, relationships between pain catastrophizing and psychological distress were clearly strongest among individual with less educational achievement and poorer social functioning. None of the other variables emerged as moderators of catastrophizing’s association with Sf-36 MH scores.

### Prediction of SF-36 BP Scores

In the model predicting SF-36 Bodily Pain scores, education and social functioning again emerged as significant moderators of catastrophizing's effects. Demographic factors explained 6% of the variance in pain scores in the initial step of the regression; women tended to report more pain (i.e., they had lower SF-36 Bodily Pain scores, indicating more severe pain). In the second step of the regression, disease factors (in particular, the DAS28) explained another 21% of the variance. As expected, higher DAS28 values were related to reports of more severe pain. In the third step, catastrophizing and social functioning explained 24% of the variance in SF-36 pain scores (higher catastrophizing and worse social function were associated with more pain). In the final step, the two interaction terms explained 4% of the variance; the association of catastrophizing with pain was strongest in subjects reporting lower levels of education or social functioning. Table 4 lists the results of the hierarchical regression analyses, and Table 5 includes findings from follow-up analyses within patient groups. In brief, PCS scores accounted for a substantial portion of the variance in pain scores in those with less educational attainment, but showed a less prominent relationship with pain among patients who had completed a college degree. Similarly, among those with reduced levels of social functioning, catastrophizing showed a relatively robust relationship with pain scores, but this association was absent among those with better scores on the SF-36 Social Function subscale. No other variables emerged as moderators of catastrophizing's association with Bodily Pain scores.

### Prediction of SF-36 PF Scores

In the model predicting SF-36 Physical Function scores, no variables moderated catastrophizing's relationship with physical function. The demographic and disease variables accounted for 9% (men reported better function) and 20% (higher Sharp and DAS28 scores were related to worse function), respectively, of the variance in SF-36 Physical Function scores. Next, catastrophizing, social function, and education explained an additional 18% of the variance, with better social functioning predicting better physical functioning (9% unique variance accounted for) and higher PCS scores predicting worse physical function (5% unique variance accounted for). For brevity, this model is not shown. Again, no moderators of this effect were observed.

## Discussion

As expected on the basis of prior studies, we found that catastrophizing was positively related to psychological distress, pain intensity, and physical dysfunction among patients with rheumatoid arthritis. These associations were observed despite controlling for multiple disease factors, including RA duration, disease severity, and accumulated joint damage. We also found that relationships of catastrophizing with distress and pain intensity were significantly moderated by education and social functioning; among RA patients who reported above-average social functioning, and among RA patients with a college education, only slight relationships of catastrophizing with pain and distress symptoms were observed, while these associations were significantly larger among patients with lower levels of education or social functioning.

One peripheral finding in this study warrants additional mention. Modest but significant correlations were noted between PCS scores and DAS28 scores in the RA patients in this sample (see Table 1). This cross-sectional association between catastrophizing and inflammatory disease activity is consistent with several prior longitudinal RA studies that reported positive relationships between catastrophizing (or helplessness, one component of catastrophizing) and elevated indices of RA severity such as worsening erythrocyte sedimentation rates 6'26. In addition, we recently observed in samples of healthy adults that

higher catastrophizing predicted a more pro-inflammatory pain response 27 and reduced habituation to pain 28. The present observation adds to a growing body of research illuminating links between cognitive/emotional processes and inflammatory processes; such reciprocal inter-relationships may be most prominent among individuals with systemic inflammatory conditions such as RA 29. Of course, this finding is cross-sectional, and it may well be that, over time, increases in disease activity cause increases in catastrophizing about disease-related pain, or that the association between DAS28 scores and catastrophizing is due to these factors' shared association with pain. Additional prospective research on catastrophizing and inflammation will help to elucidate the potential causal nature of the observed inter-relationships.

Collectively, educational achievement and positive social interactions may protect against some of the deleterious effects of catastrophizing. Interestingly, both of these factors may provide independent moderating effects; the correlation between educational achievement and SF-36 Social Function subscale scores was  $r = .13$  ( $p > .05$ ). In addition, in the regression analyses, both served as statistically significant moderators of the relationship of catastrophizing with pain and distress. In the future, careful consideration of these and perhaps other moderating variables may help to explain some of the inconsistencies in the catastrophizing literature. We had previously reported that among scleroderma patients, catastrophizing's relationship with pain was dependent on the educational level of patients 11. Additionally, research in other domains has revealed that educational level can moderate the impact of psychosocial factors on chronic illness. For example, individuals lower in educational attainment are more vulnerable to the deleterious effects of life events 30, and the impact of low self-efficacy on health outcomes is amplified among individuals from lower SES backgrounds 31. These findings suggest a differential vulnerability to negative cognitive and affective states as a function of socioeconomic status, a conclusion echoed by several recent reviews 32-33.

Similar findings seem to obtain in the realm of social interactions. At least one previous study of RA patients and their spouses reported that while catastrophizing about pain was accompanied by increases in negative affect, higher levels of satisfying spousal interactions were associated with an attenuation of the catastrophizing-distress relationship 8. Studies in other patient samples have also indicated that catastrophizing impacts on and interacts with the social environment 3-14. Patients with persistent pain who catastrophize report high levels of solicitous responses from spouses or partners 34, as well as high levels of critical and "punishing" responses to expressions of pain 35, especially as the duration of pain complaints increases 36-37. In addition, catastrophizing is associated with greater submissive interactions 13 and with an insecure adult attachment style 38. Collectively, these data suggest that pain catastrophizing is related to an interpersonal style characterized by high levels of insecure support-seeking. It seems probable that, over time, catastrophizing about pain may erode positive social relationships in the interpersonal networks of some individuals, which could contribute to higher levels of distress and pain. This possibility is highly speculative, as the studies cited earlier in this paragraph utilized varying measures of social and interpersonal functioning. Indeed, we should note that the SF-36 Social Function subscale used in the present study is principally a measure of the adverse effects of physical health problems on engagement in social activities. It is typically conceptualized as an "outcome" measure, similar to the other SF-36 subscales. Thus, we cannot draw direct conclusions in this study about the interactive effects of catastrophizing and the characteristics of an individual's social network. Rather, it appears that catastrophizing is most closely associated with adverse pain-related outcomes in those whose social activities have been most curtailed by RA.

The mechanisms by which low education or limited social function enhance catastrophizing's negative effects are not clear. Pain catastrophizing is characterized by attention and information processing biases, and a handful of studies have shown that catastrophic thinking is associated with an elevation in the perceived threat value of pain and an inability to divert attention from pain-related thoughts, feelings and sensations 39-40. It is possible, though speculative, that high-catastrophizing RA patients with more formal education, or stronger social networks, may not experience the same strong attentional or evaluative biases. In addition, threat appraisals appear to adversely affect health primarily in the context of ambiguous information 41. In this case, more-educated patients may be more knowledgeable about RA, eliminating some of the ambiguity of disease-related signals such as pain. That is, the exaggerated threat appraisals that are characteristic of catastrophizing may be blunted to some degree by accurate information about RA, and this information may be relatively more available to those with more formal education. Alternatively, pain patients with better social support 42-44 or a higher degree of educational achievement 12-45 may be better able to muster adaptive coping resources, or to seek effective treatment, in the service of managing pain. It is also possible that we are simply identifying a cumulative vulnerability relationship in which pain-related outcomes are impacted by the number of vulnerability factors that any given individual possesses (e.g., high catastrophizing, social dysfunction, low socioeconomic status, lack of health insurance, genetic predispositions, personality disorders, maladaptive health behaviors, etc.). Future research in this area would benefit from consideration of a larger number of potential vulnerability/moderational factors.

Multiple limitations of this study will need to be addressed in subsequent research. First, the current data are cross-sectional, which precludes causal inferences regarding the "effects" of catastrophizing on pain, distress, and disability. Second, the ESCAPE study was not designed to assess moderators of catastrophizing's associations with pain, and so the available data do not include information on other potential moderators such as personality variables. In our opinion, education and social function are unlikely to be the sole moderators of catastrophizing's effects. Finally, as these data derive from a single site, future studies might do best to recruit patients from a variety of settings, together with control or comparison groups, to allow examination of issues specific to rheumatic diseases as compared to chronic illness in general. Overall, this sample is fairly psychologically healthy, as evidenced by the normal-range SF-36 Mental Health scores. Many samples of chronic pain patients do report high levels of distress (relative to normative data), and it will be important to replicate these findings in other, more-distressed samples. Despite their limitations, the present findings add to a growing body of literature on the influence of catastrophizing in patients with persistent pain. Specifically, these results identify education and social function as potential moderators of catastrophizing's relationships with such factors as pain severity and psychological distress. Collectively, those with more education and better social functioning seem to be buffered from the typically negative consequences of high levels of catastrophizing. The potential clinical implications of these findings are not immediately clear. However, assessment and management of catastrophizing may be most important in individuals with other vulnerabilities such as low socioeconomic status, or social dysfunction. Moreover, these and other findings suggest that catastrophizing does not influence pain outcomes in isolation; rather, its effects might be either amplified or reduced by a variety of other (potentially modifiable) factors. In the future, identifying the particular mechanisms and pathways by which such factors confer risk or protection from catastrophizing's effects may help in the design of interventions to reduce the deleterious consequences of catastrophizing about pain.

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Table 1

Correlations of PCS total and subscale scores with other study variables

Variable	Sample mean	PCS Total	Rumination	Magnification	Helplessness
		9.4 ± 9.1	3.8 ± 3.6	2.0 ± 2.1	3.5 ± 4.0
Age (years)	61.4 ± 8.4	-.06	-.01	-.09	-.07
Years w/RA	14.0 ± 10.4	.09	.10	.01	.10
Sharp Score	76.1 ± 82.9	.00	-.02	-.07	.03
DAS28	3.2 ± 1.0	.22**	.17*	.23**	.18*
SF-36 PF	63.6 ± 26.0	-.35**	-.28**	-.34**	-.34**
SF-36 BP	63.6 ± 22.7	-.43**	-.35**	-.39**	-.44**
SF-36 SF	79.4 ± 23.4	-.49**	-.38**	-.48**	-.48**
SF-36 MH	78.7 ± 15.4	-.52**	-.39**	-.55**	-.50**
Education	5.3 ± 2.0	-.15*	-.17*	-.05	-.20**

Note. SF-36 subscale scores are on a 0–100 scale, with higher scores representing better health/functioning (e.g., less pain, etc.)

\* p < .05

\*\* p < .01

PCS= Pain Catastrophizing Scale; DAS= Disease Activity Score; SF-36 PF= Physical Function subscale of the SF-36; BP= Bodily Pain; SF= Social Function; MH= Mental Health

**Table 2**  
Results of hierarchical regression analysis predicting SF-36 Mental Health scores

Step	Variable	R <sup>2</sup> Change	F Change	Standardized $\beta$	p-value
1	Age	.04	3.3*	.02	.76
	Sex			.19	.01
2	RA Duration	.09	4.8**	-.07	.43
	Sharp Score			.13	.16
	Serological status			.08	.27
	DAS28			-.28	.001
3	PCS	.31	31.8***	-.39	.001
	Education			.04	.47
	Social Function			.36	.001
4	PCS X Social	.06	7.8***	.33	.001
	PCS X Education			.19	.04

Final Model: F(11,171)=15.0, p < .001, R<sup>2</sup> = .50

PCS= Pain Catastrophizing Scale

\*\*\*\* p  $\leq$  .001

\*\* p  $\leq$  .01

\* p  $\leq$  .05

**Table 3**  
Hierarchical regression analyses predicting Sf-36 Mental Health scores separately in various groups

Educational Groupings						
No Post High-School Degree			≥ Associate's Degree			
Step	Variables	Unique R <sup>2</sup>	F Change	Beta	Unique R <sup>2</sup>	F Change
1	Demographics	.07	3.3*		.02	0.7
2	RA Variables	.14	3.7**		.06	1.4
3	Catastrophizing	.27	41.2***	-.55***	.09	9.9**
Model: F(7,85)= 10.9, p<.001, R <sup>2</sup> = .48 Model: F(7,82)= 2.7, p=.01, R <sup>2</sup> = .17						
Groupings by Social Functioning						
Below Median on SF-36 Social Function			Above Median SF-36 Social Function			
Step	Variables	Unique R <sup>2</sup>	F Change	Beta	Unique R <sup>2</sup>	F Change
1	Demographics	.01	0.5		.01	0.1
2	RA Variables	.04	0.9		.08	1.9
3	Catastrophizing	.25	29.9***	-.51***	.02	2.6
Model: F(7,81)= 5.0, p<.001, R <sup>2</sup> = .30 Model: F(7,86)= 1.5, p=.17, R <sup>2</sup> = .11						

Note: Demographics= Age and sex; RA Variables= RA duration, serostatus, Sharp scores, and DAS28 scores

\*\*\*  
p ≤ .001,

\*\*  
p ≤ .01,

\*  
p ≤ .05

**Table 4**

Results of hierarchical regression analysis predicting SF-36 Bodily Pain scores

Step	Variable	R <sup>2</sup> Change	F Change	Standardized $\beta$	p-value
1	Age	.06	6.1**	-.04	.78
	Sex			.25	.001
2	RA Duration	.21	13.6***	.04	.61
	Sharp Score			.10	.15
3	Serological status			-.10	.14
	DAS28			-.45	.001
	PCS	.24	29.6***	-.40	.001
	Education			.11	.13
4	Social Function			.35	.001
	PCS X Social	.04	4.4**	.24	.001
	PCS X Education			.17	.03
Final Model: F(11,171)= 18.9, p < .001, R <sup>2</sup> = .55					

PCS= Pain Catastrophizing Scale

\*\*\*\* p  $\leq$  .001

\*\* p  $\leq$  .01

\* p  $\leq$  .05

**Table 5**  
Hierarchical regression analyses predicting Sf-36 Bodily Pain scores as a function of education

Educational Groupings						
No Post High-School Degree			≥ Associate's Degree			
Step	Variables	Unique R <sup>2</sup>	F Change	Beta	Unique R <sup>2</sup>	Beta
1	Demographics	.06	2.7		.12	5.8**
2	RA Variables	.22	6.7**		.27	8.9***
3	Catastrophizing	.18	22.3***	-.44***	.04	5.2* - .20*
Model: F(7.85)= 10.2, p<.001, R <sup>2</sup> = .46 Model: F(7.82)= 8.5, p<.001, R <sup>2</sup> = .43						
Groupings by Social Functioning						
Below Median on SF-36 Social Function			Above Median SF-36 Social Function			
Step	Variables	Unique R <sup>2</sup>	F Change	Beta	Unique R <sup>2</sup>	Beta
1	Demographics	.03	1.0		.10	4.8*
2	RA Variables	.14	3.5*		.11	3.1*
3	Catastrophizing	.13	14.7***	-.38***	.01	0.4 - .06
Model: F(7.81)= 4.8, p<.001, R <sup>2</sup> = .30 Model: F(7.86)= 3.3, p=.004, R <sup>2</sup> = .22						

Note. Demographics= Age and sex; RA Variables= RA duration, serostatus, Sharp scores, and DAS28 scores

\*\*\* p ≤ .001,

\*\* p ≤ .01,

\* p ≤ .05