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## Investigating chronic pain as an in-group using the prisoner's dilemma

Tracy W. Brown

*Tarleton State University*, [tracy.brown@go.tarleton.edu](mailto:tracy.brown@go.tarleton.edu)

Cristian M. Botello

*Tarleton State University*, [cristian.botello@go.tarleton.edu](mailto:cristian.botello@go.tarleton.edu)

Amber L. Harris Bozer

*Tarleton State University*, [bozer@tarleton.edu](mailto:bozer@tarleton.edu)

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### Abstract

Kinship is a strong predictor of altruism. However, chronic pain is a homeostatic threat to survival that creates a social in-group which we predicted would result in increased altruism over and above kinship, because it is driven by shared empathy. Participants included 139 individuals that were divided into a chronic pain or control group. Participants completed six Prisoner's Dilemma scenarios with a sibling or chronic pain accomplice. Pain altruism and sibling altruism scores were calculated based on decisions to cooperate with or defect on an accomplice. A mixed ANOVA revealed that there were no significant differences between groups. The marginal difference between the groups suggests that chronic pain may create an in-group altruism that is just as strong as kinship.

*Keywords:* Prisoner's Dilemma, social in-groups, game theory, kinship, chronic pain, empathy

### Investigating Chronic Pain as an In-Group using the Prisoner's Dilemma

Social in-groups are formed using social categories or similar attributes and individuals in social in-groups assimilate higher levels of altruism towards individuals in their in-group compared to non-members (Ruckmann et al., 2015). The "Prisoner's Dilemma" (PD) is a social game that assess altruism levels between a targeted group (i.e. chronic pain sufferers) and controlled accomplices (i.e. siblings). PD scenarios measure altruistic behaviors by evaluating decisions to cooperate with an accomplice for a mutual benefit or defect in attempt to receive a larger benefit (Ale, Brown, & Sullivan, 2013). Defection is additionally associated with risk behaviors due to the possibility of a greater loss if both parties defect (Sabater-Grande, & Georgantzis, 2002).

Many researchers have revised the "Prisoner's Dilemma" (PD) to evaluate altruistic behaviors among in-groups (Oskamp & Perlman, 1965; Weisel & Böhm, 2015; El Seidy & Almutaser, 2015; Haji, 1992), and have revealed enhanced altruism within groups that share similar behaviors, cognitive patterns, or kinship which is a strong predictor of altruism (Oh, 2001; Stark & Wang, 2004). Chronic pain is one possible social in-group that could also show high levels of altruism due to the shared empathy towards people that are in pain and the motivation that occurs when pain creates challenges to homeostasis. Tamburin et al. (2014) also identified increased risk behaviors among chronic pain suffers during other game tasks (i.e. Iowa Gambling Task), that may elude more defection towards non-pain accomplices during the current study. This study used the PD to investigate if chronic pain creates a social in-group that displays increased cooperation or if chronic pain sufferers display riskier behaviors of defection towards a non-pain accomplice.

Relevant research over the emotional/affective and decision-making/evaluative dimensions of chronic pain can facilitate prediction of how a chronic pain participant might respond in a PD setting. Cooperation during the PD has been linked to altruism levels (Weisel & Böhm, 2015), and researchers have associated risk behaviors with decisions of defection (Sabater-Grande, & Georgantzis, 2002). Risk-taking behaviors are also highly associated with chronic pain sufferers (Seifert, 2012). Individuals with chronic pain were more likely to make riskier decisions in the Iowa Gambling Task when compared to healthy controls (Hess, Haimovici, Muñoz, & Montoya, 2014). A similar study added that a chronic pain group seemed to have an absence of a learning process during the task and performed poorly compared to the healthy controls (Tamburin et. al., 2014). Researchers have concluded that the emotional effects of chronic pain negatively influence decision-making which contributes to higher risk taking (Verdejo-Garcia, Lopez-Torrecillas, Calandre, Delgado-Rodriguez, & Bechara, 2009). Chronic pain sufferers tend to hold negative views and have decision-making impairments (Smith & Osborn, 2007; Snelling, 1994). However, other research reveals that sufferers have high levels of empathy towards others in chronic pain (Finlay & Elander, 2016).

For example, the homophily principle is the tendency for people seek out others that have common experiences and characteristics, and the principle describes how in-groups can change personal attitudes towards social interactions (McPherson, Smith-lovin, & Cook, 2001). Chronic pain sufferers demonstrate the homophily principle by maintaining high levels of empathy towards other sufferers within a social support group (Sternke, Abrahamson, & Bair, 2016). In-group research among chronic pain sufferers has largely focused on the use of social support groups and report benefits for physical and mental health (Turk, Okifuji, Sinclair, & Starz, 1998; Uchino, 2009; Turk, Rudy, & Sorkin, 1993). Finlay and Elander (2016) reported that chronic

pain sufferers attended a support group for the desire of empathic and socially comparative relationships that improved negative outlooks. Improved social views and acceptance of pain was also found after chronic pain sufferers attended a single session group intervention (Jones, Lookatch, & Moore, 2013). Societal views of what constitutes a chronic pain condition is based on tissue damage and not much concern for the emotional distress that is caused (Sullivan, 2004).

In the work environment; a significant amount of chronic pain sufferers claim bosses tend to ignore them and become irritated when the topic of their pain is brought up (Peter D. Hart Research Associates, 2003). Other researchers have evaluated the evolution of cooperation in social dilemmas and determined that reciprocal altruism (i.e. the decision for both parties to cooperate for a mutual benefit) may have the same cooperative effect kinship shows amongst like minded individuals (Ale et al., 2013). Research has found higher levels of empathy and altruistic behaviors among intergroups that share similar attributes (Vanman, 2016), but lower levels associated with societal views towards chronic pain (Fitzgibbon, Giummarra, Georgiou-Karistianis, Enticott, & Bradshaw, 2010). Research has reported that pain sufferers have a hard time achieving a sick role due to the fear of health-care professionals, family members, and friends questioning the pain that is experienced (Glenton, 2003).

Family member sympathy towards a relative with chronic pain results in improved emotional distress among sufferers (Miller, Hollist, Olsen, & Law, 2013). The purpose of the present study was to elucidate altruism behaviors towards individuals with chronic pain and investigate if chronic pain creates an in-group that results in a higher level of altruism compared to a sibling in-group. Sibling altruism presents an opportunity for a comparison group because there is a vast ethological literature basis for the power of kinship altruism on social interactions.

In a PD setting; kinship has been found to promote cooperation and elucidates that cooperation is increased the closer two organisms are genetically related (Segal & Hershberger, 1999).

Similarly when kinship was used in a more broad sense, participants were more likely to cooperate with those that had similar behavioral or cognitive patterns regardless of relatedness (Oh, 2001).

To assess chronic pain as an in-group; an altered version of the PD was created with scenarios that represented either a sibling accomplice (kinship altruism measure) or an accomplice with chronic pain (social in-group measure). The independent variables were the groups formed (self-reported chronic pain or no pain control). During each scenario, a decision to cooperate or defect allowed analyses to compare group decisions. The dependent variables were altruism scores (sibling altruism or pain altruism) that were generated by summing the decisions to cooperate or defect. Chronic pain creates an in-group which we predicted would lead to greater cooperation in the PD over sibling altruism because it may be driven by shared empathy between chronic pain sufferers. Chronic pain creates a homeostatic imbalance which can present a salient threat to an organism's survival. This evokes compensatory responses including changes in relationships with others, which may take precedence over the need for kin to survive (i.e. the rationale for kinship altruism). To our knowledge, no other study has been conducted using the PD to probe altruism within chronic pain in-groups. We hypothesized that because of the empathy shared by people with chronic pain, that they create a social in-group that is stronger than kinship. Therefore; a chronic pain group was expected to have higher in-group cooperation compared to a sibling in-group during a PD.

## **Method**

### **Participants**

Participants consisted of students and faculty of Tarleton State University that were recruited using a link that was distributed via email, flyers, social media, and university announcements sent to the student body and faculty. Participants were asked to complete a survey on Qualtrics for the study. A total of 253 participants responded to the survey study and 114 had to be excluded from the final data set. Exclusions included participants that either did not complete the survey (excluded through list-wise deletion), were not raised with siblings, or were left handed or ambidextrous. Right handed participants were included because the data was collected by an EEG lab where handedness is an exclusion criteria. Participants ranged from 18-74 years of age and consisted of 108 females and 31 males. Participants were asked to self-report if they had chronic pain lasting more than 12 weeks. A total of 54 participants reported having chronic pain lasting more than 12 weeks (chronic pain group) and 85 participants reported that they did not have chronic pain (control group).

## **Materials**

The first PD scenario in our survey, originally created by Davis (1997), allowed the statistical measure of altruistic behaviors based on the decisions to cooperate with an accomplice. Kendall, Yao, and Chong (2007) offered additional clarification of the PD design that aided with the creation of the subsequent scenarios. Our PD scenarios related altruistic behaviors to cooperative decisions made with an accomplice in order to receive a mutual payoff (i.e. the participant and accomplice receive the same jail time if they say nothing to the police). While risk behaviors were associated with defective decisions due to the outcome of receiving either the best payoff or the worst payoff (i.e. a participant receives no jail time for telling the police it was the acquaintance, but more jail time if the accomplice does the same).

The 12 Prisoner's Dilemma scenarios used in the current study maintained the latter design by offering a mutual payoff for cooperation and a higher payoff for defection only if one party chooses to do so. Therefore, decisions to defect could represent risky behavior tendencies; while decisions to cooperate represent altruism. The hypothetical scenarios were formed into a survey and administered using Qualtrics. The acquaintances in the scenarios were hypothetical siblings or chronic pain sufferers in order to observe altruistic behaviors towards the two groups as mediated by kinship altruism or chronic pain as a social in-group. Six of the scenarios included a chronic pain acquaintance while the remaining scenarios included a sibling acquaintance (see Appendix A for all PD scenarios used). When completing the survey, participants read through the scenarios and were given the choice to cooperate with or defect on an accomplice. Altruism levels were then contingent on the cooperative decisions given by either the chronic pain or control groups.

### **Statistical Procedures**

Microsoft Excel was used to clean and score data. Responses were scored as follows: decisions to cooperate with an accomplice were given a score of 10 for the scenario and decisions to defect were given a score of zero. For the six sibling scenario questions, each participant's responses were summed into a sibling altruism score for each participant. The same method was used to generate chronic pain altruism scores. SPSS v24 was used to compute a mixed ANOVA in order to compare the scores for sibling altruism and pain altruism across groups.

### **Results**

A mixed ANOVA was ran with the groups (chronic pain/control) as the between-subjects factor and altruism scores as the within-subjects factors (sibling altruism/chronic pain altruism).

We hypothesized that because of the empathy shared by people with chronic pain, that they create a social in-group that is stronger than kinship. In other words, we expected to find a main effect of group, and an interaction effect between group and altruism. Levine's test for the equality of variances demonstrated that the assumption of the equality of error variance was not violated,  $p > .05$ . There was no main effect of altruism,  $F(1,137) = 276.36$ ,  $p = .136$ , meaning that there were no significant differences in pain altruism or sibling altruism overall. There was no main effect of group,  $F(1,137) = .425$ ,  $p = .515$ , which means that the chronic pain group and the control group did not show any significant difference in decision making overall. Lastly, there was no interaction effect,  $F(1,137) = 1.465$ ,  $p = .228$  (see Appendix B for Figure 1) and found the two groups were similar in their altruistic behaviors no matter what in-group the accomplice fit into. There was no support for the hypothesis.

### **Discussion**

This research was designed to address the poverty of research concerning altruism behaviors towards chronic pain sufferers and the evaluation of chronic pain as an in-group. This study adds to the findings of risk behaviors among chronic pain sufferers in a social dilemma and the altruism behaviors of healthy individuals towards individuals with chronic pain. The results of our study did not support our hypothesis that chronic pain creates an in-group that yields stronger altruism than kinship. The finding that there was no significant difference between cooperation with a sibling or an accomplice with chronic pain suggests that the presence of chronic pain is a powerful trigger for altruism. This is intriguing because kinship is one of the strongest predictors of altruism. Chronic pain evokes empathy among chronic pain sufferers (Sternke et al., 2016), and empathy may be driving the high cooperation with chronic pain accomplices in the present study.

In a previous study, a PD setting was created where temptation payoff was increased and the result was that participants chose to defect and viewed the accomplice as weak (Wang, Ye, Cheong, Bao, & Xie, 2018). In the present study, when the pain group was given a decision to defect for personal gain or cooperate for a mutual benefit; the pain group cooperated at the same level as the control group without chronic pain. Therefore; our findings suggests that in a social dilemma that requires an altruistic behavior with a sibling or a chronic pain sufferer; a chronic pain sufferer does not show increased risk behaviors. This result contrasts with studies demonstrating that chronic pain individuals expressing riskier decisions compared to healthy controls (Hess et. al., 2014). This can be explained because in the present study, risk may be mitigated because of the social in-group factor facilitated by empathy.

Although the chronic pain group did not have higher levels of altruism than the control group (sibling altruism), the groups cooperated at nearly the same level. The research that has identified empathy for pain sufferers (Ruckmann et al., 2015); would support the cooperation found in our chronic pain in-group and sibling in-group. The cooperation with the chronic pain accomplice was not exclusive to individuals with chronic pain.

### **Limitations**

Since research relates empathy with kinship (Stark & Wang, 2004); one limitation of the present study was a direct measure of empathy for individuals with chronic pain. An additional question we should have asked our non-pain sibling group is if they had any close relationships with someone with chronic pain to further investigate findings that associate increased empathy for chronic pain sufferers (Miller et al., 2013). Another limitation our study may have is the mutual payoff to cooperate in all of our scenarios. The mutual payoff has been found to create reciprocal altruism (Ale et al., 2013), and may explain the reasons for cooperating rather than

empathy. By adding additional scenarios that vary in amounts of payoff that either increase or decrease temptation to defect would further investigate altruism towards a chronic pain sufferer versus a sibling.

### **Conclusion**

Kinship altruism is one of the strongest predictors of altruism in the ethological literature. Our study uniquely reveals that chronic pain can elicit strong cooperation tendencies similar to kinship altruism, irrespective of whether the participant suffers from chronic pain themselves. Future studies will be conducted to continue to investigate chronic pain as a social in-group.

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## Appendix A

## Prisoner's Dilemma Scenarios

1. You and your sibling, are in jail and suspected of committing a crime. You are isolated from each other and do not know how the other will respond to questioning. The police invite both of you to implicate the other in the crime (defect). What happens depends on what both of you do, but neither of you know how the other will respond. If Luke betrays you (yields to the temptation to defect) while you remain silent, then you receive 5 years in jail; while Luke gets off free (and vice versa). If you both choose to cooperate with each other (not the police) by remaining silent, there is insufficient evidence to convict both of you, so you are both given 1-year sentence for a lesser crime. If both of you decide to defect, then you have condemned each other to a 2-year sentence. What would you choose to do? Cooperate or defect.
2. You and your sibling both run different companies that produce Energy Drinks. You are both approached separately with an opportunity to advertise in order to increase sales. Neither of you will know if the other sibling will choose to advertise. If you both decline advertisements, then your profits will remain equally the same (cooperate). If you decide to purchase the advertisement and your sibling does not (defect); then your company's profit will increase by 20% (and vice versa). If you both decide to purchase advertisements (defect) then you will both each lose 10% in profit. What would you choose to do? Cooperate or defect.
3. You and an accomplice that experiences lower chronic back pain from a recent DUI (Driving Under the Influence) accident, are being interrogated separately for a robbery you both committed. If you do not tell the officer anything (cooperate), then you and your

accomplice will each receive 2 years in jail. If you decide to tell the officer that your accomplice was the only one to commit the crime (defect), then the accomplice will receive 5 years in jail; while you get away with no time spent in jail. If you both decide to tell the officer (defect), then you both each spend 3 years in jail. What would you choose to do? Cooperate or defect.

4. You and your sibling own the corn market under two different corn companies that you both separately run. You are separately approached by a market analyst that suggests that you restrict production to increase the value of the product. If you both decided to restrict (cooperate), then both companies would increase the value of the product by \$100. If you decide not to restrict your product (defect), and your sibling does restrict; then only your product's value would increase by \$200 (and vice versa). Neither you or your sibling will know what each other will choose. What would you choose to do? Cooperate or defect.
5. You and an acquainted partner that experiences severe natural occurring arthritis are being interrogated for a car you both stole. The police do not have enough physical evidence to tie you both to the scene but do have enough to book you both on a lesser charge of trespassing. If you both do not say anything to the police (cooperate), you both will receive a 3-year sentence. The police officer tells you that if you tell him what happened; your partner will receive 7 years and you will walk free (defect). If you both decide to tell the police about each other; then you both will receive a 5-year sentence each. What would you choose to do? Cooperate or defect.
6. You and your sibling both discover 2 ancient artifacts that are worth thousands and have the choice to sell them together or separately. You can both decide to split (cooperate) a \$10,000 offer from a museum. Or, you can decide to sell only your artifact (defect) to a

private buyer for \$7,000. If you both decide to sell to the private buyer, then you each receive \$3,000 each and the museum offer will expire. What would you choose to do?

Cooperate or defect.

7. You and a friend that has chronic knee pain from playing recreational sports are approached by a financial advisor. Since you both each own a separate clothing store; the advisor is suggesting you invest in advertisement. If you decide to purchase advertising (defect), then only your sales will increase 30% while your friends will decrease 30%. If you both decide to advertise (defect), then you will both will lose 20% in sales. If you both decline advertising (cooperate), then sales will resume as normal. What would you choose to do? Cooperate or defect.
8. You and your sibling are training separately for a swimming competition. You are both approached separately by a specialized trainer to offer some experienced advice. If you choose to take their advice (defect), then you will win first place and your sibling will get third place. If you both decide to take the trainer's advice (defect), then you will both tie for third. If you both decide to ignore the trainers advice (cooperate), you will both tie for second. Neither of you will know how the other answers. What would you choose to do? Cooperate or defect.
9. You and an acquaintance that experiences chronic shoulder pain due to natural joint wear, both manage a laundromat business. One day a service technician offers new wiring to you and your partner separately. The new wiring will save the business thousands in energy over the year. You can not tell the partner (defect) about the new wiring and pocket \$10,000 of savings as a sales bonus. Or, you can inform them about the new wiring (cooperate) and each receive \$7,500 in energy savings. If you both decide to take

the \$10,000 as a sales bonus, then the company will have \$5,000 missing. What would you choose to do? Cooperate or defect.

10. You and a friend that developed chronic ankle pain after a self-inflicted motorcycle accident, are facing criminal fraud charges. The detectives are interviewing you separately and give you two different choices. You can either tell them that your friend was the only one committing fraud and send them to prison for 10 years while you walk free. Or, you can remain silent (cooperate) and you both will receive a lesser charge and spend 3 years each in prison. If you decide to blame one another (defect), then you will both receive a 7-year sentence. What would you choose to do? Cooperate or defect.
11. You and your sibling are offered scholarships for education separately to the same school. If you choose to accept a full 4-year scholarship (defect), your sibling will only receive 1 year. If you both decide to take the partial scholarship (cooperate), you will both receive 3 years of school. If you both decide to accept the full 4-year scholarship (defect), it will be divided in half and both of you will receive 2 years of school. Cooperate or defect?
12. You and an acquaintance that suffers from a natural disorder that causes chronic neck pain, are both approached separately about selling your homes for new development. If you decide to sell your home first (defect); you will receive \$50,000 profit and your acquaintance's home will become devalued by \$30,000. If you both decide to wait to sell (cooperate), you will each receive an offer of \$30,000 profit for your home. If you both decide to be the first to sell (defect), you will countered with a lower offer and lose \$20,000 in profit. Cooperate or defect?

Appendix B

Altruism Scores in the Prisoner’s Dilemma Scenarios by Group.

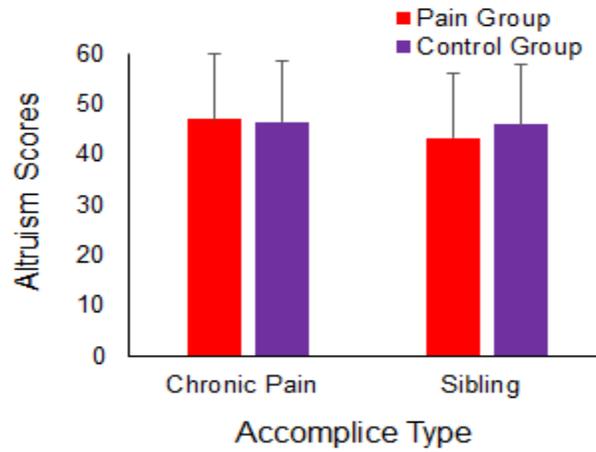


Figure 1. Participants with chronic pain (n=54) did not demonstrate significantly more altruism to siblings or individuals with chronic pain when compared to control participants that do not have chronic pain (n=85).