

Original Article**Laughter, Humor and Pain Perception in Children: A Pilot Study****Margaret Stuber, Sherry Dunay Hilber, Lisa Libman Mintzer, Marleen Castaneda, Dorie Glover and Lonnie Zeltzer**

Semel Institute at UCLA, 760 Westwood Plaza, Los Angeles, CA 90024-1759

Although there are many clinical programs designed to bring humor into pediatric hospitals, there has been very little research with children or adolescents concerning the specific utility of humor for children undergoing stressful or painful procedures. Rx LaughterTM, a non-profit organization interested in the use of humor for healing, collaborated with UCLA to collect preliminary data on a sample of 18 children aged 7–16 years. Participants watched humorous video-tapes before, during and after a standardized pain task that involved placing a hand in cold water. Pain appraisal (ratings of pain severity) and pain tolerance (submersion time) were recorded and examined in relation to humor indicators (number of laughs/smiles during each video and child ratings of how funny the video was). Whereas humor indicators were not significantly associated with pain appraisal or tolerance, the group demonstrated significantly greater pain tolerance while viewing funny videos than when viewing the videos immediately before or after the cold-water task. The results suggest that humorous distraction is useful to help children and adolescents tolerate painful procedures. Further study is indicated to explore the specific mechanism of this benefit.

Keywords: children – distraction – laughter – pain**Is Laughter Good Medicine for Children's Pain?**

Laughter has long been viewed as 'good medicine' for a variety of ailments. Only relatively recently have there been careful investigations as to the validity and mechanism of this widely held belief (1, 2). In the past few years, studies dealing with humor and laughter in relationship to health in adults have been published from Japan (3, 4), Canada (5), Germany (6), Australia (7), Taiwan (8) and the United States (9, 10). These studies have examined such diverse topics as the impact of laughter and humor on inflammatory cytokines in rheumatoid arthritis (11), the renin-angiotensin system in type 2 diabetes mellitus (12), growth hormone, IGF-1 and substance P (13), allergic skin wheal responses (14), bronchial responsiveness in patients with bronchial

asthma (15) and binocular rivalry (7). Of particular clinical interest has been the investigation of the impact of humor and laughter on pain perception and pain tolerance (16–19). These studies of the effectiveness of humor, music, arithmetic and horror as distracters have suggested that compelling distraction increases pain tolerance in adults, regardless of whether or not the distraction is humorous.

Relatively little research has been done on the relationship between humor or laughter and health in children. However, there have been some studies focusing on procedural pain, a distressing problem for children, parents and healthcare providers. One interesting longitudinal study found that a distraction task during a painful intervention could have an impact on pain reactivity in children for up to 2 years after the initial distraction (20). Another study examined evidence for the existence of a 'pain-sensitive temperament', which predicts procedural distress and response to psychological interventions (21). None have specifically looked at

For reprints and all correspondence: Dr Margaret Stuber, Semel Institute at UCLA, 760 Westwood Plaza, Los Angeles, CA 90024-1759. Tel: +1-310-825-5213; E-mail: mstuber@mednet.ucla.edu

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laughter as the mechanism for the effectiveness of humorous interventions for pain.

The primary objectives of the current pilot study were to:

1. Evaluate the methodology and feasibility of a comprehensive study of the relationships between humorous distracters, laughter, pain tolerance and pain severity in healthy children.
2. Evaluate whether there was evidence suggesting the need for further larger studies in the areas of humorous distracters, laughter, pain tolerance and pain severity in children.
3. Help refine the questions that should be pursued in larger studies of interventions to help children deal with painful procedures, e.g. to help clarify what types of variables would be important to include.

Specific hypotheses being investigated were

1. Subjective appraisal of pain severity is less for pain experienced while watching a humorous video than before or after watching a humorous video.
2. Pain tolerance is greater for pain experienced while watching a humorous video than before or after watching a humorous video.
3. Subjective appraisal of pain is inversely related to laughter during a painful experience.
4. Pain tolerance is directly related to laughter during a painful experience.

Setting the Stage

The study was conducted in two phases, each of which was approved by the UCLA Institutional Review Board (IRB). In Phase 1, 37 children ages 7 to 13 years from local elementary schools were recruited using flyers sent home with them from school (with permission and approval of the flyers by the schools). Interested parents were required to contact the research team to consent for participation. A wide variety of classic and contemporary comedy shows and movies had been prescreened and selected segments chosen by Rx Laughter as suitable for the age group of the children. All materials were used with permission, but without any suggestions or involvement from the owners or participants in the videos. All materials were approved for use in this study by the UCLA Institutional Review Board (IRB).

The purposes of this Phase were (i) to evaluate whether these shows (a) would be perceived as funny by elementary school-age children, ages 7 to 13 years and (b) would cause them to laugh, and (ii) to provide interrater reliability training for members of the research team counting incidents of laughter. At each showing, a group of approximately five children ages 7 to 13 years watched a series of 5-min video samples. Laughs of each child were counted as they watched. Following each video

section, the children completed a rating on a 1 to 4 scale of how funny they found the video. This protocol was done with four different groups of children, using different combinations of shows, until reliability was established in laughter ratings and certain tapes had been established as consistently evoking laughs and being judged as funny by the children. The first four authors were present for these sessions. Parents were not present while the children viewed the video samples. A decision was made to focus on slightly older children in the next phase, based on difficulties the younger children had completing the rating scales.

Once the most effective stimulus tapes had been selected and the laughter ratings standardized, healthy children ages 7 to 16 years were recruited for participation in the second phase of the study. This recruiting was done using IRB-approved flyers posted in buildings across the University of California, Los Angeles campus. The flyers described the study, and invited interested parents to call and learn about the study, before arranging a time to participate. Screening was done at the time of the phone call to ensure that the children had no serious chronic or acute illnesses which would be likely to alter their pain tolerance or appraisal. A total of 18 children, ages 7 to 16 years, completed all components of the second phase of the study. These included 12 boys and 6 girls, with a mean age of 12 years.

The Procedures

The Cold Pressor Task

This task was similar to that used in studies of the impact of distraction on pain in adults and following the protocol established by other studies with children in this laboratory. An ice-chest measuring 38-cm wide, 71-cm long and 35-cm deep was fitted with a plastic mesh screen to separate crushed ice from a plastic large-hole mesh armrest in water maintained at 10°C. Water was circulated through the ice by a pump to prevent local warming about the hand. Participants placed a hand in cold water to a depth of 2" above the wrist for each trial, and remained to tolerance with an uninformed 3-min ceiling, following an established protocol, and as approved by the UCLA IRB (22). The arm was warmed between trials by being wrapped in a warm towel as soon as it was taken out of the water, and kept wrapped for 5 min.

Verbal instructions given to the child before the cold pressure task for Trial 1 were: 'In this cooler is cold water. What you are going to do next is put your hand in the cold water and hold it there as long as you feel able. When you put your hand in, do it with the palm of your hand facing up towards the ceiling so that the back of your hand lays flat against the surface of the grate

(demonstrate position of hand in the air). When you can no longer hold your hand in, take it out, and we'll dry it and then warm it up for you. I may tell you to take your hand out before you decide to do so. You can pick whichever hand you'd like, but once you pick, you will need to use the same hand each time we do this. Which hand would you like to use?

For cold pressure task Trials 2 and 3 the verbal instructions given were, 'Okay then. When you are ready, place (but don't slide) your hand in the water palm-side up. While your hand is in the water, remember not to talk to us.' Subjects were advised to use the same hand as in the previous trials.

Pain Tolerance

Pain tolerance was a behavioral measure defined as the amount of time, in seconds, elapsed from the onset of the pain stimulus to participants' withdrawal from the stimulus (length of time the hand was immersed). This was measured with a stopwatch by an observer in the room. This was one of the primary dependent variables.

Pain intensity

Pain intensity was a subjective appraisal of pain. Pain intensity ratings were obtained using a vertical sliding visual analogue scale (VAS) anchored with 0 at the bottom indicating the least amount and 10 at the top indicating the greatest amount. The scale also had two types of visual cues: color cues, graded from white at the bottom to dark red at the top, and facial expression cues, with a neutral face at the bottom and a negative facial expression at the top. Pain intensity was assessed immediately after each trial, with participants providing a VAS rating in response to the question 'At its worst, how much pain did you feel?' This was one of the primary dependent variables.

Laughter and Smile Rating

Participants were observed by a researcher in the room who coded incidents of smiles and of laughter. Raters had been trained to have excellent inter-rater reliability. This was one of the primary independent variables.

Subjective Humor Rating

Participants were asked to rate how funny the video was that they watched. This was added to control for the possibility that, despite prior testing, the videos would not be perceived as equally funny and not be effective in eliciting laughter. The 'How funny was it' measure was a vertical visual analogue scale anchored with a sad face and the words 'not funny' at the bottom, and a happy face with the words 'very funny' at the top. Kids were asked to mark 1 of 21 (not numbered) points between these two anchors to indicate how funny they thought the

video clips were. This was used to monitor that the videos were seen as humorous.

The Trials

There were three cold pressor task trials: (i) baseline, which was before watching a funny video, (ii) after watching a funny video and (iii) while watching a funny video. Participants and their parents were brought to the pain laboratory before the trials began, were shown the equipment, and were given an explanation of the procedures. Each child was then asked to give written assent and each parent asked to give written consent on IRB-approved consent and assent forms. Parents then left the laboratory and remained in the waiting room during the trials, and were not present in the laboratory while their children participated in the trials.

Trial 1

Each participant was instructed to immerse and retain his/her hand in the water until the hand immersion became intolerable (with an uninformed 3-min ceiling). The participants immersed the same hand in the cold water for all the three trials. The time the hand was immersed was recorded in seconds, and the child was asked to indicate on the VAS how painful the water had been. After a 5-min recovery period, during which time the hand was dried and wrapped in a warm towel, the next trial began.

Trial 2

The participating child was then shown a total of 15 min from 3 or 4 video segments already established as humorous for this age group during the first phase of the study. Incidents of laughter were recorded during the viewing. After watching the video the child was asked to rate how funny they thought the video was. The child then again submerged a hand in cold water, and the length of time it was retained was recorded. After hand withdrawal, the child was asked to indicate on the VAS how painful the water had been. At the end of the 5-min recovery period, during which time the hand was dried and wrapped in a towel to warm, the child was given instructions for Trial 3.

Trial 3

A period of 15 min of paperwork was used to match the 15 min interval between Trials 1 and 2. Then, the child was asked to pick one of the previously watched video segments to view again. The child submerged a hand while watching the video segment. Given the uninformed 3-min ceiling for the hand submersion, the length of this video session was never more than 3 min. Incidents of laughter and the length of time the hand was

Table 1. Pain appraisal and tolerance by trial

Condition	Mean pain appraisal (SD)	Mean pain tolerance in seconds (SD)
No Video (Trial 1)	4.60 (2.88)	52.26 (36.6)
Following Humorous Video (Trial 2)	4.24 (3.08)	58.74 (48.1)
During Humorous Video (Trial 3)	4.57 (3.31)	80.42 (59.21)*

* $P < 0.05$.

submerged were observed and recorded. After hand withdrawal, the child was once again asked to indicate on the VAS how painful the water had been, while the hand was dried and wrapped in a towel to warm.

Analysis

Repeated measures Analysis of Variance (ANOVA) with Huyn-Feldt corrections were used to assess pain appraisal ratings and pain tolerance (submersion time) across the three trials. Pearson 2-tailed correlations were obtained for the number of laughs, ratings of 'how funny', ratings of pain and submersion time (pain tolerance).

Results

Hypothesis 1: Is Appraisal of Pain Severity Decreased While Watching a Humorous Video?

The overall pain severity appraisal ratings were in the moderate range, with a mean of 4.60 and a SD of 2.88 at baseline on a scale of 0 to 10. There were no statistically significant differences between the visual analog ratings of pain for the children for the three trials of hand emersion (Table 1). Subjective pain ratings were not affected by watching a humorous video.

Hypothesis 2: Is Tolerance of Pain Increased While Watching a Humorous Video?

Repeated measures ANOVA indicated pain tolerance increased over trials, as shown in Table 1 [$F(1,26) = 9.63$, $P = 0.02$]. Planned contrasts comparing each video trial to the no video baseline condition indicated a significant difference between baseline and Trial 3 (during video), but no significant difference between baseline and Trial 2 (following video).

Hypothesis 3: Is Amount of Laughter Associated with Pain Appraisal?

The number of laughs did not significantly correlate with pain appraisal ratings during either Trial 2 ($r = -0.29$) or Trial 3 ($r = -0.21$). Higher numbers of laughs while

Table 2. Pearson correlations of variables

	Pain tolerance	How funny	Number of laughs
Pain appraisal			
Trial 2			
Pearson correlation	-0.08	-0.34	-0.29
Sig. (2-tailed)	0.74	0.17	0.24
Trial 3			
Pearson correlation	-0.17	-0.45	-0.21
Sig. (2-tailed)	0.52	0.07	0.43
Pain tolerance			
Trial 2			
Pearson correlation	-	-0.02	-0.31
Sig. (2-tailed)	-	0.93	0.22
Trial 3			
Pearson correlation	-	0.22	0.22
Sig. (2-tailed)	-	0.38	0.38
How funny			
Trial 2			
Pearson correlation	-	-	47
Sig. (2-tailed)	-	-	0.05*
Trial 3			
Pearson correlation	-	-	0.36
Sig. (2-tailed)	-	-	0.15

watching the video were significantly associated with the child's rating of how funny the video was during Trial 2 ($r = 0.47$, $P < 0.05$) but did not reach significance for Trial 3 ($r = 0.36$, $P = 0.15$) (Table 2).

Hypothesis 4: Is Amount of Laughter Associated with Pain Tolerance?

The number of laughs while watching the video was not significantly correlated with pain tolerance for either Trial 2 or Trial 3 (Table 2).

Discussion

This small and preliminary study yielded some expected as well as some unexpected results. As expected, based on clinical experience and the literature with adults, humorous videos were found to be useful in increasing tolerance for a moderately painful stimulus. The increase was robust enough to be statistically significant even with such a small sample, and enough time longer to suggest that such an intervention would be of some clinical utility. What was surprising was that this increased tolerance was not associated with a change in pain severity appraisal. Subjective ratings of pain did not change over the three trials, despite a marked increase in tolerance during the

third trial. The number of laughs was also not associated with pain severity appraisal or with pain tolerance. The mechanism by which the humorous videos increase pain tolerance thus appears not to be through changes in the cognitions of pain appraisal or through the actual physical effects of laughter.

Studies of adults have found that emotionally engaging video segments were equally effective in increasing pain tolerance, whether the videos were funny, sad or frightening. The primary mechanism has therefore been interpreted as a compelling and emotional distraction from the pain leading to increased tolerance (16–18). Since only humorous videos were used in this study, this hypothesis was not evaluated. Indeed, it is not clear that the IRB would allow such a study with children. It is difficult to imagine parents or medical personnel being eager to use frightening or sad videos as distraction for children, particularly those undergoing painful procedures. Thus, even if such videos might be equally distracting, they would not be of clinical utility for helping children deal with expected and necessary pain.

For those who do humorous interventions with children who are sick or in pain, these findings do suggest that the primary objective is to engage the child, and that this can be effective whether or not the child actually laughs out loud. This implies that even children who are reserved in their expressions of emotion or whose illnesses limit their ability to laugh out loud can have benefit from engaging, humorous interventions. The interventions also may be of help even if the child does not report a subjective decrease in pain appraisal. As appears to be the case with some pain medications, the effect of the humorous video may be to decrease the distress or suffering or enhance coping rather than impact the actual sensation of the pain.

The study was successful in its goals to establish feasibility of this type of study and to help outline some further questions to be explored. Nonetheless, there are some significant limitations to this study. It was a pilot study, with a small sample size and significant potential confounds. The small sample size precluded analysis of variables known to be important to pain severity appraisal and pain behavior such as gender, intelligence, socioeconomic status and age. The order of the trials was not varied between subjects, also due to the small sample size. This opens the question of whether the increase in pain tolerance is due to an accommodation to the stimulus. The lack of difference between Trial 1 and Trial 2 suggests that there was not a significant accommodation between these trials. Previous studies from this laboratory using a counterbalanced design found no impact of order in response to the cold pressor for the first, second or third task in the lab setting. However, lack of counter-balancing the trials among the subjects remains a limitation, a factor suggesting a need

for replication of the study with a larger sample. The results must be viewed as preliminary.

Clinically, the results of this study support the ongoing efforts to provide humorous distraction for children undergoing painful procedures. Laughter itself may be less important than the emotional involvement in humor. Even the expectation of humor may have a positive effect. One published study of adults found that expectations that a specific distracter would be helpful were associated with an increased threshold for discomfort (19). It is possible that an additional component which added to the pain tolerance in the third trial was that the children were able to view a video which they had already seen, and chose to see again, creating a positive expectation for enjoyment.

This study was conducted with healthy children. Thus, it would appear to be applicable to healthy children going through painful procedures, such as diagnostic tests or preventative interventions. It is not clear whether or not these findings could be generalized for children who are ill. Anecdotal evidence suggests that humorous interventions are well-received by children in the hospital, and that other types of distracters are useful for children undergoing painful procedures. Further study is indicated to understand the best way to use humorous interventions for ill children as well as the mechanism of the effect.

Future suggested studies include investigations of differences in pain tolerance in both healthy and ill children in response to various activities, including

- passive humor (e.g. watching funny videos),
- active or interactive humor (e.g. telling jokes, or doing funny things),
- passive distraction (e.g. watching drama or action videos), or
- active distraction (e.g. playing video games).

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