Effect of music on chronic osteoarthritis pain in older people

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Background. Osteoarthritis is the most common degenerative disease in humans. It usually begins in middle age and is progressive. Chronic pain in older people presents a significant obstacle in maintaining function and independence. Previous studies have shown that music can improve motivation, elevate mood, and increase feelings of control in older people.

Purpose. The purpose of this randomized clinical trial was to examine the influence of music as a nursing intervention on osteoarthritis pain in elders.

Method. Data were collected using the short form of the McGill Pain Questionnaire with 66 elders suffering from chronic osteoarthritis pain. Differences in perceptions of pain were measured over 14 days in an experimental group who listened to music for 20 minutes daily and a control group who sat quietly for 20 minutes daily. All participants completed the Short Form McGill Pain Questionnaire (SF-MPQ) on day 1, 7, and 14 of the study.

Results. Results of *t*-tests indicated that those who listened to music had less pain on both the Pain Rating Index on day 1 ($P = 0{\cdot}001$), day 7 ($P = 0{\cdot}001$) and day 14 ($P = 0{\cdot}001$) and on the Visual Analogue Scale on day 1 ($P = 0{\cdot}001$), day 7 ($P = 0{\cdot}001$) and day 14 ($P = 0{\cdot}001$), when compared with those who sat quietly and did not listen to music. A repeated measure analysis of variance controlling for pretest measures demonstrated a significant decrease in pain among experimental group participants when compared with the control group on the pain descriptor section of the SF-MPQ ($P = 0{\cdot}001$) and the visual analogue portion of the SF-MPQ ($P = 0{\cdot}001$).

Conclusion. Listening to music was an effective nursing intervention for the reduction of chronic osteoarthritis pain in the community-dwelling elders in this study.

Keywords: music, osteoarthritis, chronic pain, elders, nursing, randomized control trial

Background

Osteoarthritis, a degenerative joint disease, is the most common disease in humans with an insidious onset that is gradually progressive over the years (Fauci *et al.* 1998). The pathophysiology of osteoarthritis begins with roughening or loss of surface of the hyaline cartilage of a joint with pitting and irregularities. The typical areas of involvement are the weight bearing areas of articular cartilage. Osteoarthritis begins in middle age and pain is usually the earliest symptom (Nash 1999). It is a common cause of physical and psychosocial disability (Hopman-Rock *et al.* 1996). The chronic

pain of osteoarthritis constitutes a significant obstacle for elderly persons in maintaining optimal function and independence (Fauci *et al.* 1998). As elders become less independent in activities of daily living and are forced to remain at home because of chronic pain, they lose a sense of autonomy and social connection (Ferrell 1991). Depression, decreased socialization, sleep disturbance, and impaired function are common psychological consequences of chronic osteoarthritis pain (American Geriatrics Society 1998). Chronic pain is defined as the pain that persists beyond the normal duration of injury or tissue damage. This definition includes the idea that chronic pain rather than the pathology is considered the major problem, once reversible factors have been excluded (Tallis *et al.* 1998).

Osteoarthritis pain is both chronic and cyclic (American Geriatric Society 1998). It begins with a focus or obsession on the pain and physical impairment, which can lead to social isolation and depression. Depression increases feelings of fatigue and can exacerbate chronic pain. The essence of management in chronic osteoarthritis pain is to establish appropriate pain-coping strategies and discourage behaviours that may perpetuate the pain syndrome of chronic pain (Tallis *et al.* 1998).

With the understanding of the ability of chronic pain to reduce the quality of life in elders, Healthy People 2010 (US Department of Health and Human Services (US DHHS) 2000) has set a goal to increase the quality and years of healthy life among the population. Outcomes specific to osteoarthritis are to decrease: (1) mean days without arthritic related severe pain; (2) activity limitations caused by arthritis; and (3) personal care limitations.

Therapies that influence emotional, sensory, and affective components of pain perception can break the cycle of chronic pain (American Geriatric Society 1998). Non-pharmacological methods of analgesia have been investigated for managing chronic pain. Positioning for comfort, touch therapies, and distraction techniques have been shown to reduce pain in the participants studied (Ferrell 1991, Bellamy & Bradley 1996, Doody *et al.* 1996, Cooner & Amorosi 1997, Daley 1997).

The intervention in this study is listening to music. Music is defined as the art of listening to significant arrangements of sound that usually have rhythm, pitch, and tone colour (adapted from Funk & Wagnall 1998). In studies using music as a therapy, elders have said that music improved motivation, elevated mood, and emphasized feelings of responsibility and control (Bailey 1986). Music is thought to release endorphins and change catecholamine levels in ways that facilitate pain relief and decrease blood pressure, heart rate, respiratory rate, oxygen consumption, and serum lactic acid levels (Guzzetta 1989, Fischer 1990, Gardner 1990, McCaffery & Beebe 1994, Pert & Chopra 1999). Music has been shown to induce relaxation and distract persons from focusing on pain (Locsin 1981, Guzzetta 1989, Jacobson 1990, McCaffery 1999, McCaffrey & Good 2000). Relaxation and distraction techniques reduce muscle tension surrounding the injured area (Ceccio 1984). Because listening to music promotes positive outcomes in affect and attention, it is likely that music might relieve the physical pain of osteoarthritis.

Updike (1990) examined the effect of music on anxiety, stress, and the experience of pain. There were significant decreases in mean arterial pressure, systolic, and diastolic blood pressure, which are indicators of increased anxiety, after listening to music. Comments from the subjects regarding their experience of listening to music included diminished, increasingly manageable, or absent pain.

Good *et al.* (1999) studied 500 patients for the effects of music and jaw relaxation on postoperative pain relief. The intervention was initiated on the day of surgery and data was collected on postoperative days 1 and 2. Participants in the combination group that included both the interventions of relaxation and music had significantly less pain on all post-tests. The researchers hypothesized that initiating these therapies for longer periods of time might increase duration of the treatment effect.

Listening to music has been shown to decrease rheumatoid arthritis pain in women.

Schorr (1993) demonstrated that pain perception is decreased when women with rheumatoid arthritis listen to music for 20 minutes. However, the lack of a control group reduced the ability to predict that music was the only factor that caused the change in pain perception.

Studies have demonstrated that music can reduce the perception of pain, reduce anxiety, and foster relaxation. No prior study, however, has demonstrated that music can reduce pain in community-dwelling elders with chronic osteoarthritis.

Theoretical framework

The theoretical framework for this study was Rogers' Science of Unitary Human Beings (SUHB) (1980). Rogers (1980) theorized that human energy fields are in continuous mutual process with environmental energy fields. Because of the continuous interaction between the human and environmental fields, Rogers believed that in order to effectively treat manifestations of illness, persons must be considered and understood from a unitary perspective, which includes field pattern interactions (Daley 1997). Manifestations arise from

the mutual process of a human and an environmental field, some of which can be perceived as physical. Pattern is the distinguishing characteristic of each energy field. While patterns are not directly observable, one is able to observe the manifestations of pattern. The manifestation of the unique pattern of chronic pain gives identity to a unique human energy field. Pain can be regarded then, as a manifestation of a person's unitary being.

Integrality is one of the principles within SUHB that describes the nature and direction of change. It specifies the continuous mutual process of human and environmental fields, whereby person and environment are a unitary whole (Malinski 1991). Through knowing participation, individuals in interaction with the environmental field can shape the human and environmental pattern.

One manifestation of human environmental mutual patterning is that of chronic pain. As a manifestation of pattern, humans perceive chronic pain in unique and individual ways. Music, as part of the environmental field pattern may be useful to humans in changing the manifestation of chronic pain. When elders listen to music in an effort to reduce chronic pain, they are demonstrating a knowing participation in the mutual process of changing the pattern of chronic pain through interaction with music in the environmental energy field.

The study

Research questions

The study examined the following research questions:

- Do community-dwelling elders with chronic osteoarthritis pain who listen to music for 14 days have less post-test pain on day 1, 7, and 14 than those who do not listen to music?
- Do community-dwelling elders with chronic osteoarthritis pain who listen to music have less pain across the time period of 14 days than those who do not listen to music?

Design

The study was a randomized controlled trial, with one experimental and one control group.

Sample

The study employed a randomized clinical trial to limit sampling error and to obtain participants in the control and experimental groups who were comparable. A non-probability, convenience sample of community-dwelling elders from two counties in southeast Florida was recruited for this study by making announcements and posting flyers at five senior centres and one church. Interested elders were asked to call the study director to obtain information and sign up as a participant.

Inclusion criteria were: (a) elders over 65 years of age; (b) diagnosed with osteoarthritis; (c) experiencing pain from that diagnosis which measures at least a 3 on a rating scale of 1–10 on at least 15 days of the month; (d) able to hear music; and (e) able to independently operate a tape player. The single exclusion criterion was use of narcotic analgesics. Decreased cognitive ability caused by the use narcotic medications could inhibit the ability to use a tape player, thereby diminishing accurate measurement of the independent variable.

Because women are twice as likely to have osteoarthritis as men (Fauci *et al.* 1998), a ratio of 2:1 women to men was used to assign participants to groups to accurately reflect the distribution of osteoarthritis in the population. Other variables, such as non-steroidal anti-inflammatory medications used, physical therapy, or musical training were not matched between groups. Random placement of participants in control and experimental groups was expected to provide similar profiles of these non-matched variables in each group. The focus of the study was to understand the effect of music on the manifestation of the pattern of chronic pain regardless of other experiences or interventions.

The process of randomization was accomplished by creating an equal number of slips of paper marked either C for control or E for experimental group. These were placed in envelopes so that 22 control and 22 experimental slips were in one pile for women and 11 control and 11 experimental slips were in another pile for men. Each pile of envelopes were sealed and placed in a box and thoroughly mixed. Without unsealing them the envelopes were stacked. After a potential participant indicated a willingness to be involved in the study, met eligibility criteria and signed the informed consent, he/she picked the top envelope and opened it. Those who opened envelopes with a C slip of paper were in the control group and those who opened envelopes with an E slip were in the experimental group.

The final sample consisted of 66 participants aged 65 years and older who reported a diagnosis of osteoarthritis. There were 33 participants in each group, 22 were women and 11 were men. In the experimental group the average age was 76·58 years (SD 6·00) and in the control group 75·61 (SD 5·85). The average number of years each participant had experienced chronic pain from osteoarthritis was 15·09

(SD 10·90) in the experimental group and 11·64 (SD 4·85) in the control group.

Procedure

Two sections in the Short Form McGill Pain Questionnaire (SF-MPQ) (Melzack 1975) were used to measure the perceived level of pain in this study. The Pain Descriptor Scale section of the SF-MPQ measured the evaluative aspects of pain and the Visual Analogue Scale (VAS) measured present pain intensity. The VAS measured 100 mm in length and interval scores were obtained by counting the number of millimetres from zero to the pain mark made by each participant.

Graham *et al.* (1980) evaluated the reliability and consistency of the Long Form McGill Pain Questionnaire. When Melzack (1975) developed the SF-MPQ he found the correlation consistently high at 0·77 at pretest and 0·88 at post-test for pain rating totals. For the VAS, the correlation was 0·78 for pretest and 0·87 for post-test measures.

The experimental group was given a cassette tape player and a cassette prepared by the primary investigator on which 20 minutes of relaxation music were recorded. The tape consisted of three musical selections by Mozart: (1) Andantino from Concerto for Flute, Harp, and Orchestra in C, K.299; (2) Overture A Le nozze di Figaro, @K492; and (3) Sonata Symphonie No. 40, first movement. The first and third selections were at 60 beats per minute and the middle selection was somewhat faster at 72 beats per minute. Music with a tempo between 60 and 80 beats per minute is considered relaxing (Ortiz 1998). All of the participants in the study stated that they found the music enjoyable.

Participants in the experimental group were asked to listen to the entire tape each day for 14 days at approximately 1 hour after completing their morning toilet. Participants were instructed to sit in the same comfortable chair each day and to avoid other distractions such as reading, speaking on the telephone, listening to the radio, or watching television. On the first day, seventh day, and 14th day of the study period, each participant completed the SF-MPQ immediately before and after listening to the 20 minutes of music. Participants received the pretest and post-test SF-MPQ 1 day prior to the day it was to be completed and were asked to place the forms in the mail on the day of completion. Each participant was given the phone number of the researcher to use if they experienced problems with the tape player or tape. Participants kept a record of their adherence to study protocols in a journal.

The control group sat in a quiet comfortable place for 20 minutes each day approximately 1 hour after completing their morning toilet for 14 days. This group completed the SF-MPQ before and after sitting quietly on day 1, 7, and 14. They were asked to sit in a relaxed manner in a comfortable chair and avoid distractions such as the speaking on the telephone, listening to the radio, or watching television during the 20 minutes sitting period. Reading newspapers, books or magazines were permitted in the control group. The SF-MPQ was sent to and collected from the control group in the same manner as in the experimental group. Participants in the control group kept a record of compliance with the study protocols in a journal.

Ethical considerations

Approval from the Institutional Review Board was obtained to ensure protection of human subjects. All participants signed consent forms agreeing to participate in the study. Confidentiality was maintained by using numbers to identify participants rather than names.

Data analysis

The Statistical Program for the Social Sciences (SPSS) (SPSS Inc. 2001) was used to analyse data. To answer the first research question, the pretest score for each participant was subtracted from the post-test score each time the SF-MPQ was completed. Mean values of the resulting scores for the control and experimental groups were calculated and a *t*-test was used to determine if there were significant differences in these mean values. Scores from the Pain Rating Index and the VAS were analysed separately for day 1, 7, and 14. Table 1 shows the mean values and SDs of each group for both the

Table 1 Descriptive statistics showing changes in reported pain levels by group and by day

Test/time	Group	*n*	*M*	SD
Pain Rating Index				
Day 1	Experimental	33	5·03	4·68
	Control	33	0·06	0·74
Day 7	Experimental	33	3·84	4·22
	Control	33	0·06	0·86
Day 14	Experimental	33	2·18	
	Control	33	0·00	1·08
Visual Analogue Scale				
Day 1	Experimental	33	21·72	20·47
	Control	33	1·69	3·58
Day 7	Experimental	33	12·24	2·13
	Control	33	4·59	0·79
Day 14	Experimental	33	14·13	2·46
	Control	33	4·29	0·74

Pain Rating Index and the VAS at pretest and post-test on day 1, 7, and 14.

The assumption of equal variance was not met based on Levene's test. However, the *t*-test ratios were equal whether we assumed equal variance or not. Table 2 presents the *t*-test scores and levels of significance for the differences between the mean values of the two groups on the Pain Rating Index and the VAS for day 1, 7, and 14.

To understand better which group demonstrated the greater reduction in pain rating and intensity, post-test scores were divided by pretest scores and then multiplied by 100 to obtain a percentage reflecting the similarity of reported pain levels at pre- and post-test, where 100% reflects identical levels of reported pain and 50% indicates half as much pain at post-test as pretest. Table 3 presents the percentage consistency between each group at post-test when compared with pretest for each test on day 1, 7, and 14, and the SD. The *t*-test was used to determine the significance of differences in these percentages between the groups. Table 4 presents the *t*-test scores and levels of significance for the differences in these percentages on the Pain Rating Index and the VAS for day 1, 7, and 14.

To answer the second research question, a repeated measures analysis of covariance controlling for pretest measures was used to determine the differences in the groups Pain Descriptor Scale and VAS across the three post-test data points.

Table 2 *t*-Test results for comparison of experimental and control group on pre–post changes in reported pain levels by day

Test/time	*t*	d.f.	*P* value	Mean difference
Pain Rating Index				
Day 1	−6·26	64	0·001	−5·09
Day 7	−5·04	64	0·001	3·78
Day 14	−5·45	64	0·001	2·18
Visual Analogue Scale				
Day 1	−6·47	64	0·001	23·42
Day 7	−8·29	64	0·001	18·87
Day 14	−6·71	64	0·001	17·27

Table 3 Descriptive statistics showing percentage similarity in reported pain levels by group and by day

Test/time	Group	*n*	*M*	SD
Pain Rating Index				
Day 1	Experimental	33	54·31	34·78
	Control	33	100·00	20·32
Day 7	Experimental	33	35·50	35·50
	Control	33	99·64	14·06
Day 14	Experimental	33	50·49	33·76
	Control	33	105·78	36·39
Visual Analogue Scale				
Day 1	Experimental	33	66·12	30·39
	Control	33	102·54	6·08
Day 7	Experimental	33	70·64	25·91
	Control	33	111·09	9·80
Day 14	Experimental	33	63·15	28·72
	Control	33	103·68	6·69

Table 4 *t*-Test results for comparison of experimental and control group on percentage of pre–post similarity in reported pain levels by day

Test/time	*t*	d.f.	*P* value	Mean difference
Pain Rating Index				
Day 1	6·51	64	0·001	45·68
Day 7	7·47	64	0·001	49·68
Day 14	6·11	64	0·001	55·29
Visual Analogue Scale				
Day 1	6·69	64	0·001	36·42
Day 7	8·38	64	0·001	40·44
Day 14	7·78	64	0·001	40·53

Results

The randomized clinical trial is a classic means of examining the effects of a treatment by comparing the treatment group to a non-treatment group. *t*-Tests demonstrated a significant difference between the experimental group and the control group in pre-to-post change in reported pain levels. The experimental groups reported far less pain at post-test than pretest on all 3 days, while the control group reported about the same level of pretest and post-test pain on all 3 days on the Pain Rating Index, day 1 ($t = 6{\cdot}263$, d.f. = 64, $P = 0{\cdot}001$, $n = 66$), day 7 ($t = 5{\cdot}042$, d.f. = 64, $P = 0{\cdot}001$, $n = 66$), and day 14 ($t = 5{\cdot}455$, d.f. = 64, $P = 0{\cdot}001$, $n = 66$). In addition, *t*-tests demonstrated a significant difference between the experimental group and the control group in pre-to-post change on the VAS. The experimental group reported less pain at post-test than pretest on all 3 days, while the control group reported about the same level of pretest and post-test pain on day 1 ($t = 6{\cdot}473$, d.f. = 64, $P = 0{\cdot}001$, $n = 66$), day 7 ($t = 8{\cdot}293$, d.f. = 64, $P = 0{\cdot}00$, $n = 66$), and day 14 ($t = 6{\cdot}716$, d.f. = 64, $P = 0{\cdot}001$, $n = 66$).

The *t*-tests demonstrated a significant decrease in the percentage of pain perceived by the experimental group compared with the control group using the Pain Rating Index on day 1 ($t = 6{\cdot}514$, d.f. = 64, $P = 0{\cdot}001$, $n = 66$), day 7 ($t = 7{\cdot}473$, d.f. = 64, $P = 0{\cdot}001$, $n = 66$), and day 14 ($t = 6{\cdot}111$, d.f. = 64, $P = 0{\cdot}001$, $n = 66$). In addition, *t*-tests

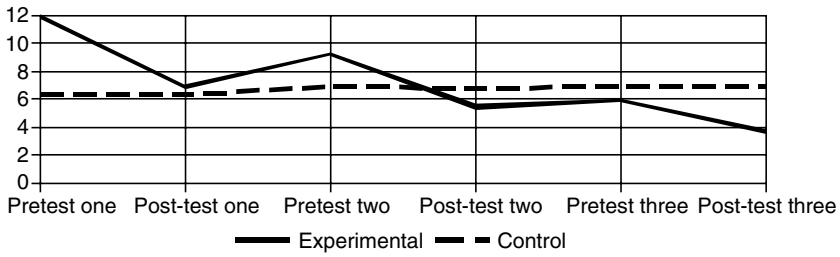

Figure 1 Mean values for pre- and post-test Pain Descriptor Scale.

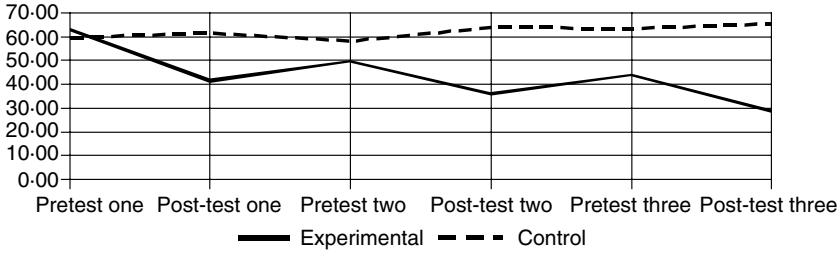

Figure 2 Mean values for pre- and post-test Visual Analogue Scale.

demonstrated a significant reduction in the percentage of pain in the experimental group compared with the control group on the VAS on day 1 ($t = 6{\cdot}697$, d.f. $= 64$, $P = 0{\cdot}001$, $n = 66$), day 7 ($t = 8{\cdot}387$, d.f. $= 64$, $P = 0{\cdot}001$, $n = 66$), and day 14 ($t = 7{\cdot}781$, d.f. $= 64$, $P = 0{\cdot}001$, $n = 66$).

The repeated measures analysis of variance showed that there was a continued decrease in pain in the experimental group when compared with the control group across the 14-day period. Those who listened to music had continued decrease in pain descriptor scores over the three post-tests data points compared with the control group, whose pain remained the same across the 14 days ($F = 13{\cdot}467$, d.f. $= 64$, $P = 0{\cdot}001$, $n = 66$) (see Figure 1). In addition, a continued decrease in VAS post-test scores across the three data points was exhibited by the experimental group in comparison with the control group, whose post-test scores remained the same throughout the 14-day study period ($F = 25{\cdot}498$, d.f. $= 64$, $P = 0{\cdot}001$, $n = 66$) (see Figure 2).

Discussion

Findings support a difference in pain perception in elders with osteoarthritis who listen to music. Participants in the experimental group had steadily decreasing pain scores on both the Pain Descriptor Scale and the VAS over the 14-day study period. Thus, listening to 20 minutes of relaxing music daily resulted in less chronic osteoarthritis pain than sitting and resting without music at each of the three data collection points. The experimental group continued to have further decrease in pain perception across the whole study period, while the control group remained at relatively the same pain level.

This randomized clinical trial provides evidence that community-dwelling elders who listen to music in a relaxed atmosphere have decreased chronic osteoarthritis pain when compared with those who do not listen to music. Further, the study demonstrates that in the group who listened to music, pain continued to decrease across the 14-day study period as compared with the group who did not listen to music and whose pain remained constant.

These results expand on the study completed by Good *et al.* (1999), which demonstrated music's ability to reduce acute postoperative pain. Analysing the effects of music on chronic pain from osteoarthritis furthers the understanding of the ability of music to reduce chronic pain. Good *et al.* (1999) identified the need to study the effects of music over a longer period of time. The present study is the first to be conducted for an extended period with participants listening to music each day, and establishes that having participants listen to music for 14 days increases its positive effects on chronic osteoarthritis pain.

The study confirmed the work of Schorr (1993) on the use of music to decrease arthritis pain, and added strength to the results by using a randomized control trial design and a larger sample size. Listening to music for 14 days also expanded on Schorr's study, whose participants listened only once for 30 minutes, because a longer listening period enhanced pain reduction across all data points in the group with chronic pain. The inclusion of males in the study gave a more complete picture of the capacity of music to intervene in the chronic pain cycle of osteoarthritis.

What is already known about this topic

- Osteoarthritis is the most common disease in humans.
- Chronic pain associated with osteoarthritis causes disability and depression in elders.
- Therapies that influence emotional, sensory, and affective components of pain perception can break the cycle of chronic pain.

What this paper adds

- Music is able to decrease pain in community dwelling elders with chronic osteoarthritis pain.
- When elders continued to listen to the music daily for 14 days the pain continued to decrease.
- Music listening is a safe, cost effective, nursing intervention for use with community dwelling elders who experience chronic osteoarthritis pain.

Our results have significant implications for the clinical practice. As nurses continue to develop and enhance the unique body of knowledge that constitutes their practice, therapies that can be nurse-initiated and monitored will enhance our ability to manage patients with chronic pain. McCaffery (1999) suggests that nurses are part of a pain management team that is also comprised of physicians, pharmacists and patients themselves. If nurses were skilled in the use of music as a pain reduction therapy, this would increase the ability of the pain management team to reduce chronic pain effectively in older people.

Nurses have a responsibility to promote comfort and well-being and to recognize pain as a priority in the care they provide (Kolcaba 1994, McCaffery & Beebe 1994). This study was an investigation into a non-pharmacological, non-invasive, inexpensive, and portable method of pain reduction that nurses can use when treating community-dwelling elders with chronic osteoarthritis pain.

Limitations of the study include lack of control for non-narcotic analgesic therapies and the arbitrary period of listening to music for 14 days. Further investigation should implement control of non-narcotic analgesic therapies and extend the number of days for the treatment intervention.

Conclusion

This study provides evidence that music is an effective tool for the relief of chronic osteoarthritis pain in community-dwelling elders. Listening to music not only reduced pain at each testing interval but also pain relief increased over the 14-day listening period. Because listening to music can easily be used in community settings, it can be considered an effective nursing intervention for those elders with chronic pain from osteoarthritis. Further investigation will identify additional diagnoses appropriate for this intervention.

Our findings advance the understanding of pain as a unitary experience. Music as a manifestation of the environmental field is able to affect the perception of chronic pain in elders with osteoarthritis. Nurses can use music, a non-invasive, inexpensive, safe modality, as part of their understanding of people as unitary human beings who are more than and different from the sum of their parts.

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