Exploring the Use and Efficacy of Complementary and Alternative Interventions for Managing Chronic Pain in Older Adults: A systematic review

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ABSTRACT

The aim of this study was to synthesize and critically appraise the existing literature examining the use and efficacy of CAM in community-dwelling older adults with chronic pain. The PRISMA model guided a literature review search method. A literature search was undertaken using MEDLINE, CINAHL, Ovid, ProQuest, and hand searching. The search included articles written in English published for the period of 2000-June 2018. The finding of the study showed that: A literature search yielded 20 experimental designs (13 for physical interventions and 7 for psychosocial interventions). Seventeen articles were randomized controlled trials, two articles were a pilot study, and one article was a quasi-experimental design. Twelve articles (60%) reported statistically significant differences ($p<.05$) between the CAM treatment intervention groups and the control groups in pain scores; the CAM treatment groups showed lower in pain intensity. Many CAM interventions in all of the studies reported improvement of chronic pain management among older adults. However, the limitations of the reviewed studies are small sample sizes and absence of randomization. More research is needed to investigate CAM interventions and its long-term effects and its efficacy with selected conditions such as chronic neck and back pain, arthritis, and post-surgical rehabilitation.

Keywords: Chronic pain, Arthritis, Pain management, Complementary and alternative medicine, Aged or elderly

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Background

Chronic pain is the most common chronic condition among people aged 65 and older. It can lead to impaired sleep (Black et al., 2015), disabilities, falls (Leveille et al., 2009), depression (Eggormont et al., 2012), and an overall reduced quality of life (Jakobsson & Hallberg, 2002). When people have pain, they initiate a process of adaption to manage their pain. Roy and Andrew (1991) state that "adaptation is the process and outcome whereby the thinking and feeling person, either as individuals or in groups, use conscience awareness and choice to create human and environmental integration." (p.152) Therefore, in order to adapt to manage pain, people with chronic pain try to cope with their pain by seeking treatments such as pharmacologic and non-pharmacologic approaches.

Elderly people usually receive pharmacologic approaches to manage chronic pain. However, because of age-related changes, older people are reported to have a significantly higher risk of side effects or adverse events from pain medication, including worsening of heart failure, high blood pressure, constipation, and liver and kidney damage (Dedhiya et al., 2010). Hence, the use of complementary and alternative medicine (CAM) is becoming increasingly prevalent in older populations (AGS Panel, 2009). Older adults use CAM therapies quite frequently, with a wide variation occurring in prevalence rates, ranging from 30% to 100% (Najm et al., 2003; Ness et al., 2005). The increasing proportion of older adults using these therapies indicate that it is likely that the number of older people who are seeking CAM to manage their chronic pain and to improve their quality of life will increase in the future (Williamson et al., 2003).

Complementary and Alternative Medicine (CAM) is "a group of diverse medical and health care practices and products that are not presently considered to be part of conventional medicine" (NCCIH, 2015). The National Center for Complementary and Integrative Health (NCCIH) categorizes CAM approaches into five domains, including: 1) Alternative medical systems, such as traditional Chinese medicine; 2) Manipulative and body-based interventions, such as message therapy; 3) Mind-body interventions, such as meditation and prayer; 4) Energy therapies, such as qigong and reiki; and 5) Biological-based systems, consisting of herbalism (NCCIH, 2015). CAM therapies are suitable for older adults to counteract chronic pain due to their good tolerance and short-term efficacy.

In addition, many CAM techniques provide an alternative therapeutic balance to pain medication, reducing the doses of medications, and minimizing side effects and adverse events (Alexander, 2009).

Although CAM therapies for pain management have been increasingly used in the United States, the research of their effectiveness in relieving chronic pain particularly in older populations has been limited. Additionally, there is no clear consensus on the best treatment for relieving chronic pain for older adults. Therefore, the use and efficacy of CAM to manage pain in older populations needs to be described and identified in order to improve pain management strategies for older adults.

Objective

To synthesize and critically appraise the existing literature examining the use and efficacy of complementary and alternative medicine (CAM) in community-dwelling older adults with chronic pain.

Search Methods

The literature review that supports this paper will follow the PRISMA guidelines (Moher et al., 2010). A literature search will be undertaken using the Medline, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Proquest Nursing and Allied Health sources, and Ovid. The search will include articles written in English published during the period of 2000 - 2015. The key search terms are “chronic pain,” “arthritis,” “pain management,” “complementary and alternative medicine,” and “aged or elderly” Additionally, a hand search of the bibliographies of identified original articles will also be done.

Eligibility criteria

The inclusion criteria include experimental studies that examines the use of any CAM as a primary intervention, measures chronic pain as a primary outcome, limits to those the studies that include older adults aged ≥ 65 years old who have experienced chronic pain as indicated by medical history (e.g., lower back pain, neck pain, headaches, arthritis, and fibromyalgia), and any studies that were published in English between 2000 and June 2018.

The exclusion criteria for the studies selected included any articles not published in the English language, articles involving mindfulness meditation, articles that focused on CAM for other chronic conditions, (e.g. hypertension and diabetes)

and any articles that dealt with mental health concerns as a primary focus. Articles without quantitative or qualitative data analysis, or with more than half of the total participants in the study aged < 65 years old were excluded.

Quality Appraisal

This literature review study addressed the PICO process which outlined the problem (P): older adults with chronic pain; the intervention (I) : complementary and alternative interventions; the comparison (C): compared evidence in the literature review; and the outcome (O): complementary and alternative treatments can relieve chronic pain in older adults. The quality appraisal was concentrated on the type of study design and the outcomes.

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Data Abstraction

The researcher reviewed titles and abstracts from the search results. Author's names, institutions, and journal of publications were all considered in the process of synthesis and literature review. All aspects were reviewed in each article including purpose of study, conceptual framework, study design, sample, and relevancy of the findings. Table 1 shows all included studies that met the criteria and were discussed in this synthesis and literature review.

Results

Data Sources and Literature Search

Twenty of the 120 articles met the inclusion criteria for this literature review. There were 13 which dealt with physical interventions and seven which were concerned with psychosocial interventions

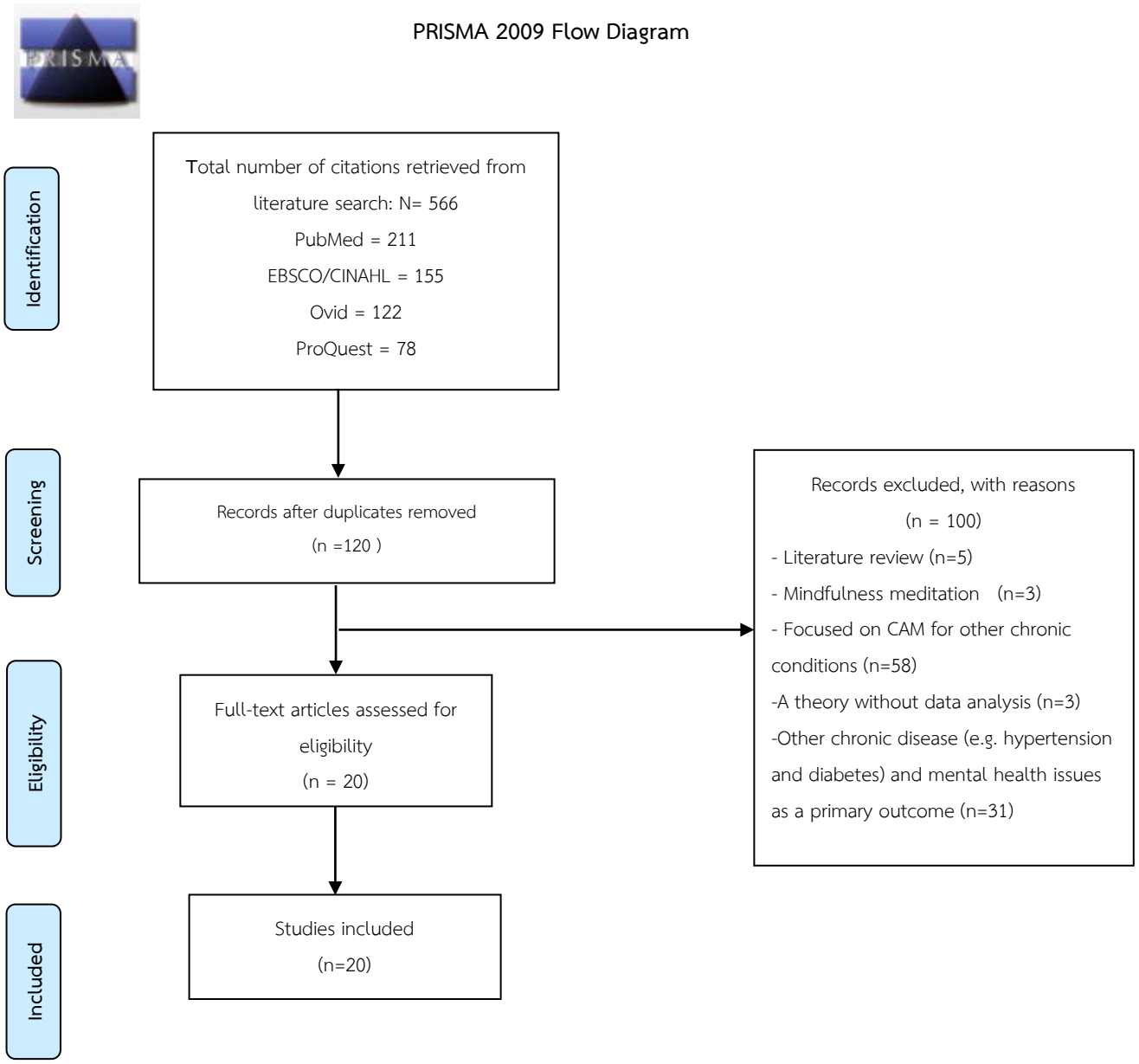

Figure 1 Flow diagram of the results of the literature search

Figure 1 showed PRISMA diagram of the process of inclusion and exclusion criteria of this literature review. Reasons for elimination after the full text were reviewed were based on the following considerations: any nonintervention studies, articles which dealt with mindfulness meditation, studies dealing with pharmacologic pain therapies, any study that proposed of a theory without data analysis, those studies unrelated to

chronic pain, and those that focused on people aged less than 65 years old. The most common CAM treatments were acupuncture and acupuncture combined with other interventions (n=5), self-management education (n=4), general exercise (n=2), qigong (n=2), yoga (n=3), TENS (n=1), music therapy (n=1), cognitive-behavioral therapy (n=1), and guided imagery (n=1) (Table1).

Among those 20 articles, 10 articles (50%) studied participants with knee pain, six articles (30%) studied participants in various pain sites or identified other pain locations such as neck pain (two studies, 10%), shoulder and headache (one study, 5%), and back pain (one study, 5%). Table 1 summarizes all articles, consisting of type of intervention, sample size, treatment and control groups, outcome measures, results, and levels of evidence.

Outcome Measurements

The primary outcomes in all articles were the reduction of pain and coping with pain. The secondary outcome measures in all studies were the improvement of physical function, quality of life, and psychological health related to CAM interventions.

Complementary and Alternative Interventions

1) Physical interventions

Exercise Therapy

Two RCTs assessed the effectiveness of exercise in relieving chronic pain in older adults (Hughes et al., 2004; Hughes et al., 2006). Both studies assessed the effects of fitness and strength among older adults with osteoarthritis. As a result, at 6 months, participants in the intervention group (n=115) reported less pain (*p=.04*) and better self-efficacy in exercise *(p=.001)* than participants in a control group (n=105) (Hughes et al., 2006). Additionally, these studies showed that exercise is an efficient and low-cost intervention for older populations who experience lower extremity osteoarthritis (Hughes et al., 2004; Hughes et al., 2006). There were no adverse health outcomes that were observed in the intervention group, meaning that this intervention is safe for elderly people with OA.

Transcutaneous Electric Nerve Stimulation (TENS)

This literature review found only one study that used randomized controlled trials to measure the effectiveness of Transcutaneous Electric Nerve Stimulation (TENS) and Electro - Acupunture (EA) in

relieving chronic pain among community-dwelling older adults (Ng et al., 2003). Participants were assigned to the TENS, EA, and control group. Participants in the EA group (n=8) received low-frequency EA (2 Hz) stimulation at two acupuncture points around the knee for 20 minutes. Participants in the TENS group (n=8) received low-frequency TENS of 2 Hz and pulse width of 200 micros on the same acupuncture points for 20 minutes. Electronic treatment was carried out for eight sessions in two weeks. In the control group, participants (n=8) received only osteoarthritis knee care and education. Results showed significant differences in the TENS group after treatment for relieving knee pain. At a 2-week follow up, prolonged analgesic effect was maintained in the TENS and the EA groups. Therefore, both TENS and EA treatments were effective in relieving OA knee pain in older adults (Ng et al., 2003).

Qigong

Two studies assessed the effectiveness of exercise in relieving neck and back pain in older populations (von Trott et al., 2009; Yang & Kim, 2005). Von Trott and colleagues (2009) compared the effectiveness of a qigong group to an exercise therapy group as well as to a wait list group after 24 sessions that lasted for three months. There was no significant difference noted for relieving neck pain between qigong groups and these other two groups. Conversely, Yang and Kim (2005) reported that qigong decreased pain intensity and improved emotional states after six weeks, but these effects were not found in the wait-list group. Both studies reported no adverse events for the participants practicing qigong. These studies recommended the use of qigong therapy to help older populations manage their chronic pain, improves emotional state, and improves physical functioning (von Trott et al., 2009; Yang & Kim, 2005).

Yoga

Three studies assessed the effectiveness of yoga in relieving knee and lower extremity pain in older populations (Park& McCaffrey, 2012; Cheung et al., 2014; Park et al., 2014). One RCT study found that there was significant improvement in pain relief in the yoga group compared to a wait-list group (*p=.01).* In addition, yoga helped improve problems with sleep disturbances. However, sleep quality declined significantly at 20 weeks (Cheung et al., 2014). Park and McCaffrey (2012) used a pilot study to assess an 8-week chair yoga program among older people with osteoarthritis and

reported that overall stiffness and physical functioning improved, but the level of pain and depression had not been alleviated (Park & McCaffrey, 2012).

In addition, Park and colleagues (2014) used a quasi-experimental study to measure the effects of Chair yoga on pain and physical and psychological functioning. This study showed that there was greater improvement in life satisfaction and depression in the treatment group than in the control group. Therefore, these studies support the notion that yoga is statistically significant in pain reduction and improving physical limitation. These studies further suggest that yoga offers a low-cost exercise program option that decreases functional disability resulting from the inactivity of older adults (Park et al., 2011).

Acupuncture

Five studies met inclusion criteria to assess the effectiveness of acupuncture for chronic pain (Berman et al., 2004; Ga et al., 2007; Foster et al., 2007; Foster et al., 2010; Meng at al., 2003). The results from three studies reported that acupuncture was effective in managing chronic pain in the treatment group when compared with than in the control group (Berman et al., 2004; Foster et al., 2007; Meng at al., 2003), whereas two studies showed that there was no significant difference between these two groups in the effectiveness of relieving chronic pain in older adults (Ga et al., 2007; Foster et al., 2010). This literature review found consistent evidence that acupuncture helped in managing pain among various types of chronic pain. Assessing long-term outcomes at 6-12 months of treatment, it was found that acupuncture was significantly effective in relieving knee pain (Berman et al., 2004) and back pain (Meng at al., 2003). However, when compared to other physical treatments such as pain education and exercise therapy, there were no consistent results regarding effectiveness (Foster et al., 2007). Moreover, another study compared the festiveness of TENS and acupuncture in relieving chronic low back pain in older adults. Results showed that after completing both TENS and acupuncture treatments there were significant benefits noted after three months (Ng et al., 2003).

2) Psychosocial Interventions

Music therapy

Only one RCT was reviewed in this study (McCaffrey & Freeman, 2003). This RCT included a treatment group that listened to music about 20 minutes per day for about a half of a month, while a control group sat in a quite spot 20 minutes daily for two weeks.

Researchers assessed the levels of pain reported by both groups at days 1, 7, and 14, using the Visual Analog Scale (VAS) and the short-form McGill Pain Questionnaire (SF-MPQ). Participants in both groups were asked to complete the SF-MPQ before and after listening to music (treatment group) and after sitting in a quite spot (control group) on day 1, 7, and 14. Participants in the control group were asked to sit in a relaxed manner in a comfortable chair. In addition, they were asked to avoid distraction such as listening to the radio, speaking on the telephone, and watching television during the 20 minutes sitting period. However, reading books, magazines, and newspapers was permitted for participants in the control group. Results showed that people who listened to music showed a statistically significant greater decline in pain level at days 1, 7, and 14 than people who sat quietly and did not listen to music. From these results, it can be suggested that music therapy reduces chronic pain in older populations (McCaffrey & Freeman, 2003).

Cognitive-Behavioral Therapy

This literature review found only one RCT study assessing the effectiveness of a Cognitive - Behavioral Therapy (CBT) interventions in older adults with chronic pain (Green et al., 2009). Participants in the treatment group (n=46) received a 10- week pain management program with a cognitive behavioral orientation. This program included weekly 60-mintue sessions (eight of the weekly sessions were individual sessions with a psychological therapist, one was a group educational session with a pharmacist, and one was a group session with a physical therapist). Researchers assessed pain levels, pain relief, and coping ability at baseline immediately after finishing ten individual sessions and three months after the sessions. Participants in the wait-list group were assessed using the same questionnaire at baseline and ten weeks following baseline measure. However, data from participants in the wait-list group were not collected at 3- month follow-up. Results showed that there were significant differences noted only after immediately finishing the ten individual sessions between the two groups. Participants in the treatment group were more likely to report pain level relief and more frequently employed the use of a coping strategy than those in the control group (Green et al., 2009).

Self-Management Education

Four studies that adequately met inclusion criteria examined the effectiveness

of self-management education programs (Rybarczyk et al., 2001; Ersek et al., 2003; Ersek et al., 2008; Haas et al., 2005). There were various techniques used under controlled conditions: Two studies used a wait-list control (Rybarczyk et al., 2001; Haas et al., 2005) and another two studies used book directed pain treatment (Ersek et al., 2003; Ersek et al., 2008). Results showed varied outcomes. Participants who had received classroom instruction in self-management reported less perceived pain and reported lower pain levels than a control group after the study had ended (Haas et al., 2005). A pilot study showed a significant improvement among participants who reported experiencing reduced pain intensity and experienced increased physical functioning in a treatment group at the end of study (Ersek et al., 2003). Additionally, the 2008 extension of the study of Eresk included more substantial control conditions consisting of discussing persistent pain training and follow-ups with telephone after treatment. Results showed that there were no significant differences on the main outcomes between these two groups after intervention or at 6-month or 1-year follow-up (Ersek et al., 2008).

Guided Imagery

This literature review found one study that examined the effectiveness of using guided imagery to increase progressive muscle relaxation (PMR) to decrease pain levels and to increase mobility among older females with osteoarthritis. (Baird & Sands, 2004). This treatment included personalized PMR scripts and guided imagery instruction that aimed at replacing negative thinking patterns, with thinking patterns directed to decrease pain levels and increase mobility. Participants in the experimental group (n=17) were asked to make entries in a journal about their symptoms three times per week and to record the number of times they had practiced guided imagery. Participants in the control group (n=10) received standard care and were asked to make entries in a journal about their symptoms three times per week as well as how do they manage them. As a result, the experimental group reported less pain and reported more improved mobility than the control group at the end of the intervention (12 weeks) (Baird & Sands, 2004). The technique of Guided imagery (GI) is similar to mindfulness meditation technique to achieve relaxation. However, people who use GI need to listen to verbal suggestions each time to create a flow of thoughts that

help individuals focuses on imagined visual, tactile, auditory, or olfactory sensation. It is beneficial to combine PMR with GI because it results in both physiology and psychological relaxation by decreasing the sensation of pain, reducing muscle contractions, and reducing responses to stress (McCaffery & Pasero, 1999).

Summarized Results from All Studies Included

This literature review found 18 studies that were conducted in the United States, one study was conducted in Hong Kong (Ng et al., 2003), and another in South Korea (Yang &Kim, 2005). Participants in all studies were people aged ≥ 65 years old. On average, most of the populations were Caucasian, female, middle-class, and were well educated. Most articles used the Western Ontario and McMasters Universities Index (WOMAC) and the Visual Analog Scales (VAS) to measure pain and physical functioning. The most frequent CAM was acupuncture and acupuncture along with combined exercise (n=5). The largest randomized controlled trial examined acupuncture performed in 23 sessions over 26 weeks among 570 older adults with osteoarthritis (Berman et al., 2004). Physical interventions (13 studies) were used more frequently than psychological interventions (seven studies).

Most articles (n=12, 60%) reported statistically significant differences (*p<.05*) between the CAM treatment interventions and the control groups which did not receive any treatments after intervention. Eight studies (40%) showed that CAM interventions were not effective in decreasing the level of pain using these interventions (See Table1).

Seventeen articles were Randomized Controlled Trials (RCTs), two articles were pilot studies (Baired& Sands, 2004; Park& McCaffrey, 2012), and one article was a quasi-experimental design (Park et al., 2014). The levels of evidence of RCTs were level 1 (RCTs), and the pilot study and the quasi-experimental design were categorized as level 2 (Dearholt et al., 2012 see Table 2). This literature review found well-designed and executed RCT that provides the highest levels of evidence to support diagnostic and CAM interventions in relieving pain in older adults (Aslam & Emmanuel, 2010).

Discussion

After a literature review, it has been found that there are many types of complementary and alternative treatments among older adults. The use of

complementary and alternative treatments was highly prevalent in older populations. It was notably higher than in the general adult population nationally (cherniack et al., 2001). However, when reviewing articles that focused on the effect of CAM in managing chronic pain as a primary outcome among community-dwelling older adults, it was found that not too many studies investigated the effectiveness of physical interventions as well as psychosocial interventions in elderly people dealing with chronic pain. There were significant finding in this literature review. First, some CAM interventions were found to be effective for relieving chronic pain among older populations such as using exercise therapy, yoga, and acupuncture. Therefore, the success regarding CAM interventions based on these various studies is worth repeating (Berman et al., 2004; Hughes et al., 2004). The evidence of CAM interventions in managing chronic pain is plentiful enough to encourage the wider use of CAM. Other CAM interventions such as TENS, self-management educational interventions, and qigong did not report sufficient empirical evidence after rigorous studies had been done regarding their effectiveness in relieving chronic pain based on summaries (Ersek et al., 2008; von Trott et al., 2009). Secondly, it could not be concluded that CAM approach was as effective or was more effective than control group interventions among older populations. Some studies showed no significant difference between treatment and control groups (Haas et al., 2005; Ersek et al., 2008; von Trott et al., 2009). In addition, studies did not determine the extent to which the observed interventions effects took place among a subgroup of elderly people. It can be suggested that more studies are needed to explore the best format, content, duration, intensity, and efficacy of these interventions in elderly people (Reid et al., 2008).

Third, it can be found that some older adults are interested in using CAM not due to dissatisfaction with pharmacologic managements, but because CAM is more consistent with their health and lifestyle values (Cuellar et al., 2007). Older adults with poor quality of life tend to use CAM to improve their quality of life, and poor quality of life is highly related to mortality rates. It should be suggested that more research and improved education on CAM and quality of life is a vital next step in addition to the improvement of physical disorders and functional status (Nguyen et al., 2010). Moreover, with the occurrence of polypharmacy in older adults, the result of

CAM modalities that can eliminate or limit the use of analgesic medications is promising. Therefore, CAM practices are safe, popular, and are a low-cost option (Nguyen et al., 2010). Most reviewed studies did not report adverse events and very few participants dropped out of CAM interventions. CAM can be considered to be a cost-effective pain management option while conventional health care costs continually increase. These treatments have minimal adverse events and reduce healthcare costs by reducing admissions to nursing homes, hospitals, and assisted living facilities (Hashefi, 2013).

Limitations

Methodological limitations were found in this literature review. First of all, some studies did not indicate important demographic characteristics that led to primary outcomes regarding pain. Information regarding age (young old, middle old, oldest old), race and ethnicity, and clinical information (pain medication use, comorbidities, cognitive impairment) was not included. These characteristics may play a significant role in identifying the appropriate types of CAM required for relieving chronic pain in a diverse elderly population. Secondly, there were other methodological limitations in many of these studies such as inadequate blinding, small sample size, and low statistical power due to a sample size. This literature review found reporting of effective sizes in only a few articles (Rybarczyk et al., 2001; Haas et al., 2005; Hughes et al., 2006). These articles did not have sufficient follow-ups to determine if the effects were maintained. Third, even though many articles used the same standard of measurement to assess chronic pain such as BPI and VAS, it is not evident that many studies had controlled for comorbidities consisting of different types of chronic pain, different types of pain location, or different types of medical problems related to pain. Thus, there was inconsistency in assessing chronic pain across these studies. Some articles showed different attrition (Rybarczyk et al., 2001) and some included multiple pain sites that diluted the results of efficacy regarding one type of chronic pain (Haas et al., 2005;Ga et al., 2007; Berman et al., 2009). Last, it is worth mentioning that participants had been prescribed and had been taking over-the-counter pain medications. Three articles had excluded elderly people who were using pain medications before enrolling in the studies (Meng et al., 2003; Ga et al., 2007; von Trott et al., 2009). Therefore, the

genuine effects of the treatments may be less likely to be realized unless older adults using pain medications were included as a control group.

Future research should control for comorbidities that are related to other types of chronic diseases and other types of pain such as fibromyalgia and osteoarthritis. In addition, it would be beneficial to design more double-blind tests using larger sample sizes combined with more sufficient follow-ups implemented at 6 months and 1 year in order to examine the effects of treatments over time. Last but not least, participants in most studies were older adults with musculoskeletal pain consisting primarily of knee and low back pain. Future studies should study diverse groups of older populations with other types of pain, multiple comorbidities, cognitive impairments, and disabilities to examine the most appropriate CAM approaches for older populations.

Conclusion

This paper presents the findings of a literature review that explores the use and effectiveness of CAM to manage chronic pain among older adults. All studies reported that some CAM interventions can help to improve coping with pain, physical functioning, quality of life, problems with sleep disturbance, and psychological well-being in older people. However, CAM interventions may not be beneficial for all individuals. For some, the time commitment required to obtain the results may be an obstacle. Future research should investigate the effects of CAM intervention over the long term. In addition, studies are needed in order to extend the current findings, and to allow greater comparability across the various interventions. Further investigations about CAM interventions for particular conditions such as fibromyalgia and post-surgical rehabilitation would also be useful.

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Table 1. Study Characteristics of Physical and Psychosocial Interventions

First Author/ Year	Study design	Type of intervention	No of participants	Treatment and control groups	Outcome measures	Results	LOE Quality
Physical intervention General exercise							
Hughes et al., 2004	RCT	Exercise therapy	IG=80 CG=70	**IG**- 90-min sessions held exercise program (range of motion, resistance training, aerobic walking) three times per week for 8 weeks. **CG**- wait-list control	- WOMAC	- Participated in the intervention group experienced a statistically significant improvement in exercise efficacy (*p=.02*) and significant decreases in lower extremity stiffness at 2 and 6 months.	I
Hughes et al., 2006	RCT	Exercise therapy	IG=115 CG=100	**IG-** exercise behavior change program held 3 time per week for 2 months followed by home-based reinforcement **CG-** wait-list control	- WOMAC - Geri-AIMS Pain	- At 6 months, treatment participants showed significant improvement in relieving pain (*p=.040*), and a marginally significant increase in self-efficacy for arthritis pain management (*p=.052*). - Exercise is efficient and is low cost option for elderly people with lower extremity OA.	I
TENS							
Ng et al., 2003	RCT	TENS with EA	IG1=8 IG2=8 CG=8	**IG1-** low-frequency EA (2 Hz) on two acupuncture points of the painful knee for 20 minutes	Numeric Rating Scale	- After 8 sessions, significant reduction of knee pain in both EA group and TENS group (*p<.01*). - At a 2-week follow up, prolonged analgesic	I

Abbreviation: AIMS = Arthritis Impact Measurement Scale; BPI = Brief Pain Inventory; CBT = Cognitive Behavioral Therapy; CES-D= Center for Epidemiologic Studies Depression Scale; CG= Control Group; CI = Confidence Interval; CPCI = Chronic Pain Coping Inventory; EA = Electro-Acupuncture; FACES = Wong-Baker FACES Pain Scale; GCPS = Graded Chronic Pain Scale; IG= Intervention group; LOE= Levels of evidence; MPQ = McGill Pain Questionnaire; OA = Osteoarthritis; OASI = Osteoarthritis Screening Index; OMERACT-OARSI = Osteoarthritis Research Society International Initiative; PAQ = Pain Awareness Questionnaire; PBQ = Pain Beliefs Questionnaire; PCA = Patient-Controlled Anesthesia; PPI = Pressure Pain Intensity Scores; PPQ = Patient Pain Questionnaire; PMR = Progressive Muscle Relaxation; PSQI= Pittsburgh Sleep Quality Index ; RCT= Randomized Control Trial; RDQ = Roland-Morris Disability Questionnaire; SF-36 = Medical Outcomes Study 36-Item Short Form Health Survey; SF-MPQ = Short Form McGill Pain Questionnaire; SPPB= Short Physical Performance Battery; TENS = transcutaneous electrical nerve stimulation; VAS = Visual Analogue Scale; Nottingham Health Profile; WOMAC= Western Ontario and McMasters

First Author/ Year	Study design	Type of intervention	No of participants	Treatment and control groups	Outcome measures	Results	LOE Quality
				IG2- low-frequency TENS of 2 Hz and pulse width of 200 micros on the same acupuncture points for 20 minutes **CG -** only OA knee care and education		Effect was maintained in the TENS and the EA groups.	
Qigong							
Yang & Kim, 2005	RCT	Qigong therapy	IG= 20 CG= 23	**IG-** Qigong therapy 20 minutes per week about 4 weeks **CG-** standard care	VAS	- Statistically significant reduction in pain intensity in the treatment group after 2-week of follow-up (*p<.001*). - Treatment group showed larger decreases in tension-anxiety with time than control group after 6-week of follow-up.	I
Trott et al., 2009	RCT	Qigong and exercise therapy	IG= 38 CG= 40	**IG-** Qigong for 3 months (24 sessions at 45 minutes) **CG-** wait-list control	-VAS - SF-36 - Neck Pain and Disability Scale	-After 3 months, no significant differences in pain intensity between the qigong group and the waiting list control group (VAS mean difference, -11mm, 95% CI=24.0-2.1, *p=.099*) or between the qigong and exercise therapy group (2.5mm, 95%CI=15.4-10.3, *p=.70*)	I
Yoga							
Cheung et al., 2014	RCT	Yoga therapy	IG= 18 CG= 18	**IG**- one 60-minute Hatha yoga class per week for 8 weeks. **CG-** wait-list control	-WOMAC -SPBB -PSQI	-Significantly greater improvement in WOMAC pain (adjusted means [SE]) (8.3 [.67], 5.8 [.67]; *p = .01*), stiffness (4.7 [.28], 3.4 [.28]; *p = .002*) and SPPB (repeated chair stands) (2.0 [.23], 2.8 [.23]*; p = .03*) at 8 weeks. -Sleep disturbance was improved, but the PSQI total score declined significantly at 20 weeks.	I
Park & McCaffrey, 2012	Pilot study	Chair yoga therapy	n=10	45-minute yoga sessions biweekly for 8 week	-WOMAC - CES-D	-Yoga was not effective in decreasing pain level or improving depression symptoms.	II

First Author/ Year	Study design	Type of intervention	No of participants	Treatment and control groups	Outcome measures	Results	LOE Quality
Park et al., 2014	A quasi experi-mental design	Chair yoga therapy	IG=14 CG= 11	**IG-** Chair yoga for 45-minute sessions per week for 8weeks **CG-** the HEP program for 45-minute sessions per week for 8weeks	-McGill Pain -CES-D -Life Satisfactio n Index for the Third Age, Short Form	- No significantly greater decrease in perceived pain over time for the treatment group and the control group (*p=.234*) - A significant slope difference in depression between the treatment group and the control group during the intervention phase (*p=.007*) - A statistically significant greater change in life satisfaction over time in the treatment group than the control group (*p=.012*)	II
Acupuncture							
Berman et al., 2004	RCT	Acupuncture	IG1=190 IG2=191 CG=189	**IG1**-true acupuncture over 26 weeks **IG2**-sham acupuncture over 26 weeks **CG**-education - six 2-hour group sessions based on the Arthritis Self-Management Program over 12 weeks	-WOMAC - SF36 -Assessment 6 minute walk	- Older adults in the true acupuncture group experienced significantly greater improvement in WOMAC (mean difference -.87, 95% CI=-1.58 to -.16, *p=.003*).	I
Ga et al., 2007	RCT	Acupuncture	IG= 18 CG= 21	**IG**-acupuncture 3 times per week for 2 weeks **CG**- 0.5% lidocaine injection three times for 2 weeks	-VAS -FACES - PPI -Passive range of motion	No significant difference between two groups in reduction of pain in VAS, FACES, and PPI scores at days 7, 14, and 28 (*p>.05*).	I

First Author/ Year	Study design	Type of intervention	No of participants	Treatment and control groups	Outcome measures	Results	LOE Quality
Foster et al., 2007	RCT	Acupuncture, exercise, and advice	IG1=116 IG2=117 IG3=119	IG1- Advice and exercise for 6 weeks IG2- Advice and exercise plus true acupuncture for 3 weeks IG3- Advice and exercise plus non-penetrating acupuncture for 3 weeks	-WOMAC -OMERACT -OARSI	- At 6 months, no statistically significant difference on the pain subscale from baseline between the IG2 group compared to the IG1 group. - Compared with IG1, there were small statistically significant improvements in pain intensity and unpleasantness at 2 and 6 weeks for IG2, and at all follow up points for IG3.	I
Foster et al., 2010	RCT	Acupuncture and exercise	IG= 70 CG= 280	**IG**- with an acupuncture preference **CG**- no acupuncture preference	-WOMAC -OMERACT -OARSI	- At 6 and 12 months, there was no significant relationship between patient baseline treatment preferences and change in knee pain.	I
Meng at al., 2003	RCT	Acupuncture	IG= 24 CG= 23	**IG**- acupuncture biweekly session for 5 weeks **CG**- standard therapy for 5 weeks	-VAS -RDQ - Charlson Comorbidity Index	Acupuncture group had a significant decrease in pain scores of 0.2 ± 1.3 compared with control group, who had an increase of 0.7 ± 1.1, with an intergroup difference of 0.7± 2.2 (*P = .02*).	I
Music therapy							
McCaffrey & Freeman, 2003	RCT	Music therapy	IG= 33 CG= 33	**IG-** listen to the entire tape each day for 14 days at approximately 1 hour after completing their morning toilet **CG-** sit at in a quiet comfortable place for 20 minutes each day approximately 1 hour after completing their morning toilet for 14 days	MPQ	-Participants who listened to music had significant lower on the Pain Rating Index on day 1 (p=0.001), day 7 (p=0.001) and day 14 (p=0.001) and on the Visual Analogue Scale on day 1 (p=0.001), day 7 (p=0.001) and day 14 (p=0.001), when compared with those who sat quietly and did not listen to music.	I

First Author/ Year	Study design	Type of intervention	No of participants	Treatment and control groups	Outcome measures	Results	LOE Quality
Self-management education							
Ersek et al., 2003	RCT	Pain self-management 45 education program (classroom based)	IG= 22 CG=23	**IG**- a 7-week pain self-management group **CG**- an educational booklet about chronic pain management	-SF-36 -GCPS - CPCI	- Participants in self-management group showed significantly greater improvement in physical role functioning (*P = .04*) and pain intensity (*P = .02*) than the control group.	I
Ersek et al., 2008	RCT	Pain self-management 45 education program (classroom based)	IG= 133 CG=123	**IG-** a 7-week pain self-management group that hold discussions about persistent pain, training, and practice of self-management techniques; booster and follow-up telephone calls after treatment **CG**- book about pain management, follow up telephone calls at weeks 1, 4,12, 16, 22, 30	-RDQ -BPI -GDS -CPCI	-No significant differences in outcomes were found between groups at post-intervention at 6-month and 12-monthh follow-up (*p>.05*). - The treatment group reported a significantly greater improvement over time in two process measures, as measured by the Chronic Pain Coping Inventory: use of exercise and use of relaxation.	I
Haas et al., 2005	RCT	Self-management education program (classroom based)	IG= 60 CG=49	**IG-** chronic disease self-management 2.5-hour session per week for 6 weeks **CG-** wait-list control	Modified Von Korff Scale	-No significant difference between treatment group and a wait-list control for improving pain (*p=.83*) after treatment. - At 6-month follow-up, significant difference in disability days, participants in treatment group reporting 9.2 fewer disability days than participants in control group (*p=.03*).	I
Rybarczyk et al., 2001	RCT	Multidimensi-onal wellness education program	IG= 113 CG=130	**IG**- 8-week educational program on wellness, mind–body relationship, communication, and problem-solving techniques	SF-MPQ	-At post-treatment, the intervention group had significant decreases in pain, depression symptoms, anxiety, and sleep quality compared with control group (SF-MPQ 8.3-6.4, *p<.05*).	I

First Author/ Year	Study design	Type of intervention	No of participants	Treatment and control groups	Outcome measures	Results	LOE Quality
		(classroom based)		**CG-** wait-list		-No statistically significant difference at 1-year follow-up.	
Guided imagery							
Baird & Sands, 2004	A pilot study	Guided imagery with PMR osteoarthritis pain in many sites	IG= 17 CG=10	**IG**- listening twice a day to a 10-to-15-minute audiotaped script and instruction in guided imagery with PMR. **CG**- Usual care	-AIMS2 -Mobility	Statistically significant reduction in pain (AIMS2: F (1, 26) = 4.406, p = .046) and mobility difficulties (F (1, 22) = 9.619, *p= .005*) at week 12compared to the control group.	II
Cognitive - behavioral Therapy							
Green et al., 2009	RCT	CBT program	IG=46 CG=49	**IG**- a 10-session psychosocial (i.e. cognitive behavioral orientation) pain management program **CG**- wait-list control	-PBQ -CPCI -BPI	- Significant reduction in pain beliefs in treatment group compared to control group (PBQ: F(1,89)=7.75, *p<.01*) - Treatment group increased use of relaxation as coping strategy (CPCI: F(1,91)=11.75, *p<.01*)	I

Table 2. Johns Hopkins Nursing EBP: Levels of Evidence (Dearholt et al., 2012)

Level	Criteria
I	-Experimental study, randomized controlled trial (RCT) - Systematic review of RCTs, with or without meta-analysis
II	-Quasi-experimental Study -Systematic review of a combination of RCTs and quasi-experimental, or quasi-experimental studies only, with or without meta-analysis.
II	-Non-experimental study -Systematic review of a combination of RCTs, quasi-experimental and non-experimental, or non-experimental studies only, with or without meta-analysis. -Qualitative study or systematic review, with or without meta-analysis
IV	-Opinion of respected authorities and/or nationally recognized expert committees/consensus panels based on scientific evidence.
V	- Based on experiential and non-research evidence.