National Guidelines for the Management of Pain in Older Adults

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Pain in the older person is often under reported and poorly assessed. Access to better healthcare and improved social support has increased the average life expectancy resulting in older people having a higher prevalence of pain and related problems. The British Pain Society supports and welcomes the 2nd edition of the publication of the *"National Guidance on Managing Pain in the Older Adult"* and would go alongside the 2018 publication National Guidance for the Assessment of Pain in Older People (Schofield et al 2018). The International Association for the Study of Pain has marked 2019 as part of the Global year against pain in the most vulnerable and the British Pain Society congratulate the efforts of Prof Schofield and colleagues in bringing out a valuable guide to healthcare care professionals in the practical aspects of delivering appropriate care and managing pain in these population.

In the older adult, musculoskeletal pains due to osteoarthritis of the knee, hips, shoulder and small joints of the hand are common painful problems as well as neuropathic pain problems and cancer-related pain. The older generation has a stoic approach to pain and this along with traditional beliefs and attitudes makes pain management difficult as patients sometimes prefer a self-management strategies, which on its own may only provide sub-optimal pain relief. Often the unsaid words are more important in assessing the pain and valuable information is obtained from carers and healthcare practitioners in assessing the pain and related problems. In nursing homes, this has led to increased use of opioids, which in turn gives rise to cognitive dysfunction and other undesirable side-effects which limits the increasing use of medicines to manage pain. This highlights

the importance of multidisciplinary assessment and management of these patients in a timely manner. This document jointly produced by the British Pain Society and the British Geriatric Society gives a comprehensive synopsis of the latest evidence in the prevalence, issues and management of pain in the older person.

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The Royal College of Nursing welcomes the publication of the second edition of this guidance which builds upon the national guidance for the assessment of pain in older people (Schofield et al 2018). The launch is timely as it coincides with the significant work of the International Association for the Study of Pain global year 2019 campaign against pain in the most vulnerable jointly led by Prof Pat Schofield and Prof Miriam Kuntz.

Pain in older people has a high prevalence, yet is under reported and is associated with frailty and falls. The older person's attitudes and beliefs about their pain can be a barrier to effective management. Pain assessment and management in is often undertaken by informal carers and members of the nursing team and they are well placed to ensure that the effectiveness of interventions is assessed and recorded. Structured pain assessment remains a fundament of practice as the recognition of a neuropathic component will significantly change the treatment strategy. Musculoskeletal pain is very common in this population and remains highest in residential care settings.

The increasing use of pain management programmes and exercise is to be lauded as pain is a biopsychosocial experience, maintaining strength and flexibility is important and as we age we have increased adverse effects from medicines.

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Executive Summary

The aim and objectives of this review were as follows:

Aim: to provide up to date guidance on pain management for the older population (65+).

Objectives

1) To describe the population and current prevalence.

2) To identify the current literature regarding attitudes and beliefs held by health professionals and informal carers.
3) To identify and present the latest evidence regarding pharmacological and non-pharmacological management of chronic pain.
4) To identify a global picture by reviewing national guidelines from around the world.
5) To demonstrate the most current evidence regarding palliative pain for this population.
6) A detailed review of the current evidence base for the management of pain in this population which should be viewed alongside the national pain assessment guidelines (2018) and as an addition to the national management guidelines published in 2013.

This guidance document reviews the epidemiology and management of pain in older people via a systematic literature review of published research. The aim of this document is to inform any health professionals in any care settings who work with older adults on best practice for the management of pain and to identify any gaps in the evidence which may require further research. The assessment of pain has recently been updated, so we have not addressed this in the document. https://www.bgs.org.uk/sites/default/files/content/attachment/2018-05-24/The%20Assessment%20of%20Pain%20in%20Older%20People%20UK%20National%20Guidelines.pdf

Within this publication we have included sections on palliative care and information for informal carers sections which is new. In terms of prevalence, the evidence remains the same in that pain increases with advancing age and is more common in females than makes. Knees, hips and back remain the common pain sites and pain associated with osteoporosis and osteoarthritis is common. As before we have focussed our review on chronic pain and community settings, but we still observe that pain prevalence is higher within the nursing home environment. This demonstrates that there has been very little change in pain management within this setting since 2013.

Research into attitudes and beliefs has increased over the past five years with the recognition that certain beliefs result in an escalation of the pain experience amongst this population. Furthermore, spousal beliefs have a significant impact upon how the individual copes with their pain. However, there is some research which demonstrates success in changing attitudes and beliefs by using CBT and pain management programmes an area worth expanding upon. In terms of guidelines, we only reviewed those published in the English language, therefore, the three main countries of publication were UK, US and Australia. Other guidelines for example Germany were not written in English were therefore not reviewed, but we do acknowledge they exist. The evidence around carers perspectives emphasises that generally informal carers are based placed to lead on assessment and management

of pain decisions, even better than the named nurse, particularly when decisions are being made around palliative care. There is very little evidence regarding palliative care neds of those specifically over the age of 65years and nothing related to the promotion of a “good death” or related to other conditions such as COPD, heart failure or dementia. Nevertheless, what literature there is, in relation to the latter suggests that pain is a significant predictor of behaviour in adults with severe dementia.

From a pharmacological perspective, there has not been much in the way of developments since the publication of the 2013 guidelines. It is still important to remember that older adults are more likely to be experiencing physiological changes which will make them susceptible to increased risk of side effects. Oral administration is the preferred route, although for some pain syndromes, topical can be more effective. Timing of drugs is of importance and only one drug should be added or changed at one time. However, combination therapies can be useful.

Paracetamol is often recommended as the drug of choice, but we now know that there is an increased likelihood of adverse events associated with long term use. None of the NSAIDs are safe in this population, so they should only be used for the shortest time, including topical. Opioids should only be used for the shortest duration. Buprenorphine is more cost effective than Fentanyl and most commonly studied in the UK. Morphine is the most effective in end of life care. Gabapentin, pregabalin, amitriptyline and duloxetine are considered the most appropriate first line treatment for the management of neuropathic pain.

As in the 2013 guidelines, the evidence base for the current guidelines is limited. In spite of the fact that there is a strong rationale for the use of psychological approaches. It would appear that there is still limited evidence for CBT as an effective treatment for chronic pain in older people however; the numbers of papers which consider pain management programmes and more novel interventions suggest that combined or integrated strategies to manage chronic pain may be beneficial to older populations.

In terms of physical activity. It is well documented that exercise is beneficial for the management of chronic pain. But as with the 2013 guidelines there has still been limited research in terms of exercise specific to older adults. From the evidence we did review, we are able to conclude that exercise should be tailored to the needs of the individual regardless of age and should involve strengthening, endurance and flexibility exercises as an important role in self-management. But understanding motivation and barriers to exercise is an important factor and should be supported with education to aid understanding of the rationale behind the exercise.

In terms of invasive approaches, we focussed upon specific conditions. Trigeminal neuralgia, Vertebroplasty & Kyphoplasty revealed no new studies. It is important therefore to refer to the 2013 guidelines. In terms of spinal stenosis, caudal epidural with local anaesthetic with or without steroids effect pain relief. Epidural or percutaneous epidural adhelyosis can treat specific types of stenosis depending on the location of the stenosis. Spinal cord stimulation gives pain relief for a considerable time if not a curative approach. In terms of PHN, there is one study using fTMS. The findings suggest that repeated daily stimulation deliver prolonged pain relief lasting 1-3 months than a single rTMS session with effects lasting less than a week. The treatment of postherpetic neuralgia pain in older people is limited to findings of this one study. However, it is clear that repetitive transcranial magnetic stimulation (rTMS) can be of value in selected patients with postherpetic neuralgia in relieving pain for up to 3months.

The recommendations in this paper are informed by a comprehensive literature review utilising a systematic approach.

Methodology

This paper builds on the previous work (2). A team of pain professionals including members of the British Geriatric Society, British Pain Society and Royal College of Nursing worked together to produce a comprehensive overview of the guidance for pain management in older people. The team comprised of representatives from care of older people and pain specialists. The professions represented included epidemiology, geriatric medicine, pain medicine, nursing, physiotherapy, occupational therapy, psychology, pharmacology and service users. Members of the team were allocated to representative groups related to particular aspects of the topic of pain in older people.

At a preliminary meeting groups were established to revisit the areas identified in the earlier guidance with the addition of two further areas for consideration namely palliative care and carers.

After general discussion about approaches to start the search a few key terms were identified for an initial generic search to be undertaken. An information scientist supported the generation of an initial search (main strategy noted in Appendix 1), from this a database was generated utilising the bibliographic software RefWorks to enable the sharing of references. Separate search strategies were then used to identify particular papers supporting the identified subtopics of physical therapy, prevalence, attitudes, carers, palliative care, education, pharmacology, interventions, psychology and assistive devices.

Each group member identified topic specific key terms to enable searching.

Papers were rejected that did not meet the following inclusion criteria:

• Studies in English language.

• Types of study: randomised controlled trials (RCTs), cohort studies, non-experimental studies and descriptive studies.

• Types of participants: all adults over 65 years with chronic pain, living in community settings

• Interventions and specific comparisons to be made: all drug and non-drug intervention studies, including comparisons with placebo, standard care and waiting list control.

The recommendations provided here are based on an initial literature search using Medline, CINAHL, the Cochrane Central Register of Systematic Reviews and Psychinfo. A systematic search strategy was undertaken using both Boolean search and proximity operators in May 2018 including papers published between 2009 (the date of the last review) and April 2018. Reference lists of papers and review articles were also searched for possible inclusions. The process of development of this paper followed the reporting guidelines identified by Moher et al (3).

Quality of included papers was assessed using the Sottish Intercollegiate Guidelines Network (SIGN) methodological grading system.

(https://www.sign.ac.uk/assets/sign_grading_system_1999_2012.pdf).

Following acceptance of papers, each author graded the papers according to the following system, as proposed by Harbour & Miller (4)

1 ++ High quality meta -analysis, systematic reviews of RCTs or RCTs with a very low risk of bias.

1 + Well-conducted meta-analyses, systematic reviews of RCTs or RCTs with a low risk of bias.

1 – Meta-analysis, systematic reviews or RCTs or RCTs with a high risk of bias.

2 ++ Hi quality systematic reviews of case control or cohort studies or high quality case -control or cohort studies with a very low risk of confounding bias or chance, and a high probability that the relationship is causal.

2+ Well conducted case-control or cohort studies with a low risk of confounding bias or chance and a moderate probability that the relationship is causal.

2 – Case-control or cohort studies with a high risk of confounding, bias or chance and a significant risk that the relationship is not causal.

3 Non-analytic studies, e.g. case reports, case series.

4 Expert opinion.

Results

A main initial search identified a total of 6751 papers from Medline and CINAHL and from Psychinfo a further 1173 records within which the reviewers searched for the particular topics as detailed in each of the following sections.

Background

Pain in older people is a potentially huge problem. The pain experienced by older people is largely under reported and consequently poorly managed. It has been well documented that 40% of older adults living in the community are experiencing poorly controlled chronic pain and this figure increases significantly in the nursing home population to as high as 80% (1). We are also aware that the population is ageing. In the UK as with the rest of the world we are going to see a significant increase in the older population over 65 years and those over 85 years. Chronic pain in this population is associated with increased risk of falls and an increase in frailty. Therefore, it is essential that we have national guidance for both the assessment and the management of pain in the older population. The assessment guidance was republished in 2018. This is an update on the 2013 Paper "Guidance on the Management of Pain in Older People" (2). It is anticipated that these guidelines will be updated in 3-5 years.

At the time of writing we are aware that there is constantly changing literature in the field of pain and a growing body of evidence in the care of older adults. We feel that this is a snapshot in time and should be viewed alongside the 2013 guidelines as there have been some changes.

Prevalence of Pain in Older Adults.

Eighty-five papers relating to prevalence were initially identified from within the main search out of which 49 were finally selected for inclusion. The majority (n = 10) were from the USA, with Korea (n = 4), Sweden (n=4) and Canada (n = 3) being the next highest. There was only one paper from the UK. From the studies we found that there were three conducted in nursing homes, and a fourth study conducted in a veterans' hospital in the USA. There was one hospital study and the rest were community based.

From a methodological perspective, the majority of the studies were surveys (n= 21), although some of these studies appeared to be more epidemiologically focused using large data bases. Other studies were described as longitudinal, cross sectional, observational, case note review, cohort studies and one interview study. There were four systematic reviews. The sample sizes were quite large in many of the surveys. For example, the study from New South Wales utilised 8881 participants (5) and a USA based internet study utilised 35718 participants (6).

The results of the studies are very similar to those found in the studies of the 2014 guidelines (2). All of the studies with the exception of one found that pain prevalence increased with advancing age. The study by Fejer & Ruhe (7) contradicted this result with their systematic review by demonstrating a reduction in pain complaints over the age of 80. All of the studies supported the concept that females are more prone to expression of pain than males. The most common pain complaints as reported previously were knees, hips and low back pain. Only one paper reported that females reported more pain sites including; hands, shoulders, neck, back, hips, knees and feet in a USA cohort study of 5093 male participants (8). There was also a consensus that the pain was associated with osteoporosis or osteoarthritis (9).

A few new findings post 2014 were identified with this review. For example, in a study of 4703 participants over 75 years in the last two years of their lives demonstrated that 24% of the patients had chronic pain and in 60% of this cohort the pain was associated with arthritis. The prevalence of pain increased in the last four months of life (10). A predisposing factor for chronic pain in later life is obesity (11, 12). A number of papers discussed self-management of pain in this age cohort (13,14). But the authors commented that use of self-management was largely due to undertreatment by pharmacological methods.

In contrast, a study by Hemmingsson et al (15), which looked at pain prevalence in nursing home residents, found an increase in the use of opioid prescribing, but a decrease in the use of Tramadol.

A high incidence of neuropathic pain was found in a nursing home population across 12 nursing homes in Holland using a case note survey (16). In terms of dementia, a cross sectional survey in the USA demonstrated that 63% of older adults with dementia had chronic pain compared to 54% of adults without dementia in a sample of 7609 community dwelling older adults (17).

Summary:

In conclusion, ageing and disability increases the potential for chronic pain (18). The common pain sites are knees, hips and low back often associated with osteoarthritis and osteoporosis. Females are more likely to develop chronic pain and it is often associated with obesity. Older adults with dementia are more likely to be experiencing chronic pain. Whilst there are a number of studies reporting the prevalence of chronic pain in this population acknowledging the phenomenon exists, undertreatment remains rife.

Attitudes and Beliefs:

This section explores the role of attitudes and beliefs in relation to how older adults experience and cope with chronic pain, and the resulting functional and psychological consequences. While within this population underlying physiological processes relating to ageing do have an impact upon chronic pain, it is also affected by psychological, cognitive and societal factors which the biopsychosocial model of pain recognises. Within this model research has explored and demonstrated that attitudes and beliefs of older adult patients can have a significant influence on how they cope with their pain, their help-seeking behaviours, how they engage with treatment and therapy, and the level of impairment it causes physically and psychologically (19). The following review explores literature in this area, contributing to the rationale that older adults' beliefs and attitudes are implicated in how pain should be recognised and treated, and thus need to be considered by healthcare providers supporting this population.

Review:

Research indicates attitudes and beliefs can be implicated in older adults' willingness to seek help or treatment for their pain. Makris et al. (20) found older adults anticipated and therefore accepted pain as a part of the ageing process. This belief, which was reinforced by ageist and dismissive attitudes from healthcare providers, lead to a reluctance to seek help, as healthcare providers were perceived as unable to assist. Stoicism, or the belief pain should be accepted or hidden from others, was a consistent theme within other studies found. Cornally & McCarthy (21) found 78% of older adults in their sample indicated 'it is no good complaining about their pain'.

Older adults who hide pain or express stoicism expectedly, are less willing to seek help (21). It may also be older adults are less willing to seek help due to how they prioritise their chronic pain. Older adults from 65 years to over 80 years believe pain is not a priority in the presence of often multiple competing comorbidities (20, 22).

Pain beliefs not only affect older adults' willingness to seek help, but also their psychological wellbeing and functional ability. Older adults who stoically accept pain as a part of ageing report loss of independence and control, depressive symptoms, loneliness and disability in daily activities (20, 23, 24, 25, 26). This suggests this belief leads to a psychological and physiological hopelessness among older adults, which may explain the lack of coping skills or mechanisms for pain discussed in the literature. Interestingly, Tse & Vong (23) found older adults who express hopelessness in that their pain will be constant and permanent, also report more intense pain. Alternatively, more intensive pain may contribute to more psychological disturbance.

Fear avoidance beliefs have also been found to effect older adults' willingness to engage in pain treatment (27, 28). According to the fear-avoidance model, fear avoidance beliefs and resulting behaviours can lead to individuals becoming trapped in a cycle of chronic disability and pain (29). Indeed evidence indicates this is applicable among older adults; fear avoidance beliefs such as activity will cause symptom escalation and pain is sign of damage, are associated to poorer physical performance, avoidance of activity, lower gait speed and increased disability (24, 27, 28). One study reported fear avoidance beliefs relating to exercise was greater in those with more severe pain which required surgery, suggesting the greater the pain and necessary intervention the greater the associated fears (28). Fears and beliefs about treatment options, such as medications and surgical interventions not only affect engagement with treatment but also willingness to receive future treatment (20).

Recognising the impact of attitudes and beliefs in the treatment of chronic pain, a number of studies have developed educational or training programmes to improve attitudes and beliefs in relation to pain and exercise.

Green et al. (30) and Nicholas et al. (26) both developed programmes using principles of cognitive behavioural therapy (CBT) which were successful as reducing fear-avoidance of exercise and maladaptive organic pain beliefs. The programmes also reduced distress and depressive symptoms and encouraged physical activity for the self-management of pain. Both programmes demonstrated long-term effects, for as long as 1-year post-programme (26). Other programmes not of a CBT orientation have demonstrated similar successes, promoting more positive views towards exercise and a better understanding of conditions, however they also highlighted limitations (31,32).

Hurley et al. (31) found older adults maintained maladaptive beliefs that pain is inevitable with age, untreatable and exacerbated by activity. This led to acceptance of disability, avoidance of help seeking and poorer adherence or engagement with treatment plans. Once again demonstrating, not only the significant impact of beliefs and attitudes but additionally, the challenges faced in attempting to change them.

The evidence reviewed indicates that healthcare practitioners must consider older adults' attitudes and beliefs, and how they may be implicated in their willingness to help-seek, and their responses to treatments, particularly that which requires physical activity. They must also consider screening and evaluation of older adults' psychological state, the research reviewed suggests an intertwined relationship between pain beliefs, and psychological and physical disability. Research developing interventions to alter older adults' attitudes and beliefs indicates CBT may offer a means to deliver successful and sustainable gains, however more research is needed to explore how such programmes can be delivered within the reality of healthcare contexts.

This guideline and its recommendations echoes those made previously; however there has been a significant increase in papers identified which suggests a growing recognition of the importance of the patient experience and perspective. This has allowed for a more in-depth discussion on the relationship of older adults' attitudes and beliefs on treatment engagement and outcomes. Akin to the previous guidelines, stoicism and fear-avoidance continue to be key obstacles, however interestingly no generational differences in either were explicitly explored in the studies despite samples ranging from 65 years to over 80 years. Likewise, all but one study (21), compared differences in attitudes and beliefs based on individual differences. In terms of the sample populations, all but one (23) were based in the community, while there is an increasing move for ageing in place older adults within residential care have consistently higher pain prevalence than those living in the community (2). This suggests literature found does not include a significant proportion of older adults with chronic pain. Most study samples were recruited through visits to healthcare services or data was derived as secondary analysis. Samples were therefore unrepresentative of those older adults who do not self-present or do not have access to healthcare.

The previous guideline discussed the role of spousal beliefs and attitudes, and how these can impact upon a significant other's pain experience, no papers were found further exploring this issue. Considering the landscape of care currently and the significant role of familial/spousal caregivers in supporting older adults, it is perhaps surprising their attitudes and beliefs about pain were unrepresented in the current literature.

Finally, the attitudes and beliefs of healthcare providers was beyond the scope of this review, however the literature reviewed does indicate they have ageist and stigmatising views of pain, and that these can reinforce older adults maladaptive beliefs and avoidance of help-seeking. This highlights the importance of looking at both patients and healthcare providers' attitudes and beliefs together.

Summary:

- Older adults accept their chronic pain with stoicism and demonstrate fear avoidance beliefs, which prevents them from help-seeking, and leads to treatment avoidance and poor engagement with treatment recommendations.
- There is an intertwined relationship between pain beliefs and functional and psychological impairments caused by chronic pain. Certain pain beliefs exacerbate disability and cause escalation of chronicity.
- Educational and training programmes implementing principles of CBT demonstrate some sustainable gains in reducing maladaptive attitudes and beliefs. However, more work is needed to see how such programmes can be successfully integrated into healthcare care.
- Since the previous guidelines, research in the area has increased, such reveals a growing recognition of the significance of the older adults' perspective in the assessment of pain and planning of pain management within this population. This is not to say however, there remains limitations of this current body of literature.
- The evidence presented provides a clear recommendation, that healthcare providers must consider older adults attitudes and beliefs, in addition to their psychological state, when addressing pain in this population.

Guidelines

This section offers a brief overview of other existing guidelines published in the area since the development of the previous guideline document (2), including those from the UK and around the world. Guidelines from some countries, such as the German Pain Society and the Spanish Society of Pain, are not discussed as have not been published in English.

Only a handful of English language guidelines for pain management in older adults specifically have been identified (33, 34, 35, 36) since Abdulla et al. (2).

As mentioned in the previous document, in 2009 the American Geriatric Society (35) updated their guidelines for the management of persistent pain in older adults and subsequent supplementary documents were published in 2011 (33). This update and supplementary documents discuss drug and non-pharmacological management, additional methods for assessing pain in the cognitively

impaired and age-related physiological changes which should be considered. The risk of NSAIDs for older adults is a key theme.

More recently in 2018, the Australian Pain Society updated their 2005 guidelines on the management of pain for older adults' livings in residential settings (36). This update includes sections on end-of-life pain management and nutrition and it directed at all healthcare staff involved in the assessment and management of pain in older populations.

A number of other guidelines which are not age discriminative or developed for older people are available for clinicians and healthcare providers' reference. The Scottish Intercollegiate Guidelines Network have developed general guidelines on the management of chronic pain (37) and The Canadian guidelines for opioid therapy (38) offer recommendations on the management of persistent non-cancer pain. Similarly, the British Medical Association (39) has produced guidelines supporting the safe prescription of analgesics. Other condition specific guidelines have also been developed such as the NICE guidelines on the management of neuropathic pain (40).

For pain management at end-of-life NICE (41) and the British Medical Association (39) have both provided documents covering palliative pain management, including routes of administration and management of opioid side-effects. Other guidelines which have been developed are orientated towards the provision of pain management programmes and services (42, 2). These documents offer clinical guidance for those delivering pain management programmes and offer a framework for organisations or commissioners involved in the planning or sustainability of these programmes.

The guidelines discussed identify some concerning gaps in the evidence base which underpin the recommendations made. Similar to this document, the American Geriatrics Society (35), the UK National Institute for Health & Care Excellence (43), the British Medical Association (39) and Scottish Intercollegiate Guidelines Network (37) comment on the deficiency of high-quality evidence for the efficacy and safety of pharmacological and non-pharmacological pain management. This has resulted in recommendations which are based on expert consensus rather than evidence-based, or indeed not based on age-appropriate evidence. The latter might explain the lack of older adult specific guidelines available too, given the paucity of research to inform best-practice recommendations.

Summary:

- Guidelines for the management of pain in older adults written in English have been developed in the UK (2); the US (35); and Australia (36).
- Other guidelines which are not age discriminative are available to offer recommendations for the management of specific conditions (e.g. neuropathic pain, NICE 40), end-of-life pain management (39, 41), and non-cancer chronic pain (37, 38, 43).

- The evidence-base to inform guidelines is still limited, resulting in recommendations informed by expert opinion, not high-quality evidence.

Older adults living with chronic pain: the impact upon carers

Carers, often a family member, provide care, typically unpaid, to someone with whom they have a personal relationship and who would have difficulty coping without this support. Increasingly, carers are being relied upon to provide care and support to enable older relatives to live at home and age in place. With advancing years, the prevalence of pain and disease can increase and carers may take on greater responsibilities. Carers may act as proxy decision makers, they can be involved in symptom assessment and treatment management and may have their own health and information needs alongside those of the cared for person. These needs may continually change, which can be a source of anxiety and contribute to the overall burden experienced by carers.

Chronic pain in the context of palliative care and dementia/cognitive impairment featured in eight of the ten papers. In keeping with one of the central tenets of palliative care, which offers a support system to help family members cope during the patient's illness and in their own bereavement, those papers that focused on palliative pain management evidenced the impact of chronic pain and the role of informal carers with the greatest clarity.

Palliative pain

The roles and perspectives of carers in managing pain in the context of palliative care was the focus of three articles (44, 45, 46). Findings from both McPherson papers (44, 45) were derived from the same dataset to describe the lived experience of cancer pain from the perspectives of both older patients living at home and their caregivers. An emphasis on dyads rather than the separate experiences of patients and caregivers gave credence to the interactional process of caregiving. The only UK based study included in this section was an article by Dawber et al (46). The authors examined the agreement between patients, their named nurse and family carers in terms of pain symptom assessment on the medical wards of a district general hospital. They found family carers were better proxies for patients when assessing pain when compared to the named nurse. Given the subjectivity of pain, family carers' personal knowledge of the patient was deemed important in determining pain symptoms.

Pain management in patients with dementia/cognitive impairment

Poor pain management (untreated pain) for older adults with cognitive impairment who are unable to communicate verbally, has been identified as a risk factor for depression and agitation of carers; the roles and perspectives of carers featured in five articles in this section. A study by Murray et al (47) in an urban outpatient clinic in Chicago, with a convenience sample of people with dementia

(PWD) and their carers, compared the most bothersome symptoms as reported each by PWD and their carers, to establish whether common symptom assessment measures captured what was most important to each group. Pain was the most frequently reported symptom by PWD; for carers, pain was the second most frequently reported after symptoms of cognitive decline. This highlighted the priority given to routine pain assessment by both PWD and their carers. Another US-based study also examined carer report of patient pain (48). Involving a community-based sample of 272 older adults and their carers, the authors evaluated which specific behavioural and psychiatric symptoms of dementia (BPSD) were associated with carer reports of patient pain. Their findings indicated that pain was a more significant predictor of behaviour for individuals with severe dementia compared to those with mild/moderate dementia. The role of caregivers was a central tenet of the article by Kaiser and Kaiser (49) which illustrated their personal account of caring for their 90-year old mother with Alzheimer's disease. They highlighted their experiences of poor pain management for their mother and advocated the development of improved training for health professionals in order to engage and collaborate with family carers from hospital to home to ensure a seamless plan of care.

Two articles that provided a description of the Preventing Aggression in Veterans with Dementia (PAVeD) intervention, explored whether identifying pain and emotional distress as risk factors and incorporating the carer into the treatment process, would help prevent or alleviate aggressive behaviour in people with dementia, thereby helping to reduce carer burden (50, 51). It was a family-centred intervention that could be tailored to individual situations. However, a randomised controlled trial of the intervention did not demonstrate any differences in the incidence of aggression or pain levels between those who had received the skills training compared to those who had not and whilst this is an important negative finding, quantitative evaluations can provide an incomplete assessment of carers' experiences.

General pain studies

The two remaining articles explored carers' perspectives of their older relatives' pain and the impact of pain on family relationships. Hsu et al (52) explored carers' observations and perceptions of their older relatives' knee osteoarthritis pain and pain management. This was a convenience sample of 28 family members from one medical centre and a regional hospital in Taiwan. In this descriptive study, the older adults described their pain to their relatives and its impact on their activities and functioning.

However, they were reluctant to take regular pain medicine and waited until they could no longer tolerate the pain before taking analgesia. This was due to negative attitudes regarding pain medication such as worries about side-effects or possible addiction. The carers in this study reported observing their relatives' pain in terms of limitations to their activities and described their roles as

needing to find a solution by taking the care-recipient to see a doctor or encouraging surgery. Pillemer et al (53) considered the impact of older parents' pain symptoms on the quality of the parent-adult child relationship. This study was conducted in the US with 698 adult children within 293 families. Whilst the expectation was that the presence and severity of pain would negatively affect the relationship between mother and adult child, this was not found to be the case.

Summary statements

- Carers take on roles in pain management in terms of communication, being an advocate, assessing pain, managing side-effects and finding solutions.
- Once patients are unable to self-report pain, carers can act as proxies in pain assessment which may be more accurate than health care professional assessment due to their personal knowledge of the cared for person. However, assessing pain can be challenging for carers due to the complexities associated with the presence of co-existing symptoms and the impact of a high carer burden associated with the demands of the caring role.
- Involvement in helping others with their pain management can be a source of worry, concern, upset, frustration, and anger for carers.
- Educational and family-centred interventions have had limited benefits in supporting carers in their pain management roles. However, a more integrated approach involving a co-existing and evolving care between formal and informal health systems has been suggested.
- The relationships between health care professionals and caregivers are important as a means to improving pain management for older adults.

Palliative and end-of-life care

As the population demographic changes so early diagnosis and management of previously life limiting conditions, including cancers and co-morbidities of ageing, has led to increased longevity (54). However, this leaves many with long term chronic conditions and unmet palliative healthcare concerns including pain.

Only five articles related to the provision of palliative and end-of-life care pain management for adults aged 65 years and over to meet the criteria for inclusion (54, 55, 56, 57, 58). The same author had published two of these papers using the same dataset.

The articles reviewed focused on cancer, mixed acute and chronic end-of-life care pain management in various settings that included hospital, hospice and the community. Studies were mainly retrospective, longitudinal cohort, cross-sectional and non-randomised design studies.

With claims of limited evidence to address whether differences exist in the management of cancer pain between patients receiving usual care by hospital-based primary specialists and those receiving

an early palliative/supportive intervention, Bandieri et al (54) addressed this and found that in the choice of analgesic strategy, the main recommendations provided by international guidelines were better adhered to with the adoption of an integrated care model compared to a routine approach.

Findings from their study identified that the risk of severe pain was reduced when an integrated care model was used compared with a model of routine care based on the involvement of a primary specialist alone. Likewise, research conducted by Laguna et al (57) has demonstrated inpatient palliative care (IPC) teams' effectiveness in managing pain during hospitalization but suggest a lack of continuity in pain management following discharge. These findings support IPC effectiveness in managing patient pain during hospitalization and reinforce the need for improved care coordination and support during care transitions. Using the same dataset, Laguna et al (58) investigated pain differences between whites, blacks, and Latinos after an IPC intervention and found a significant reduction in self-reported pain across all racial and ethnic groups. Despite these reductions, Latinos remained 62% more likely than whites to report experiencing pain at hospital discharge. Although limited in its inability to explain these findings, IPC teams with greater awareness and recognition of the potential influence of religious and cultural beliefs held by particular racial and ethnic groups deemed a potential barrier to palliative care pain management enables strategies to be put in place.

A study conducted by Fisher et al (55) focused on patients diagnosed with colorectal cancer (CRC) living exclusively in the community advocating the role of palliative care programmes (PCPs) as a means to enabling access to end-of-life care within the community demonstrate the role PCPs play in these settings alone. Data were derived from a retrospective, linked administrative database study of people diagnosed with CRC between January 1, 2001 and December 31, 2005 in Nova Scotia, Canada. Adjusting for all covariates, filling a prescription for a strong opioid was associated with enrolment in a palliative care programme and is once again indicative of the role that palliative care services play in the provision of end-of-life care in the community.

Practice variation in pain management has been a long-standing concern across health care settings and in a study conducted by Herr et al (56), hospices are no exception to that.

Their findings highlighted the inconsistences associated with pain management across 16 participating US hospices in the provision of pain management for older adults with palliative and end-of-life care needs. Using baseline data from a large-scale, randomized, controlled, experimental study testing the effect of a multifaceted, translating-research-into-practice intervention to promote adoption of evidence-based practices (EBPs) for pain assessment and management in older adults

with cancer at end of life. Findings suggest that EBPs for assessment and pain management for older cancer patients are not being fully implemented, or if they are, are not being documented. As a result, research examining strategies to increase translation of EBP guideline recommendations to consistent use in hospice practice and research on the ability of this methodology to apply to a broader population and still retain its validity are needed.

Studies focused exclusively on people over 65 related to palliative pain care management are scarce and the available evidence-based lacks high-quality RCT findings. The evidence that is available points to the importance of specialist knowledge provided by specialist palliative care teams and programmes designed to inform pain care management for older adults at the end-of-life. Despite changes in demography, longevity and mortality whereby death and chronic illness are now largely concentrated in older age groups and, fundamental to achieving a 'good death', the paucity of articles meeting the inclusion criteria highlights the shortage of evidence on this important, yet hitherto neglected area of practice. No evidence relating to the palliative and end-of-life care pain management of co-morbid or other long-term conditions such as COPD, heart failure or dementia in older adults were identified during the course of the review. As such, further evidence is required to inform good clinical practice and the palliative care pain management for older adults with these conditions.

Pharmacology

Primary research in older adults

As with the previous version of these guidelines (2), the results of the literature search demonstrate that very few studies focused on the use of analgesic medicines in older adults. A large proportion of the results were expert opinion, most of which were based on data extrapolated from studies involving adults between the ages of 18-65 years.

Physiological changes in older people that should be considered when prescribing analgesia

As adults age there are recognised physiological changes to various body systems which can affect the pharmacokinetics and pharmacodynamics of prescribed medicines. However, older adults are a heterogeneous population and often have multiple comorbidities so there are some general principles which should be considered when prescribing analgesia.

General principles of pharmacological management of pain in older people

The general pharmacological principles have not changed since the previous version of these guidelines (2) and are summarized below:

- Always consider the use of non-pharmacological strategies such as physiotherapy, cognitive behavioural approaches and acupuncture, to reduce or eliminate the need for medicines.

- Physiological changes in older people increase the sensitivity to some analgesic drugs, which might necessitate appropriate dose titrations or replacement with an alternative medicine.
- The incidence of side effects with drug therapy is higher in older people, particularly in the presence of comorbidities and polypharmacy. These factors need to be carefully considered when introducing new medication to minimise the chance of drug–disease and drug–drug interactions.
- Always consider the route of administration. Although the oral route is preferred, as it is convenient and the least invasive, topical treatments may have similar efficacy to other routes with fewer adverse events.
- Timing of medicine administration is important. Consider rapidly acting formulations with shorter half-lives for severe, episodic pain. This may need to be balanced with more regular background analgesia for patients who experience continuous pain. Ideally modified release formulations should be considered as this can improve adherence.
- Only start or change one medicine at a time. Start with a low dose, use a slow dose titration and allow sufficiently long intervals to allow the assessment of effect. Treatment should be monitored regularly and, if required, adjusted to improve effectiveness and limit adverse events.
- Combination therapy should be considered. Drugs with complementary mechanisms of action may have synergistic effects to provide greater pain relief with fewer side effects than higher doses of a single drug.

Paracetamol

Results

Forty papers were identified which discussed the use of paracetamol in older adults. Of these, 34 were classified as expert opinion, 4 were primary research and 3 were systematic reviews with meta-analysis.

General advice

Although there is considerable research into the effects of paracetamol on chronic pain, the majority of these excluded patients over 65 years (59). Paracetamol has long been viewed as an effective analgesic in a variety of inflammatory chronic pain conditions and has been considered as a safer alternative to non-steroidal inflammatory drugs (NSAIDs) (60). As a result it is often recommended as a first line treatment for chronic pain in older adults (40, 41, 61, 62).

However, recent research suggests that paracetamol has very limited efficacy in chronic pain (64) and long-term use may be associated with significant risk of adverse events (65). These guidelines therefore advise that regular paracetamol should be used with caution for chronic pain in older adults.

Effectiveness

Most expert reviews cite that paracetamol is an effective analgesic of chronic pain in older adults. However, recent systematic reviews with meta-analysis (although not specific to older adults) demonstrated very little benefit for short term use of paracetamol in osteoarthritis (64) and lower back pain (66). The only older-adult-specific study identified in this review was a small trial in patients with dementia, which showed that paracetamol (3g/day) was superior to placebo in terms of functional outcomes and patient involvement in activities (67).

Adverse events

A recent meta-analysis of 8 cohort studies demonstrated that there was an increased risk of cardiovascular and gastrointestinal adverse events and overall mortality associated with long term daily use of paracetamol (65). Previously, it was considered that no dose adjustments were necessary in older adults, unless there was evidence of hepatic insufficiency (68). There are now reports which suggest an increased risk of hospitalisation with older adults as a result of chronic use of paracetamol at doses higher than 3g per day (69, 70). In contrast, Fulton et al. (71) showed there was no increased risk of significant cardiovascular events in hypertensive older adults prescribed regular paracetamol. Although more research is needed in this area, the emerging evidence suggests that paracetamol should be used with caution in older adults.

Non-steroidal anti-inflammatory drugs (NSAIDs)

Results

A total of 37 papers were identified which discussed NSAIDs. Most of these papers were not specific to older adults.

General advice

Since the publication of the first guidance (2), there has been little change in the use of oral NSAIDs in older people. In fact, if anything, awareness of their possible harmful effects has increased and strong caution has been expressed by different professional bodies (72). At present, no safe NSAID for oral use in older people is available in clinical practice. Furthermore, no effective medicine can be added to definitively protect against and prevent the possible adverse gastrointestinal (GI), cardiovascular and renal effects of this group of drugs. Although NSAIDs are effective analgesic and anti-inflammatory drugs, it is important to review regularly the balances between risks and benefits. Prescribing NSAIDs in older people needs to be patient-focused, specific and personalized to the individual patient and for a short course only.

Adverse events

A meta-analysis examining the cardiovascular safety of various NSAIDs found that naproxen was least harmful compared with other non-selective and selective NSAIDs (73). However, two recently published trials showed that the selective NSAID celecoxib, has a relatively superior upper GI

bleeding safety profile (CONCERN) (74) and a better cardiovascular risk profile (PRECISION) (75) when given with a proton-pump inhibitor (PPI). In the CONCERN study, patients included had a previous upper GI bleed and needed aspirin for cardio-prophylaxis, a clinical scenario commonly seen in older people. Although the two trials were not specific to older people, the mean age was approximately 72 years in the CONCERN study and 63 years in the PRECISION study. The CONCERN study concluded that celecoxib plus a PPI is the preferred choice of treatment in patients at high risk of both cardiovascular and gastrointestinal events and who require concomitant aspirin and NSAID (74). Alongside this recommendation, the trial showed that the risk of bleeding was unacceptably high at 6% and the cumulative risk (based on time-to-outcome analysis) for both celecoxib and naproxen was similar in the first 3 months. Given the high risk of adverse events, regular treatment with oral NSAIDs in older people should, in our view, be avoided unless absolutely necessary. In patients where a short course of oral NSAID is unavoidable, a lowest effective dose may attain a risk – benefit balance to justify treatment.

Opioids

Results

There were 81 papers that included opioids. In studies of specific opioids, eleven different opioids were used (appendix, Table A). The most commonly studied drugs were opioids that were more recently marketed, including transdermal buprenorphine (14 studies), oxycodone (± naloxone) (10 studies), and tapentadol (3 studies). The most commonly reported conditions were chronic pain (13 studies), osteoarthritis (9 studies) and neuropathic pain (6 studies) (appendix, Table B). Thirteen studies considered the side effect safety of opioids, including risk of fracture (2 studies), side effects on initiation (1 study), and delirium (1 study). The quality of most publications was low (appendix, Table D).

General advice

Over time there has been greater caution in the use of opioids for the management of chronic pain (76). Limitations in trial design and duration have implications for the interpretation of outcomes, while concerns about side effects and harms are increasing. There is some evidence to support the short-term use of opioids in chronic pain but there are concerns over whether this efficacy is sustained with long term use (77).

Specific opioids

Codeine

Often considered a ‘weak’ opioid, codeine may be appropriate where paracetamol and other non-opioid analgesics have been ineffective in chronic non-cancer pain (62). In combination with paracetamol, codeine was equally effective as transdermal buprenorphine for the management of

painful osteoarthritis (78). Compared with other opioids, the risk of cardiovascular events was higher for codeine (RR, 1.62; 95% C, 1.27-2.06) after 180 days treatment and all-cause mortality was increased after 30 days (2.05; 1.22-3.45) compared with hydrocodone users (79).

Buprenorphine

Buprenorphine was the most commonly studied opioid. In the UK, the majority of prescriptions for transdermal buprenorphine were prescribed most frequently for painful osteoarthritis (80) and significantly more patients persisted with treatment at 6 and 12 months compared with those receiving other opioid analgesics, including tramadol, codeine and dihydrocodeine, despite increased incidence of constipation, dizziness, and nausea and vomiting. In a systematic review, there were no differences between transdermal buprenorphine and fentanyl in the incidence of dizziness, somnolence, nausea and treatment discontinuation (81). However, transdermal buprenorphine caused constipation for fewer people.

Transdermal buprenorphine is less costly and more effective than transdermal fentanyl and oxycodone, showing better clinical outcomes at lower cost, and represents a cost-effective treatment option for patients with chronic pain from both health insurance and societal perspectives in Germany (82). In the UK, transdermal buprenorphine was estimated to be more cost-effective than tramadol with an incremental cost-effectiveness ratio of less than £7,000 (83).

Fentanyl

Fentanyl is an extremely potent opioid that is administered most commonly as a transdermal patch for the management of chronic pain. Compared with transdermal buprenorphine, fentanyl causes constipation for more people and leads to a higher number of serious adverse events (81). In Germany, transdermal fentanyl was less cost-effective that transdermal buprenorphine in patients with chronic pain over a time horizon of 6 years (82).

Morphine

In a retrospective chart review of ten carefully selected older patients with intolerance to other opioid analgesics seen at a tertiary care pain clinic in Toronto Ontario, morphine liquid was effective (pain intensity reduction 6.35 to 2.95) for serious biomedical painful conditions (84), mostly neuropathic pain and mechanical low back pain. The initial dose for all patients was 1-3 mg three times/day and maintenance dose ranged from 5 to 30 mg/day.

Oxycodone

Oxycodone has been available in Europe for approaching twenty years. It has good oral bioavailability and it produces more predictable plasma concentrations than morphine. When used to manage moderate to severe chronic osteoarthritis pain, oxycodone controlled-release (CR) has similar efficacy and tolerability with comparable side effect profile to other opioids (85). All-cause

mortality was elevated after 30 days for oxycodone users (RR, 2.43; 95% CI, 1.47-4.00) compared with hydrocodone users (79). When compared with no opioid, opioids including morphine, fentanyl, oxycodone, and codeine were not associated with delirium (86).

Oxycodone/Naloxone

The combination product of oxycodone/naloxone prolonged-release (PR) was developed to reduce opioid gastrointestinal side effects, particularly constipation. Naloxone binds preferentially to opioid receptors in the gastrointestinal tract and then undergoes extensive first pass metabolism in the liver allowing oxycodone to reach the central nervous system in order to exert its therapeutic effect. Several studies have evaluated the effects of oxycodone/naloxone PR for chronic pain in older people (87, 88, 89). Although studies have recruited a relatively small number of people, the results suggest that the combination is as effective as other opioid analgesics with improvements in bowel function and reductions in laxative use. In a pilot study, oxycodone/naloxone PR was effective in improving pain and other symptoms associated with dementia, with adequate safety and tolerability profiles (89). However, the combination product is included on the NHS England list of medicines not recommended to be routinely prescribed (90). But of course this only provides weak evidence according to Harbour & Miller (4)

Tapentadol

Tapentadol is a novel centrally acting analgesic with both opioid and monoaminergic activity. It does not have metabolites with significant analgesic activity, which theoretically presents some advantages, particularly in comparison with tramadol. In a systematic review comparing tapentadol extended release (ER) with oxycodone controlled-release (CR) in elderly adult patients (aged >75 years) with moderate to severe, chronic osteoarthritis knee or low back pain, tapentadol ER was associated with significant reductions in pain intensity from baseline to week 15 compared with placebo ($p = 0.0075$); however, differences between the oxycodone CR and placebo groups failed to reach statistical significance ($p = 0.1195$) (91). With a dual mechanism of analgesic action, the overall opioid load is lower and this is associated with significantly less gastrointestinal side effects and constipation (92). Currently, there remains limited evidence to support the use of tapentadol over other opioids, which have been on the market longer, are less expensive, and have more established safety profiles (92).

Tramadol

According to consensus guidelines from the Canadian Pain Society, tramadol and controlled-release opioid analgesics are recommended as second-line treatments for moderate to severe neuropathic pain (94). Between 2007 and 2013, there was a marked reduction in tramadol prescribing in Swedish nursing homes (15) and a substantial rise in prescribing of other opioids.

A review on the management of persistent pain in older people proposed that if initial treatment goals are not met, a trial of a topical nonsteroidal anti-inflammatory drug or tramadol, or both is recommended (95).

Compared with hydrocodone, after 30 days of opioid exposure the risk of fracture was significantly reduced for tramadol (RR, 0.21; 95% CI, 0.16-0.28) (78). However, in a cost utility analysis, tramadol was associated with 1,058 more fractures per 100,000 patients per year compared with transdermal buprenorphine (82).

In a systematic review tramadol was associated with increased risk of delirium compared with no opioid (hazard ratio 7.1, 95% CI 2.2–22.5) (86).

Opioid - Paracetamol combination therapies

There been several studies evaluating the efficacy and safety of the paracetamol-tramadol combination product in treating moderate-to-severe pain. An observational, longitudinal, multicentre, open, non-comparative, prospective study in France demonstrated reductions in pain intensity, improved pain relief, patient satisfaction and clinical global impression evaluated by the patient, regardless of pain aetiology or duration of the underlying pathology (96). In an observational study in Japan of 24 older adults with chronic low back pain, a combination of paracetamol and tramadol (325mg/37.5mg) relieved leg pain greater and more quickly than back pain symptoms (97). However, over half of the patients reported significant gastrointestinal side effects (nausea, constipation or dizziness/vertigo), despite prophylactic treatment with anti-emetics. Whilst these studies are interesting, the combined paracetamol/tramadol preparation is also included on the NHS England list of medicines not recommended to be routinely prescribed (90).

Adjuvant Drugs

Results

A total of 37 papers which discussed the role of adjuvant drugs (amitriptyline, nortriptyline, duloxetine, venlafaxine, carbamazepine, oxcarbazepine, gabapentin and pregabalin) for the treatment of chronic pain in older adults were identified. Most were expert reviews and not specific to older adults.

Antidepressants

Tricyclic antidepressants (amitriptyline and nortriptyline)

Tricyclic antidepressants are thought to act mainly by modulating reuptake of noradrenaline and serotonin (and possibly through other mechanisms). They have been advocated as a first line treatment for neuropathic pain for many years. However recent systematic reviews conclude that there is limited evidence to support the efficacy of amitriptyline (98) or nortriptyline (99) in neuropathic pain due to the lack of good quality research. Despite this both amitriptyline (40) and

nortriptyline remain amongst the first line treatments for chronic neuropathic pain and fibromyalgia (100).

The side effects of amitriptyline may limit its use in older adults, particularly with regard to somnolence, cardiovascular and gastrointestinal/bladder problems; and consequently, increased risk of falls. As such amitriptyline or nortriptyline should be introduced with caution and carefully monitored.

Serotonin-noradrenaline reuptake inhibitors (duloxetine and venlafaxine)

Duloxetine and venlafaxine both have similar mechanism of action. However, only duloxetine is recommended as a first line treatment for neuropathic pain (40). A recent systematic review demonstrated that duloxetine is effective in treating neuropathic pain but only at doses of 60 -120 mg per day (101). These doses are unfortunately often associated with adverse events, although these tend to be mild. In contrast venlafaxine, despite having a similar mechanism of action to duloxetine, only has limited efficacy for neuropathic pain and is therefore not recommended (102).

Duloxetine may also be beneficial in treating chronic musculoskeletal pain (103). A recent randomised, placebo-controlled trial demonstrated that duloxetine (60mg per day) improved pain and functional scores (50% duloxetine vs 9% placebo) in older patients with chronic osteoarthritic knee pain (104). Another study reported a secondary sub-group analysis of older patients (>65 years) from two previous clinical trials (105). These data showed that duloxetine (60mg/day) produced a significant reduction in osteoarthritis pain scores compared to placebo. However, 50% of patients on duloxetine reported adverse events (orthostatic hypotension, constipation, nausea and somnolence) which resulted in discontinuation by 22% of patients. A third, smaller study conducted a placebo run-in trial of duloxetine (90mg/day) in patients aged 50-80 years old (mean age 64 years) (106). Patients reported a significant reduction in pain intensity and physical function after 10 weeks of active treatment compared to a two-week blinded-placebo run-in period. Eight of 25 participants discontinued the study early.

Of the remaining 17 participants, 14 experienced significant adverse events; the most common of which were sedation/fatigue, sexual dysfunction, constipation or diarrhoea. Although the efficacy of duloxetine in these studies is consistent with that of younger adults (103), the incidence of adverse events appears to be somewhat higher.

Anticonvulsants

Carbamazapine and Oxcarbazepine

Although carbamazepine and oxcarbazepine are not recommended as first line treatments for neuropathic pain, they are often used to treat the paroxysmal pain associated with neurological conditions such as trigeminal neuralgia (107).

Recent systematic reviews showed that, whilst carbamazepine had some limited efficacy in trigeminal neuralgia, diabetic neuropathy and post stroke pain (108), there was little evidence to support the use of oxcarbazepine (109). Both studies reported a high incidence of adverse events of mild-moderate severity which precipitated a high withdrawal rate. The nature if these side effects (e.g. CNS depression, leukopenia, hepatic toxicity) suggest that carbamazepine should not be recommended for older adults (107). There may also be a high risk of very severe cutaneous adverse events in older adults treated for neuropathic pain (110). Moreover, as carbamazepine is a potent inducer of cytochrome p450 enzymes (notably CYP3A4, CYP2C9 and CYP1A2) it represents a challenge when patients are on multiple medicines (111).

Gabapentin and pregabalin

Gabapentin and pregabalin are advised as first choice drugs for older adult patients with neuropathic pain (40, 100). A recent systematic review showed moderate quality evidence for the efficacy of gabapentin in diabetic neuropathy and post herpetic neuralgia, but only at doses of 1800 – 3600 mg daily (108). Similar conclusions were drawn for pregabalin at doses of 300 – 600 mg daily (98). There was a relatively high incidence of mild-moderate adverse events with both gabapentin (63% patients) and pregabalin (≈50% patients); these included dizziness, somnolence, peripheral oedema, and gait disturbance. Neither of these studies specifically addressed older adults.

A more recent study analysed the results from two randomised, placebo-controlled trials to compare the efficacy and tolerability of gabapentin (extended release formulation) in older (>75 years) versus younger (<75 years) patients with post-herpetic neuralgia (112). The results showed that at doses of 1800mg daily, gabapentin significantly reduced pain scores in both age groups to a similar degree for up to 8 weeks. The incidence of adverse events were also similar in the two age groups (mainly dizziness, nausea and somnolence) which were most often reported at the start of treatment and were significantly reduced after the 4-week introductory period.

A small cohort study (113) showed that pregabalin (75 mg daily) produced good-excellent pain relief in approximately 60% of older patients (mean age 72 years) with chronic lower back pain (with neuropathic pain). However, this was only monitored over a 4-week period and there was no placebo group.

A small, open-label study by the same authors (114) showed that pregabalin (150mg daily) produced a significant reduction in pain scores for patients with neuropathic pain associated with lower back pain after 4 weeks but was less effective against non-neuropathic pain. This contrasts with NICE recommendations for use of anticonvulsants for LBP without sciatica.

Gabapentin and pregabalin are generally well tolerated and have few interactions with other medicines. However, each drug undergoes very little hepatic metabolism and so is reliant on renal excretion. Caution is therefore advised with patients with impaired renal function (115). Somnolence and sedation side effects are common in older adults and can exacerbate the effects of other CNS depressants (116). Some studies suggest that this can increase the risk of falls in elderly patients, particularly those living in a care home setting, but this has not been fully explored with ambulatory patients living in their own homes (117). A retrospective population-based study showed that there was an increased risk of hospitalisation as a result of altered mental status in older adults with high dose (>600mg daily) versus low dose (<600mg daily) gabapentin in the first 30 days following initiation of treatment (118). This risk was greater still in patients with impaired renal function. A lower starting dose and slower titration of gabapentin and pregabalin is therefore recommended. It should be noted that the new controlled drug classification of gabapentinoids to schedule C will necessarily influence prescribing habits.

Topical Therapies

Topical therapies may have an important contribution to make in pain management in the elderly. Specific benefits such as their efficacy, lower adverse events and the opportunity to be used as an adjunctive therapy, make them a valuable consideration.

NSAIDs

To avoid the systemic adverse events associated with oral NSAIDs, topical preparations have been recommended as an alternative. They are better tolerated and have fewer adverse effects (119). Depending on the carrier compound, the active drug penetrates the skin and enters soft tissue and joints at varying rate. Systemic absorption does occur but compared to oral NSAIDs, levels in the blood are much lower. However, a systematic literature review reported that gastrointestinal adverse events were experienced in up to 15% of older patients (95). Adverse local skin reactions (e.g. rash or pruritis) at the site of application have been reported in 10-39% of cases.

A recent Cochrane review of available RCTs on the efficacy and safety of topical NSAIDs in chronic musculoskeletal pain in all ages (102) concluded that both topical diclofenac and ketoprofen provided good levels of pain relief in osteoarthritis but only for a minority of people. There was no evidence that it was effective in other chronic, painful conditions.

However, in a more recent meta-analysis of 43 studies, which included RCTs and observational studies, topical NSAIDs were superior to placebo in relieving local pain and improving function (120). It is felt that in osteoarthritis, topical NSAIDs are superior to other treatment options due to a combination of both contextual effects and specific treatment effects (121). These findings however were not specific to older people.

Topical NSAIDs can therefore provide effective pain relief when localized to a few superficial joints, such as the hands or knees. Evidence from a recent randomized controlled trial showed comparable efficacy between topical diclofenac sodium and oral NSAIDs in knee osteoarthritis, and fewer adverse effects. Of all the topical NSAIDs, diclofenac patches were superior for osteoarthritis pain and piroxicam most effective for functional improvement. However, it is important to note that different preparations (e.g. gel, solution, patches) may have different effectiveness (120). Moreover, there is little evidence to support long term use of these topical preparations (99).

Although no large, long-term studies in older people have been carried out, there is a consensus that topical NSAIDs are safe and effective in treatment of osteoarthritis. Many professional bodies have produced guidelines on the use of topical NSAIDs as first line choice of therapy in the treatment of osteoarthritis (122).

Lidocaine

Various clinical trials have suggested that topical lidocaine (5% medicated plaster) can be effective in the treatment of chronic neuropathic pain (123, 124). However, recent systematic reviews have demonstrated only low quality evidence to support the use of this treatment (99, 100) and it is also included on the NHS England list of medicines with limited effectiveness (90).

Capsaicin

A recent review of topical analgesics for acute and chronic pain in adults, they found that a single-application of a topical high-concentration (8%) capsaicin patch had moderate quality evidence of limited efficacy in peripheral neuropathic pain (125). With respect to topical creams with low-concentration capsaicin (typically 0.025%-0.075%) used for pain relief associated with post herpetic neuralgia, peripheral diabetic neuropathy and osteoarthritis, the authors found that evidence was of very low quality. Evidence on adverse event withdrawals were of very low quality. The authors also commented that there was no evidence in the reviews that specially related to older people.

Summary Statements

- Paracetamol can be considered for sort term treatment but should be used with caution for long term treatment for older patients with chronic pain. The efficacy of paracetamol in chronic pain is poor and there is emerging evidence that long term use can be associated with significant adverse events.

- NSAIDs should be avoided for the management of chronic pain in older people. A short course of NSAIDs can be considered on an individual basis, if the risk-benefit ratio is favourable, using the lowest effective dose for the shortest possible time
- Although opioids may be beneficial in acute pain and at the end of life, there is limited evidence of benefit for many types of long-term pain, such as osteoarthritis and low back pain. Where used, doses should be kept low and intermittent rather than regularly. There are numerous opioids available and the choice will depend on pain intensity and co-morbidities.
- Gabapentin, pregabalin, amitriptyline and duloxetine are recommended as first line treatments for neuropathic pain. Amitriptyline and duloxetine may also have some efficacy in treating other chronic pain conditions, such as fibromyalgia. Caution is advised in older adults due to central nervous system side effects and as such these drugs should be introduced gradually and carefully monitored.
- Topical NSAIDs (ketoprofen and diclofenac) are recommended as first line treatment for short term pain relief in osteoarthritis as a safer alternative to oral NSAIDs in older adults. Capsaicin and lidocaine should only be considered as second line treatments for neuropathic pain.

Psychological and psychosocial interventions to manage pain

The previous guidelines noted that the evidence base for behavioural interventions was limited (2). Yet there is a considerable psychological component of pain which needs consideration. Pain is not only physically debilitating it has the potential to lead to social isolation, anxiety and depression. Hence, psychological methods utilise biopsychosocial approaches to focus on pain as a response to the interaction between nociceptive /neuropathic physical responses, emotions, thoughts and behaviours within a sociocultural context. A Cochrane review undertaken in 2011, (126) considered the potential for psychological interventions for pain management in heterogeneous adult populations and, noted that cognitive behavioural therapy (CBT) has a small effect in adult populations.

Since 2009, the date of the search for the previous guidelines, interest in exploring the effectiveness of psychological approaches has expanded. Within the generic search in Medline ClNAHL and Proquest PsychINFO the following search terms were applied:

psychological, psychology, psychiatric, mental health, depression, anxiety, suicide, self harm, well being / well-being, Cognitive Behavioural Therapy (CBT), cognitive behavioral therapy, compassion, pain management programme, Pain management program, pain self management.

Some 956 papers were identified as potentially suitable using the above criteria (MD & ZM) out of which 53 papers were selected for closer scrutiny.

Using the SIGN criteria (Scottish Intercollegiate Guidelines Network 2015), two reviewers (PS & MD) agreed and graded the following 14 research papers (see table) in this review. The retrieved papers fall broadly into three categories Pain Management Programmes, CBT and other psychological interventions.

Cognitive Behavioural Therapy

Andersson et al (127) in a study of the older people with chronic pain randomly allocated 21 people either to a CBT intervention arm (n=11) or a waiting list. The older people were recruited from a newspaper advertisement for people with chronic neck or back pain. Only minimal effects were noted in the intervention group. In a 2014 study, older people (N=367) with osteoarthritis and insomnia were subject to six weekly sessions of CBT (128). This was a randomised cluster trial with three arms CBT for pain (n=122), CBT for pain and insomnia (n=122) and an educational only group (n=123). Post treatment and nine months later, outcomes measured included pain severity, insomnia severity and depression. Attempts were used to accommodate missing data and linear regression modelling used to estimate all effects at 18 months. What is noteworthy from this study is that the effect sizes for those who received the sleep and pain CBT intervention suggest greater, if only small, potential long-term benefits.

A form of CBT was considered in a 2016 trial (129) with people experiencing hip and knee pain (N=256). The effects of the intervention were noted in this multisite RCT, one group received training in Pain Coping Skills (PCST) whilst the other received the usual care package. Though some small benefits were noted, when utilising pain scales, outcomes in terms of distress and pain catastrophizing showed little improvement. Those of greater age were noted as being more responsive to the intervention. However, reported distress and coping with distress, as experienced by some of the participants, appeared to be confounding factors for interventions involving self-management.

The benefits of CBT as part of a pain management programme were considered in an Australian study of older people (N=141) with a history of chronic (non-cancer) pain (26). Participants were randomised to one of three arms Exercise Attention (n=53), Pain Self-Management (n= 49) and a waiting list group (n=39). Measures including pain intensity, pain distress and pain catastrophizing were considered post intervention, at one month, six month and twelve month intervals.

Regression analyses were applied to consider some of the relationships between outcome measures and it was noted that pain (post intervention) was predictive of pain at one year and pain

catastrophizing was related to the experience of pain and disability over time. However, some overall benefits of CBT over exercise were noted in this population.

Pain Management Programmes

Green and colleagues (30) devised a psychosocial pain management programme for older adult and tested it on 95 older people living in the community. Out of the total 46 received the 10-session intervention and 49 did not. Data was collected post intervention and then 3 months later, pain beliefs and some coping behaviours appeared to improve but overall pain outcomes were not enhanced by the intervention.

In a later study, an intervention involving a three week outpatient 'pain rehabilitation programme, including opioid withdrawal, was applied to three adult age groups, those aged 18--39, the 40-59 age group and those aged over 60 (130). The intervention was assessed using the multidimensional pain inventory (MPI), health, depression and pain catastrophizing scales. The older participants (>60 = 78) reported a greater improvement in all outcomes at 6 months following the programme. The consumption of medication, including opioids, was also significantly reduced. On the whole the older age group in this study did better on a range of assessments including pain severity, depression and perceived control.

Ehrenbrushoff et al (131) considered the evidence for psychological interventions for back pain in older people, finding only three trials (N=271) which were suitable for inclusion. However, there was little evidence that the combination of psychological interventions, mindfulness, CBT and meditation, with physical exercise had any effect when compared with placebo. In a more recent review of psychological approaches Eccleston et al (132) found only three trials which considered older people with small improvements noted following pain management programmes. Heterogeneity of populations, small sample sizes and other methodological issues appeared to confound the findings in each of these reviews. Of note, both reviews identified research largely originating from the same research institute (University of Pittsburgh School of Medicine).

A University of California randomised controlled trial compared acceptance and commitment therapy (ACT) and cognitive and behavioural therapy (CBT) for chronic pain in older and younger adult populations (133). The older participants (n=21) older people were particularly responsive to ACT. The 8-week ACT arm focused on helping the older people to live well with pain rather than reduce it, the benefits were reflected in the responses in the Brief Pain Inventory interference scale.

Residents from 10 nursing homes in Hong Kong who had experienced pain in the last 6 months were randomised to either an integrated pain management programme IPMP (n=296) or a control group (n=239) (134). The IPMP group received an 8-week programme of exercise and either multisensory

stimulation therapy or art and craft activity with significant reduction in measures of pain intensity ($p < 0.001$). However, it cannot be established whether the activity or the exercise component was the beneficial element. In a subsequent study the same team used motivational interviewing and physical exercise programme as an intervention with 56 older people with chronic pain in nursing homes (134). The 31 participants in the 8-week intervention arm showed significant improvements ($p < 005$) in pain intensity, pain self-efficacy, anxiety, happiness and mobility.

Other psychological interventions

A team at the university of Pittsburgh undertook a feasibility study using an 8-week mindfulness programme with older adults (>65) (135). The educational intervention, a Mindfulness-Based Stress Reduction Programme was randomised to 140 in the intervention arm and 142 in the control arm. Unfortunately, short term improvements were not maintained and were statistically insignificant. Another educational intervention utilised by Barefoot and team (136) contrasted the 10-week intervention (n= 23) of a Pain Self-Management Programme incorporating a self-help book with a control group (n= 14). Those in the self-management group found the information helpful but this was not reflected in improved pain using a variety of measures.

Guided imagery, and its potential benefits for older people in pain, was explored in a study of 31 older people in a Thai residential care home (137). Depression, stress, anxiety and pain scales were used in a pre-test post-test study to consider the benefits to two groups; one receiving usual care the other the intervention. After a 16-day intervention period the two groups were compared and no benefits were noted to either group. With such small numbers this study was not generalisable; however the absence of any effects even in a heterogeneous small sample such as this is questionable.

The effect of humour as a pain-relieving intervention was considered in an RCT of older people in Iranian nursing homes with some benefit noted. Humour was utilised in the form of 6 x 60 minute sessions over a period of 6 weeks. The intervention group (n= 28) and control group's experiences were contrasted with the pain intensity in the intervention group significantly lower (138).

It would appear that there is still limited evidence for CBT as an effective treatment for chronic pain in older people however; the numbers of papers which consider pain management programmes and more novel interventions suggest that combined or integrated strategies to manage chronic pain may be beneficial to older populations. It is important to note that amongst these studies there is no standard agreement of the content of what CBT or any of the Pain Management Programmes should consist of.

Physical activity as pain management

Promotion of physical activity is an important component of management of persistent pain in adults, and a recent overview of systematic reviews concluded from the available evidence that physical activity and exercise may help with pain, physical function, psychological function and quality of life, while being associated with few adverse events (139). The quality of the evidence was considered to be low, mainly hampered by the small size of studies, and the findings were not conclusive (139).

This overview was not exclusive to older people with persistent pain yet the findings are consistent with current thinking about this population, expressed in our previous guidance (2)

This is that increase and maintenance of physical activity in older people with persistent pain is important to counter the deleterious consequences of inactivity on fitness, function, independence and quality of life commonly found in this population (2).

Our updated search of literature found more studies focused on people over 65 with persistent pain. However, such studies are still relatively few and high quality evidence in the form of RCTs with low bias remains scarce. The evidence from the studies (140, 141, 142, 143, 144, 145) adds varying degrees of support to our previous interpretation of the evidence that pain and function can be improved with interventions comprising strengthening, flexibility and endurance activities to increase physical activity (2). The previous guidance highlighted the potential of incorporating balance exercises into programmes because of the link between persistent pain and falls in older people (2). That link has since been further demonstrated and balance training was incorporated into new studies (140, 144).

Still live is the question as to which type of exercise should be selected for which type of individual older person with persistent pain. The current crop of papers provide no further insight into this question, which goes beyond the scope of what they set out to do. Still live, therefore, is our previous recommendation, based on conclusions from a review of low back pain for adults of all ages (2) that the selection of activity and exercise should be heavily influenced by the preference of the older person with persistent pain. Such preference will, of course be tempered by the availability and accessibility of required facilities. The new papers (again because it is out of scope of their aims) add little to the previous recommendations that the level of activity should be tailored to the individual's capacity, and the recommendations from American guidelines pertaining to this remain apt (146).

The new papers add to the range of activities that have been applied and evaluated for older people with persistent pain – dance (147), Qigong (148); and modified yoga (149). This points to an increasing set of options to those previously listed - walking, progressive resistance exercise, aerobic exercise, water-based activity, and activities sometimes classed as body-mind exercise like yoga and Tai-Chi. Exergaming, the use of virtual reality and gaming technology for exercise, continues to develop and has been applied for older people with persistent pain. An alluring aspect of exergaming lies in the possibilities of using virtual environments when required real facilities are unavailable or inaccessible.

The previous guidance accentuated the importance of motivation and overcoming barriers to activity and exercise (2).

The basic premise is that activity or exercise will not be of benefit if the person does not actually carry it out, however powerfully its benefits are suggested or prescribed. The previous recommendations were that cognitive-behavioural approaches and supervision should be used to facilitate the benefits of activity for older people with persistent pain. Three studies combined cognitive behavioural therapy (26), counselling (140) and motivational interviewing (143) to their exercise programmes but the effects of these were not tested in isolation from the exercise. Neither of the studies showed any evidence to suggest that such approaches should not be used.

Some of the studies discuss the use of exercise/activity in the context of self-management and the value of exercise/activity for self-management by "aging" adults (as opposed to exclusively adults over 65) with persistent pain has been reported (150). One new study reported the findings of an intervention combining the Chronic Disease self-management Programme with exercise reporting short-term improvement in physical function and possible benefits for pain in older adults with persistent pain (151).

In conclusion, the recommendations from the previous guidelines still apply. While there have been more studies carried out exclusively in older people with persistent pain these are still few in number and of variable quality.

Recommendations/summary statements

- Exercise/physical activity may benefit pain, physical function, psychological function and quality of life
- Exercise should involve strengthening, flexibility, endurance and balance, customised to individual capacity and needs.

- Motivation and barriers to exercise/physical activity should be discussed and planned for.
- Personal preference should be considered as an important motivating factor in negotiation of exercise/physical activity.
- Exercise/physical activity can form an important part of self-management.

Education

A major barrier to persistent pain management is a lack of understanding by the person with pain as to what their pain is and how it affects them. People are more inclined to rationalise their experience of persistent pain in the context of acute pain using a biomedical model of disease and cure that is a poor fit compared to a biopsychosocial model. Education is used as a potential solution to manage pain.

A systematic review of randomised controlled trials of educational intervention for adults with persistent pain concluded that the evidence base for effects of education was of limited quantity and quality; and that there was insufficient evidence of benefits of education on its own on pain or disability (139). This was consistent with the only study included in the review that used a sample of adults over 65 years: this small sized trial reported increased knowledge of pain following education but no effects on pain, while disability was not measured (152). Our current search found no further high quality evidence.

The systematic review of Geneen (139) did suggest that a particular form of education - Pain Neurophysiological Education (PNE) - showed some evidence of a decrease in disability, increase in psychological coping and increase in knowledge about persistent pain. A subsequent meta-analysis of studies investigating PNE showed no significant effects on pain; statistically significant reduction of disability that did not reach criteria of clinical significance; and statistically and clinically significant improvements in psychological coping (153). Neither that review nor our current search found any high quality evidence about PNE specific to adults over 65 with persistent pain. One study, in a subgroup analysis of a sample of adults over 50 with persistent low back pain produced low quality evidence to raise a possibility of PNE increasing understanding about pain for adults between 70 and 79 (32).

While awaiting specific evidence about adults over 65 with persistent pain, it is sensible, in theory and taking a lead from evidence in adults over 18, to recommend that education is offered alongside other pain management approaches.

Interventions

This section represents an update of the 2013 guidelines. It does not replace the previous guidelines and as such these guidelines still stand today. These guidelines examine the same disorders as previously addressed however, there remains limited studies relating to pain in older people.

Trigeminal neuralgia (TN)

No new relevant studies since 2013.

Spinal stenosis

Spinal stenosis is the narrowing of the spinal cord leading to compression of the nerve roots causing back and leg pain. It is commonly associated with lower limb paraesthesias and leg weakness. It is a common condition affecting older adults.

Karm et al (154) reported the results of a randomised, single blinded, active-controlled trial in which 60 patients with refractory central lumbar spinal stenosis with neurogenic claudication were divided into groups who underwent percutaneous epidural adhesiolysis (PEA) using inflatable balloon catheter or not. Patients were assigned to receive either the balloon-less catheter (n=30; 66.1±2.2 years) or the inflatable balloon catheter intervention (n=30; mean age 65.51±6.4 years). The procedural techniques of the interventions were described in detail. The outcomes were measured at baseline, 1, 3 and 6 months after PEA. The results showed significant difference between groups in the Numerical Rating Scale (NRS-11), the Oswestry Disability Index (ODI) and Global Perceived effect of Satisfaction (GPES) and Medication Quantification Scale III. At 6 months there was a significant difference between the groups, pointing to better outcomes among patients who had PEA using the inflatable balloon catheter. The use of inflatable balloon catheter in PEA led to significant pain reduction and functional improvement. It can be concluded that PEA with inflatable balloon catheter is a better intervention option in patients with lumbar spinal stenosis than balloon-less catheter PEA.

In a study of 62 patients with lumbar spinal stenosis, Briggs et al (155) examined the effectiveness of epidural steroid injections. In a single centre, prospective non-randomized, observation study, patients who had not had any previous lumbar injections within 6 months or lumbar surgery were selected. The mean age of patients was 74 years. Following skin preparation and local anaesthesia, a 20-gauge, 3-5-inch Tuohy spinal needle was advanced using a fluoroscopic guidance towards the intended interlaminar target site. A 5mL injectate consisting of 1mL Triamcinolone acetonide [40mg/mL] and 4mL0.5%preservative-free Xylocaine was administered. For the caudal injections the preparation administered was a 10 mL of injectate made up of 1mL triamcinolone acetonide [40mg/mL], 5 mL preservative-free normal saline and 4mL preservative-free 0.5% Xylocaine. The outcome measures were the SF-16 Questionnaire which assesses functional health and wellbeing.

Covariates that could affect responses to pain treatment were also assessed and included gender, age, body mass index, history of hip or knee replacement surgery and comorbidities. The results showed improvement in pain scores at 1 month and 3 months post injection form the baseline. A higher emotional health score at baseline, indicated association with greater pain reduction over 3 months. Similarly, patients who were assessed as obese at baseline showed significant improvement in pain scores over 3 months compared to non-obese patients. The study demonstrated that lower back pain in this group of patients (LSS) can be relieved with injection treatment but varies in association with personal characteristics, patients with healthier emotional status and obesity reporting more pain relief over 3 months post injection. It was not clear from the findings presented and discussed whether or not there was any difference in pain alleviation noted between the caudal and the laminar routes of administration.

Manchikanti et al (156) reported the results of a 2-year follow-up randomized, double-blind, controlled trial of fluoroscopic caudal epidural injections in central spinal stenosis (LCS). The study design was to test the effectiveness of caudal epidural injections with or without steroids in providing long-lasting pain relief in patients with chronic low back pain associated with lumbar central stenosis (LCS). Patients (n=100) were randomly assigned to one of two groups. Group I patients (n=50; mean age 56.9±14.5 years) received caudal epidural injections of local anaesthesia, lidocaine 0.5% preservation-free. Group II patients (n=50; mean age 55.7±15.9 years) were administered epidural injections of 10ml made up of 0.5% lidocaine, 9mls mixed with 1 ml of non-particulate betamethasone, 6mg. This was followed by an injection of 2mls of 0.9% sodium chloride solution to flush the content from the sacral canal. The outcome measures were in part similar to those used by Karm et al (154) and included the Numeric Rating Scale (NRS), the Oswestry Disability Index2.0 (ODI), employment status, and opioid intake. Baseline scores were compared with treatment and control groups at 3, 6, 12, 18 and 24 months intervals. The results showed that patients receiving the intervention reported higher percentage of improvement but without statistically significant difference between the two groups. This led to the conclusion that caudal epidural injections of local anaesthetic with or without steroids effect pain relief in a modest proportion of patients with LCS.

Kamihara and colleagues (157) reported a study into the efficacy of spinal cord stimulation (SCS) for the treatment of leg pain associated with lumbar spinal stenosis (LSS). The leg pain experienced and reported by patients with LSS was considered as mixed pain. It was hypothesised that such pain would respond to SCS treatment. Data form 91 patients, mean age 73.2 years, were collected retrospectively. The procedures used before and during the use of SCS were described, included a

trial stimulation before the SCS was used. The technical procedure and the instruments used were described.

The results included analysis of subgroups. 59 out of the 91 patients had shown 50% or greater alleviation of pain. In all 41 patients underwent the implantation of a pulse generator in the left hypogastric region. 39 out of 41 patients showed a good response to SCS, sustained for one year or longer. The results showed no significant intergroup difference on efficacy.

The authors concluded that SCS was effective in the management of leg pain associated with LSS and deemed useful in pain relief during the time between conservative and surgical therapy.

In another selected study of the use of spinal cord treatment (SCS) in the treatment of of chronic pain in patients with LSS, Constantini et al (157) evaluated the long-term patient outcomes.

Data from three European centres were analysed. 69 patients aged between 46-94 years with a mean age of 70±10.1 years, with intractable chronic pain associated with LSS underwent a similar procedure as described by Kamihara et al (158), in 34 patients a single lead was applied whereas in 35 patients two leads were applied. Pain was measured using a visual analogue scale (VAS), quality of life measured with the Oswestry Disability Index (available for only two centres, N=28) and baseline data was compared with a median follow-up of two years. Results showed that the VAS score improved significantly from baseline readings, with a mean improvement of 63% at 24 months follow-up. Patients also reported decreased use of medication which included opioids and NSAIDS. Patients also reported improved quality of life. It was noted that six patients experienced adverse events in the form of lead dislocation and system infection.

The literature evaluated in this section seem to offer diverse treatment modalities in the management of pain associated with spinal stenosis. Depending on the location of the stenosis, the findings of studies suggest that epidural steroid injections or percutaneous epidural adhelyosis (PEA) can be techniques of choice in specific type of stenosis with equal effectiveness in alleviating pain. Similarly, the results of studies on effectiveness of spinal cord stimulation suggest that in selective cases patients should benefit from pain relief for a considerable length of time if not completely cured. Recommendations for the choice of treatment will be based on thorough medical examination and the results of investigations.

Vertebroplasty & Kyphoplasty

A fresh search of the literature on Medline did not yield any papers that met the inclusion criteria. Most papers were related to fractures.

Postherpetic Neuralgia pain

Postherpetic *Neuralgia* pain (PHN) is a common cause of pain in older adults and is a complication of herpes zoster due to neural ischaemia and can become irreversible.

Ma and colleagues (159) reported a study they conducted with 40 patients with the administration of high-frequency repetitive transcranial magnetic stimulation (rTMS). The mean age of patients was 65.4 years. They termed it a 'sham stimulation controlled randomized trial' with three phases: 1) a baseline optimal medical treatment for 15 days; 2) rTMSsessions for 10 days; and 3) 1-month and 3-month follow-up evaluations. Patient who completed phase 1 were included in phase 2.

The application of magnetic stimulation was undertaken using a magnetic stimulator with a liquid-nitrogen-cooled coil oriented to the scalp. The intervention consisted of 10 sessions, each session comprising of 300 five-second pulses with a frequency of 10 Hz, administered at an interval of 3 seconds between each administration, giving a total of 1500 pulses per session.

The main treatment outcome was pain relief as recorded before stimulation to final stimulation (session 10), and at 1 and 3 months, after final simulation (session 11 and 12). Other outcome measures included pain intensity, using the McGill Pain Questionnaire (sf-MPQ), Visual Analogue Scale (VAS), sleep quality (SQ), depression (Self Rating Depression Scale, SDS), impression of change (Patient Global Impression of Change, PGIC) and medication regulation (MR).

The results showed that there were no adverse events related to the rTMS in either the experimental or control group. The results showed VAS was significantly reduced in the intervention groups than the control group. There were no significant changes reported in the VAS reduction rate associated with age or duration of pain.

The findings suggest that repeated daily stimulation deliver prolonged pain relief lasting 1-3 months than a single rTMS session with effects lasting less than a week. Recommendations

The treatment of postherpetic neuralgia pain in older people is limited to findings of this one study. However, it is clear that repetitive transcranial magnetic stimulation (rTMS) can be of value in selected patients with postherpetic neuralgia in relieving pain for up to 3months.

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Appendix One

Table A: Medicines included in studies

Drug	Studies
Paracetamol	44
NSAIDs	38
Aspirin	3
Celecoxib	8
Diclofenac	11
Etoricoxib	3
Ibuprofen	9
Indometacin	1
Ketoprofen	3
Naproxen	1
Opioids	75
Buprenorphine	22
Codeine	11
Fentanyl	11
Hydromorphone OROS *	7
Morphine	2
Oxycodone	22
Oxycodone/Naloxone	23
Oxymorphone *	1
Propoxyphene *	1
Tapentadol	9
Tramadol	26
Antidepressants	18
Amitriptyline	7
Duloxetine	8
Nortriptyline	2
Venlafaxine	2

Anticonvulsants	25
Carbamazepine	5
Oxcarbazepine	1
Gabapentin/pregabalin	20

*unavailable in UK

Appendix Two: Types of painful condition studied

Condition	Number of studies
Osteoarthritis	9
Renal colic	1
Chronic pain	13
Neuropathic pain	5
Pain in dementia	1
Low back pain	1
Pain in frail older people	1
Osteoporosis	1

Appendix Three: Search Strategies & Terms Used

Main Search as applied in Medline with results on 30.05.18

2009-March2018 inclusive

Limited to English language

S1.

AB ("older adults" OR elder OR elderly OR seniors OR senior OR geriatrics OR aging OR ageing OR "age related" OR "over 65*" OR pensioner) OR TI ("older adults" OR elder OR elderly OR seniors OR senior OR geriatrics OR aging OR ageing OR " age related" OR "over 65*" OR pensioner)

S2.

AB (pain OR "pain management" OR "pain relief" OR "pain control" OR "pain reduction") OR TI (pain OR "pain management" OR "pain relief" OR "pain control" OR "pain reduction")

S1 + S2 combined

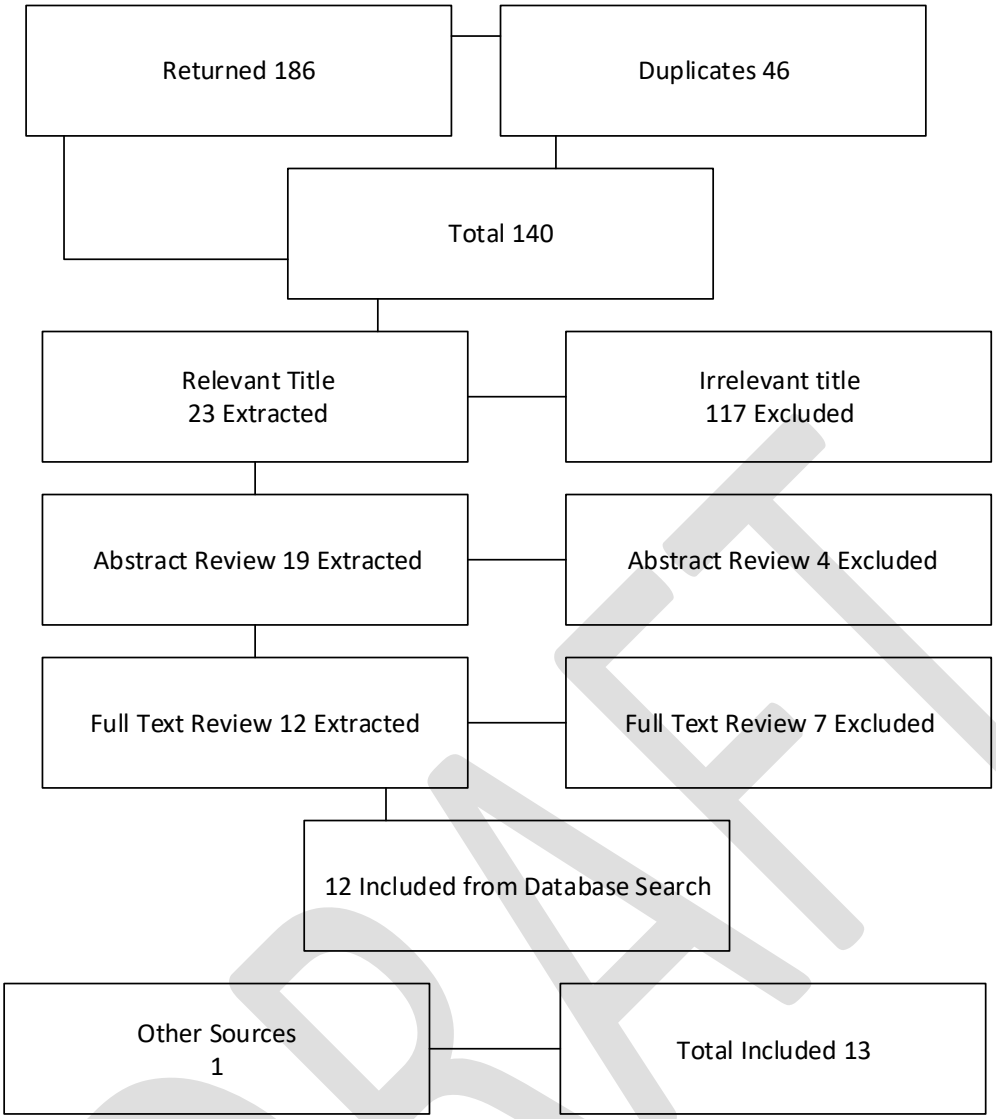
EBSCOhost generic search in Medline AND ClNAHL combined (N= 6751):

Link to search in Proquest PsychINFO (N=1,173)

Appendix Four: Search strategy for attitudes section

In addition to the standard terms used, key search terms used included ‘attitudes’ and ‘beliefs’. A total of 140 papers were identified from database searches and a further 5 from additional searches (reference lists and Google). Following a review of the titles, 117 were excluded and 23 referred for abstract review. Of this 23, 4 papers were excluded and 19 full texts were reviewed. A total of 12 papers were included from the database search. Additional searches returned 5 papers, of which 4 were excluded. A final 13 papers are included in the review (Figure X).

Figure X: Flow Chart for Attitudes & Beliefs Search



Papers were primarily excluded as they either focused on the attitudes, beliefs or education of healthcare providers; reported on populations below 65 years; or did not provide a breakdown of results by age where age-range was spread. The following inclusion and exclusion criteria was applied:

Exclusion Criteria:

- Did not include over 65 years plus.
- Referred to attitudes, beliefs or education of healthcare providers.
- Not published in English.

Inclusion Criteria:

- Studies referring to attitudes and beliefs in relation their impact on: pain intensity, psychological impact, functional impairment, and coping strategies.
- Intervention studies designed to change attitudes and beliefs.

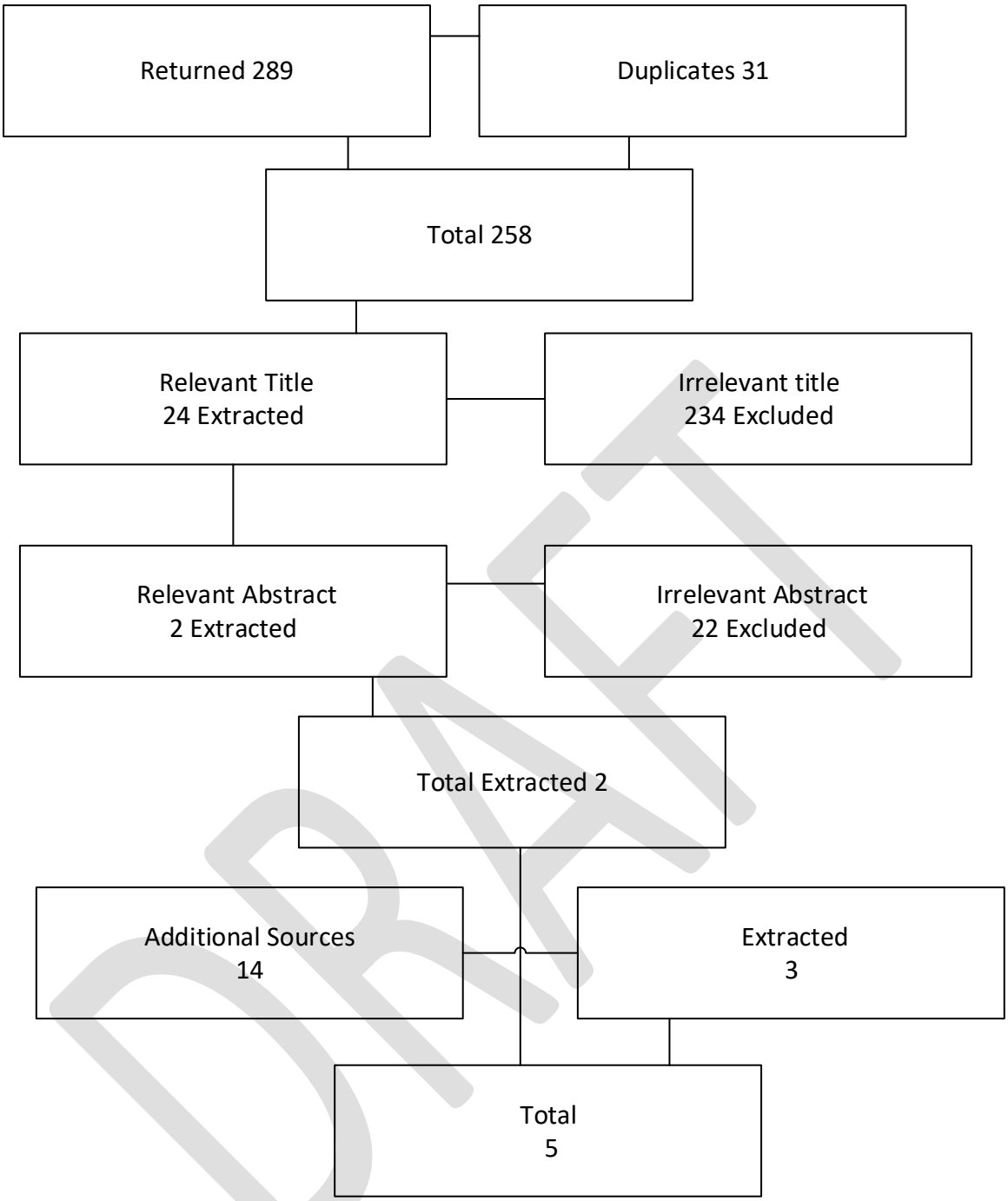
- Reviews including studies from post 2009 only.

Methodologically, most papers included are cross-sectional studies which implemented questionnaires (6), 3 papers used qualitative methods, and 4 papers reported on educational programmes. Given the subject matter, it is unsurprising cross-sectional methods are the most popular form of study design. The absence of RCTs and prominence of cross-sectional methods is reflected in the level of evidence grading which predominantly cluster around grading 2 (Harbour & Miller). Papers were derived from 6 countries, the USA was most popular (6), followed by the UK (2). Other countries included Brazil (1), Australia (1), Spain (1) and Hong Kong (1).

Appendix Four: Guidelines Search Summary

In addition to the standard terms used, key search terms used included 'guidelines' and 'recommendations'. A total of 258 papers were identified from the database searches. Following a review of the titles, 234 were excluded and 24 referred for abstract review. Of this 23, 22 papers were excluded and 2 full texts were reviewed. A total of 22 papers were included from the database search. Given that guidelines were not likely to have been published, rather circulated through pain society websites, additional searches were carried out. These additional searches of pain societies and reference lists from database articles returned an additional 14 papers for review. From these 11 papers 3 were extracted for inclusion. A total of 5 papers were therefore included.

Flow Chart of Search for Guidelines



Papers were primarily excluded as they were opinion or discussion based, providing an overview of expert recommendations or a review of challenges/evidence in the area. Other papers were excluded as they discussed existing guideline content or were not official guideline documents. From additional searches a number of official guideline documents were identified, however only those included actually referred to older adults, or gave significant reference to them. Many guidelines made brief reference or made general recommendations which were not aged discriminative.

The following inclusion and exclusion criteria were applied:

Exclusion Criteria:

- Did not include any or significant reference to older adults (>65 years).
- Not official evidence-based guidelines, based on expert opinion or discussion piece.
- Not published in English.
- Not accessible or open-access.

Inclusion Criteria:

- Evidence-based guidelines referring to pain management in older adults.
- English.
- Published after 2009.

Methodological appraisal was not appropriate for papers included, given that included guidelines have appraised included evidence.

Appendix Five: Carers search

Databases (Medline, CINAHL, PsycINFO, Cochrane and AMED) were searched using the following search terms:

Search terms were the same as Margaret's original S1 + S2 and then combined with (AND) S3.

S3

AB (caregiv* or carer or "informal carer" or "unpaid carer") OR TI (caregiv* or carer or "informal carer" or "unpaid carer")

March 2009- March 2018

English Language

149 papers were initially identified, resulting in a yield of 98 after removing duplications. Titles and abstracts were reviewed independently by two reviewers (GB and SAF) according to the inclusion and exclusion criteria below.

Inclusion criteria

- Unpaid (informal) carers of any age contributing to the care of an older adult aged 65 years and above living with chronic pain
- Chronic pain is defined by self-report
- Naturalistic enquiry with no restrictions on setting of study
- Empirical studies providing data directly from carers
- Peer-reviewed published papers

Exclusion criteria

- Professional/paid carers
- Carers contributing to the care of those under the age of 65 years
- Unpublished theses and conference papers
- Published papers based on expert opinion and/or commentary

Any discrepancies were discussed and a final sample of 10 papers that focused on chronic pain in older adults and the roles of, and impact on, carers were included in the final analysis. Overall, the levels of evidence of the ten articles included in this section of the review were graded as low.

Appendix Seven: Palliative Search

A total of 155 articles were identified by searching the relevant databases. These included AMED, Medline, CINAHL, PsycINFO and Cochrane using the search terms Pain, Pain Management, Older People and the MESH alternatives (older people >65) and any of the following terms Hospice, Palliative, Terminal, Dying, End of Life and Dementia. Many of those initially identified did not relate specifically to older adults aged 65 years and above and were excluded from the review.

Appendix Eight: Attitudes & Beliefs- Pat & Rebecca

Ref No	First Author	Year	Country	Study Design	Methods	Population Studied	Sample/ Response Rate	Age Group	Type of Pain	Results	Grade
	Camacho-Soto, A.	2012	USA	Cross Sectional	Questionnaire	Community	200	Mean age= 73.9 years	Low back pain	Fear avoidance beliefs were significantly associated to poorer physical performance and increased disability.	2
	Cornally, N.	2011	UK	Cross Sectional	Questionnaire	Community	72	60-74 years (57%) 75-84 years (37%) >85 years (6%)	Chronic pain of any location	Help-seeking behaviours were effected by education, gender, pain intensity and level of stoicism.	2
	Green, M.	2009	USA	Intervention	Questionnaire	Community	98 49 control 49 Experimental	Control mean age=77.6 years Experimental mean age= 72.3 years	Musculars keletal	Cognitive behavioural intervention was associated to more adaptive pain beliefs and use of relaxation coping strategies.	2+

	Holden, M.	2012	USA	Cross Sectional	Questionnaire Interviews	Community	1,276 59%	Mean age= 66 ± 10 years 57% female, 43% male	Knee pain	There are many barriers and facilitators to older adults' willingness to engage in exercise. However, less than 50% agreed exercise was beneficial to knee pain.	2
	Hurley, M.	2010	UK	Intervention	Interviews	Community	23	Mean age= 68 years 65% female, 35% male	Knee pain	Integrated exercise-based rehabilitation programme for arthritic knee pain was not associated with improved beliefs about knee pain, however were more willing to engage in exercise to manage knee pain.	2
	Jinks, C.	2010	UK	Cross sectional	Interview	Community	28 16%	Mean age= 66 years 71% male, 29% female	Knee pain	The management of knee pain is the responsibility of the individual.	3

	Louw, A.	2017	USA	Intervention	Questionnaire	Community	50	Mean age= 64 years 56% female, 44% male	Low back pain	Beliefs relating to exercise and ageing were improved following a brief educational intervention.	2
	Makis, U.	2015	USA	Cross Sectional	Interview & focus group	Community	93	Mean age= 83 years 57% female, 43% male	Back pain	Older adults do not seek help for back pain due to age-related beliefs, resistance to intervention/treatment, and competing comorbidities.	3
	Makis, U.	2014	USA	Cross Sectional	Interview	Community	23	Mean age= 86 years 57% female, 43% male	Back pain	Older adults perceive restricting back pain impact upon them physically, psychologically and socially.	3
	Miro, J.	2014	Spain	Cross Sectional	Questionnaire	Community	139	Mean age= 75 years	Chronic pain	Older adults who have maladaptive pain beliefs have greater activity	2

										interference and poorer psychological wellbeing.	
	Nicholas, M.	2017	Australia	Intervention	Questionnaire	Community	141	Mean age= 74 years	Chronic pain	CBT based pain management programme significantly improved disability, distress, depression and fear avoidance beliefs for older adults with chronic pain.	2+
	Teixeira, L. F.	2016	Brazil	Cross Sectional	Questionnaire	Community	532	Mean age= 69 years 85.7% female, 14.3% male	Low back pain	Attitudes and beliefs of LBP is related to depression, disability and poor expectation of return to activities.	2
	Tse, M.	2012	Hong Kong	Cross Sectional	Questionnaire	Nursing home	239	Mean age=	Not reported	Pain related attitudes is positively associated to depression, poorer physical and mental health status, pain intensity and loneliness.	2

Appendix Nine: Informal caregivers and pain management

Reference no	First Author	Year	Country	Population & Sample	Age-older adults	Type of pain	Intervention/Study type	Results	Grade
	Dawber, R.	2016	UK	50 triads of terminally ill patients, informal caregivers and health care professionals recruited from medical wards of an acute general hospital- 65 older adults, 54 informal caregivers, 61 health care professionals	Mean age 75.4 years	Palliative pain	Prospective questionnaire	Agreement on assessment of symptoms was better for informal care givers (ICG) than health care professionals (HCP). The ICG is a better proxy than the HCP and results highlight best proxy pain agreement by the ICG.	2+
	Fowler, J.H.	2015	USA	3 veterans recruited as	86, 89 & 85	Chronic back pain, arthritis	Case study	Findings from three case studies indicate	3

				patients through database screening and clinic visits.		pain, lower back pain		that a behavioural in-home intervention designed to teach caregiver(s) how to recognise signs of pain and distress in people with dementia (PWD) may help prevent the development of aggression and pain in PWD.	
	Hodgson, N.	2014	USA	272 dyads of community dwelling dementia patients and their caregivers participating in a randomised control trial	Mean age 82.1 years	Pain in dementia- not specified	Cross sectional retrospective	Perceptions of the relationship of pain to behavioural and psychiatric symptoms of dementia (BPSD) as reported by informal caregivers as proxy indicate that pain is a more significant predictor of behaviour for individuals with	2-

								severe dementia compared to those with mild/moderate dementia.	
	Hsu, K-Y.	2015	Taiwan	Convenience sample of 28 primary family caregivers of older outpatients with osteoarthritis from a medical centre and regional hospital.	Mean age 74.2 years	Knee osteoarthritis pain	Qualitative descriptive	Older adults commonly shared their pain with their adult children and reflects the importance of family as a support system in Chinese society. Family caregivers observed their older relatives' had limited pain management strategies but provided few pain management strategies to help. Most participants had limited knowledge of osteoarthritis pain and negative attitudes	3

								associated with the use of pain medicine was evident.	
	Kaiser, R. M.	2016	USA	90 year old woman in receipt of care at a hospital and her two children.	90	Abdominal pain	Case study	Paper recounts how poor communication between and among clinical teams is pervasive. The patient and family were not consistently listened to, or integrated, into the clinical team.	3
	Kunik, M. E.	2017	USA	203 community dwelling veterans with pain and dementia and their caregivers.	Mean age 78.21 years	Not specified	Randomised controlled trial	A focused intervention designed specifically for caregivers of PWD at risk of increased aggressive behaviour due to pain, no significant differences in aggression incidence between intervention and control groups	1-

								were found.	
	McPherson, C. J.	2013	Canada	Purposive sample of 18 patients with advanced cancer in receipt of palliative care at home and 15 family caregivers.	Mean age 78 years	Cancer pain	Qualitative descriptive	Cancer pain explored from the perspectives of older patients and their caregivers living at home identified three main themes: 1. Feeling cancer pain 2. Reacting to cancer pain 3. Living with cancer pain The findings emphasise the need to assess cancer pain within the individual's current circumstances in the context of life-limiting illness, caregiving and ageing.	3
	McPherson,	2014	Canada	Purposive sample of 18	Mean age	Cancer pain	Qualitative descriptive	Two main themes incorporating four	3

				patients with advanced cancer in receipt of palliative care at home and 15 family caregivers.	77.7 years			subthemes were identified: 1. Communicating the pain including: their roles in pain assessment, identification and expression of pain, and the communication of pain between patients and caregivers. 2. Finding a solution including: roles and approaches in controlling pain, beliefs about cancer pain control, experience with side effects and perspectives on goals and treatments. An emphasis on dyads rather than separate	

								experiences of patients and caregivers gives credence to the interactional process of caregiving.	
	Murray, T. M.	2012	USA	Convenience sample of 115 PWD and 150 caregivers recruited as dyads from an outpatient geriatrics clinic.	81 +/- 7 (SD)	Limited verbatim examples of pain outlined in the paper	Retrospective	Pain was the leading symptom reported by PWD and caregivers.	3
	Pillemer, K.	2017	USA	285 older mothers and 678 adult children participating in a longitudinal project designed to understand the quality of	Mean age 71 years	Self- report. Not specified.	Survey	No effects on emotional closeness or tension in relationships between adult children and older mothers who experienced higher levels of persistent pain.	2-

				intergenerational relationships.					

Appendix Ten: Palliative Care

Reference no	First Author	Year	Country	Population & Sample	Age-older adults	Type of pain	Intervention/Study type	Results	Grade
	Bandieri	2012	Italy	survey of patient data32 Italian cancer hospitals N=1450	mean 65	cancer pain	Standard care (602) compared with palliative and supportive care ePSC (848)	ePSC integrated with primary oncologic care (relative risk 0.69; 95% confidence interval 0.48-0.99; P=0.045) was an independent factor associated with a 31% reduced risk of suffering from severe pain. An ePSC team provides the most effective standard of analgesic therapy for cancer pain.	2
	Fisher	2014	Canada	657 people with colorectal cancer in Nova Scotia	>66	cancer pain	retrospective data analysis	36.7% filled at least one prescription for any opioid in the six months before death.	3

								Persons were less likely to fill a prescription for a strong opioid if they were older (OR=0.97, 95% CI=0.95-0.99), male (OR=0.59, 95% 0.40-0.86), and diagnosed less than six months before death (OR=0.62, 95% CI=0.41-0.93).Conclusion: Palliative Care Programme (PCP) may play an important role in enabling access to end-of-life care within the community.	
	Herr	2010	USA	16 US hospices N=399	>65	cancer pain	Experimental interventional study pain intensity following evidence based practice pain interventions	83.5% of patients with admission reports of pain had an order for pain medication. review of the pain	2+

							(EBPs) and guidelines	treatment plan at each reassessment (35.7%); reassessment of moderate or greater pain (5.3%); consecutive pain reports of 5 or greater followed by increases in pain medication (15.8%); monitoring of analgesic-induced side effects (19.3%); initiation of a bowel regimen for patients with an opioid order (32.3%); and documentation of both nonpharmacological therapies (22.5%) and written pain management plans (0.6%). Findings	

								highlight positive EBPs and areas for improving the translation of EBPs into practice.	
	Laguna	2012	USA	484 seriously ill patients at a Los Angeles Hospital with life threatening, complex, chronic conditions	>65	Mixed, acute & chronic	Longitudinal cohort study, 2 year Pre-test post test	Mean pain was significantly different between baseline and later measurement Findings support IPC teams' effectiveness in managing pain during hospitalization but suggest a lack of continuity in pain management following discharge.	2
	Laguna	2014	USA	385 People with life threatening chronic	>65	Mixed, acute & chronic	retrospective Effects of inpatient palliative care on self-reported pain, and	Individuals were asked to rate their pain intensity at four points during hospitalisation	3

				conditions in a Los Angeles medical centre			differences between white, black and latino people	All experienced significant reductions in pain after the intervention. Despite pain decreases, Latinos remain more likely than whites to report pain at follow-up.	

Appendix Eleven: Pharmacology

Ref No	***First author***	***Year***	***Country***	***Study design***	***Methods***	***Drug and class***	***Sample / response***	***Age group***	***Type of pain***	***Results***	***Grade***
(Abou-Raya, Abou-Raya and Helmii, 2012)	Abou-Raya	2012	Egypt	RCT	Randomised 1:1 Placebo	Duloxetine (antidepressant)	278 patients VAS WOMAC	>65 years	Osteoarthritis	Significant reduction in WOMAC pain scores at 16 weeks	1-
(Biondi et al., 2015)	Biondi	2015	USA	RCT (pooled)	Secondary analysis	Tapentadol	210 patients NRS	>75 years	Osteoarthritis	Significant pain relief (100-250 mg twice daily) vs placebo	2++
(Chan et al., 2017)	Chan	2017	China	Cohort	Randomised 1:1	Naproxen Celecoxib	514 patients GI side	Mean age 72	Osteoarthritis	Incidence of recurrent GI bleeds over 18 months:	2++

					No placebo		effects	years		Naproxen 12.3% Celecoxib 5.6%	
(Chaparro et al., 2013)	Chaparro	2013	USA Canada	Systematic Review		Opioids	15 studies 5540 patients Pain intensity		Chronic low back pain	Low-medium quality evidence for short term efficacy for opioids versus placebo. There is no support for long term use of opioids.	
(Conaghan et al., 2011)	Conaghan	2011	UK	Open label	Randomised No placebo	Buprenorphine (7 day patch; 5-25 microg/hr) Co-codamol (various doses)	209 patients BS-11 pain score WOMAC	Mean age 71 years	Osteoarthritis	Approximately 50% reduction in pain scores. High drop-out rate and high incidence of adverse events both groups (86%-89%)	2++
(Derry et al., 2019)	Derry	2019	UK	Systematic review	Cochrane Systematic review	Pregabalin	8 studies 3283 patients		Neuropathic pain (various)	Moderate quality evidence for efficacy of pregabalin (300-600mg per day) for neuropathic pain	1+
(Derry et al., 2018)	Derry	2018	UK	Systematic review	Cochrane Systematic review	Non-steroidal anti-inflammatory	39 studies 10,361 patients	59-65 years	Musculoskeletal	Topical diclofenac and ketoprofen can provide good pain relief for	1++

						drugs (NSAIDs; topical)				minority of people. Some evidence that substantial placebo effect from carrier gel.	
(Derry et al., 2017)	Derry	2017	UK	Systematic review of reviews	Cochrane Systematic review	NSAIDs (topical) Lidocaine (topical) Capsaicin (topical)	13 Reviews 206 studies 30,700 patients	Not defines	Musculoskeletal Neuropathic	Limited efficacy of topical diclofenac and ketoprofen in chronic hand and knee osteoarthritis. Limited efficacy of capsaicin in post herpetic neuralgia	1+
(Derry et al., 2015)	Derry	2015		Systematic review	Cochrane Systematic review	Nortriptyline	6 studies 310 patients	49-64 years	Neuropathic pain	Low quality evidence for no efficacy of nortriptyline in neuropathic pain	1-
(Derry and Moore, 2014)	Derry	2014	UK	Systematic review	Cochrane Systematic review	Lidocaine (topical)	12 studies 508 patients	57-77 years	Neuropathic	No evidence to support use of topical lidocaine to treat neuropathic pain	1++
(Finnerup et al., 2015)	Finnerup	2015	Denmark USA	Systematic review	Meta-analysis	Various	229 studies		Neuropathic	Strong recommendation: tricyclic antidepressants, serotonin-noradrenaline	1++

			Germany France Finland							reuptake inhibitors, gabapentin and pregabalin Weak recommendations: tramadol, lidocaine patches, capsaicin	
(Fleet et al., 2018)	Fleet	2018	Canada	Retrospective, population study	Record review	Gabapentin	110,184 patients Incidence of hospitalisation	>65 years	Altered mental state	Initialisation of treatment with higher doses of gabapentin (>600mg per day) resulted in higher risk of hospitalisation versus lower doses (<600 mg per day)	2+
(Gallagher, Leighton-Scott and van Staa, 2009)	Gallagher	2009	UK	Retrospective cohort study	Record review Matched cohorts	Buprenorphine (patch) Compared with codeine, dihydrocodeine or tramadol)	4968 patients Treatment persistence	62% of patients >65 years	Osteoarthritis (48.7%)	Small but significant increase in persistence with buprenorphine patch treatment over 6-12 months compared to other opioids.	2-
(Guerriero et al., 2016)	Guerriero	2016	Italy	Open label prospective study	No placebo	Oxycodone-naloxone	50 patients >30% reduction in	>70 years		78% of patients experienced pain reduction >30% after 52	2+

							pain (NRS)			weeks	
(Gupta and Li, 2013)	Gupta	2013	USA	Placebo controlled RCT	Phase III	Gabapentin (gastroretentive)	732 patients ADP SIS	(531 <75 years; 192>75 years	Post-herpetic neuralgia	Significant reduction in pain scores for >75 years or <75 years versus placebo.	1+
(Haß et al., 2009)	Haß	2009	Germany	Cost effectiveness analysis	Probability analysis	Opioids	QALY (Quality adjusted life years)			Buprenorphine was superior to fentanyl and oxycodone in terms of QALY and lower cost	3
(Hemmingsson et al., 2018)	Hemmingsson	2018	Sweden	Cross sectioned surveys		Opioids	4933 patients (2814 in 2007 and 2119 in 2013) Medication use	Mean ages 84.6 years (2007) and 85 years (2013)		Increase in overall use of opioids between 2007 (62.8%) and 2013 (66.5%)	2+
(Imamura,	Imamura	2015	Japan	Open label		Tramadol	24 patients	Mean	Chronic low	A significant reduction in	3

2015)						Paracetamol	VAS RDQ	age 65.1 years	back pain	leg pain was observed after 1 week. Lower back pain was reduced after 1 month	
(Kim et al., 2013)	Kim	2013	Korea	Case review	Database	Carbamazepine	286 cases 1,144 controls Adverse skin reactions	>65 years	Neuropathic	Carbamazepine is associated with a 10-fold increased risk of severe skin reactions in older adults.	3
(Lazzari et al., 2016)	Lazzari	2016	Italy	Single-centre, retrospective, observational study		Oxycodone/naloxone	186 patients API	>75 years	Various	60% of patients reported a pain improvement of ≥ 30% after 60 days with a decreased use of laxatives.	3
(Lee, Lakha and Mailis, 2015)	Lee	2015	USA	Retrospective chart review		Morphine (oral liquid)	10 patients NRS	Mean age 75.5 years	Neuropathic (9) Musculoskel etal (1)	After 14 months, patients reported a mean 3.4 point reduction in NRS with morphine (5-30mg/day)	3
(Lunn, Hughes	Lunn	2014	UK	Systematic review		Duloxetine	12 studies 4977		Neuropathic pain	Duloxetine at 60-120mg per day is effective in the	1+

and Wiffen, 2014)									Fibromyalgia	treatment of chronic neuropathic pain (moderate quality) and fibromyalgia (low quality)	
(Machado et al., 2015)	Machado	2015	Australia	Systematic review with meta-analysis		Paracetamol	13 studies (RCTs)	Mean age of 7/13 studies >60 years	Spinal pain Osteoarthritis	Paracetamol is ineffective at reducing pain intensity or improving quality of life in patients with low back pain	1+
(Makris et al., 2014)	Makris	2014	USA	Case report and review		Various	92 studies 3 patients			Conservative approach to pain management in older adults recommended. Avoid use of NSAIDs	3
(Mejjad, Serrie and Ganry, 2011)	Mejjad	2011	France	Observational prospective study		Paracetamol Tramadol	2663 patients	>65 years		64.8% of patients reported a reduction in pain intensity (-3.1 points) after 1 month.	2
(Micca et al., 2013)	Micca	2013	USA	Post hoc, subgroup analysis of		Duloxetine	487 patients NRS BPI	>65 years (mean	Osteoarthritis (knee)	A significant reduction in pain intensity over 13 weeks vs placebo in both	1-

				2 RCTs				72) <65 years (mean 56)		younger and older groups. A significantly greater discontinuation due to adverse events in older vs younger groups	
(Moore et al., 2015)	Moore	2015	UK	Systematic review	Cochrane Systematic review	Amitriptyline	17 studies 1342 patients		Neuropathic pain	Low quality evidence for limited efficacy in neuropathic pain.	1-
(Nissen et al., 2016)	Nissen	2016	Various	Cohort study		Celecoxib Naproxen Ibuprofen	24,081 patients Cardiovascular adverse events	Mean age 63 years	Osteoarthritis Rheumatoid arthritis	The risk of cardiovascular AEs was the same for celecoxib, naproxen or ibuprofen. The risk of GI AEs was lower for Celecoxib versus naproxen or ibuprofen.	2+
(Oomens and Forouzanfar, 2015)	Oomens	2015	Netherlands	Systematic review		Various	18 studies	Age 34-84 (mean 58) years	Trigeminal neuralgia	Lack of evidence does not allow any recommendations for first line treatment in the elderly.	1-

(Petrò et al., 2016)	Petrò	2016	Italy	Prospective, open label study		Oxycodone-naloxone	53 patients NRS	Mean age 83 years		A significant reduction in pain intensity (6.6±1.0 vs 2.3±1.1) after 45 days.	2-
(Roberts et al., 2016)	Roberts	2016	UK	Systematic review with meta-analysis	Cohort studies	Paracetamol	8 studies	<65 years	Various	Significantly increased risk of cardiovascular and gastrointestinal adverse events, and mortality with regular paracetamol.	2++
(Sakai et al., 2015a)	Sakai	2015	Japan	Open label prospective trial		Pregabalin Tramadol/paracetamol	32 patients VAS	Mean age 72.5 years	Low back pain (+/- neuropathic pain)	Pregabalin produced a small but significant reduction in pain intensity after 4 weeks. Tramadol/paracetamol produced a small but significant reduction in pain after 2 weeks	2-
(Sakai et al., 2015b)	Sakai	2015	Japan	Open label prospective trial		Pregabalin	32 patients VAS	>65 years	Low back pain (+/- neuropathic pain)	23/32 patients reported good or excellent pain relief after 4 weeks	2-
(Saragiotto et al.,	Saragiotto	2016	Australia	Systematic review		Paracetamol	3 trials 1825 patients		Low back pain	No significant difference was noted between	1-

2016)							Pain intensity QoL			paracetamol and placebo	
(Solomon et al., 2010)	Solomon	2010	USA	Matched cohort		Opioids	6275 patients	Mean age 78	Various	Significant variation in the safety profile of each medication reviewed.	2++
(Sullivan et al., 2009)	Sullivan	2009	USA	Single blind, placebo run-in trial		Duloxetine	25 patients	Mean age 64 years	Osteoarthritis pain	A significant improvement in patient reported pain scores and physical function after 10 weeks.	1-
(Swart et al., 2017)	Swart	2017	Netherlands	Systematic review	Cohort studies	Opioids	6 studies			Tramadol and meperidine had increased risk of delirium compared with other opioids	2-
(Trelle et al., 2011)	Trelle	2011	Switzerland	Systematic review with meta-analysis		NSAIDs	31 studies 116,429 patients			All NSAIDs reviewed had increased risk of cardiovascular adverse events.	1++
(Wiffen et al., 2017)	Wiffen	2017	UK	Systematic review		Gabapentin	37 studies 5914 patients		Postherpetic neuralgia Diabetic neuropathy	Moderate quality evidence that gabapentin is effective in some people with neuropathic	1+

										pain at doses of >1800 mg per day	
(Wiffen et al., 2014)	Wiffen	2014	UK	Systematic review		Carbamazepine	11 studies 480 patients		Trigeminal neuralgia Diabetic neuropathy Post stroke pain	Limited efficacy in neuropathic pain with relatively high incidence of adverse events. Adverse event withdrawal was common (11%)	1+
(Wolff et al., 2012)	Wolff	2012	Various	Systematic review		Buprenorphine (patch) Fentanyl (patch)	56 studies			Buprenorphine patches were better tolerated than fentanyl and may offer reduced incidence of adverse events for older adults.	1+
(Zeng et al., 2018)	Zeng	2018	China UK	Systematic review with meta-analysis		NSAIDs (topical)	36 RCTs 7 observational studies		Osteoarthritis	Topical NSAIDs are effective and safe for osteoarthritis pain	1++
(Zhou et al., 2017)	Zhou	2017	China	Systematic review		Oxcarbazepine	5 studies 862 patients		Diabetic neuropathy Radiculopath	Little evidence to support the use of oxcarbazepine in neuropathic pain	1+

									y		

Key : ADP: average daily pain, API: average pain intensity, BPI: brief pain inventory,PHQ-9: Patient Health Questionnaire-9, SIS: sleep interference score, VAS: visual analogue scale, NRS: numerical rating scale, WOMAC: BS-11: ,RDQ: Roland-Morris Disability Questionnaire, QoL: Quality of life

Appendix Twelve: Psychology

							SIGN grade
Andersson	2011	Group based CBT	RCT	11 Exp 10 Control 72 years +	Canada	Supports CBT. But numbers very small	3
Barefoot	2012	Pain Management workbook	RCT	54 Exp 46 Control 65 years +	Can	Satisfied with PSM manual but recommends more research	3
Behrouz	2017	Humor therapy in nursing homes. 73 years	RCT Random allocation	N = 28 Exp N = 27 Control	Iran	Significantly lower pain in experimental group	3
Broderick	2016	Pain Coping Skills Training	RCT	N=256	USA	small improvement in pain noted, greater in oldest participants	3
Darchuck	2010	complex intervention including 3 week Pain Rehab Programme	Quasi experimental time series	N=411 older N=78	USA	reports of significant improvements at 6 months post treatment	1
Elsegood	2012	Guided imagery	pre-test, post-test study	N=31	Thailand	No significant effect noted	1
Green	2009	Pain Management programme (tailored for older people)	RCT random allocation	N=46 experiment	Canada	Some changes in pain beliefs and behaviour	3

				N=49 wait		noted in oldest participants	
McCurry	2014	CBT for pain & insomnia	cross sectional study-Three experimental arms	N=367	USA	CBT no significant benefits noted	1+
Morone	2016	Education v Mindfulness	RCT	N=282 N=140 mind body programme N=142 education	USA	only short term benefits of intervention	3
Nicholas	2017	Training in pain self-management	RCT	N=141 N=53 control N= 49 intervention N= 39 waiting	Australia	significant effects of CBT at 1 year	3
Tse	2012	Integrated pain management programme	cluster RCT	N=535 N= 296 intervention N= 239 control	HK, China	post intervention significant reduction in pain intensity noted	3
Tse	2013	motivational interviewing and physical exercise	RCT blinded	N=56 N=31	HK, China	Significant improvements in pain intensity	3

				intervention N=25 control			
Weatherell	2016	compared acceptance and commitment therapy (ACT) and cognitive and behavioural therapy (CBT)	randomised controlled trial	N=114 N=21(>65)	USA	Older adults more responsive to ACT	3

Appendix Thirteen: Physical Activity

First author	Year	Study design	Intervention	Sample	Age	Main results	Grade
Foley	2011	RCT	The two experimental interventions were gym-based exercise programmes (including resistance, Aerobic, flexibility and balance training) varying only in frequency of delivery: either once or twice a week, directly compared with usual care (control).	Community-based exercise centre for older adults, located in Metropolitan Adelaide, South Australia.	Intervention means (SD), 78.5 (6.8) 78.3 (6.5) Control Mean (SD) 79.9 (8.4)	Most of the outcomes (69%, 11/16) were maintained over the intervention period with no Significant group effects detected. Physical activity levels recorded in the control group showed a significant proportion of participants were actively exercising once weekly	1+
Oesch	2017	Non-blinded randomized controlled clinical trial	the effect on adherence, motivation, enjoyment and balance abilities of conventional self-regulated exercises with exergames older people	Walenstadtberg Rehabilitation Clinic in Switzerland. Older people who are referred	>65	No benefit was found for self-regulated exergames compared with self-regulated conventional exercises regarding adherence, measured as	1+

				for inpatient rehabilitation from acute hospitals or by general practitioners.		daily training volume	
Abd El-Kader	2016	RCT !	Group (A) received treadmill aerobic exercise, while the second group (B) was considered as a control group and received no training intervention for two months.	Forty elderly patients with Alzheimer's disease with age ranging from 65 to 75 years	Intervention group 68.94 (5.76) CG 69.13 (6.12)	Treadmill walking exercise training is an effective treatment policy to improve quality of life, systemic inflammation and psychological wellbeing in Alzheimer's.	1+ or ++

Chae	2013	Pilot study! Non-comparative	All participants performed a program which consisted of stretch and strength exercises with traditional therapy 10 w	12 patients who were hospitalized with a physician diagnosis of knee OA rehabilitation facility in Seoul.Ko	Male 73.7 (5.4), female 76.2 (5.0)	After the 10 weeks exercise, RF, VL, and VM activities of all participants had significant increased and pain the knee had significantly overall in the program	3 – pilot non comparative study
Krampe	2014	Feasibility study-comparative randomised	Two-group pre-post test 12 week (24 sessions) Healthy-Steps intervention group n=19vwith a wait-list control group n=15. The wait-list control group did not participate in the dance sessions during the study but continued normal activity.	37senior apartment residents (31 females; with lower extremity pain/stiffness	IG 79.4 (8.75) CG 81.7 (9.1)	Healthy-Steps dance-based therapy is a feasible option with preliminary efficacy for increasing gait speed for older adults with lower extremity pain/stiffness. Also, results showed no statistically significant reduction in pain/stiffness between	1+

						the two groups. However, compared to baseline, there was a suggestion of pain/stiffness reduction within the dance group (P ¼ 0.094)	
LAU	2014	Pilot study with before and after design – non comparative	individual and group exercises were delivered twice a week for 10 weeks in a public indoor swimming pool by registered physiotherapists	Elders aged 65 years and above attending any one of the four EHCs in Kowloon, Hong Kong.	Mean age 70 (2)	In this study, the intervention was associated with a reduction in knee pain, improved strength of knee extensors, improved knee ROM, and overall body balance; all of which were confirmed by improvements in the sit-to-stand test.	3
Tse 1	2014	RCT	PEP was an eight-week training program given by physiotherapist and nurses once a week. It consisted of warm-up exercises, muscle	396 Older persons living in nursing homes who had suffered from	IG with PEP (n ¼ 225, age ¼ 85.45 (6.2), CG without the	eight-week PEP, including muscle strengthening and stretching for the painful areas, balancing, and self-administered acupressure,	1 +

			strengthening, stretching, balancing, and self-administered massage to acupressure points. The control group received no training during the eight weeks	musculoskeletal pain six months prior to the study	PEP (n ¼ 171, age ¼ 85.44 (6.35).	was effective in reducing pain and improving psychological function and joint mobility. In addition, the participants who attended the PEP had significantly lesser pain than those who had not received the PEP	
Avelar	2011	RC clinical trial	The intervention lasted for 12 weeks, 3 times per week. The participants were randomized into two groups: (1) squat training with whole-body vibration, and (2) squat training without vibration	23 elderly persons volunteer to participate	Age (years) VG 75 (5), EG 71 (4)	Comparison between the functional performance of participants in the postintervention period and at baseline shows an improvement in the group of individuals allocated to WBV associated with squatting exercises in all the functional tests.	1+
Brovold	2012	RCT	For the the IG The exercise program consisted of	108 participants recruited from	79 (6.5) 79 (6.9) 80 (6.1	The results from this study show that the additional	1++

			counselling, balance- and progressive resistance training and support from the physical therapist at Geriatric Day-Hospital (GDH) and after discharge at home. (2 phases). The Control-group received counselling, balance training and support from the physical therapies	GDH in Norway were randomized into the (IG) (n = 53) or (CT) (n =55).		resistance exercises for the IT-group resulted in less pain and more energy after 12 weeks of training but that participants in both groups (balance only and combined resistance and balance) reported increased their physical functioning	
HUI	2009	RCT	Intervention group (IG), which included 23 sessions of dance (ow impact aerobic dance) over 12 weeks, or a control group (CG) were they continue their usual daily activities. All participants were assessed at baseline and 12 weeks.	111 community-dwelling volunteers were recruited from ten social centers for seniors in the Shatin District of Hong Kong	IG 68.0 (4.5) CG 69.1(4.2)	For the 'body pain' domain in SF-36, the mean score of IG decreased from 78.67 to 76.92 (score difference -1.75) from baseline to 12 weeks, whereas the mean score in the CG increased from 74.62 to 81.00 (score	1++

						difference + 6.38).	
Park	2014	quasi-experimental research design	The intervention group for Sit and Fit yoga consisted of two 45-minute sessions per week for 8 weeks. CG received a Health Education Programme (HEP) program consisted of two 45-minute sessions per week for 8 weeks. Participants in this group received general health education about OA.	38 Participants were recruited from the senior center in Broward County, Florida. Some with AD who randomised to the IG not to the CG which involved attention .	Mean Age 79 (6.42)	There was no significant difference between groups in initial pain level (HEP = 13.06, yoga = 13.85, *P* = .819). The fixed effects indicated no significantly greater decrease in perceived pain over time for the chair yoga group when compared with the HEP group (*P* = .234)	1+
TSE (pain concept)	2014	quasi experimental with pre-post-test design	The intervention is allocated to 2 groups MSET and MSCT, which consisted of 6 sessions about 1.h hours each. Each session was divided into 2 parts: 1) a multi-sensory stimulation session 2) 30 min teaching exercise for the MSET and	82 participants recruited from 2 elderly community centres allocated into 2 groups 43 for MSET and 39 for the MSCT.	Mean Age 72 (9.5), 71 (8.4)	Both groups reported significant improvement in PA, anxiety scale, happiness scale, and significant pain reduction.	1+

			coping skills training for the MSCT				
Kuss	2016	Phase I/phase II trial of a complex intervention. A mixed methods design	specifically adjusted GA treatment regimen to the needs of older adults with chronic low back pain, these adjustments were then paired with educational messages and a few carefully chosen exercises requiring frequent repetitions	16 community dwelling older adults with chronic low back pain and three primary care physical therapists attempted the program	Mean (73.965.9 years on average)	There was a clinically relevant increase in physical function by 20.3%, and a decrease in pain intensity	2++
Oh		!! Cross-sectional Survey !!					
Hasegawa	2013	Non-randomised control trial	The intervention group involved attending a 2-h weekly exercise session for a total of 12 classes. Each session included a 30-min	These participants were divided into two groups: IG	Mean for women 74.6 (4.8), for Men 78.8 (3.4)	For the 144 participants with knee pain who completed the trial, there were no significant differences in	1+

			health check-up and 90 min of lecture plus exercise. The control participants were only observed throughout the 12-week Experimental period.	(n = 98) take part in the exercise class; CG (n = 222) who did not wish to join the exercise class, but agreed to cooperate in the survey.		either VAS or WOMAC pain score at baseline between the intervention and control groups. In men, none of the indices showed significant differences	
Irandoust	2015	Design not mentioned!! It is likely epermintal Quasi randomised CT	The aquatic program was conducted in a heated pool (depth 1.20m) at water temperatures between28 and 3°C consisted of 2 aerobic sessions and 1 session of resistance training. All sessions lasted 60 min and included a warm-up period (10 min), the main program (40 min), and a cool down period (10	32 elderly men from Qazvin, Iran	Aquatic training, with a mean age of 68.4±2.9 yr (3 d/wk for 12 wk), and a control group (67.6±3.1 yr).	Low back pain significantly decreased in the aquatic training group ($p<0.05$)	1+ or ++ !

			min). The aerobic regimen included exercises such as water walking, jogging, walking and jogging in combination with various arm movements, sidestepping, water cycling, and adapted water games (volley and basket). The subjects in the control group did not participate in any kind of exercise program. They were asked to carry out their usual daily activities.				
Kim H.	2013	RCT	Women with knee pain (*n* = 150) were randomly assigned into four groups; exercise (Ex) and heat/steam generating sheet (HSGS) (*n* = 38), Ex (*n* = 37), HSGS (*n* = 38), or health education (HE) (*n* = 37. Ex group	302 who reported knee pain in the baseline survey were classified as potential participants	>75	The results showed VAS improvements in the Ex + HSGS and HSGS groups. Total JKOM score, muscle strength, and functional mobility significantly improved in the Ex + HSGS group compared with the	1++

			attended a 60-min comprehensive training program twice a week for 3-months			HE group. The combined effects of both Ex and heat therapy seems to have an added benefit of decreasing pain	
Kim M.	2016	Single blind RCT	Self-exercise with a therapeutic inflatable ball (SEIB) and US therapy (twice weekly for 4 consecutive weeks).	Forty elderly individuals participated in the study. All participants had MTrPs in the upper trapezius on at least one side for 3 months or longer	SEIB (n = 22; mean age, 70.23 – 6.11 years) or ultrasound (US) therapy (n = 18; mean age, 67.99 – 5.64 years)	The noninferiority test indicated that SEIB was not inferior to US for VAS, PPT, and CLF. SEIB for 4 weeks has an effect similar to that of US for desensitizing myofascial pain and increasing joint flexibility	1 +
Marconcin	2018	RCT	The SMEG (the treatment group) performed a 90-minute intervention twice a week for 12 weeks. The first 30 minutes of each session constituted the self-management component,	67 participants recruited from within a community in Portugal , completed the study : 32 in the	mean age 69.1±5.8 years	The main findings of this study demonstrated that the participants in the SMEG had significantly better results after the intervention than the individuals in the EG in the	1+

			and the following 60 minutes were allotted for the exercise component. The EG (the control group) received a book,12 telephone calls, and three education sessions. Both groups (SMEG and EG) also received a supplement of glucosamine (1500 mg) and chondroitin (1200 mg) sulfates, harpagophytum extract (100 mg), and hyaluronic acid (10 mg) with a recommendation for the use of two sachets per day	Educational Group and 35 in the Self-Management and Exercise Group		CWP scale (a component of the self-management behavior variable) and health-related physical fitness measures (aerobic capacity and functional lower limb strength)	
Peungsuwan	2014	RCT	The TPT and SPT programs consisted of two phases. The first phase include class-based TPT and SPT group intervention programs at an appointed public indoor	31 patients with KOA aged 50–85 years from two selected villages with similar socioeconomic	Mean age SPT group 69.8±8.4 TTP group 67.8±6.4	After 2 months, the six-minute walk test (6MWT), Western Ontario and McMaster Universities Arthritis Index (WOMAC), and SF-36 testing showed	1++

			area. The second phase was performing the actual home self-care program with TPT or SPT alone, at least three times/week for twelve months. Each exercise was performed five times/session, two sets/day, and this was increased every two weeks until reaching 40 times/session	statuses in a suburban community of Khon Kaen Province, Thailand		significant improvement in both groups, but the improvement of the TPT group was greater. After 1year, only the score for the 6MWT was greater in the TPT group than in the SPT group. [Conclusion] The TPT program yielded better results for the 6MWT, but, both programs had beneficial effects on the pain, function, and QOL of middle-aged and older patients with KOA in the community setting.	
Tse 2.	2013	Single blinded RCT	8-week MIE was developed for community-dwelling older persons with chronic pain. A weekly session provided for 15 hours in the community centres. The	Participants were recruited by convenience sampling in two elderly community	>65	Significant improvements in pain intensity, pain self-efficacy, anxiety, happiness and mobility after the motivational interviewing and physical exercise	1++

			programme consisted of two main components: MI counselling, also regarded as pain education, and physical exercise, regarded as a pain controlling and coping skill. At the same time, the control group followed their regular activities in the centres during the eight weeks	centres in Hong Kong with similar locations and demographic status.		programme ($p<0.05$) for experimental group, while no significant improvement in control group except on the happiness scale.	
Von Trott	2009	RCT	Patients were randomly assigned to 1 of the 2 treatment groups (qigong or exercise therapy) or the waiting list group in a 1:1:1 ratio. Both qigong and the exercise therapy consisted of 24 sessions (each 45 minutes), were held over a	117 patients were recruited at 4 residences for elderly people, all situated in central Berlin (Germany). All patients were mobile and lived	Mean age for : Q 75.9 (7.6) E 76.0 (7.2) W 75.7 (7.6)	The study found no significant effect after 3 months of qigong or exercise therapy compared with no treatment. Also, no significant differences for pain, neck pain, disability, and quality of life among the 3 groups.	1++

			period of 3 months (2 sessions per week) in groups of 6 to 12 participants and used the same gymnasiums. Patients in the waiting list group did not receive qigong or exercise therapy for the whole period. After 6 months they were offered an intervention of their choice.	independently in their own flats.			
Self-management papers							
Chan	2011	Longitudinal-quasi experimental study	There were 302 participants in the intervention group who received the CDSMP immediately, and 365 participants in the wait-list control group who received		IG 72.57 (8.57) CG 76.05 (7.94)	Of the 10 outcome measures in health status, 5 showed more favourable outcomes in the intervention group. Social/role activities	1+

			usual care for 6 months			limitation (p=0.004), depressive symptoms (p=0.001), health distress (p=0.014), and pain and discomfort (p=0.006) were significantly reduced.	
Nicholas	2012	RCT	Randomly allocated groups to one of 3 conditions: Pain Self-Management (PSM), Exercise-Attention Control (EAC), and Waiting List (WL) control	141 patients with chronic pain conditions referred by their doctor for treatment at the Pain Management and Research Centre, Royal North Shore Hospital, Sydney, Australia	>65	Immediately post treatment indicated that relative to the Exercise-Attention Control (EAC) group, the PSM group was significantly improved on measures of pain distress, disability, mood, unhelpful pain beliefs, and functional reach. Relative to the WL group, the EAC group made no significant gains on any of the measured variables.	1++

Reid	2017	Randomised pragmatic trial (cluster randomised trial)	Two hundred eighty-five received care from a PT randomized to the intervention group, and 303 received care from a PT in the UC group	588 participants from nonprofit home health agency, the Visiting Nurse Service of New York (VNSNY), and involved all 17 VNSNY rehabilitation teams. The teams of PTs were randomized as intervention (9 teams) or UC (8 teams) groups.	73.0 (9.9)	The treatment and UC groups had significant reductions in pain-related disability, pain intensity, and ADL limitations and increases in gait speed. No significant treatment differences were identified. Subgroup analyses failed to identify a group for which the intervention was consistently effective.	1+

Appendix Fourteen: Interventions section*

	First Author	Year	Country	Study design/Methods	Intervention (s)	Population included	Sample/response	Age group	Type of pain	Results	CASP Score
	Briggs	2010	US	Prospective, non-randomised, observational study	Epidural steroid Injection treatment	62 patients, aged 60 and over with a diagnosis of degenerative lumbar spinal stenosis (LSS)	62 patients, 61 still enrolled at 3 months, with 56 returning surveys	Mean age 74	Lower back pain	Changes in pain scores at 1 month and 3 months showed significant changes from baseline. The mean pain score was 27.4 (SD=13.6) at baseline, 41.7 (SD22.0) at one month and 35.8 (SD=19.0) at three months. Other significant changes noted were for	2+

										emotional health and body mass index.	
	Constantini	2010	Italy	Prospective, multicentre study	Spinal cord stimulation (SCS)	Patients with lumbar spinal stenosis (LSS)	69 patients. Response rate n=53, 77%	46-94 years (mean age 70 years	Back and radicular pain (n=53), radicular pain only (n=16)	Drug consumption decreased over follow-up period 927 months); opioids from 29% to 13%, NSAIDs 75% to 49%). Improvement in functional ability.	1+
	Friedly	2014	US	Double-blind, multi-centre trial	Epidural injections of glucocorticoids plus lidocaine or lidocaine alone	400 patients with lumbar central spinal stenosis	200 patients were randomized to each group. Those who completed 6-week assessment were included and due to losses, data was	Mean age 68	Moderate to severe leg pain	No significant difference was found on the Roland-Morris Disability Questionnaire (RMDQ) between the glucocorticoids	1++

							analysed form 193 patients in each group.			plus Lidocaine group and the lidocaine alone group.	
	Friedly	2018	US	Double-blind randomized controlled trial	Epidural injections of either local anaesthesia with corticosteroids (n=200) or local anaesthesia only (n=200). Corticosteroids were chosen by physicians.	400 patients with back or leg pain and central lumbar spinal stenosis	372 patients were treated at baseline and were included in the study.	Median age 68	Back or leg pain	Patients treated with corticosteroid plus lidocaine had reduces cortisol at week 3 compared with baseline, while patients treated with lidocaine only experienced an increase in cortisol.	1+
	Kamihara	2014	Japan	Retrospective study	Spinal cord stimulation (SCS)	91 patients with lumbar spinal	59 patients during trial period, response	Mean age 73.2	Leg pain. Nerve root type and	41 patients underwent implantation.	1+

						stenosis (LSS)	rate, 65%	years	Mixed pain	Good response to SCS continued for one year or more after implantation in 39 patients (95%)	
	Karm	2018	Korea	Randomized, single-blinded, active-controlled trial	Percutaneous epidural adhesiolysis (PEA) with balloon decompression. One group had PEA with balloon-less catheter and one group had PEA with inflatable balloon.	60 patients with refractory central lumbar spinal stenosis (LSS)	60 patients enrolled, allocated to each groups (balloon-less group, n=30) and (inflatable balloon group, n=30), lost at follow-up, with intention to treat analysis at 6 months on 20 and 24 patients in each group, respectively.	Not clearly stated	Chronic lower back pain and/or lumbar radicular pain	Significant differences were found between the groups on measures of pain, ≥50%, the ODI reduction ≥30%.	1+

	Ma	2015	China	Randomized controlled trial	Repetitive transcranial magnetic stimulation (rTMS). real rTMS (r-r-TMS) compared with sham rTMS (s-rTMS). Patients received 10 sessions of real or sham rTMS	49 patients were randomized to the r-rTMS group (n=24) or the s-rTMS group (n=25)	There were losses in each group during allocation and follow-up, leading to eventual analysis of data from 20 patients in each group.	Mean age 65.4 for the r-rTMS group and 67.3 for the s-rTMS group	Intractable pain	Pain intensity was measured. The real rTMS group greater reduction in pain intensity at each point of measurement except for the first and second point. Results showed rTMS to be an effective and safe therapy for this group of patients.	1+
	Manchikanti	2012	US	Randomized double-blind, active-controlled trial	Caudal epidural injections without (lidocaine 0.5%) or	100 patients divided into 2 groups	100 patients. All patients studied over 2 years.	Mean 56.9+/-14.5 years	Chronic low back pain related to lumbar central stenosis	Significant pain relief and functional status improvement was found in 51% in patients receiving	1+

					with steroids (lidocaine 0.5% mixed with 1 ml of 6mg non-particulate betamethasone)				(LCS)	lidocaine only whilst 57% in intervention group, at the end of 2 years.	

Appendix Fifteen: Guidelines

Ref No	First Author	Year	Country	Summary
	Miaskowski, C.	2011	USA	A supplementary document to The American Geriatrics Society (AGS, 2009) guidelines on the management of persistent pain. Based on the expertise of 3 members of the AGS who developed the 2009 update.
	Schofield, P.	2013	UK	Summary of previous 2013 guidelines (Abdulla et al., 2013). Concludes that many interventions and pharmacological treatments require further research in older adult populations. The evidence-base for non-pharmacological methods also needs to be advanced.
	The American Geriatric Society (AGS)	2009	USA	Update of 2002 AGS guidelines. Concludes that evidence-base at the time of publication was not adequate or sufficiently exhaustive to inform routinely encountered clinical decisions in relation to managing pain in older adults.
	The British Geriatric Society (BGS)	2013	UK	Guidelines for the development of pain management programmes for older adults with chronic pain conditions.
	The Australian	2018	Australia	Guidelines for the assessment and management of pain in older adults living in long-term care settings. Updated from 2003 guidelines with the

	Pain Society			addition of sections on nutrition and end-of-life.

*Methodological appraisal was not appropriate for papers included, given that included guidelines have appraised included evidence.