Supplementary file 4: meta-synthesis of free-text data

Five overarching themes were identified once the free-text responses were content-analysed.

Theme 1: Exercise/physical activity is a core intervention in OA care
Exercise/physical activity was identified as a beneficial intervention for OA care because of biopsychosocial and wellbeing outcomes associated with exercise/physical activity (subtheme 1.1); evidence for the effectiveness of exercise/physical activity as a therapeutic intervention for OA (subtheme 1.2); and indications for exercise/physical activity in the perioperative period (subtheme 1.3).

- *Subtheme 1.1: Biopsychosocial and wellbeing outcomes associated with exercise/physical activity*

  Respondents identified that exercise/physical activity provides a range of general health benefits, beyond just benefits to OA disease management. In the context of OA care, exercise/physical activity is associated with benefit to the musculoskeletal system by improving joint range of movement, muscle strength and subsequent joint stability, bone health and tissue flexibility. Exercise/PA also has a role in slowing disease progression associated with OA, improves symptoms associated with OA, including pain, stiffness, and joint instability; and improves functional ability including balance, capacity to work and participation.

  Exercise has shown to have many benefits outside of OA as well as direct benefits for OA itself and pain management. (ID27, physiotherapist)

  Research has shown that exercise/physical activity decreases pain, along with ensuring muscle strength and joint flexibility is maintained or improved, often improving movement patterns. (ID236, physiotherapist)

  Healthy lifestyle changes such as increased activity can make a difference in joint pain if done correctly. By strengthening and conditioning the muscles and ligaments around the joints it can improve the function and stability of the joint. (ID2, nurse)

  In addition to physiologic benefits to the musculoskeletal system, respondents identified the profound benefit of exercise/physical activity to other body systems and outcomes, such as optimising cardiovascular and endocrine health, promotion of weight loss/control and reduction in the risk and morbidity and mortality sequelae associated with other chronic conditions. Exercise/physical provides psychosocial benefits to the individual by improving mental wellbeing, increasing confidence, motivation and self-esteem to facilitate socialisation and participation. In particular, group exercise can enhance mental wellbeing through secondary effects of peer support and socialisation. Exercise/physical activity also has a key role in the management of chronic pain by addressing fear avoidance associated

with movement and reducing pain sensitivity.

Moving improves mental and physical health and assists in reducing the risk of developing other chronic conditions. (ID653, nurse)

Physical exercise, tailored to the level of pain and disability, will always benefit the patient's general functioning and benefit psychosocially as well as physically. (ID248, general practitioner)

Having a sedentary lifestyle increases the risk of other diseases with a higher mortality and morbidity rate such as cardiovascular disease, diabetes etc. With a good exercise plan, OA patients will be able to get the exercise that would not be hard on their joints (e.g. swimming) and decrease their risk of the abovementioned diseases. (ID197, medical student)

Exercise is proven in its role to reduce disability from pain, improve mental health outcomes, reduce inflammation, and also reduce morbidity from other chronic diseases. It can be modified based on ability and is therefore appropriate for all populations. (ID917, GP registrar)

Exercise/physical activity was identified as a key strategy to empower people with OA to take an active role in managing their condition and take control of their health, thus creating a general sense of wellbeing and self-efficacy. It was noted that individuals who engage in exercise/physical activity tend to have better outcomes, including the opportunity to reduce the use of medicines such as analgesics and opioids (identified by clinicians).

Ongoing and regular exercise promotes optimal joint function as well as increasing wellbeing and an individuals ability to cope with stress and chronic pain. (ID1332, nurse)

Exercise gives a sense of empowerment/control over circumstances, and release of endorphins, both of which will help cope with pain and make positive lifestyle changes. (ID69, medical student)

Physical activity is a promising intervention to reduce opioid intake, benefit for cardiovascular and mental health. These outcomes should be further promoted when comparing the efficacy of exercise program to other therapeutic management of osteoarthritis. (ID1638, physiotherapist)

Clinicians also identified the risks associated with not participating in exercise/physical activity, such as developing other chronic conditions and weight gain. Nonetheless, they also identified there were ceiling effects for the benefits of exercise/physical activity in OA care.

The risks of not exercising fair outweigh the risks of exercising. (ID941, physiotherapist)

If the disease process is very advanced then physical activity is going to be of no benefit, and in fact could be more damaging and is likely to cause extreme pain. If mild to moderate osteoarthritis then physical activity or an exercise programme may be of benefit and help to reduce pain. (ID1422, nurse)

- *Subtheme 1.2: Evidence for the effectiveness of exercise/physical activity as a therapeutic intervention for OA*

  Respondents identified that exercise/physical activity was the most effective non-pharmacologic intervention for OA care for reducing pain and improving function, and as such, it was a key component of clinical practice guidelines.

  Exercise is considered the most effective non-pharmacological treatment for reducing pain and improving movement in osteoarthritis. It is shown to improve joint range of movement, muscle strength, cardiovascular fitness and reduces stress and body weight. (ID381, medical student)

  Exercise has been shown to improve outcomes from patients of all severities of OA in the long-term. Benefits can be seen in even light-moderate intensity exercises. In addition, exercise might decrease all-cause mortality by reducing rates of obesity and CVD. (ID112, medical student)

  Guidelines have good evidence for ongoing physical activity to aid in management of OA. (ID268, GP)

- *Subtheme 1.3: Indications for exercise/physical activity in the perioperative period*

  Exercise/physical activity was considered an effective strategy to delay surgical intervention for OA and for those who do proceed to surgery, important pre- and post-operatively to optimise outcomes.

  Recent evidence has shown exercise programs can delay the need for surgery by years and can often be as effective at decreasing pain as surgery. (ID1099, physiotherapy student)

  Exercise has huge benefits on a systemic level, not just specific to the joint(s) in questions and can reduce the risk of requiring surgery. (ID1011, physiotherapy student)

  Exercise program helps to strengthen muscle around the joint. If the patient with severe OA is undergoing surgery, this will help post surgical recovery. (ID859, GP registrar)

Theme 2: Components of exercise/physical activity as a management strategy for people with OA and the importance of tailoring to the individual.

Regular exercise/PA is an essential component of OA management and rarely are there contraindications to participating in exercise/PA for people with OA. It is important to tailor exercise/PA programs according to the person's clinical presentation (symptom severity, functional limitations, disability) taking into account social, geographic, and infrastructure (e.g. transport) considerations. Tailoring an exercise/physical activity program to the individual is important to maintain motivation and engagement and reduce risk of exacerbation in OA symptoms (e.g. pain flares, muscle soreness) and negative impacts on quality of life. Tailoring can be achieved through environment, mode, and dose modifications. Exercise/PA should be also be tailored according to individual's capacity and preferences (e.g. programs may incorporate strengthening, mobility, functional tasks, weight-bearing or non-weight-bearing modes). Currently, the best-practice guidelines do not provide sufficiently clear guidance about dose, type, or mode parameters (identified by clinicians).

Physical activity is important at any stage to maintain whatever mobility exists. It is vital for physical and mental wellbeing. Physical activity or exercise can be tailored to take account of limitations and current mobility. (ID717, nurse)

Exercise is extremely important for pain management and function in people with OA. Everyone can benefit from engaging in physical activity, regardless of their stage of disease. (ID1813, physiotherapist)

There is no patient for whom an appropriate exercise program will not help with overall wellbeing, although access and compliance are the primary barriers. (ID275, GP)

Everyone with OA should be taking part in some form of physical activity, the level and type will just need to change depending on their symptoms. (ID29, physiotherapist)

Exercises can be tailored to suit the patient, and can be undertaken in a seated, standing, or lying position. Benefits of exercise are not just physical, but also psychological. The less physical activity a person does, the more incapacitated they can become. If they are unable to do exercises to improve their condition, then a trial of maintenance exercises may be of benefit. Group exercise can be beneficial to see other patients at different stags of the disease process. (ID1930, physiotherapist)

Exercise is a crucial and integral part of preventative medicine and maintaining good health. Exercise programs certainly have to be adjusted as necessary for pain tolerance & patient factors, e.g. exercise with low impact on joints such as swimming or cycling, but physicians and patients should work together to ensure that exercise is possible and enjoyable at all stages of OA if at all possible. (ID485, medical student)

Main difficulty is there is little research around best types of exercises and most effective prescription/doses. (ID388, physiotherapist)

Theme 3: System and service benefits of exercise/physical activity as a management strategy for OA care

In addition to benefits derived by the individual, system- (subtheme 3.1) and service-level (subtheme 3.2) considerations from exercise/physical activity were also described.

- *Subtheme 3.1: Health system benefits of exercise/physical activity*

  At the health system (macro)-level, clinicians identified that exercise/physical activity could reduce population burden of disease of OA, while not recommending exercise/physical activity in OA care would likely increase demands on the system. Further, system-level burden would likely increase through claiming disability benefits amongst people who believed they were unable to exercise. In terms of system-level expenditure, exercise/physical activity was considered a relatively inexpensive treatment option.

  If they are physically active it helps to improve their general health well being including mental health and to improve quality of life. In certain age groups it helps to keep their functional independence and so less burden on health care. (ID928, physiotherapist)

  Patients who believe they are unable to exercise due to their OA may also be more likely to believe they are unable to do other things, such as work or hobbies. This belief could facilitate unnecessary use of disability benefits (i.e. patient can actually work but doesn't see that they could) or mental illness such as depression. It could also impact on social wellbeing. (ID69, medical student)

- *Subtheme 3.2: Service-level delivery considerations for exercise/physical activity as a management strategy in OA care*

  Respondents identified that implementation success of exercise/physical activity programs or interventions requires co-operation between medical and allied health practitioners and often health professionals need to monitor programs. While respondents largely identified the important role of exercise/physical activity in OA care, they acknowledged it was ultimately the individuals' choice and enforcing exercise/physical activity amongst all patients had the potential to compromise the therapeutic relationship. Nonetheless, education about the importance of exercise/physical activity in the management of OA remains critical. (3.2.1-3.2.5)

Theme 4: Risk benefit trade-offs of exercise/physical activity in the treatment of OA

Respondents suggested that initiating exercise/physical activity early in the disease course is important to encourage positive health behaviours that support musculoskeletal health in the longer term.

Exercises can prevent weakening of the muscles around the joint. It also becomes more difficult to start when the condition progresses due to pain. (ID1601, physiotherapist)

While exercise/physical activity is indicated for OA management, respondents cautioned that it is important to achieve a balance between prescription parameters and symptom exacerbation, disease progression, and co-morbidities (e.g. palliation, other chronic disease, mental illness).

There should be a balance of exercise and rest to keep mobile. (ID525, nurse)

Most people with OA can engage in some physical activity to maintain joint ROM and strength without further causing degenerative changes. I see many people waiting for joint replacements and the wait where I am is up to 3 years. So physical activity can be limited as it can cause an increase in stress to other weight bearing joints. I do not live in an area where people can go to a pool or have access to recreational programs so safe effective exercise options are limited. I am also in Canada where outside activities is limited in the winter. (ID1839, physiotherapist)

Need to consider age, living setting, cognitive status and functional outcomes that it can have. For a person awaiting a joint replacement, exercise could be painful. (ID822, physiotherapy student)

I agree that all people should aim to continue exercising (especially non-weight bearing), adjust their thoughts around pain and aim to work with their pain. I do think however that practically some patients will be in a lot of pain in severe disease or with a bad exacerbation of their pain and they should not be forced to exercise. (ID143, medical student)

Respondents considered the benefits of exercise/physical activity far outweighing the low risk of harm. Further there are significant risks associated with inactivity and not engaging in exercise/physical activity is a poor prognostic sign for pain, function, and psychosocial outcomes.

The benefits of even passive range of motion compared to no exercise or movement of the joint outweigh the negative side effects. (ID1919, physiotherapist)

Benefits of moving would outweigh not moving in almost all cases. (ID633, GP registrar)

Exercise physiologists may be engaged to structure an exercise program tailored to individual needs. Inactivity may cause or impact on other health problems e.g. diabetes, heart conditions. (ID12, nurse)

Theme 5: Exercise/physical activity and pain

Respondents strongly emphasises that engagement in exercise/physical activity can be heavily influenced by patients' beliefs about pain and fear avoidance. Patients' beliefs about pain, structural changes and appropriateness of exercise/physical activity was identified as a potential barrier to care.

Respondents identified that engagement in exercise/physical activity may be limited by pain and some pain with exercise would be inevitable for some people with OA, but this should not preclude participation since structural changes/disease progression does not reliably correlate with symptoms.

The experience of joint degradation and joint pain, seem to me, to not always correlate. Meaning, some patients may have minor joint degradation and experience a lot of pain, while others do not experience as debilitating pain, but have more severe OA. Regardless of the severity of joint OA, exercise has been shown to pose positive healing effects to joint itself, but also, has positive psycho-social effects, and neurological changes. (ID407, physiotherapy student)

There will be some level of activity that is tolerable for everybody. We know that pain does not necessarily correlate with the stage of the disease so someone with "severe OA" would likely still benefit from an activity program to promote improved flexibility, strength and balance. (ID1645, physiotherapist)

Respondents suggested that engagement in physical activity is likely to be more successful when pain is well managed through appropriate analgesia and psychosocial supports. In particular, clinicians identified that pre-conceived beliefs about pain and exercise can be a substantial barrier to participation, so optimising beliefs about the relationship between pain and exercise through psychologically-informed practice is often needed (e.g. addressing fear avoidance).

There are many psychosocial aspects that could be contributing (as pain is both a sensory and emotional experience), and some people may need to address these psychosocial factors as a priority (however most people can address these factors in conjunction with an exercise program). (ID298, physiotherapist)

Pain may always be a limiting factor to the amount or type if activity completed, but it can be monitored with type/amount being changeable. You also however do not want exercise/movement to explicitly be linked with pain, as psychologically this may prolong symptoms and impact on quality of life. (ID1100, physiotherapy student)

Patients with severe increase in pain with exercise and comorbidity may need more considerate management with a psychosocial approach before implementing exercise. (ID848, medical student)

Respondents also identified that unremitting pain may suggest indication or joint replacement surgery.

Physical activity is important for management of OA. However, if the OA is so severe that it prevents any tolerable physical activity due to pain, then surgical intervention with joint replacement or other relevant option is needed. At some point, encouraging physical activity will be pointless if it causes too much pain so the patient won't do it and surgical intervention is the best option. Other then this very severe level, I would encourage physical activity in almost all cases. (ID51, medical student)

Some people will require surgical intervention. I would not recommend this until all other options have been exhausted but it very rarely an appropriate thing to do. (ID1197, physiotherapist)