Evidence based hydrotherapy: a community of practice approach

Pamela Jane Smith

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Abstract

Health Care Professionals and patients report that hydrotherapy is valuable in managing inflammatory arthritis and musculoskeletal pain. However, clinical services are increasingly required to justify the clinical and cost effectiveness of hydrotherapy.

The aims of this thesis were to:

1. Identify the best available evidence for hydrotherapy in adults and children with musculoskeletal pain and inflammatory arthritis for uptake by clinical services using a Critically Appraised Topic (CAT) methodology.
2. Explore how this evidence could be useful in clinical practice and services, through a knowledge mobilisation Community of Practice with a range of stakeholder representatives using a Focus Group study.

Firstly, the CAT methodology determined the best empirical research evidence for the clinical and cost effectiveness of hydrotherapy, producing a clinical bottom line for further exploration. A facilitated discussion was subsequently undertaken with a range of stakeholders in a Community of Practice, and analysed using focus group methodology, to establish how to increase uptake of this evidence, exploring barriers and enablers to implementation.

Seven studies were identified that led to the CAT clinical bottom line. Systematic reviews (n=4) and clinical trials (n=3) show that hydrotherapy improves pain and function for patients with inflammatory arthritis in the short term and is comparable with land based exercises. There was limited evidence to justify cost effectiveness and return to work or school.

Eight members of a stakeholder group attended a community of practice. Eight key themes were highlighted such as the limitation of existing evidence, the need for qualitative studies and the importance of understanding barriers and facilitators in providing hydrotherapy services.

In conclusion this thesis has identified an evidence to practice gap for hydrotherapy as a complex intervention, and suggestions for closing this gap for the management of inflammatory arthritis and musculoskeletal pain.

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List of Abbreviations

ARMA	Arthritis and Musculoskeletal Alliance
ARUK	Arthritis Research United Kingdom
AS	Ankylosing Spondylitis
ATACP	Aquatic Therapy Association of Chartered Physiotherapists
CASP	Critical Appraisal Skills Programme
CAT	Critically Appraised Topic
CBL	Clinical Bottom Line
CLAHRC	Collaborations for Leadership in Applied Health Research & Care
CoP	Community of Practice
CSP	Chartered Society of Physiotherapy
GP	General Practitioner
HACP	Hydrotherapy Association of Chartered Physiotherapists
iCSP	Interactive Chartered Society of Physiotherapy
JIA	Juvenile Idiopathic Arthritis
KM	Knowledge Mobilisation
KTA	Knowledge to Action
LBP	Low Back Pain
NASS	National Ankylosing Spondylitis Society
NHS	National Health Service
NICE	National Institute for Health & Care Excellence
NPT	Normalisation Process Theory
OA	Osteoarthritis
PARiHS	Promoting Action in Research Implementation in Health Services
PICO	Patient Intervention Comparison Outcome Process
PPIE	Patient and Public Involvement and Engagement
RA	Rheumatoid Arthritis
RCT	Randomised Controlled Trial

RE-AIM	Reach, Effectiveness, Adoption, Implementation and Maintenance Framework
SR	Systematic Review
WHO	World Health Organisation
WMA	World Medical Association

Chapter one: Introduction

1.1 Introduction

This chapter contains the background to the thesis, an overview of the aims and an explanation of how the subsequent chapters will be structured.

1.2 Background to thesis

The term ‘musculoskeletal conditions’ can include a broad range of health conditions that affect the joints bones and muscles, and also autoimmune diseases and non-specific low back pain (National Health Service (NHS), England, 2017). The increasing number of older people and the changes in lifestyle throughout the world mean that the burden on people and society will increase dramatically and has been recognized by the United Nations and World Health Organisation (Woolf, 2000). Musculoskeletal conditions are extremely common and millions of people, adults and children alike, within the United Kingdom are limited by symptoms such as pain and stiffness, which can affect aspects of their everyday quality of life (Woolf & Pfleger, 2003). A recent report in 2017 indicated that within the United Kingdom 200,000 people are diagnosed with Ankylosing Spondylitis; 12,000 children have Juvenile Idiopathic Arthritis; over 400,000 people have Rheumatoid Arthritis; 8.75 million people aged 45 and over have sought treatment for Osteoarthritis; and approximately 10 million people have persistent back pain (Symmons et al., 2002; Arthritis Research UK, 2017). They also report

that this presently has an estimated cost to the UK economy of over £8.6 billion and over 30 million working days are lost each year due to these conditions, and with the inevitable increase of an aging population and rising levels of obesity and physical inactivity the prevalence of musculoskeletal conditions is expected to rise (Palazzo et al., 2016). Therefore there is a need to ensure that cost effective and appropriate exercise rehabilitation and preventative strategies are available for this population group to help reduce the cost on the UK economy in the future (Brooks, 2006).

Hydrotherapy, the therapeutic use of warm water, is one such form of exercise modality and its unique qualities are utilised to aid patient rehabilitation (Reid-Campion, 2000). It has a long history dating back to approximately 850BC (Le-Quesne & Granville, 1936). Hydrotherapy can help in a number of ways to relieve pain, increase joint range of movement and muscle strength, and improve general fitness (Cameron, 2013). The majority of people tend to enjoy water based activities and movements that can be achieved within hydrotherapy pools, which may prove more difficult on dry land (Cole & Becker, 2004). Hydrotherapy is a commonly used modality in hospital and rheumatology centres and is recommended as an adjunct treatment approach to physiotherapy in the National Institute for Health and Clinical Excellence (NICE) guidelines to improve general fitness, enhance joint flexibility and muscle strength and help to manage functional impairments (NICE, 2009 [CG79] & NICE, 2017 [NG65]).

Within our local geographical area there are a number of hospital based hydrotherapy pools which cover the West Midlands population of Stoke-on Trent, Wolverhampton and Oswestry. Clinicians and patients anecdotally recognise that hydrotherapy treatment is extremely valuable in managing adults and children with

inflammatory arthritis and musculoskeletal pain. Local groups of clinicians and academics, such as the Haywood User Group and the National Ankylosing Spondylitis Society (NASS) advocate that it provides a unique environment to assist patients to achieve their full potential. However locally and nationally it is also recognised that this form of treatment is expensive when compared to land based therapy, and increasingly hospital managers and commissioners are required to justify why hydrotherapy pools should remain open, and many physiotherapy departments are being asked to review the cost effectiveness of their services (iCSP, 2014[1]). In some areas hydrotherapy pools have closed and hydrotherapy sessions are being offered in private gyms without appropriate changing areas and trained clinical support which is alluded to in more detail in Chapter two.

NHS England (2014) and independent analysts have calculated that there will be a gap between resources and patient needs of nearly thirty billion pounds a year by 2020/21 (NHS - Five year Plan, 2014). They report that long term health conditions attribute to 70% of the health service budget and to sustain a comprehensive high-quality NHS three areas will need to be reviewed: demand; efficiency and funding, increasing pressure on health service managers and commissioners to justify the services they provide.

Years lived with disability have been reported to have increased over the past two decades with musculoskeletal disorders being one of the most common causes (Vos et al., 2012). Hydrotherapy is advocated to benefit some musculoskeletal

[1] iCSP 2014 – Interactive Chartered Society of Physiotherapy (2014). Available: http://www.csp.org.uk/icsp/topics/clinical-audit-aquatic-therapy-demonstrating-cost-effectiveness [Accessed: 10/10/15]

disorders, and Hospital hydrotherapy pools are closing, and the evidence to justify the continued use of this expensive modality is lacking. Whilst it is recognised that good quality evidence takes years to filter into practice (Blair, 2014), issues such as lack of awareness of the evidence and poor understanding of the evidence, along with a lack of facilities to explore the evidence have been cited as potential barriers to getting this evidence into clinical practice (Shifaza et al., 2014). This delay in getting evidence into everyday clinical practice is known as the 'evidence to practice gap' (Woolf, 2008). To help address this gap the development of the Collaborations for Leadership in Applied Health Research and Care and the Academic Health Science Networks were set up to help produce robust research and mobilise this knowledge into practice in the NHS (National Institute for Health Research, 2017).

This overview of the clinical challenges and limited evidence highlights a number of areas to explore:

- anecdotally clinicians and patients find hydrotherapy clinically effective - does the evidence support this?
- clinicians need to justify the cost effectiveness of their modalities to the NHS - is there any evidence to support this?
- what is the best way to close the evidence to practice gap?

1.3 Thesis aims

This thesis aims to:

1. Identify the best available evidence for hydrotherapy for adults and children with musculoskeletal pain and inflammatory arthritis
2. Explore how this best evidence could be translated into clinical practice, through knowledge mobilisation with clinicians, academic staff, students, managers within the National Health Service and experts within the field.

1.4 Overview of thesis

To answer these aims, there were two main phases and methodological approaches to this thesis:

Phase 1 – A Critically Appraised Topic (CAT) process was adopted to search for and review the best available evidence for hydrotherapy for adults and children with musculoskeletal pain and inflammatory arthritis to generate a clinical bottom line.

Phase 2 – A qualitative study of a Community of Practice to:

1. Highlight the barriers to implementing the clinical bottom line from the hydrotherapy CAT
2. Generate potential solutions to enable this knowledge (i.e the clinical bottom line) is mobilised to ensure best evidence for patients requiring

hydrotherapy is embed at: an individual level; a team level; an organisational level and a system level.

Each of these phases are reported in more detail in subsequent chapters.

1.5 Overview of chapters

This chapter (Chapter one) contains the background to the thesis, an overview of the aims and an explanation of how the subsequent chapters will be structured.

Chapter two introduces the complex nature of therapy in warm water and describes how this therapeutic modality has evolved from its inception to present day. The physical properties of water and how they affect the human body physiologically to enhance rehabilitation will be explained. The Chartered Society of Physiotherapy Professional Guidelines will be introduced and the increased pressure that NHS services are under which is affecting NHS pool closures

Chapter three provides an overview of the musculoskeletal conditions and related symptoms that are included in this thesis. The NICE clinical guidelines to support best practice in the prevention and management of these conditions are also discussed.

Chapter four introduces the concept of knowledge mobilisation, and explains why there is a need to address the challenges associated with the evidence to practice gap. It also introduces a Community of Practice (CoP) as a knowledge mobilisation approach.

Within chapter five the elements of both quantitative and qualitative research methodologies are described to justify the chosen methodology for the thesis. It also explains the value of patient and public involvement in the development of research questions as well as being participants within the studies.

Chapter six provides a rationale for each of the methodological approaches used in the thesis. The sampling strategy, data collection and analysis methods are also included in this chapter.

Chapter seven presents a detailed account of the Critically Appraised Topic (CAT) methodology. The results will be reported and the strengths and limitations of the methodology will be discussed, with suggestions of how to develop these in the future explored.

Chapter eight presents a detailed account of the Community of Practice (CoP) methodology. The results will be reported and the strengths and limitations of the methodology will be discussed, with suggestions of how to develop these in the future explored.

Chapter nine summarises the aims and phases of the thesis. An overview of the results explored. The strengths and limitations of the thesis will be presented, together with clinical and future research implications proposed. A final conclusion will be expressed.

1.6 Chapter Summary

This chapter has explained the rationale for the thesis, including an overview of the aims and an explanation of how the subsequent chapters will be structured.

Chapter two: Water Therapy; Hydrotherapy; Aquatic Therapy

2.1 Introduction

The previous chapter identified that clinicians and patients anecdotally recognise the therapeutic benefit of hydrotherapy. Clinicians are being asked to justify the cost effectiveness of this modality by National Health Service (NHS) mangers.

The following chapter summarises the history of therapy using water and how it has evolved both within the NHS and the private sector to present day. It explains the physical properties of water and how they affect the human body physiologically to enhance patient rehabilitation.

The Chartered Society of Physiotherapy Professional Guidelines will be introduced and the increased pressure that NHS services are under which is affecting NHS pool closures.

2.2 The History of Water Therapy; Hydrotherapy; Aquatic Therapy

Behrend (1960) believed that the therapeutic use of water predates all other modalities used in physical medicine, reporting that it has been used worldwide by the Chinese, Greeks, Hebrews and Persians for many centuries, not only for rehabilitation but also for religious ceremonies; cleanliness and recreational purposes. Le-Quesne and Granville (1936) report in one of the earliest references in the literature found by Homer (approx. 850 B.C.), who documented that as a

mark of honour, the sorceress Ulysses was offered a bath in order to cleanse prior to being anointed with expensive perfume. The Spartans who were known for their fitness and military prowess were also forced to take daily plunges in rivers by their superiors, to improve their fitness as part of their training regime (Crebbin-Bailey et al., 2005). Public baths in the fifth century AD became common place in Greece and Celsus, who was a Roman physician and great supporter of warm public baths is thought to have reported it as one of the three essentials to a perfect therapeutic system, the other two being exercise and friction, although he also reported the risk of disease and advised that people with open wounds should refrain from bathing (Adams, 2015). These baths were not only utilised for therapeutic benefits, but also became highly fashionable meeting places. Bath in Somerset and Buxton in the Peak District, United Kingdom, were both occupied by the Romans and are historically known for their Spas that utilised the hot springs located within the towns. After the fall of the Roman Empire and even into the sixteenth century bathing became less popular as everyone used the same bath and skin diseases were prevalent (Adams, 2015).

During the nineteenth century the physiological effects of water were again being recognised and physicians supported its use and documented its physiological effects (Le-Quesne & Granville, 1936). They also report that within this time period areas (with natural springs) such as Baden-Baden and Bad Ragaz in Europe together with Bath and Buxton in England, grew in popularity again for its effects both psychological and physically. Clinicians were documenting the benefits and endorsing its use for chronic conditions such as gout, rheumatism, osteoarthritis and rheumatoid arthritis, neuralgia as well as some skin disorders and digestive disorders (Langham & Wells, 1997; Cossic & Galliou, 2006). Dr Charles

Scudamore in the early 19th century and latterly Dr W.H. Robertson proposed that patients should utilise water therapy, as an adjunct to medical treatment for these conditions (Adams, 2015). Dr Robertson also recommended that only a medical person with a specialised knowledge in hydrotherapy should treat patients, which is supported today by the Chartered Society of Physiotherapy (2015) and Bates and Hanson (1996).

In the nineteenth century Spas in England provided free treatment to those who could not afford to pay e.g. Devonshire Hospital at Buxton and Warneford Hospital in Leamington Spa (Cossic & Galliou, 2006). The economic success of these spas with their unique facilities was dependant on being able to maintain regular fee paying clients. This was being put in jeopardy due to the increased demand from clients who required charitable (free) treatment. Therefore towards the end of the nineteenth century hospitals with Spa facilities, specifically for the clients that were less able to pay, were built with funds generated from 'the Gentry' and charitable societies, allowing the fee paying clients to attend separate, less crowded facilities (Borsay, 2000).

In the twentieth century the potential of water cures to help improve health continued to be recognised. The huge number of casualties that resulted from both the first and second world wars increased the popularity of hydrotherapy as a means of rehabilitation and its use in tackling rheumatism resulted in an even greater demand for Spas (Harris, 1963; Reid-Campion, 2000). Additionally, during the polio epidemic in the 1940's and 1950's, its unique properties of buoyancy and resistance enabled patients to rehabilitate with greater ease and safety than on dry land (Kenney & Ostenso, 1943). The rehabilitation at these spas consisted of several weeks' accommodation for the patients, and family members were also

encouraged to stay at the same facilities to offer support. The financial implications of these long periods of rehabilitation highlighted the need to ensure that families with lower income were also able to access these facilities. The introduction of the NHS in 1948 meant that free treatment for all at English Spas was made available. Decisions regarding medical treatments were now being made by regional boards focussing on a full range of community and hospital based health services not just water based treatments in spas. In the longer term the financial pressures, the promise of new drug therapies and the growth of land based physiotherapy influenced the withdrawal of funding away from municipal spas, as these spas were seen more as recreational facilities focussing more on leisure and beauty (Adams, 2015).

To date private providers, specialist schools and specialist centres, some of which are funded via charitable organisations and some NHS Hospitals are still providing hydrotherapy services. The financial implications of the mid twentieth century remain today and the constant need to justify the cost effectiveness of all therapeutic rehabilitation treatments is at the top of the NHS agenda.

2.3 Types of Water Therapy

Currently there are many forms of water therapy, of which some of the underlying principles for each overlap, but there are distinct differences which are explained below.

Balneotherapy comes from the Latin word ‘balneum’ (bath) and has been defined as bathing in thermal waters with the addition of minerals such as sodium, magnesium, calcium and iron (Johnson, 1990). Similarly, Thalassotherapy is

defined as repeated exposure to sea air and repeated immersions in warm sea water or thalassotherapy pools within Spas in France, Sweden and the UK (Crebbin-Bailey et al., 2005). Balneotherapy and Thalassotherapy are more passive therapy treatments, where the main focus is on the effects of immersion, temperature and/or minerals within the water.

Watsu is a more recent form of water therapy and emerged in the 1980's and involves a practitioner continuously holding a person closely, while on their backs in chest high warm water. While immersed they are gently moved rhythmically, in order to reduce stress and promote relaxation (Cole & Becker, 2004).

Hydrotherapy is derived from two Greek words – 'hudor' meaning water and 'therapeia' meaning healing (Collins, 2017). It has been defined as a treatment that involves immersion in hot water that helps to reduce pain and muscle spasm allowing individuals to perform exercises that they would be unable to complete on dry land (Batterham et al., 2011). In 1984 the Hydrotherapy Association of Chartered Physiotherapists (HACP) was founded with an initial remit to ensure that Physiotherapists had sufficient skills and knowledge to promote Hydrotherapy as a safe and effective treatment modality. However the term 'hydrotherapy' is also used for very different practices such as colonic irrigation and bathing in Spas.

In order to define it as a form of water based therapy, in 2008 the committee members of the HACP changed their name to The Aquatic Therapy Association of Chartered Physiotherapists (ATACP). They subsequently defined Aquatic Therapy in 2014 as a physiotherapy programme utilising the properties of water, designed by a suitably qualified Physiotherapist. The programme should be specific for an

individual to maximise function, which can be physical, physiological, or psychological. Treatments should be carried out by appropriately trained personnel, ideally in a purpose built, and suitably heated Aquatic Physiotherapy Pool (CSP, 2015).

Due to this relatively recent name change and for the purpose of this study information on both Hydrotherapy and Aquatic Therapy has been included in the literature review and thesis and both will be used interchangeably as they both incorporate the effects of water and physical exercise guided by a trained physiotherapist. Balneotherapy, Thalassotherapy and Watsu have not been included due to their more passive interventions and are not currently provided by NHS services.

2.4 Physical Properties of Immersion in Warm Water

Hydrotherapy has been described as a unique experience, which enables movement and non-weight bearing activities to be possible much earlier than land exercises (Reid-Campion, 2000). The physical properties of water that enable this to occur are described below in more detail.

2.4.1 Buoyancy & relative density

Davis and Harrison (1988) and Skinner and Thomson (1983) utilise Archimedes' principle of: when a body is wholly or partially immersed in fluid at rest, it experiences an up thrust which is equal to the weight of the fluid it displaced. This

principle indicates that the buoyancy of the water supports the body and counterbalances the effect of gravity. Whilst the human body will normally float due to its density being less than water, there will always be varying individual levels of buoyancy dependant on the mineral content of the water; the amount of air in the lungs; fat content; muscle bulk and the body position in the water. The resultant buoyancy reduces the stress on weight bearing joints, muscles and connective tissue while also helping a therapist support the weight of the patient's body or limbs while completing rehabilitation exercises (Cameron, 2013). Harrison and Bulstrode (1987) report that a person standing upright and immersed in water to the neck reduces the weight through their feet by 90%, allowing early gait training and muscle strengthening to be initiated earlier than on dry land. Rehabilitation can be further enhanced using the principles of buoyancy by utilising floats or buoyancy aids.

2.4.2 Surface tension

The viscosity of water provides resistance against the direction of the body or limb being moved (Roberts, 1982). This resistance can be increased further when the speed of the body or body part moving through the water is also increased causing turbulence. Equipment can be utilised to increase the length or breadth of the arms or legs being moved e.g. paddles or flippers, providing the opportunity for the therapist to increase muscle strength and cardiovascular fitness, and facilitate gait education (Cole & Becker, 2004).

2.4.3 Hydrostatic pressure

Pascal's Law suggests that when a fluid exerts equal pressure on all surfaces of a body at rest at a given depth, this pressure increases in proportion to the depth of the fluid (Cameron, 2013). If a person is standing upright the amount of hydrostatic pressure exerted on the lower limbs is slightly greater than normal diastolic blood pressure and can therefore improve circulation and alleviate oedema (Hall et al., 1990). These effects would be reduced if an individual was more horizontal and closer to the surface of the water e.g. swimming or floating.

2.4.4 Thermodynamics

Most public swimming pools operate within a temperature in the range of 27-29 degrees centigrade, which is often too cold for rehabilitation purposes where patients are less active. Normally hydrotherapy pools operate in the range of 33.5-35.5 degrees centigrade that allows longer periods of exercise with an optimum temperature (CSP, 2015). The therapist monitors patients carefully as some studies suggest that cardiac output can increase by 80% at 37 degrees centigrade and 121% at 39 degrees centigrade (Weston et al., 1987).

2.5 Physiological and Psychological Effects of Activity in Warm Water

John Harvey Kellogg was an American physician and nutritionist who is more widely renowned for his development of dry breakfast cereals (Encyclopaedia

Britannica, 2017). At the end of the nineteenth century he equipped a laboratory and began to study the physiological effects of water. In his book Rational Hydrotherapy, he suggests that the body responds physiologically to immersion in warm water from the stimuli of thermal, mechanical or chemical reactions and that this can alter according to the length of time the body is immersed (Kellogg,1901). Textbooks and research papers over the years have supported and developed on these initial explanations of the physiological responses to immersion in warm water, and the following chapter explores some of these authors' current suggestions surrounding the physiological, therapeutic and psychological responses in more detail.

2.5.1 Musculoskeletal effects

The buoyancy of the water supports enhanced weight bearing activities in order to complete strengthening and range of movement exercises with less trauma and pain for inflammatory arthropathies, osteoarthritis and traumatic conditions (Cowan et al., 2010). It is also reported to aid balance and reduce the risk of falling in the elderly and allows the body to be fully supported in an elongated position with minimal support to enhance rehabilitation of chronic neuromuscular conditions (Bates & Hanson, 1996; Moody et al., 2012). The graded resistance that the water and buoyancy aids can provide helps to improve muscle strength in patients with neuromuscular conditions and fibromyalgia (Cameron, 2013).

2.5.2 Pain relief

Exercise in warm water is thought to reduce pain, muscle stiffness and promote relaxation (Elkayam, 1991). There is an assumption by therapists and patients, that warmer water is more conducive to pain relief (Hall et al., 2008). Neuromuscular, haemodynamic, and metabolic responses to skin heating have been described however there does not appear to be any studies that have reviewed the effects of whole-body immersion and core temperature changes during exercise in water, which might give more specific results (van-Griensven, 2013). The Pain Gate Control Theory by Melzack and Wall (1965) proposed that both psychological and physical factors can affect how the brain interprets the amount of pain that is felt from a given stimuli. Some authors attribute the pain reduction to the 'washing out' of the pain-producing metabolites due to an increase in circulation, together with an increased supply of nutrients to the area for the repair process (Wadsworth & Chanmugan, 1980; Lehman & DeLateur, 1982). Basbaum and Fields (1978) reported that heat can result in a reduction of the level of pain perception by an increase in the release of endogenous opiates from the brainstem. The warmth and sensation of the water has also been suggested to contribute to pain relief, allowing patients to complete exercises that they may not be able to adhere to on dry land, however, evidence appears to be limited with studies having small numbers with inconsistent results (Bender et al., 2005; Hall et al., 2008; McVeigh et al., 2008).

2.5.3 Cardiovascular effects

The hydrostatic pressure exerted on the lower limbs while immersed to the neck displaces venous return to the heart, increasing cardiac volume which according to Starlings Law can result in an increase in the force of cardiac contraction and an increase in stroke volume (Hall et al., 1990; Cider et al., 2006). It is suggested that this results in approximately a 30% increase in cardiac output (Cameron, 2013). Michaud et al (1992) report that water based exercise programs could be used in cardiac rehabilitation, however clinicians would have to use judgement if patients with a diagnoses of congestive heart failure were referred for hydrotherapy to ensure their safety. This is also highlighted in the contraindications and precautions guidance that the Chartered Society of Physiotherapy indicate to ensure patient safety (CSP, 2015).

2.5.4 Respiratory effects

The shift of venous blood from the lower limbs to the thorax due to the hydrostatic pressure together with the hydrostatic pressure on the thorax increases the resistance to breathing (Hertler et al., 1992). This decrease in expiratory reserve volume together with the decrease in vital capacity increases the total work of breathing by approximately 60% (Cameron, 2013). These effects can be utilised to improve the efficiency and strength of the respiratory system while clinicians carefully monitor patients to ensure safe practice is achieved. Due to the humidity levels in hydrotherapy pools and the absence of pollen, some researchers

advocate clients with exercise induced asthma should be referred to help improve their exercise tolerance (Bar-Or & Inbar, 1992).

2.5.5 Renal changes

Renal changes have been documented in response to the redistribution of blood volume and the relative central hypervolemia. Katz et al (1990) proposed that there is an increase in urine production and urinary sodium and potassium excretion. Patients with chronic kidney disease have been reported to show improvement in kidney function after completing low intensity, water exercises twice weekly over twelve weeks (Pechter et al., 2003). Due to this proposed increase in urine production it is essential to ensure that patients' hydration is maintained post treatment (CSP, 2015).

2.5.6 Psychological effects

The psychological effects of exercise in warm water are similar in adults and children and the social interaction of being able to complete activities on an equal footing with peers and family members can boost confidence and morale (Reid-Campion, 2000). Patients have reported feeling much better or very much better immediately after being treated with hydrotherapy, but were unable to confirm how long this benefit lasted (Eversden et al., 2007). Enjoyment and benefit was suggested as an important motivator to support adherence to this treatment modality, however as with many hydrotherapy studies the sample size was small

and the voluntary nature of the participants may have created a selection bias (Moody et al., 2012).

2.6 Therapeutic Benefits and Rehabilitation Possibilities

Hydrotherapy is used in hospitals and rheumatology centres and is recommended as a treatment approach in NICE guidelines (NICE [NG65], 2017). The NHS (2017) website indicates that it helps to relax and support muscles and joints, while providing resistance to gradually strengthen muscles to improve mobility and function. This is further supported by charitable organisations e.g. Arthritis Research UK and National Ankylosing Spondylitis Society (NASS) who advocate that hydrotherapy can help to: relax muscles and ease pain which helps to facilitate exercise and improve muscle strength, enhancing an individual's ability to gradually build up strength and flexibility (Arthritis Research UK, 2017 & NASS, 2017). Clinicians and patients anecdotally recognise that hydrotherapy treatment is extremely valuable in supporting adults and children with inflammatory arthritis and musculoskeletal pain, providing a unique environment to assist patients to achieve their full potential.

The therapeutic benefits that hydrotherapy is reported to provide and the medical conditions its specific properties are proposed to enhance patient rehabilitation are illustrated in Table 2.1.

Table 2.1: Conditions reported to benefit therapeutically from hydrotherapy

Physical properties of immersion in warm water	Therapeutic effects	Conditions reported to benefit	Supporting references for the conditions that benefit from the therapeutic effects
Buoyancy & relative density	• Reduces percentage of weight bearing in legs • Improves pain relief • Reduces muscle spasm • Improves joint range of movement • Improves gait mobility • Improves proprioception, balance and fear of falling • Social interaction, feeling of normality, fun	• Early fracture rehabilitation • Post surgery e.g. joint replacement • Osteoarthritis • Rheumatoid Arthritis and associated spondyloarthropothy • Obesity • Chronic degenerative conditions • Life limiting disorders e.g. cerebral palsy, muscular dystrophy • Complex co-morbidities • Fibromyalgia	Barone & Gangaway, 2015; Bates & Hanson, 1996; Cameron, 2013; Cole & Becker, 2004; Escalante et al., 2010; Hall et al., 1990; Hall et al., 2004; Kunde, 2014; McVeigh et al., 2008; Moodly et al., 2012; Reid-Campion, 2000; Waller et al., 2014;
Hydrostatic Pressure	• Improves circulation and reduces peripheral oedema and or inflammation • Improves joint range of movement • Increases aerobic capacity • Improves exercise tolerance • Improves respiratory function	• Early fracture rehabilitation • Post surgery e.g. joint replacement • Osteoarthritis • Rheumatoid Arthritis and associated spondyloarthropothy • Obesity	

Physical properties of immersion in warm water	Therapeutic effects	Conditions reported to benefit	Supporting references for the conditions that benefit from the therapeutic effects
Surface tension/viscosity	• Improves muscle strength, imbalance, flaccidity • Increases aerobic capacity • Improves exercise tolerance • Improves proprioception, balance and fear of falling	• Early fracture rehabilitation • Post surgery e.g. joint replacement • Osteoarthritis • Rheumatoid Arthritis and associated spondyloarthropothy • Chronic degenerative conditions • Life limiting disorders e.g. cerebral palsy, muscular dystrophy • Fibromyalgia	Barone & Gangaway, 2015; Bates & Hanson, 1996; Cameron, 2013; Cole & Becker, 2004; Escalante et al., 2010; Hall et al., 1990; Hall et al., 2008; Kunde, 2014; McVeigh et al, 2008; Moodly et al., 2012; Reid-Campion, 2000; Waller et al., 2014;
Temperature	• Improves pain relief • Reduces muscle contraction/spasm • Improves joint range of movement • Increases sensory awareness • Social, feeling of normality, fun	• Early fracture rehabilitation • Post surgery e.g. joint replacement • Osteoarthritis • Rheumatoid Arthritis and associated spondyloarthropothy • Chronic degenerative conditions • Life limiting disorders e.g. cerebral palsy, muscular dystrophy • Complex co-morbidities	

A critical account of the effectiveness of hydrotherapy for the musculoskeletal conditions that are represented in this thesis is detailed below. This is not a systematic review, but an overview of the literature that was captured during the CAT literature search which is detailed in chapter seven. This was supplemented with hand searches of references of the reported studies and an additional electronic search in January 2018 to capture any recent studies subsequent to the original literature search date range of 2005 to 2015.

Osteoarthritis

Osteoarthritis (OA) is reported to be the most common form of arthritis and one of the leading causes of pain and disability worldwide and is accompanied by varying degrees of functional limitation and reduced quality of life (NICE, [CG177], 2014). Aquatic therapy has been reported to improve pain, function, quality of life and strength in adults who suffer from lower limb OA (Foley et al., 2003; Cochrane et al., 2005; Fransen et al., 2007; Lund et al., 2008; Lim et al., 2010; Wang et al., 2011; Bartels et al., 2016).

Bartels et al (2016) completed the most recent systematic review of thirteen randomised controlled trials (n=1190 participants) and reported that aquatic therapy produced small short term effects (up to 20 weeks) on pain and quality of life in adults with OA. In order to assess the quality of the studies five people independently assessed the risk of bias as recommended by the Cochrane Handbook for Systematic Reviews of Interventions (Higgins, 2011). Batterham et al (2011) completed a systematic review of ten randomised controlled trials (n = 772 participants) and suggested that patients with OA and rheumatoid arthritis reported improved outcomes for function and mobility for aquatic exercise which

were comparable with land based exercise in the short term (up to 24 weeks). The quality of the trials were assessed using the eleven item PEDro Scale, which is recognised as being a reliable tool to use (Maher et al., 2003). Two independent reviewers indicated that the trials showed high heterogeneity due to the variation in the studies that were compared, and the interventions that were completed i.e. treatment, dosage, frequency, duration. Common themes between the systematic reviews were highlighted: limited number of good quality methodological trials, with small numbers, in a single site with varying intervention protocols. It is proposed that longer term, more methodologically sound trials are needed.

Some authors suggest that when aquatic therapy is compared with land based exercise both are equally effective in reducing pain and improving function and quality of life in the short term (Lund et al., 2008; Wang 2011). However it has been indicated that a greater percentage of adverse events and subject withdrawals occur in land based exercise sample groups (Lund et al., 2008). This could suggest greater compliance with aquatic exercises, motivating more regular class attendance with improved health related quality of life and function (Patrick, 2001; Foley et al., 2003; Fransen et al., 2007). With the associated links of obesity and increased falls risk in adults with osteoarthritis, aquatic therapy has been reported to improve pain disability, quality of life and fall risk factors, when used in conjunction with land based education (Arnold et al., 2008; Lim et al., 2010). However the heterogeneity of the interventions, small sample sizes in single sites and non-blinding of participants due to the pragmatic aspect of the studies may have affected the results of these studies and reduced generalisability.

A randomised controlled trial to determine the cost effectiveness of group community water based therapy over a one year period for the management of lower limb osteoarthritis was completed by Cochrane et al (2005). They concluded that group based exercise in water in a leisure centre base over 12 months can reduce pain and improve quality of life in adults with lower limb OA and may be a useful adjunct in their management. They suggested that exercise needs to be sustained to maintain benefit and that a favourable cost benefit outcome could be possible, with a saving in the water exercise group of £123 - £175 per patient per annum, per quality adjusted life-year. The primary outcome of pain was measured by the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the secondary outcome of quality of life was measured by the SF-36, both of which have been suggested as reliable measures to use (Bellamy et al., 1988; Brazier et al., 1999). Generalisability of the results is limited due to a number of reasons: the non-blinding of treatment allocation of participants due to the pragmatic nature of the research; the participants had a broad range of lower limb OA distribution and severity; the sample group were recruited from one general practice in North Staffordshire as opposed to the initial sixteen due to inadequate computerised databases within fifteen of the practices; the intensity of the intervention varied due to the severity of the participants symptoms within the group based water exercise; and the variance in costs associated with the sample groups. The water exercises were completed in a leisure centre pool, with a water temperature of 29ºC, and not in a specific hydrotherapy pool that are recommended to be maintained at a temperature of 33-37ºC. If the water exercises had taken place in hydrotherapy pools the results may have been different.

Summary

In summary aquatic therapy is reported to improve pain, quality of life and function in adults with lower limb OA in the short term (Batterham et al., 2011; Bartels et al., 2016). Common methodological issues highlighted within the studies are: non-blinding of participants; heterogeneous intervention protocols; small sample sizes and single sites, which limit generalisability of the results. Group water based exercise in community pools has been reported to have a favourable cost benefit outcome, this together with the limited adverse events and participant withdrawals reported in the literature, and the proposed increased adherence to the intervention, hydrotherapy may be a useful adjunct for the management of OA symptoms (Cochrane et al., 2005; Fransen et al., 2007; Lund et al., 2008).

Rheumatoid Arthritis

Rheumatoid arthritis (RA) is a chronic autoimmune disease that causes inflammation in multiple joints, but mainly the small joints of the hands and feet, and patients report symptoms of painful, swollen joints, stiffness and fatigue (NICE, 2018; Arthritis Research UK, 2018). Hydrotherapy has been reported to improve both physical and psychological benefits in relation to pain, function, muscle strength and health status for adults with RA (Hall et al., 1996; Bilberg et al., 2005; Batterham et al., 2011; Al-Quabaeissy et al., 2012).

Two systematic reviews consisting of sixteen randomised controlled trials (n = 10 and n = 6) concluded that patients with RA who participated in group aquatic therapy sessions reported reduced pain, improved health status, function, mobility and patient satisfaction in the short term (Batterham et al., 2011; Al-Qubaeissy et al., 2012). The quality of the trials in both systematic reviews were assessed

using the eleven item PEDro Scale (Maher et al., 2003). They both reported similar outcomes indicating that the literature contained heterogeneous interventions i.e. dosage, intensity, frequency and duration (varying between 12 and 24 weeks), and small numbers (less than 60 participants), conducted in single sites, all of which could affect the generalisability and reliability of the results. One of the randomised controlled trials (RCT) in Sweden lasted four years and determined that there was no significant improvement in participant reported pain, however their self-reported activity levels improved significantly in the once weekly hydrotherapy intervention group (Stenstrom et al., 1991). Dagfinrud and Christie (2007) report that patients with RA tend to be less physically active than the general population, therefore this improvement in activity levels is beneficial to these patients. However, due to the lack of long term studies, the long term benefit of hydrotherapy was deemed as inconclusive (Al-Qubaeissy et al., 2012).

Eversden et al., (2007) completed a RCT and demonstrated that adults with RA who participate in hydrotherapy are more likely to report significant improvement in the primary outcome of self-rated overall health status in the short term (6 weeks), however the secondary outcomes of pain and function were comparable with land based exercises. The interventions lasted 30 minutes once per week, over a six week period, which although represents current clinical practice in the United Kingdom a longer term trial may give more beneficial results that could support the management of patients with RA. The primary outcome was also measured immediately after the intervention and not re-evaluated at 3 months with the secondary outcomes, therefore it remains unclear how long the participants perceived benefit of hydrotherapy lasts.

Summary

All of the studies included an element of group exercise, either land or hydrotherapy. Exercise classes generally provide opportunities for socialisation and mutual support and both have been reported to be important determinants of continued exercise and self-reported feelings of well-being, which is important to remember when appraising study results (Eyler, 2003). It has been reported that low to high intensity exercise of hydrotherapy, dance and cycling for RA patients improves muscle endurance, flexibility and strength (Bilberg et al., 2005). It may be necessary to combine both aquatic exercise and other forms of exercise to improve both the physical and psychological symptoms associated with RA (Hall et al., 1996). A pragmatic approach may be required depending on the patient specific requirements or the extent of their disease related symptoms, and the resources available to the multidisciplinary team caring for the individual (Melsios et al., 2008).

Juvenile Idiopathic Arthritis

Juvenile Idiopathic Arthritis (JIA) is chronic childhood disease which is characterised by persistent joint inflammation (Cassidy & Petty, 2005). Symptoms associated with JIA include joint swelling, pain, stiffness, muscle weakness, atrophy and associated restricted movement and function (Stanley & Ward-Smith, 2011; Bromberg et al., 2014). Aquatic therapy has been reported to improve quality of life, disease outcome, pain and muscle strength (Takken et al., 2003; Epps et al., 2005; Takken et al., 2008; Elnaggar & Elshafey, 2016). Cavello et al., (2017) recommended that aquatic exercises should be used as part of a structured

exercise programme to support the multidisciplinary team management of these patients.

Epps et al. (2005) suggested that a combined programme of hydrotherapy and land based exercises improved quality of life and disease outcome more than land based exercises only; however this slight improvement was not statistically significant. The primary outcome was measured by the Childhood Health Assessment Questionnaire (CHAQ) which is recognised as a reliable tool to use (Nugent et al., 2001 & Lam et al., 2004). The treating therapist, physician, participant and parent were not blinded to the treatment due to the nature of the intervention. This study was based over three centres within the United Kingdom which supports generalisability, however the number of participants was small (n=78) which could affect reliability of the results. The authors calculated mean costs between the groups and concluded that there was no evidence to justify the cost effectiveness of a combined programme over a land based exercise programme alone.

Takken et al., 2003 reported small but statistically insignificant improved effects following an aquatic fitness programme, in community based pools for measures of function, joint status and quality of life in a small number of JIA participants (n=54) using the recognised CHAQ, Juvenile Arthritis Functional Assessment Scale (JAFAS) and Juvenile Arthritis Functional Assessment Scale (JAQQ) outcome measures for this population (Lovell et al., 1989; Singh et al., 1994; Duffy et al., 1997). The intervention consisted of a one hour supervised programme in pools located in twenty different locations over a six month period with a comparator of usual care. All participants were issued with instructions on paper and a tape recording to ensure adherence to the set programme. The intervention

took place in twenty different community pool locations with temperatures varying between 30-33ºC, and not in a specific hydrotherapy pool that are recommended to be maintained at a temperature of 33-37ºC. If the water exercises had taken place in hydrotherapy pools the results may have been different.

A significant improvement in pain and muscle strength was reported in participants with JIA following a combination of resistive underwater exercises and interferential therapy when compared with a control group of land based exercises over a period of three months (Elnagger & Elshafey, 2016). The outcome measures used were the HUMAC NORM, CSMI 2009, USA Testing and Rehabilitation Isokinetic System for muscle strength and a visual analogue scale (VAS) for pain (Bijur et al., 2001; CSMI – HUMAC NORM, 2018). The HUMAC NORM does not appear to have been used previously with this type of patient and therefore it is unknown if it is a sensitive or reliable outcome measure to use for this population group. The study consisted of small numbers (n=30), the intervention took place in a single site based in Egypt and the frequency of the intervention is not representative of current clinical practice within the United Kingdom (45 minutes, 3 times per week), which could reduce the generalisability of the results. Due to the combined intervention, it is difficult to judge if the significant improvement reported resulted from the combined effects or the independent effects of the interferential therapy or the underwater exercises. The inclusion of a hydrotherapy only and interferential therapy only group might have helped to clarify the results.

Various types of exercise interventions for individuals with JIA have been shown to be an effective way of managing these patients (Rossler et al., 2014). Systematic reviews in 2008, and more recently in 2018 evaluated the effectiveness of a

number of exercise interventions to improve function and disability for JIA patients (Takken et al., 2008; Kuntze et al., 2018). Interventions included in these reviews were strengthening, proprioceptive, aerobic and pilates exercises as well as hydrotherapy. Study quality was assessed by the recognised as reliable PEDro tool and Downs and Black tool (Maher et al., 2003; Downs & Black, 2008). Both systematic reviews concluded that limited evidence and the heterogeneity of the outcomes and interventions used within the studies reduced the ability to provide conclusive evidence to support the use of any exercise therapy including aquatic therapy or land based exercise (Takken et al., 2008; Kuntze et al., 2018). None of the studies reported any adverse effects and minimal participant dropouts in relation to aquatic therapy, and most produced beneficial clinical effects, although the statistical significance varied.

Summary

There appears to be limited evidence to conclude the benefit of hydrotherapy to improve the symptoms associated with JIA. Although limited in numbers, the studies do report good adherence and limited adverse effects with aquatic therapy (Takken et al., 2003; Kuntze et al., 2018). Improved adherence helps to encourage children with JIA to participate in exercise, which in turn provides enthusiasm and confidence to become lifelong participants in sport and exercise and helps patients manage their own arthritis (Cavallo et al., 2017). This is imperative due to the longevity of this condition. Further research with strong study design, over a longer term should be considered to provide evidence for the effectiveness of hydrotherapy in the management of this type of patient (Takken et al., 2008; Basile et al., 2017; Kuntze et al., 2018).

Low Back Pain

Low back pain has been defined as pain, usually between the lower rib margins and the buttock creases and may be accompanied by pain in one or both legs, this primary symptom also contributes to the overall level function of these individuals (Dionne et al., 2008). Aquatic exercise programmes are frequently used as treatment for patients with musculoskeletal disorders including low back pain (Verhagen et al., 2012). Studies have indicated that aquatic exercise is a safe and effective treatment modality for this type of patient to help reduce the associated symptoms of pain, physical function, disability and improve quality of life (Dundar et al., 2009; Baena-Beato et al., 2014; Shi, et al., 2018).

A recent systematic review of eight RCT's in 2018 concluded that aquatic exercises can show statistically significant reduction in pain and increased physical function in patients with low back pain (Shi et al., 2018). The aquatic interventions within the trials all varied in intensity, frequency, duration and content as did the comparator of no exercise, various land based exercise programmes and education booklets. The site locations also varied from hydrotherapy pools in National Health Hospitals, to sports centres and community swimming pools. Outcome measures included a visual analogue scale (VAS) for pain, the Oswestry Low Back Pain Disability Questionnaire (OLBDQ) for disability and the Short Form 36 Health Survey (SF-36) for quality of life. These are well recognised, valid and reliable outcome measures for this population (Hemmingway et al., 1997; Fritz & Irrgang, 2001; Boonstra et al., 2008). Meta-analysis of the results was possible and they were clearly displayed using forest plots and confidence intervals. The authors acknowledged that the heterogeneous nature of the interventions, small

numbers of participants involved in the included trials and variation in sites reduced generalisability and reliability of the results.

A controlled clinical trial in 2014, concluded that a two month intensive water exercise programme of five sessions a week decreased levels of back pain and disability, resulting in improved quality of life, for adults with low back pain, when compared with no treatment (Baena-Beato et al., 2014). The outcome measures of a VAS for pain and OLBDQ for disability and SF-36 for quality of life were utilised and taken at baseline and two months. The frequency of the intervention, small sample size (n=49) and single sites based in Spain reduces the generalisability and reliability of the results. The study was unable to randomise the participants due to obligations to the sports centre supporting the intervention, therefore all participants allocated to the control group were put on a waiting list and offered the intervention programme at the end of the study which might have affected participant bias and subsequently affected the self-reported measures.

A randomised controlled trial by Dundar et al., 2009, concluded that water based exercises improved disability and quality of life more than a home land based exercise programme for patients with low back pain, in the short term (12 weeks). Outcome measures included a visual analogue scale (VAS) for pain and the Oswestry Low Back Pain Disability Questionnaire (OLBDQ) for disability and the Short Form 36 Health Survey (SF-36) for quality of life which were measured at base line, four weeks and twelve weeks. The number of aquatic sessions (5 x 1 hourly per week) may not be representative of treatment in the United Kingdom (UK) due to the current limited pool and session availability within the National Health Service. The small sample size (n=65), based in one centre in Turkey and the frequency of the intervention may reduce the generalisability and reliability of

the results to the UK population. The unsupervised exercises at home compared to the supervised aquatic exercises may have affected compliance and adherence of the participants and therefore affected the reported outcomes and results of the study.

Summary

Although limited in numbers the studies reported no side effects to the intervention and minimal participant dropouts which could suggest that aquatic exercise is a safe and effective treatment option in reducing pain, disability and improving quality of life in the short term. However, due to the heterogeneous nature of the trials further high-quality investigations on a larger scale may be required to confirm the results (Shi et al., 2018).

Ankylosing spondylitis

Ankylosing spondylitis (AS) is a chronic systemic inflammatory rheumatic disease of unknown cause that affects the spinal joints and the junction of the intervertebral spinal ligaments and vertebrae that leads to ankyloses (National Institute for Health and Care Excellence, 2018). Symptoms of pain, disability and fatigue, resulting in reduced function for the individuals have been reported for individuals diagnosed with this condition (Braun, J. & Sieper, J. 2007). Aquatic therapy has been suggested as a beneficial treatment to help alleviate the symptoms of pain and improve patients overall well-being and quality of life (Van-Tubergan et al., 2001; Dundar et al., 2014).

A randomised control trial in 2014 reported improvements in pain and quality of life for patients with AS after completing a twelve week aquatic therapy programme in comparison to a home land based exercise programme (Dundar et al., 2014). The intervention group received one hour supervised aquatic therapy, five times per week, for four weeks, with a poolside warm up prior to the session. This was compared to a one hour home based exercise programme with an instruction booklet and weekly telephone call to support participant adherence. The outcomes were measured at baseline, four weeks and twelve weeks using the Bath Ankylosing Spondylitis Functional Index (BASFI) and Bath Ankylosing Spondylitis Disease Activity Index (BASDI) (Calin et al., 1994; Garrett et al., 1994). The authors did not specify the content of the warm up exercises prior to the supervised aquatic therapy and the unsupervised exercises at home which may have affected compliance of the participants and subsequently the results. The small numbers (n=69) in one base in Turkey and frequency of interventions may affect reliability in the results and reduce generalisability locally.

A randomised controlled trial in 2001 compared an intensive three week course of combined group hydrotherapy and group land based exercises, with combined home exercises and once a week group land based exercise programme (Van-Tubergan et al., 2001). All participants (n=120) in the trial participated in weekly group exercise sessions for a further thirty-seven weeks after the initial three weeks. They reported that the intensive combined group of group hydrotherapy and land exercises showed significant benefits on patient reported pain and overall well-being, using the BASFI, and that these effects could last up to ten months. The outcomes were measured at baseline, four weeks, four months, seven months and ten months with blinded assessors, the participants were randomised

to the groups but not blinded to the intervention due to the pragmatic aspect of the study. The authors did not specify the content of the hydrotherapy session which would limit the ability to replicate this trial. The intervention took place in spa pools in the Netherlands and Austria, which also contained minerals within the water, and the effects of the minerals may have contributed to the results reported. The limited availability of spas within the United Kingdom and the frequency of the interventions limit generalisability of the results.

Both of the trials compared therapeutic exercises applied in group settings to exercises performed individually. The comparisons may provide information on the effect of the group setting rather than the effect of the specific intervention. Dagfinrud et al., 2008, suggested that patients who participate in groups may improve more than patients who exercise on their own and could be resultant of non-physical factors such as mutual encouragement, increased motivation and sharing of experiences. These factors may contribute to benefit patient well-being, but may not indicate the effectiveness of an exercise programme of either land or water based.

Summary

There have been few studies into the effects of hydrotherapy to improve the symptoms associated with AS. The small numbers of participants, heterogeneous interventions, and outcomes measures reduce the strength of the evidence available, and whilst there is evidence of the short term benefit of hydrotherapy, long term studies of either land based exercise or hydrotherapy and adherence to exercise in general, which is paramount in a chronic condition such as AS, appear to be rare (Dziedzic et al., 2008).

Overall Summary

A critical account of the effectiveness of hydrotherapy for the musculoskeletal conditions that are represented in this thesis has been detailed above. Most of the literature reviewed compares hydrotherapy with land based exercise of varying types or hydrotherapy and land based with land based exercise. The majority of the available literature, whilst of varying quality indicates that hydrotherapy improves pain, muscle strength, function and quality of life, in the short term for patients with osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, juvenile idiopathic arthritis and low back pain.

With the associated poor adherence to exercise programmes, there is a need for health care professionals to support individuals with adherence to treatment (Munro, 2004; Wang 2011). When people are unable to exercise on land, or find land based exercises difficult, aquatic programs provide an enabling alternative strategy, or a combination of aquatic and land based exercises should be considered (Lund et al., 2008; Batterham et al., 2011).

The small numbers of participants, heterogeneous nature of the interventions and varied outcomes measures within these studies limits the strength of the evidence (Herbert & Bo, 2005). There is a need for further long term, methodologically rigorous investigations comparing aquatic therapy with other forms of physical activity for patients with these conditions to confirm the effectiveness of hydrotherapy, as well as patient adherence to varying exercise programmes (Hall et al., 1996; Cochrane et al., 2005; Bartels et al., 2016; Shi et al., 2018).

2.7 Hydrotherapy Services

Independent analysts together with the NHS have reported that there will be a gap between resources and patient needs of nearly thirty billion pounds a year by 2020/21, indicating that to sustain a comprehensive high-quality NHS, demand efficiency and funding would need to be reviewed, with patient experience requiring consideration (NHS - Five year Plan, 2014). This was important and recognised in 1919 by Sir George Newman, Chief Medical Officer who suggested that health was influenced by both the physical and social environment and that measures to address the burden of illness across all social classes should include encouraging healthy lifestyles as well as providing better access to General practitioners (GP) and hospital services (Adams, 2015).

Presently private providers, specialist schools, specialist centres funded via charitable organisations and some NHS Hospitals provide specific hydrotherapy services. With the financial pressures of the mid twentieth century remaining today and the constant need to justify the cost effectiveness of all therapeutic rehabilitation treatments being at the top of the NHS agenda, it is recognised that this form of treatment is expensive and there is an increasing demand to justify why hydrotherapy pools should remain open, and many physiotherapy departments are being asked to review the cost effectiveness of their services (NHS - Five year Plan, 2014). In some areas, Hydrotherapy pools have closed for example Llanfrechfa Grange Hospital and Orpington in South London in 2013 (South Wales Argus, 2013; Guardian, 2013). This could result in hydrotherapy sessions being offered in private gyms sometimes without appropriate changing areas and trained clinical support (Cameron, 2013) However, the pool in

Orpington, with support of charitable donations to complete the refurbishment, was reopened in 2016 (King's College Hospital NHS Foundation Trust, 2016). NHS Lothian have been reviewing Hydrotherapy services within three of their hospitals to assess their viability due to the expense associated with the running and maintenance costs (The Herald, 2015). In contrast there have also been new facilities opened via charitable donations, like the £500,000 pool at the Alan Shearer Centre in the North East of England, to help maintain free services for disabled people throughout the region (Chronicle Live, 2016).

Research undertaken to establish the number of NHS hydrotherapy pools there are within England suggests that this information is lacking. An internet search did result in a report by Muscular Dystrophy UK (2015) that conducted a review into the provision of hydrotherapy treatment in the United Kingdom for people with muscle-wasting conditions. Their work indicated that animal owners have a much higher chance of accessing a hydrotherapy pool for their animals, than people with muscle-wasting conditions do. Their figures suggest that in the UK, there are at least 362 hydrotherapy pools solely for the use of animals, compared to 179 pools that Muscular Dystrophy UK knows of, that are suitable for people with muscle-wasting conditions to use for hydrotherapy treatment (Muscular Dystrophy UK, 2015).

The candidate contacted the Chartered Society of Physiotherapy (CSP) in June 2017 to ask their advice on locating this information and was subsequently informed to post a comment on the Interactive CSP website for the Aquatic Therapy Special Interest group. In summary they were unable to confirm how many NHS pools there were within the United Kingdom, however there was interest in the value of completing an audit to gain this information. In September

2017 AStretch, a group of physiotherapists with a special interest and expertise in spondyloarthritis, are launching a National survey in partnership with the National Ankylosing Spondylitis Society to map hydrotherapy resources across the UK to assist those affected by spondyloarthritis to find a local aquatic service. This survey should help to improve the lack of information that appears to be available presently.

2.8 Professional Society Guidance

The Aquatic Therapy Association of Chartered Physiotherapists (ATACP) are a physiotherapy organisation that has been recognised by the Chartered Society of Physiotherapy (CSP) since 1984, and was previously known as the Hydrotherapy Association of Chartered Physiotherapists (HACP). They have produced a document to provide guidance to physiotherapy managers, physiotherapists, physiotherapy students and non-physiotherapists working in aquatic physiotherapy settings about providing a safe and effective aquatic physiotherapy service for patients, to address the limited amount of hydrotherapy knowledge and skills that was being taught at an undergraduate level (CSP, 2015). This document also provides details on precautions and contraindications therapists should take into consideration before referring a client for treatment in a pool environment and information relating to how pools should be managed with guidance on room and pool temperature; chemical levels; infection control and evacuation procedures to ensure patient safety and hygiene . The documents recommendations were based on the available evidence base and included expert opinion. The members of the association hold an annual general meeting and

produce a biannual journal, called ‘Aqualines’. This journal is free to members and they indicate that it includes features on research, treatment notes and case studies, information on professional issues, ATACP officer reports, correspondence, general news, and advertises forthcoming events and courses. In order to ensure therapists have the knowledge and skills to perform safe and effective treatments, the ATACP supports post graduate education and hold twice yearly study days at different locations within England to encourage attendance and share best practice. More recently the ATACP has become a registered stakeholder of the National Institute for Health and Care Excellence (NICE) and contributed to the consultation for the review of the latest guidelines in the management of spondyloarthritis.

2.9 Chapter Summary

This chapter has described how therapy in warm water has evolved from its inception to present day. The therapeutic benefits that have been accredited to the physiological changes that occur during immersion in warm water have been explained. The CSP professional body’s guidelines have been introduced along with highlighting the increased financial pressure that NHS Services are presently under in order to maintain hydrotherapy pools and services.

The next chapter provides an overview of the musculoskeletal conditions that are included in this thesis. The National Institute for Care and Excellence (NICE) clinical guidelines that recommend the management of these conditions will also be stated.

Chapter three: Overview of Musculoskeletal conditions

3.1 Introduction

The previous chapter summarised the history of hydrotherapy and reported how the physiological effects can therapeutically benefit musculoskeletal conditions.

Within Phase 1 of this study a number of musculoskeletal conditions were included in the search terms of the library search.

This chapter gives an overview of each of the musculoskeletal conditions that are included in this thesis and also the clinical guidance that the National Institute for Clinical Excellence (NICE) recommend for the prevention and management of these conditions.

3.2 Musculoskeletal Conditions

Musculoskeletal conditions are largely managed in primary and community based services, with treatment and support for people with low back pain and osteoarthritis been estimated to account for 4.6 million appointments per year (Belsey, 2002). They are defined as conditions that affect the joints, bones and muscles, and also include rarer autoimmune diseases and back pain (NHS England, 2017). Musculoskeletal conditions are reported to have a major impact on the health of the population and are the commonest cause of disability and the most frequent reason for long-term absence from work (Dziedzic et al., 2007). Many people with osteoarthritis report more than one joint is involved, which impacts on physical function, and therefore treatment is advised to be targeted at multi sites, reducing disability (Peat et al., 2006). Osteoarthritis and low back pain

along with rheumatoid arthritis, juvenile idiopathic arthritis and ankylosing spondylitis were included within the literature review of this study as NICE suggest that people over the age of sixteen with these conditions should be referred to a specialist physiotherapist to initiate a structured exercise programme, of which hydrotherapy should be used as an adjunctive therapy to manage pain and improve function (NICE [NG65], 2017). These conditions were also the vast that were treated within the hydrotherapy pool at the hospital where the candidate was previously employed, as a specialist hydrotherapy physiotherapist. A number of other musculoskeletal conditions e.g. fractures and fibromyalgia, and neurological conditions e.g. stroke, muscular-dystrophy, were also treated within this facility, but for the purpose of this study have not been included.

Each of the musculoskeletal conditions will be described in more detail highlighting their specific associated symptoms that hydrotherapy has been reported to benefit in chapter two.

3.2.1 Ankylosing Spondylitis

Ankylosing spondylitis (AS), or more recently coming under the umbrella term of spondyloarthritis is a common inflammatory rheumatic disease (NICE [NG65], 2017). It affects the axial skeleton, causing characteristic inflammatory back pain, which can lead to structural and functional impairments and a decrease in quality of life (Braun & Sieper, 2007). Eventually the individual bones of the spine may fuse and can result in a kyphotic posture. AS usually occurs between 20-30 years of age and has gender rations of 2:1 (male: female), but can vary between studies, and over time is equally common in both males and females (van-Tubergen, 2014). People with AS experience high rates of depressive symptoms as a result

of the pain and functional limitations caused by the condition (Baysal et al., 2011). The most prevalent quality of life concerns include stiffness, pain, fatigue and poor sleep patterns, resulting in the reported withdrawal from work being three times more common than in the general population (Boonen et al., 2001). Functional restrictions in these patients are reported with a disease duration of 20 years or greater if they have physically demanding jobs (Ward et al., 2005).

3.2.2 Rheumatoid Arthritis

Rheumatoid arthritis (RA) is a chronic, systemic, inflammatory, symmetrical polyarthritis disease that can be both erosive and deforming, with associated symptoms of pain, swelling and stiffness (Al-Qubaeissy et al., 2013). RA typically affects the small joints of the hands, as well as the wrists, knees, ankles, elbows, shoulders and feet (Tehlirian & Bathon, 2008). It can affect adults of any age and primarily affects women, however its peak onset is between forty and sixty years old and appears to affect women two to three times more than men (Alamanos & Drosos, 2005). Recent studies have indicated that being overweight or obese, and cigarette smoking can increase the risk of developing RA (Qin et al., 2015). The main co-morbidities associated in patients with RA are cardiovascular and lung disease (Bongartz et al., 2010; Lopez-Mejias et al., 2016). The inevitable reduced mobility that is associated with RA increases the risk of developing osteoporosis and falls, which could lead to subsequent fragility fractures (Pye et al., 2010). Depression in these patients is associated with the increased levels of pain and reduced function, with a third of these individuals being unable to work two years after onset, growing to half within ten years (Dickens et al., 2002; NICE, 2009).

The reduced physical activity in patients diagnosed with RA can inevitably become a cycle of disease progression and increased pain which could affect both their physical and mental health and wellbeing.

3.2.3 Osteoarthritis

Osteoarthritis (OA) refers to a clinical syndrome of joint pain accompanied by varying degrees of functional limitation and reduced quality of life and is reported to be the most common form of arthritis, and one of the leading causes of pain and disability worldwide (NICE, [CG177], 2014). The most common site for OA is the knee, followed by the hands, hip and wrists and pain is the primary symptom, with secondary symptoms of swelling, stiffness and reduced function (Arthritis Research UK, 2017). The risk of developing OA increases with age, and generally affects more women than men. People increase the risk of developing OA who: are overweight or obese; have had occupations that involve, squatting, kneeling, prolonged lifting or have required increased manual dexterity; have had developmental problems e.g. hip dysplasia (Wluka et al., 2013; Palazzo et al., 2016). OA prevalence increases with age and is growing due to the population and the epidemic of obesity (Bijlsma et al., 2011). This will inevitably increase the subsequent growing demand for total hip and knee replacements, which is expected to quadruple by 2030 (Osteras et al., 2015). Co-morbidities such as cardiovascular disease, diabetes, depression and anxiety have been reported to be associated with OA, which could also impact on the wider health economy and require rehabilitation interventions to address patients' needs (Yoshimura et al., 2011; Rahman et al., 2013; Stubbs et al., 2016).

3.2.4 Low Back Pain

Low back pain has been defined as pain, usually between the lower rib margins and the buttock creases and may or may not be accompanied by pain in one or both legs (Dionne et al., 2008). It is a common reason for visits to general practitioners (GP), and it is estimated that 85% of these patients have nonspecific back pain with no known specific underlying disease or pathology (Hall et al., 2008). Low back pain has been reported to affect approximately one third of the United Kingdom adult population each year (Jordan et al., 2010). Pain is the primary symptom with associated reduced function, and is shown to be the second most common cause of short term absences from work after colds, flu and sickness (Chartered Institute for Professional Development, 2014). The prevalence has been shown to increase with obesity, and occupations that require squatting, kneeling, lifting and prolonged manual dexterity (Zheng et al., 2015; Palazzo et al., 2016).

3.2.5 Juvenile Idiopathic Arthritis (JIA)

JIA is a clinically heterogeneous group of disorders characterized by persistent joint inflammation, it may result in life-long disability and a reduced quality of life, particularly in patients who develop polyarthritis and who do not respond satisfactorily to treatment (Minden et al., 2012). Many patients experience detrimental effects, including joint deformity and destruction, growth abnormalities and osteoporosis, resulting in pain, impaired psychological health or difficulty with daily living (Packham & Hall, 2002). Common co-morbidities are uveitis, which

can lead to blindness if not treated early enough; and reduced bone mineral density, which can increase the risk of fractures (Lien et al., 2003; Kesen et al., 2008). The pain associated with JIA has an influence on the individual's psychosocial health as well as affecting physical well-being (Oliveira et al., 2007). As children progress to adulthood it is reported that at least one third will have ongoing active disease and will experience limitations in dexterity and mobility (Packham & Hall, 2002).

3.3 National Institute for Health and Care Excellence (NICE)

The National Institute for Health and Care Excellence (NICE) offers guidance that can be used by the NHS, local authorities, employers, voluntary groups, patients, patients families and carers to improve outcomes and promote wellbeing (NICE, 2017). They produce evidence based guidelines that make recommendations on a wide range of topics, including the prevention and management of specific conditions.

NICE suggest that people over the age of sixteen, with axial spondyloarthritis, which includes: ankylosing spondylitis, juvenile idiopathic arthritis, rheumatoid arthritis, back pain, and osteoarthritis, should be referred to a specialist physiotherapist to initiate a structured exercise programme (NICE [NG65], 2017). This programme should include stretching, strengthening and postural exercises. They also indicate that hydrotherapy should be used as an adjunctive therapy to manage pain and maintain or improve function for people with these conditions.

For rheumatoid arthritis they specifically indicate that people should have regular access to specialist physiotherapy to improve general fitness, encourage regular exercise to enhance joint flexibility, muscle strength; and to offer support to manage any functional impairment (NICE [CG79], 2009).

There does not appear to be a NICE guideline for children under the age of 16 diagnosed with JIA, however, there are the Arthritis and Musculoskeletal Alliance (ARMA) Standards of Care for Juvenile Idiopathic Arthritis (2010). Standard 35, encourages the paediatric rheumatology team to facilitate age-appropriate participation in sports and other activities. Their rationale is to: improve bone health, reducing the risk of osteoporosis; improve feelings of wellbeing; moderate the effects of pain; boost energy levels and provide opportunities to increase social interaction; and increase strength and stamina enabling participation in normal activities of daily life.

For people with osteoarthritis, NICE propose that exercise is a core treatment which should include local muscle strengthening and general aerobic fitness, and that self-management programmes, either individually or in groups should be advocated to support positive behavioural changes e.g. quality of life, occupation, mood and relationships (McAlindon et al., 2014; NICE, 2014). NICE do not specifically advocate the use of hydrotherapy within their non-pharmacological management of this condition, however they do suggest that if exercise has been found to be beneficial, the clinician should judge for each individual how to encourage participation, depending their specific needs, circumstances and self-motivation, and the availability of local facilities (NICE, 2014).

Clinical guidelines have been reported to be insufficient in ensuring that research evidence is utilised within a number of clinical settings, with only one third of the research evidence being adhered to (Mickan et al., 2011). Although the NICE guidelines try to address this ‘evidence to practice gap’, the transfer of research evidence into practice is often complex and incomplete (Glasziou & Haynes, 2005).

3.4 Chapter Summary

This chapter has provided an overview of the musculoskeletal conditions and related symptoms that are included in this thesis. The NICE clinical guidelines to support best practice in the prevention and management of these conditions have been discussed and the lack of adherence highlighted.

Knowledge mobilisation approaches have been developed to try and address the challenges associated with the evidence to practice gap and will be explored in the next chapter.

Chapter Four: Knowledge Mobilisation (KM)

4.1 Introduction

Chapter three provided an overview of the musculoskeletal conditions and the NICE clinical guidelines to support their management. The lack of adherence to these best practice guidelines was highlighted.

The second aim of this thesis is to explore how best evidence for hydrotherapy could be translated into clinical practice through knowledge mobilisation. This next chapter introduces Knowledge Mobilisation (KM) and explores the challenges associated with the evidence to practice gap and introduces a number of KM approaches to reduce that gap.

4.2 Rationale for Knowledge Mobilisation

The gap between research being completed and getting the results into practice has been a problem since the 1950's in a number of professional fields including the health care sector (Nicolini et al., 2008).

David Sackett, a pioneer of evidence-based medicine founded Canada's first department of clinical epidemiology at McMaster University in 1967 (Sackett et al., 1996). The Evidence Based Medicine movement in the 1990's led by the McMaster University in Canada suggested that to strengthen knowledge transfer, clinicians should be responsible for searching and reviewing any available

information or knowledge that could help to support best possible patient care (McMaster University, 2017). There has been an increased amount of literature being produced, which is compounded by difficulty in interpreting the results; and the lack of time that clinicians have to review this evidence. Therefore models emerged that highlighted the importance of interaction between clinical practice and research communities to reduce the evidence to practice gap (Graham et al., 2006).

Evidence based medicine has its origins in clinical epidemiology as a “science of the art of medicine, being the conscientious, explicit and judicious use of current best research evidence in making decisions about the care of individual patients” (Sackett et al., 1996). The underlying principle is that care of patients which includes making a diagnosis, providing a prognosis and offering options for treatment, is enhanced with the knowledge that has been previously studied on patients and then used to enhance clinical practice. The World Health Organisation (2005) adapted the Canadian Institutes for Health Research 2000 definition of Knowledge Translation and defined it as: the synthesis, exchange and application of knowledge by relevant stakeholders to accelerate the benefits of global and local innovation in strengthening health systems and improving peoples’ health. To help address this issue the development of the Collaborations for Leadership in Applied Health Research and Care (CLAHRCs) and the Academic Health Science Networks initiatives were set up in the United Kingdom in 2008 with nine pilot groups which have now expanded to thirteen (National Institute for Health Research, 2017) . Their mission statement suggests that high quality applied health research that is completed should focus on the needs of patients and support the translation of research evidence into the clinical practice

of the NHS. They aim to bring together health service and research organisations to: increase the production of robust research and its application into day-to-day practices of health care clinicians; underpin health care policy; and to support management of organisations. Similar initiatives were also developed in the United States and Australia as the issue of translating knowledge has been reported as a global problem (Ferlie et al., 2016).

Graham et al (2006) report that the differing terminology that is used by different authors can add to less effective knowledge mobilisation and also to confusion amongst researchers and stakeholders alike. These different terminologies appear to be used interchangeably and include: knowledge translation; knowledge exchange; knowledge mobilisation and knowledge transfer; knowledge to action; research utilisation; implementation; dissemination and diffusion.

It is recognised that good quality evidence can take years to be implemented into clinical practice, some clinicians in the field of knowledge mobilisation have suggested it can take up to seventeen years (Blair, 2014). Issues such as lack of awareness of the evidence, poor understanding of the evidence and lack of facilities and resources to explore the evidence have been cited as potential barriers to getting this evidence into clinical practice (Shifaza et al., 2014). Research is expensive to complete and in the current climate there is an ever increasing requirement to ensure its clinical applicability and that the outcomes of research get into clinical practice quicker (Turner et al., 2012).

Estimates suggest that 30-40% of patients are not receiving care according to current scientific evidence, while 20% or more of the care is not needed or potentially harmful to patients (Grol, 2003). Porcheret et al (2007) report that many

effective interventions are not used in clinical practice e.g. exercise, weight loss and written information for adults with knee pain. This indicates that the evidence to practice gap has not yet been addressed and NHS clinicians may not be giving the most evidence based care to address the needs of the patient population.

4.3 Knowledge Mobilisation Approaches

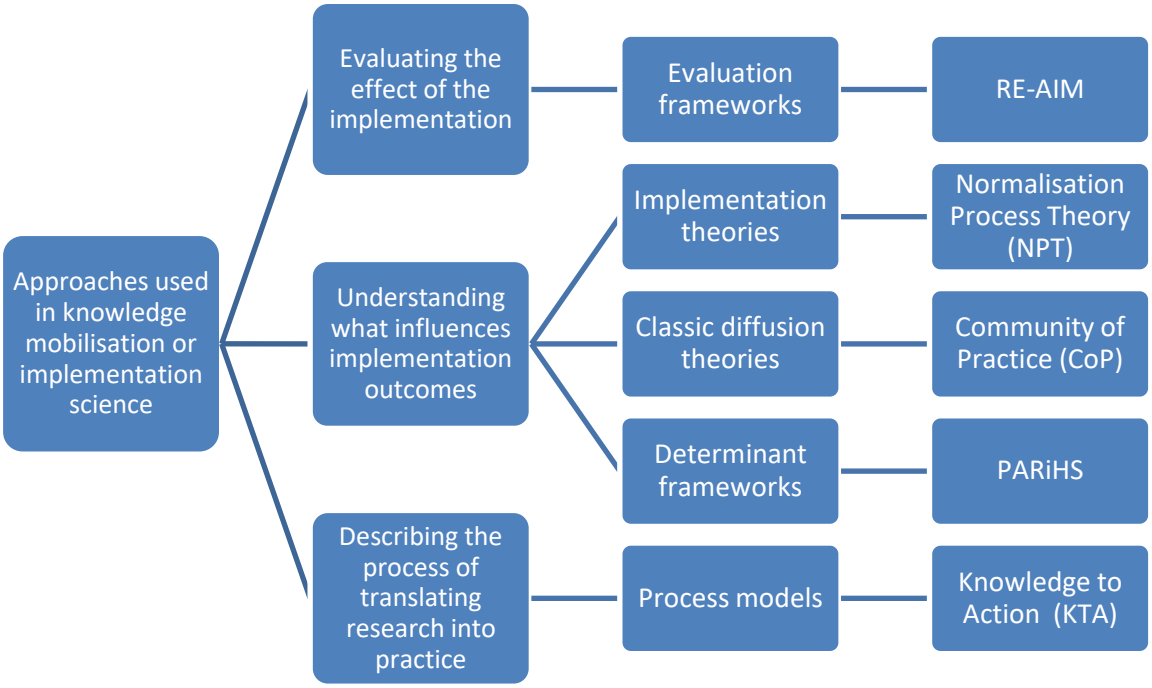
Per Nilsen (2015) reported that there are many different methods on how to mobilise knowledge and completed a narrative review in order to propose a taxonomy to distinguish these different approaches. Nilsen suggested that there was a need to address the general lack of understanding associated with knowledge mobilisation theories to ensure the most appropriate method was used to enhance successful implementation of research findings. Figure 4.1 illustrates how the theoretical approaches used in knowledge mobilisation can be divided into three overarching concepts (Nilsen, 2015):

1. Describing the process of translating research into practice
2. Understanding what influences implementation outcomes
3. Evaluating the effect of the implementation

Nested within each concept are five categories of theories, frameworks, and models used in its implementation. An example from each of the approaches reported by Per Nilsen has been added in Figure 4.1. Each of the examples will be explained in more detail in this chapter in order to highlight the similarities and differences between them and to show visually where the community of practice,

which is included in the methodology of this thesis fits into the knowledge mobilisation approaches.

Figure 4.1: Summary of Knowledge Mobilisation theories, frameworks and models



4.3.1 Process Models

Process models describe a process with a series of steps and decisions involved in the way work is completed. An example of a process model is the Knowledge to Action (KTA) process. It was developed in Canada in the 2000's in response to the confusing multiple terms used to describe the process of moving knowledge into action by providing specific steps that follow a process in order to translate research into practice. It is divided into two concepts: knowledge creation which is

represented by a funnel, which is then surrounded by the action cycle. Each of these is then sub-divided into phases or categories. Graham et al (2006) proposes that boundaries within the process are fluid, and that the action phases can occur either sequentially or simultaneously; and can then be further influenced by knowledge. The knowledge is taken from both researchers and users of research, which includes both clinicians and patients, and becomes more refined towards the apex of the inverted triangle with the production of tools and products e.g. journals and care pathways. The Action part of the process relates to the activities that support the implementation or application of the acquired knowledge, monitor its use and to evaluate its impact with practitioners.

Petzold et al (2010) successfully used the KTA process to share best practices in the management of stroke rehabilitation to clinicians, managers and researchers, however they reported that this process was expensive and clinical departments may not have the relevant resources to support this method. This was supported by Field et al (2014) who completed a systematic review to see 'how' and 'if' the KTA was used in health care and academic settings and reported that it was a practical and flexible guide to enhance getting evidence into practice, having the ability to adapt to different health care settings. Due to the complex and challenging nature of exchanging knowledge between stakeholders within health care, Graham et al (2006) indicated that there would be a need to ensure that appropriate relationships are cultivated in order to achieve a common understanding to support the effectiveness of the KTA process.

4.3.2 Determinant Frameworks

Determinant Frameworks specify types of determinants that act as barriers and enablers that may influence knowledge implementation into practice which include health care professionals behaviour change or adherence to a clinical guideline, they do not address how change takes place (Nilsen, 2015)**.** An example of a determinant framework is the Promoting Action on Research Implementation in Health Services (PARiHS) framework (Kitson et al., 1998). It is widely used to try and both explain and predict why the implementation of evidence into practice is or is not successful. Rycroft-Malone (2004) suggested that there are three elements to successful research implementation:

1. The clarity of the evidence, which would need to be scientifically robust and meet professional consensus, patient preferences and local data
2. The context is change receptive, with communities involved having a good learning culture, strong leadership, and that comprehensive monitoring and feedback processes were in place
3. Skilled internal and external facilitators were in place, to support the change process and to ensure the implementation of evidence into practice is easier by holistically enabling the stakeholders involved

PARiHS was one of the first frameworks that highlighted the importance of context with regard to the complexities of implementation and it has been suggested that this framework was useful for research implementation but that its limitation was that it had not been rigorously tested and was therefore not evidence based Kitson et al (2008). An evaluation element was suggested as an added benefit and also produced a detailed reference guide to enhance researchers' use of the PARiHS

framework in implementation (Stetler et al., 2011). More recently the iPARiHS framework was proposed with an added facilitation element both as a role and as a set of strategies and actions to enhance the implementation process (Harvey & Kitson, 2016).

4.3.3 Classic Theory

Classic theories originate from psychology and sociology and provide an understanding and/or an explanation to the aspects of implementation (Nilsen, 2015). He also suggests that they incorporate the Theory of Diffusion, which highlights the importance of opinion leaders, change agents and gate keepers for successful adoption and implementation of knowledge (Rogers, 2003). A Community of Practice (CoP) is an example of a Classic Theory; they facilitate knowledge exchange among practitioners, researchers, decision makers, and the community and originate from psychology, sociology and organisational theory. CoP have been embraced within healthcare as they have been reported to facilitate engagement from a variety of stakeholders and patient led communities (Le-May, 2009). They have been further described as groups of people who commit to each other to support the sharing of learning, develop new knowledge, share discoveries with anyone involved in similar work, to improve individual and organisational practice (Wheatley, 2007). Conklin et al (2013) suggested that the facilitation of these groups should be supported by a Knowledge Broker in order to progress the exchange of knowledge, maintain engagement of the members, and to stay focussed on the primary purpose of the CoP. Kerno (2008) highlighted some of the limitations associated with this approach which included: time

allocated to allow engagements of members with activities for them to be effective; members must co-exist with pre-existing organisational hierarchy; and that the members were open to explore change.

CoP have been used in corporate and governmental sectors, for example, the United States Army has utilised them to help solve technological challenges (United States Army, 2014) and Shell has used them to facilitate multidisciplinary learning between more than 10,000 of its employees (Milton, 2016). National Voices is a coalition of charities that promotes people being in control of their health and care. Their objective is to support patients, carers and members of the community to control and influence decisions that affect their own health and care. They recently used a CoP to help: develop leaders through peer to peer support and informal mentoring; and providing an environment where collaboration can flourish to help enable change (Kousa, 2017).

4.3.4 Implementation Theory

Implementation theories have been developed or adapted by researchers to understand and explain aspects of implementation, some of which have modified certain aspects of existing theories, which allows researchers to prioritise aspects that might be considered to be critical (Nilsen, 2015). A Normalisation Process Theory (NPT) is an example of an Implementation Theory. It is a sociological toolkit which is available to view free online and can be used to understand the dynamics of implementing, embedding, and integrating a new technology, complex intervention or working practice, which helps to break down the human processes that occur when a new set of practices are encountered within healthcare (May et

al., 2009). NPT is thought of as a means to bridge the gap between research evidence, policy and practice and is mainly concerned about what people do as both individuals and groups within organisations, to embed and maintain a new intervention, as opposed to their attitudes and beliefs (May et al., 2016). NPT has been reported to offer a framework that could be used successfully to implement knowledge mobilisation within a number of health related fields, however to ensure a diverse range of perspectives were included, stakeholders and service users should also be included (McEvoy et al., 2014).

4.3.5 Evaluation Framework

An Evaluation Framework proposes how knowledge implementation can be evaluated to determine how successful the implementation has been. The RE-AIM framework is an example of an evaluation framework for implementation scientists, health promotion professionals and practitioners and is an acronym for the framework's five evaluation components of: reach, effectiveness, adoption, implementation, and maintenance. It assists with the translation of research into practice and to estimate the public health impact of programmes and interventions and the five components are reported to assess the impact of innovations at both an individual and organisational level (Glasgow et al., 1999).

RE-AIM has been applied to evaluate intervention impact in a variety of settings including weight loss (Akers et al., 2010) and injury prevention (Finch, 2012), by assessing the effectiveness of a single intervention in achieving behaviour change of a patient, community member, student or employee (Gaglio, 2013). It has been applied less to understand the impact of knowledge implementation within

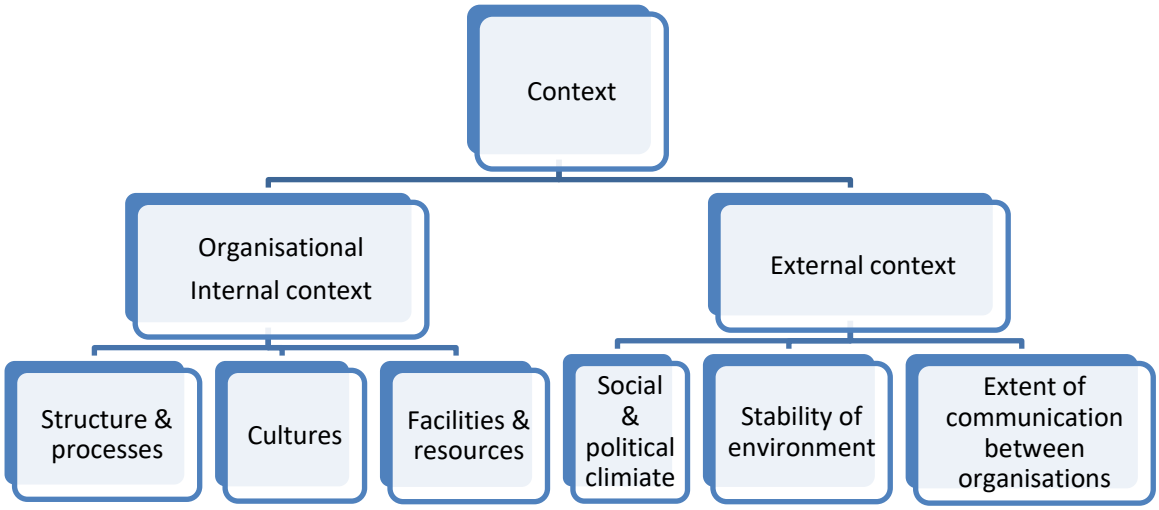
organisations, however a study completed by Sweet et al (2014) to promote physical activity among adults with spinal cord injury over a large health community in Canada, indicated that it could be used to evaluate large multi organisational activities to implement clinical practice guidelines or to bridge the evidence to practice gap.

There is considerable overlap between KM theories, models and frameworks, and it is important to identify the most relevant approach or to combine a number of approaches in order to achieve the desired outcome, and further evaluation is required to assess their effectiveness in addressing the evidence to practice gap (Davies et al., 2008; Nilsen, 2015).

4.4 Context

It has been proposed that the success and failure of information dissemination depends on the interactions that occur within organisations (Greenhalgh et al., 2004). It was suggested that a number of factors needed to be addressed in relation to context, prior to developing knowledge mobilisation processes (Ferlie et al., 2016. These factors have been summarised within Figure 4.2.

Figure 4.2: Contextual factors requiring review prior to knowledge mobilisation



Authors agree that context is an important component to review, and is included in a number of knowledge mobilisation approaches (Ward et al., 2009). Nicolini et al (2008) suggest that any one organisation (e.g. health care) may have sub organisations (e.g. clinical research, health service research, health policy) and each may require a different KM approach. A narrative review by Greenhalgh et al (2004) suggested that context is important to consider but is also unpredictable and due the available literature being vast, and the differing terminology used within the literature, the authors made some subjective judgments which may have affected the results.

Ferlie et al (2016) suggest that there is a potential for the flow of knowledge mobilisation to become 'stuck' or lost due to the complex institutional, professional and social environments that it connects between e.g. health care. Best and Holmes (2010) suggest that there are three areas that need to be considered to address knowledge mobilisation: linear; relationships; and systems. The 'linear' concept suggests that there are two separate social worlds of knowledge

production and knowledge application and that there is a limited connection between both of them (Brown, 2012). Some authors disagree with this concept because they do not take into account that knowledge is translated into practice in a social, collective and situated manner and its success has not been well evaluated within more complex health environments (Oborn et al., 2013). The 'relationship' concept suggests that learning is more social and depends on relationships (Ferlie et al, 2012) and that more engagement with end users is required (Tetroe et al., 2008). With regard to the 'system' concept, Riley (2012) suggests that health systems are a series of complex, interlocking networks and not linear. It has been proposed that the tools and strategies of how to influence knowledge mobilisation within these systems still need to be reviewed (Willis et al., 2014).

In summary organisational context needs to be considered for knowledge mobilisation within health care because these environments have multiple levels with varying cultures; varying teams and individuals which adds to the challenge of implementing change (Lau et al., 2016).

4.5 Knowledge Push and Pull

A constant that runs across all the knowledge mobilisation approaches is the importance of the dynamics between all the stakeholders. Oborn et al (2013) conducted a narrative review of the literature available on knowledge translation within health services research and management scholarship looking specifically at the theories of learning and knowledge. They proposed that it is important to involve knowledge mobilisation processes at multiple levels which include

individual, organisational and strategic levels. The necessity to move knowledge between these multiple levels was supported by Davies et al (2008) who introduce the concept of “knowledge push” (from researchers to potential users) and “knowledge pull” (from these users back to the researchers) which also needs to be addressed in order to bridge the lack of perceived connection between these two groups of stakeholders. This highlights two areas that will be discussed in more detail:

- who might be the best individuals to liaise between stakeholders?
- what is the best way to enable this to be achieved, when there are so many levels within health care organisations to connect with?

This gap between academic research and practice within the field of management is widely acknowledged (Rynes et al., 2001) and focuses on the movement of knowledge between departments within the same organisation (intra) and between two or more different organisations (inter). Within healthcare services Wenger et al (2002) suggested that a number of ways can be introduced to “build bridges” across these potential gaps including: people acting as brokers between communities; and a variety of interactions among people from different communities of practice.

The success of individuals reducing these potential gaps, also known as knowledge brokers or knowledge facilitators, depends on the closeness of the relationship and trust between organisations (Hansen et al., 1999; Lane et al., 2001). Oborn et al (2013) indicate that there is a need to build relationships and collaboration at an organisation, group and individual level and this is a key message for health services to take on board in order to facilitate knowledge

mobilisation. The variety of stakeholders, academic and occupational communities and the different languages and interpretations between these communities can result in a lack of consistency and agreement (Nicolini et al., 2008). Currie and Suhomlinova (2006) highlight that the opportunities for the integration of academic and clinical research is reduced due to the variance between different professional groups within the NHS. Additionally it has been reported that the boundaries between professional and managerial ways of organising healthcare within the NHS again blurs approaches to knowledge mobilisation (Graham, 2006).

Researchers, members of the public and service users, professional practitioners, health service managers, have all been identified as needing to be made aware of knowledge and some individuals may be members of more than one group (Lavis, 2003). Engaging a link person (knowledge broker) between these groups has been promoted by the health sector and is believed to be an important factor in encouraging the use of evidence, however, it has been indicated that the link person may have certain influence within their own organisation (where they are known and may share similar views), but may have limited impact with external organisations (Ellen et al., 2013).

An additional concern is that the relationships between the ‘knowledge brokers’ and the groups will depend on the skill-sets and personalities of those involved; many researchers may feel most confident in talking about research findings to their academic peers rather than to policy makers or managers (Ettelt et al., 2013). If there is a high turnover in the individuals involved in policy, management, practice, or academic settings it would suggest that this could be a potential barrier to developing on-going relationships.

4.6 Knowledge Mobilisation Evaluation

The literature on knowledge mobilisation has grown considerably over the last two decades. A recent study funded by the National Institute for Health Research (2015) was completed to gain an insight into the practicalities of the knowledge mobilisation approaches used to inform initiatives on how to make research more effective. They completed interviews and a web based survey across fifty one health care agencies within the UK and concluded that there was a need to more formally evaluate existing knowledge mobilisation approaches as without further evaluation they do not have a good evidence base. Additionally, Oborn et al (2013) expressed concern about a lack of clarity as to who is responsible for research governance and implementation. The long-term sustainability of knowledge implementation could be adversely affected due to the limited funding associated with relatively short term projects (Kislov et al., 2014). They proposed a more strategic approach within organisations was required, with three areas to be taken into account at an organisational level in order to increase the capacity of knowledge mobilisation:-

- An individual should be based in a healthcare organisation that is supported by or embedded into an external knowledge mobilisation team
- A team based in a healthcare organisation should be working on a knowledge mobilisation project supported by an external knowledge mobilisation initiative
- The whole organisation should be involved in one or several knowledge mobilisation projects which in turn are supported by an external knowledge mobilisation team

Bambra et al (2010) recognised that policy, professional and organisational context and political economic circumstances impacted on the design and implementation of complex interventions. A more recent narrative review by Lau et al (2015) was completed to ascertain the effectiveness of knowledge implementation strategies to ensure that the evidence to practice gap is reduced. They indicated that it was unclear which strategy was more effective and identified a need for further research to assess effectiveness of strategies targeted at the wider context and organisational levels and to examine their cost effectiveness. More recently Lau et al (2016) completed a narrative review to identify the causes associated with the evidence to practice gap for complex interventions in primary care. The authors interpreted the studies and reported that both health care professionals and commissioners need to be aware of the constantly changing context that surrounded the uptake of complex interventions in health care, and produced a framework consisting of four themes: external context; organisation; professionals; and intervention, which needed to be taken into account when addressing this evidence to practice gap.

4.7 Chapter Summary

This chapter presented an overview of some of the aspects and challenges associated with knowledge mobilisation approaches. There is considerable overlap between KM theories, models and frameworks, and it is important to identify the most relevant approach or to combine a number of approaches in order to achieve the desired outcome and these approaches require further evaluation (Davies et al., 2015; Nilsen, 2015).

The concept of a CoP has been explained and where it sits within knowledge mobilisation approaches. This concept will be explored further in the subsequent chapters as this thesis uses a qualitative focus group methodology of a CoP to highlight the barriers and potential solutions to mobilising best evidence for hydrotherapy.

Clinicians are faced with a lack of time and limited access to peer reviewed journals, some have limited critical appraisal skills and find it onerous to understand the conflicting evidence that is reported. The inconsistency with regard to the terminology used has been highlighted as an area that might be addressed with knowledge brokers or facilitators that move between stakeholder organisations to break down some of these barriers to implementing evidence based practice. Research is expensive to complete and therefore it is imperative to ensure that the evidence gets back to the front line quickly in a language that is understood by the majority and not the minority to ensure patients receive the most effective treatment.

For the purpose of this study the umbrella term of “knowledge mobilisation”, used by Ferlie et al (2016) will cover any activities aimed at collating and communicating research-based knowledge within the health care system.

The next chapter specifies and evaluates the methodological phases and approaches that have been used in the thesis.

Chapter five: Overview of Research Methods

5.1 Introduction

The previous chapters have summarised the reported benefits of hydrotherapy for musculoskeletal conditions and the increased financial pressure on NHS services to justify its continued use. Knowledge mobilisation approaches have been explored as they are designed to help reduce the challenges associated with the evidence to practice gap.

This chapter describes the elements of both quantitative and qualitative research methodologies to justify the chosen methodology for the thesis. It also explains the value of patient and public involvement in the development of research questions as well as being participants within the studies.

5.2 Quantitative methods

Quantitative methods are highly structured and aim to establish the existence of a cause-effect relationship e.g. if the introduction of an intervention causes a change in the outcome measure of interest (Sim & Wright, 2002). This predicted outcome (hypothesis) is tested by a researcher and guides research design and statistical analysis. It has been described as any type of research where measurement is involved and may refer to both the method of collecting the data and the type of data involved (Moule, 2015). The results of the research will either support the prediction or not and therefore confirm or refute the hypothesis.

An example of a quantitative methodology is a randomised controlled trial (RCT). RCT can be used to evaluate different types of interventions in different populations and settings and for different purposes making them the most appropriate study design for evaluating the effects of an intervention (Centre for Reviews and Dissemination, 2009). This interventional or experimental study design, consists of participants (either individuals or groups) being allocated randomly to one intervention or another. These participants can be allocated to a new intervention being tested or a control treatment. Both sets of participants are reviewed after a specified time period and analysed using specific outcomes that were identified at the beginning of a study. RCT are generally defined as explanatory or pragmatic, measuring efficacy and effectiveness (Jadad, 1998). They have been used within health care over many years due to their potential to control bias, however if trials are completed poorly then results could be misleading (Begg et al., 1996). Well-designed RCT are considered to be the most reliable form of scientific evidence in the hierarchy of evidence and provide the highest level of evidence for effects of an intervention based study (Peat, 2002).

A systematic review identifies relevant studies, synthesises information and presents an objective summary of the results, taking into consideration any limitations in the evidence (Sim & Wright, 2002). They use explicit methods to systematically search, critically appraise and synthesize the literature for a specific issue (Sackett et al., 2000), these methods help to limit bias by accepting and rejecting studies making conclusions more reliable and accurate (Greenhalgh, 1997). It has been regarded as secondary research, because it analyses existing research findings rather than collecting new data (Parahoo, 2014). Systematic

reviews can give a precise estimate of the effectiveness of health interventions or demonstrate where clinical knowledge is lacking (Pettigrew & Roberts, 2006).

Systematic reviews of RCT are traditionally considered the gold standard for judging the benefits of intervention based treatments (Barton, 2000). However, in 2009, Chalmers & Glasziou reported that at least 50% of research reports were not suitable because of incomplete reporting, implying that unless the methodology of randomised control trials are reported in enough detail that the clinical applicability is reduced. Rothwell et al (2005) indicated that clinicians were concerned that external validity in trials was poor and was supported by Flather et al (2006) who suggested that clinicians needed to be careful before they routinely applied RCT results into clinical practice as the health care environment where the trials were completed may differ from the actual patients presenting in practice, especially if the participants were selected and therefore not necessarily a representation of 'real life' patients.

The Consolidated Standards of Reporting Trials Guideline's 2010, main purpose is to improve the reporting of different types of health research, which in turn should improve the quality of research used to aid clinical decision-making in healthcare (Schulz et al., 2011). It uses a 25 item checklist and flow diagram to aid the reporting of RCT's in order to help readers assess a trials validity and is an evidence based, minimum set of recommendations that was initially developed in 1996 (Begg et al., 1996) and subsequently reviewed and updated in 2001 (Moher et al., 2001) and 2010 (Schulz et al., 2011). The latest version incorporates eight additional checklist items to address the applicability of more pragmatic/practice based trials (Zwarenstein et al., 2008), in order to improve the external validity of randomised controlled trials and to increase clinicians confidence in the results.

5.3 Qualitative methods

Qualitative research has become increasingly respected; complimenting and enhancing quantitative research, allowing different perspectives on unknown areas and ideas to be documented (Strauss & Corbin, 1990). Qualitative research methods are concerned with an individual's situations and experiences (Watson et al., 2008), with data collection focussing on verbal accounts or observation, which provides analytical accounts of reality (Holloway & Wheeler, 1996). The main philosophical models used in qualitative research are: phenomenology, grounded theory and ethnography (Moule, 2015).

Ethnography relies on the researcher being able to fully immerse themselves in the subject, often living amongst the culture over a long period of time and getting to know the research participants, until a clear understanding of the research objective is reached (Chesney, 2001). The researcher becomes fully immersed in the group as an active participant and experiences the group or organisation as 'an insider' and not as 'an outsider' looking in, recording extensive field notes during the process (Moule, 2015). Data are collected in a systematic way, without the researcher's own beliefs and attitudes impacting on the outcome (Brewer, 2000). An ethnography model was not thought to be appropriate to use as it did not meet the requirements of the study methodology, because the CoP was planned to take place over a short period of time and was a one off event, and the researcher did not need to be an active participant.

Grounded Theory was originally derived from sociology and first introduced by Glaser and Strauss (1967). Grounded theory seeks to understand individuals' experiences by becoming familiar with those who are being studied (Bourgeault et

al., 2011). The focus is on ongoing data collection with systematic analysis of data throughout the course of the research. Theory is then generated from the data, often leading to new theories and questions which can then support future research (Sheldon, 1998). The objectives of this thesis are to understand the participants' experiences, the data collection will only be completed once and therefore a grounded theory approach was not thought to be appropriate. However, should a series of CoP take place, with subsequent systematic analysing of the data collected; an element of the grounded theory methodology might have been appropriate.

Phenomenology has a long history in social research including psychology, sociology and social work and is based upon the work of the 20th century philosophers Edmund Husseri and Martin Heidegger. Phenomenology attempts to understand people's perceptions, experiences and understanding of a particular situation or phenomenon without interference from the researcher by utilising open questions to facilitate expression of their own ideas (van-Manen, 1990). Bourgeault et al (2010) suggest that this allows researchers to gain insights to support the development of strategies that enhance practitioners understanding and sensitivity to the population that they serve. A phenomenology methodology was therefore felt to be appropriate to use in this study, because it was essential to capture the participants' previous experiences of hydrotherapy to inform the discussions within the community of practice.

5.4 Patient and Public Involvement in Research

Involving patients and members of the public in research can lead to better research, clearer outcomes, and faster uptake of new evidence (National Institute for Health Research, 2017). They define ‘public’ as patients, potential patients, carers, users of health and social care services as well as people from organisations that represent people who use all of these services. Arthritis Research UK (2017) have recently published a ‘researcher’s guide’ to patient and public involvement in research and suggests that the patients who have experience of the conditions that are being researched, should also be involved in the development of the research as well as being the participants within the research studies (Arthritis Research UK, 2017).

Keele University has an active Patient and Public Involvement and Engagement (PPIE) group, and by listening to these individuals, who live through these conditions on a daily basis helps to support the production of research evidence (Keele University, 2017). At the Research Institute for Primary Care and Health Sciences patients, carers, relatives and members of the public who have experience of conditions are encouraged to join this rapidly expanding advisory group, which already consists of eighty members. These members are currently involved in approximately seventy different physical and health research projects (Keele University, 2017). The engagement element at Keele is where information and knowledge about research is provided and disseminated at open day events at the research centre; raising awareness of research through media; and dissemination of study findings to research participants, colleagues or members of the public.

Nationally the Arthritis and Musculoskeletal Alliance (ARMA) brings together support groups, professional bodies and research organisations in the field of arthritis and other musculoskeletal conditions (ARMA 2017). Their mission is to work collectively and collaboratively with their member organisations which range from specialised support groups for rare diseases to major research charities and national professional bodies, to meet their visions of musculoskeletal disorders being a priority in policy and practice in the United Kingdom.

The local ARMA group at the Haywood Hospital, which has recently being renamed the Haywood User Group (HUG), meets quarterly bringing together patients, patient groups, health professionals and academics to: monitor local service provision; identify, and campaign on local service issues using the ARMA Standards of Care and other policy initiatives; and to provide a forum for service users, providers and planners. This group of patients were asked for their opinions on what was important to them with regard to hydrotherapy as an intervention and the benefit if any they received from it.

5.5 Chapter Summary

This chapter has discussed quantitative and qualitative research methodologies with a specific focus on qualitative research as the candidate sought to explore and further understand the participants' knowledge and understanding of aquatic therapy using a qualitative methodology. This approach enables the researcher to "seek the deeper truth" (Greenhalgh, 2006) and establish a way to extract the rich information from those taking part, which is often not facilitated by the constraints of quantitative research.

The value of patient and public involvement in the development of research questions as well as being participants has been highlighted.

Chapter six specifies and evaluates the methodological phases and approaches that were used in the thesis.

Chapter six: Research Methods

6.1 Introduction

The previous chapter specified the phenomenology approach used to gain participants views in the community of practice.

The Critically Appraised Topic (CAT) and the Community of Practice methods provided the opportunity to move from one phase to the other.

This chapter will describe the rationale for each of these approaches.

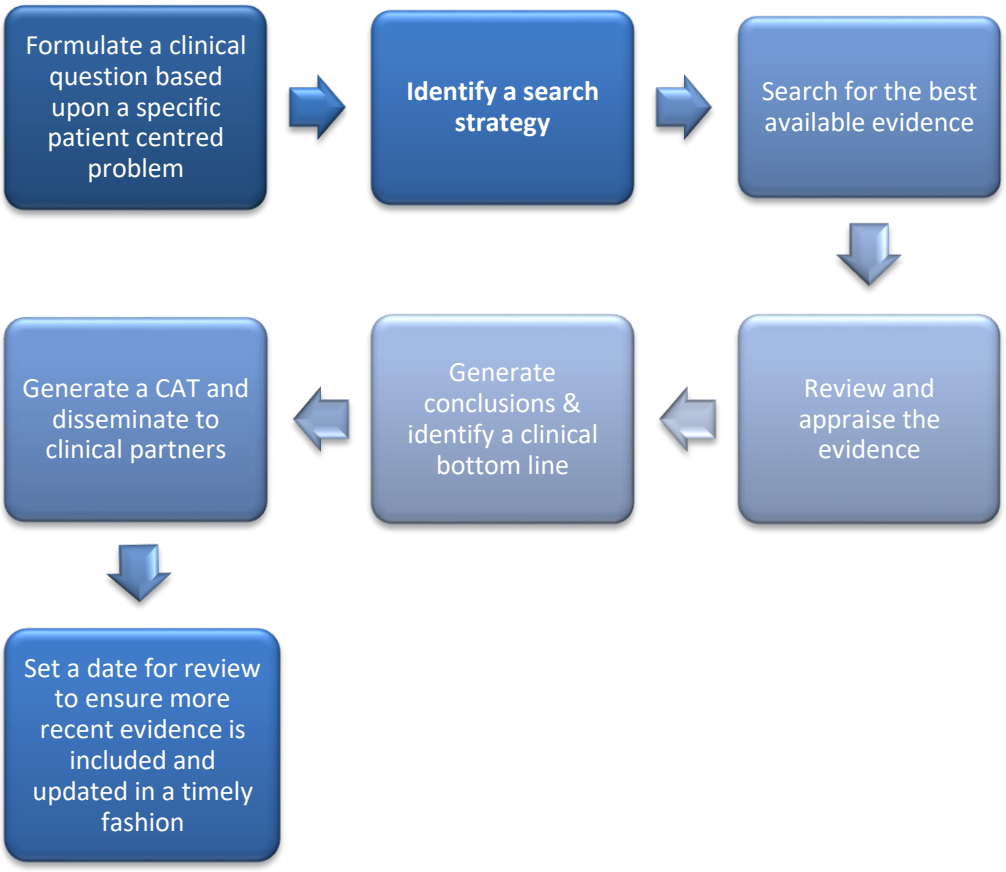
6.2 Critically Appraised Topics (CATs) Method

A Critically Appraised Topic (CAT) is a method of critically appraising and summarising the best available evidence to answer a clinical question and generates a clinical bottom line (Foster et al 2001). The CAT question is usually generated by clinicians, to help answer a common patient specific problem, and therefore has direct relevance to clinicians and patient centred care. The format of a CAT has the potential to be utilised across all areas of physiotherapy practice with the ability to generating a clinical bottom line, which is brief and takes two to five minutes to read. This is of paramount importance for clinicians in busy environments wishing to give evidence based treatments to the patients under their care (Foster et al., 2001). Reported benefits of using a CAT are; enhancement of literature searching; improvement in clinical expertise and informed clinical decisions making (Stevenson et al., 2007). It has been suggested

that there may be inadequacy and a lack of transparency in the reporting of some of these rapid review approaches and that specific reporting guidelines need to be identified to reduce these limitations (Kelly et al., 2016).

Foster et al (2001), and Stevenson et al (2007), suggest the following stages should be involved in the generation of a CAT (Figure 6.1):-

Figure 6.1: Stages involved in the generation of a CAT



Foster et al (2001) proposed that a full and comprehensive review of all the relevant literature should take place and due to the undoubted variance in some clinicians understanding of research processes, terminology and literature

searching it could be important to have experts in this field available to support the completion of CAT's to ensure that the clinical bottom lines generated are appropriate. This potential risk was addressed by Stevenson et al (2007) who included a librarian in the CAT group to support the literature search process and is further supported by Crowe et al (2012), who noted that a CAT has the ability to be used across a wide range of research designs however this is dependent on the expertise of the individuals' reviewing the literature and creating the clinical bottom lines.

Each stage of the CAT process utilised in this study will now be discussed in more detail.

6.2.1 Formulate a clinical question based upon a specific patient centred problem

The first stage in the CAT methodology is to identify an answerable clinical question. The PICO model is used in evidence based practice to generate an answerable clinical research question and to support literature search strategies and is utilised within the CAT process (Davies, 2011). This mnemonic was first suggested by Richardson et al (1995) to help break down clinical questions into searchable keywords. It has been reported as a valuable tool to assist clinicians to generate clinical research questions, but is less suited to answering diagnosis, aetiology and prognosis questions (Schardt et al., 2007). This has been highlighted in more detail in Table 6.1.

Table 6.1: PICO model for clinical questions (Richardson et al., 1995)

P	**P**atient, **P**opulation or **P**roblem
I	**I**ntervention or Exposure
C	**C**omparison
O	**O**utcome you would like to measure

Once the clinical question has been identified, the next stage in the process is to complete a comprehensive literature search.

6.2.2 Identify a search strategy and search for the best available evidence

Once the clinical question has been identified a methodical search for the best available evidence is completed. The CAT process is not a systematic review, it requires a search for the best available evidence of which randomised controlled trials and systematic reviews are suggested as the 'gold standard' of research design in health when looking at the effectiveness of intervention type questions (Sackett et al., 2000). Within the CAT group at Keele, a University Librarian has been integrated into the group to offer expert advice to ensure that the appropriate electronic databases are searched and to confirm that the literature has been reviewed appropriately (Stevenson et al., 2007). The following databases are routinely searched: Cochrane, Clinical Evidence, DARE/HTA/NHSEED, Medline, CINAHL, AMED, PsycInfo, Web of Science, Rehabdata, Embase, Joanna Briggs Institute, PEDRO, NICE, CKS, Sports Discuss, Pubmed and Evidence updates. Additional databases may be recommended by the librarian to ensure a

comprehensive search is completed. A pragmatic approach is used in order to confirm a date range for the literature search. This is based on the individuals formulating the PICO and how well researched the specific area is. A narrower time frame is set for more popular research areas.

6.2.3 Review and appraise the evidence

The evidence found then requires interrogation of the abstracts of the articles found, in order to determine the appropriateness of each to the clinical question posed, referring back to the PICO to ensure appropriateness is maintained. When the abstracts have been reviewed for appropriateness, the articles are reviewed in full to assess for quality.

Appraisal of quality is the process of careful and systematic evaluation of research in order to establish whether a study addresses a clearly focussed question, uses valid methods to address this question and has results that are important and applicable to a specific context (Glasziou et al., 2005).

There are a number of tools for assessing the quality of literature, some use scales to score studies and others use checklists without producing a score (Crowe et al., 2011). The CAT process utilised within this study uses the Critical Appraisal Skills Programme (CASP) tool (Critical Appraisal Skills Programme (CASP), 2016). Akobeng (2018) advocates its suitability for a clinical audience, who may have limited research experience, together with its easily understood series of questions and specific guidance which enhances inter-rater reliability.

The CASP tool was originally developed in 1993 by Sir Muir Gray, Director of Research and Development, Oxford Regional Health Authority, to help healthcare professionals wishing to gather evidence to support their practice, decision making or development of policy or guidelines. Adjustments have been made over the subsequent years, and it continues to be adopted as an educational tool to aid critical evaluation for health care professionals in respect of the overall quality of the evidence being reviewed (CASP, 2016). CASP helps in the development of the necessary skills to make sense of the evidence with a series of checklists to review the validity and relevance of studies. The reviewer is asked to record a 'yes', 'no' or 'can't tell' answer alongside a series of questions. The first two questions for both the randomised control trial and the systematic review are screening questions, both of these need to be answered 'yes' to ensure that it is worth proceeding with the remaining nine and eight respectively. The specific questions are highlighted in appendix 9. An overall score is not given to confirm the quality of the papers being reviewed, as the checklists were designed to be used as educational tools within a workshop setting, for example the Musculoskeletal CAT Group at Keele University. Therefore the CASP tools rely on some overall judgement of the appraisers (CASP, 2016). This overall judgement could be biased, although Pope et al (2007) advocate the use of a narrative approach to support the judgements of the appraisers to help improve confidence in the results.

The Cochrane Collaboration's tool for assessing risk of bias within results is another example of a process to give a critical judgement on the quality of studies. To increase confidence in the results they recommend that all the judgements are made independently by at least two people, with any discrepancies resolved by

discussion (Higgins & Green., 2005). Higgins et al (2011) acknowledged that using judgements within this tool may need to be evolved further, taking into account new evidence to enhance specificity of results.

Katrak et al (2004) suggest that there is no ‘gold standard’ critical appraisal tool for any study design and recommend that reviewers should ensure that they carefully select the most appropriate appraisal tool for their specific needs. It has been suggested that using a summary score together with a weighting scheme, for more important parts of the studies, may increase confidence in the judgements made with regard to the quality of the articles reviewed in CAT processes (Crowe et al., 2011).

In order to address the element of confidence in the results produced within this study a narrative summary of the literature has been included in Chapter 7.3 to help readers understand why specific judgements were made with regard to the methodological quality of the papers. Additionally tables can be found in Appendix 9, that show the CASP rating of low, moderate or good given to each of the papers that were reviewed. An independent review of the papers and judgement as to its quality was initially gained by the research student and the lead supervisor. A level of agreement was gained from the student’s and lead supervisor’s judgements based on the CASP questions and with any further disagreement, clarification was sought by an independent experienced reviewer to ensure the appropriateness of the CASP ratings given. This additional level of clarification by an experienced reviewer already exists within the Musculoskeletal CAT Group at Keele University to ensure the quality of the judgements made by the members of the group prior to publication.

6.2.4 Generate conclusions & identify a clinical bottom line

Following review of the full articles using the CASP tool the results are collated into a table format to show:

- the first author, type and year of publication
- population and setting
- intervention or exposure tested
- study results
- assessment of the quality of the study with overall comments

Conclusions are then generated in order to produce a clinical bottom line that can be shared with stakeholders. A clinical bottom line (CBL) is a concise summary of the current available evidence (Foster et al., 2001).

6.2.5 Generate a CAT and disseminate to clinical partners and set a date for review to ensure more recent evidence is included and updated in a timely fashion

The final two stages of the CAT methodology that is used by Keele University require the completed CAT to initially submit them to the next Musculoskeletal Research Facilitation Group Meeting within Primary Care at Keele University for approval. Once approved the CAT is disseminated to clinical partners via the members of the group and their website (Musculoskeletal Research Facilitation Group, 2017). A date is also agreed to complete an up to date literature search to

review any new evidence that might have emerged over a set period of time, which is subsequently evaluated and is included in an updated CAT.

The CAT methodology was thought appropriate to use as it is a rapid method of identifying the best available evidence to answer a clinical question that has direct relevance to clinicians and patients. It provided the opportunity to generate a clinical bottom line to present to the participants of the CoP.

6.3 Community of Practice (CoP) Method

A Community of Practice (CoP) is defined as a group of experts in a particular field, who are passionate about a topic and wish to discuss any concerns or problems that may arise and meet regularly in order to improve their knowledge and expertise (Wenger et al., 2002). The concept of a CoP has been attributed to Jean Lave and Etienne Wenger while they were studying apprenticeships as a learning model and has since been reported in more depth in Etienne Wengers book, 'Communities of Practice' (Wenger, 1998). Apprenticeships are thought to depict a relationship between a student and a master. Lave and Wenger were concerned that the role of learning or acquisition of skills within a group or community was being overshadowed in learning theory by independent learning, and believed that social engagement was essential in the learning process. CoP have being used for more than 20 years within businesses, education, governments, professional associations and social communities to help to improve engagement of all stakeholders to support organisational change. They stated that a CoP should include 3 characteristics:-

- The Domain – participants have a shared interest and commitment to the domain or topic being discussed
- The Community – participants engage in discussions and share information building relationships to pursue their interest in the domain/topic area. They do not have to work with each other on a daily basis
- The Practice – participants are practitioners who share their experiences, stories, tools of their particular trade/profession and ways of addressing recurring problems within their trade/profession. Requiring a sustained interaction between the participants.

Following the increased use of technology, CoP have also become virtual, in the form of on-line discussion boards or communication via mobile phones (Dube et al., 2005; Kietzmann et al., 2013). Additionally it has been reported that communities of practice have the potential to drive strategy, solve problems, transfer best practices, develop employees' professional skills and provide value to organisations (Lesser & Stork, 2001; Wenger et al., 2002). The emphasis of a CoP relies upon problem solving through learning and inquiry (Denscombe, 2008).

CoP have been embraced within healthcare as they have been reported to facilitate engagement from a variety of stakeholders and patient led communities (Le- May, 2009). Nicolini et al (2008) suggest that the success of CoP and healthy collaboration within them require two important factors to be addressed: the characteristics of the participants and the operation and structure of the meetings. Maintaining membership of CoP and cohesion within the group may be dependent on how comfortable and inclusive the participants feel. Nembhard (2009) indicated that due to the hierarchical nature of the NHS, individual's opinions who are perceived as being "lower in the professional rank" may not be heard and

accepted. Therefore it is important to ensure that all participants within the group are not made to feel disillusioned or uncomfortable in order to gain mutual trust and to facilitate an open dialogue (Jiwa et al., 2009). Chandler and Fry (2009) suggested that the NHS was unable to support clinicians' time away from the working environment to attend regular meetings and therefore did not enable 'head space' to be creative and innovative. The ever increasing necessity for clinicians to be time efficient also means that CoP may need to be focused to maintain purpose with pre-set agendas and email correspondence to maintain the groups direction and consistency (Sawchenko, 2009).

There are a number of data collection techniques that can be used in qualitative methodologies including interviews to collect in-depth information from which theory can be generated (Moule, 2015). There are three types of interviews; structured, semi-structured and unstructured. Structured interviews have pre-selected, scripted questions that use mainly closed-ended answers as opposed to unstructured interviews which ask open ended questions allowing a greater amount of latitude in the participant answers. Semi-structured interviews allow some flexibility and are based on a list of provisional topics. They can provide an element of adaptability to enable the researcher to explore any pertinent issues raised on both present and past experiences (Sim & Wright, 2002; Streubert & Carpenter, 2011). Interviews were not felt to be an appropriate tool to use in this study because the researcher wanted to enable the participants within the group to interact and generate discussion in order to enrich the data. However, focus groups sit under the umbrella of interviews and are utilised in qualitative research to better understand how people feel or think about an issue, idea, product, or service (Kruegar & Casey, 2015). Participants are usually selected and may come

from similar or different backgrounds and usually take the format of a planned series of events to produce data which will subsequently be analysed.

There are many similarities between communities of practice and focus groups with regard to the characteristics of the participants; number of participants; format and type of data collected. Due to the specific professional characteristics of the participants and the requirement to identify strategies in Phase two, the candidate used a community of practice as opposed to a focus group, to facilitate data collection, utilising focus group methodology, which is commonly used in qualitative research.

6.3.1 Sampling strategy

It has been suggested that CoP are dynamic social structures that require support and training so that they can grow, and should be initiated with a select group of key participants (Wenger et al., 2002). There is no agreement among researchers as to the required number of subjects to fully explore a topic, but this is not to say that numbers are not important to ensure an adequate sample size (Sandelowski, 1995).

Rabiee (2004) indicates that 6-10 participants in a focus group enables a variety of perspectives, but is small enough not to become disorderly or fragmented. Similarly Kruegar and Casey (2015) suggest that 5-8 participants is ideal.

There are many different terms used to describe sampling frameworks used in qualitative research including purposive or judgement sampling and convenience sampling (Sim & Wright, 2002). Convenience sampling, is as its name suggests;

recruits participants from easily located groups e.g. from a public or central location by using flyers or notices, therefore the participants recruited may not have a specific interest in the topic area being studied. In comparison, purposive sampling is used when participants are selected on their specific characteristics, which are likely to inform the topic area (Bourgeault et al., 2010). This promotes a diverse range of views that are relevant to the topic being studied and therefore provides as much insight into the subject area as possible. It has been proposed that all sampling has the potential to be purposive, because the sample is always selected dependent on the needs of the study (Coyne, 1997). For the purpose of this study we chose to utilise purposive sampling in order to select a group of people with particular characteristics.

6.3.2 Data collection, analysis and saturation

For the purpose of this study digital recording of the CoP was completed. Kreugar and Casey (2015) support the use of two portable digital recording machines, placed strategically to capture the discussions fully form all areas of the room. They suggest that researchers practice with the recorders to ensure that the resonance is satisfactory and the conversations can be adequately heard to support with transcribing data, along with advising the participants both at the beginning and the end of the recorded session that the devices are being switched on and off, so that the participants are aware of when their comments will be recorded.

6.3.3 Data analysis

Data analysis consists of the processing, summarising and interpretation of raw data into meaningful information (Moule & Hek, 2011). Thematic analysis is the most common analytical technique used in qualitative research (Kisely & Kendall, 2011). The aim of this approach is to identify, analyse and report patterns or themes within data (Crabb & Chur-Hansen, 2009). There are several legitimate guidelines available to follow and it is advised that researchers should take care when using a rigid structure as it may hinder an element of creativity (Streubert & Carpenter, 2011). As a novice researcher requiring a systematic framework to follow Sanders (2003), suggested that Colaizzi's (1978) procedural steps is an appropriate tool to analyse transcribed data and to organise the information collected into themes or categories, in order to provide structure and a clear audit trail.

The data analysis used in this study has been illustrated in the Table 6.2 and is based on Colaizzi's Descriptive Phenomenological Method (1978) (Ryan et al., 2003).

Table 6.2: Data analysis process (Colaizzi, 1978 & Ryan et al., 2003)

Step	Description
1. Familiarisation	The researcher should read the participants narratives to acquire a feeling for their ideas in order to understand them.
2. Identifying/extracting significant statements	The researcher should extract/identify significant phrases or statements from the transcripts which will help to form the whole meaning of the experience/event relating to the phenomenon
3. Formulating meanings	The researcher attempts to formulate general meanings from the statements
4. Organising meanings into common/clusters of themes	The researcher arranges the meanings and organise them into common themes or clusters of themes. Bracketing is in place to ensure the researcher resists the temptation to ignore data or themes which do not fit
5. Developing an exhaustive description of the phenomena	The researcher writes a full and inclusive description of the common themes of the phenomena under study
6. Formulate a structure of the phenomena	The researcher then condenses the exhaustive description and formulates an essential structure
7. Seeking verification of the structure of the phenomena	The researcher should return the structure of the phenomena to the participants for validation to ensure it represents their experience/views

6.3.4 Data saturation

In qualitative research data saturation refers to the point where no new information is being attained (Guest et al., 2006), and the identification of new themes or relationships between themes is exhausted (O'Reilly & Parker, 2013). Data saturation can be regarded as a slightly artificial concept as it is impossible to be completely sure that further exploration will not uncover new information (Nelson, 2017). The point at which data saturation is achieved is a subjective judgement by the researcher informed by the fact that the data collected is sufficiently in depth to

describe and understand the topic area under exploration. In this research the sample was purposively selected to ensure a broad range of experience from different professional groups (e.g. rheumatology consultant, rheumatology nurse, physiotherapy lecturer and students, private and NHS physiotherapy clinicians) who worked in varying healthcare settings to gain access to different viewpoints.

The community of practice provided the opportunity for an in depth discussion on hydrotherapy and provided data as illustrated in the quotes cited in the results section. The data that were derived from the community of practice indicate that the exploration had been sufficient to identify the key points regarding hydrotherapy.

There is always an element of subjectivity in qualitative research due to the researchers' interpretation of the data (Jooten et al., 2009), and personal bias (Streubert & Carpenter, 2011). Therefore in order to promote validity of the themes generated, both the transcripts and themes were reviewed for accuracy by an external qualitative expert. The researcher is reasonably confident that in this study data saturation was obtained.

6.4 Chapter Summary

This chapter has provided a description of the CAT and CoP approaches and a rationale for their choice in this thesis.

The sampling strategy, data collection and analysis methods have been confirmed.

The following chapter contains a detailed account of the CAT methodology, results and discussion.

Chapter Seven: Critically Appraised Topic Methodology

7.1 Introduction

This thesis consists of two methodological phases.

Phase 1 - Critically Appraised Topic (CAT) methodology

Phase 2 - Community of Practice CoP) methodology

The rationale for the CAT and CoP approaches is provided in chapter 6.

This chapter contains a detailed account of the CAT methodological phase that was completed, the results will be reported and discussed.

7.2 Critically Appraised Topic (CAT) methodology

The first phase of the study required the candidate to review the best available evidence for hydrotherapy for adults and children with musculoskeletal pain and inflammatory arthritis.

The CAT methodology of critically appraising and summarising the best available evidence was selected to generate a clinical bottom line to present to the participants within the community of practice.

Each of the following stages suggested by Foster et al (2001) and Stevenson et al (2007) were involved in the generation of the CAT and will be described in detail.

1. Formulate a clinical question based upon a specific patient centred problem
2. Identify a search strategy

3. Search for the best available evidence
4. Review and appraise the evidence
5. Generate conclusions and identify a clinical bottom line
6. Generate a CAT and disseminate to clinical partners
7. Set a date for evaluation and review to ensure more recent evidence is included and updated in a timely fashion

7.2.1 Eliciting Patient and Public Involvement Opinion

Prior to formulating the clinical question the candidate met with the local ARMA group at the Haywood Hospital at one of their quarterly meetings to gain their perspective on what was important to them with regard to hydrotherapy as an intervention and the benefit they received from it as a treatment. This group have recently changed their name to the Haywood Users Group (HUG). At the time of the meeting the pool at the Haywood Hospital had been closed for a significant period of time for repair. This may have affected some of the responses from the members. The group members were quick to acknowledge the benefits that they had received from hydrotherapy, and also one concern, from both their own experiences and also the views their peers had previously expressed. These consisted of: pain relief; ability to exercise for longer and comfortably due to the warmth of the water; feeling of normality and well-being; annoyance that the Haywood pool had been closed for a length of time; ability to exercise and gain support from a group of people with similar conditions. The research team felt that some of these suggestions should be considered when formulating both the clinical question and the search terms for the literature search.

7.2.2 Formulate a clinical question based upon a specific patient centred problem

In order to generate an answerable clinical question the Patient Intervention Comparison Outcome (PICO) process was used to help break down the question into searchable keywords. An external clinical expert within the field of musculoskeletal physiotherapy met with the candidate and their supervisor to formulate the question, incorporating some of the HUG members' suggestions. Table 7.1 illustrates how this clinical question was formulated.

Table 7.1: Clinical question using PICO process

PICO Principle	Our clinical context
Population or problem	Adults & children with ankylosing spondylitis, rheumatoid arthritis, osteoarthritis, low back pain & juvenile idiopathic arthritis
Intervention	Hydrotherapy
Comparator or control	Usual care & dry land therapy
Outcome	Reduce pain, improve function, well-being, return to work/school, cost effectiveness

The candidate chose to colour match the mnemonics in order to aid clarity of reporting the results of the literature search and clinical bottom lines to the participants within the community of practice. The external clinical expert within the field of musculoskeletal physiotherapy met with the candidate and their supervisor to confirm the appropriateness of the CAT question as shown below:

In adults & children with ankylosing spondylitis, rheumatoid arthritis, osteoarthritis, low back pain and juvenile idiopathic arthritis, does hydrotherapy, compared with usual care or dry land physiotherapy, reduce pain, improve function, well-being, return to work or school; or is it cost effective?

The next stage in the process was to complete a comprehensive literature search.

7.2.3 Identify a search strategy and search for the best available evidence

The literature search was conducted by the researcher in January 2016, with support from the University Librarian. The key search terms that were used were specified by the candidate and their supervisor and were confirmed as appropriate by an external expert within musculoskeletal physiotherapy and a member of the Keele University CAT group. The main search was conducted on-line through Keele University Library accessing a wide range of available databases. A pragmatic approach was used in order to confirm a date range for the literature search. This was based on the candidate, lead supervisor and the musculoskeletal experts experience and how well the subject area was researched. A ten year date range was agreed (2005 – 2015). Table 7.2 shows the databases that were searched; the dates of searches completed and number of articles found; a full list of the search items used and exclusion criteria can be found in Appendix 2.

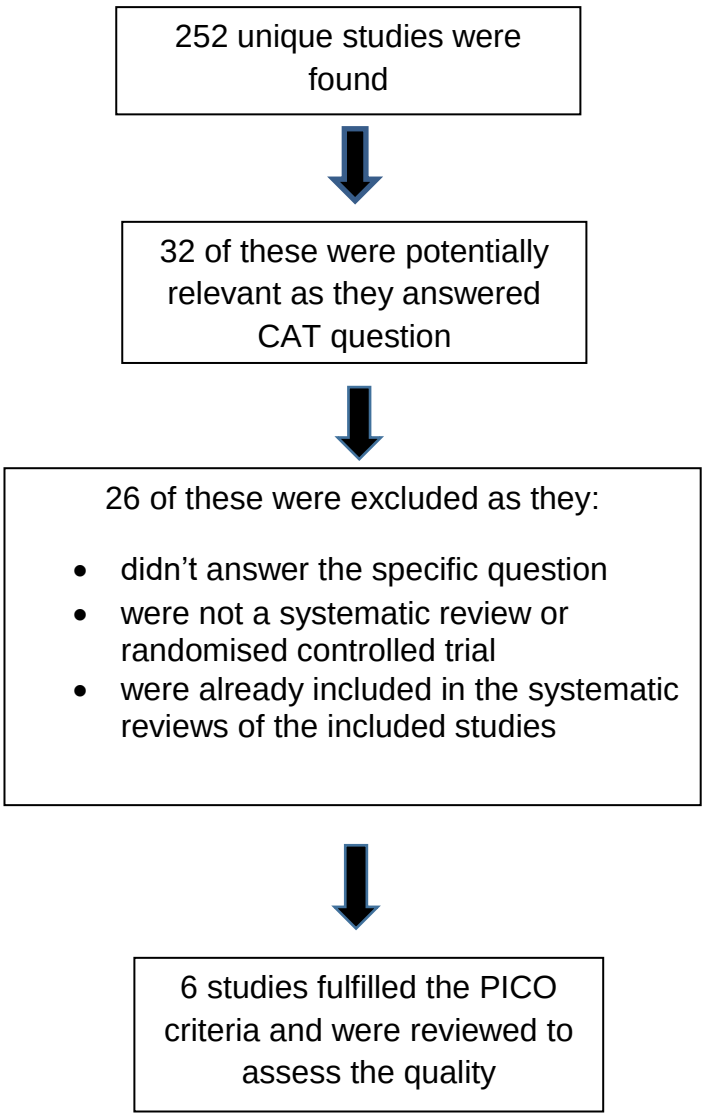
Table 7.2: Databases included in literature search

Database	Date/Issue searched	Searched from	Number of records downloaded
Cochrane Systematic Reviews	28.01.16	2005 -2015	2
Clinical Evidence	28.01.16	2005 -2015	0
DARE/HTA/NHSEED	28.01.16	2005 -2015	0
Medline	28.01.16	2005 -2015	2
CINAHL	28.01.16	2005 -2015	120
AMED	28.01.16	2005 -2015	8
PsycInfo	28.01.16	2005 -2015	0
Cochrane (CENTRAL)	28.01.16	2005 -2015	2
Web of Science	28.01.16	2005 -2015	29
Rehabdata	28.01.16	2005 -2015	2
Embase	28.01.16	2005 -2015	47
Joanna Briggs Institute	28.01.16	2005 -2015	3
PEDRO	28.01.16	2005 -2015	0
NICE	28.01.16	2005 -2015	0
CKS	28.01.16	2005 -2015	0
Sports Discuss	28.01.16	2005 -2015	13
Pubmed	28.01.16	2005 -2015	20
Evidence updates	01.02.16	2005 -2015	4
Total			252

7.2.4 Review and appraise the evidence

The literature search yielded 252 abstracts which were reviewed to determine the appropriateness of each to the clinical question posed in this study, referring back to the PICO to ensure appropriateness. Initially all abstracts where the intervention was not referred to as hydrotherapy or aquatic therapy were excluded e.g. balneotherapy, spa treatment, thalassotherapy, mud therapy and Tai Chi. Further refining then took place to ensure that the abstracts were included if they answered the specific clinical question. The CAT process is not a systematic review, it searches for the 'best' available evidence of which randomised controlled trials and systematic reviews are suggested as the best for intervention type questions of which this clinical question is. Additional refining took place and all abstracts that were not systematic reviews or randomised controlled trials were excluded, along with any duplicate RCT's that were already included in the SR's. Figure 7.1 shows the refining process in more detail.

Figure 7.1: Refining the evidence



Subsequent to the literature search, but prior to the community of practice, the research team noted a new publication (Bartels et al., 2016) that was relevant to the CAT question and was included in the process. This resulted in a total of seven abstracts being deemed appropriate.

Each of the seven full articles were reviewed and assessed for quality using the Critical Appraisal Skills Programme (CASP) appraisal tool (CASP, 2017). To increase validity of the literature review using the CASP tool, the lead supervisor

reviewed the narrative results to confirm accuracy and reduce bias of interpretation. If clarification was needed opinion was sought from a quantitative expert external to the research team.

The results of the literature review were collated into a table format (Appendix 1) and are discussed in more detail in the CAT results chapter.

The population and outcomes were again colour matched, identical to the PICO to maintain consistency, within the table, to aid the participants reviewing the literature during the CoP. A clinical bottom line was generated from the literature review in order to answer the original clinical question:

'In adults & children with ankylosing spondylitis, rheumatoid arthritis, osteoarthritis, low back pain and juvenile idiopathic arthritis, does hydrotherapy, compared with usual care or dry land physiotherapy, reduce pain, improve function, well-being, return to work or school; or is it cost effective?'

7.2.5 Generate conclusions & identify a clinical bottom line

The following conclusions were generated in order to identify a clinical bottom line. They were included within the presentation to the participants prior to the CoP and also a copy was issued to the participants before the CoP started, to act as an aide memoir/memory jogger to support the discussion. This was again colour matched to help clarification to the participants and can be seen below:-

- There is good quality evidence that aquatic therapy may have small short term effects on pain, disability, physical function, mobility and quality of life in adults with ankylosing spondylitis (AS), rheumatoid arthritis (RA), low

back pain (LBP) and osteoarthritis (OA) of the knee & hip. These effects are comparable with land based exercises. However, the long term effects are unclear.

- Evidence is available to support that there is a beneficial effect on quality of life & disease outcome for patients with juvenile idiopathic arthritis (JIA) from both aquatic therapy & land based physio, in the short term. Long term effects are unclear. No evidence to justify the cost effectiveness of aquatic therapy above land based physio alone for children.
- No research found to answer the cost effectiveness for adults and return to work or school.

The following clinical bottom line was generated from the conclusions above and was presented to the participants of the CoP along with the key findings from the literature review.

There is good quality evidence that hydrotherapy improves pain and function for patients with AS, RA, LBP, OA and JIA in the short term. However there is a lack of long term data. This is comparable with land based exercises.

There is no evidence that it is cost effective or improves patients returning to work/school.

7.2.6 Generate a CAT and disseminate to clinical partners and set a date for evaluation and review to ensure more recent evidence is included and updated in a timely fashion

The completed CAT can be found in Appendix 2, and was submitted to the Musculoskeletal Research Facilitation Group Meeting within Primary Care at Keele University in April 2017 for approval. Minor grammatical and formatting errors were highlighted and amended prior to dissemination to clinical partners via the group

members and the University website. A date has been confirmed (April 2019) to ensure that the most recent evidence is reviewed and the CAT updated appropriately.

7.3 Critically Appraised Topic (CAT) Results

Each of the seven articles that were assessed for quality using the Critical Appraisal Skills Programme (CASP) appraisal tool (CASP, 2017), will be narrated in detail. Table 7.3 summarises the studies included in the literature review of the CAT and highlights the population and outcomes that were reported in each study and the CASP tool narrative rating.

Table 7.3: Summary of studies with population, outcome and CASP rating highlighted

Type of author and author	Population						Outcome					CASP rating
	Adult Paediatric	OA	RA	LBP	AS	JIA	Pain	Function	Wellbeing	Cost effective	Return to work or school	
Bartels et al., 2016 SR	Adult	#					#	#	#			Good
Barker et al., 2014 SR	Adult	#	#	#			#	#	#			Good
Al-Qubaeissy et al., 2012 SR	Adult		#				#	#	#			Moderate
Batterham et al., 2011 SR	Adult	#	#					#	#			Moderate
Dundar et al., 2014 RCT	Adult				#		#	#	#			Moderate
Dundar et al., 2009 RCT	Adult			#			#	#	#			Moderate
Epps et al., 2005 RCT	Paediatric					#		#	#	#		Moderate

SR = Systematic review RCT = Randomised control trial OA = Osteoarthritis RA = Rheumatoid Arthritis LBP = Low Back Pain JIA = Juvenile Idiopathic Arthritis

Bartels et al., (2016). Aquatic Exercise for the treatment of knee and hip osteoarthritis. A review.

The best evidence using the CAT process, found for adults with osteoarthritis of the hip and knee was Bartels et al (2016). This was a systematic review (SR) of thirteen randomised controlled trials (RCT) up to April 2015. The aim of the study was clearly stated and its clearly focussed question aimed to evaluate the effects of aquatic exercise for people with knee or hip osteoarthritis, or both, compared to no intervention. The outcome measures used were recommended by the Outcome Measures in Rheumatoid Arthritis Clinical Trials (OMERACT III), which is an international, informally organized network aimed at improving outcome measurement in rheumatology, and included pain, disability, quality of life and radiographs (OMERACT., 2017; Bellamy, 1977). All adult participants (n= 1190) were defined as having osteoarthritis (OA) as determined by the American College of Rheumatology criteria in either their hip or knee joint(s). All the studies reviewed compared the effects of aquatic therapy to no intervention. As hydrotherapy is an intervention an RCT is appropriate when evaluating the outcome of interventions.

All the relevant bibliographic databases were searched: the Cochrane Central Register of Controlled Trials; MEDLINE; EMBASE; CINAHL; PEDro and Web of Science, as well as the reference lists of the included trials for further relevant literature, therefore this makes it a good study. There was no language restriction. Additionally they made contact with institutions, societies, and specialists with known expertise in aquatic therapy for further information and searched for any unpublished studies, therefore it is likely that all appropriate research was found. Two reviewers independently screened the studies obtained from the literature

search by reading the abstracts, searching for keywords and publication type, and resolved any uncertainties or disagreements by discussion. It may have further reduced the possibility of bias if a third reviewer had been included at this stage (Sim & Wright, 2002). In order to assess the quality of the studies five people independently assessed the risk of bias as recommended by the Cochrane Handbook for Systematic Reviews of Interventions. This risk of bias assessment tool was initially developed in 2005 by a group of 16 statisticians, epidemiologists, and review authors who agreed seven principles to adhere to (Higgins 2011). It was further developed in 2008 and 2010 and has been reported to take longer than other assessment tools to complete and that the reliability of the tool still needs to be evaluated (Hartling et al., 2009)

Statistical analyses using Review Manager Software was performed and the results of all the included studies were clearly and precisely displayed using forest plots for pain, disability and quality of life. None of the included trials had performed any type of radiographic evaluation and therefore these were not reported.

The authors proposed that there was moderate quality evidence that aquatic exercise may have small short term, and clinically relevant effects on patient reported pain, disability and quality of life. They suggested that it might be appropriate to complete better designed RCT's that: compared aquatic exercise with a control treatment (e.g. pharmacological or land based); used more defined interventions (e.g. frequency; intensity; and duration); had more specific guidance of when the outcome measures were completed.

Using the CASP (CASP, 2016) criteria the quality of this systematic review was evaluated as good quality. A third reviewer could have been used to resolve any disagreements when the studies from the literature search were initially screened for inclusion in the study to help reduce bias. A comprehensive database search was completed. The authors indicated that they were unable to confirm a definitive recommendation due to the limited number of good quality RCT's to review, and those that were reviewed reported heterogeneous interventions and outcome measures, and variance in when the outcome measures were collected. The small numbers in the study and the poorly defined interventions suggest that generalisability of the results may not be possible. The review reported that aquatic exercise shows minor adverse effects which are important for patient adherence to treatment. Cost effectiveness was not included in the outcomes of this review.

Using the CASP criteria this was considered the best good quality evidence found from the literature review because it was a well conducted systematic review, which included: reviewing the quality of relevant studies; the results were reported clearly; and appropriate outcomes were considered.

Barker et al., (2014). Effectiveness of Aquatic Exercise for Musculoskeletal Conditions: A Meta- Analysis.

The best evidence using the CAT process, found for adults with osteoarthritis, rheumatoid arthritis and low back pain was Barker et al (2014). This was a systematic review (SR) including twenty-four (n=24) randomised controlled trials

(RCT's) and two quasi experimental RCT's up to May 2013. The aim of the study was clearly stated. It had a focussed question aimed to investigate the effectiveness of aquatic exercise in the management of musculoskeletal conditions. All adult participants were diagnosed with osteoarthritis, rheumatoid arthritis, fibromyalgia, low back pain or osteoporosis using an accepted arthritis or musculoskeletal diagnostic criteria, although the diagnostic criteria specifics were not reported. The participants had a mean age of sixty years or over, the male to female ratio was not indicated. Most of the studies (16) reviewed involved participants with osteoarthritis; in five studies the participants had fibromyalgia; two of the studies included participants with RA; two studies included participants with low back pain; and in one study the participants had osteoporosis. Eighteen of the studies compared aquatic exercise with no exercise, fifteen of the studies compared aquatic exercise with land based exercise, and seven of the studies included both no exercise and land-based exercise. The outcomes measured were pain, physical function and quality of life and all were reported within the article.

As hydrotherapy is an intervention randomised controlled trials (RCT) were appropriate studies to review when evaluating the outcome of interventions. Although quasi experimental RCT's lack the element of random assignment to treatment or control and therefore the risk of bias increases (Sim & Wright, 2002). Relevant electronic databases were searched: Ovid MEDLINE, Cumulative Index to Nursing and Allied Health Literature, Embase, and the Cochrane Central Register of Controlled Trials, as well as the reference lists for the included trials for further relevant literature. They did not appear to make personal contact with any experts in the field, and search for unpublished or non-English studies and therefore we do not know if all the literature was included.

Two reviewers independently screened the studies obtained from the literature search by reading the title and abstracts prior to obtaining the full papers. If a decision could not be reached a third reviewer made a final decision, which helped to eliminate researcher bias. The quality of each paper was then independently assessed by the same initial two reviewers using the Physiotherapy Evidence Database (PEDro) scale (Maher et al., 2003). The PEDro scale is a frequently used and free tool to use and rates RCT's using a rubric of eleven criteria (PEDro, 2017). Although it has been well evaluated it has been reported to not be a full-text resource and therefore cannot be customized to local institutional needs; and clinical practitioners and students have been known to complain when the full text article is not available (Blobaum, 2006). Five of the studies required a third reviewer to make a final decision.

The results were shown clearly using confidence intervals using a forest plot, although it was reported that comparisons proved difficult to determine due to the variation in the frequency, type and length of the interventions reported in the studies.

The authors propose that aquatic exercise had moderate beneficial effects on pain, physical function & quality of life in adults with osteoarthritis, rheumatoid arthritis, fibromyalgia, low back pain or osteoporosis conditions, which appear comparable with those achieved with land based exercise. They also indicated that more large scale trials was required to review the long term effects.

Using the CASP criteria the quality of this SR was evaluated as good quality. There was a broad focus of musculoskeletal conditions and a high heterogeneity between the studies compared as the interventions varied in frequency, type, and

duration; and the outcome measures used between studies varied and were measured at varying intervals. Therefore generalisability of the results may not be possible. They did not appear to make personal contact with any experts within the field, or search for unpublished or non-English studies which means all the relevant literature may not have been included. Cost effectiveness was not included as an outcome in this study.

Al-Qubaeissy et al., (2013). The Effectiveness of Hydrotherapy in the Management of Rheumatoid Arthritis: A systematic Review.

The best evidence found using the CAT process for adults with rheumatoid arthritis (RA) was Al-Qubaeissy et al (2013). This was a systematic review which included six randomised controlled trials (n=6) up to 2011. The aim of the study was clearly stated. It had a focussed question aimed to evaluate the effectiveness of hydrotherapy in the management of patients with rheumatoid arthritis.

All adult participants (n= 419) were diagnosed with rheumatoid arthritis (RA) according to 1987 ACR criteria or Steinbrocker Functional Testing criteria for RA. Although limitations are inherent in the use of global ordinal scales, this set of criteria has been reported as being useful in describing the functional consequences of RA (Escalante et al., 2004). All studies reviewed compared a water based therapy (hydrotherapy) with land based exercise, or home exercise programmes or no treatment. All participants received hydrotherapy for a minimum of four weeks and a maximum of twelve weeks, varying between once and there times per week; one study lasted for four years where the participants received the

intervention once per week. The outcomes measures used were: pain; patient global assessment; activity of daily living; physical function; disease activity and quality of life and were reported within the article.

As hydrotherapy is an intervention RCT were appropriate studies to review when evaluating the outcomes of interventions. Relevant electronic databases were searched: AMED, CINAHL, EMBASE, MEDLINE, PubMed, Science Direct and Web of Science between 1988 and May 2011, as well as hand searches of the reference lists of the included trials for further relevant literature. They did not appear to make personal contact with any experts within the field, search for unpublished or non-English studies. However they did complete a manual search of clinically related published journals.

Two reviewers independently screened the studies obtained from the literature search by reading the abstracts prior to obtaining the full paper. The quality of each paper was then reviewed using the Physiotherapy Evidence Database (PEDro) scale (Maher et al., 2003) by the same reviewers, if disagreement between the reviewers occurred a consensus was sought, and if disagreement persisted a third independent reviewer made the final decision which helps to eliminate researcher bias.

Due to the heterogeneity of the studies included in this SR, the authors chose not to complete a meta-analysis and the results were shown in a table format. They reported that it was uncertain how precise the results were due to the reviewed articles having: inadequate reporting of the interventions used; inappropriate randomisation, concealment of allocation groups and blinding to the outcome

measurements; small sample size; different primary outcome measurements; and variable follow up periods.

The authors indicated that there is some evidence to suggest that hydrotherapy has a positive effect in reducing pain and improving the health status of patients with RA compared with no or other interventions in the short term (up to 12 weeks); however, the long term benefit was inconclusive as only one of the studies reviewed measured outcomes after four years.

Using the CASP criteria, the quality of this SR appeared to be of moderate quality. There was a high heterogeneity between the studies compared as the interventions varied in frequency, intensity, and duration; and the outcome measures used between studies were different and were followed up at varying intervals. This suggests that it would be difficult to generalise these results to any population. The review focussed on studies published in English only and no grey literature was reviewed, which means that all the relevant literature may not have been included. It was not possible to comment whether any harmful effects occurred to the participants as this was not reported. Cost effectiveness was not included as an outcome in this study.

Batterham et al., (2011). Systematic review & meta-analysis comparing land & aquatic exercise for people with hip or knee arthritis on function, mobility & other health outcomes.

The best evidence found using the CAT process for adults with rheumatoid arthritis and osteoarthritis was Batterham et al (2011). This systematic review

included ten randomised controlled trials (n=10) up to July 2010. The aim of the study had a focussed question to investigate the effects of aquatic exercise compared to land based exercise for people with RA or OA. All adult participants (n = 772) were diagnosed with either rheumatoid arthritis or osteoarthritis, although it was not reported which criteria were used to confirm the diagnosis.

The studies included needed to have reported that one group had performed aquatic exercise and the comparison group had participated in a form of land based exercise. The main outcome measures were function or mobility, in addition the authors sought data on participant's perception of aquatic compared to land based exercise with respect to satisfaction, enjoyment and compliance. The specific outcome measures used were reported in the text.

Hydrotherapy is an intervention therefore RCT's are appropriate studies to review when evaluating the outcomes of interventions. Relevant electronic databases were searched: MEDLINE, CINAHL, AMED and the Cochrane Central Register of Controlled Clinical Trials, from the commencement of each database to July 2010. They did not appear to make personal contact with any experts within the field, search for unpublished or non-English studies, or complete hand searches of the reference lists of the included trials, which means that not all the relevant literature may not have been included.

Two reviewers independently screened the titles and abstracts of the studies from the literature search prior to obtaining full scripts and any disagreements were resolved through discussion, or if a consensus was not possible a third reviewer was consulted. The quality of each paper was then reviewed using the 11 item

PEDro scale (Maher et al., 2003) by two independent reviewers and a third reviewer was available if consensus was not possible to eliminate bias.

Meta-analysis was completed using Review Manager for function and mobility and the results for these outcomes were clearly displayed using forest plots. Only one trial reported measures of participant perception and this was not included in the meta-analyses, but was reported in the text.

They suggested that the outcomes following aquatic exercise for adults with arthritis appear comparable to land based exercise, and that aquatic exercise would provide an enabling alternative if land based exercises were proving difficult to complete.

Using the CASP criteria the quality of the SR appeared to be moderate. There were no diagnostic criteria identified to diagnose OA or RA and there was a high heterogeneity between the studies compared as the interventions varied in frequency, intensity, and duration; the outcome measures used between studies varied and were measured at varying intervals, which may have affected the results of the meta- analysis. The search criteria that was reported in the study appeared limited, having not contacted experts within the field, and searched for unpublished and non-English language studies, or completing a hand search of the included trials references, which may indicate that relevant articles may not have been included. Cost effectiveness was not included as an outcome in this study.

Dundar et al., (2014). Effect of aquatic exercise on ankylosing spondylitis: a randomized controlled trial.

The best evidence found using the CAT process for adults with Ankylosing Spondylitis (AS) was Dundar et al (2014). A randomised controlled trial which included sixty-nine participants was completed. The aim of the study was to compare the effectiveness of aquatic exercise interventions with home based exercise in the treatment of AS. All adult participants (n = 69), of which fifty eight were male and eleven were female, completed the study and fulfilled the 1988 modified New York criteria for AS (van der Linden et al., 1984). Exclusion criteria were clearly identified.

They were randomised into two groups (n=35 & n=34) by allocating numbered envelopes which were concealed from the researchers. One group received twenty sessions of supervised aquatic therapy that lasted for one hour, five times per week for four weeks. This group received poolside exercises prior to the supervised aquatic therapy, however the specifics of what this consisted of was not reported. The second group were given initial instruction for twenty minutes and then issued with a training and exercise booklet which contained details of a home based exercise programme lasting sixty minutes that they needed to complete every day for four weeks. In addition to this one of the investigators called each participant every week to maintain patients' adherence to the home exercise programme. This additional telephone call was not offered to the supervised aquatic therapy group. The outcomes considered in this study were pain, disease activity, disability, spinal mobility and quality of life, however the primary outcome was not clearly specified. The outcomes were measured at

baseline, four weeks and twelve weeks. One physician assessed the baseline measurements and a second physician assessed post treatment measurements and both physicians were blinded to the treatments. However it is unclear if the second physician completed the outcomes measurements at both four weeks and twelve weeks. Results for each of the outcomes were reported using means and standard deviations. Statistical significance was reported for pain and quality of life, but not for disease activity, disability or spinal mobility.

They concluded that water based exercises produced better improvement in pain and quality of life scores of patients with AS compared with home based exercises in the short term (12 weeks)**.**

Using the CASP criteria the quality of this RCT was evaluated as moderate quality. The authors recognised that the results may have been different if the home based exercise program had been a supervised exercise program based in a hospital based gym. Due to the small number of participants that were included in this study in one centre, more reliable results might have been obtained with a larger sample size completed in a number of sites over a longer period of time. Additionally it may have maintained concealment if a blind investigator to the study completed the follow up calls to the home exercise group to check adherence. The patients that were included in this study may not be representative of local patient groups as it was completed in one centre outside of the United Kingdom, and the number of aquatic sessions that were included in the intervention may not be representative of treatment locally due to limited pool and session availability.

Due to the chronic nature of AS it may be worth considering more long term studies in order to fully represent the effect of the intervention. Patient preferences

were not included in the outcomes which are important in order to maintain patient adherence to treatment and self-management especially in a chronic condition such as AS. Cost effectiveness was not included as an outcome in this study.

Dundar et al., (2009). Clinical effectiveness of Aquatic Exercise to Treat Chronic Low Back Pain. A Randomised Control Trial.

The best evidence found using the CAT process for adults with low back pain only was Dundar et al (2009) who completed a randomised controlled trial (RCT). The aim of the study was to compare the effectiveness of aquatic exercise interventions with land based exercises in the treatment of chronic low back pain. All adult participants (n = 65) completed the study and were between twenty and fifty years old and had been diagnosed with low back pain without leg pain for more than three months. Although it is not reported how this diagnosis was made. The exclusion criteria was clearly reported. Thirty one of the participants were female and thirty four were male.

They were randomised into two groups by assigning which group they were allocated to in date and time order of when they consented to be part of the study. One group (n=32) completed an aquatic programme which lasted for one hour and was supervised by physiotherapist, with a fifteen minute pool side exercise regime including a range of movement exercises and relaxation. They were allocated twenty group sessions (7-8 per group), five sessions per week for four weeks. Each session concluded with a five minute warm down. Group two (n=33) completed a home based exercise programme that was initially demonstrated by a physiotherapist. This group were then issued with written instructions on how to

complete these exercises every day for one hour with a weekly telephone call to increase concordance over a four week period. It appeared that the groups were treated equally apart from the experimental intervention and the telephone call. The outcomes considered in this study were spinal mobility, pain, disability and quality of life, however the primary outcome was not specified. All outcomes were reported in the text and measured at baseline, four weeks and twelve weeks.

The physiotherapist that completed the treatment was not blinded, but was not part of the research team. Baseline measures were taken by one physician and the outcomes measures from weeks four and twelve were completed by a different physician and both were blinded to the treatments. A table is available to show that the groups were similar at baseline, indicating that randomisation had worked despite small numbers.

Results of each of the outcomes were reported using means and standard deviations. Statistical significance was reported for disability and physical function at both four weeks and twelve weeks.

The authors concluded that water based exercise produced better improvement in disability and the physical component of quality of life more than land-based exercise for patients with chronic low back pain in the short term (12 weeks).

Using the CASP criteria, the quality of this RCT appeared to be of moderate quality. The authors recognised the following limitations: absence of a placebo/control group, although this might have ethical considerations with regard to withdrawing patients from potential beneficial rehabilitation. Due to the small number of participants that were included in this study in one centre, more reliable results might have been obtained with a larger sample size completed in a number

of sites over a longer period of time. The inclusion of a control group, and completion in a number of sites over a longer period of time may have produced more reliable results. It was reported that blood tests and x-rays were completed prior to the study, an explanation was not included as to why these were not reported in the results, however this information would not affect the results. Additionally the unsupervised element of the home exercises compared to the supervised aquatic exercise may have reduced compliance of the participants, reduced the correctness of technique and the positive reinforcement of a therapists feedback. Generalisability of the results may not be possible as it was completed in one centre in Turkey, and the number of aquatic sessions that were included in the intervention may not be representative of treatment elsewhere due to limited pool and session availability. Cost effectiveness was not included as an outcome in this study.

Epps et al., (2005). Is hydrotherapy cost-effective? A randomised controlled trial of combined hydrotherapy programmes compared with physiotherapy land techniques in children with juvenile idiopathic arthritis.

The best evidence found using the CAT process for children with Juvenile Idiopathic Arthritis (JIA) was Epps et al, (2005) who completed a multi-centred, randomised controlled trial. The aim of the study was to compare the effects of combined hydrotherapy and land-based physiotherapy with land-based physiotherapy only. They also wished to determine the cost effectiveness of combined hydrotherapy and land-based physiotherapy. All of the participants (n = 78) had been diagnosed with JIA for more than three months before the age of

sixteen, were stable on medication and had at least one disease active joint. It did not specify which diagnosis criteria was used. JIA is arthritis of unknown aetiology beginning before the age of 16 years and persisting for at least 6 weeks, while excluding other known conditions (Petty et al., 2004). The participants were between the ages of eight and nineteen years old (43 girls and 35 boys). Six of the participants that were randomised did not complete the study.

Participants were randomised into two groups by an independent statistician who conducted three separate block randomisations, allocating to the land or combined group. The combined group (n = 39) completed eight hours of hydrotherapy and eight hours of land based exercises over a period of two weeks and then one hydrotherapy session per week for two months. All sessions were supervised by a physiotherapist. The land only group (n=39) completed sixteen hours of land based physiotherapy over a two week period then one land based session per week for two months. All sessions were supervised by physiotherapists. Participants in both groups were issued with individualised home exercises to complete daily during the two month period after the initial intensive two weeks. It appeared that the groups were treated equally apart from the experimental intervention and an independent clinical expert observed physiotherapists treating patients at all of the centres to ensure that the intervention followed protocol. However the authors reported that the staff turnover and time constraints within the centres affected some of the planned observations so a full set of guidelines were sent to maintain adherence.

The primary outcome considered in this study was documented as improvement in disease outcome and was measured by the Childhood Health Assessment Questionnaire, which considers activities of daily living (Klepper et al., 2003) and

has been validated (Nugent et al., 2001 & Lam et al., 2004). Outcomes were measured at baseline, two months and six months. After the two month period community physiotherapists used their judgement to decide whether the participants' treatment should continue or stop, but there were no outcome measures taken after this point. The principle investigator, health economist and independent statisticians were blinded to the intervention groups, however the treating physiotherapist, physician, patient and parent could not be blinded, as they were involved in the treatment. One physician assessed the baseline measurements, two and six month follow up measurements for disease activity. The principle investigator completed all other outcome measures at baseline, two and six months with an independent clinical expert observing to ensure adherence.

The raw data from within group comparisons was reported with no composite score. There was no evidence of p values being reported. The confidence intervals were not included in the annotated tables but were identified in the body of the text and showed no significant difference between the groups. There were some inconsistencies within the labelling of the tables and some ambiguity with the outcomes being defined as either primary or secondary.

The authors proposed that a beneficial effect from both combined hydrotherapy and land based physiotherapy treatment and land based physiotherapy treatment alone was achieved on quality of life and disease outcome for patients with JIA in the short term (6 months). The authors also calculated mean costs between the combined group and land group taking into consideration: in-patient stay costs; outpatient referral costs; intervention costs; GP visit costs; time costs to parents; outpatient physiotherapy costs. They concluded that there was no evidence to

justify the cost effectiveness of combining hydrotherapy and land based physiotherapy above land based physiotherapy alone.

Using the CASP criteria the quality of this RCT appeared to be of moderate quality. No side effects or harm to the patients was reported in this study. This study was based over three centres within the United Kingdom, and the sample size was small, therefore generalisability may be affected. A control group or hydrotherapy only group was not included. Participants with active disease were excluded from the trial. This is the only study that has evaluated the cost effectiveness of hydrotherapy compared to land based physiotherapy and the authors allude to the fact that it would be a potential area for further research to be completed.

7.3.1 Overview of methodological observations

There were few studies identified by the literature search that reviewed the cost effectiveness for hydrotherapy for either adults or paediatrics, return to work or school, or patient preferences. The most recent articles in the COCHRANE Database (COCHRANE, 2017) on the cost effectiveness for hydrotherapy is the study that has been included in this review by Epps et al (2005), indicating that economic evaluations of this type of intervention are rare (Fioravanti et al, 2017).

There were also a number of methodological limitations highlighted during the appraisal of the identified literature, these include:

- small sample sizes were recruited from single sites mainly, which reduces the generalisability of the results

- aquatic exercise was not compared with a control treatment (e.g. pharmacological or land based). However this may have ethical considerations with regard to withholding patients from potential beneficial rehabilitation
- heterogeneous interventions (e.g. frequency, intensity, type and duration) and heterogeneous outcome measures limited the ability for some of the studies to complete meta-analysis and report confidence intervals.
- minimum long term follow up which may be appropriate for the types of chronic conditions included in the studies
- third reviewers were not always used to eliminate bias when abstracts were reviewed in systematic reviews
- trials were not set up to explore cost effectiveness

No adverse effects were reported in the literature with regard to hydrotherapy, which is important to patient safety and self-management in these types of chronic conditions. The limited amount of cost effective data, suggest that the benefits of aquatic exercise outweigh any harm, and would support clinicians continued use of hydrotherapy to treat patients with these conditions. Hydrotherapy appears to provide an enabling alternative if land based exercises were proving difficult to complete. However, the number of interventions that have been included in the trials may not be possible locally due to limited pool or session availability.

The limitations of the CASP tool have already been identified within the thesis, as the questions require a yes or no or can't tell answer and there does not appear to be a specific scoring system in order to apply to each article, therefore a narrative

approach is used to review each article (Pope et al., 2007). To increase validity of the literature reviewed by the candidate, the lead supervisor reviewed the narrative results to confirm accuracy and reduce bias of interpretation. If clarification was needed opinion was sought from a quantitative expert external to the research team.

7.3.2 Reported Clinical Bottom Line

Conclusions were generated in order to produce a clinical bottom line that was shared with the participants of the community of practice. Prior to dissemination to stakeholders external to the thesis, the completed CAT, which included the clinical bottom line, was submitted to the Musculoskeletal Research Facilitation Group Meeting within Primary Care at Keele University for approval, who highlighted minor grammatical and formatting errors which were amended prior to publication.

The Critically Appraised Topic has now been published (Musculoskeletal Research Facilitation Group, Keele University, 2017) and reported the following clinical bottom line which was divided into adults and paediatrics:-

Clinical bottom line - Adults

There is good quality evidence that hydro/aquatic therapy may have small short term effects on pain, disability, physical function, mobility and quality of life in adults with Ankylosing Spondylitis, Rheumatoid Arthritis, low back pain and Osteoarthritis of the knee & hip.

The long term effects are unclear.

These effects are comparable with land based exercises.

No research has been found in relation to cost effectiveness; return to work or in determining patient preferences.

Clinical bottom line - Paediatrics

There is no statistically significant evidence that land based exercise alone can improve functional ability, quality of life, or pain for children with JIA.

Some evidence is available to support that there is a beneficial effect on quality of life & disease outcome for patients with JIA from both aquatic therapy & land based physio, in the short term.

The long term effects are unclear.

One study reported that there is no statistically significant evidence to justify the cost effectiveness of aquatic therapy above land based physio alone for children.

No research has been found in relation to return to school.

7.4 Discussion - Critically Appraised Topic (CAT)

The methodological approach of the CAT process used within this study will now be evaluated. Two overarching areas will be discussed:

- Strengths and limitations as a methodological process
- The CAT as a means of knowledge mobilisation

7.4.1 Strengths and limitations of a CAT as a methodological process

Strengths

The CAT process in the thesis provided a summary of the best available evidence to answer the clinical question and generated a clinical bottom line, which has been reported in the results, and takes a few minutes to read which supports busy clinicians in health environments. This rapid method of reviewing the literature helps to reduce the evidence to practice gap by mobilising knowledge quicker.

It highlighted that that there were limited studies during the literature search that reviewed the cost effectiveness for hydrotherapy for either adults or paediatrics; return to work or school; or patient preferences. This could highlight potential areas for future research.

Limitations

The CAT process uses the PICO method for refining the search items used in the literature search. The CAT original question in this study centred on the intervention of hydrotherapy against a comparator of land based exercise. Systematic reviews and randomised controlled studies are appropriate studies to

select when reviewing intervention type questions. However, a question centred on the patient experience of hydrotherapy may have been more appropriate, indicating that a more qualitative literature review might have elicited a different set of results.

Presently within the CAT group the questions tend to lend themselves towards being answered by interventional type research. There may be an underlying premise that questions are asked in this way and other types of methodologies are not considered. Recruitment, selection or sample bias in research relates to the over or under representation of the target population found in the participant group (Moule, 2015). Recruitment bias can also be found in education and has been suggested as having two types: unconscious and implicit (Equality Challenge Unit, 2013). They describe unconscious bias as happening automatically by an individual making quick judgments of people and situations, influenced by our background, cultural environment and personal experiences; and implicit bias questions the level to which these biases are unconscious if we are made aware of them. Initially the members of the CAT Group were largely musculoskeletal physiotherapists, who may possess similar characteristics, the recruitment over time of a broader vocational group of experts has helped to reduce this bias, in order to adapt to the health needs of the population. More recently the recruitment of a librarian into the group has helped to support the literature search process of the CAT (Stevenson et al., 2007).

New evidence is emerging constantly, which means that there is a need to ensure that the CATs that are generated are regularly updated to ensure that clinical practice is current. The final CAT has been submitted to the Musculoskeletal Research Facilitation Group within Primary Care at Keele University for approval,

prior to dissemination to clinical partners. A date has been set to complete an up to date literature search to review any new evidence that might have emerged which will be evaluated and the CAT updated. This ensures that new evidence will be continually reviewed and shared with stakeholders.

The CASP tool questions require a yes, no or can't tell answer and there does not appear to be a specific scoring system in order to apply to each article, therefore key themes are extracted and a narrative approach is used to review each article (Pope et al., 2007). To increase validity of the literature review using the CASP tool, the lead supervisor reviewed the narrative results to confirm accuracy and reduce bias of interpretation. If clarification was needed opinion was sought from a quantitative expert external to the research team.

Currently academic quantitative experts attend the CAT group meetings offering insight into any new evidence that has been published to support the group in determining the relevance of the CAT questions and offering advice of when the evidence might be reviewed according to the specialism being discussed. By including a qualitative academic expert the same principles could also be applied on clinical questions that wish to understand people's perceptions, experiences and understanding of a clinical situation or intervention, as well as being able to offer advice on any new emerging evidence from a qualitative perspective.

7.4.2 The CAT as a means of knowledge mobilisation

The CAT is currently used within the Musculoskeletal Research Facilitation Group within Primary Care at Keele University to produce a clinical 'bottom line' to answer common patient specific problems that is generated by clinicians. The Group has a broad spectrum of members from Staffordshire, Cheshire and Shropshire and includes: doctors; nurses; physiotherapists; occupational therapists; podiatrists; and researchers. All members are passionate about the subject area and have dedicated time to meet. Similarly communities of practice have been reported to: encourage engagement from a variety of stakeholders by facilitating knowledge exchange among practitioners, researchers, decision makers, and patient led communities (Le- May, 2009). They have been further described as groups of people who commit to each other to support the sharing of learning, develop new knowledge, share discoveries with anyone involved in similar work, to improve individual and organisational practice (Wheatley, 2007). Kerno (2008) identified that organisations needed to allocate group members dedicated time to attend these events for them to be effective.

A Community of practice has been reported as a method to mobilise knowledge (Nilsen 2015), therefore with the similarities between a CoP and a CAT group it would suggest that both are appropriate means of mobilising knowledge. Within the CAT group there are members who understand the context within their own organisations and may know how to influence to make change happen. This suggests that the members of the CAT group are important along with the facilitators or knowledge brokers who move between organisations in order to

disseminate information such as the clinical bottom line. The CAT group could be one step in a knowledge mobilisation process.

The research skills that the candidate has acquired over the period of the study has increased resulting in more confidence to critically review the literature and assess its quality. The candidate is a clinical expert in hydrotherapy who anecdotally through clinical experience values its benefit to patients. Members of the CAT group may have similar biases within their own specialist area this indicates that there are certain inherent research skills that these knowledge mobilisers within the group should possess, to inform a comprehensive and critical review of the literature.

Davies et al (2015) suggested that there is a need to evaluate knowledge mobilisation approaches to ensure their effectiveness. The current CAT group and the completed CAT's that have already been produced and disseminated on the website. There is a possibility that the website could review how many 'hits' the website receives and also the individual CAT's to ascertain which and when stakeholders are viewing this information and to help inform the CAT group future strategy.

7.5 Chapter Summary

This chapter has presented a detailed account of the CAT methodology. The results of the literature have been reported with the production of a clinical bottom line that has been disseminated to stakeholders, and highlighted potential areas

for future research including cost effectiveness; potential to return to work or school; and patient preferences.

Strengths and limitations of the methodology have been discussed and suggestions of how to develop these in the future have been explored together with the potential to evaluate the CAT group by monitoring the activity on the website in order to inform future strategy.

In summary the Cat proved to be a successful rapid method to search for and review the best available evidence, however the potential to recruit a qualitative expert into the group has been proposed to promote an additional perspective on the methodologies that might be utilised to answer the clinical questions posed.

The next chapter contains a detailed account of the CoP methodological phase that was completed, the results will be reported and discussed.

Chapter eight: Community of Practice (CoP) Methodology

8.1 Introduction

This thesis consists of two methodological phases.

Phase 1 - Critically Appraised Topic (CAT) methodology

Phase 2 - Community of Practice CoP) methodology

The rationale for the CAT and CoP approaches is provided in chapter six, and the detailed account of the CAT methodological phase, results and discussion is provided in chapter seven.

This chapter contains a detailed account of the CoP methodological phase, the results will be reported and discussed.

The second phase of the study required the candidate to present the key findings and the clinical bottom line that had been generated from the CAT to the participants of the CoP. A qualitative phenomenology methodology was felt to be appropriate to use because it was essential to capture the participants' previous experiences of hydrotherapy to inform the discussions within the community of practice. Interviews were not felt to be an appropriate tool to use because the researcher wanted to enable the participants within the group to interact and generate discussion in order to enrich the data. Therefore an open facilitated discussion format was used to capture all the participants' views on:-

- the clinical bottom line and the evidence that was presented to them from the CAT review

- the barriers and potential solutions to implementing the clinical bottom line

Although there are many similarities between CoP and focus groups with regard to the characteristics of the participants; number of participants; format and type of data collected, due to the specific professional characteristics of the participants and the requirement to identify strategies, the candidate used a CoP as opposed to a focus group, to facilitate data collection, utilising focus group methodology, which is commonly used in qualitative research.

8.2 Sampling strategy

For this study purposive sampling was utilised in order to select a group of people with a particular characteristics (Bowling, 2014). In this case experts in the field of hydrotherapy, those responsible for treating and managing patients, those responsible for managing patient services, those responsible for training physiotherapy students both within the National Health Service (NHS), private and academic settings and the students that receive the education within both an academic and NHS setting.

No other specific guidance on the sample size for a CoP was identified so, the guidance suggested by Rabiee (2004) and Kruegar and Casey (2015) was followed and a purposive sample with a target size of nine was recruited. The participants were identified by the candidate as either experts in the field of hydrotherapy via local and national clinical and professional networks, or were currently working within the local hospital geographical area to Keele University and supporting physiotherapy student education, and Keele University

physiotherapy academic staff and students. The purposive characteristics of the participants invited to take part in the CoP are described below:

- Non physiotherapy rheumatology health professionals including a rheumatology consultant and rheumatology nurse as these members of the multidisciplinary team are involved in referring adult and paediatric patients to hydrotherapy. These participants also support undergraduate education of both medical and nursing students
- Local Private and NHS Physiotherapists who assess adults and paediatric patients' suitability for hydrotherapy and also treat patients with hydrotherapy. These participants also support undergraduate physiotherapy student education, and would offer perspectives from both private and NHS clinicians with professional expertise and experience
- Local NHS Service Provider Manager responsible for commissioning physiotherapy services and who understands the practicalities associated with planning and providing therapy services, of which hydrotherapy would be included
- Local University Physiotherapy Lecturer who supports the teaching element of hydrotherapy and has an understanding of the education requirements and limitations associated in undergraduate physiotherapy courses and also an awareness of evidence based practice taught within undergraduate physiotherapy courses
- Local University Physiotherapy final year students who have been taught both the theory and practical principles of hydrotherapy both at university and during clinical placements in order to gain their perspectives as soon to be newly qualified physiotherapists. It was identified in the ethics application

that two students would be recruited to the CoP to act as mutual support for each other within this group of experts

- Members of the Chartered Society of Physiotherapy – Aquatic Therapy Special Interest Group who would be able to give the most current and national perspective to the group discussions in relation to treatment and evidence based practice.

The aim was to sample one from each group apart from the students which was identified in the ethics application.

8.3 Running schedule of the Community of Practice (CoP)

The candidate chose to hold the CoP at the sustainability hub which is located on the Keele University Campus, as it was a neutral venue, away from all of the participants' normal working/learning environments in order to try to avoid any distractions. Keele University is also a known site within a manageable travelling distance for most of the participants and relevant ease if travelling by train/motorway. Due to unforeseen circumstances the students were unable to attend the original CoP and subsequently contacted the candidate to offer further support for the study if possible. The University Ethical Review Panel subsequently granted this request and a second CoP was conducted with the two students (Appendix 8). The sustainability hub was not available for the second CoP venue, however the candidate negotiated a private meeting room in the School of Health and Rehabilitation on the University campus to negate travel time for the students and also negotiated a time that did not affect any of their teaching or vacation commitments.

The running schedule includes: a list of facilitators of the CoP and their roles; a list of the participants; a timetable of events; semi-structured questions, supplementary questions and associated prompts; room seating plan and field note proforma (Appendix 4). The candidate followed the guidance on how to plan and run focus groups using a topic guide as advocated by Kruegar and Casey (2015). This guidance specified that the questions needed to be carefully predetermined and sequenced; open-ended, easy to understand and logical to the participant to ensure that the participants engaged with the topic area and felt able to share their feelings and thought processes with no pressure to reach a consensus. Bourgeault (2010) suggests that semi-structured questions retain flexibility while also allowing a degree of standardisation; therefore the researcher chose to use a semi-structured schedule with suggestions of questions to use by the facilitator in order to address the main topic areas of the research. However, it was felt important to allow the participants to share their own ideas therefore prompts and supplementary questions were also included for the facilitator to refer to if required.

The candidate and research supervisor formulated the following topic areas and semi-structured questions to present to the participants within the CoP, which were verified for appropriateness by an external qualitative researcher.

Topic 1 - Highlight the barriers to implementing the clinical bottom line.

- What are your thoughts on the evidence that has been presented to you?
- What do you feel are the main barriers to ensuring that the best available evidence for hydrotherapy gets into clinical practice?
- What use is this information to you?

Topic 2 - Generate potential solutions to enable its implementation.

- What do you feel would help to get this evidence into practice?
- How would you share this evidence within your environments?
- How might you ensure this evidence is embed at an individual, team, organisational and system level?

They were also included in the running schedule that was submitted to the University Ethics committee for approval. The research team subsequently reviewed the content and format of the running schedule during the pilot of the community of practice presentation. In order to pilot the running schedule, the candidate met with the team two weeks prior to the CoP so that they could review and comment on the presentation to the participants and the running schedule, to ensure all were aware of their individual requirements for the session and that the processes involved were fit for purpose, so that the researcher could reflect and refine any aspects. A number of grammatical amendments were required to the presentation and the candidate was encouraged to read less from the slides and have confidence in their knowledge of the subject area.

The running schedule structure took into account the candidate's previous extensive experience in teaching and organising undergraduate and postgraduate training sessions, and is supported by Maslow's Hierarchy of Needs (Maslow, 1943). Maslow suggests that our actions are motivated in order to achieve certain needs and is usually portrayed in five levels. The four lower levels need to be satisfied before the higher order needs that include creativity and problem solving (which would be required by the participants) can be achieved. Therefore the room environment, refreshments, comfort breaks and length of presentation for the

community of practice were considered along with enough time for the participants to generate a rapport with each other.

8.4 The Research Team

The research team consisted of four members:

- The researcher who presented the evidence via a power-point presentation to the participants of the CoP and observed the CoP
- Lead Supervisor who facilitated the CoP
- Second Supervisor who observed the process in order to feedback at the end of the CoP
- Field Note Keeper (to note, body language, engagement, dynamics etc)

The candidate chose not to facilitate the CoP to reduce the possibility of influencing the direction of the discussion and eliminate personal bias. The Lead Supervisor was recruited to facilitate and was instructed in generating open discussion to ensure all participants could reflect on each other's opinions, enhancing engagement and minimising the impact of stronger view points (Patton, 2002; Kruegar & Casey, 2015).

The Field Note Keeper was issued with a proforma, using guidance from an experienced qualitative researcher to use during the CoP, in order to document the individual participants body language, voice intonation, engagement and overall dynamics/interaction of the group. The second supervisor was instructed in

observing the process and providing overall feedback at the end of the CoP in order to review how the CoP process could have been enhanced.

The running schedule was then reviewed by an experienced qualitative researcher within the University, who was external to the research team for its appropriateness prior to submission to the University ethics committee for approval.

8.5 Conducting of the Community of Practice (CoP)

When the participants arrived they were welcomed by the researcher and asked to review the invitation letter and information sheet again prior to completing a consent form. These had been previously emailed to the participants requesting their willingness to take part in the CoP. Informed consent is essential and ensures that participants have been fully informed and understand what the study entails and agree to take part voluntarily. Written consent was obtained from the participants by the researcher prior to the CoP taking place, allowing the researcher the opportunity to explain the purpose of the study again; explain how the CoP would be conducted; give assurance that their identity was protected and to answer any questions that the participant might have. This also gave the participant the opportunity to withdraw from the study without prejudice or impact on their relationship or role with the University.

There was a five minute delay to the original start time of the presentation prior to the CoP to allow extra time for the invited students to arrive. The students did not arrive and the research team agreed to start the presentation without them. Consent was gained by all participants that attended.

The participants' self-allocated their participant number and seating position within the CoP in order to maintain confidentiality. This was determined randomly when the participants arrived and entered the room. On completion of the consent form a number was allocated to the participant and the participant was asked to sit at the desk with the corresponding number. Each participant was also issued with a pack containing copies of the: invitation letter, information sheet, presentation slides, results of CAT with population and outcome highlighted. Four sheets of blank note paper were placed at each seating position. The participants were requested to write down any thoughts or questions generated during presentation as they may aid discussion in the CoP and would therefore be captured in the recordings. When the CoP had finished the candidate collected the note sheets and shredded them the same day, they were not included in the data analyses.

Once the participants had taken their allocated seat the candidate presented the key findings of the research and the clinical bottom line in the form of a presentation.

8.5.1 Presentation to the participants

The research team felt that it was important to present an overview of the processes that had been involved in the thesis to generate the clinical bottom line to ensure that all the participants were at the same level and to enhance the discussions within the community of practice.

A power-point presentation was chosen to relay this information to the participants to aid efficiency and to ensure that the data was displayed in an easy to view

format. A copy of the presentation slides can be requested from the candidate. In summary the presentation included:-

- Introduction to research team, housekeeping and timings of the morning
- Ground rules associated with the Community of Practice (CoP)
- A historical view of hydrotherapy leading to current day practice
- The thesis aims
- Overview of the CAT methodology
- Summary of the results of the CAT and the clinical bottom line
- Participants were given the opportunity to withdraw and advised when the recording was to start and end.

The presentation aimed to take thirty minutes. Following the presentation a comfort break was taken prior to the start of the CoP to allow participants to gather their thoughts and review the clinical bottom line in their own time. This was considered valuable in order to meet the participants individual learning styles as some individuals require more time to reflect on information that has been presented than others (Honey & Mumford, 1986).

8.5.2 Community of Practice (CoP) - Two

A second CoP was completed ensuring that the student participants' personal experience and perspectives would enrich the data collected. An application was submitted and approved by the University Ethical Review Panel (Appendix 8). This additional community of practice used exactly the same information and processes as the first CoP. The only difference was that due to other commitments only the candidate and the facilitator attended the CoP with the two students.

8.5.3 Data collection within the Community of Practice (CoP)

Two portable digital recording machines were placed strategically to capture the discussions fully from all areas of the room to ensure that the data could be transcribed fully. Both at the beginning and the end of the CoP the facilitator advised the participants that the recorders were being switched on and off.

The duration of the first CoP was 76 minutes and 4 seconds and had six participants; the duration of the second CoP with two participants was 46 minutes and 44 seconds.

8.5.4 Data analysis

The candidate chose to apply Colaizzi (1978), seven steps to analyse the transcribed data. A detailed overview of how each step was applied is detailed below:-

1. The candidate fully transcribed verbatim the recorded data from the audio tapes from both CoP. In order to increase the validity of the data; confirm accuracy and reduce bias of interpretation, the lead supervisor listened to the original recording and compared this to the transcript (Halcomb, 2006). Areas that were highlighted as misinterpreted or words that were missing, that may have altered the accuracy of the data, were re-listened to and corrected by the candidate. The candidate then read through the CoP transcripts fully twice to increase familiarity with the data and then re-read to ensure understanding of thoughts and feelings.

2. Each transcript was analysed to identify all statements in the transcript that related to the study. These statements were highlighted with a luminous colour on the word document and then cut and pasted on to a separate word document in order to re-read the data. During this process continued immersion in the data was facilitated and enabled identification of emerging early themes.
3. Each significant statement was studied to determine a sense of its meaning and also the text on the transcript was reviewed, both before & after the statement to ensure that the contextual meaning was not misinterpreted. An external qualitative expert outside of the research team conducted their own independent analysis of the transcript data and was able to clarify that the significant themes and subsequent meanings originated from the data.
4. These meanings were then organised into clusters of common themes ensuring that bracketing was in place in order to resist the temptation to ignore themes that did not fit with the candidates' preconceived ideas.
5. A full and inclusive written description of the resultant themes was completed. Significant statements were extracted in order to support the themes that had been generated.
6. This description was then condensed into a formulated list of the themes, which has been incorporated into the results chapter and was verified by an external qualitative expert outside of the research team.
7. Colaizzi (1978), suggests that the final validation stage of data analysis should involve returning the structure of the phenomena to the participants for validation to ensure it represents their experience/views. This stage was not included as it was not incorporated into the original ethics proposal. The

candidate identified to the participants during the CoP that the research study would be shared with them once completed. On reflection it would have been valuable to have incorporated this stage into the ethics proposal in order to ensure rigour and will be included as a limitation to the study design.

The flow chart in Appendix 5 demonstrates how the data was reduced and analysed for one of the themes generated using Colaizzi's (1978), procedural steps. This process was applied in the generation of all the themes. An example of the CoP transcript is included in Appendix 6, a full copy can be viewed on request.

8.6 Ethical considerations

The World Medical Association (2013) developed the Declaration of Helsinki as an internationally accepted statement of ethical principles for medical research involving human subjects, including research on identifiable human material and data. Consequently research projects involving human subjects require ethical review and approval from a research committee before any research can begin (Watson et al., 2008), unless the research is purely documentary, based on sources that are already available within the public domain.

Written informed consent is essential and ensures that participants have been fully informed and understand what the study entails and agreement to take part is voluntarily. Written informed consent was obtained from the participants, by the candidate prior to the CoP taking place, allowing the researcher the opportunity to

explain the purpose of the study again and how the CoP would be conducted; give assurance that identity was protected and to answer any questions that the participants had. This also gave the participant the opportunity to withdraw from the study. Consent was gained by all participants and there were no withdrawals from the study. A copy of the consent form that the participants were asked to complete can be found in Appendix 7.

The ethical issue identified in this study focussed primarily on the candidate knowing some of the participants in a professional capacity and therefore it was important to ensure that participants at no time felt under pressure to agree to participate. This was addressed by emailing the participants, as opposed to face to face or personal request to participate. There were no other ethically sensitive, challenging or issues of risk identified prior to the research being completed. However participants' were provided with the candidates contact details in case they had any questions or concerns following the completion of the study. It was confirmed that all data would be treated in confidence and anonymised; although on the patient information sheet it was made clear that there could be a risk that the participants may be identified by their role.

Due to the nature of the research being undertaken ethical approval was required by Keele University Research Ethics Committee only, and was subsequently granted on 14th July 2016 (Appendix 8). The two student participants that were unable to attend the first CoP contacted the researcher advising that they would still like to support the study if possible. In order to further enrich the data an application to amend the study was submitted to the University Ethical Review Panel requesting an additional community of practice to take place with the two student participants and was granted on 28th October 2016 (Appendix 8).

8.7 Reliability and Validity

There is always an element of subjectivity associated with qualitative research that may not be noticeable in quantitative research, due to the values, beliefs, experience and interests of the researcher's interpretation of the data (Jooten et al., 2009). Holloway and Wheeler (1996) suggest that reliability is the extent that the research is reproducible if repeated and validity is dependent on the research tool used, being fit for purpose. The researcher has explained the choice of research methodology in the previous chapters which would enable the study to be repeated.

There is also the need to show that the study is rigorous by establishing trustworthiness (Koch, 1994). Trustworthiness can be demonstrated by ensuring that the study methodology and analysis has included a clear decision trail. Reflexivity is the process of reflecting on yourself as a researcher, taking into account your own beliefs and how they may influence the study design; influencing participants' views and analysis of the data (Patton, 2002). In order to establish trustworthiness and reflexivity two external qualitative experts were integrated into the supervision team: the first gave guidance on the study design; and the second reviewed the data and validated the themes produced (Kisely & Kendall, 2011). The candidate also did not facilitate the CoP to negate the possibility of their own beliefs influencing the participants discussion.

Bracketing is the cognitive process of putting aside one's own beliefs and not making judgements about what is observed or heard within the research study

(Jooten et al., 2009). However, the lack of consistency in the term ‘bracketing’ is evidenced by different authors proposing that it encompasses: beliefs and values; thoughts and hypothesis; biases; emotions; preconceptions; and assumptions about the phenomenon being studies (Tufford & Newman, 2012). Chan et al (2013), suggest that bracketing should be in the researchers mind when initiating the research proposal and throughout the whole process. In order to maintain honesty and openness thoughts should be identified together with their ideas and presuppositions about the topic, as well as their personal biases (Struebert & Carpenter, 2011). It is inferred that during the process of data collection researchers cannot be completely detached from their own views. In order to address this planned open interview questions that allow discussion by the participants with the use of prompts to ask for clarification may support validity of the data produced (Haggman-Lailila, 1999) . There is a suggestion that the researcher is inseparable from the phenomena that they are observing (Hughes, 1990) and there is no consensus as to who, what, when and how bracketing should be achieved (Sim & Wright, 2002), leading to inconsistencies within the approach of bracketing (LeVasseur, 2003).

The candidate in this study has a history of using hydrotherapy as a treatment modality with patients and therefore has beliefs about what is important; and also knew some of the participants, therefore there is an inevitable element of the candidate’s preconception within the research study.

To remain open and honest the main preconceptions of the candidate when entering the study were:-

- *the literature review would identify good quality evidence that hydrotherapy in adults and children would reduce pain and improve function, wellbeing and return to work or school more than usual care or dry land physiotherapy*
- *the literature review would identify evidence that hydrotherapy was not cost effective compared to usual care or dry land physiotherapy*
- *by sharing the results of the literature review and engaging the participants within the CoP that good quality evidence would be translated into clinical practice*
- *the CoP would help to produce a strategy to identify solutions to help ensure that this evidence was embed at: an individual level; a team level; an organisation level and a system level.*

In an attempt to address the concept of bracketing the candidate chose to identify key open semi-structured questions with suggestions of prompts and supplementary questions to encourage discussion among the participants, which can be seen within the CoP running schedule (Appendix 3). To reduce the possibility of influencing the direction of the discussion towards their own personal bias, the candidate chose not to facilitate the CoP. The lead supervisor was recruited to facilitate and was instructed to generate open discussion to ensure all participants could reflect on each other's opinions to enhance engagement and minimising the impact of stronger view points (Patton, 2002). The lead supervisor was a physiotherapist with an expertise in musculoskeletal disease but was not a hydrotherapy expert.

It has been reported that there are four ways to ensure effective evaluation of qualitative research: credibility; transferability; dependability and confirmability

(Guba & Lincoln, 1989). Transferability looks at the study as a whole and whether the results can be transferred to the wider population and credibility requires the study to be believable and true. Through including the methodology and identifying the participants' demography, and using their quotes to support the themes generated the reader is able to make their own evaluation as to whether the findings are transferable to the wider population (Koch, 1994; Maltby et al., 2010). In addition to this an example of how the themes have been generated from the transcript is included in Appendix 5. In order for the study to show dependability a clear audit trail is required (Koch, 1994) and this can has been addressed by including every stage of the research design with supporting appendices. Guba and Lincoln (1989) recommend that the data presented (e.g. the results) should link directly to the source, and this is demonstrated by enclosing an example of a CoP transcription with the quotes from the participants highlighted is Appendix 6, a full highlighted transcript can be viewed on request. The intention was to use field notes to capture the non-verbal interactions of the groups, this did not occur but did not detract from the quality of the data as the tape recording of the community of practice was able to identify the level of interaction by group members. To further demonstrate reliability and validity, two external experts in qualitative research were integrated into the supervision team one to review the format of the CoP running schedule prior to ethical approval and one to review the data and themes generated which are reported in the results chapter.

8.8 Community of Practice Results

The demographic characteristics of the participants who supported the community of practices (CoP) are presented. The data from both of the CoP were transcribed and the candidate's supervisor confirmed its accuracy (Halcomb & Davidson, 2006). The transcribed data from both of the CoP were amalgamated and an external reviewer conducted their own independent analysis and was able to clarify that the themes generated and subsequent meanings originated from the data.

In summary there were two main topic areas to focus on within the CoP and semi-structured questions were used to help facilitate the discussion and generate the data. An overview of the main topic areas and semi-structured questions within each topic area can be seen below and can also be located in the running schedule in Appendix 3:-

Topic 1 - Highlight the barriers to implementing the clinical bottom line.

- What are your thoughts on the evidence that has been presented to you?
- What do you feel are the main barriers to ensuring that the best available evidence for hydrotherapy gets into clinical practice?
- What use is this information to you?

Topic 2 - Generate potential solutions to enable its implementation.

- What do you feel would help to get this evidence into practice?
- How would you share this evidence within your environments?
- How might you ensure this evidence is embed at an individual, team, organisational and system level?

8.8.1 Demographics of Participants

A sample of 8 participants took part in the community of practice, the demographic characteristics of the participants are included in Table 8.1.

Table 8.1: Demographic characteristics of the participants in the study

Participant number	Occupation	Sex	Speciality
1	Local Private Physiotherapist, supporting Keele University Physiotherapy student education	Female	Musculoskeletal adults and children
2	Local Lecturer/Practitioner in Rheumatology Nursing	Female	Musculoskeletal adults and children
3	Local NHS Service Provider Manager & Practising Physiotherapist supporting Keele University Physiotherapy student education	Female	Musculoskeletal adults and children
4	Local NHS Physiotherapist, supporting Keele University Physiotherapy student education	Male	Musculoskeletal adults and children
5	Senior Lecturer and Honorary Consultant Rheumatologist at Keele University and Local Rheumatology Centre	Female	Musculoskeletal adults
6	Keele University Physiotherapy Lecturer with interest in hydrotherapy	Female	Musculoskeletal adults and children
7	Keele University 3rd year student physiotherapist	Male	Completed placement in hydrotherapy
8	Keele University 3rd year student physiotherapist	Male	Completed placement in hydrotherapy

The duration of the first CoP was 76 minutes and 4 seconds and had six participants; the duration of the second CoP with two participants was 46 minutes and 44 seconds.

8.8.2 Themes Generated

From the analysis performed on the data that was generated from both of the CoP, the following eight themes were identified and will be described in full under the heading of each theme:

1. The context of Hydrotherapy in clinical practice and the focus of current research findings are different
2. Current reliance on quantitative research
3. Amount and quality of evidence
4. Health Professionals understanding of the value of Hydrotherapy
5. Availability of Hydrotherapy services
6. Role of voluntary organisations and service users voice
7. Professional responsibility in advocating hydrotherapy
8. Funding opportunities

Theme 1: The context of hydrotherapy in clinical practice and the focus of current research findings are different

Differences were identified by the participants between the objectives of using hydrotherapy in clinical practice and the objectives of research papers investigating the effectiveness of hydrotherapy.

Seven out of the eight participants identified that in clinical practice, hydrotherapy has many objectives including: developing confidence to exercise, both independently and as part of a social group; as an introduction to engaging in other types of exercise; to enhance psychological wellbeing; and as a long term self-management option of exercise to help patients manage their conditions.

'It's the confidence as well, if they (children with Juvenile Idiopathic Arthritis (JIA)) see another child with JIA, coz, you know it's quite rare – they feel quite isolated – but if they see another child with a similar condition, who they are playing with (in the hydrotherapy pool), if you like, it can break down a lot of barriers and build their confidence as well' (P2)

'They (the patients) are in a social environment and they can erm get better together, you could say and erm any difficulties they erm , one patient might be having, another patient might be able to influence them positively. That erm, just that positive nature and the positive environment - they can feel that it's more useful than a land based intervention' (P7)

'We can use hydro for something and then take someone into a gym, because they have got so much better in water' (P4)

'I saw it not just as a treatment for there and then but as an introduction to a way of an individual being able to exercise permanently' (P3).

'We use it as an opportunity to be able to get some of those patients that we can't actually get into a gym straight off, to get them going and then move them onto the land based. So, I think a direct comparison isn't actually a true clinical representation' (P1)

'For some in spines, the psychological impact – it was almost the feeling I used to swim before I had my injury and now I can still swim' (P8)

'They come away feeling more enlightened and relaxed and fulfilled really' (P7)

'The biggest change for them (children with Juvenile Idiopathic Arthritis (JIA)), in that they were really afraid, and they didn't want to move, because they thought it was all going to get worse, it was going to hurt more. But actually getting them in the pool, playing games of volley ball in the water, they had a ball and they didn't realise they were exercising' (P6)

'I'm just thinking of referrals that we've had e.g. 4year old just come out of hip spikers, through to ACL's – to more of the chronic pain management' (P4)

'We may use it (hydrotherapy) as an interim, to get to a land based programme, and in a long term condition, we may use it as a whole way of life – hence the evening groups and the self-help groups. Or it may be that long term conditions has deteriorated so significantly, we need to go back to it (hydrotherapy), to step up to get some sort of exercise.' 'It (hydrotherapy) is a way of life, it is perhaps an option that people choose to maintain themselves in a way?' (P3))

Whereas in the research studies which investigated the effectiveness of hydrotherapy, the focus was not on the clinical objectives of self-management, developing confidence to exercise, psychological well-being or an intervention to manage a long term condition. Instead the objectives of these studies appeared to be exclusively focussed on comparing hydrotherapy with another exercise intervention.

Five of the participants felt that the research studies focussed on comparing hydrotherapy with land based exercises and that this was an artificial comparison as in clinical practice, hydrotherapy and land based exercises are used for two different purposes:-

'I think perhaps one of the negative things about hydro research that has been done, is that hydro has been used as a comparator to land to actually promote land based exercise rather than actually to look at hydro – some of the research that has been done already, I think, is possibly underselling the hydro element' (P6)

'I was just thinking, from a research point of view, if your trying to compare hydro with land based exercise – I don't know if hydro will ever beat land based exercises, so I think the way we use hydro is almost like a precursor type of thing so that they will be able to do land based (exercises) better. From a research point of view I don't know how they compared it' (P4)

'When the evidence is comparing the two (hydro and land based exercises), I don't think that is a direct comparison, I think they need to look at what difference it has made to people that couldn't do something else' (P1)

'It's (hydro) a unique intervention, it's not like land based, it can't be compared to land based' (P7)

'A lot of the research is head to head (hydro versus land based therapy) as opposed to how it is potentially implemented in the wider erm environment, which is I think, probably something that would change my opinion, that if you were really looking at the research, is to see what they are actually researching, is actually what goes on, on the ground' (P8)

The participants seemed disappointed that in the limited amount of research that had been undertaken on the effectiveness of hydrotherapy the clinically observed benefits of hydrotherapy had not been investigated.

Theme 2: Current reliance on quantitative research

Three participants questioned whether quantitative methods to evaluate hydrotherapy were the most appropriate research design to assess the value of hydrotherapy: -

'Are RCT's the best way to answer this question or is it actually better through case studies? Because in those sort of complex patients like you were talking about with spinal problems, knee problems and everything, they are never going to be represented in an RCT because they are too complicated (P5)

'I think perhaps researchers are focussing on the wrong types of studies' (P1)

'The negative things about hydro research that has been done is that the hydro has been used as a comparator' (P6)

The rheumatologist felt that randomised controlled trials (RCT's) may not be the most appropriate evidence to review or use as a study design for this type of treatment modality: -

'Hugely ambitious to summarise the evidence on hydrotherapy when it is so heterogeneous' (P5)

'Trials (RCT's) are not the answer'…..'good illustration of where the evidence hierarchy doesn't work' (P5)

Three participants advocated the use of a qualitative approach to explore the value of hydrotherapy. All participants nodded in agreement that the 'patient journey' would be valuable evidence to collect: -

'It is very powerful, the patients story'. 'If we gathered multicentre data and maybe focussed on specific case histories' (P6)

'Look at the patient journey…how much do they access other health professionals by treating them better now (with hydro), so that later on they don't end up in walk-in centres, A&E's, GP's' (P4)

'It's that sort of evidence (the patient journey) that is very visual and effective at getting the message across….. I think we need some qualitative research….. You might be able to then develop vignettes, where you think it (hydro) has a role….adds value' (P5)

All participants nodded in agreement when it was suggested by two participants that it might be appropriate to undertake a health service evaluation, regarding hydrotherapy provision, in order to ascertain demand on NHS services: -

'What happens when a community pool is closed, where people are self-managing, what increase on demand does that then have on the NHS… how can we reduce demand on the NHS?' (P1)

'Some of it doesn't have to be answered with research, its health service evaluation isn't it?' (P5)

Seven of the participants' suggested that the outcomes being measured focussed on physical improvements and excluded other variables such as enhanced psychological and social outcomes including increased confidence, social participation and a feeling of normality: -

'I'm not convinced that any of those (outcome measures) pick up quality of life or a confidence change in children (P6)

'Time doing something normal' (P8)

'So not thinking about the physical improvement, the measurement of physical improvement, but thinking about the psychological impact' (P2)

'I think the outcome measures seems to be the difficult thing to do - is it to measure the improvement you are making to people' (P4)

'The research isn't picking out that it's an option of exercise, but it does provide an awful lot more' (P3)

'The quality of life scales often overlook social functioning, so things like social participation, work, all that sort of thing' (P5)

'It's a very difficult thing to objectively measure, as someone who works with patients, you pick up on satisfaction and quality of life. That sort of to me was a sort of key thing for the patient, was patient satisfaction' (P8)

'Not overlooking the power of the patients experience' (P1)

Four participants felt that there was a need to collect data on cost effectiveness; patient satisfaction; quality of life; medication use; and healthcare utilisation to help justify the benefit of hydrotherapy to managers and commissioners:-

‘*Going back to work, if that means you are no longer on benefits, then that’s a fantastic cost effectiveness, so I think we are missing that at the moment’ (P6)*

‘If you were in charge of saying yes or no to funding, is that an interest in terms of patient satisfaction as opposed to a solid outcome measure such as improving disability or reducing time on a ward’ (P8)

‘Quality of life is, from a patients perspective is sometimes hard to capture, but certainly in my experience of hydro, the patients said “but I actually feel day to day that I can do more at home, or play with their grandchildren” (P6)

‘I don’t think in the literature it highlighted the benefits of not just patient satisfaction but also, especially when you think about the children and that peer support’ (P2)

‘The medication use and healthcare utilisation has probably not been used in the outcome measures.’ ‘There might even be health economic things (outcomes) there about social participation, work and so on’ (P5)

Theme 3: Amount and quality of evidence

Four of the participants felt that the amount of evidence in the public domain acted as a potential barrier to reviewing the research; and two participants were concerned about the quality of the evidence available: -

‘Relating things to myself in terms of the volume of evidence might be a barrier’ (P8)

'Like having that volume of 250 papers condensed down' (P7)

'We have to be responsible about how we report this (clinical bottom line generated from the CAT process), so if the trials and the evidence hasn't been mapped to how you think it works in practice and there again you might need to change your question slightly' (P5)

'There isn't the research out there that's of sufficient quality that you can then give to people, and say, this is what happens' (P4)

Theme 4: Health Professionals' understanding of the value of Hydrotherapy

All six of the qualified participants expressed concern that a lack of underpinning knowledge on the purpose of hydrotherapy at both an undergraduate and postgraduate level might have an effect on the type of patients that are referred to this service:-

'There are barriers to, not the evidence, but to understanding its role. That you can use it (hydro) with someone that you wouldn't think you could do anything with, in order to get them to a level where they could do land exercise. I'm not sure that a lot of rheumatologists would know that' (P5)

'It's not just rheumatologists (that don't understand hydro) I would extend that to orthopods as well and lots of medics' (P3)

'Some of the views of people that don't understand are that people just go into the water and have a little bit of a splash around rather than it actually being a therapeutic intervention' (P1)

'If they (GP's) don't know the difference between the benefits of hydro & land exercises, they might say, well there's a big cost we can save so let's get rid of hydro' (P2)

'Our undergrads (physiotherapy students), if they are lucky, they might get a placement (hydrotherapy). But equally if they don't they might only get 1 hour in the pool in the whole of their 3 year training' (P6)

'There are deficits in medics training of AHP roles.' 'do they (trainee medics) spend time with physios / OT's, do they see what they do? Probably not' (P5)

'The type of referral is always going to be a constant battle. Hydro traditionally has always been a bit of a dumping ground because they don't know what else to do with people' (P4)

Three participants suggested that training packages or national courses could be designed to incorporate a hydrotherapy element to increase awareness for both qualified and trainee doctors and physiotherapists, which in turn, could support more appropriate referrals:-

'Would their (General practitioners') referrals be more appropriate if there was a sort of an education package offered?' (P3)

'With regard to designing our British Society Rheumatology Course. Maybe the first day would have doctors, trainees and physios learn about the benefits and

roles, then the day after could be for physios in terms of post graduate education for Hydro?' (P5)

'With the obligation (of attendees) to get into the pool and experience it' (P2)

Three participants felt it might also be useful to engage patients in the education process to help manage their expectations should this intervention be offered to them:-

'There might be room for some patient education there' (P8)

'Highlight that hydrotherapy is going to be a useful intervention to them (patients)' (P7)

'Managing their (the patients) expectations' (P1)

Theme 5: Availability of Hydrotherapy services

Two of the participants suggested that due to the limited availability of hydrotherapy sessions land based exercise was the favoured treatment option and hydrotherapy was offered as a complementary adjunct: -

'*It (hydro) was purely a bonus, complimentary' (P8)*

'Land based physiotherapy interventions, they always remained paramount…because the patient could erm utilise those interventions at a time that suited them…hydrotherapy was quite limited' (P7)

A local NHS physiotherapist indicated that the hydrotherapy pool that they treated patients in could perhaps be managed differently in order to maintain the service: -

'The pool where we are doesn't seem to be managed well' …..'they have given it (the management) to people who don't understand hydro' …..'do managers want to keep it (hydro pool) open' (P4)

This point of view was supported by three participants who commented that extended working patterns might help to increase access to hydrotherapy services:-

'You could sort of manage staff differently to allow more time in the pool' (P8)

'Seven days a week' (P7)

'Is it (hydro pool) used in the evenings and at weekends?' (P6)

A local NHS physiotherapist explained that closure of a community pool affected the amount and type of referral to an NHS hydrotherapy centre: -

'When a local pool (community heated pool) closed down that changed hydro dramatically for us…."I'll (the patient) go through the NHS and access it through them", so the numbers and type of patients that you would get changed' (P4)

Six participants proposed the possibility of building relationships with community and school swimming pools, that have warmer pool temperatures, and commissioning hydrotherapy services external to NHS pools. This would enable patients to self-manage their conditions and increase access to hydrotherapy: -

"Looking at going out into the community, and building relationships with education and looking in the special schools. Utilising what is already out there as much as possible' (P3)

'Utilising the community more,…...rent a pool per hour for example for patient groups' (P8)

'Check out local pools'…'It can't be offered to everyone because it is a limited resource. We can't erm just accommodate everyone. We have to probably utilise groups rather than singular patients. Getting a lot of people in and having a faster appropriate turnover' (P7)

'I tend to look for small pools with ease of access that are warmer, where people can go on their own. I want to promote self-management' (P1)

'Once we have finished with them (the patients), give them a list of other pools where patients can then go' (P4)

'You've got a condition where you are not very mobile, the patients won't go to a cold pool' (P2)

A local private physiotherapist indicated that it might be the patient's responsibility to use private hydrotherapy physiotherapists to help manage their condition: -

'Perhaps we need to look at services going out into the private sector, with an expectation that patients do their maintenance themselves within the private sector - a little bit like dentistry' (P1)

Theme 6: Role of voluntary organisations and service users' voice

Four participants proposed that service users, National Ankylosing Spondylitis Society (NASS) and Arthritis Care may be able to help subsidise hydrotherapy

treatment sessions and implement guidelines which could help to support the commissioning of services;

'There is a role maybe… with those third sector organisations who actually subsidise hydro on the QT really'. 'The NASS group and Arthritis Care, say "we can't give you anymore on the NHS, but this is your way of continuing on in the same pool, in the same environment' (P6)

'Something like Arthritis Research erm like a national body….could implement or drive forward treatment guidelines' (P8)

'Patient testimonials are what brings people into our business (private physio), its word of mouth and that is completely overlooked in commissioning, until there is an outcry by service users when a service is taken off' (P1)

'From a paediatric point of view, and involve the parents and perhaps that will add to body of information that could be tapped into' (P2)

'There is very powerful expert and patient opinion that we are hearing, although we haven't got patient rep here, that this (hydro) is effective' (P5)

Theme 7: Professional responsibility in advocating Hydrotherapy

Six of the participants suggested that Professional Bodies and qualified Physiotherapists, as autonomous practitioners, should determine patients suitability for hydrotherapy; promote it as a specialist service; recommend treatment guidelines and support appropriate research to justify its use nationally :-

'There isn't any evidence that we've found, but we all feel passionate that we've got our own evidence, how do we get that message across in a national environment' (P5)

'Hydrotherapy association, or something like a national body that could fund some of the research eh guidelines or assistance in terms of implementing services (P8)

'Maybe we need to be in charge of who we choose to access that service (hydrotherapy)' (P1)

'The idea of a block of six (sessions of hydrotherapy) for everybody horrifies me, I just think everybody's different, somebody may need two, somebody might want ten. We are autonomous practitioners, and we should be saying, 'actually I'm not doing that, that's not acceptable' (P6)

'The only thing we have at the moment is just all most all the contra-indications, that's the only thing that stops people getting into the pool. Being just physically not able to, for medical reasons' (P4)

'We (physiotherapists) need to be a bit more specific on our dosages and our aims of treatment' (P3)

'Maybe as a profession we need to look at this (hydro) as a very skilled area to be working in'… 'I think we have got to be much more proactive in our approach to pushing research forward from different angles, it doesn't have to be RCT's and maybe shouldn't be' (P6)

'This is a good intervention that we can use, let's promote it'… 'utilise the CSP (Chartered Society of Physiotherapy)' (P7)

Theme 8: Funding opportunities

Four participants identified a need to source more imaginative methods of income generation to support completion of appropriate research which could be used to promote commissioning of hydrotherapy services; and to aid pool running costs : -

'Commissioners actually can sometimes place more value on patient stories and case narratives, rather than the evidence'…. 'get some case studies locally to try and push the argument (with commissioners) in terms of getting funding for pool maintenance and that sort of thing' (P5)

'Need to link in more with our clinical colleagues and almost commission some case studies that can be MSc projects'….'proper case histories that you write up in a rigorous way and get published'….'some devoted funding to actually support this' (P6)

'More rigorous costing in terms of a business. Trying to figure, sort of, what it would cost for a patient per hour. Guidelines sort of for implementing it as a service' (P8)

'We only sort of get rheumatology really that is like paid for and possibly orthopaedics – but I think GP's are free….50-60% of the referrals that we get that they are not actually charging for'… 'what information or training don't they (commissioners) have, that's causing them to then think that hydro isn't worthwhile' (P4)

'Course aimed at AHP's, run at the Haywood to help generate income' (P5)

8.9 Community of Practice Discussion

The transcribed data from the CoP was analysed using Colaizzi's (1978) procedural steps and generated the following eight themes:

1) The context of Hydrotherapy in clinical practice and the focus of current research findings are different
2) Current reliance on quantitative research
3) Amount and quality of evidence
4) Health Professionals understanding of the value of Hydrotherapy
5) Availability of Hydrotherapy services
6) Role of voluntary organisations and service users voice
7) Professional responsibility in advocating hydrotherapy
8) Funding opportunities

The semi-structured questions that were used within the CoP acted as a guide for the facilitator and were divided into two topic areas:

- Highlight the barriers to implementing the clinical bottom line
- Generate potential solutions to enable its implementation

During the participant discussions within the CoP and the subsequent data analysis it became apparent that the participants were offering opinions on both the barriers and solutions to the questions posed at the same time. The facilitator allowed the discussions to flow, with guidance only to move onto the next topic area once the discussions had naturally finished, enabling rich data to be collected and resulted in the generation of eight themes. Each of the themes that were

generated will be explored in more detail, any potential barriers or solutions that the participants expressed will be reported under each theme.

8.9.1 Theme 1: The context of hydrotherapy in clinical practice and the focus of current research findings are different

The participants identified a difference between how hydrotherapy is used within clinical practice and the focus of the literature that had been reviewed. The participants reported that in clinical practice hydrotherapy has many objectives including developing confidence to exercise, both independently and as part of a social group; as an introduction to engaging in other types of exercise; to enhance psychological wellbeing; and as a long term self-management option of exercise to help patients manage their conditions. Hydrotherapy has been described as a unique experience, which provides a beneficial rehabilitation environment (Reid-Campion, 2000). The term 'complex intervention' has been defined as an intervention that has several interacting components which operate at multiple levels (Lau et al., 2016). The physiological, therapeutic and psychological responses that occur due to the physical properties of exercising in warm water has been explained fully in the Water Therapy Chapter, outlining the 'complexity' of this form of treatment as an intervention. The Medical Research Council Guidance (Craig et al., 2008) suggests that any complex interventions are complex due to: the number of interacting components; the number and difficulty of behaviours required by those delivering or receiving the intervention; the number of groups or organisational levels targeted by the intervention; the number and variability of outcomes; and the degree of flexibility that the intervention

permits. Complexity and how complex interventions are evaluated remains a key issue for health service and public health researchers (Petticrew, 2011). It could be suggested that the context of hydrotherapy and land based exercises are different. The participants also alluded to this as the literature that had been reviewed appeared to compare the effectiveness of hydrotherapy to land based exercise. Land based exercise may pose different organisational and economic burdens associated with staffing and maintenance costs.

8.9.2 Theme 2: Current reliance on quantitative research

The research participants identified that quantitative methods may not be the most appropriate research design to evaluate the value of hydrotherapy. They advocated the use of a qualitative approach, with outcomes measures focussing on more psychological and social outcomes. They also indicated that cost effectiveness and healthcare utilisation data may help to justify its benefit to managers and commissioners.

The CAT methodology used within this study follows the premise that systematic reviews and randomised controlled trials are the 'gold standard' of research design in health when looking at the effectiveness of interventions (Sackett et al., 2000). A systematic review summarises the results of health care studies and a randomised controlled trial is a type of interventional or experimental study design, consisting of participants being allocated to one intervention or another and reviewed after a period of time against outcomes that were identified at the beginning of the study (Sims & Wright, 2002). To explore how the experience of the intervention undertaken, in this case hydrotherapy, has impacted on the individual may lead to

a more comprehensive understanding of the clinical benefits of hydrotherapy than is currently known. This suggests that the evidence that was reviewed using the current CAT methodology might not capture all the benefits gained from hydrotherapy.

During the discussion the consensus amongst the participants was that due to the quantitative nature of the studies reviewed, the outcomes focussed mainly on physical improvements and excluded other variables such as enhanced psychological and social outcomes, including increased confidence, social participation, a feeling of normality and patient satisfaction, which had been observed by the participants in clinical practice. The Measure Yourself Medical Outcomes Profile was developed by Bristol University in 2007 and aims to measure the outcomes that the patient considers are the most important (University of Bristol, 2017). It is free to use on line, brief and patient-centred and is suggested as a useful tool to use in case studies, however due to the individualised nature it is reported to be unsuitable as a basis for economic evaluations. Pattman et al (2013) found it to be a feasible and responsive measure to use for hydrotherapy, however this study was not included in the narrative review by Larmer et al (2014) who indicated that no reported outcome measures had been evaluated specifically for hydrotherapy interventions and that further research to develop a valid, reliable measure specifically for people with arthritis receiving hydrotherapy as an intervention was warranted.

The Health and Care Professions Council, Standard 12 of the Standards of Proficiency for Physiotherapists (2013) reflects a growing need for quality assurance, where it states that registrant physiotherapists must be able to assure

the quality of their practice. This includes gathering qualitative and quantitative data, participating in audit activity, using appropriate outcome measures and evaluating interventions to ensure they meet service users' needs and changes in health. With outcomes increasingly becoming the currency of modern healthcare, patient-reported outcome measures (PROMs) and patient reported experience measures (PREMs) are key to demonstrating the success of physiotherapy. Therefore it is important for physiotherapists to promote and support the development of accurate outcome measures that reflect the quality and effectiveness of interventions like hydrotherapy to enhance service delivery.

Participants also suggested that different research methodological approaches to gain information on health care utilisation and cost effectiveness might help to justify the value of hydrotherapy to clinicians and health care commissioners. It appeared that there were limited studies during the literature search that reviewed the cost effectiveness for hydrotherapy for either adults or paediatrics. The most recent article in the COCHRANE Database (COCHRANE, 2017) on the cost effectiveness for hydrotherapy is the study that has been included in this review by Epps et al (2005).

Cochrane et al., 2005, completed a randomised controlled trial to determine the cost effectiveness of group community water based therapy over a one year period for the management of lower limb osteoarthritis and concluded that a water-exercise programme produced a favourable cost–benefit outcome. The study was conducted in a community leisure centre with temperatures of 29ºC which is lower than specialised hydrotherapy pools of 33-37ºC. The participants of the community of practice supported the authors' views suggesting that more research into this subject area in both community and specialised hydrotherapy pools might be

appropriate to investigate access and effectiveness of treatment and cost within both of these environments, from both a provider and participant perspective.

8.9.3 Theme 3: Amount and quality of evidence

There was a suggestion from half of the participants that the amount of evidence in the public domain and its appropriateness could act as a potential barrier to clinicians reviewing the research available. It has been reported that with the increased amount of literature being produced; and the lack of time that clinicians have to review the evidence; that knowledge mobilisations models have emerged to try and reduce this evidence to practice gap (Graham et al., 2006). However, Shifaza et al (2014) added that poor understanding of the evidence and the lack of resources to explore the evidence could also be a potential barrier. One way of addressing the amount of evidence in the public domain is by using a Critically Appraised Topic Framework (CAT), which was used in this study. A CAT is developed from a clinical question; providing a summary of the best available evidence; in order to generate a clinical bottom line, which is brief and takes two to five minutes to read (Foster et al., 2001). The CAT groups that have been set up within the Musculoskeletal Research Facilitation Group within Primary Care at Keele University bring clinical experts together from a number of health profession from within Staffordshire, Shropshire and Cheshire, to develop clinically relevant questions that are shared on a website for easy access. A systematic review is a tool for researchers, whereas a CAT is a tool that can be used by clinicians and could help to address the concerns of the participants with regard to the amount of evidence to review.

The participants in the study were also concerned with regard to the quality of the research reviewed and how this was reported in the clinical bottom line. The inclusion of using experts in literature searching as indicated by Stevenson et al (2007) would help to address this issue to ensure that the appropriate data bases were searched and that appropriate tools are used to assess the quality of the articles included in the review. However, Kelly et al (2016) suggested that there may be a lack of transparency in the reporting of some of the rapid review approaches and that specific reporting guidelines need to be identified to reduce these limitations.

8.9.4 Theme 4: Health Professionals understanding the value of hydrotherapy

All six of the participants expressed concern that a lack of underpinning knowledge on the purpose of hydrotherapy at both an undergraduate and postgraduate level might have an effect on the type of patients that are referred to this service.

Within the Physiotherapy Undergraduate Course at Keele University, students have a thirty minute taught practical session in their third year of study, supported by a work package covering the theoretical and health and safety aspects of hydrotherapy. Students may also obtain hands on experience with patients, under supervision of a qualified physiotherapist, if they are allocated to a clinical placement that includes hydrotherapy rehabilitation for their patients. Some Universities do not include a teaching element on hydrotherapy within their undergraduate Physiotherapy syllabus. There are recognised post graduate national courses and study day opportunities to increase physiotherapist and other

AHP's knowledge and skills in hydrotherapy. One participant suggested that holding a national course e.g. British Society Rheumatology Course at the Haywood Hospital that involved medics, nurses and allied health professionals might help all professionals understand the benefits of hydrotherapy as it was highlighted that some health professionals in other parts of the country may not have access to pools and might be unaware of its value. Educating health professionals in this manner might enable them to refer their patients for treatment elsewhere; or educate their patients with self-management options.

8.9.5 Theme 5: Availability of Hydrotherapy Services

It was indicated by two of the participants that due to the limited number of timetabled hydrotherapy sessions available that it was offered as a complimentary adjunct to land based exercise.

Most pools within the NHS appear not to offer hydrotherapy outside of normal weekday working hours (Monday to Friday, between 8.30am and 5.00pm), which would increase access to hydrotherapy services. Private physiotherapists tend to have more flexibility in offering sessions both in and outside these hours and at the weekends to address the needs of childrens school activities and adults work patterns.

The NICE guideline for Rheumatoid Arthritis, Quality Statement 4 advocates that patients that have been diagnosed with RA should be offered self-management activities, not as a 'one-off' but repeated throughout the course of the disease (NICE, 2017). During the participants discussion it was proposed that the closure

of a local community pool, which maintained its water at a warmer temperature than normal swimming pools, affected the amount and type of referral to the NHS hydrotherapy centre. Inappropriate referrals from local General Practitioners were received as a result of patient pressure. Some of these patients who had previously received treatment for RA and OA at the local NHS hydrotherapy centre, were discharged and referred to self-manage at the community pool, which on closure meant that they had limited facilities to continue therapy and therefore requested their doctors to refer them back to the NHS pool.

The participants then offered possible solutions to address the limited access by building relationships with community and school swimming pools, which have warmer pool temperatures, and commissioning hydrotherapy services external to NHS pools. The Department for Children Schools and Families, Education and Funding Agency, produced guidance in 2014 on the design of Hydrotherapy pools within mainstream and special schools (Department for Children Schools & Families, 2014). The guidance states that hydrotherapy pools are used by vulnerable people and must be safe and accessible. They indicate that health and safety considerations and infection control are paramount and that to ensure all individuals are treated with dignity and respect that all pools need:

- accessible changing, toilet and showering facilities (including pool-side showers) for both independent or assisted use
- accessible wet changing areas must be provided adjacent to the pool
- at least one hoist for independent or assisted access to the pool

This would indicate that the transfer of some hydrotherapy services from hospital based pools into the community might be possible to enable patients to self-manage their conditions.

The candidate communicated personally with a previous manager of physiotherapy services in York NHS Foundation Trust, who completed a cost benefit analysis of Hydrotherapy services in 2011/2012. This analysis compared current costs associated with the running, maintaining and staffing of the hydrotherapy pool at York Hospital and the re-provision of their hydrotherapy service including staff and travel costs, to two special schools and a newly built leisure centre which housed a full suite of hydrotherapy services that met all of their patient needs. The results favoured moving commissioned services into the community and the footprint of the hydrotherapy pool, plant room and suite of changing facilities was utilised to house other hospital services.

One participant (private physiotherapist) suggested that it might be the patient's responsibility to manage their own condition by utilising physiotherapists that offer hydrotherapy services, however these can prove to be expensive and some of the public may not be able to afford this, unless they have private health care insurance cover. They also advised that prescriptions, dental care, eye care, wigs are all examples of NHS services where you have to pay a contribution towards the costs of your own care. The money raised is reported to help fund the salary costs of more than 14,500 nurses in the NHS (NHS Choices, 2017) and the participant proposed that this may be a way forward with regard to supporting the cost of hydrotherapy services. Hydrotherapy's anecdotal complexity as an intervention could be magnified due to its perceived financial drain by commissioners on service provision, not only with regard to staffing but also the

ongoing maintenance and running costs associated with hydrotherapy pools, which has resulted in a number of pool closures.

8.9.6 Theme 6: Role of voluntary organisations and service users' voice

Four participants proposed that service users and support groups including the National Ankylosing Spondylitis Society and Arthritis Care may be able to help subsidise hydrotherapy treatment sessions and support implementation guidelines and commissioning of services.

NHS England is involved in the commissioning of health services in England and promotes patient and public involvement to improve all aspects of health care including: patient safety; patient experience and health outcomes. In October 2014 they produced their 'Five Year Forward View' and expressed their wish to build strong partnerships with charitable and voluntary sector organisations. They have further committed in the NHS England Research Plan, 2017 to: promote patient and public participation in research; encourage commissioners to identify and articulate evidence needs and research needs around patient insight; and to contribute to the design of the NHS Choices website to improve access to research opportunities and recruitment.

National Ankylosing Spondylitis Society (2017), suggest that the most important thing for individuals to help themselves, is to participate in exercise. They indicate that hydrotherapy helps alleviate the symptoms of stiffness, pain, risk of developing a stooped posture and tiredness or fatigue that is associated with ankylosing spondylitis (NASS, 2017). This is supported by the recently published

guideline by NICE in 2017 which advocates the use of hydrotherapy to manage pain and maintain or improve function (NICE [NG65], 2017). NASS have recently worked in partnership with the Faculty of Health and Rehabilitation, Lancaster University to help identify NASS's research priorities and in 2015 funded four research projects based on these findings (NASS, 2015).

Arthritis Research UK are merging with Arthritis Care in 2017. Their mission is to change attitudes towards arthritis, provide better support for patients and carers, and support research for treatments, interventions and cures (Arthritis Research UK, 2017). They promote the use of hydrotherapy in order to relax muscles and ease pain, which encourages exercise and increase in joint range of movements and muscle strength. Within their website they offer advice on how to access both GP referrals to hydrotherapy and also self-help group sessions in either NHS or community pools.

The National Rheumatoid Arthritis Society (2017), advocate the importance of regular exercise that should incorporate stretching, strengthening, aerobic and balance exercises. The types of exercise that they suggest are walking, gym based activities and exercising in water. They have a website with freely available information which has a section on research to help raise awareness and improve the care of people with RA (NRAS, 2017).

The European Science Foundation (2011) proposed that for successful and sustainable knowledge implementation that specific groups of stakeholders needed to be targeted which included: patients and the general public; patient organisations; and philanthropic organisations. Patient and Public involvement has been recognised and accepted with regard to its benefit on improving research

processes and considering the needs of patients (Thornton, 2008). It has been implemented in the UK, Europe, the United States and Australia and the National Institute for Health Research (NIHR) encourages patients and the public to be involved in all stages of the research process. This increased involvement of patients and members of the public in the research process as well as being research subjects has been documented. It has now been suggested that they can support knowledge mobilisations, not only by improving patients' knowledge and potentially improving their behaviours and their use of health care, but also by coaching patients on how to communicate more effectively with health professionals during consultations and therefore indirectly affecting patient outcomes (Davies et al, 2015).

8.9.7 Theme 7: Professional responsibility in advocating Hydrotherapy

Six of the participants suggested that Professional Bodies and qualified physiotherapists should determine patients' suitability for hydrotherapy; promote it as a specialist service; recommend treatment guidelines; and support appropriate research to justify its use nationally.

The current focus on Quality, Innovation, Productivity and Prevention (Department of Health, 2012) requires all health professionals to account for their practice. Similarly, the CSP Quality Assurance Standards (2012) suggest that all physiotherapists should acquire and regularly update the relevant knowledge and skills in order to determine patients' suitability for treatment interventions, and subsequent referral to appropriate continued care or self-management options on

discharge. More recently the CSP (2017) are in the process of identifying research priorities in areas of practice requiring urgent evidence and requesting anyone with experience of physiotherapy in the UK to identify the questions that need answering, so that they can focus on the most urgent needs of patients to promote health and wellbeing (CSP, Research Priorities, 2017). They have already funded research to determine the clinical and cost effectiveness of an exercise and self-management programme compared with General Practitioner standard care.

8.9.8 Theme 8: Funding opportunities

The participants suggested that there might be the opportunity to source more imaginative methods of income generation to support the running costs associated with hydrotherapy pools. The Darent Valley Hospital in Kent has opened its hydrotherapy pool to the public offering 'self-hydrotherapy' sessions lasting thirty minutes each at a cost of £5.00 per session. These sessions have been timetabled to fit in alongside their normal patient treatment hydrotherapy sessions (Dartford & Gravesham NHS Trust, 2017). Moulton College in Northamptonshire is a private physiotherapy rehabilitation centre that offers baby and children swimming lessons alongside their hydrotherapy treatment sessions (Moulton Injury & Rehab Centre, 2017). The ATACP are willing to hold their recognised courses at various sites with pool facilities which could have two effects: firstly to generate funding; secondly there would be the potential to increase health professionals understanding of this intervention. Referrals for hydrotherapy from various referral sources e.g. GP's, orthopaedics etc. must have the relevant processes in place to ensure that financial reimbursement takes place between healthcare services.

These income generation methods, alongside evening and weekend sessions, and donations supplied by self-help groups such as NASS and Arthritis Care could help to support pool running and maintenance costs.

The participants also proposed that designated funding might be required to support the gathering and subsequent publishing of case studies or patient stories that could be provided to commissioners to prove the value of hydrotherapy. We have already discussed the potential of accessing funding from charitable organisations and the CSP to support research projects. The ATACP already report case studies within the 'Aqualines' magazine. There may be the opportunity to work with undergraduate and post graduate courses within Universities to generate case studies or Masters Projects. There does not appear to be a hydrotherapy masters module advertised for healthcare professionals to attend, however there may be the possibility to work with the ATACP accreditation course to see if there is potential to develop this to a masters level qualification.

NHS England in 2014 and independent analysts have calculated that there will be a gap between resources and patient needs of nearly thirty billion pounds a year by 2020/21 (NHS England, 2014). Therefore there is a need to address innovative ways to support the running and maintenance costs that are associated with hydrotherapy services.

8.10 Methodological strengths and limitations of the CoP

The methodological approach of the CoP will now be evaluated. Two overarching areas will be discussed:

- Strengths and limitations as a methodological process
- The CoP as a means of knowledge mobilisation

8.10.1 Methodological Strengths of the Community of Practice

Data saturation has been described as the point where no new information is being produced and that the identification of new themes or relationships between the themes is exhausted (Sim & Wright, 2002; Moule, 2015). Failure to reach data saturation can have a negative impact on the validity of study results (Kerr, 2010). This study collected data from two CoP, the data from each was amalgamated and the themes generated were reviewed by an external expert for accuracy and data saturation was achieved.

Both of the CoP participants engaged fully with the discussion. The dynamic of the group, produced rich data to evaluate. All participants valued and respected each other's opinions which offered an excellent forum for knowledge exchange.

An experienced facilitator was recruited to facilitate the CoP and generated open discussion to ensure all participants in both CoP one and two could reflect on each other's opinions, enhancing engagement and minimising the impact of stronger view points (Patton, 2002; Kruegar & Casey, 2015). Semi-structured questions

were utilised to ensure that the relevant topic areas were covered to ensure that all the topic areas were discussed.

8.10.2 Methodological Limitations of the Community of Practice

Purposive sampling was used to select a group of people with a particular characteristic (Bowling, 2014). In this case, experts in the field of hydrotherapy; those responsible for treating and managing patients; those responsible for managing patient services; those responsible for training physiotherapy students both within the National Health Service (NHS), private and academic settings and the students that receive the education within both an academic and NHS setting. Within this group, experts in hydrotherapy from the CSP Special Interest Group (ATACP) were invited to give a national perspective, however they were unable to attend. This resulted in a national perspective on the current situation of hydrotherapy and any future plans or ideas that might already be in place was not included in the discussion. This could affect the generalisability of the results.

Patients were not included in the purposive sampling, their inclusion would have given an important perspective to the results and was a limitation to the study (National Institute for Health Research – Patients & the Public, 2017).

The numbers within the CoP (n=6 & n=2) and the qualified status of the participants could suggest that the dynamics of the groups were different. The transcripts highlight that more prompting was required from the facilitator during the second CoP. This may be explained by the participants in the first CoP being experienced clinicians and managers who may have had previous experience of

these type of forums. The small numbers of participants, based in one local centre reduced the generalisability of the results.

Colaizzi (1978), suggests that the final validation stage of data analysis should involve returning the results of the themes to the participants for validation to ensure it represents their experience/views. This stage was not included as it was not incorporated into the original ethics proposal. The candidate identified to the participants during the CoP that the research study would be shared with them once completed. On reflection it would have been valuable to have incorporated this stage into the ethics proposal in order to ensure rigour.

8.10.3 The CoP as a means of knowledge mobilisation

A community of practice has been reported as a method to mobilise knowledge, encouraging engagement from a variety of stakeholders by facilitating knowledge exchange among practitioners, researchers, decision makers, and patient led communities (Le-May, 2009; Nilsen, 2015).

The participants within the CoP engaged and collaborated fully with the process, resulting in the production of rich data to analyse and generate themes. These participants were selected on their specific characteristics using purposeful sampling, to fully inform the topic area promoting a diverse range of views that was relevant to the topic being studied, providing as much insight into the subject area as possible (Bourgeault et al., 2010). The CAT group members that generate the clinical questions are from similar professional backgrounds with similar interests. The participants that were recruited for the CoP in this study included a

broader spectrum of professionals at a more organisational level to help reduce the evidence to practice gap for a complex intervention (Lau et al., 2016).

The CoP proved to be a successful method to share the evidence generated from the CAT and to generate potential solutions to enable knowledge mobilisation.

8.12 Chapter summary

The CoP provided a forum for the participants to openly and honestly discuss and express their personal and professional views on the evidence presented from the CAT.

The main topic areas for the participants to discuss within the CoP were to:

- Highlight the barriers to implementing the clinical bottom line
- Generate potential solutions to enable its implementation

The recorded data was transcribed and analysed using Colaizzi's (1978), procedural steps to generate eight themes:

1. The context of Hydrotherapy in clinical practice and the focus of current research findings are different
2. Current reliance on quantitative research
3. Amount and quality of evidence
4. Health Professionals understanding of the value of Hydrotherapy
5. Availability of Hydrotherapy services
6. Role of voluntary organisations and service users voice
7. Professional responsibility in advocating hydrotherapy
8. Funding opportunities

By exploring the themes that were generated in this chapter, the following conclusions can be drawn.

- Themes one, two and three propose that the type, amount and quality of the evidence presented to the participants was a potential barrier to implementing the clinical bottom line.
- Themes four, six and seven suggest that the successful implementation of the clinical bottom line, which involves complex interventions, relies on it being shared at all levels or organisations, with all stakeholders.
- Themes four, six, seven and eight indicate that health professionals, professional bodies, patient groups and charitable organisations could help to influence the generation of research studies which in turn could be presented to commissioners to support funding of hydrotherapy services

This chapter has also highlighted the methodological strengths and limitations of the CoP within this study and the value of it as a method to mobilise knowledge for complex interventions**.**

In summary the CoP proved to be a successful method to share the evidence generated from the CAT and to generate potential solutions to enable knowledge mobilisation.

The following chapter will summarise the phases of the study and an overview of the results will be explored. The potential of adding the community of practice to the CAT process will also be discussed.

Chapter nine: Overall discussion

9.1 Introduction

This chapter will summarise the aims and phases of the thesis. An overview of the results will be explored. The added value of an additional community of practice to the CAT group process will be discussed, and the strengths and limitations of the thesis will be presented.

Clinical and future research implications will be proposed and a final conclusion will be expressed.

9.2 Summary of thesis aims and phases

This thesis aimed to:

1. Identify the best available evidence for hydrotherapy for adults and children with musculoskeletal pain and inflammatory arthritis
2. Explore how this best evidence could be translated into clinical practice, through knowledge mobilisation with clinicians, academic staff, students, managers within the National Health Service and experts within the field.

To answer these aims, there were two main phases and methodological approaches to this thesis:

Phase 1 – A Critically Appraised Topic (CAT) process was adopted to search for and review the best available evidence for hydrotherapy for adults and children with musculoskeletal pain and inflammatory arthritis to generate a clinical bottom line.

Phase 2 – A qualitative study of a Community of Practice to:

- Highlight the barriers to implementing the clinical bottom line from the hydrotherapy CAT
- Generate potential solutions to enable this knowledge (i.e. the clinical bottom line) is mobilised to ensure best evidence for patients requiring hydrotherapy is embed at: an individual level; a team level; an organisational level and a system level.

9.3 Overview of CAT results

The Cat proved to be a successful rapid method to search for and review the best available evidence and produced the clinical bottom line below to share with the participants of the community of practice to meet the first aim of the thesis:

Clinical bottom line - Adults

There is good quality evidence that hydro/aquatic therapy may have small short term effects on pain, disability, physical function, mobility and quality of life in adults with Ankylosing Spondylitis, Rheumatoid Arthritis, Low Back Pain and Osteoarthritis of the knee & hip. The long term effects are unclear. These effects

are comparable with land based exercises. No research has been found in relation to cost effectiveness or return to work.

Clinical bottom line - Paediatrics

There is no statistically significant evidence that land based exercise alone can improve functional ability, quality of life, or pain for children with JIA. Some evidence is available to support that there is a beneficial effect on quality of life & disease outcome for patients with JIA from both aquatic therapy & land based physio, in the short term. The long term effects are unclear. One study reported that there is no statistically significant evidence to justify the cost effectiveness of aquatic therapy above land based physio alone for children. No research has been found in relation to return to school.

The CAT process is utilised within the CAT group at Keele University. The CAT group structure and members characteristics are similar to a community of practice suggesting that both are appropriate methods to mobilise knowledge.

9.4 Overview of Community of Practice results

The community of practice generated eight themes:

1. The context of Hydrotherapy in clinical practice and the focus of current research findings are different
2. Current reliance on quantitative research
3. Amount and quality of evidence
4. Health Professionals understanding of the value of Hydrotherapy

5. Availability of Hydrotherapy services
6. Role of voluntary organisations and service users voice
7. Professional responsibility in advocating hydrotherapy
8. Funding opportunities

The following conclusions can be drawn from these themes to meet the second aim of the thesis.

- Themes one, two and three propose that the type, amount and quality of the evidence presented to the participants was a potential barrier to implementing the clinical bottom line.
- Themes four, six and seven suggest that the successful implementation of the clinical bottom line, which involves complex interventions, relies on it being shared at all levels or organisations, with all stakeholders.
- Themes four, six, seven and eight indicate that health professionals, professional bodies, patient groups and charitable organisations could help to influence the generation of research studies which in turn could be presented to commissioners to support funding of hydrotherapy services

9.5 Summary of the CAT and CoP Results

The CAT within this study generated a clinical bottom line that was disseminated to a community of practice in order to reduce the evidence to practice gap which is the overarching aim of knowledge mobilisation. A community of practice has been reported as a method to mobilise knowledge (Nilsen, 2015). The participants that were recruited for the CoP in this study included a broader spectrum of

professionals at a more organisational level to help reduce the evidence to practice gap for a complex intervention (Lau et al., 2016). The CAT group members at Keele University that generate the clinical questions are from similar professional or academic backgrounds with similar interests .The members, value and respect each other, are passionate about the subject area and have dedicated time to meet. CoP have been reported to: encourage engagement from a variety of stakeholders by facilitating knowledge exchange among practitioners, researchers, decision makers, and patient led communities (Le-May, 2009).

The CAT group at Keele is a CoP, although the recruited members may present a more clinical and academic bias. The CoP within this study had a broader spectrum of participants who were professionals at a more organisational level.

The results of this thesis have proposed that hydrotherapy is a complex intervention due to: the number of interacting components; the number and difficulty of behaviours required by those delivering or receiving the intervention; the number of groups or organisational levels targeted by the intervention; the number and variability of outcomes; and the degree of flexibility that the intervention permits (Craig et al., 2008). Professional and organisational context and political economic circumstances can also impact on the implementation of complex interventions (Bambra et al., 2010). Context has also been recognised as important in mobilising knowledge and implementing research findings at an organisational level within both the Knowledge to Action Process (Graham et al., 2006) and the PARiHS Framework (Rycroft Malone, 2004). Contexts have been reported as being dynamic, and that some contextual factors might provide barriers to implementation in one organisation, or promote implementation in

others (Lau et al., 2016). Johnson and May (2015) suggest that it is important to understand how some interventions fail to be integrated into clinical practice.

Lau et al (2016) produced a conceptual framework to indicate how to achieve successful implementation of complex interventions, where the barriers might already be within the context (setting) of the intervention that needed understanding, along with an awareness that the context in healthcare is dynamic and that an appropriate implementation strategy that incorporated all these features was required. This conceptual framework comprises of four components: the complexity of the intervention being mobilised; the professionals within the organisation; the context of the organisation; external contextual factors. Figure 9.1 uses this conceptual framework to identify visually how the themes generated from the CoP support this viewpoint (Lau et al., 2016).

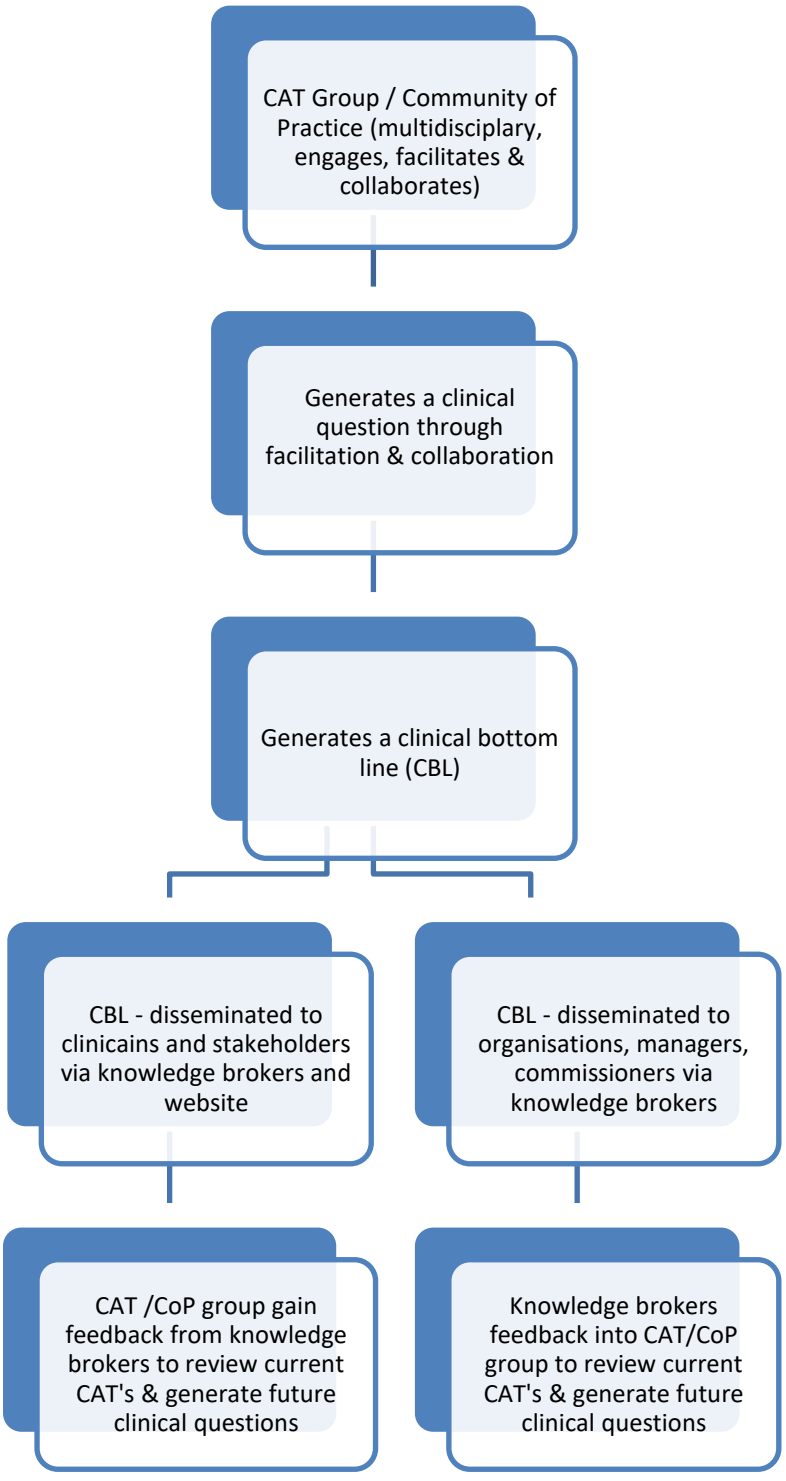
Figure 9.1: CoP generated themes related to conceptual framework

In summary context has been proposed as an area to be considered within complex organisational environments in order to influence knowledge mobilisation. This could be further exacerbated by the evidence to practice gap of a complex intervention such as hydrotherapy.

9.6 Added Value of CoP and CAT to Support Knowledge Mobilisation

The Figure 9.2 suggests how the CAT group, which has a similar structure and members characteristics, and an additional CoP (or CAT group) have the potential to work together to support knowledge mobilisation. The inclusion of knowledge brokers or facilitators moving between both groups, who possess the appropriate skill set, personality and terminology to effectively translate this knowledge within various professional and organisational environments would increase the effectiveness of this process (Ettelt et al., 2013).

Figure 9.2: Additional CAT/CoP to support knowledge mobilisation.



9.7 Strengths and limitations of the thesis

The aims of the thesis were achieved and the CAT process and the CoP both proved to be successful methods to share best research evidence to stakeholders to enable knowledge mobilisation.

A full systematic review was not completed in this thesis, which may indicate that all the available evidence was not reviewed, resulting in a lack of confidence in the results. Knowledge mobilisation is the interface between research and practice which has been reported to take nearly twenty years to get into practice (Blair, 2014). The aim of this study was to review the best available evidence using the rapid CAT process to answer a clinical question in order to generate a clinical bottom line to present to a clinical audience within a community of practice to help address this evidence to practice gap (Graham et al., 2006).

This thesis highlights the heterogeneity of the available research; complexity of hydrotherapy as an intervention; and the complexity of mobilising knowledge in complex organisational environments were strong themes throughout the analysis.

The literature review from this CAT process together with the CoP identified a qualitative gap in the type of questions that were been generated and the literature being reviewed. Indicating that recruitment of qualitative experts into the process might be appropriate. Additionally it has been identified that the structure of the CAT group at Keele University is similar to a community of practice and is therefore an appropriate forum for knowledge mobilisation.

As a new researcher reviewing the literature on knowledge mobilisation my understanding was hindered because of the different terminology that has been used for similar items by different authors. This lack of understanding, together with my lack of research experience and information technology skills may have contributed to my effective use of time that is inevitable with post graduate education. I feel my knowledge and skills have developed throughout the process and I will be able to transfer these to my present and future employment.

9.8 Implications for future research

This thesis raises several issues worthy of future research. It appeared that there were limited studies during the literature search that reviewed the cost effectiveness for hydrotherapy for either adults or paediatrics; return to work or school; or patient preferences. Indicating that economic evaluations of this type of intervention are rare (Fioravanti et al, 2017).

The heterogeneous nature of the interventions, heterogeneous outcome measures and short term follow up of the literature reviewed indicates that better methodological research with long term follow up might be indicated.

The potential to recruit a qualitative expert into the CAT group has been proposed to promote an additional perspective to ascertain any gaps there might be in qualitative research to answer clinical questions that are concerned with a patient's experiences or preferences (Holloway & Wheeler, 1996).

9.9 Clinical implications

At a time when the NHS is servicing a growing and ageing population, the UK government estimates the need for £22 billion in NHS savings by 2020/21 (H.M. Treasury, 2015). The participants proposed in the CoP that evidence supporting clinical interventions needs to be presented to commissioners, as they appear to be the most powerful voice in terms of providing hydrotherapy services. This thesis identified that hydrotherapy is a costly and complex service, it is not just a treatment between clinicians and patients. More qualitative or health service evaluation studies may include the relevant information that commissioners require so that they can make an informed decision with regard to its effectiveness. This requires knowledge to be mobilised to all stakeholders including commissioners of health services, effectively and in a timely manner. The CAT process and CoP that have been analysed in this thesis appear to be appropriate methods to use.

No adverse effects were reported in the literature with regard to hydrotherapy, which is important to patient adherence to treatment and self-management in these types of chronic conditions. This would suggest that with the limited amount of cost effective data, the benefits of aquatic exercise would support clinicians continued use of hydrotherapy to treat patients with these conditions. Hydrotherapy appears to provide an enabling alternative if land based exercises were proving difficult to complete. However, the number of interventions that have been included in the trials may not have generalisability due to limited pool or session availability.

9.10 Final conclusions

Context has been proposed as an area to be considered within complex organisational environments in order to influence knowledge mobilisation, which could be further exacerbated by a complex intervention such as hydrotherapy. This thesis proposes the potential to include an additional CAT group at an organisational level, which includes managers and commissioners. The recruitment of qualitative experts to the primary CAT group, might provide the mechanisms to promote additional perspectives on the methodologies that could be utilised to answer clinical questions for complex interventions, and the complex organisational environment that they need to be implemented within. This evidence based research would help to support the continued provision of this specialist treatment modality for patients with their ever increasing complex needs in a culture of financial constraints.

References

Adams, J.M. (2015*) Healing with Water: English Spas and the Water Cure, 1840-1960*. Manchester: Manchester University Press.

Akers, J.D., Estabrooks, P.A., Davy, B.M. (2010) Translational research: bridging the gap between long-term weight loss maintenance research and practice. *J Am Diet Assoc.* 110(1), 1511-1522.

Akobeng, A.K. (2005) Principles of evidence based medicine. *Archives of disease in childhood*. *90*(8), 837-840.

Alamanos, Y., Drosos, A.A. (2005) Epidemiology of adult rheumatoid arthritis. *Autoimmun Rev*. 4(1), 130-136.

Al-Qubaeissy, K.Y., Fatoye, F.A., Goodwin, P.C., Yohannes, A.M. (2013) The Effectiveness of Hydrotherapy in the Management of Rheumatoid Arthritis: A systematic Review. *Musculoskeletal Care.* 11(1), 3-18.

Arnold, C.M., Busch, A.J., Schachter, C.L., Harrison, E.L., Olszynski, W.P. (2008) A randomized clinical trial of aquatic versus land exercise to improve balance, function, and quality of life in older women with osteoporosis. *Physiotherapy Canada*. *60*(4), 296-306.

Arthritis and Musculoskeletal Alliance (2010) Standards of care for children and young people with Juvenile Idiopathic Arthritis. Available: www.arma.uk.net [Accessed: 15/04/2017]

Arthritis and Musculoskeletal Alliance (ARMA) (2017). About ARMA. Available: http://arma.uk.net/arma-posts/ [Accessed: 8/9/2017]

Arthritis Research UK (2017). How does hydrotherapy help? Available: https://www.arthritisresearchuk.org/arthritis-information/therapies/hydrotherapy/how-does-it-help.aspx [Accessed: 10/9/2017]

Arthritis Research UK (2017). Patient & Public Involvement – A researcher's guide. ARUK publications. Available: http://www.arthritisresearchuk.org/research/news-for-researchers/2017/july/patient-and-public-involvement_a-researchers-guide.aspx [Accessed: 12.5.2017]

Arthritis Research UK (2018). Rheumatoid Arthritis. Available: https://www.arthritisresearchuk.org/arthritis-information/conditions/rheumatoid-arthritis.aspx [Accessed: 01/03/2018]

Arthritis Research UK (2017). State of Musculoskeletal Health 2017-Arthritis & other musculoskeletal conditions in numbers. Available: https://www.arthritisresearchuk.org/arthritis-information/data-and-statistics/state-of-musculoskeletal-health.aspx [Accessed: 24/9/2017]

Baena-Beato, P.Á., Artero, E.G., Arroyo-Morales, M., Robles-Fuentes, A., Gatto-Cardia, M.C., Delgado-Fernández, M. (2014) Aquatic therapy improves pain, disability, quality of life, body composition and fitness in sedentary adults with chronic low back pain. A controlled clinical trial. *Clinical rehabilitation*. *28*(4), 350-360.

Bambra, C., Gibson, M., Sowden, A., Wright, K., Whitehead, M., Petticrew, M. (2010) Tackling the wider social determinants of health and health inequalities: evidence from systematic reviews. *J Epidemiol Community Health*. 64, 284-291.

Barker, A., Talevski, J., Morello, R., Rahmann, A., Urquhart, D. (2014) Effectiveness of Aquatic Exercise for Musculoskeletal Conditions: A Meta- Analysis. *American Congress of Rehabilitation Medicine.* 95, 1776-86.

Barone, D., Gandaway, J.M. (2015) Aquatic physical therapy for low back pain: what are the outcomes? *Journal of Aquatic Physical Therapy*. 15(2), 18-24.

Bar-Or, O. and Inbar, I. (1992) Swimming and asthma benefits and deleterious effects. *Sports Med*. 14, 397-405.

Bartels, E.M., Juhl, C.B., Christensen, R., Hagen, K.B., Danneskiold-Samsoe, B., Dagfinrud, H., Lund, H. (2016). Aquatic Exercise for the treatment of knee and hip osteoarthritis. *The Cochrane Collaboration (Review).* 3: 1-66.

Barton, S. (2000) Which clinical studies provide the best evidence? *British Medical Journal*. 321(7256), 255-256.

Basbaum, A., Fields, H.L. (1978) Endogenous pain control mechanisms: review and hypothesis. *Ann. Neurol*, 4, 451-62.

Basile, S. (2017) Juvenile Arthritis and exercise Therapy: Current Research and Future considerations. *J Child Dev Disord*. 3(2), 7.

Bates, A. and Hanson, N., (1996) *Aquatic Exercise Therapy*. Philadelphia: W.B. Saunders Company.

Batterham, S.I., Heywood, S., Keating, J.L. (2011) Systematic review & meta-analysis comparing land & aquatic exercise for people with hip or knee arthritis on function, mobility & other health outcomes. *BMC Musculoskeletal Disorders.* 12(123) 1-13.

Baysal, Ö., Durmuş, B., Ersoy, Y., Altay, Z., Şenel, K., Nas, K., Uğur, M., Kaya, A., Gür, A., Erdal, A. et al. (2011) Relationship between psychological status and disease activity and quality of life in ankylosing spondylitis. *Rheumatology international*. *31*(6), 795-800.

Begg, C., Cho, M., Eastwood, S., Horton, R., Moher, D., Olkin, I., Pitkin, R., Rennie, D., Schulz, K.F., Simel, D. et al. (1996) Improving the quality of reporting of randomised controlled trials. The CONSORT statement. *The Journal of the American Medical Association.* 276(8), 637-639.

Behrend. H.J., (1960). Foreword, In Hydrotherapy (F.G. Finnerty and T. Corbitt, eds), London: Ungar

Bellamy, N., Buchanan, W.W., Goldsmith, C.H., Campbell, J., Stitt, L.W. (1988) Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to anti-rheumatic drug therapy in patients with osteoarthritis of the hip or knee. *The Journal of Rheumatology*. *15*(12), 1833-1840.

Bellamy, N., Kirwan, J., Boers, M., Brooks, P., Strand, V., Tugwell, P. (1977) Recommendations for a core set of outcome measure for future phase III clinical trials in knee, hip and hand osteoarthritis. Consensus development at OMERACT III. *Journal of rheumatology*. 24(4), 799-802.

Belsey, J. (2002) Primary care workload in the management of chronic pain. A retrospective cohort study using a GP database to identify resource implications for UK primary care. *Journal of Medical Economics*. 5, 39-50.

Bender, T., Karaglle, Z., Balint, G.P., Gutenbrunner. C., Balint. P.V., Sukenik, S. (2005) Hydrotherapy, balneotherapy and spa treatment in pain management. *Rheumatol Int*. 25, 220-224.

Best, A. and Holmes, B. (2010) Systems thinking, knowledge and action: Towards better models and methods. *Evidence & Policy*. 6(2), 145-159.

Bijlsma, J.W., Berenbaum, F., Lafeber, F.P. (2011) Osteoarthritis: an update with relevance for clinical practice. *The Lancet*. *377*(9783), 2115-2126.

Bijur, P.E., Silver, W., Gallagher, E.J. (2001) Reliability of the visual analogue scale for measurement of acute pain. *Acad Emerg Med*, 8, 1153-1157

Bilberg, A., Ahlmen, M., Mannerkorpi, K. (2005) Moderately intensive exercise in a temperate pool for patients with rheumatoid arthritis: a randomized controlled study. *Rheumatology*. *44*(4), 502-508.

Blair, M. (2014) Getting evidence into practice; implementation science for paediatricians. *Archives of Disease in Childhood*. 99, 307-309.

Blobaum, P. (2006) Physiotherapy evidence database (PEDro). *Journal of the Medical Library Association*. *94*(4), 477.

Bongartz, T., Nannini, C., Medina-Velasquez, Y.F., Achenbach, S.J., Crowson, C.S., Ryu, J.H., Vassallo, R., Gabriel, S.E., Matteson, E.L. (2010) Incidence and mortality of interstitial lung disease in rheumatoid arthritis: A population-based study. *Arthritis & Rheumatology*. *62*(6), 1583-1591.

Boonen, A., Chorus, A., Miedema, H., van der Heijde, D., Landewe, R., Schouten, H., van der Tempel, H. van der Linden, S. (2001) Withdrawal from labour force due to work disability in patients with ankylosing spondylitis. *Annals of the Rheumatic Diseases*. *60*(11), 1033-1039.

Boonstra, A. M., Schiphorst-Preupe, H. R., Renerman, M. F., Posthumus, J. B., Stewart, R. E. (2008) Reliability and validity of the visual analogue scale for disability in patients with chronic musculoskeletal pain. *Int J Rehabil Res*. 31, 165-69.

Borsay, P. (2000) *The Image of Georgian Bath, 1700-2000: Towns, Heritage and History*. Oxford: Oxford University Press.

Bourgeault, I., Dingwall, R., De Vries, R. (2010) *The SAGE Handbook of Qualitative Methods in Health Research*. London: Sage Publications Limited.

Bowling, A. (2014) *Research methods in health: investigating health and health services*. England: McGraw-Hill Education.

Braun, J. and Sieper, J. (2007) Ankylosing spondylitis. *The Lancet*. *369*(9570), 1379-1390.

Brazier, J.E., Harper, R., Munro, J., Walters, S.J., Snaith, M.L. (1999). Generic and condition-specific outcome measures for people with osteoarthritis of the knee. *Rheumatology*. *38*(9), 870-877

Brewer, J. (2000) *Ethnography*. United Kingdom: McGraw-Hill Education.

Bromberg, M.H., Connelly, M., Anthony, K.K., Gil, K.M., Schanberg, L.E. (2014). Self-Reported Pain and Disease Symptoms Persist in Juvenile Idiopathic Arthritis Despite Treatment Advances: An Electronic Diary Study. *Arthritis & Rheumatology*. *66*(2), 462-469.

Brooks, P.M. (2006) The burden of musculoskeletal disease: a global perspective. *Clinical rheumatology*. *25*(6), 778-781.

Brown, C. (2012) The policy preferences model: A new perspective on how researchers can facilitate the take up of evidence by educational policy makers. *Evidence & Policy*. 8(4), 455-472.

Calin, A., Garrett, S., Whitelock, H., Kennedy, L.G., O'Hea, J., Mallorie, P., Jenkinson, T. (1994) A new approach to defining functional ability in ankylosing spondylitis: the development of the Bath Ankylosing Spondylitis Functional Index. *J. Rheumatol*. 21(12), 2281-5.

Cameron, M.H. (2013). *Physical Agents in Rehabilitation: from Research to Practice.* 4th Edition. St.Louis, Missouri: Elsevier/Saunders.

Cassidy, J.T. and Petty, R.E. (2005).*Textbook of Paediatric Rheumatology (5th ed).* Saunders: Philadelphia

Cavallo, S., Brosseau, L., Toupin-April, K., Wells, G.A., Smith, C.A., Pugh, A.G., Stinson, J., Thomas, R., Ahmed, S., Duffy, C.M., Rahman, P. (2017) Ottawa Panel evidence-based clinical practice guidelines for structured physical activity in the management of juvenile idiopathic arthritis. *Archives of physical medicine and rehabilitation*. *98*(5), 1018-1041.

Centre for Reviews and Dissemination (2009) *Systematic Reviews, CRD's guidance for undertaking reviews in health care*. University of York: York Publishing. Available: https://www.york.ac.uk/crd/guidance/ [Accessed: 23/8/2017]

Chalmers, I. and Glasziou, P. (2009) Avoidable waste in the production and reporting of research evidence. *The Lancet.* 383, 86-89.

Chan. Z.C.Y., Fung. Y., Chien. W. (2013) Bracketing in Phenomenology: Only Undertaken in the Data Collection and Analysis Process. *The Qualitative Report*. 18(59), 1-9.

Chandler. L. and Fry. A. (2009) Can communities of practice make a meaningful contribution to sustainable improvement in health care and social care? *Journal of Integrated Care.* 17(2), 41-48.

Chartered Institute for Professional Development (2014). Absence management. Annual survey report. London: Chartered Society of Physiotherapy.

Chartered Society of Physiotherapy (2012). *Quality Assurance Standards for Physiotherapy Delivery – Summary Document*. London. Available: www.csp.org.uk /standards

Chartered Society of Physiotherapy (2015). *Aquatic Therapy Association of Chartered Physiotherapists (ATACP) - Guidance on Good Practice in Aquatic Physiotherapy*. London. Chartered Society of Physiotherapy.

Chartered Society of Physiotherapy (2017). About ATACP. Available: http://atacp.csp.org.uk/about-atacp

Chartered Society of Physiotherapy (2017). Research Priorities. Available: http://www.csp.org.uk/professional-union/research/priorities [Accessed 24/7/2017]

Chesney, M. (2001) Dilemmas of Self in the Method. *Qualitative Health Research*. 11(1), 127-135.

Chronicle Live (2016). Alan Shearer opens new hydrotherapy suite at his centre for disabled people. Available: http://www.chroniclelive.co.uk/news/north-east-news/alan-shearer-opens-new-hydrotherapy-11940376 [Accessed: 10/4/2017]

Cider, A., Svealv, B.G., Tang, M.S., Schaufelberger, M., Andersson, B. (2006) Immersion in warm water induces improvement in cardiac function in patients with chronic heart failure. *Eur J Heart Fail*. 8(3), 308-13.

Cochrane Library (2017). Available: http://onlinelibrary.wiley.com/cochranelibrary/search/ Accessed 11th September 2017

Cochrane Library (2018) Cochrane Central Register of Controlled Trials: Issue 3 of 12, March 2018. Available: http://cochranelibrary-wiley.com/cochranelibrary/search/. [Accessed: 18/04/2018]

Cochrane, T., Davey, R.C. Edwards, S.M.M. (2005) Randomised controlled trial of the cost-effectiveness of water-based therapy for lower limb osteoarthritis. *Health Technol Assess*, 9(31).

Colaizzi, P.F. (1978) *Psychological research as the phenomenologist views it*. Existential Phenomenological Alternatives for Psychology. New York: Oxford University Press.

Cole, A.J. and Becker, B.E. (2004) *Comprehensive Aquatic Therapy.* 2nd Edition. Philadelphia: Butterworth Heinemann.

Collins English Dictionary (2017). Definition of 'hydrotherapy'. Available: https://www.collinsdictionary.com/dictionary/english/hydrotherapy [Accessed: 29/8/2017]

Conklin, J., Lusk, E., Harris, M. Stolee, P. (2013) Knowledge brokers in a knowledge network: the case of Seniors Health Research Transfer Network knowledge brokers. *Implementation Science*. *8*(1), 7-8.

Cossic, A. and Galliou, P. (2006) *Spas in Britain and France in the Eighteenth and Nineteenth Centuries*. Newcastle: Cambridge Scholars Press.

Cowan. S.M., Blackburn, M.S., McMahon, K., Bennell, K.L. (2010) Current Australian physiotherapy management of hip osteoarthritis. Physiotherapy. 98, 289-295.

Coyne. I.T. (1997) Sampling in qualitative research: Purposeful and theoretical sampling: merging or clear boundaries. *Journal of Advanced Nursing*. 26, 623-630.

Crabb. S. and Chur-Hansen. A. (2009) Qualitative research: why psychiatrists are well placed to contribute to the literature. *Australasian Psychiatry*. 17, 398-401.

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., Petticrew, M. (2008) Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ*. 337, a1655.

Crebbin-Bailey, J., Harcup, J., Harrington (2005) *The Spa Book:The Official Guide to Spa Therapy. Cengage Learning EMEA.*

Critical Appraisal Skills Programme (2016). Available: http://www.casp-uk.net/ [Accessed: 23/11/2015 and 24/6/2017]

Crowe, M., Sheppard, L., Campbell, A. (2012) Reliability analysis for a proposed critical appraisal tool demonstrated value for diverse research designs. *Journal of clinical epidemiology*. *65*(4), 375-383.

CSMI - (2018) - HUMAC NORM. Available: http://www.csmisolutions.com/products/isokinetic-extremity-systems/humac-norm. [Accessed: 18/02/2018]

Currie, G. and Suhomlinova, O. (2006) The impact of institutional forces upon knowledge sharing in the UK NHS: the triumph of professional power and the inconsistency of policy. *Public Administration*. 84, 1–30.

Dagfinrud, H., Birger, K., Kvien, T.K. (2008) Physiotherapy interventions for ankylosing spondylitis. Cochrane Database of Systematic Reviews.

Dagfinrud, H., Christie, A. (2007) Patients with rheumatoid arthritis feel better after exercises in warm water than after similar exercises on land. *Australian Journal of Physiotherapy.* 53: 130-131

Dartford & Gravesham NHS Trust (2017). Hydrotherapy. Available: http://www.dvh.nhs.uk/our-services-specialists/a-to-z-of-services/therapies/physiotherapy/hydrotherapy/ [Accessed: 21/9/2017]

Davies, H., Nutley, S., Walter, I. (2008) Why 'knowledge transfer' is misconceived for applied social research. *Journal of Health Services Research & Policy*. 13, 188-190.

Davies, H.T.O., Powell, A.E., Nutley, S.M. (2015) Mobilising Knowledge to improve UK health care: learning from other countries and other sectors – a multimethod mapping study. *Heath Services & Delivery Research*. 3(27).

Davies, K.S. (2011) Formulating the Evidence Based Practice Question: A Review of the Frameworks. *Evidence Based Library and Information Practice*. 6 (2), 75-80.

Davis, B.C. and Harrison, R.A. (1988) *Hydrotherapy in Practice*. Singapore: Churchill Livingstone.

Denscombe, M. (2008) Communities of Practice: A research paradigm for the mixed methods approach. *Journals of Mixed Methods Research*. 2(3), 270-283.

Department for Children, Schools and Families (2014). Designing for disabled children and children with special educational needs. London: Education and Funding Agency. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/276698/Building_Bulletin_102_designing_for_disabled_children_and_children_with_SEN.pdf

Department of Health, 2012. The Operating Framework for the NHS in England. London: Department of Health.

Dickens, C., McGowan, L., Clark-Carter, D., Creed, F. (2002) Depression in rheumatoid arthritis: a systematic review of the literature with meta-analysis. *Psychosomatic Medicine*. 64(1), 52-60.

Dionne, C.E., Dunn, K.M., Croft, P.R., Nachemson, A.L., Buchbinder, R., Walker, B.F., Wyatt, M., Cassidy, J.D., Rossignol, M., Leboeuf-Yde, C., Hartvigsen, J. (2008) A consensus approach toward the standardization of back pain definitions for use in prevalence studies. *Spine*. *33*(1), 95-103.

Downs, S.H., Black, N. (2008) The feasibility of creating a checklist for the assessment of the methodological quality of both randomised and non-randomised studies of health care interventions. *J Epidemiol Community Health.* 52,377-384

Dube, L., Bourhis, A., Jacob, R. (2005) The impact of structuring characteristics on the launching of virtual communities of practice. *Journal of Organisational Change Management.* 18(2), 145-166.

Duffy, C.M., Arsenault, L., Duffy, K.N., Paquin, J.D., Strawczynski, H. (1997) The Juvenile Arthritis Quality of Life Questionnaire--development of a new responsive index for juvenile rheumatoid arthritis and juvenile spondyloarthritides. *The Journal of Rheumatology*. *24*(4), 738-746.

Dundar, U., Solak, O., Toktas, H., Demirdal, U.S., Subasi, V., Kavuncu, V., Evcik, D. (2014) Effect of aquatic exercise on ankylosing spondylitis: a randomized controlled trial. *Rheumatol Int.* 34, 1505-1511.

Dundar, U., Solak, O., Yigit, I., Evcik, D., Kavuncu, V. (2009) Clinical effectiveness of Aquatic Exercise to Treat Chronic Low Back Pain: A Randomised Control Trial. *Spine.* 34(14), 1436-1440.

Dziedzic, K., Jordan, J.L., Foster, N.E. (2008) Land- and water-based exercise therapies for musculoskeletal conditions. *Best Practice & Research.* 22(3), 407-418.

Dziedzic, K., Thomas, E., Hill, S., Wilkie, R., Peat, G., Croft, P.R. (2007) The impact of musculoskeletal hand problems in older adults: findings from the North Staffordshire Osteoarthritis Project (NorStOP). *Rheumatology.* 46(6), 963–967.

Elkayam, O., Wigler, I., Tishler, M., Rosenblum, I., Caspi, D., Segal, R., Fishel, B. Yaron, M. (1991) Effect of spa therapy in Tiberias on patients with rheumatoid arthritis and osteoarthritis. *The Journal of rheumatology*. *18*(12), 1799-1803.

Ellen, M.E., Leon, G., Bouchard, G., Lavis, J.N., Ouimet, M., Grimshaw, J.M. (2013) What supports do health organisations have in place to facilitate evidence-informed decision-making? A qualitative study. *Implementation Science*. 8,84.

Elnaggar, R.K. and Elshafey, M.A. (2016) Effects of Combined Resistive Underwater Exercises and Interferential Current Therapy in Patients with Juvenile Idiopathic Arthritis. *Am. J. Phys. Med. Rehabil*. 95(2), 96-102.

Encycolpaedia Britannica. (2017) *John Harvey Kellogg.* Available: https://www.britannica.com/biography/John-Harvey-Kellogg [Accessed: 23/9/2017]

Epps, H., Ginnelly, L., Utle,y M., Southwood, T., Gallivan, S., Sculpher, M., Woo, P. (2005). Is hydrotherapy cost-effective? A randomised controlled trial of combined hydrotherapy programmes compared with physiotherapy land techniques in children with juvenile idiopathic arthritis. *Health Technol Assess*. 9, 39.

Equality Challenge Unit. (2013). *Unconscious bias and higher education.* Available: https://www.ecu.ac.uk/wp-content/uploads/2014/07/unconscious-bias-and-higher-education.pdf [Accessed 10/9/2017]

Eyler, A.A. (2003) Correlates of physical activity: Who's active and who's not*? Arthritis Care Res*. 49, 136-40.

Escalante, A., Haas, R.W., del-Rincon, I. (2004) Measurement of global functional performance in patients with rheumatoid arthritis using rheumatology function tests. *Arthritis Res Ther*. 6(4), 315-325.

Escalante, Y., Saavedra, J.M., Garcia-Hermosa, A., Silva, A.J., Barbosa, T.M. (2010) Physical exercise and reduction of pain in adults with lower limb osteoarthritis: A systematic review. *Journal of Back and Musculoskeletal Rehabilitation*. 23,175-186.

Ettelt, S., Mays, N., Nolte, E. (2013) Policy research linkage: what have we learned from providing a rapid response facility for international healthcare comparisons to the Department of Health in England? *Evidence & Policy*. 9(2), 245-254.

European Science Foundation 92011) Strasbourg. Forward Look: Implementation of Medical Research in Clinical Practice .www.esf.org [Accessed: 23/2/2017]

Eversden. L., Maggs. F., Nightingale. P., Jobanputra. P. (2007) A pragmatic randomised controlled trial of hydrotherapy and land exercises on overall wellbeing and quality of life in rheumatoid arthritis. *BMC Musculoskeletal Disorders*. 8:23.

Ferlie, E., Crilly, T., Jashapara, A., Peckham, A. (2012) Knowledge mobilisation in healthcare: A critical review of health sector and generic management literature. *Social Science & Medicine*. 74, 1297-1304.

Ferlie. E., Montgomery. K., Reff-Pedersen. A. (2016). *The Oxford Handbook of Healthcare Management*. Oxford: Oxford University Press.

Field, B., Booth, A., Ilott, I., Gerrish, K. (2014) Using the Knowledge to Action Framework in practice: a citation analysis and systematic review. *Implementation Science.* 9,172.

Finch, C.F. (2012) *Implementing and evaluating interventions. In Injury Research.* Boston: Springer.

Fioravanti, A., Karagulle, M., Bender, T., Karagulle, M.Z. (2017) Balneotherapy in osteoarthritis: facts, fiction and gaps in knowledge. *European journal of integrative medicine*. 9, 148-150.

Flather, M., Delahunty, N., Collinson, J. (2006) Generalising results of randomised trials to clinical practice: reliability and cautions. *Clinical Trials.* 3, 508-512.

Foley, A., Halbert, J., Hewitt, T., Crotty, M. (2003) Does hydrotherapy improve strength and physical function in patients with osteoarthritis – a randomised controlled trial comparing a gym based and a hydrotherapy based strengthening programme. *Annals of the Rheumatic Diseases*. 62(12), 1162-1167

Foster, N., Barlas, P., Chesterton, L., Wong, J. (2001) Critically Appraised Topics (CAT's). *Physiotherapy*. 87(4), 179-190.

Fransen, M., Nairn, L., Winstanley. J., Lam, P., Edmonds, J. (2007) Physical activity for osteoarthritis management: A randomised controlled trial evaluating hydrotherapy or Tai Chi classes. Arthritis Care & Research. 57(3), 407-414.

Fritz, J.M. and Irrgang, J.J. (2001) A comparison of a modified Oswestry Low Back Pain Disability Questionnaire and the Quebeck Back Pain Disability Scale. *Phys Ther,* 81, 776 – 788.

Gaglio, B., Shoup, J., Glasgow, R.E. (2013) The RE-AIM framework: a systematic review of use over time. *Am J Public Health*. 103, 38-46.

Garrett, S., Jenkinson, T., Kennedy, L.G., Whitelock, H., Gaisford, P., Calin, A. (1994) A new approach to defining disease status in ankylosing spondylitis: the Bath Ankylosing Spondylitis Disease Activity Index. *J. Rheumatol*. 21(12), 2286-2291.

Glaser, B.G. and Strauss, A. (1967) The Discovery of Grounded Theory: Strategies for Qualitative Research. Chicago: Aldine.

Glasgow, R.E., Vogt, T.M., Boles, S.M. (1999) Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *Am J Public Health*. 89, 1322-1327.

Glasziou, P. and Haynes, B. (2005). The paths from research to improved health outcomes. *Evidence-Based Medicine*. 10(1), 4-7.

Graham, I. D., Logan. J., Harrison, M.B., Straus, S.E., Tetroe, J., Caswell, W., Robinson, N. (2006) Lost in knowledge translation: Time for a map. *Journal of Continuing Education in the Health Professions.* 26(1), 13–24.

Greenhalgh, T. (1997) Papers that summarise other papers (systematic reviews and meta-analyses). *BMJ. 315* (7109), 672.

Greenhalgh, T. (2006). *How to Read a Paper*. Oxford: Blackwell Publishing.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., Kyriakidou, O. (2004) Diffusion of innovations in service organisations: Systematic review and recommendations. *The Milbank Quarterly*. 82(4), 581-629.

Grol, R. and Grimshaw, J. (2003) From best evidence to best practice: effective implementation of change in patients care. *The Lancet.* 362(9391), 1225-1230.

Guardian (2013). Hydrotherapy pool closures leave NHS patients high and dry. Available: https://www.theguardian.com/society/2013/jan/22/hydrotherapy-pool-closures-nhs-cuts [Accessed: 10/7/2017]

Guba, E. and Lincoln, Y. (1989) *Fourth Generation Evaluation.* California: Sage.

Guest, G., Bunce, A., Johnson, L. (2006) How many interviews are enough? An experiment with data saturation and variability. *Field Methods*. 18(1), 59-82.

Hagman-Laitila. A. (1999) The authenticity and ethics of phenomenological research: How to overcome the researchers own views. *Nursing Ethics*. 6(1), 12-22.

Halcomb, E.J. and Davidson, P.M. (2006) Is verbatim transcription of interview data always necessary? *Applied Nursing Research*. 19(1), 38-42.

Hall, J., Grant, J., Blake, D., Taylor, G., Garbutt, G. (2004) Cardiorespiratory responses to aquatic treadmill walking in patients with rheumatoid arthritis. *Physiotherapy Research International*. *9*(2), 59-73.

Hall, J., Swinkels, A., Briddon, J., McCabe, C.S. (2008) Does aquatic exercise relieve pain in adults with neurologic or musculoskeletal disease? A systematic review and meta-analysis of randomised controlled trials. *Arch Phys Med Rehabil*. 89, 873-883.

Hall, J., Biisson, D., O'Hare, P. (1990) The Physiology of Immersion. *Physiotherapy.* 76(9), 517-521.

Hansen, M.T., Nohria, N., Tierney, T. (1999) What's Your Strategy for Managing Knowledge? *Harvard Business Review*. 77(2), 106-117.

Harris. R. (1963). *Therapeutic Pools. In Medical Hydrology*. New Haven: Elizabeth Licht Publisher.

Harrison, R.A. and Bulstrode. S. (1987) Percentage weight bearing during partial immersion in the hydrotherapy pool. *Physiotherapy Practice.* 3(2), 60-63.

Hartling, L., Ospina, M., Liang, Y., Dryden, D.M., Hooton, N., Seida, J.K., Klassen, T.P. (2009) Risk of bias versus quality assessment of randomised controlled trials: cross sectional study. *BMJ. 339*, p.b4012.

Harvey, G. and Kitson, A. (2016) PARIHS revisited: from heuristic to integrated framework for the successful implementation of knowledge into practice. *Implementation Science.* 11, 33.

Health and Care Professions Council. (2013) Standards of Proficiency: Physiotherapists. London. Available: http://www.hpc-uk.org

Hemingway, H., Stafford, M., Stansfeld, S., Shipley, M., Marmot, M. (1997) Is the SF-36 a valid measure of change in population health? Results from the Whitehall II study. *Bmj*, *315*(7118), 1273-1279.

Herbert, R.D. and Bo, K. (2005) Analysis of quality of interventions in systematic reviews. *BMJ*. 331(7515), 507-509.

Hertler, L., Provost-Craig, M., Sestili, D., Hove, A. and Fees, M. (1992). Water running and the maintenance of maximum oxygen consumption and leg strength in runners. *Medicine & Science in Sports & Exercise*. *24*(5), p23.

Higgins, J.P., Altman, D.G., Gøtzsche, P.C., Jüni, P., Moher, D., Oxman, A.D., Savović, J., Schulz, K.F., Weeks, L., Sterne, J.A. (2011) The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *Bmj*, *343*, 5928.

Higgins, J.P. and Green, S. (2005) *Cochrane handbook for systematic reviews of interventions - Cochrane Book Series.* England: John Wiley & Sons Ltd.

HM Treasury. Spending review and autumn statement (2015). Norwich: Available: https://www.gov.uk/government/publications/spending-review-and-autumnstatement-2015-documents

Holloway, I. and Wheeler, S. (1996) *Qualitative Research for Nurses*. Oxford: Blackwell Science.

Honey, P. and Mumford, A. (1986) *The Manual of Learning Styles.* 2nd Edition*.* Berkshire: Peter Honey Publications.

Hughes. J.A. (1990) *The Philosophy of Social Research*. 2nd Edition. London: Longman.

Jadad, A.R. (1998) *Randomised Controlled Trials*. BMJ books. London: Blackwell Publishing.

Jiwa. M., Deas. K., Ross. J., Shaw. T., Wilcox. H., Spilsbury. K. (2009) An inclusive approach to raising standards in general practice. Working with a community of practice in Western Australia. *BMC Medical Research Methodology*. 9(1), 1-13.

Johnson. R.H. (1990) Arthur Stanley Wohlmann: the first government balneologist in New Zealand. *Medical History Supplement*. 10, 114-126.

Jooten, D. McGhee, G. Marland, G. (2009). Reflexivity: promoting rigour in qualitative research. *Nursing Standard.* 23(23), 42-46.

Jordon, K.P., Kadam, U.T., Hayward, R., Porcheret, M., Young, C., Croft, P. (2010) Annual consultation prevalence of regional musculoskeletal problems in primary care: an observational study. *BMC Musculoskeletal Disorders*. 11(1), 144.

Katrak, P., Bialocerkowski, A.E., Massy-Westropp, N., Kumar, V.S., Grimmer, K.A. (2004) A systematic review of the content of critical appraisal tools. *BMC medical research methodology*. *4*(1), 22.

Katz, V.L., McMurray, R., Berry, M.J., Cefalo, R.C. and Bowman, C. (1990) Renal responses to immersion and exercise in pregnancy. *American journal of perinatology*. *7*(02),118-121.

Keele University (2017) Patient Public Involvement Engagement (PPIE). Available: https://www.keele.ac.uk/ppie/ [Accessed: 8/9/2017]

Kellogg J.H. (1901) *Rational Hydrotherapy*. Philadelphia: F.A. Davis Company.

Kelly, S.E., Moher, D., Clifford, T.J. (2016). Quality of conduct and reporting in rapid review: an exploration of compliance with PRISMA and AMSTAR guidelines. Systematic Reviews. 5:79

Kenney. E.and Ostenso, M. (1943) *And they shall walk*. New York: Dodd Mead & Company.

Kerno, S.J. (2008) Limitations of communities of practice: A consideration of unresolved issues and difficulties in the approach. *Journal of Leadership & Organisational Studies*. 15(1), 69.

Kerr. C. (2010). Assessing and demonstrating data saturation in qualitative inquire supporting patient-reported outcomes research. *Expert Review of Pharmaco-Economics & Outcomes Research*. 10(3), 269-281.

Kesen, M.R., Setlur, V., Goldstein, D.A. (2008) Juvenile idiopathic arthritis-related uveitis. *International ophthalmology clinics*. *48*(3), 21-38.

Kietzmann, J., Plangger, K., Eaton, B., Heilgenberg, K., Pitt, L., Berthon, P. (2013) Mobility at work: a typology of mobile communities of practice and contextual ambidexterity. *Journal of Strategic Information Systems.* 3(4), 282-297.

King's College Hospital NHS Foundation Trust (2016) Refurbished hydrotherapy pool reopens at Orpington Hospital. Available: https://www.kch.nhs.uk/news/media/press-releases/view/21862 [Accessed:10/7/2017]

Kisely, S. and Kendall, E. (2011) Critically appraising qualitative research: a guide for clinicians more familiar with quantitative techniques. *Australasian Psychiatry*. 19,4.

Kislov, R., Waterman, H., Harvey, G., Boaden, R. (2014) Rethinking capacity building for knowledge mobilisation: developing multilevel capabilities in healthcare organisations. *Implementation Science.* , 9:166.

Kitson, A., Harvey, G., McCormack, B. (1998) Enabling the implementation of evidence based practice: a conceptual framework. *Qual Health Care.* 7(3), 149-158.

Kitson, A.L., Rycroft-Malone, J., Harvey, G., McCormack, B., Seers, K., Titchen, A. (2008) Evaluating the successful implementation of evidence into practice using the PARiHS framework: theoretical and practical challenges. *Implementation Science*. 3:1.

Klepper, S.E. (2003) Measures of Paediatric Function. *Arthritis & Rheumatism (Arthritis Care & Research)*. 49(5), 5 -14.

Koch, T. (1994). Establish rigour in qualitative research: the decision trail. *Journal of Advanced Nursing.* 19, 976-986.

Koussa. N. (2017). Enabling change through communities of practice: Wellbeing Our Way. National Voices. Available: https://www.nationalvoices.org.uk/sites/ [Accessed: 17/07/2017]

Krueger, R.A. and Casey, M.A. (2015) *Focus Groups: A Practical Guide for Applied Research.* 5th Edition. London: Sage Publications.

Kunde, L. (2014) Evidence Summary: Back (Low) and Pelvic Pain (Pregnancy related): Prevention and treatment. *The Joanna Briggs Institute*. *Article review*

Kuntze, G., Nesbitt, C., Whittaker, J.L., Nettel-Aguirre, A., Toomey, C., Esau, S., Doyle-Baker, P.K., Shank, J., Brooks, J., Benseler, S., Emery, C.A. (2018) Exercise Therapy in Juvenile Idiopathic Arthritis: A Systematic Review and Meta-Analysis. *Archives of Physical Medcine and Rehabilitation*. 99: 178-93.

Lam, C., Young, N., Marwaha, J., McLimont, M., Feldman, B.M. (2004) Revised versions of the Childhood Health Assessment Questionnaire (CHAQ) are more sensitive and suffer less from a ceiling effect. *Arthritis Rheum*. 51(6), 881-889.

Lane, P.J., Salk, J.E., Lyles, M.A. (2001) Absorptive capacity, learning, and performance in international joint ventures. *Strategic Management Journal*. 22, 1139–1161.

Langham, M. and Wells, C. (1997) *A History of the Baths at Buxton*: Leek: Churnet Valley Books.

Larmer, P.J., Bell, J., O'Brien, D., Dangen, J., Kerston, P. (2014) Hydrotherapy outcome measures for people with arthritis: A systematic review. *New Zealand Journal of Physiotherapy*. 42(2),54-67,

Lau, R., Stevenson, F., Nio-Ong, B., Dziedzic, K., Treweek, S., Eldridge, S., Eldridge, S., Everitt, H., Kennedy, A., Kontopantelis, E. et al. (2015) Achieving change in primary care - effectiveness of strategies for improving implementation of complex interventions: a systematic review of reviews. *BMJ Open*. *5*(12), p.e009993.

Lau, R., Stevenson, F., Nio-Ong, B., Dziedzic, K., Treweek, S., Eldridge, S., Everitt, H., Kennedy, A., Qureshi, N., Rogers, A. et al. (2016) Achieving change in primary care – causes of the evidence to practice gap: systematic review of reviews. *Implementation Science*. 11:40.

Lavis, J.N., Robertson, D., Woodside, J.M., McLeod, C.B., Abelson, J. (2003) How can research organisations more effectively transfer research knowledge to decision makers? *The Milbank Quarterly*. 81(2), 221-248.

Le-May, A. (2009) *Introducing communities of practice*. Oxford: Blackwell Publishing.

Le-Quesne, R. M. and Granville, M. (1936) *Hydrotherapy – A textbook for students*. London: Cassell Company Ltd.

Lehman, J.F, and DeLateur, B.J. (1982) *Therapeutic Health and Cold*. Baltimore: Williams and Wilkins.

Lesser, E.L. and Storck, J. (2001) Communities of Practice and organisational practice. *IBM systems Journal.* 40(4), 831-841.

LeVasseur. J. (2003). The problem of Bracketing in Phenomenology. *Qualitative Health Research.* 13 (3), 408-420.

Lien, G., Flatø, B., Haugen, M., Vinje, O., Sørskaar, D., Dale, K., Johnston, V., Egeland, T., Førre, Ø. (2003) Frequency of osteopenia in adolescents with early-onset juvenile idiopathic arthritis: A long-term outcome study of one hundred five patients. *Arthritis & Rheumatology. 48*(8), 2214-2223.

Lim, J.Y., Tchai, E., Jang, S.N. (2010) Effectiveness of aquatic exercise for obese patients with knee osteoarthritis: a randomized controlled trial. *PM&R*. *2*(8), 723-731.

López-Mejías, R., Castañeda, S., González-Juanatey, C., Corrales, A., Ferraz-Amaro, I., Genre, F., Remuzgo-Martínez, S., Rodriguez-Rodriguez, L., Blanco, R., Llorca, J., Martín, J. (2016) Cardiovascular risk assessment in patients with rheumatoid arthritis: The

relevance of clinical, genetic and serological markers. *Autoimmunity Reviews 15*(11), 1013-1030.

Lovell, D.J., Shear, E., Hartner, S., McGirr, G., Schulte, M., Levinson, J., Howe, S. (1989) Development of a disability measurement tool for juvenile rheumatoid arthritis. The Juvenile Arthritis Functional Assessment Scale. *Arthritis & Rheumatology*. *32*(11), 1390-1395.

Lund, H., Weile, U., Christensen, R., Rostock, B., Downey, A., Bartels, E.M., Danneskiold-Samsøe, B., Bliddal, H. (2008) A randomized controlled trial of aquatic and land-based exercise in patients with knee osteoarthritis. *Journal of Rehabilitation Medicine*. *40*(2), 137-144.

Maher, C.G., Sherrington, C., Herbert, R.D., Moseley, A.M., Elkins, M. (2003) Reliability of the PEDro scale for rating quality of randomized controlled trials. *Physical therapy*. *83*(8),713-721.

Maltby. J., Williams. G., McGarry. J., Day. L. (2010) Research Methods for Nursing and Healthcare. Essex: Pearson Education Limited.

Maslow, A.H. (1943) A Theory of Human Motivation. *Pyschological Review.* 50(4), 370-96.

May, C.R., Johnson, M., Finch, T. (2016) Implementation, context and complexity. *Implementation Science*. 11: 141.

May, C.R., Mair, F., Finch, T., MacFarlane, A., Dowrick, C., Treweek, S., Rapley, T., Ballini, L., Ong, B.N., Rogers, A et al. (2009) Development of a theory of implementation and integration: Normalisation Process Theory. *Implementation Science*. , 4, 29.

McAlindon, T.E., Bannuru, R., Sullivan, M.C., Arden, N.K., Berenbaum, F., Bierma-Zeinstra, S.M., Hawker, G.A., Henrotin, Y., Hunter, D., Jet al. (2014) OARSI guidelines for the non-surgical management of knee osteoarthritis. *Osteoarthritis and cartilage*. *22*(3), 363-388.

McCarthy, C.J., Arnall, F.A., Strimpakos, N., Freemont, A. and Oldham, J.A. (2004). The biopsychosocial classification of non-specific low back pain: a systematic review. *Physical Therapy Reviews*. *9*(1), 17-30.

McEvoy, R., Ballini, L., Maltoni, S., O'Donnell, C.A., Mair, F.S., MacFarlane, A. (2014) A qualitative systematic review of studies using normalisation process theory to research implementation processes. *Implementation Science*. 9, 2.

McMaster University, Canada. Evidence Based Clinical Practice. Available: http://ebm.mcmaster.ca/about_background.htm [Accessed: 15/9/2017]

McVeigh, J.G., McGaughey, H., Hall, M., Kane, P. (2008). The effectiveness of hydrotherapy in the management of fibromyalgia syndrome: a systematic review. *Rheumatology international*. *29*(2), 119.

Melzack, R.and Wall, P.D. (1965) Pain mechanisms: A new theory. *Science*. 150, 971.

Metsios, G.S., Stavropoulos-Kalinoglou, A., Veldhuijzen van Zanten, J.J.C.S., Treharne, G.J., Panoulas, V.F., Douglas, K.M., Koutedakis, Y., Kitas, G.D. (2007) Rheumatoid arthritis, cardiovascular disease and physical exercise: a systematic review. *Rheumatology*. *47*(3), 239-248.

Michaud, T.J., Brennan, D.K., Wilder, R.P. and Sherman, N.W. (1992). Aqua-run training and changes in treadmill running maximal oxygen consumption. *Medicine & Science in Sports & Exercise*. *24*(5), 23.

Mickan, S., Burls, A. and Glasziou, P. (2011) Patterns of 'leakage' in the utilisation of clinical guidelines: a systematic review. *Postgraduate medical journal*, 87, 670-679.

Milton, N. (2016). Trust in large communities of practice. Available: http://www.kmworld.com/Articles/News/KM-In-Practice/Shell-creates-communities-of-practice-9986.aspx [Accessed: 2/6/2017]

Minden, K., Niewerth, M., Zink, A., Seipelt, E., Foeldvari, I., Girschick, H., Ganser, G., Horneff, G. (2012) Long-term outcome of patients with JIA treated with etanercept, results of the biologic register. *JuMBO Rheumatology*. 51, 1407-1415.

Moher, D., Schulz, K.F., Altman, D.G. (2001). The CONSORT statement: revised recommendations for improving the quality of reports of parallel group randomized trials. *BMC Medical Research Methodology*. 1, 2.

Moody, J., Hale, L., Waters, D. (2012) Perceptions of a water-based exercise programme to improve physical function and falls risk in older adults with lower extremity osteoarthritis: barriers, motivators and sustainability. *New Zealand Journal of Physiotherapy.* 40(2), 64-70.

Moule, P. and Hek, G. (2011) *Making Sense of Research: An introduction for Health and Social Care Practitioners.* London: SAGE Publications.

Moule. P. (2015). *Making Sense of Research in Nursing: Health & Social Care*. 5th Edition. London: SAGE Publications.

Moulton Injury & Rehab Centre (2017). Hydrotherapy. Available: http://sportstherapy.moulton.ac.uk/Services/Hydrotherapy [Accessed: 21/09/2017]

Munro, J.F., Nicholl, J.P., Brazier, J.E., Davey, R., Cochrane, T. (2004) Cost effectiveness of a community based exercise programme in over 65 year olds: cluster randomised trial. *Journal of Epidemiology & Community Health*. *58*(12), 1004-1010.

Muscular Dystrophy UK (2015) Hydrotherapy in the UK: The urgent need for increased access. Available: http://www.musculardystrophyuk.org/app/uploads/2015/12/INF11-Hydrotherapy-report-FINAL1.pdf [Accessed: 15/6/2017]

Musculoskeletal Research Facilitation Group. Keele University. Available: (www.keele.ac.uk/ebp/mrfgroup) [Accessed: 21/9/2017]

NASS (2015). Research Fund Awards. Available: https://nass.co.uk/research/2015-research-fund-awards/ [Accessed: 1/9/2017]

NASS (2017). Exercise for your AS. Available: https://nass.co.uk/nass/en/exercise/exercise-for-your-as/ [Accessed 1/9/2017]

National Collaborating Centre for Chronic Conditions (Great Britain) and National Institute for Clinical Excellence (Great Britain), 2008. Osteoarthritis: national clinical guidelines for care and management in adults. Royal College of Physicians.

National Institute for Health and Care Excellence (2018). Ankylosing Spondylitis. Available: https://cks.nice.org.uk/ankylosing-spondylitis#!backgroundsub [Accessed: 03/02/2018]

National Institute for Health and Clinical Excellence, [CG79], (2009). Rheumatoid arthritis in adults: management. Available: https://www.nice.org.uk/guidance/cg79 [Accessed 12/09/2015 & 12/09/2017]

National Institute for Health and Clinical Excellence, [CG177], (2014). Osteoarthritis: care and management. Available: https://www.nice.org.uk/guidance/cg177/chapter/Introduction [Accessed 22/09/2017]

National Institute for Health Care and Excellence (2018). Rheumatoid Arthritis. Available: https://cks.nice.org.uk/rheumatoid-arthritis#!topicsummary [Accessed: 21/01/2018]

National Institute for Health and Clinical Excellence, (2017). Rheumatoid Arthritis in over 16's [QS33]. Available: https://www.nice.org.uk/guidance/qs33/chapter/quality-statement-4-education-and-self-management [Accessed 1/9/2017]

National Institute for Health and Clinical Excellence, (2017). Spondyloarthritis in over 16s: diagnosis and management. [NG65]. Available: www.nice.org.uk/guidance/ng65 [Accessed: 04/04/2017]

National Institute for Health Research, (2015). *Going the Extra Mile Report.* London. Available: https://www.nihr.ac.uk/patients-and-public/documents/Going-the-Extra-Mile.pdf

National Institute for Health Research, (2017). Patients and the Public. Available: https://www.nihr.ac.uk/patients-and-public/ [Accessed; 8/9/2017]

National Institute for Health Research. CLAHRC Partnership Programme. Available: https://www.clahrcprojects.co.uk/about [Accessed:14/9/2017]

Nelson, J. (2017) Using conceptual depth criteria: addressing the challenge of reaching saturation in qualitative research. *Qualitative research*. *17*(5), 554-570.

Nembhard. I.M. (2009) Learning and improving in quality improvement collaboratives: which collaborative features do participants value most? *Health Services Research*. 44, 359-378.

NHS Choices (2017). NHS England – Help with costs. Available: http://www.nhs.uk/NHSEngland/Healthcosts/Pages/patient-co-payments.aspx [Accessed: 1/9/2017]

NHS England (2014). Five Year Forward View. Available: https://www.england.nhs.uk/ourwork/futurenhs/ [Accessed: 03/09/2017]

NHS England (2017). Musculoskeletal conditions. Available: https://www.england.nhs.uk/ourwork/ltc-op-eolc/ltc-eolc/si-areas/musculoskeletal/. [Accessed: 07/08/2017]

NHS England (2017). NHS England Research Plan. Available: https://www.england.nhs.uk/wp-content/uploads/2017/04/nhse-research-plan.pdf. [Accessed: 05/09/2017]

Nicolini, D., Powell, J., Conville, P., Martinez-Solano, L. (2008) Managing knowledge in the healthcare sector: A review. *International Journal of Management Reviews*. 10(3), 245-263.

Nilsen, P. (2015) Making sense of implementation theories, models and frameworks. *Implementation Science.* 10(1), 53.

NRAS (2017). The importance of exercise. Available: http://www.nras.org.uk/the-importance-of-exercise [Accessed: 5/52017]

Nugent, J., Ruperto, N., Grainger, J., Machado, C., Sawhney, S., Baildam, E., Davidson. J., Foster, H., Hall, A., Hollingworth, P et al. (2001) The British version of the Childhood Health Assessment Questionnaire (CHAQ) and the Child Health Questionnaire (CHQ). *Clin Exp Rheumatol.* 19(4), 163-167.

Oborn, E., Barrett, M., Racko, G. (2013) Knowledge translation in healthcare: Incorporating theories of learning and knowledge from the management literature. *J.Health Organ Manag*. 27(4), 412-431.

Oliveira, S., Ravelli, A., Pistorio, A., Castell, E., Malattia, C., Prieur, A.M., Saad-Magalhães, C., Murray, K.J., Bae, S.C., Joos, R., Foeldvari, I. (2007). Proxy-reported health-related quality of life of patients with juvenile idiopathic arthritis: the Pediatric Rheumatology International Trials Organization multinational quality of life cohort study. *Arthritis Care & Research*. 57(1), 35-43.

OMERACT Outcome Measures in Rheumatology (2017). Available: https://www.omeract.org/index.php [Accessed: 10/9/2017]

O'Reilly, M. and Parker, N. (2013) 'Unsatisfactory saturation': a critical exploration of the notion of saturated sample sizes in qualitative research. *Qualitative Research Journal*. 13(2), 190-197.

Østerås, N., van Bodegom-Vos, L., Dziedzic, K., Moseng, T., Aas, E., Andreassen, Ø., Mdala, I., Natvig, B., Røtterud, J.H., Schjervheim, U.B., Vlieland, T.V. (2015) Implementing international osteoarthritis treatment guidelines in primary health care: study protocol for the SAMBA stepped wedge cluster randomized controlled trial. *Implementation Science*. *10*(1), 165.

Packham, J.C. and Hall, M.A. (2002) Long-term follow-up of 246 adults with juvenile idiopathic arthritis: functional outcome. *Rheumatology*. 41(12), 1428-1435.

Palazzo, C., Nguyen, C., Lefevre-Colau, M.M., Rannou, F. and Poiraudeau, S. (2016) Risk factors and burden of osteoarthritis. *Annals of physical and rehabilitation medicine.* 59(3), 134-138.

Parahoo, K. (2014). *Nursing research principles, process and issues.* 3rd Edition. Basingstoke: Palgrave Macmillan.

Patrick, D.L., Ramsey, S.D., Spencer, A.C., Kinne, S., Belza, B., Topolski, T.D. (2001) Economic evaluation of aquatic exercise for persons with osteoarthritis. *Medical Care*. *39*(5), 413-424.

Pattman, J., Hall, J., Record, E. (2013) Effectiveness of Aquatic Physiotherapy in Clinical Practice. *International Journal of Aquatic Research and Education*. 7, 396-406.

Patton, M.Q. (2002) *Qualitative Evaluation and Research Methods*. 3rd Edition. Thousand Oaks, CA: Sage Publications.

Peat, G., Thomas, E., Wilkie, R., Croft, P. (2006) Multiple joint pain and lower extremity disability in middle and old age. *Disability & Rehab.* 28(24), 1543-1549.

Peat, J. (2002). *Health Science Research: A Handbook of Qualitative Methods.* London: Sage Publications.

Pechter, Ü., Ots, M., Mesikepp, S., Zilmer, K., Kullissaar, T., Vihalemm, T., Zilmer, M. and Maaroos, J. (2003) Beneficial effects of water-based exercise in patients with chronic kidney disease. *International Journal of Rehabilitation Research*. *26*(2), 153-156.

PEDro (2017) – Physiotherapy Evidence Database. Available: https://www.pedro.org.au/ [Accessed: 5/9/2017]

Petticrew, M. and Roberts. H. (2006). *Systematic reviews in social sciences: a practical guide.* Malden: Blackwell Publishing.

Petticrew, M. (2011) When are complex interventions 'complex'? When are simple interventions 'simple'? *European Journal of Public Health*. 21(4), 397–398.

Petty, R.E., Southwood, T.R., Manners, P., Baum, J., Glass, D.N., Goldenberg, J., He, X., Maldonado-Cocco, J., Orozco-Alcala, J., Prieur, A.M. et al. (2004) International League of Associations for Rheumatology classification of juvenile idiopathic arthritis: second revision, Edmonton, 2001. *The Journal of rheumatology*. 31(2), 390-392.

Petzold, A., Korner-Bitensky, N., Menon, A. (2010) Using the Knowledge to Action Process Model to Incite Clinical Change. *Journal of Continuing Educations in the Health Professions*. 33(3), 167–171.

Palazzo, C., Nguyen, C., Lefevre-Colau, M.M., Rannou, F., Poiraudeau, S. (2016). Risk factors and burden of osteoarthritis. *Annals of physical and rehabilitation medicine*. *59*(3), 134-138.

Pope, C., Mays, N., Popay, J. (2007) *Synthesizing qualitative and Quantitative research evidence: A guide to methods.* Maidenhead: Open University Press.

Porcheret, M., Jordan, K., Croft, P. (2007) Treatment of knee pain in older adults in primary care: development of an evidence based model of care. *Rheumatology.* 46(44), 638-648.

Pye, S.R., Adams, J.E., Ward, K.A., Bunn, D.K., Symmons, D.P. O'Neill, T.W. (2010) Disease activity and severity in early inflammatory arthritis predict hand cortical bone loss. *Rheumatology*. 49(10), 1943-1948.

Qin, B., Yang, M., Fu, H., Ma, N., Wei, T., Tang, Q., Hu, Z., Liang, Y., Yang, Z., Zhong, R. (2015) Body mass index and the risk of rheumatoid arthritis: a systematic review and dose-response meta-analysis. *Arthritis research & therapy*. *17*(1), 86.

Rabiee F. (2004) Focus-group interview and data analysis. *Proceedings of the Nutrition Society*. 63, 655–660.

Rahman, M.M., Kopec, J.A., Anis, A.H., Cibere, J., Goldsmith, C.H. (2013) Risk of cardiovascular disease in patients with osteoarthritis: a prospective longitudinal study. *Arthritis care & research*. *65*(12), 1951-1958.

Reid-Campion M. (2000) *Hydrotherapy: Principles and Practice*. Butterworth Heinemann. Oxford.

Richardson, W.S., Wilson, M.C., Nishikawa, J., Harward, R.S.A. (1995) The well-built question: A key to evidence-based decisions. *ACP Journal Club*. 123, A12-13.

Riley, B.L. (2012) Knowledge integration in public health: A rapid review using systems thinking. *Evidence & Policy*. 8(4), 417-432.

Roberts. P. (1982) Hydrotherapy: its history, theory and practice. *Occupational health; a journal for occupational health nurses*. 33, 235-244.

Rogers, E.M. 2003 *Diffusion of innovations*. New York: Free Press.

Rössler, R., Donath, L., Verhagen, E., Junge, A., Schweizer, T., Faude, O. (2014) Exercise-based injury prevention in child and adolescent sport: a systematic review and meta-analysis. *Sports medicine*. *44*(12), 1733-1748.

Rothwell, P.M. (2005) External validity of randomised controlled trials: To whom do the resuts of this trial apply? *The Lancet.* 365(9453), 82-93.

Ryan, S., Hassel, A., Dawes, P., Kendall, S. (2003) Control perceptions in patients with rheumatoid arthritis: the impact of the medical consultation. *Rheumatology*. 42(1), 135-140.

Ryecroft-Malone, J. (2004) The PARIHS Framework – A Framework for guiding the Implementation of Evidence Based Practice. *Journal of nursing care quality.* 19(4), 297-304.

Rynes, S., Martunek, J., Daft, R. (2001) Across the great divide: knowledge creation and transfer between practitioners and academics. *Academy of Management Journal*. 44(2), 340-55.

Sackett, D., Strauss, S.E., Scott-Richardson, W., Glasziou, P., Haynes, B.R. (2000). *Evidence-based medicine. How to practice and teach EBM*. 2nd Edition. London: Churchill Livingstone.

Sackett, D.L., Rosenberg, W. M., Gray, J. A., Haynes, R. B., Richardson,W. S. (1996) Evidence based medicine: what it is and what it isn't. *BMJ*. 312(7023): 71–72.

Sandelowski, M. (1995) Focus on Qualitative Methods. Sample Size in Qualitative Research. *Research in Nursing and Health*. 18: 179-183.

Sanders, C. (2003) Application of Colaizzi's method: Interpretation of an auditable decision trail by a novice researcher. *Contemporary Nurse.* 14:3, 292-302.

Sawchenko, L. (2009). The interior health nurse practitioner community of practice: Facilitating NP integration in a regional health authority. *Communities of practice in health and social care*, 28-35.

Schardt, C., Adams, M.B., Owens, T., Keitz, S., Fontelo, P. (2007) Utilisation of the PICO framework to improve searching PubMed for clinical questions. *B.MC Medical Informatics and Decision Making.* 7, 16.

Schulz, K.F., Altman, D.G., Moher, D. (2011) CONSORT 2010 statement: Updated guidelines for reporting parallel group randomised trials. *International Journal of Surgery.* 9, 672-677.

Sheldon, L. (1998) Grounded Theory: issues for research in nursing. *Nursing Standard.* 12(52), 47-50.

Shi, Z., Zhou, H., Lu, L., Pan, B., Wei, Z., Yao, X., Kang, Y., Liu, L., Feng, S. (2018). Aquatic Exercises in the Treatment of Low Back Pain: A Systematic Review of the Literature and Meta-Analysis of Eight Studies. *American journal of physical medicine & rehabilitation*. *97*(2), 116-122.

Shifaza, F., Evans, D., Bradley, H. (2014) Process and Challenges of the Practical Aspect of Developing EBP Champions. 2nd Annula Worldwide Nursing Conference (WNC 2014).doi:10.5176/2315-4330_WNC14.18, 241-244.

Sim. J. and Wright. C. (2002). *Research in Health Care-Concepts, Designs and Methods.* Cheltenham: Nelson Thornes Ltd.

Singh, G., Athreya, B.H., Fries, J.F., Goldsmith, D.P. (1994). Measurement of health status in children with juvenile rheumatoid arthritis. *Arthritis & Rheumatology*, *37*(12), 1761-1769.

Skinner, A.T., and Thomson, A.T. (1983) *Duffields Exercise in Water*. London: Bailliere Tindall.

South Wales Argus (2013). Repair costs force Llanfrechfa Grange Hospital hydrotherapy pool to close. Available: http://www.southwalesargus.co.uk/news/10442761.Repair_costs_force_Gwent_hydrotherapy_pool_to_close/ [Accessed: 10/7/2017]

Stanley, L.C. and Ward-Smith, P. (2011) The diagnosis and management of juvenile idiopathic arthritis. *J Pediatr Health Care. 25,191-194.*

Stenström, C.H., Lindell, B., Swanberg, E., Swanberg, P., Harms-Ringdahl, K. and Nordemar, R. (1991) Intensive dynamic training in water for rheumatoid arthritis functional class II-a long-term study of effects. *Scandinavian journal of rheumatology*, *20*(5), 358-365.

Stetler, C.B., Damschroder, L.J., Helfrich, C.D., Hagedorn, H.J. (2011) A Guide for applying a revised version of the PARIHS framework for implementation. *Implementation Science*. 6, 99.

Stevenson, K., Bird, L., Sarigiovannis, P., Dziedzic, K., Foster, N.E. and Graham, C. (2007) A new multidisciplinary approach to integrating best evidence into musculoskeletal practice. *Journal of evaluation in clinical practice*. *13*(5), 703-708.

Strauss, A. and Corbin, J. (1990) *Basics of Qualitative Research: grounded theory procedures and techniques*. California: Sage.

Streubert, H.J. and Carpenter, D.R. (2011) *Qualitative Research in Nursing: Advancing the Humanistic Imperative*. 5th Edition. China: Wolters Kluwer Health / Lippincott Williams & Wilkins.

Stubbs, B., Aluko, Y., Myint, P.K., Smith, T.O. (2016) Prevalence of depressive symptoms and anxiety in osteoarthritis: a systematic review and meta-analysis. *Age and ageing*. *45*(2), 228-235.

Sweet, S.N., Martin-Ginis, K.A., Estabrooks, P.A., Latimer-Cheung, A.E. (2014) Operationalizing the RE-AIM framework to evaluate the impact of multi-sector partnerships. *Implementation Science*. 9, 74.

Symmons, D., Turner, G., Webb, R., Asten, P., Barrett, E., Lunt, M., Scott, D., Silman, A. (2002) The prevalence of rheumatoid arthritis in the United Kingdom: new estimates for a new century. *Rheumatology*. *41*(7), 793-800.

Takken, T., van Brussel, M., Engelbert, R.H., van der Net, J.J., Kuis, W., Helders, P.P.J.M. (2008) Exercise therapy in juvenile idiopathic arthritis (Review). *The Cochrane Library.* 2.

Takken, T., van der Net, J.J., Kuis, W., Helders, P.P.J.M. (2003) Aquatic fitness training for children with juvenile idiopathic arthritis. *Rheumatology*. 42, 1408-1414.

Tehlirian, C.V., Bathon, J.M., Waldburger, J.M., Firestein, G.S., Oliver, A.M., St Clair,E.W. (2008). Primer on the Rheumatic Diseases.

Tetro, J., Graham, I.D., Foy, R., Robinson, N., Eccles, M.P., Wensing, M., Durieux, P., Legare, F., Palmhoj-Nielson, C., Adily, A. (2008) Health research funding agencies support and promotion of knowledge translation: An international study. *The Milbank Quarterly.* 86(1), 125-155.

The Herald (Sunday Herald) (2015). Patient pools threatened with closure. Available: http://www.heraldscotland.com/news/13202338.Patient_pools_threatened_with_closure/ [Accessed: 4/4/2017]

Thornton, H. (2008). Patient and public involvement in clinical trials. *BMJ: British Medical Journal.* 336(7650), 903.

Tufford. L. and Newman. P. (2012) Bracketing in Qualitative Research. *Qualitative Social Work*. 11(1), 80-96.

Turner, L., Shamseer, L., Altman, D.G., Schulz, K.F., Moher, D. (2012). Does the use of the CONSORT Statement impact the completeness of reporting of randomised controlled trials published in medical journals? A Cochrane review. *Systematic Reviews.* 1:60

University of Bristol (2017). Welcome to MYMOP. Available: http://www.bris.ac.uk/primaryhealthcare/resources/mymop/ [Accessed 16/09/2017]

US Army. (2014). RDECOM Communities of Practice. Available: https://www.army.mil/article/124346/ [Accessed: 2/6/2017]

Van der Linden, S., Valkenburg, H.A., Cats, A. (1984) Evaluation of diagnostic criteria for ankylosing spondylitis. A proposal for modification of the New York criteria. *Arthritis Rheum.* 27(4), 361-8.

Van Manen, M. (1990) *Researching Lived Experience: Human Science for an Action Sensitive Pedagogy*. London: Althouse Press.

Van Tubergan, A. (2015) The changing clinical picture and epidemiology of spondyloarthritis. *Nature Reviews Rheumatology.* 11(2), 110-118.

Van Tubergen, A., Landewé, R., Van Der Heijde, D., Hidding, A., Wolter, N., Asscher, M., Falkenbach, A., Genth, E., Thè, H.G., van der Linden, S. (2001) Combined spa–exercise therapy is effective in patients with ankylosing spondylitis: a randomized controlled trial. *Arthritis Care & Research. 45*(5), 430-438.

Verhagen, A.P., Cardoso, J.R. Bierma-Zeinstra, S.M. (2012) Aquatic exercise & balneotherapy in musculoskeletal conditions. *Best Practice & Research Clinical Rheumatology*. *26*(3), 335-343.

Vos, T., Flaxman, A.D., Naghavi, M., Lozano, R., Michaud, C., Ezzati, M., Shibuya, K., Salomon, J.A., Abdalla, S., Aboyans, V. et al. (2012) Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*. 380(9859), 2163-2196.

Wadsworth, A.T. and Chanmugan, A.P.P. (1980) *Electro-physical Agents in Physiotherapy.* Australia: Science Press.

Waller, B., Ogonowska-Slodownik, A., Vitor, M., Lambeck, J., Daly, D., Kujala, U.M., Heinonen, A. (2014) Effect of Therapeutic Aquatic Exercise on Symptoms and Function Associated with Lower Limb Osteoarthritis: Systematic Review with Meta-analysis. *Physical Therapy*. 94(10), 1383-1395.

Wang, T.J., Lee, S.C., Liang, S.Y., Tung, H.H., Wu, S.F.V., Lin, Y.P. (2011) Comparing the efficacy of aquatic exercises and land-based exercises for patients with knee osteoarthritis. *Journal of clinical nursing*, *20*(17-18), 2609-2622.

Ward, M.M., Weisman, M.H., Davis, J.C., Reveille, J.D. (2005) Risk factors for functional limitations in patients with long-standing ankylosing spondylitis. *Arthritis Rheum*. 53, 710-717.

Ward, V., House, A., Hamer, S. (2009) Developing a framework for transferring knowledge into action: A thematic analysis of the literature. *Journal of Health Services Research and Policy*. 14(3), 156-164.

Watson, R., McKenna, H., Cowman, S., Keady, J. (2008) *Nursing Research Designs and Methods.* Philadelphia: Churchill Livingston.

Wenger, E. (1998) Communities of Practice: Learning, Meaning, and Identity: Cambridge: Cambridge University Press.

Wenger, E., McDermott, R., Snyder, W.M. (2002). Cultivating Communities of Practice: A Guide to Managing Knowledge. Harvard Business Press.

Weston, D.F.M., O'Hare, J.P., Evans, J.M., Corrall, R.J.M. (1987) Haemodynamic changes in man during immersion in water at different temperatures. *Clinical Science*. 73(6), 613-616.

Wheatley, M.J. (2007) Leadership of Self-Organized Networks Lessons from the War on Terror. *Performance Improvement Quarterly*. *20*(2), 59-66.

Willis, C.D., Best, A., Riley, B., Herbert, C.P., Millar, J., Howland, D. (2014) Systems thinking for transformational change in health. *Evidence & Policy*. 10(1), 113-126.

Willis, C.D., Mitton, C., Gordon, J., Best, A. (2012) System tools for system change. *BMJ Quality and Safety*. 21(3), 250-262.

Wluka, A.E., Lombard, C.B., Cicuttini, F.M. (2013) Tackling obesity in knee osteoarthritis. *Nature Reviews Rheumatology*. *9*(4), 225-235.

Woolf, A.D. (2000). The bone and joint decade 2000-2010. *Annals of Rheumatic Disease.* 59, 81-82.

Woolf, A.D. and Pfleger, B. (2003) Burden of major musculoskeletal conditions. Bone and Joint Decade 2000 –2010. *Bulletin of the World Health Organization*. 81, 646-656.

Woolf, S.H. (2008). The meaning of translational research and why it matters. *Jama.* 299(2), 211-213.

World Health Organization (2005) Bridging the "Know-Do" gap: Meeting on knowledge translation in global health*.* Geneva: WHO.

World Medical Association (2013). Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. *JAMA*. 310(20), 2191–2194.

Yoshimura, N., Muraki, S., Oka, H., Kawaguchi, H., Nakamura, K., Akune, T. (2011) Association of knee osteoarthritis with the accumulation of metabolic risk factors such as overweight, hypertension, dyslipidaemia, and impaired glucose tolerance in Japanese men and women: the ROAD study. *The Journal of rheumatology. 38*(5), 921-930.

Zheng, H. and Chen, C. (2015) Body mass index and risk of knee osteoarthritis: systematic review and meta-analysis of prospective studies. *BMJ open*. *5*(12), p.e007568.

Zwarenstein, M., Treweek, S., Gagnier, J.J., Altman D.G., Tunis, S., Haynes, B., Gent, M., Oxman, A.D., Moher, D. (2008) Improving the reporting of pragmatic trials: an extension of the CONSORT statement. *British Medical Journal.* 337, 2390.

Appendices

Appendix: 1 Results of CAT with population & outcome highlighted

First Author, year and type of study	Population and setting	Intervention or exposure tested	Study results	Assessment of quality and comments
Bartels et al 2016 SR	13 RCT's Included. (n= 1190) All **adult** participants had defined **OA** by ACR criteria in either 1 or 2 hip/knee joints. Searched up to April 2015.	Evaluating effects of aquatic therapy compared to no intervention.	Moderate quality evidence that aquatic exercise may have small short term, and clinically relevant effects on patient reported **pain disability and quality of life** in people with knee & hip OA. Long term effect is unclear. More properly designed studies required to compare aquatic exercise with control treatment, pharmacological treatment or land based exercise. Better defined interventions e.g. intensity, frequency, duration. Treatments:- Frequency varied between 2-3 times per week. Duration of treatment varied between 20-60 mins per session. Length of intervention varied between 6 – 20 weeks. Outcome measures used:- Pain = WOMAC pain sub scale, VAS, SF 36, Health Assessment Questionnaire (HAQ) pain subscale. Disability = Activities of Daily Living, Western Ontario & McMaster Universities Arthritis Index (WOMAC), physical function subscale (SF 36), HAQ, Quality of life = SF-36/SF-12/SF-8, EuroQol, KOOS sub score, Quality of well being, Arthritis Impact Measurement Scale	Best good quality evidence found for adults. Comprehensive database search. All CASP criteria ticked yes. Limited number of good quality RCT's to base definitive recommendation. No 3rd reviewer used for disagreements between 2 initial reviewers.

			Outcomes were measured at varying intervals - from 6 weeks to 18 months.	
Barker et al 2014 Systematic review	24 RCT's & 2 quasi RCT's included. Mean age participants **>60** Participants diagnosed with **OA/RA/fibromyalgia, low back pain & osteoporosis**. 16 of the studies participants had OA. Searched up to 2013	Patients received: -hydro and no exercise (n=18). -hydro and land based exercise (n=15). -hydro and both land based & no exercise (n=7)	Evidence suggests that aquatic exercise has moderate beneficial effects on **pain, physical function & quality of life** in adults with MSK conditions, in the short term. More research required with regard to long term effects. These short term beneficial affects appear comparable with those achieved with land based exercise. Treatments - Duration of studies outcomes varied between 3-20 weeks for 24 of the studies & 1 x 32 & 1 x 52 weeks, treatment sessions varied between 30-60 minutes long, frequency of treatment varied between 1 – 7 times per week. Outcome measures used:- Pain – VAS, HAQ, SF36, SF 12, EQ-5D, BPI, Functional Capacity, WOMAC, AIMS, KOOS, FIQ. Physical function – HAQ, DRI, SF-36, SF-12, EQ-5D, Functional capacity, FAP, SPF scale, AAP, WOMAC, AIMS-2, KOOS, ASEQ, OP functional disability questionnaire, FIQ. Quality of Life – EQ-5D, SF 36, SF-12, AQoL, PQOL, Quality of well-being, Global self-rating index, AIMS-2, Arthritis QoL, KOOS.	High heterogeneity. Variation in studies comparison of treatment (types of exercises used) and dosage/frequency. Broad focus of conditions. Variation in outcome measure used. Review focussed on studies published in English only & no grey literature reviewed.
Al-Qubaeissy et al 2012 Systematic review	6 RCT's included. **Adults 18 and over** (n= 419)	Patients received hydro for a minimum 4 weeks compared with land based exercise, or home	Some evidence to suggest that hydrotherapy **reduces pain & improves the health status** of patients with RA compared with no or other interventions in the short term (up to 12 weeks).	High heterogeneity due to variation in studies, comparison of treatment and dosage.

	All participants diagnosed with **RA** according to 1987 ACR criteria or Steinbrocker Searched up to 2011.	exercise programme, or no treatment.	However, the long term benefit is inconclusive as only 1 study lasted for 4 years. Treatments – all study interventions differed. Treatment sessions varied between 30 & 60 mins per session. Frequency of treatment varied between 1-3 times per week. Duration of studies varied between 4-12 weeks, with only 1 study lasting 4 years, with outcomes measured at 2 year intervals. Outcomes used: **Pain –** VAS, McGill Questionnaire, Arthritis Impact measurement Scale (AIMS), Health Assessment questionnaire (HAQ), SF-36, **Health status** – EuroQoL (EQ-5D), SF-36, AIMS-2	PEDro scale used to assess quality of studies by 2 independent reviewers. 3rd reviewer used if unable to agree. Review focussed on studies published in English only & no grey literature reviewed.
Batterham et al 2011 Systematic review	10 RCT's included. **Adults (18 and over) with RA or OA.** Searched up to July 2010.	Studies must have reported that one group performed aquatic exercise and the comparison group participated in a form of land based exercise	Outcomes (**function, mobility and patients satisfaction**) following aquatic exercise for adults with arthritis appear comparable to land based exercise in the short term (up to 24 weeks). When people are unable to exercise on land, or find land based difficult, aquatic programs provide an enabling alternative strategy. No research was found that examined **patient's satisfaction/ preferences.** Treatment all study interventions differed: Treatment sessions varied between 30-60mins per session. Frequency of treatment varied between 1-7 times per week. Duration of studies varied between 4-18 weeks. Content of each treatment session varied in depth of reporting.	High heterogeneity due to variation in studies comparison, treatment and dosage, may have affected results. Review focussed on English only & no grey literature. PEDRO quality scale used. 3rd reviewer used if first 2 unable to agree following discussion .

			Outcomes measured/re-measured varied between 4 and 24 weeks. Outcomes used: Function – WOMAC, The knee injury & osteoarthritis outcome score (KOOS), Health assessment questionnaire (HAQ),AIMS-2, Mobility – 50 Foot walk test (50 FWT), Timed up & go test,30 second chair stand.	
Dundar et al 2014 RCT	69 participants. **18 and over**. Patients fulfilling 1988 modified New York criteria for **AS.** n=35 & n=34. Faculty of Medicine and & Rehab, Kocatepe University, Turkey.	Aquatic therapy – 20 sessions, 5 x per week for 4 weeks. 60 mins each session. Vs Home based exercise programme – daily, for 4 weeks. 60 mins each session.	Aquatic exercises improve **pain** and **quality of life** scores of patients with Ankylosing spondylitis compared with home based exercises**.** (12 weeks – ??short term) Outcomes used: Pain – VAS Bath AS Functional index Bath AS metrology index Bath AS disease activity Short form – 36 (SF36) Measured at baseline, 4 & 12 weeks	Small number of participants (69). 1 centre. 1 x investigator completed follow up calls to home exs group to check adherence, physio that had been blind to the study may have been better to complete calls to maintain concealment.
Dundar et al 2009 RCT	65 participants. **20-50years old.** **Low back pain** without leg pain	Comparison between Aquatic programme (n=32) supervised by physio, 20 sessions, 60 mins long, 5xper week for 4 weeks, 7-8 in a group.	Concluded that aquatic **exercise improves disability & quality of life** more than land-based exercise for patients with chronic **low back pain**. (12 weeks – ??short term) However due to the limitations of the study they suggest that – a supervised water based exercise programme is moderately effective for chronic low back pain.	1 centre. Small numbers (65) No control group

	for more than 3months Faculty of Medicine and & Rehab, Kocatepe University, Turkey.	Vs Land home based programme demo by physio once, issued written instructions to complete 1 x per day for 60 mins, weekly telephone to increase concordance for 4 weeks.	Outcomes used: Schober test – spinal mobility ROM – inclinometer & goniometer Disability – modified Oswestry Low back disability quest.. Quality of life – SF-36 Measured at baseline, 4 & 12 weeks	Unsupervised home exs may have reduced compliance.
Epps et al 2005 RCT	78 participants Hydro & land n=39 Land only n= 39 4-19years old Diagnosed with JIA for more than 3 months before age 16. 3 centres Birmingham Childrens Hospital. Great Ormond Street Childrens Hospital.	Compared: Hydro & land based physio programme. 8 hours of hydro & 8 hours of land exs over a 2 week period, then 1 x per week hydro for 2 months. With Land based physio programme. 16 hours over a 2 week period then 1 x per week for 2 months.	Beneficial effect on **quality of life & disease outcome** for patients with **JIA** from both hydro & land based physio & land based only physio programmes. No statistical difference between either group. No evidence to justify the **cost effectiveness** of hydro & land based physio above land based physio alone. Outcomes used: Disease status = Childhood Health Assessment Questionnaire (CHAQ), physicians global assessment of disease activity, parents global assessment of overall wellbeing, joint ROM, number of active joints & erythrocyte sedimentation rate. Quality of Life = Child health questionnaire, parent completed 50 item (CHQ-PF50) Cost effectiveness = Costs per quality-adjusted life-year (QALY), EuroQol five dimensions questionnaire (**EQ-5D**)	Small sample size. Multi centred. No control group. No hydro only group. Excluded participants with active disease, which may have affected results. Single blinded. No follow up call by physio to ascertain if home exs were being completed or as a reminder to complete.

	Middlesex Adolescent Unit.	All participants issued with home exs to complete daily during the 2 months after the 2 week intensive.	Measured at baseline, 2 & 6 months	

Appendix: 2 Completed CAT

Specific Question:

In adults and children with Ankylosing Spondylitis, Rheumatoid Arthritis, Osteoarthritis, Low Back Pain and Juvenile Idiopathic Arthritis, does hydrotherapy, compared with usual care/dry land physiotherapy, reduce pain and function, improve well-being and return to work/school, or is it cost effective?

Clinical bottom line

There is good quality evidence that hydrotherapy improves pain and function for adults with inflammatory arthritis in the short term. However, there is a lack of long term data. This is comparable with land based exercises. There was no available evidence that could answer the cost effectiveness or return to work element of our question.

There is some evidence that hydrotherapy and land based exercise has a beneficial effect on quality of life and disease outcome for children with Juvenile Idiopathic Arthritis (JIA) in the short term. There was no evidence available to justify cost effectiveness above land based exercise, or long term data. There was no available evidence that could answer the return to school element of our question.

Why is this important?

Hydrotherapy, or water/aquatic therapy, is the use of water to relieve discomfort and promote physical well-being.

When provided in a healthcare context**,** it is anecdotally perceived as an expensive treatment, and as such there is continual pressure to ensure its cost effectiveness. Departments/users are continually being asked to support its use and increasingly service managers need to justify its cost effectiveness compared to land based therapy.
Hydrotherapy is not available in all NHS Physiotherapy Departments, but can be found in specialist centres or special educational schools.

The specialist and NHS centres manage adults and children with a wide range of conditions which can include inflammatory arthritis and musculoskeletal pain.

We are interested to explore if there is any good quality evidence to support the use of hydrotherapy in clinical practice. As clinicians we recognise that there are particular groups of patients who appear to benefit from hydrotherapy over land based exercise.

Inclusion Criteria

Systematic reviews or randomised controlled trials between 2005 – 2015.

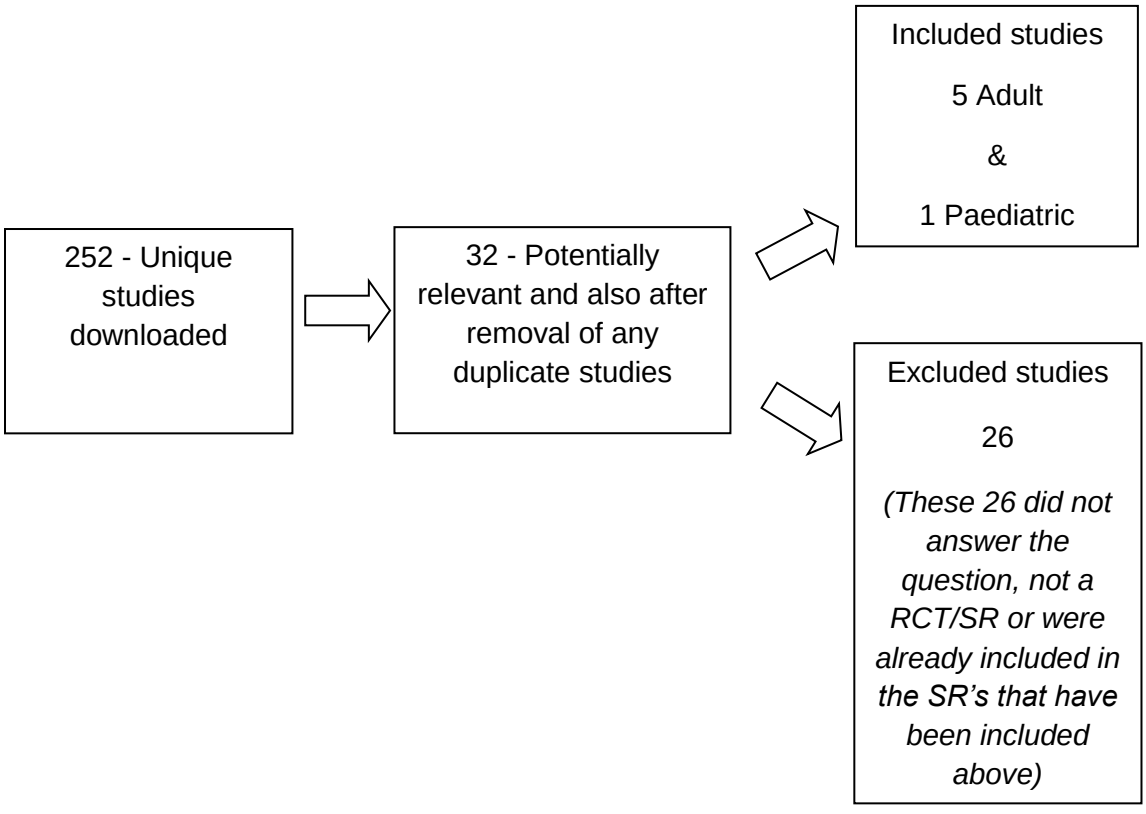
	Description	Search terms
Population and Setting **Exclusion criteria =** Fibromyalgia Neurological disorders e.g. cerebral vascular incidents, head injury Chronic pain	Adults and children Musculoskeletal pain Inflammatory arthritis	Osteoarthritis Juvenile Idiopathic Arthritis (JIA) Joint pain Degenerative Adults Children Paediatrics Rheumatoid Arthritis Psoriatic Arthritis Ankylosing Spondylitis Stills disease Inflammatory conditions Inflammatory arthropathy Idiopathic Arthritis Musculoskeletal pain Back pain
Intervention or Exposure	Hydrotherapy Any form of water based or aquatic therapy	Aquatic Therapy Hydrotherapy Balneotherapy Water Therapy Spa treatment Halliwick Therapeutic Aquatic Exercise Supervised Hydrotherapy
Comparison	Land based therapy	Land based therapy or exercise Physiotherapy Physical therapy Therapeutic exercise Home exercises Electrotherapy Usual therapy care
Outcomes of interest	Pain Function Well-being Return to work Return to school or studies Cost effectiveness	Physical function Pain Cost effective Clinical effectiveness Short term effects Long term effects Well being Quality of life Confidence Disability scores Reduced medication Return to work Return to school or studies Number of work days lost Number of sick days Health & well being Family Education

Databases Searched on 28th January 2016

Database	Date/Issue searched	Searched from	Number of records downloaded
Cochrane Systematic Reviews	28.01.16	2005 -2015	2
Clinical Evidence	28.01.16	2005 -2015	
DARE/HTA/NHSEED	28.01.16	2005 -2015	
Medline	28.01.16	2005 -2015	2
CINAHL	28.01.16	2005 -2015	120
AMED	28.01.16	2005 -2015	8
PsycInfo	28.01.16	2005 -2015	0
Cochrane (CENTRAL)	28.01.16	2005 -2015	2
Web of Science	28.01.16	2005 -2015	29
Rehabdata	28.01.16	2005 -2015	2
Embase	28.01.16	2005 -2015	47
Joanna Briggs Institute	28.01.16	2005 -2015	3
PEDRO	28.01.16	2005 -2015	0
NICE	28.01.16	2005 -2015	
CKS	28.01.16	2005 -2015	
SportsDiscuss	28.01.16	2005 -2015	13
Pubmed	28.01.16	2005 -2015	20
Evidence updates	01.02.16	2005 -2015	4
Total			252

Please contact the author if you would like a copy of the search history

Results



Subsequent to the literature search the author was made aware of a new publication (Bartels et al 2016) that was relevant to the CAT question and has been included in the clinical bottom line.

Therefore 7 studies have been included in the results.

Adults

First Author, year and type of study	Population and setting	Intervention or exposure tested	Study results	Assessment of quality and comments
Bartels et al 2016 Systematic Review	13 RCT's Included, (n= 1190) All adult participants had defined OA by American College of Rheumatology (ACR) criteria in either 1 or 2 hip/knee joints. Searched up to April 2015.	Evaluated effects of aquatic therapy compared to no intervention	Moderate quality evidence that aquatic exercise may have small short term, and clinically relevant effects on patient reported pain disability and quality of life in people with knee & hip OA. Long term effect is unclear. Better designed studies required to compare aquatic exercise with control. Interventions varied in frequency; intensity; duration. Outcome measures used between studies varied & measured at varying intervals.	Best good quality evidence found for adults with OA of hip and knee. Comprehensive database search. Limited number of good quality RCT's to base a definitive recommendation. Didn't have a 3rd reviewer used for disagreements between 2 initial reviewers.
Barker et al 2014 Systematic review	24 RCT's & 2 quasi RCT's included Mean age participants >60 Participants diagnosed with OA/RA/fibromyalgia, low back pain & osteoporosis.	Patients received: -hydro and no exercise (n=18) -hydro and land based exercise (n=15)	Evidence suggests that aquatic exercise has moderate beneficial effects on pain, physical function & quality of life in adults with musculoskeletal conditions, in the short term.	Best evidence found for adults with OA/RA/fibromyalgia, low back pain, osteoporosis. High heterogeneity.

	16 of the studies participants had OA. Searched up to 2013	-hydro and both land based & no exercise (n=7)	More research required with regard to long term effects. These short term beneficial affects appear comparable with those achieved with land based exercise. Interventions varied in frequency; intensity; duration. Outcome measures used between studies varied & measured at varying intervals.	Variation in studies comparison of treatment (types of exercises used) and dosage/frequency. Broad focus of conditions. Variation in outcome measure used. Review focussed on studies published in English only & no grey literature reviewed.
Al-Qubaeissy et al 2012 Systematic review	6 RCT's included. Adults 18+ (n= 419) All participants diagnosed with Rheumatoid Arthritis (RA) according to 1987 ACR criteria or Steinbrocker Functional Testing criteria for RA. Searched up to 2011.	Patients received hydro for a minimum 4 weeks compared with land based exercise, or home exercise programme, or no treatment.	Some evidence to suggest that hydrotherapy reduces pain & improves the health status of patients with RA compared with no or other interventions in the short term (up to 12 weeks). However, the long term benefit is inconclusive as only 1 study lasted for 4 years. Interventions varied in frequency; intensity; duration. Outcome measures used between studies varied & measured at varying intervals.	Best evidence found for adults with RA. High heterogeneity due to variation in studies, comparison of treatment and dosage. PEDro scale used to assess quality of studies by 2 independent reviewers. 3rd reviewer used if unable to agree.

				Review focussed on studies published in English only & no grey literature reviewed.
Batterham et al 2011 Systematic review	10 RCT's included. Adults 18 + with RA or OA. Searched up to July 2010.	Studies must have reported that one group performed aquatic exercise and the comparison group participated in a form of land based exercise	Outcomes following aquatic exercise for adults with arthritis appear comparable to land based exercise in the short term (up to 24 weeks). Interventions varied in frequency; intensity; duration. Outcome measures used between studies varied & measured at varying intervals.	Best evidence found for adults with RA or OA. High heterogeneity due to variation in studies comparison, treatment and dosage, may have affected results. Review focussed on English only & no grey literature. PEDRO quality scale used. 3rd reviewer used if first 2 unable to agree following discussion.
Dundar et al 2014 Randomised Controlled Trial	69 participants. 18 + Patients fulfilled 1988 modified New York criteria for AS. 2	Aquatic therapy – 20 sessions, 5 x per week for 4 weeks. 60 mins each session. Vs	Aquatic exercises improve pain and quality of life scores of patients with Ankylosing spondylitis (AS) compared with home based exercises**.** (12 weeks – ??short term) Outcomes used:	Best evidence found for adults with AS only. Small number of participants (69).

	groups n=35 & n=34. Faculty of Medicine and & Rehab, Kocatepe University, Turkey.	Home based exercise programme – daily, for 4 weeks. 60 mins each session.	Pain – VAS Bath AS Functional index Bath AS metrology index Bath AS disease activity Short form – 36 (SF36) Measured at baseline, 4 & 12 weeks	Completed in 1 centre only in Turkey. Same investigator completed follow up calls to home exs group to check adherence. May have been better to use a blind investigator to the study to complete calls to maintain concealment.
Dundar et al 2009 Randomised Controlled Trial	65 participants. 20-50years old. Low back pain without leg pain for more than 3months Faculty of Medicine & Rehabilitation, Kocatepe University, Turkey.	Comparison between Aquatic programme (n=32) supervised by physio, 20 sessions, 60 mins long, 5xper week for 4 weeks, 7-8 in a group. Vs Land home based programme demo by physio once, issued written instructions to complete 1 x per day for 60 mins, weekly	Concluded that aquatic exercise improves disability & quality of life more than land-based exercise for patients with chronic low back pain. (12 weeks = short term) However due to the limitations of the study they suggest that – a supervised water based exercise programme is moderately effective for chronic low back pain. Outcomes used: Schober test – spinal mobility ROM – inclinometer & goniometer Disability – modified Oswestry Low back disability quest.. Quality of life – SF-36	Best evidence found for adults with low back pain only. 1 centre. Small numbers (65) No control group Unsupervised home exs may have reduced compliance. Unsure of dropouts to the study.

		telephone to increase concordance for 4 weeks.	Measured at baseline, 4 & 12 weeks	

Paediatric

First Author, year and type of study	Population and setting	Intervention or exposure tested	Study results	Assessment of quality and comments
Epps et al 2005 Randomised Controlled Trial	78 participants Hydro & land n=39 Land only n= 39 4-19years old Diagnosed with JIA for more than 3 months before age 16. 3 centres Birmingham Childrens Hospital. Great Ormond Street Childrens Hospital. Middlesex Adolescent Unit.	Compared: Hydro & land based physio programme. 8 hours of hydro & 8 hours of land exs over a 2 week period, then 1 x per week hydro for 2 months. With Land based physio programme. 16 hours over a 2 week period then 1 x per week for 2 months. All participants issued with home exs to complete daily during the 2 months after the 2 week intensive.	Beneficial effect on quality of life & disease outcome for patients with JIA from both hydro & land based physio & land based only physio programme No statistical difference between either group. No evidence to justify the cost effectiveness of hydro & land based physio above land based physio alone. Outcomes used: Disease status = Childhood Health Ax Questionnaire (CHAQ), physicians global assessment of disease activity, parents global assessment of overall wellbeing, joint ROM, number of active joints & erythrocyte sedimentation rate. Quality of Life = Child health questionnaire, parent completed 50 item (CHQ-PF50) Cost effectiveness = Costs per quality-adjusted life-year (QALY), EuroQol five	Best evidence found for children with JIA. Small sample size. Multi centred. No control group. No hydrotherapy only group. Excluded participants with active disease, which may have affected results. Single blinded. No follow up call by physio to ascertain if home exs were being completed or as a reminder to complete

			dimensions questionnaire (EQ-5D). Measured at baseline, 2 & 6 months	

Summary

Adults

There is good quality evidence that hydro/aquatic therapy may have small short term effects on pain, disability, physical function, mobility and quality of life in adults with Ankylosing Spondylitis, Rheumatoid Arthritis, low back pain and Osteoarthritis of the knee & hip.

The long term effects are unclear.

These effects are comparable with land based exercises.

No research has been found in relation to cost effectiveness or return to work.

Paediatrics

There is no statistically significant evidence that land based exercise alone can improve functional ability, quality of life, or pain for children with JIA.

Some evidence is available to support that there is a beneficial effect on quality of life & disease outcome for patients with JIA from both aquatic therapy & land based physio, in the short term. Long term effects are unclear.

One study reported that there is no statistically significant evidence to justify the cost effectiveness of aquatic therapy above land based physio alone for children.

No research has been found in relation to return to school.

Implications for Practice/research

The evidence would support clinicians continued use of hydrotherapy to treat patients with these conditions.

Further research may need to focus on long term outcomes and cost effectiveness

What would you tweet? (140 characters)

Hydrotherapy improves pain and function for patients with inflammatory arthritis in the short term and is comparable with land based exercises.

References

Al-Qubaeissy, K.Y., Fatoye, F.A., Goodwin, P.C., Yohannes, A.M. (2013). The Effectiveness of Hydrotherapy in the Management of Rheumatoid Arthritis: A systematic Review. *Musculoskeletal Care*.11: 3-18

Barker A., Talevski J., Morello R., Rahmann A., Urquhart, D. (2014). Effectiveness of Aquatic Exercise for Musculoskeletal Conditions: A Meta- Analysis. *American Congress of Rehabilitation Medicine.* 95: 1776-86

Bartels, E.M., Juhl, C.B., Christensen, R., Hagen, K.B., Danneskiold-Samsoe, B., Dagfinrud, H., Lund, H. (2016). Aqautic Exercise for the treatment of knee and hip osteoarthritis (Review). *The Cochrane Collaboration.* 3: 1-66

Batterham, S.I., Heywood, S., Keating, J.L. (2011). Systematic review & meta-analysis comparing land & aquatic exercise for people with hip or knee arthritis on function, mobility & other health outcomes. *BMC Musculoskeletal Disorders.* 12:123 1-13

Dundar, U., Solak, O., Toktas, H., Demirdal, U.S., Subasi, V., Kavuncu, V., Evcik, D. (2014). Effect of aquatic exercise on ankylosing spondylitis: a randomized controlled trial. Rheumatol Int. 34: 1505-1511

Dundar, U., Solak, O., Yigit, I., Evcik, D., Kavuncu, V. (2009). Clinical effectiveness of Aquatic Exercise to Treat Chronic Low Back Pain. A Randomised Control Trial. *Spine.* 34:(14) 1436-1440

Epps, H., Ginnelly, L., Utle,y M., Southwood, T., Gallivan, S., Sculpher, M., Woo, P. (2005). Is hydrotherapy cost-effective? A randomised controlled trial of combined hydrotherapy programmes compared with physiotherapy land techniques in children with juvenile idiopathic arthritis. *Health Technol Assess*. 9: 39

Appendix: 3 Community of Practice (CoP) Running Schedule

Project Title: Hydrotherapy – barriers and enablers to evidence based practice

Checklist:

- 2 x Digital recorders + spare batteries (additional x 1 IPad as backup) to improve quality of recording in different locations of the room)
- Informed consent forms for completion on arrival & copies of information sheets for participant information, clock
- Room booking, setting up of environment & refreshments (tea, coffee, water, snacks), participant number cards for tables.

Research team:

Pam Smith, Student Researcher	Presenting evidence to CoP and observer
Lead Supervisor	Facilitator of CoP after CAT evidence has been presented to the participants.
Field note keeper	Field note keeper (body language, intonation of individual participants & engagement/overall dynamics of the group) & in charge of recording/timing.
Second Supervisor	Observing process and overall feedback

External Attendees/Participants:

Local Physiotherapy Clinicians/Practice Educator who have expertise in adult hydrotherapy and paediatric hydrotherapy	
Member of the Chartered Society of Physiotherapy – Aquatic Therapy Special Interest Group	
Local NHS Hydrotherapy Service Provider Manager	
School of Health & Rehabilitation, Keele University, Lecturer with interest in Hydrotherapy	
Current Keele 3rd year Undergraduate Physiotherapy Students	
Local Rheumatology Consultant	
Local Rheumatology Consultant Nurse	

Time and probes/prompts	Schedule of events and topic guide
9.00 – 9.30	**Welcome refreshments, registration by Candidate will issue/aid completion of consent forms.**
9.30 Candidate	**Introduction & housekeeping.** • Researcher will welcome attendees and express thanks for taking the time to attend. • Introduction of lead researcher & facilitators and their roles • Explain timings of meeting, toilets, fire, refreshments • Participants will be asked if they have read and understood the information about the study and will be invited to ask any questions related to the study prior to being asked to sign the consent form in the presence of the researcher. A copy will be kept by the researcher. • Researcher will record participants name on a log, and attribute a participant number • Researcher will clarify that the CoP will be audiotaped and will show the participants the digital recorder that will be used to record the discussions. • The researcher will clearly state when the recorder is being switched on & off
Candidate	**Present the Purpose of the CoP** The researcher will explain the reasons why the CoP is taking place and to share the project aims below: 1. Highlight the best available evidence for hydrotherapy for adults and children with musculoskeletal pain and inflammatory arthritis 2. To ensure that this best evidence is translated into clinical practice, through engagement with physiotherapy educators, physiotherapy academic staff, students, managers and NHS experts within the field.
Candidate	**Explain the ground rules – the researcher will explain the following:** ➢ that a number of questions will be asked in order to guide the discussion within the CoP. ➢ that it will be an informal discussion and that everything that is said will be held confidentially and anonymised ➢ no right or wrong answers ➢ please respect others contributions and where possible to help transcribing please minimise interruptions or side conversations, but please feel free to respond to each other's comments

	➢ please feel free to say what you really think and feel ➢ we would request that the content is not shared and that other participants details are kept confidential ➢ confirm that consent has been given to be audio recorded and that the discussion should take no longer than 1 hour
9.45 – 10.15 Candidate	**Present the evidence** • The researcher will present the key findings of the evidence that has been identified via a Critically Appraised Topic process to generate a clinical bottom line. This should take approx. 30 minutes. • Researcher to advise participants to write down any thoughts/questions that may be generated during the presentation on the paper supplied. These can then be discussed during the CoP and therefore included in the recordings/data capture. These will then be collected in at the end and shredded.
	A reminder of the ground rules will be highlighted to the group. **After the tape has been switched on the following topics will be explored in the CoP.** **Questions and prompts are outlined below**
10.30 Lead supervisor	**Warm up** • Participants will be asked to introduce themselves by their Christian name and to state where they last went on holiday. This is to help to identify the participants on the recordings and to support data collection. A log identifying the participants name and allocated number will be kept on a separate sheet.
	Topics The main focus of the topics with the CoP is to 1. Highlight the barriers to implementing the clinical bottom line 2. Generate potential solutions to enable its implementation
Suggestions of Prompts to help discussions Why? Describe/give details?	**Topic 1** 1. What are your thoughts on the evidence that has been presented to you? 2. What do you feel are the main barriers to ensuring that the best available evidence for hydrotherapy gets into clinical practice 3. What use is this information to you?

Examples? What makes you say that? What do others think? Can you describe in more detail what experience you had? Anything else?	
Suggestions of Prompts to help discussions Why? Describe/give details? Examples? What makes you say that? What do others think? Can you describe in more detail what experience you had?	**Topic 2** 1. What do you feel would help to get this evidence into practice 2. How would you share this evidence within your environments 3. How might you ensure this evidence is embed at: ➢ an individual level ➢ a team level ➢ an organisational level ➢ a system level

Anything else?	
	Supplementary Questions to generate further discussion on above topics if required: ➢ What are your thoughts/experiences with regard to what is happening nationally with regard to hydrotherapy services? ➢ What are your thoughts/experiences with regard to what is happening locally with regard to hydrotherapy services? ➢ Can you expand on any local issues? ➢ Are there any access issues with regard to Hydrotherapy services? ➢ What challenges are you aware of with regard to Hydrotherapy services? ➢ In your experience what do you feel are the main barriers and enablers/solutions to maintain hydrotherapy services locally & nationally? ➢ Has everybody had an opportunity to say what they wanted to? ➢
11.30 Candidate	Researcher will then thank the participants & research team for taking part and advise them that the tape is being switched off. Tape is switched off
12.30 – 13.00 All research team	After the participants have left the room, the researcher and facilitators need to complete a 15-20 minute oral reflection on the process. • Timing of morning as a whole • Length of each session • Clarity of presentation • General engagement • Environment • Equipment • Allocated roles • Paperwork

Suggested format for Field notes to capture group discussion and aid data analysis (as per Kruegar & Casey – Focus Groups – A practical guide for applied research 2015 page 112) e.g.

Hydrotherapy – barriers and enablers to evidence based practice

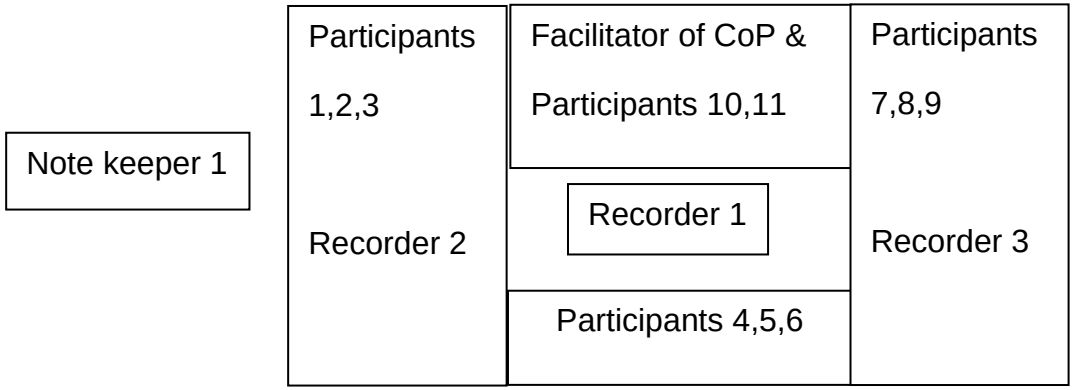
Community of Practice - 29th September 2016 – 9am – 12.30pm

Sustainability Hub, Keele University

Research team:

Candidate	Presenting evidence to CoP and observer
Lead Supervisor	Facilitator of CoP after CAT evidence has been presented to the participants.
	Field note keeper (body language, intonation of individual participants & engagement/overall dynamics of the group) & in charge of recording/timing.
Second Supervisor	Observing process and overall feedback

Seating plan of CoP - Diagrammatic representation of a circle – Participant numbers will be on the table and participants will self-select where they sit.



Field note keeper 1 – example (these are used to support analysing the data from the recordings)

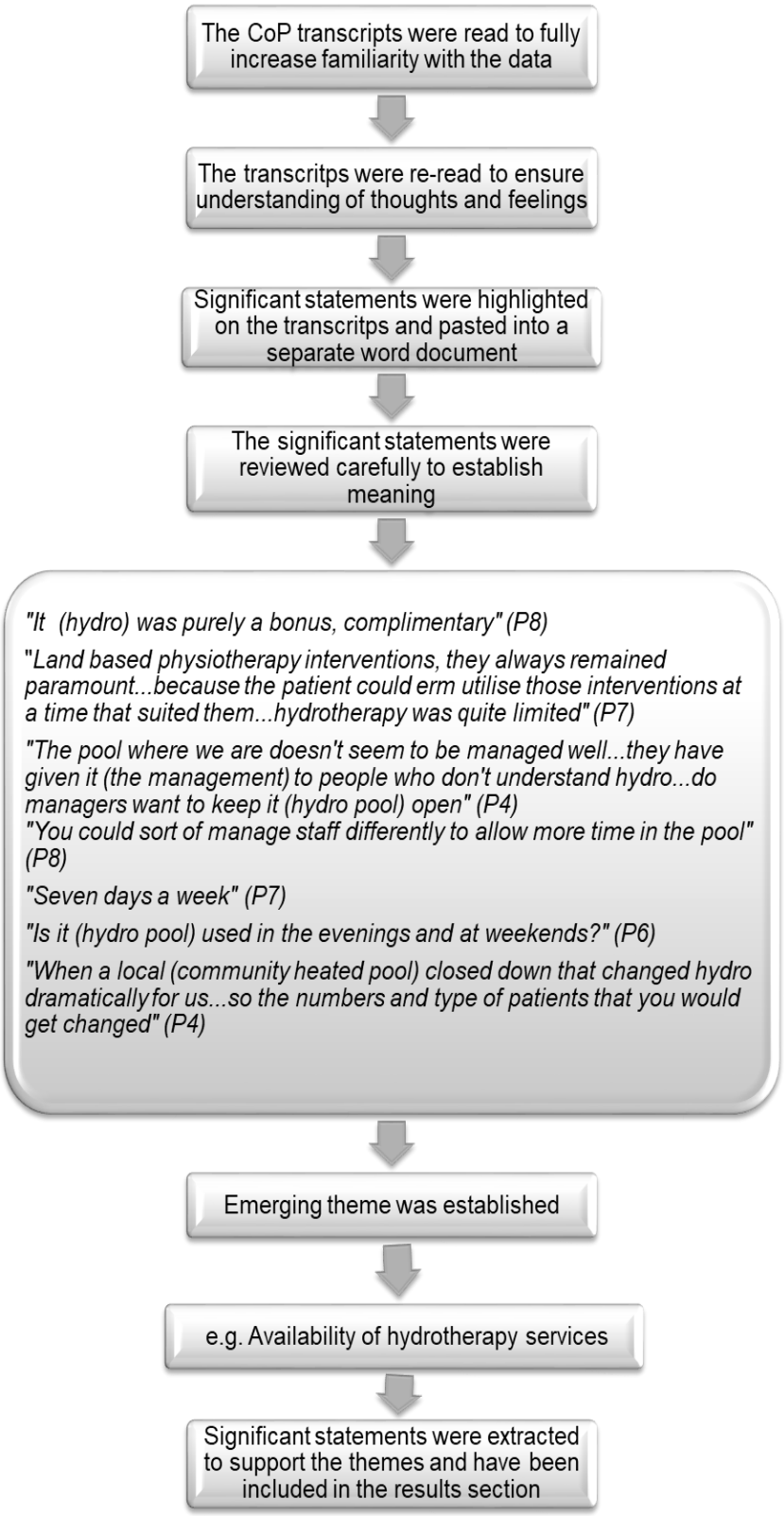
Topic 1	Participant number	Key Notes – individual participants body language, voice intonation, engagement & over all dynamics/interaction of the group	Key Quotes –
	1	Quietly spoken. Leaned forward.	"I think that……
	3	Interrupted. Folded arms.	"but I thought……
	all	Nodding of heads in the group to P3 response above	"has anybody else found that…..
	1,5,6	Shook heads to P4's response	" I would disagree…..

Topic 2	Participant number	Key Notes – individual participants body language, voice intonation, engagement & over all dynamics/interaction of the group	Key Quotes -

Guidance for field note taker:-

- **Insightful quotes are captured as completely as possible on the right hand side**
- **When the facilitator moves to another question, a horizontal line is drawn under the information logged. This allows the researcher to go back & locate the relative field notes to a specific question when reviewing the recordings.**

Appendix: 5 Example of Thematic Analysis to Generate Themes



Appendix: 6 Transcript Example from the Community of Practice with Participant Quotes Highlighted

		Ok, ok can I can I ask you both then about your experience of when a sort of decision was made to go into hydro was it a, was it a sort of, was it either going to be land or going to be hydro or was it a stepped care approach, was it either going to be one or the other. How were those sort of decisions made and were there any sort of barriers that you could identify that made that decision in the process	
	8	Em on spines it was purely a bonus, complimentary, them receiving hydro never interfered with any of their other physio sessions in terms of timetabling, they didn't not receive the same land based therapy that they would have otherwise had scheduled - it was additional	5
		Ok so expand on this bonus, when you say a bonus what do you mean	
	8	Em so it was don't in the morning so when the vast majority of the 1-1 physio in the gym happened, and then the gym was the afternoon. It kind of did seem a bit like a bonus, because everyone enjoyed it , so it was yes, they could still, some like consideration would be taken into account if physio was happening that afternoon, tiredness, fatigue etc, but it would still be , it was never compromised what was going on in the gym or what was going on in the wards for a hydro session.	
		Right ok, so it was never an either or in your case it was almost sort of a complimentary add on	
	8	Yep	
19.52		Ok – in your experience ????	
	7	It was very the same like it really em just em that hydrotherapy could offer em an alternative approach but they never eh eh the land based, if you want to call it land based physiotherapy interventions, they always remained em paramount really, because em the patient could em utilise those interventions at a time that suited them really in their own time or in and around the time of their physiotherapy session em but hydrotherapy was quite limited, like you could not get it anytime it was more of a complement, complementary	5
		Do you think that was a barrier really to it being utilised, you know this limited, limited availability almost	
	7	Absolutely - yea cause em the patients that I worked with they, they really enjoyed the hydrotherapy sessions and they find that they actually find the hydrotherapy do a lot more than what the land based training was doing, but they just said they would rather have like being doing this every day but like I can only come on a Wednesday and a Friday or something like that (hmm) and I think if they did have more hydrotherapy input, if it was available they yeah they sure might have a different sway	
		You both just mentioned there that patients enjoyed hydro what were the sort of benefits that they reported to you of that experience	

	8	For some in spines the psychological impact feeling slightly post pre injury , it was almost just the feeling I used to swim before I had my injury and now I can still swim was quite a big thing and for sort of more incomplete patients that weren't on their feet, or couldn't be on their feet at the time it, it I found that it just to some extent time off the ward and time doing something normal and not directly em, spending 2-3 months stage at each hospital on a ward or in a gym, I could imagine that almost that ability to get back to something	1 2

Appendix: 7 Patient Consent Form

Community of Practice Consent Form

Project Title: Hydrotherapy – barriers and enablers to evidence based practice.

Name and contact details of Principal Investigator:

Pam Smith

Post Graduate Student
Research Institute for Primary Care and Health Sciences
Keele University, Staffordshire, ST5 5BG

Office: 01782 734889 Email: *p.j.smith2@keele.ac.uk*

Please tick the box if you agree with the statement:

I confirm that I have read and understood the Information Sheet V2 dated 16.6.16 for the above study and have had the opportunity to ask questions. ☐

I understand that my participation is voluntary, that I am free to refuse to answer a question, or withdraw my consent at any time, without giving a reason. ☐

I understand that the Community of Practice (CoP) will be taped and transcribed, and that the tapes will be securely stored in the Research Institute for Primary Care and Health Sciences at Keele University, but will contain no personal identifying information. I also understand that the tapes and transcripts will be kept for a minimum of 10 years and after this time they will be destroyed. ☐

I understand that anonymised transcripts will be archived securely and that transcripts may be re-used by researcher colleagues from the Research Institute for Primary Care and Health Sciences or other research centres in the future. All such information will be fully anonymised. ☐

I agree to allow the CoP data collected to be used for future research projects and to be contacted to participate in future research. ☐

I agree to take part in the above study. ☐

_____	_____	_____
Name of Participant	Date	Signature

_____	_____	_____
Name of Researcher	Date	Signature

Thank you for your help with the research study

If you have any further questions about this study you can telephone the researcher, Pam Smith on 01782 734889 or email p.j.smith2@keele.ac.uk

ID Number: ☐

Appendix: 8 Keele University Ethical Approval

14 July 2016

Ref: ERP1287

Pam Smith
PCHS

Dear Pam

Hydrotherapy - barriers and enablers to evidence based practice

Thank you for submitting your revised application for review. I am pleased to inform you that your application has been approved by the Ethics Review Panel. The following documents have been reviewed and approved by the panel as follows:

Document(s)	Version Number	Date
CoP Invitation Letter	3	13-07-2016
Participant Information Sheet	2	16-06-2016
Consent Form	2	16-06-2016
CoP Schedule and Topic Guide	1	16-06-2016

If the fieldwork goes beyond the date stated in your application, **31st October 2017**, or there are any other amendments to your study you must submit an 'application to amend study' form to the ERP administrator at research.erps@keele.ac.uk stating **ERP1** in the subject line of the e-mail. This form is available via http://www.keele.ac.uk/researchsupport/researchethics/

If you have any queries, please do not hesitate to contact me via the ERP administrator on research.erps@keele.ac.uk stating **ERP1** in the subject line of the e-mail.

Regards

Yours sincerely

pp C H Bonnerman

Dr Jackie Waterfield **Chair – Ethical Review Panel**

CC RI Manager

Supervisor

Directorate of Engagement & Partnerships
T: +44(0)1782 734467

Keele University, Staffordshire ST5 5BG, UK
www.keele.ac.uk +44 (0)1782 732000

28th October 2016

Ref: ERP1287

Dear Pam,

Hydrotherapy - barriers and enablers to evidence based practice

Thank you for submitting your application to amend study, requesting approval to complete an additional community of practice with the original student participants. I am pleased to inform you that your application has been approved by the Ethical Review Panel.

Just to remind you, if the fieldwork goes beyond the **31st October 2017**, or there are any other amendments to your study you must submit an 'application to amend study' form to the ERP administrator at research.erps@keele.ac.uk stating **ERP1** in the subject line of the e-mail. This form is available via http://www.keele.ac.uk/researchsupport/researchethics/

If you have any queries, please do not hesitate to contact me via the ERP administrator on research.erps@keele.ac.uk, stating **ERP1** in the subject line of the e-mail

Regards

Yours sincerely

Dr Jackie Waterfield
Chair – Ethical Review Panel

Appendix 9: CASP questions considered when appraising the quality of randomised controlled trials and systematic reviews

Appendix 9 - CASP questions considered when appraising the randomised controlled trials from the CAT process

	Dundar et al., 2009	Dundar et al., 2014	Epps et al., 2005
Did the trial address a clearly focussed question?	Yes	Yes	Yes
Was the assignment of patients to treatments randomised?	Yes	Yes	Yes
Were patients, health workers and study personnel blinded?	Yes	Yes	Yes
Were the groups similar at the start of the trial?	Yes	Yes	Yes
Aside from the experimental intervention, were the groups treated equally?	No	No	Yes
Were all of the patients who entered the trial properly accounted for at its conclusion?	Yes	Yes	Yes
How large was the treatment effect? (Consider – was primary outcome clearly specified, were results found for each outcome, has selective reporting taken place?)	No	No	No
How precise was the estimate of the treatment effect? (Consider – confidence limits & statistical significance)	Yes	Yes	No
Can the results be applied in your context? (or to the local population?)	No	No	No
Were all clinically important outcomes considered? (Consider – was the need for this trial clearly described?)	Yes	Yes	Yes
Are the benefits worth the harms and costs? (Consider – if not addressed – what do you think?)	Yes	Yes	Yes
CASP judgement	Moderate	Moderate	Moderate

Appendix 9 - CASP questions considered when appraising the systematic reviews from the CAT process

	Al-Qubaeissy et al., 2012	Barker et al., 2014	Bartels et al., 2016	Batterham et al., 2011
Did the review address a clearly focussed question?	Yes	Yes	Yes	Yes
Did the authors look for the right type of papers?	Yes	Yes	Yes	Yes
Do you think all the important, relevant studies were included?	No	No	Yes	No
Did the review's authors do enough to assess the quality of the included studies?	Yes	Yes	Yes	Yes
If the results of the review have been combined, was it reasonable to do so?	Yes	Yes	Yes	Yes
What are the overall results of the review? (Hint - are you clear about the review's results?)	Yes	Yes	Yes	Yes
How precise are the results? (Hint – are confidence intervals given?)	No	Yes	Yes	Yes
Can the results be applied to the local population?	No	No	No	No
Were all important outcomes considered? (Hint – is there other information you would have liked to have seen?)	Yes	Yes	Yes	Yes
Are the benefits worth the harms & costs? (Hint – if not addressed – what do you think?)	Can't tell	Yes	Yes	Can't tell
CASP judgement	Moderate	Good	Good	Moderate