Musculoskeletal conditions and physical activity in Scotland-policy statement

Musculoskeletal conditions such as rheumatoid arthritis, osteoarthritis, back pain and osteoporosis are the leading cause of long-standing illness in Scotland. Arthritis Research UK believes musculoskeletal conditions must become a public health priority in Scotland and that improving levels of physical activity is integral to supporting people to maintain and improve their musculoskeletal health. We recommend that:

1. The Scottish Government should make physical activity a core part of the public health agenda and recognise the barriers that people with musculoskeletal conditions may face in participating in physical activity.
2. The Scottish Government should work with relevant professional bodies to support healthcare and other professionals with the appropriate training needed to promote physical activity so that individuals meet and/or exceed government guidelines on recommended levels of physical activity. This includes training on the provision of personalised advice for people with musculoskeletal conditions that takes into account differing levels of ability and accessibility issues.
3. The Scottish Government should maintain or increase public health spend on physical activity in real terms so that funding is available for physical activity programmes, particularly those evidence-based programmes designed specifically for individuals with musculoskeletal conditions.

For further information please see:
Arthritis Research UK, Musculoskeletal conditions and public health Scotland: policy statement. October 2016
Arthritis Research UK, Physical Activity: policy statement. January 2014
Arthritis Research UK, Providing physical activity for people with musculoskeletal conditions. Publication 2017.

1. Musculoskeletal conditions in Scotland

Musculoskeletal conditions are the leading cause of long standing illness in Scotland.[1] Poor musculoskeletal health often goes hand in hand with other indicators of morbidity such as obesity and mental health issues. Tackling poor musculoskeletal health will in the long-term both improve individual health outcomes and reduce the costs to society.

Key statistics	
Burden of disease	• It is estimated that nearly 700,000 people in Scotland live with osteoarthritis.[2] • It is estimated that 37,000 people in Scotland live with rheumatoid arthritis.[3] • 1 in 5 people in Scotland live with chronic pain[i,4] and 1 in 20 experience severe, disabling chronic pain, with the commonest sites of chronic pain being the back and the joints.[5]
Physical inactivity in Scotland	• Physical inactivity is a leading risk factor for global morbidity and accounts for 5% of disability adjusted life years (DALYs) in the UK.[6] • In Scotland, physical inactivity results in around 2,500 premature deaths each year (equal to seven a day).[7] • Physical inactivity costs the NHS in Scotland around £91 million annually and is the second biggest cause of mortality (joint with smoking, and behind high blood pressure).[8]
Economic impact on health and public health services in Scotland	• The NHS spend on the annual musculoskeletal health budget in Scotland is £353 million.[9] This is the 10th largest NHS Annual Programme Budget in Scotland.[10]

i Chronic pain is defined as "Pain which has persisted beyond normal tissue healing time', generally taken to be three months for non-malignant pain by the International Association for the Study of Pain.

	• In 2013, back pain, neck pain, upper limb problems and other musculoskeletal problems together accounted for the greatest number of working days in the UK lost at 30.6 million days.[11]

2. What is physical activity?

Physical activity can be defined by four characteristics: type, intensity, frequency and duration. It can include 'all forms of activity, such as everyday walking or cycling, active play, work-related activity, active recreation such as working out in a gym, dancing, gardening or playing active games, as well as organised and competitive sport'.[12] It can be classified into intensity levels which directly translate into an energy expenditure.[13] Physical activity intensity can be subject to the amount of effort invested, as well as the physical fitness of an individual. Most activities including an aerobic or cardiovascular component are classified into a higher intensity level, such as moderate or vigorous. These activities typically increase heart beat and breathing, as well as inducing sweat. In addition, physical activity can be quantified in terms of frequency (i.e., the number of times an individual engages in activity over a given period, such as a week) and duration (i.e. the amount of time spent in any given activity per episode, such as 10 or 30 minutes). These components are integral to understanding physical activity patterns and trends at an individual and population level as they relate to health and well-being.

Regular physical activity can reduce the risk of developing many long term conditions including musculoskeletal conditions, stroke, coronary heart disease, type 2 diabetes and some cancers.[14] Even a small increase in physical activity can help minimise the risk of developing a long term condition and improve quality of life.[15] In addition, physical activity is associated with maintaining healthy body weight, improved mood/mental health and reports of higher health-related quality of life.[16]

3. Musculoskeletal health and the benefits of physical activity

Keeping physically active is especially important for musculoskeletal health because it can help strengthen muscles, keep bones healthy and prolong the life of joints, as well as help to maintain a healthy body weight. Physical activity in early life is important because it promotes healthy development of the adult skeleton. Over 90% of adult bone mass is accumulated during childhood and adolescence.[17] Bone strength is one of the most important factors in determining whether a minor injury, such as a fall from a standing height, will lead to a fragility fracture. The positive effects of physical activity on bone development in childhood and adolescence can reduce fracture risk much later in life. In addition, a healthy weight throughout childhood and adolescence which is maintained in adulthood can reduce the risk of knee osteoarthritis.[18]

Physical activity can be beneficial for people with conditions of musculoskeletal pain such as osteoarthritis or low back pain, as well as those who have had a joint replacement. Evidence suggests that activity such as quadriceps strengthening exercises and aerobic walking are effective at reducing pain and disability in people with knee osteoarthritis.[19] For people with inflammatory joint conditions such as rheumatoid arthritis, moderate physical activity can help reduce stiffness and improve range of movement and joint flexibility.[ii] Overall, remaining active is an important part of self-management for people with musculoskeletal conditions and can help reduce pain, disease progression and disability.[iii]

ii In England, NICE clinical guidelines state that specialist physiotherapy services should be available so people with rheumatoid arthritis can learn appropriate exercises and improve their general fitness.
iii In England, NICE clinical guidelines recommend exercise as a core treatment for osteoarthritis (NICE CG 177).
In Scotland, Healthcare Improvement Scotland (HIS) provides access to five types of NICE guidance Multiple Technology Appraisals; Single Technology Appraisals; NICE Interventional Procedures; NICE diagnostics guidance and NICE medical technologies guidance. For clinical guidelines HIS submits comments as a stakeholder on behalf of NHS Scotland.

Additionally, there is a 36% to 68% risk reduction of hip fracture at the highest level of physical activity.[20] Despite the known multiple health benefits, physical inactivity is high among older adults, women, those overweight/obese and those residing in areas of greater socioeconomic deprivation, populations in which musculoskeletal conditions are also commonly found.[21]

A musculoskeletal condition can be a barrier to physical activity due to pain and restriction of movement. People with musculoskeletal conditions may also have differing levels of 'patient activation'. Patient activation is a measure of a person's skills, confidence and knowledge to manage and cope with their health including the motivation to be physically active.[22] However, there are lots of myths around physical activity for people with musculoskeletal conditions such as that it will only make pain and discomfort worse (often due to mobility issues) and that it is always better to rest. People who mistakenly fear that physical activity or work will exacerbate their problem, may be at increased risk of long-term pain and disability.[23] Physical activity programmes are an opportunity to dispel these myths.

Healthcare professionals should be aware of the prevalence of physical inactivity among those with musculoskeletal conditions, as well as the additional barriers to physical activity. Existing guidance provided by the RCGP states that GPs should agree treatment goals and facilitate supported self-management, particularly around pain, function and physical activity'[24]

Healthcare professionals may require further professional development to ensure that they have the knowledge and confidence to advise people effectively. In addition, healthcare professionals may encounter resistance to such advice, so they must be trained on behaviour change techniques on how to motivate and guide individuals to adopt new lifestyle changes to promote increased physical activity levels.

4. The cost and impact of physical inactivity in the UK and in Scotland

Physical inactivity is a leading risk factor for global morbidity and accounts for 5% of disability adjusted life years (DALYs) in the UK.[25] Much of the UK population is at increased risk of developing a long-term musculoskeletal condition (e.g. osteoarthritis) due to their physical inactivity.[26]

Inactive people (*those who do not meet levels set out in the guidelines set out in Annex C*) face serious risks to their health and wellbeing including impacts on their musculoskeletal health. For example, research shows that:

- Low bone density can lead to a higher risk of osteoporosis and result in fractures – up to 50% of hip fractures could be avoided with regular physical activity.[27]
- Inactive employees have double the number of days off work compared with active employees.[28]
- In later life, inactive people lose the basic strength and flexibility for daily activities and so many lose independence to poor mental health.[29]

Data from the Scottish Health Survey 2015 detailed that only 63% of adults aged 16 and over met the current moderate/vigorous physical activity guideline of 150 minutes a week. There has been no significant change to this proportion since 2012. Men were more likely than women to meet the guideline (67% compared to 59%).[30] (For more information see Annex C).

In Scotland, physical inactivity results in around 2,500 premature deaths each year (equal to seven a day).[31] This costs the NHS in Scotland around £91 million annually and is the second biggest cause of mortality (joint with smoking, and behind high blood pressure).[32]

5. Scottish policy on physical activity

For more general information on Scottish public health policy please see Arthritis Research UK, Musculoskeletal conditions and public health in Scotland - policy statement (2016).

Scotland has been a trailblazer when it comes to physical activity policy to improve public health and well-being. It was one of the first countries to introduce a national physical activity strategy: 'Let's Make Scotland More Active' in 2003 which built upon previous work undertaken by the National Physical Activity Taskforce set up by Ministers in 2001.[33] The strategy states that 'the health of two-thirds of the Scottish adult population is now at risk from physical inactivity'[34] and that 'up to 50% of hip fractures could be avoided with regular physical activity'.[35] It sets out an ambition to 'achieve 50% of all adults aged over 16 and 80% of all children aged 16 and under meeting the minimum recommended levels of physical activity by 2022.' The three central recommendations of the strategy are:

- maintaining existing levels of physical activity (ensuring that the trend towards reducing activity levels is reversed);
- increasing activity levels across the entire population; and
- bringing about basic changes in activity levels in specific sections of the population.[36]

The strategy was reviewed in February 2009 and the review found no evidence to suggest that the strategy should be substantially revised.[37] However, the report also concluded that:

"The Government needs to ensure physical activity continues to be a vital component of its public health work and also continues to be integrated into all relevant and related policy, e.g. education, environment, sports, transport".[38]

The Scottish Government invests over £3 million each year on physical activity projects aimed at increasing participation in walking, jogging and sport towards more people meeting the recommended Chief Medical Officer (CMO) physical activity guidelines. The physical activity budget has been maintained at £3.275 million for 2013/14 and 2014/15.[39]

The Scottish Government has a National Performance Framework which currently consists of 55 indicators which enables it to track progress of national outcomes.[40] One of the indicators is increasing the number of adults meeting physical activity recommendations, based on the four UK CMOs' revised activity guidelines of 2011.[41]

Increasing the proportion of the population meeting physical activity levels each year was a key legacy aspiration for the Commonwealth Games and in 2014 the Scottish Government published 'A More Active Scotland: Building a Legacy from the Commonwealth Games'.[42] The central aspiration of the report is that more people will be physically active as a result of interventions by health and care services, resulting in fewer people requiring treatment. It also emphasises the importance of active travel and the built environment as central to improving physical activity (see text box below). The report makes a number of pledges to deliver improved physical activity programmes around five themes:

- Environment
- Workplace setting
- Health and social care
- Education settings
- Sport and active recreation

Key recommendations were:

- The Scottish Government will be an exemplary employer in encouraging staff to be more physically active.
- The National Physical Activity Pathway will be embedded in all appropriate clinical settings across the healthcare system.[43]
- Integrated care services will routinely take account of physical activity.

Integrating physical activity into daily living

Active travel
Active travel means using non-motorised transport to complete a significant part or all of a journey for example from home to work or to school. Evidence suggests that switching active travel for short motor vehicle trips can improve both health outcomes for individuals and reduce costs to the NHS.[44]

Built environment
The built environment can be an important enabler but also barrier to physical activity, particularly in terms of ensuring accessibility for people with musculoskeletal conditions. Research has shown that designing urban environments to be activity-supportive could have large effects on physical activity and help people to achieve meeting guidelines more easily.[45]

NHS Health Scotland's Health Protection Health Services (HPHS) briefing: 'Physical Activity in the Healthcare Setting' (2015) makes the case for brief physical activity interventions in healthcare settings such as hospital outpatient departments. Interventions should be targeted at patients 'who are at risk of certain chronic conditions' and would 'benefit from being more active'[46] (for full list of target groups see Annex D). The briefing also states that health professionals should:

'*Take into account individuals' circumstances, preferences, and barriers to being physically active and health status (for example whether they have a medical condition or a disability).*'[47]

6. How is Arthritis Research UK involved?

We have a long-standing record of working alongside people with arthritis and researchers in Scotland. We are committed to preventing the onset of arthritis, developing a cure for arthritis and transforming the lives of those with arthritis:

- We are currently funding almost £13 million of research, educational projects and training in Scotland.
- We are currently working on a Scottish version of our MSK-Calculator which maps the prevalence of musculoskeletal conditions by local area.[48]
- The MSK-HQ (a questionnaire to evaluate musculoskeletal health) is being piloted by physiotherapists and podiatrists in clinical settings in Scotland.[49]

- We are funding a walking intervention programme called Walk with Ease (developed in the USA by the Arthritis Foundation) specifically designed for people with arthritis and musculoskeletal conditions. It has been shown to be effective in reducing arthritis-related symptoms and improving physical function when delivered in either a group or self-directed format.
- In 2014 we published the report 'Musculoskeletal Health: A public health approach' which has a foreword from the four UK CMOs.[50]
- We funded the development of the ESCAPE (Enabling self-management and coping with arthritic pain through exercise) programme and are promoting its uptake in Scotland (for more information see Annex B Case Study).

7. Recommendations

National Level

We recommend that:

1. The Scottish Government should make physical activity a core part of the public health agenda and recognise the barriers that people with musculoskeletal conditions may face in participating in physical activity.
2. The Scottish Government should work with relevant professional bodies to support healthcare and other professionals with the appropriate training needed to promote physical activity so that individuals meet and/or exceed government guidelines on recommended levels of physical activity. This includes training on the provision of personalised advice for people with musculoskeletal conditions that takes into account differing levels of ability and accessibility issues.
3. The Scottish Government should maintain or increase public health spend on physical activity in real terms so that funding is available for physical activity programmes, particularly those evidence-based programmes designed specifically for individuals with musculoskeletal conditions.
4. To support local communities to promote active travel in the community.
5. To support local communities to design the built environment to facilitate and increase physical activity.
6. To collect data on levels of physical activity among those with musculoskeletal conditions.

Local Level

Following the recent integration of adult health and social care services, we recommend that integration authorities:

7. Work with local authorities and healthcare organisations to take into account the impact of musculoskeletal health when designing, implementing and evaluating programmes to target physical inactivity and the barriers to people with musculoskeletal health issues.
8. Include people with musculoskeletal conditions when undertaking a Joint Strategic Needs Assessment of local population health as part of the development of strategic commissioning plans.
9. Signpost individuals with musculoskeletal conditions to appropriate physical activity intervention programmes.
10. Support employers to facilitate active travel and promote physical activity in the workplace as pledged in 'A More Active Scotland'.[51]

Tim Marshall, December 2016

External review:
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8. Annex A: Case Study Vitality

Vitality

Vitality is a quality assured physical activity programme run by NHS Greater Glasgow & Clyde (GG&C) and the local authority. The classes support participants to exercise at a level suitable to their functional abilities. The classes are suitable for people with different physical abilities and medical conditions including stroke, heart conditions multiple sclerosis, osteoporosis and breathing difficulties amongst others.

Vitality replaced previous disease-specific classes which ran within local authorities. These classes were bottle necking and problems arose when participants had multiple conditions, hence why Vitality was developed. A steering group was set up with NHS GG&C professionals and local authority staff to develop a quality assured physical activity programme for participants with long term medical conditions.

The classes are led by highly trained and experienced instructors (as per the Vitality quality assurance framework) who are able to tailor exercises to suit any participant. The exercises performed within the classes are aimed to help participants carry out daily activities more easily.

There are four different classes available for participants to attend which ensure that, if appropriate, participants can progress to the next class and improve further with their health and fitness goals.

There are various ways participants can access Vitality - self referral by completing the Vitality suitability questionnaire; from Primary Care; from Live Active Referral Scheme or direct from NHS Rehab service.

Participants attend the appropriate class at their chosen venue (all local venues now operate Vitality) and attend 15 minutes before the start of their first class. This allows the instructor time to go through their questionnaire and ask any appropriate questions.

Text from the Physical activity and health alliance website:
http://www.paha.org.uk/CaseStudy/vitality

9. Annex B: Case Study ESCAPE

ESCAPE (Enabling self-management and coping with arthritic pain through exercise)

The ESCAPE programme promotes specific exercises self-management and active coping strategies for people with osteoarthritis to reduce both the physical and psychosocial effects of joint pain. Typically the programme lasts for six weeks, delivered by physiotherapists twice a week to small groups. The gym-based exercise sessions last for 30-45 minutes and are designed to increase strength, balance, co-ordination and confidence. The programme is now well-established and is running at a number of sites including hospital outpatient departments, community hospitals and leisure centres.

This programme has been extensively evaluated and shown to reduce pain, improve general quality of life and reduce the depression that affects people with osteoarthritis.[52] Compared to usual outpatient physiotherapy, ESCAPE is more cost-effective,[53] with long-term cost savings (up to 30 months) attributable to lower usage of accident and emergency services, referrals and clinical investigations. Participants report positive experiences, finding that the programme dispels fears that exercise may aggravate joint pain and increases confidence in their ability to use self-managed exercise strategies.[54]

The programme has been rolled out across England and has also been delivered in Ireland. We hope that in the future it will also be used in Scotland.

http://www.escape-pain.org/about-escape/overview

10. Annex C: Guidelines and summary of adult and child activity levels in Scotland as reported in The Scottish Health Survey 2015[55]

In 2011 the Chief Medical Officers of the four UK countries revised physical activity guidelines. (The revisions followed guidance issued by the World Health Organisation and are in line with similar changes made to advice on activity levels in both the USA and Canada). These are as follows:

Age Group	Guidelines (UK wide)
Early years-children under 5 years	• Physical activity should be encouraged from birth, particularly through floor-based play and water-based activities in safe environments. • Children capable of walking unaided should be physically active daily for at least 180 minutes (3 hours), spread throughout the day. • Minimise amount of time spent being sedentary (being restrained or sitting) for extended periods (except time spent sleeping).
Children and young people aged 5 to 18	• Should engage in moderate to vigorous activity for at least 60 minutes and up to several hours every day. • Vigorous activities, including those that strengthen muscles and bones, should be carried out on at least 3 days a week. • Extended periods of sedentary activities should be limited. • Should be active daily.
Adults aged 19-64	• Should engage in at least moderate activity for a minimum of 150 minutes a week (accumulated in bouts of at least 10 minutes) - for example by being active for 30 minutes on five days a week. • Alternatively, 75 minutes of vigorous activity spread across the week will confer similar benefits to 150 minutes of moderate activity (or a combination of moderate and vigorous activity). • Activities that strengthen muscles should be carried out on at least two days a week. • Extended periods of sedentary activities should be limited.
Adults aged 65 and over	• In addition to the guidance for adults aged 19-64, older adults are advised that any amount of physical activity is better than none, and more activity provides greater health benefits. • Older adults at risk of falls should incorporate activities to improve balance and coordination on at least two days a week.

Adult physical activity levels in Scotland

- In 2015, just under two-thirds (63%) of adults met the moderate to vigorous physical activity (MVPA) guidelines. Additionally, 12% of respondents reported some physical activity, 5% reported low levels, and 21% reported very low levels.
- Men were significantly more likely than women to meet the guidelines on physical activity in 2015 (67% compared with 59%), as in previous survey years.
- Just over a quarter (26%) of adults met both the MVPA and muscle strengthening guidelines, with men being significantly more likely to do so than women (29% compared with 24%).

- The proportion of adults meeting both guidelines decreased with age, from 42% of those aged 16-24 to 7% of those aged 75 and over.
- Adults spent an average of 5.2 hours being sedentary on weekdays and 5.9 hours on weekend days, excluding time at work.

Child physical activity levels in Scotland

- In 2015, just under three-quarters (73%) of children met the guideline on physical activity (including school-based activity), a similar proportion to that seen in 2008 (71%).
- Boys (77%) were more likely to meet the guideline than girls (69%).
- The proportion of children meeting the guideline in 2012-2015 was significantly higher if their mother was active at the recommended level than if their mother was not. There was no significant difference according to whether their father met the recommendations or not.
- Around two-thirds (68%) of children had participated in sport in the prior week, a similar level to 2014 (67%) but lower than in 2008 (71%).
- Sports participation levels were comparable for boys (69%) and girls (66%).
- Children were sedentary for an average of 3.3 hours on weekdays and 4.5 hours on weekend days, excluding time at school or nursery.

11. Annex D: Health Protection Health Services (HPHS) physical activity briefing (2015)[56]

Target groups in the healthcare setting

There are four key patient groups identified where physical activity can help in the prevention or treatment of disease:

• Inactive patients – individuals who do not meet the current physical activity recommendations, or are sedentary but have no recognised health issues, have the most to gain from becoming moderately active. The majority of the population comes into contact with the healthcare service at some stage, which provides an opportunity to identify those who are inactive and to promote activity.

• Prevention for those at a higher risk of chronic illness – includes those who have one or more risk factors for chronic disease such as high blood pressure, cholesterol and overweight and who may not be meeting the recommended levels of physical activity.

• People with chronic illness – increasing physical activity can often reduce or replace the need for drug-based treatment and can have other positive benefits such as sustaining a healthy weight and increasing mental wellbeing.

• Older adults – those who are currently mobile and independent can benefit considerably by participating in moderate physical activity as well as undertaking balance and strengthening exercises. Elderly individuals with less mobility and independence can also benefit by participating in carefully designed exercises in group sessions in care homes or other accommodation.

1 The Scottish Government (2016). A National Clinical Strategy for Scotland. http://www.gov.scot/Resource/0049/00494144.pdf
2 Arthritis Research UK (2017) MSK Calculator data
3 Arthritis Research UK (2017) MSK Calculator data
4 International Association for the Study of Pain. Classification of Chronic Pain, Second Edition (Revised). http://www.iasp-pain.org/PublicationsNews/Content.aspx?ItemNumber=1673&navItemNumber=677
5 Smith B (2016). Chronic Pain in Scotland: Highlighting the need for chronic pain services in 2016 and beyond. http://chronicpainscotland.org/wp-content/uploads/2016/05/Chronic-Pain-in-Scotland-v1-4-Briefing-and-Background-Paper.pdf
6 Murray C J et al. (2013). UK Health Performance: Findings of the Global Burden of Disease Study 2010. Lancet 381(9871): 997-1020.
7 The Scottish Government (2014). A More Active Scotland (Building A Legacy from the Commonwealth Games) http://www.gov.scot/Resource/0044/00444577.pdf
8 The Scottish Government (2014). A More Active Scotland (Building A Legacy from the Commonwealth Games) http://www.gov.scot/Resource/0044/00444577.pdf
9 The Scottish Government (2015). programme budgeting data http://www.gov.scot/Publications/2015/08/4735/4
10 The Scottish Government (2015. programme budgeting data http://www.gov.scot/Publications/2015/08/4735/4
11 Office of National Statistics (2014). Full report: Sickness Absence in the Labour Market, February 2014
12 Department of Health (2011). Start Active, Stay Active: a report on physical activity from the four home countries' Chief Medical Officers.
13 Ainsworth, B. E, et al (2000). Compendium of physical activities: an update of activity codes and MET intensities. Med. Sci. Sports Exerc., Vol. 32, No. 9, Suppl., pp. S498-S516, 2000 http://www.juststand.org/portals/3/literature/compendium-of-physical-activities.pdf
14 Department of Health (2015). Physical activity infographic.
15 Lee IM et al (2012). Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet Volume 380, No. 9838, p219–229
16 Austin et al (2011). Association between adherence to physical activity guidelines and health-related quality of life among individuals with physician-diagnosed arthritis Quality of Life Research 21(8):1347-57 https://www.researchgate.net/publication/51753000_Association_between_adherence_to_physical_activity_guidelines_and_health-related_quality_of_life_among_individuals_with_physician-diagnosed_arthritis
17 Heaney RP et al (2000). Peak bone mass. Osteoporosis Int 11(12): 984-1009
18 Wills AK et al (2011). Life course body mass index and risk of knee osteoarthritis at the age of 53 years: evidence from the 1946 British birth cohort study. See comment in PubMed Commons below Ann Rheum Dis. 2012 May;71(5):655-60. doi: 10.1136/ard.2011.154021. Epub.
19 E Roddy, W Zhang and M Doherty (2005). Aerobic walking or strengthening exercise for osteoarthritis of the knee? A systematic review, Ann Rheum Dis 64: 544-8.
20 Department of Health (2011). Start Active, Stay Active: a report on physical activity from the four home countries' Chief Medical Officers.
21 Martin et al (2014). Patterns of leisure-time physical activity in a British birth cohort at early old age. PLoS One (2014) 9(6): e98901; Changes in daily activity patterns with age in US men and women; National Health and Nutrition Examination Survey 2003-04 and 2005-06. J Am Geriatr Soc 62(7):1263-71.
22 NHS England (2014). https://www.england.nhs.uk/2014/05/patient-activation/
23 Arthritis Research UK (2014) Musculoskeletal Health, A Public Health Approach
24 Royal College of General Practitioners (2013) e-learning module on musculoskeletal care http://www.rcgp.org.uk/clinicalandresearch/clinical-resources/musculoskeletal-and-rheumatology.aspx
25 Christopher J L Murray et al. (2013), UK health performance: findings of the Global Burden of Disease Study 2010, Lancet 381:9871, 9971020.
26 Holth HS et al (2008). Physical inactivity is associated with chronic musculoskeletal complaints 11 years later: results from the Nord-Trondelag Health Study. BMC Musculoskelet Disord 9159
27 The Scottish Government (2003). Let's Make Scotland More Active http://www.gov.scot/Resource/Doc/47032/0017726.pdf
28 The Scottish Government (2003). Let's Make Scotland More Active http://www.gov.scot/Resource/Doc/47032/0017726.pdf
29 The Scottish Government (2003). Let's Make Scotland More Active http://www.gov.scot/Resource/Doc/47032/0017726.pdf
30 The Scottish Government (2016) The Scottish Health Survey 2015 http://www.gov.scot/Resource/0050/00505798.pdf
31 The Scottish Government (2014). A More Active Scotland (Building A Legacy from the Commonwealth Games) http://www.gov.scot/Resource/0044/00444577.pdf
32 The Scottish Government (2014). A More Active Scotland (Building A Legacy from the Commonwealth Games) http://www.gov.scot/Resource/0044/00444577.pdf
33 The Scottish Government (2003). Let's Make Scotland More Active http://www.gov.scot/Resource/Doc/47032/0017726.pdf
34 The Scottish Government (2003). Let's Make Scotland More Active http://www.gov.scot/Resource/Doc/47032/0017726.pdf
35 The Scottish Government (2003). Let's Make Scotland More Active http://www.gov.scot/Resource/Doc/47032/0017726.pdf
36 The Scottish Government (2003). Let's Make Scotland More Active http://www.gov.scot/Resource/Doc/47032/0017726.pdf
37 The Scottish Government (2009). Five-year review of 'Let's Make Scotland More Active' – A strategy for physical activity http://www.healthscotland.com/uploads/documents/1150-HS%20PA%205yr%20Review%20Final.pdf
38 The Scottish Government (2009). Five-year review of 'Let's Make Scotland More Active' – A strategy for physical activity http://www.healthscotland.com/uploads/documents/1150-HS%20PA%205yr%20Review%20Final.pdf
39 The Scottish Government (2014) http://www.gov.scot/Topics/ArtsCultureSport/Sport/MajorEvents/Glasgow-2014/Commonwealth-games/Indicators/PAIP
40 http://www.gov.scot/About/Performance/scotPerforms/indicator/physicalactivity
41 Department of Health (2011), Start Active, Stay Active: a report on physical activity from the four home countries' Chief Medical Officers.
42 The Scottish Government (2009). Five-year review of 'Let's Make Scotland More Active' – A strategy for physical activity http://www.healthscotland.com/uploads/documents/1150-HS%20PA%205yr%20Review%20Final.pdf
43 NHS Health Scotland (2014). Physical activity pathway factsheet http://www.healthscotland.com/uploads/documents/21759-PhysicalActivityPathwayForSecondaryCare_1.pdf
44 Public Health England (2016). Working Together to Promote Active Travel A briefing for local authorities

45 Sallis et al (2016). Physical activity in relation to urban environments in 14 cities worldwide: a cross-sectional study, Lancet 28;387(10034):2207-17
46 Physical Activity HPHS Briefing (2015) http://www.healthscotland.com/uploads/documents/5409-HPHS%20Physical%20Activity%20Briefing%2008-16.pdf
47 Physical Activity HPHS Briefing (2015) http://www.healthscotland.com/uploads/documents/5409-HPHS%20Physical%20Activity%20Briefing%2008-16.pdf
48 http://www.arthritisresearchuk.org/policy-and-public-affairs/policy-priorities-and-projects/musculosketal-health-services/the-musculoskeletal-calculator.aspx
49 http://www.arthritisresearchuk.org/policy-and-public-affairs/policy-priorities-and-projects/musculosketal-healthservices/musculoskeletal-health-questionnaire.aspx
50 Arthritis Research UK (2014) Musculoskeletal Health, A Public Health Approach
51 The Scottish Government (2014). A More Active Scotland (Building A Legacy from the Commonwealth Games) http://www.gov.scot/Resource/0044/00444577.pdf
52 Hurley Met al (2007). Clinical effectiveness of a rehabilitation program integrating exercise, self-management, and active coping strategies for chronic knee pain: a cluster randomized trial. Arthritis Rheum 2007; 57(7):1211-1219.
53 Hurley M et al. (2012). Long-term outcomes and costs of an integrated rehabilitation program for chronic knee pain: a pragmatic, cluster randomized, controlled trial. Arthritis Care Res (Hoboken) 2012; 64(2):238-247.
54 Hurley M et al.(2010). Health beliefs before and after participation on an exercised-based rehabilitation programme for chronic knee pain: doing is believing. BMC Musculoskelet Disord 2010; 11:31
55 The Scottish Government (2016) The Scottish Health Survey 2015
56 Physical Activity HPHS Briefing (2015) http://www.healthscotland.com/uploads/documents/5409-HPHS%20Physical%20Activity%20Briefing%2008-16.pdf