Full title: Health professionals' perceptions of the effects of exercise on joint health in rheumatoid arthritis patients

Short title: HPs' perceptions of exercise on joint health in RA

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Abstract

Objectives. Although exercise is an important factor in the management of RA, research indicates patients perceive that health professionals (HPs) are uncertain about the place of exercise in treatment and its relationship to joint damage. This study investigated perceptions of HPs regarding the effects of exercise on joint health in RA patients.

Methods. A questionnaire investigating perceptions of exercise and joint health was distributed via professional networks and websites. Confirmatory factor analysis (CFA) was used to analyze questionnaire data and develop a focus group interview guide. Focus groups were conducted with multi-disciplinary teams (MDTs) of rheumatology HPs and analysed using framework analysis.

Results. 137 rheumatology HPs (95 female; 27-65 years) completed questionnaires. CFA showed that a 4-factor model provided a marginally acceptable fit. Analysis of four focus groups (n=24; 19 female; 30-60 years) identified five themes relating to HPs perceptions of exercise and joint health in RA patients: **'**Exercise is beneficial', 'Concerns about damage to joints', 'Patients have barriers to exercise', 'HP knowledge differs' and 'Patients may think service delivery is vague'.

Conclusions. HPs were highly aware of the benefits and importance of exercise for RA patients. However, to remove the patient perception that HPs lack certainty and clarity regarding exercise it is important to ensure: 1) consistent promotion of exercise across the whole MDT; 2) clear provision of information regarding rest, joint protection, and exercise; 3) HP education to ensure consistent, accurate knowledge, and understanding of the potential for conflicting advice when promoting exercise as part of an MDT.

Introduction

A large body of research has confirmed the positive effects of exercise in the management of RA (e.g. de Jong et al., 2005; Ekblom et al., 1975; Hakkinen et al., 2001; Hakkinen et al., 2003; Hakkinen et al., 2005; Lemmey et al., 2009; van den Ende et al., 2000) in terms of increased muscle force, aerobic capacity, functional ability and an increased sense of well-being (Guidelines for the management of rheumatoid arthritis, 2002). Despite the benefits of physical activity, RA patients are not as active (Sokka et al., 2008; van den Berg et al., 2007) and are less fit (Ekdahl et al., 1992) than the general population. This is associated with negative outcomes of a sedentary lifestyle such as increased cardiovascular disease (Bacon et al., 2001), for which RA is an independent risk factor (Warrington et al., 2005).

In addition to the barriers to exercise within the general population (Trost et al., 2002), RA patients have further considerations such as pain (Wilcox et al., 2006), uncertainty as to the type of exercise to do to avoid harm or injury (Lambert et al., 2000) and concerns that exercise damages joints (Law et al., 2010; Law et al., 2013). Concern regarding the effects of exercise on joints is not purely patient driven. Research has questioned the safety of high-intensity weight-bearing exercises for RA patients (de Jong et al., 2003; Munneke et al., 2005). However, more recent research has reinforced that these exercises are safe and effective in this population (de Jong et al., 2009; Hakkinen et al., 2001; Hakkinen et al., 2004).

Law and colleagues (2010; 2013) investigated patient perceptions of the effects of exercise on joint health and concluded that RA patients perceived that HPs lacked certainty and clarity regarding specific exercise prescriptions and the effects on joint health. This is significant as RA patients value information given by their HPs (Lambert et al., 2000) and also expect HPs to be experts in rheumatology (Ahlmen et al., 2005). Other research into HPs' perceptions of exercise has established that HPs believe exercise to be important for RA patients (Hurkmans et al., 2011). Moreover, rheumatologists and physiotherapists have been found to have more positive expectations of conventional exercise (e.g., range of movement) programs than of high-intensity exercise (e.g., aerobic) programs (Munneke et al., 2004). Additionally, discussions concerning exercise between rheumatologists and patients were more likely to occur when the rheumatologist believed exercise was useful in the management of RA (Iversen et al., 1999).

Although current research has focused on HPs' perceptions relating to exercise in RA, seemingly no studies have investigated HPs' perceptions relating to exercise and joint health. As such, the current study aims to investigate this important area.

Participants, methods and analysis

A mixed-methods study was employed involving a quantitative questionnaire survey followed by qualitative focus groups with rheumatology HPs. Ethics approval was granted by the local NHS research ethics committee (09/WNo01/17) and the relevant University ethics committee. Written consent was not obtained for the questionnaire survey as completion of the questionnaire was taken to imply consent.

Questionnaire recruitment

Questionnaires were distributed via a number of methods to HPs whose patients included individuals with RA. Professional network groups in the UK (North West England, Scotland and Wales) facilitated invitations by sending a link to the questionnaire to their members. The questionnaire was posted on the British Society for Rheumatology (BSR) and British Health Professionals in Rheumatology (BHPR) websites. Links to the questionnaire were also sent to associated practitioners with whom the researchers had links, to distribute among their MDTs. Finally, the BSR handbook was used to identify rheumatology HPs. Questionnaires were sent out to a total of 807 rheumatology HPs.

Questionnaire development and administration

The questionnaire was adapted from that used by Law et al. (2013) and included a demographic section, a section regarding participants' thoughts about exercise and RA patients' joint health with responses on a 1 (Strongly Disagree) to 5 (Strongly Agree) Likert-type scale, and the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003). The IPAQ assesses physical activity and requires participants to report the estimated time spent sitting, walking, and performing moderate and vigorous activities over the past seven days. It then classifies responses into the categories low, moderate or high levels of physical activity (Craig et al., 2003). The questionnaire was piloted by rheumatology HPs (n=8) from the local NHS hospital. Word meanings were discussed and edited, and unnecessary questions were removed. The finalized questionnaire was uploaded onto an online survey system (Bristol Online Surveys) and was available for four months.

Questionnaire data analysis

Negatively worded items were reverse scored and confirmatory factor analysis (CFA) was conducted using LISREL (version 8.5) on the exercise and joint health section. This method of factor analysis uses an *a priori*-specified model and examines whether the data collected confirm the specified model (Schumacker and Lomax, 2004). The hypothesized model was based on the 5-factor model (1) health professionals showing a lack of exercise knowledge; 2) not knowing what exercise should be done; 3) worry about causing harm to joints; 4) not wanting to exercise as joints hurt; and 5) having to exercise because it is helpful) identified by Law and colleagues (2010), with the wording adapted to reflect HPs rather than RA patients. Fit was assessed using Satorra-Bentler χ^2 (Hu and Bentler, 1999), the comparative fit index (CFI $\geq$ 0.95; Schreiber et al., 2006), the root mean squared error of approximation (RMSEA; $\leq$ 0.06; Hu and Bentler, 1999) and the standardized root mean square residual (SRMR; < 0.08; Hu and Bentler, 1999) and using previously described methods (Law et al., 2010), a model with the best fit was established. Mean responses to items within each theme were calculated and further data analysis was conducted using Excel and SPSS (version 17.0).

Focus group guide development

Results from the questionnaire were used in the development of the focus group guide (Figure 1). Following a brief introduction (Litosseliti, 2003) and a discussion regarding the definition of exercise, three main questions were asked: (i) What are your thoughts about exercise and joint health in your RA patients? (ii) What do you tell your RA patients about exercise? (iii) What do you think about the following quote: 'RA HPs perceive that exercise is beneficial for their RA patients and are confident in their knowledge and ability to prescribe effective exercises, however, RA patients perceive that HPs lack certainty and clarity regarding exercise and joint health'. The focus group guide also included a number of prompts pertaining to each of the questions.

Focus group recruitment and administration

Invitations to take part in moderated focus groups were sent via professional links. Moderated focus groups took place at four hospitals in North Wales and North West England, each lasting ~1½ hours and containing 5-7 rheumatology HPs. A purposive sampling strategy was used to create groups of HPs

who fulfilled a range of MDT roles including rheumatologists, physiotherapists, occupational therapists and nurse specialists. Each focus group was conducted by S.H. and R-J.L. according to the focus group guide and was audio-recorded.

Focus group data analysis

Focus group data were anonymized and transcribed verbatim. Data were analyzed according to the principles of framework analysis (Richie and Spencer, 1994; Richie et al., 2003) which employs use of an *a priori* 'framework' therefore utilizing information such as previous research (e.g. Law et al., 2010) to deduce findings from current data (Barnett-Page and Thomas, 2009). Transcripts were analyzed independently by S.H. and J.T. and subsequent discussions identified the thematic network. S.H. then independently conducted the indexing and charting stages of analysis, after which final discussions with J.T. and R-J.L. identified constructs and themes to form the analytical model.

Results

Questionnaire results

137 HPs responded to the questionnaire (17% response rate). Physical activity classification from the IPAQ was found to have no effect on questionnaire responses ($p>0.05$). Respondents' characteristics are detailed in Table 1.

During data interrogation, 4 poorly performing items (factor loadings < 0.4) were removed, and two factors were collapsed (1) health professionals showing a lack of exercise knowledge; 2) health professionals not knowing what exercise should be recommended). The final 36-item, 4-factor model represented a marginally acceptable fit (Table 2). HP responses to items within each factor were explored. Most HPs disagreed with items within factors 1-3: HPs showing a lack of exercise knowledge' (78%), 'Worry about causing harm to joints' (86%) and 'Not wanting to recommend exercise as patients are in pain' (90%). Only 3% of participants disagreed with items within factor 4 'Having to recommend exercise because it is helpful', while 34% neither agreed nor disagreed.

Focus group results

Four moderated focus groups were held involving 24 participants in total. Participant characteristics are detailed in Table 1. Twenty five constructs each linking to one of five themes were identified, all relating to HPs perceptions of exercise and joint health in RA patients (Figure 2). The following five themes were identified: **'**Exercise is beneficial', 'Concerns and clarity about damage to joints', 'Patients have barriers to exercise', 'Health professional knowledge differs' and 'Patients may think service delivery is vague', and are summarized below with participant quotes provided. Participants have been identified by professional group, age and years of experience e.g. [Physiotherapist; age 43 years; 13 years of experience].

Exercise is beneficial

This theme reflected HPs' beliefs that exercise is a vitally important element in RA treatment and management. Exercise was seen as beneficial for all RA patients and had long-term advantages. The psychological and physical effects of exercise were highlighted as being advantageous, explicitly for RA patients in relation to joint health and muscle wasting.

> "From a professional point of view, as doctors and nurses and physio's, occupational therapists (OT's) treating these patients definitely our point is exercise is very important, an integral part of the treatment and management." [Rheumatologist;55;17]
>
> "[…] also psychologically they feel a lot happier and healthier if they continue to exercise and be active." [Nurse;58;9]
>
> "[…] the effect of exercise on the synovium itself and the fact that you're improving the fluid to the joint and you're improving the way the joint itself works and improving the blood supply to it." [Physiotherapist;43;13]

Patients have barriers to exercise

This theme reflected HP awareness of the difficulties facing RA patients in relation to exercise. Pain and fatigue were highlighted as major barriers for RA patients. General barriers to participation were discussed such as time, access, cultural and socioeconomic factors, and factors relating to confidence and body image. The combination of general barriers to exercise participation plus specific RA barriers meant

that some HPs felt that during some consultations it was more productive to discuss other aspects of patient care, as exercise promotion would not be effective.

"Their two main obstacles are pain and fatigue normally." [Rheumatologist;44;16]

"[…] I don't think that people exercise generally anyway and if you've got a disease and pain, I think it's even harder to kind of motivate yourself." [Rheumatologist;44;16]

"No matter how much you know and how much you advise you hit brick wall because it's just not part of their lifestyle." [Nurse;51;15]

"[…] when they are so bad, their confined like acute flare bad, there is no point talking about exercise." [Rheumatologist;age not collected;16]

Despite the difficulties however, HPs discussed a variety of ways of combating barriers to exercise by encouraging the use of painkillers prior to exercise, fitting exercise into patients' daily routines and encouraging realistic goal setting. Additionally, HPs aimed to ensure exercise was a positive experience by encouraging exercises that patients enjoy, and also suggesting opportunities for encouragement and support.

"[…] ideally you want the exercise experience to be a positive experience" [Rheumatologist;30;3]

"[…] hydro is the big seller […] because it's warm, it's nice, it's lovely, it's social you know and its great and they do tend to continue with that." [Physiotherapist;43;13]

"I think also teaching them about the use of analgesia and anti-inflammatory drugs prior to exercise." [Nurse;age and years of experience not collected]

Concerns about damage to joints

This theme demonstrates that HPs were aware that patients have concerns about exercise and joint health. Relating to patient concerns, HPs stressed the importance of patient education. This included education about pain, the disease itself, especially the difference between OA and RA, and how to exercise effectively using correct techniques and pacing.

"I think a lot of patients are quite worried when you talk about exercise because they think it's actually going to damage their joints." [OT;52;8]

"[…] educating them why we are doing it [exercise] is so important." [Physiotherapist;36;8]

"I would say just because you have pain it does not mean that you are damaging your joints." [Rheumatologist;44;16]

"Well it is the classic isn't "I'm going to wear my joints" out even though they have got an inflammatory arthritis […] you have to go back to the basics then and talk to them about the fact that this isn't a wear and tear problem this is an inflammatory problem." [Physiotherapist;56;28]

"It's about getting them to understand that they can actually break up those sessions and still do their thirty minutes but they can do it in ten minute breaks rather than in one go if they are fatigued." [Nurse;51;15]

Although HP knowledge of the topic was highlighted, suggesting that they perceived that exercise does not cause damage, some concerns were explicitly expressed by HPs about exercise leading to joint damage, and there were other comments that could be interpreted as suggesting certain exercises caused damage.

"If it makes you feel better then carry on doing it [exercise] as long as it's not you know heavy weight bearing exercise that might cause damage." [Nurse;age and years of experience not collected]

"I think quite often we get them to exercise in water […] it is one way they can get more mobility and not do anymore damage to their joints." [Physiotherapist;57;18]

"[…] some of them [non-specific rheumatology HPs] may say "exercise through a flare", and you know you might be causing more joint damage." [Physiotherapist;39;15]

"They're worried about causing more damage so it's just getting that across to them that as long as they are doing it [exercises] properly […] then it shouldn't cause any damage." [OT;51;32]

Health professional knowledge differs

HPs perceived themselves to be knowledgeable in relation to exercise. However, it was acknowledged that members of the MDT all have different and specific roles (a concise account of specific

roles based on transcribed quotes from focus groups is available in Table 3). Furthermore, it was felt that HPs without specific expertise in rheumatology may inadvertently cause confusion to patients because of their lack of disease specific knowledge.

> "And sometimes I have directed people towards local leisure centres and the feedback has been that the people there have actually been advising them not to do too much […] because they don't know enough about arthritis." [Nurse;51;15]
>
> "[…] you've got other musculoskeletal physio's who don't [just treat RA patients] and they may not know the ins and outs of RA." [Physiotherapist;39;15]

Exercise was also seen as a complex topic. Here it was suggested that relaying information to patients was difficult without a solid evidence base. It was also suggested that advice regarding the importance of rest and joint protection from some HPs was likely to be perceived by patients as conflicting with advice about exercise, therefore causing patient confusion. Furthermore, it was acknowledged that in some patient groups, such as younger patients, patients with joint deformities, and those with specific personal goals were harder to prescribe for and discuss exercise with.

> "I think for a long time there wasn't a great deal of research to say whether exercise and load-bearing exercise was beneficial or detrimental to joints […] I think the difficulty is when you haven't got a solid evidence base for you to work on, it's quite hard for you to then pass on [information] to the patients themselves as to what is safe." [Physiotherapist;43;13]
>
> "The reason they [patients] often say they are not sure is because on one hand you're telling them to exercise and on the other you're telling them to rest…" [OT;51;32]
>
> "What they are used to is us prescribing medicines which are very clear about take one twice a day, take one three times a day […] and it's this where I think they may find the lack of clarity, coming from the fact that it [exercise] is individual." [Nurse;51;15]
>
> "When you have got somebody […] you know deformed hands, shoulders are stuck, and knees are quite damaged. I think those are the people you need to be careful with what exercises you give and

that is where I probably won't be as confident and where I will ask the physio's to come in and individually assess and give advice." [Rheumatologist;44;16]

"[…] the breadwinner who has suddenly been out of work, their priority is to get physically fit to go back to work, and they don't see the effort of exercising, that isn't their goal." [Nurse;51;15]

Patients may think service delivery is vague

This theme reflected that HPs understood that exercise prescription in an RA setting was a complicated topic and that this may come across to patients as being vague. This was suggested because HPs currently try to provide individualized exercise programs, meaning that the same advice is not given to all patients, which could be interpreted as a lack of HP certainty.

"If you have got somebody who is elderly, you would treat them differently than you would someone of a younger age." [Nurse;48;9]. "But if you're telling me that, I could perceive that you weren't confident in what you were telling me because you were varying it so much." [Nurse;51;15]

"[…] I also wonder is it because we can't always say that for every patient with rheumatoid arthritis, that this [exercise] is OK for every patient and that this level of exercise is OK for every patient […] so it might sound vague from all of us because it has to be specific for that person." [Physiotherapist;43;13]

"I suppose the more people that you see the more likely you are to feel confused about things because you won't be getting just one message." [Rheumatologist;40;11]

In addition, changes in treatment approaches over time may also cause confusion. Also the pathway of referral could be seen as confusing for a patient, and could come across as a lack of HP knowledge. Despite this, the multidisciplinary process was considered important by HPs as the most effective means of providing care for RA patients. Finally within this theme, HPs highlighted that it was important that patients recognized their responsibility for the management of their disease and general health and well-being, including compliance to exercise routines. This was reinforced by HP attempts to "empower people to take care of themselves" [Nurse;51;15].

"[…] it used to be the other way around, so you had RA and you were put onto rest therapy and there is no doubt as well that for some people that the rest does help their pain. So it's not that I don't believe that exercise is not a very important thing for people with RA, just to bear in mind that people might have heard other things." [Rheumatologist;40;11]

"You need boundaries at the end of the day, I am not a physiotherapist. There are basics that I can tell an individual but it's also important to say to them look we now need to move you on to somebody who can [prescribe specific exercise]." [Nurse;44;15]

"We all know what our roles are and where our levels of expertise are and when to pass backwards and forwards. Now whether that's perceived by the patient that we don't understand something? It's like if I don't understand something about the drugs, it's not that I don't have the certainty and clarity, again it's just not my role, and I would defiantly pass back to who I see the experts are." [Physiotherapist;43;13]

"I think it is everybody's responsibility, it's their responsibility for their general health and well-being. It's not our responsibility." [Rheumatologist;44;16] "But lots of people think it is our responsibility." [Nurse;48;9]

Disconfirming elements and additional concepts and ideas

Although the aim was to represent the overall views of participants, disconfirming elements were highlighted during analysis. For example, in relation to the theme 'Patients may think service delivery is vague', although it was thought that the multidisciplinary approach could come across to patients as confusing it was also seen as useful. It was stated that the multidisciplinary approach "streamlines" patient care therefore increasing patient's awareness of the different aspects which are involved in it. There were also differences in what was suggested to be exercise, for example it was suggested that "exercise doesn't have to be going to the gym, it can be somebody literally getting up and doing the housework or taking the children to school and doing the shopping" [OT;52;8]. Other individuals, sometimes within the same MDT, stated that that was not sufficient and suggested "you need to exercise to the point where you are actually sweating and have had a good workout" [Rheumatologist;44;16] and "it should be additional to your daily activity" [Rheumatologist;55;17]. There were also discussions beyond the scope of this study relating to

methods of encouraging exercise in this population including free prescriptions for exercise for individuals with musculoskeletal disease and buddy systems.

Discussion

HPs' acute awareness of the benefits of exercise for RA patients were articulated in both the survey and focus groups. Similar positive views of exercise for RA patients have previously been observed with rheumatology HPs (Hurkmans et al., 2011; Munneke et al., 2004). HPs were highly aware that RA patients had disease specific barriers to engaging in exercise, such as pain and fatigue, but were additionally affected by barriers influencing the general population, such as cultural factors. In previous research patients highlighted pain as a major barrier to participation in exercise (Law et al., 2010; Wilcox et al., 2006), yet HPs in the current study indicated that they not only understand barriers to exercise but they also actively employ methods to encourage patients to overcome their RA specific barriers, such as education and the use of painkillers prior to exercise. HPs' promotion of patient coping strategies may explain the response to Theme 3 in the questionnaire ('Not wanting to recommend exercise as patients are in pain'), as it may have been perceived that approaches to combating RA patient barriers to exercise are already employed.

Despite HP's generally having positive attitudes towards exercise, and knowledge on the topic of exercise and joint health, they, like patients (Law et al., 2010), also expressed some concerns. Even with the high percentage of questionnaire respondents who strongly disagreed/disagreed with Theme 2 ('Worry about causing harm to joints'), direct and indirect suggestions particularly regarding high-intensity weight-bearing exercise were made suggesting that certain types of exercise could cause damage to joints. This is consistent with other research which found rheumatologists and physiotherapists to have more positive expectations of traditional exercise (e.g., range of movement) programs than of high-intensity exercise (e.g., aerobic) programs (Munneke et al., 2004), and another study (Hurkmans et al., 2011) where only a minority of HPs felt exercise recommendations were 'safe' for RA patients with high disease activity. However, views such as these may be a result of the perceived lack of definitive research relating to the effects of exercise on joint health (de Jong et al., 2003; de Jong et al., 2005; de Jong et al., 2009). As suggested in our focus groups, concerns regarding high-intensity weight-bearing exercise may result in a lack of physical improvements in RA patients, as exercise prescriptions are not of sufficient intensity for patients to adequately benefit. Therefore, as previous research also suggests, it is important to develop HPs' knowledge

of the 'safety' of exercise (Hurkmans et al., 2011). Interestingly, exercise educational development was recently highlighted by the HP community as a relevant area (Lillie et al., 2013) and has been the conclusion of other recent research (Nessen et al., 2014). A suggestion for future development was the provision of training materials specifically on the topic of exercise for HPs, for use in conjunction with or in addition to current education programs (Lillie et al., 2013; Ryan et al., 2013).

Although previous research has indicated that patients felt that HPs lacked exercise knowledge, and certainty and clarity in their exercise recommendations (Law et al., 2010), HPs in the current study strongly disagreed with this and made a number of suggestions for this patient perception. Firstly, it was suggested that patients may not understand exercise advice given by HPs. This was proposed as being due to changes in RA treatment. For example, the former use of immobilization as a safe and effective treatment for RA patients (Partridge and Duthie, 1963) now conflicts with the inclusion of exercise in the current guidelines (Luqmani et al., 2006; Luqmani et al., 2009). Furthermore, the recommendation of both rest and exercise could appear contradictory to patients and was highlighted as an aspect making RA a complex disease to treat and manage for both HPs and patients. These suggestions highlight the importance of HPs acknowledging and addressing the confusion which results from the conflict between the prescription of rest, splints and joint protection on one hand and exercise on the other. Secondly, HPs saw the MDT as effective in RA treatment and management however, it was suggested that patients may perceive the process of referral within the MDT as a lack of HP certainty and clarity in regards to exercise. In addition to referral within the MDT, differences in HP roles across the MDT were highlighted in our focus groups (Table 3), and are consistent with other research (Carr et al., 2001; Cushnagham and McDowell, 2003). This is also congruent with research that found that rheumatologists rated their competence in promoting physical activity to their RA patients as lower than that expressed by clinical nurse specialists or physical therapists. It was suggested that this might be explained by rheumatologists feeling that exercise promotion is more the role of other HPs (Hurkmans et al., 2011). Despite this, low confidence in the promotion of exercise to patients does not appear limited to rheumatologists. In a recent cross-sectional survey into the educational needs of nurses and allied health professionals working with patients with arthritis, 37% of responders did not feel that they had the knowledge or skills to provide RA patients with advice on exercise (Lillie et al., 2013). This is further evidence to support the need for exercise educational development for HPs (Lillie et al., 2013; Nessen et al., 2014; Ryan et al., 2013). This would in turn enable a consistent message regarding

exercise to be promoted across all members within the MDT, which may reduce patient perceptions of lack of HP certainty and clarity. Finally, it was suggested that HPs aim to provide patients with individual exercise prescriptions, although positive in intention, may be perceived as confusing to patients. Individualized exercise has been advocated in research (de Jong et al., 2005), highlighted in current RA guidelines (Luqmani et al., 2006; Luqmani et al., 2009), and has been suggested as a way of improving patient perceptions of exercise (Cooney et al., 2011). It has additionally been stated that because HPs underestimate patients' wish for information about exercise and their ability to cope with it, they do not provide sufficient information, which leads to patient dissatisfaction (Coulter et al., 1999).

There are limitations of the current study, including that one of the participating MDT's had close links to the University. Their association could have provided them with knowledge from experts in the field of exercise research that other groups may not have access to. In addition, it is recognized that the study team are pro-exercise, and as the qualitative findings were not reviewed by anyone external to the research team this is acknowledged as a potential source of bias. Nevertheless, analysis was performed independently by different members of the study team including those not involved in data collection, which is a strength of this work. Finally, the application of these results is limited by the low questionnaire response rate and only including HPs from within an MDT setting.

In conclusion, HPs were highly aware of the benefits of and barriers to RA patients in relation to exercise. The complexity of RA treatment and management was suggested as the cause of patient perceptions that HPs lack certainty and clarity regarding exercise. However, in order to remove these patient perceptions it appears necessary to reinforce previous suggestions (Cooney et al., 2011; Law et al., 2010) that the entire MDT is important in the role of exercise promotion. Alongside consistent promotion of exercise throughout the MDT, it is important that a clear message regarding rest, joint protection, and exercise is provided to patients to avoid the provision of confusing messages. These factors would be supported by exercise educational development for HPs which has also been recommended by other researchers (Lillie et al., 2013; Ryan et al., 2013), and may help to increase HP confidence to provide patients with consistent and accurate information about exercise. This would in turn, reinforce the generally positive beliefs already held by HPs regarding the importance of exercise in an RA population.

Key words

Rheumatoid arthritis, exercise, joint health, health professional perceptions

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Table 1: Characteristics of health professionals who participated in the survey and focus groups

Survey																
		Gender (%)		**Age (years, %)****				**Location (%)**				**IPAQ (%)**			**Years of practice (years, %)***	
	n	**Male**	**Female**	**<30**	**31-45**	**46-60**	**>60**	**England**	**Scotland**	**Wales**	**Other**	**Low**	**Moderate**	**High**	**<5**	**6-15**	**>16**
Rheumatologists	76	46	54	1	42	41	15	75	14	11	0	7	37	57	-	-	-
Nurses	24	8	92	0	38	58	4	54	17	21	8	8	26	67	-	-	-
Physiotherapists	18	17	83	6	44	50	0	67	17	17	0	5	17	78	-	-	-
OTs	10	0	100	0	50	50	0	70	10	20	0	10	40	50	-	-	-
Other HPs	9	22	78	22	33	44	0	89	11	0	0	11	33	56	-	-	-
Total	137	42	95	4	57	63	12	97	20	18	2	10	44	83	-	-	-
Focus group																	
Rheumatologists	5	40	60	0	75	25	0	80	-	20	-	-	-	-	0	20	80
Nurses	8	0	100	0	14	86	0	75	-	25	-	-	-	-	0	86	14
Physiotherapists	5	20	80	0	60	40	0	80	-	20	-	-	-	-	0	60	40
OTs	4	25	75	0	25	75	0	50	-	50	-	-	-	-	25	50	25
Other HPs	2	50	50	0	50	50	0	50	-	50	-	-	-	-	50	0	50
Total	24	5	19	0	9	13	0	17	-	7	-	-	-	-	2	11	10

*One value unspecified; **Three values unspecified

Table 2: Completely standardised factor loadings in the final model of the questionnaire

Item	1	2	3	4
1. As a health professional I am not specific about exactly how to exercise to my RA patients	0.53			
2. As a health professional, I know what exercise to recommend	0.68			
3. As a health professional, I don't know what to tell my RA patients about how exercise affects their joints	0.72			
4. As a health professional I know what to tell my RA patients about exercise	0.76			
5. As a health professional, I have not been able to answer my RA patients questions about exercise	0.62			
6. I know what to tell my RA patients about exercise	0.84			
7. I know which joints I should prescribe exercises for	0.70			
8. I don't know the best sort of exercise to recommend to my RA patients	0.77			
9. I am unsure how much exercise I should prescribe	0.77			
10. I am unsure if it is a good idea to suggest exercise when my RA patient's joints are 'bad'	0.53			
11. I wonder if my RA patients should exercise at all	0.40			
12. I am unsure when to prescribe exercise	0.81			
13. I wonder if it is causing my RA patients damage if it hurts when they exercise		0.73		
14. I worry that exercise causes more damage to my RA patient's joints		0.82		
15. I am concerned that by prescribing exercise, it will add to damage that has already been caused by RA		0.63		
16. I feel people with RA should be careful with repetitive movements		0.43		
17. I worry that by prescribing exercise it will cause harm to my RA patient's joints		0.56		
18. I would not consider prescribing exercise to my RA patients if their joints are hurting			0.51	
19. I don't think my RA patients should exercise when they are in pain			0.48	
20. The amount of pain an RA patient is experiencing affects whether I think I should prescribe exercise or not			0.52	
21. If my RA patient's joints hurt I don't think they should exercise			0.71	
22. I don't think I should suggest exercise because I know my RA patients joints will hurt immediately afterwards			0.37	
23. The amount of pain my RA patients are in affects whether I suggest they exercise or not			0.52	
24. I don't think I should prescribe exercise because I think my RA patients joints will hurt the day afterwards			0.52	
25. I feel exercise is helpful for the joint health of my RA patients				0.66
26. Exercise helps to keep my RA patients joints moving				0.68
27. I worry that my RA patient's joint function will get worse if I don't prescribe exercise				0.46
28. I feel my RA patient's joints need exercise				0.64
29. I feel that if my RA patients keep mobile through exercising, they will have less pain in their joints				0.60
30. I worry that my RA patients will end up disabled if I don't prescribe exercise				0.58
31. I feel that if my RA patient's keep their muscles strong by exercising it helps to take the weight off the joint				0.40
32. I feel exercise makes my RA patients joints stronger				0.63
33. I feel exercise relieves my RA patient's joint pain				0.66
34. I feel that exercise does not help improve my RA patient's joint function				0.57
35. I believe my RA patient's need to use their joints to keep them working				0.76
36. Exercise prevents my RA patient's joints seizing up				0.66

Satorra-Bentler χ^2=863.04*; Comparative fit index=0.93; Root mean square error of approximation=0.058; Standardized root mean square residual=0.94; *=$p < 0.01$

1=Health professionals showing a lack of exercise knowledge; 2=Worry about causing harm to joints; 3=Not wanting to recommend exercise as patients are in pain; 4=Having to exercise because it is helpful

Table 3: Example quotes from health professionals describing the important elements of the different health professional roles

Health professional	Role definition
Consultant Rheumatologist	➢ 'As a consultant I emphasize the importance and benefits of exercise to RA patients' ➢ 'If the topic of exercise comes up I am happy to discuss it with a patient but I don't think it is our role to prescribe exercise' ➢ 'I tend to give general rather than specific exercise advice' ➢ 'We have time constraints' ➢ 'It is rare that patients ask us about exercise' ➢ 'We only see patients that are unwell'
Rheumatology Nurses	➢ 'We promote exercise importance and explain the advantages of taking part in exercise' ➢ 'I teach RA patients about their medications and introduce the concept of exercise' ➢ 'I refer to physiotherapists for specific advice but do suggest exercises and suggest graded exercise and things like cycling and swimming' ➢ 'Exercise is higher priority for us than for consultants but not as high as for a physiotherapist'
Physiotherapists	➢ 'Patients do ask us about exercise and sometimes they are very keen' ➢ 'I give specific exercise advice to RA patients' ➢ 'Exercise promotion is a vital part of our role' ➢ 'RA patients that come into our department would always leave with some kind of home exercise program' ➢ 'Individualized and graded exercise is recommended which must be realistic for the patient'
Occupational Therapists	➢ 'We discuss joint protection with patients' ➢ 'I am specific in the exercise advice I give to my RA patients' ➢ 'We try and fit exercise around an individual's activities of daily living' ➢ 'We recommend individualized and graded exercise'

1. INTRODUCTION
Tell us your name and for how long and in what capacity you have been working with patients with RA. Also how active you consider yourself to be?

2. INTRODUCTORY EXERCISE
How do you define exercise?

3. KEY QUESTIONS
What are your thoughts about exercise and joint health in your RA patients?
Prompts: How do you feel exercise affects your RA patient's joints?
What specific advantages/disadvantages do you feel exercise has for your RA patient's joints?
Are prescriptions different for different patients?
Tell us about your perceptions of your RA patients exercise behaviour?
How do your thoughts about exercise affect your exercise prescription?
How do your thoughts about your joints affect your exercise prescription?

What do you tell your RA patients about exercise?
Prompts: Do you specify times, intensities and durations? (FITT)
What types of exercise do you prescribe-aerobic/anaerobic/high intensity?
Is this the same during flares?
Is this the same if it is/is not control by drugs?
If you do not tell your RA patients about exercise; why not? And what else (if anything) do you suggest helps?

Does your exercise prescription depend on any of the following?
- Areas that are affected by RA?
- The patients stage of treatment
- The extent of joint damage
- Disease activity
- Joints affected
- Individual specific considerations e.g. affected by social situation

What specific exercises do you suggest?

What do you think about the following quote based on research looking at RA patient and health professional (HP) perceptions about exercise and joint health?
'*RA HP's perceive that exercise is beneficial for their RA patients and are confident in their knowledge and ability to prescribe effective exercises. However, RA patients perceive that HP lack certainty and clarity regarding exercise and joint health'.*
Prompts: Why the discrepancy between HP's beliefs self-reported actions and patients perceptions?
Do you ask advice?
Where do you get exercise information from?
What is best practice?
Are there any limitations to the provision of best practice?

4. ENDING QUESTIONS
Is there anything you would like to add/anything we have missed?

5. ASSISTANT MODERATOR SUMMARY
Is this an adequate summary? Has anything been missed/misinterpreted?

Figure 1: Focus group topic guide

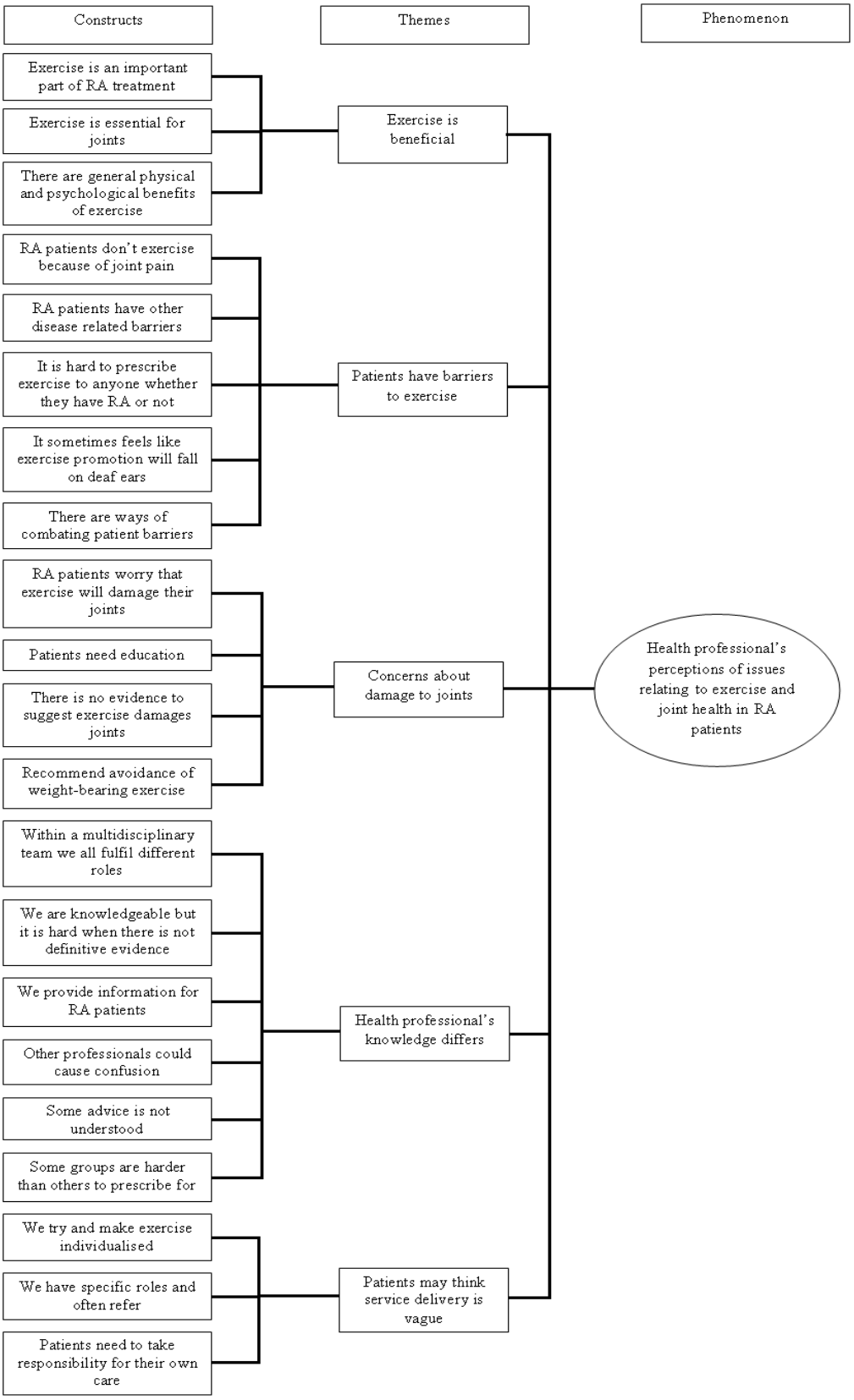

Figure 2: Analytical model of health professional's perceptions of issues relating to exercise and joint health in RA patients