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Health professional's awareness of and confidence in using physical activity measures across four European countries

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TITLE PAGE

Health professional's awareness of and confidence in using physical activity measures across four European countries

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'Key messages' consisting of 4-5 bullet points (of no more than one sentence each) summarising the key points of your article under the following question headings:

What is already known about this subject?

- Physical activity is important for people with inflammatory joint diseases and appropriate monitoring of PA can serve as a motivator for the behaviour

What does this study add?

- Health professionals generally see the importance of measuring PA
- There is a lack of confidence in using objective measures of PA among some health professionals

How might this impact on clinical practice?

- Tailored education on measuring PA may be beneficial in improving confidence in measuring physical activity, and increase the use of PA measures among health professionals in rheumatology

ABSTRACT

Objectives: Physical activity (PA) can improve outcomes in people with inflammatory joint diseases (IJDs). Accurate measurement of PA among health professionals (HPs) is important. The objectives of this study were to determine rheumatology HPs awareness of and confidence in using PA measures in people with IJDs, their own self-reported PA levels and to identify HPs related educational needs.

Methods: Rheumatology HPs in Denmark, Sweden, Ireland and Belgium participated in an online survey. Descriptive statistics and latent class analysis (LCA) was undertaken (SPSS v21and SASv9.4) to describe data aggregates and range and to identify sub-classes of groups with respect to use of PA measures.

Results: Three hundred and twenty two (n = 322, 75% female) HPs responded from Denmark (n = 50, 15.5%), Sweden (n = 66, 20.5%), Ireland (n = 28, 8.7%), and Belgium (n = 178, 55.3%) and the majority of respondents (n = 286, 92%) reported it was important to measure PA in people with IJDs. Only 28.2% of HPs used simple body worn sensors to measure PA levels in their patients. The majority were interested in online education on measuring PA (83%). LCA was used to generate classes of use of measures of PA revealed three distinct classes with different membership reflecting differences in self-reported PA levels, awareness of PA measures, further education requirements and professional background.

Conclusions: The majority of respondents reported that they considered measuring PA as important in people with IJDs; however, the majority lacked confidence in how to measure it. There is strong interest in further education around measuring PA. Three distinct respondent classes were identified to inform targeted education on how to measure PA.

Strengths and limitations of this study –

- First survey to examine how rheumatology health professionals in four European countries measure physical activity in their clinical practice and their confidence in doing so
- The use of latent class data analysis to identify sub-groups to aid tailoring of further education relating to physical activity measurement in clinical practice is novel in this field
- An overall response rate could not be calculated as two countries could not determine the total sample surveyed
- Translation of the survey, which was originally designed in English, may have inadvertently led to a reduction in face validity of the survey.

INTRODUCTION

Regular physical activity (PA) is associated with improvements in health-related outcomes, such as quality of life, aerobic fitness, and disease-related characteristics, including pain and stiffness in people with inflammatory joint diseases (IJDs) [1-4]. However, research has shown lower levels of PA in the arthritis population [5-9], thus better promotion of PA among people with IJDs is necessary. Health professionals (HPs) are ideally placed to promote PA and its health benefits with their patients [10].

Previous studies have investigated attitudes and educational needs relating to health-enhancing PA among HPs in the Netherlands [11] and Ireland [12]. However, these studies focused on whether HPs valued PA for people with arthritis and did not focus on how to measure PA in this population. In order to promote PA and to determine if people with IJDs are progressing with PA, HPs need to be aware of current methods of measuring PA. Accurate measurement of PA is important for clinical decision making and monitoring of changes in outcomes. The range and complexity of devices available to measure PA has increased in recent times [13-15]. These devices, while presenting an opportunity to measure PA more comprehensively, may be a barrier to PA measurement in practice due to their perceived complexity for use, cost, and availability in clinical practice. Yet, these devices are increasingly used by patients necessitating that HPs are confidently able to discuss PA measurement using them [16 17]. To inform education aimed at enhancing HPs knowledge of and confidence in using PA measures in practice, it is first necessary to survey HPs current awareness and confidence in measuring PA. Identifying barriers to measuring PA in clinical practice is also important to gain a comprehensive understanding of what may prevent HPs from accurately using PA measures in practice.

Tailored interventions are preferable in changing HPs practices [18]. Advanced analysis of HPs characteristics can assist with identifying subgroups for tailored education. Latent class analysis (LCA) is a statistical approach that allows for identification of subclasses based on response patterns from the overall sample in a survey[19]. As previous studies have noted that some HPs' own physical activity levels may have an influence on how they advise their patients about being physically active [20 11], it is worthwhile to include a measure of HPs own PA when determining awareness of PA measurement in people with IJD.

Thus the aim of this study was to determine rheumatology HPs awareness of and confidence in using PA measures in people with IJDs, their own self-reported PA levels. A second aim was to identify if there were sub-classes within this population who were in need of education relating to use of PA measures in people with IJD to help tailor training on this.

METHODS

The reporting guideline[21] was used to guide reporting of this survey.

Design

A cross-sectional on-line survey design was used as it was identified as the most suitable method to meet the objectives of the study across the four countries

Sample

Rheumatology HPs in Denmark, Sweden Ireland and Belgium in Europe were invited to participate in an online survey. Participants were recruited to participate through their national rheumatology health professional association/group. Health professionals in this study included all health professionals working in rheumatology including medical, nursing and allied health professionals. Separate ethical approval was granted by each participating country's research ethics committees.

Survey

The study steering group developed an online survey following review of previously used questionnaires to measure PA among HPs[11 12]. The questionnaire (supplementary file 1) was divided into sections: demographic profile; PA measurement; current practice; aerobic capacity testing (ACT), educational needs. To determine respondents own PA levels the Short Questionnaire to Assess Health Enhancing Physical Activity (SQUASH) was used [22]. The SQUASH contains 11 questions on physical activity related to commuting activities, leisure time and sports activities, household activities, and activity at work and school and is reported to have acceptable reliability (overall reproducibility: r = 0.58) and validity, (correlation with an activity monitor for the total activity score was r= 0.45)[22]. The SQUASH was used in a similar study examining rheumatology HPs involvement in PA promotion [11]. In this study the total minutes of activity per week was used as it incorporates frequency and duration of all included activities.

To ascertain face validity of the questionnaire used in this study, discussions were organised in each country by the country representative and up to four other HP´s, to cover the different professional groups. These debriefings were held in order to explore whether the constructs surveyed within each questionnaire reflected the aims under study (i.e. to identify missing or problematic questions/constructs) and were understandable in each language. No issues relating to conceptualisation in any language following translation were identified. The questionnaire was translated into each country's main language(s). Data was then back-translated where necessary and the final results presented in English.

Data Collection

The questionnaire was conducted online through SurveyMonkey, KI Survey or SurveyXact. In each country the chairperson for each relevant HP association was contacted requesting permission for their group's members to participate. When this permission was granted the chairperson acted as gatekeeper by sending the email containing the study information, survey link and researcher details to their group's members. This online approach was chosen as the advantages of distribution include a broad geographic distribution, convenience to respondents and guaranteed respondent confidentiality [23]. The first page of the survey contained detailed information on the study and consent was implied if the respondent continued past this page to complete the survey. Reminders were sent to members, via the chairperson, at one month post the initial email three weeks apart.

Data Analysis

Descriptive statistics of the demographic profile were derived from the data. Categorical data were described as counts and percentages. Continuous data that approximated a Gaussian distribution were described as means and standard deviations, otherwise the continuous data was described as medians and interquartile ranges. Differences between the demographic variables were tested using chi-square tests and ANOVA test where appropriate. Latent class analysis (LCA)[19] , a probability-based model, was used to generate classes of use of measures of PA. A number of latent class models, with 1 class up to 4 classes, were compared and two model fit indexes, Akaike information criterion (AIC) and Bayesian information criterion (BIC), were used to identify the optimal number of latent classes. The model with the smallest AIC and BIC indicates the best fitting model. Data analysis was carried out using the (SPSS v21, IBM USA) and SAS (v 9.4, SAS Institute, USA).

RESULTS

A total of 322 HPs responded to the survey, with country and socio-demographic profiles provided in Table 1. The overall response rate for the survey could not be calculated, as exact membership numbers were not available in each country. On an individual country basis, the response rates were available for Ireland (65%) and Sweden (25%) only.

Table 1 Demographic profile of respondents

	Variable	Count (%)
Country	Denmark	50 (15.5)
	Sweden	66 (20.5)
	Ireland	28 (8.7)
	Belgium	178 (55.3)
Gender	Female	243 (75.5)
	Male	79 (24.5)
Age	18-24	7 (2.2)
	25-34	54 (16.8)
	35-44	81 (25.2)
	45-54	89 (27.6)
	55-64	87 (27.0)
	56-74	4 (1.2)
Profession	Occupational Therapist	30 (9.3)
	Physiotherapist	242 (75.2)
	Registered Nurse	42 (13.0)
	Others*	8 (2.5)
Place of Work	Hospital Part-time	60 (18.6)
	Hospital Fulltime	94 (29.2)
	Private Part-time	18 (5.6)
	Private fulltime	104 (32.3)
	Primary part-time	1 (0.3)
	Primary fulltime	3 (0.9)
	Mixed Place of Work	26 (8.1)
	Other	16 (5.0)
Patients treated with arthritis - %	<5%	97 (30.1)
	6-10%	63 (19.6)
	11-25%	33 (10.2)
	26-50%	25 (7.8)
	51-75%	26 (8.1)
	76-100%	76 (23.6)
	Other	2 (0.6)
Important to measure PA	Yes	286 (86.1)
	No	26 (7.8)
	No response	20 (6.0)
Want further PA education	Yes	226 (68.1)
	No	32 (9.6)
	No response	74 (22.3)

Want online further education on PA (n=258)	Yes	214 (82.9)
	No	44 (17.1)
SQUASH (total minutes per week) (mean/sd)		3874 (2231.0)

*Others – Podiatrists, rheumatologists, social worker, pharmacist

The majority of respondents were female (n = 243, 75.5%). The highest proportion of participants was from Belgium (n= 178, 55.3%) and then Sweden (n = 60, 20.5%) with 15.5% (n=50) from Denmark and 8.7% (n=28) from Ireland. The majority of respondents were physiotherapists (n = 242, 75.2%), 13.0% (n=42) were registered nurses and 9.3% (n = 30) were occupational therapists while 2.5% (n = 8) specified "other" as their profession (included social worker, pharmacist, rheumatologists and podiatrists). Respondents were most likely to be employed full time in a private (32.3%) or hospital (29.2%) setting.

Measuring Physical Activity

When asked about the importance or not of measuring PA in people with IJDs the majority (n=286, 86.1%) stated it was important while 26 HPs (7.8%) said measuring PA was not important (Table 1). Of those stating it was not important to measure PA (n = 26), the majority (n=24, 92%) were physiotherapists (10% of overall physiotherapy sample), from Belgium (n = 21, 80.8%), were mostly older aged (55-65) (n = 11, 42%) with only country differences statistically significantly different (p=0.006) (Table 2).

Table 2 Demographic profile of respondents' views on importance of measuring physical activity

		Important to Measure			
		No (n=26)	**Yes (n=286)**	**p-value**	**Effect size**
		Count (%)	**Count (%)**		
Age	18-24	1 (3.8)	4 (1.4)	0.247	0.146
	25-34	3 (11.5)	49 (17.1)		
	35-44	4 (15.4)	75 (26.2)		
	45-54	6 (23.1)	82 (28.7)		
	55-64	11(42.3)	73 (25.5)		
	65-74	1 (3.8)	3 (1.0)		
Gender	Female	16 (61.5)	222 (77.6)	0.065	0.105
	Male	10 (38.5)	64 (22.4)		

Country	Denmark	5 (19.2)	45 (15.7)	0.006*	0.199
	Sweden	0 (0.0)	66 (23.1)		
	Ireland	0 (0.0)	27 (9.4)		
	Belgium	21 (80.8)	148 (51.7)		

The majority of HPs (n = 226 (68.1%)), wanted further education on PA measurement while 32 (9.6%) did not want further education on this (Table 1). There was strong interest in online education with the majority of respondents who answered yes to wanting further education (n=214, 82.9%) interested in this online format.

Respondents were most confident using, educating about and interpreting data from simple body worn sensors (pedometers, simple accelerometers, smartphone apps) and paper questionnaires/diaries and least confident using, educating about and interpreting complex body worn sensors (sensors that collect multiple data on one device) and digital diaries and questionnaires (PA surveys on phones for example) (Table 3).

Table 3 Descriptives of confidence in using, educating about and interpreting physical activity measures[#]

	Simple body worn sensor **Median (IQR)**	**Complex body worn sensor** **Median (IQR)**	**Paper questionnaire** **Median (IQR)**	**Paper diary** **Median (IQR)**	**Digital questionnaire** **Median (IQR)**	**Digital diary** **Median (IQR)**
Confidence in using	7.0 (7.0)	4.0 (8.0)	7.0 (7.0)	8.0 (6.0)	3.5 (7.0)	3.0 (6.0)
Confidence in educating	5.0 (9.0)	2.0 (7.0)	8.0 (7.5)	6.0 (9.0)	2.0 (7.0)	2.0 (7.0)
Confidence in interpreting	6.0 (9.0)	3.0 (7.0)	7.0 (7.0)	6.0 (8.0)	4.0 (8.0)	3.0 (7.0)

[#]Confidence scores legend

Possible score range 0-10 – 0 = not confident, 10 = very confident

Physiotherapists were likely to use all sensors compared to occupational therapists and nurses, whereas occupational therapists and nurses were most likely to use paper / digital questionnaires (Table 4).

Table 4: Health professionals' confidence in using, educating about and interpreting physical activity measures by profession[#]

	Occupational Therapist (n=30)	Physiotherapist (n= 242)	Registered Nurse (n=42)	Others* (n=8)
	Median (IQR)	**Median (IQR)**	**Median (IQR)**	**Median (IQR)**
Confidence in using PA measures by profession				
Simple	5.0 (3.5)	7.0 (7.0)	5.0 (9.0)	5.5 (6.25)
Complex	3.5 (6.0)	5.0 (8.0)	2.0 (5.0)	1.0 (8.5)
Paper Q.	8.0 (3.0)	7.0 (7.0)	8.0 (8.0)	6.5 (7.25)
Paper D.	8.0 (4.25)	6.0 (8.0)	6.0 (8.0)	5.0 (7.25)
Digital Q.	5.0 (4.25)	3.0 (6.0)	5.0 (7.5)	5.0 (5.5)
Digital D.	5.0 (4.0)	2.0 (6.0)	3.0 (7.0)	5.0 (5.0)
Confidence in educating patients to use PA measures by profession				
Simple	5.0 (6.5)	6.0 (9.0)	1.0 (5.0)	2.0 (2.0)
Complex	4.0 (5.5)	4.0 (8.0)	0.0 (4.0)	1.0 (2.75)
Paper Q.	8.0 (2.5)	8.0 (8.0)	5.0 (10.0)	6.5 (6.0)
Paper D.	8.0 (4.5)	6.0 (9.0)	5.0 (10.0)	5.5 (5.25)
Digital Q.	6.0 (5.0)	2.0 (7.0)	2.0 (9.0)	5.0 (4.75
Digital D.	5.0 (5.5)	2.0 (7.0)	2.0 (8.0)	5.0 (4.75)
Confidence in interpreting results from PA measures by profession				
Simple	6.0 (5.0)	7.0 (9.0)	2.0 (6.0)	1.0 (2.25)
Complex	4.0 (6.0)	4.0 (8.0)	0.0 (2.5)	0.0 (0.5)
Paper Q.	9.0 (3.0)	7.0 (7.0)	7.0 (10.0)	4.0 (7.0)
Paper D.	8.0 (4.0)	5.0 (8.25)	6.0 (9.0)	4.0 (7.0)
Digital Q.	6.0 (4.0)	3.0 (8.0)	3.0 (7.5)	2.0 (5.25)
Digital D.	5.0 (4.0)	2.0 (7.0)	2.0 (7.0)	2.0 (5.25)

*Others – Podiatrists, rheumatologists, social worker, pharmacist

[#]**Confidence scores legend**

Possible score range 0-10 – 0 = not confident, 10 = very confident

Abbreviations

Simple – Simple body worn sensor

Complex – Complex body worn sensor

Paper Q – Paper questionnaire

Paper D – Paper diary

Digital Q – Digital questionnaire

Digital D. = Digital diary

Physiotherapists reported greater confidence in using, educating about and interpreting simple and complex body worn devices, which was statistically significant for confidence in using simple devices ($p<0.005$), educating patients about simple devices ($p=0.003$) and interpreting simple devices only ($p=0.023$) (Table 4). Respondents reported not having the equipment, costs and difficulty interpreting the results as the most common barriers to using all body worn sensors to measure PA.

Physical Activity levels

The SQUASH questionnaire was used to measure HPs own PA levels. The mean total minutes of activity per week for the whole sample was 3,884.2 (sd 2,231.0) minutes (table 5).

Table 5 Respondents own physical activity levels (SQUASH[#]) demographics

		SQUASH Mean (sd)	p-value	Eta-squared
Sex	Female (n=183)	3859.1 (2205.6)	0.841	0.000
	Male (n=49)	3931.1 (2345.7)		
Age	18-24 (n=3)	6286.7 (2737.3)	0.062	0.045
	25-34 (n=36)	4717 (2088.3)		
	35-44 (n=64)	3576 (2348.1)		
	45-54 (n=67)	3720.9 (2076.7)		
	55-64 (n=60)	3725.5 (2248.2)		
	65-75 (n=2)	4223.0 (229.1)		
Country	Denmark (n=41)	3781.5 (1478.5)	<0.000*	0.248
	Sweden (n=46)	2881.3 (1385.8)		
	Ireland (n=27)	1662.9 (914.6)		

	Belgium (n=118)	4808.7 (2390.5)		
Profession	Occupational Therapist (n=16)	3118.1 (2029.6)	0.361	0.014
	Physiotherapist (n=180)	3986.6 (2219.2)		
	Registered Nurse (n=31)	3759.7 (2388.6)		
	Others** (n=5)	2959.0 (2193.1)		

**Others – Podiatrists, rheumatologists, social worker, pharmacist

total minutes of activity per week

The 25-34 age category had the highest total minutes of activity per week but there was not a significant difference amongst age groups. Denmark had the highest country total minutes of activity per week (3,781.5, sd1,478.5) while Ireland had the lowest (1,662.9, sd 914)). Physiotherapists had the most active profile with a mean of 3,986.6 (sd 2219.2) total minutes of activity per week. SQUASH total minutes of activity per week significantly differed across groups for country only ($p<0.001$, eta squared 0.248).

Latent Class Analysis

Latent class analysis was used to generate classes of use of measures of PA. Models with one through four latent classes were compared in order to select a model of activity levels. The BIC suggests that the 2-class solution was superior (BIC = 99.03) while the AIC suggests the 3-class solution (AIC = 46.04). An examination of both the two- and three-class models suggested that the 3-class model had greater parsimony (supplementary file 3). The membership probabilities and the item response probabilities for the 3-class LCA solution are presented in supplementary file 3 while the association between the classes and the socio-demographics are shown in Table 6.

Table 6: Association between latent classes and socio-demographics

		Class 1 (*Traditional*) (n=91) Count (%)	Class 2 (*Reluctant*) (n=157) Count (%)	Class 3 (*Early Adopters*) (n=42) Count (%)	P-value	Effect Size[a]
Country	Denmark	9 (9.89)	40 (25.48)	1 (2.38)	<0.001*	0.276
	Sweden	32 (35.16)	17 (10.83)	17 (40.48)		
	Ireland	12 (13.19)	14 (8.92)	0 (0.0)		
	Belgium	38 (41.76)	86 (54.78)	24 (57.14)		
Gender	Female	71 (78.02)	126 (80.25)	30 (71.43)	0.467	0.073
	Males	20 (21.98)	31 (19.75)	12 (28.57)		
Age	18-24	1 (1.10)	3 (1.91)	0 (0.0)	0.741	0.109
	25-34	14 (15.38)	26 (16.56)	8 (19.05)		
	35-44	26 (28.57)	36 (22.93)	14 (33.33)		
	45-54	25 (27.47)	52 (33.12)	9 (21.43)		
	55-64	25 (27.47)	37 (23.57)	10 (23.81)		
	65-74	0 (0.0)	3 (1.91)	1 (2.38)		

Profession	Occupational Therapist	14 (15.38)	12 (7.64)	1 (2.38)	0.001*	0.195
	Physiotherapist	63 (69.23)	112 (71.34)	41 (97.62)		
	Registered Nurse	14 (15.38)	27 (17.20)	0 (0.0)		
	Other	0 (0.0)	6 (3.82)	0 (0.0)		
Place of work	Hospital part-time	22 (24.18)	25 (15.92)	11 (26.19)	0.344	0.164
	Hospital full-time	26 (28.57)	51 (32.48)	11 (26.19)		
	Private part-time	2 (2.20)	11 (7.01)	2 (4.76.)		
	Private full-time	25 (27.47)	49 (31.21)	13 (30.95)		
	Primary care part-time	0 (0.0)	0 (0.0)	1 (2.38)		
	Primary care full-time	2 (2.20)	1 (0.64)	0 (0.0)		
	Mixed practice	9 (9.89)	11 (7.01)	3 (7.14)		
	Other	5 (5.49)	9 (5.73)	1 (2.38)		
Important to measure	No	2 (2.20)	20 (12.74)	0 (0.0)	0.001*	0.213
	Yes	89 (97.80)	137 (87.26)	42 (100.0)		
PA Education	No	5 (5.62)	25 (18.94)	2 (5.41)	0.005*	0.203
	Yes	84 (94.38)	107 (81.06)	35 (94.59)		

ACT Education	No Yes	8 (8.99) 81 (91.01)	31 (22.96) 104 (77.04)	3 (8.57) 32 (91.43)	0.009*	0.191
Years qualified	Median (IQR)	20 (17)	24 (18)	20.5 (17)	0.996	<0.001
Years Rheumatology	Median (IQR)	12 (13)	9 (20)	16 (21)	0.015*	0.030
SQUASH	Mean (SD)	3626.67 (2439.94)	3949.98 (21.28.98)	4274.36 (1995.48)	0.33	0.01
*statistically significant relationship [a]Cramer's V effect size used for categorical variables, otherwise eta-squared is used						

- Class 1 – *traditional group* - accounted for 34.66% of individuals. People in this class had a high probability of using paper/digital means to measure PA, were mainly from Belgium, Sweden and Ireland, tended to be older and had lower years' experience working in rheumatology than Class 3 and greater years' experience in rheumatology than Class 2. They also had the lowest total minutes of activity per week.

- Class 2 – *reluctant group* - resulted in the highest class membership probability, 49.62%. People in this group tended not to use any method of measurement, were older, had the shortest experience working in rheumatology, but the longest years working overall, were mainly nurses and from Belgium and Denmark and had a greater group membership who do not want further education about PA. This group's PA levels were higher than Class 1 but lower than class 3.

- Class 3 – *early adopters* - accounted for 15.72% of the sample and can be categorised as those who use all methods to measure PA. This groups members were mainly physiotherapists from Belgium and Sweden who were working in rheumatology longer than Class 1 and 2 members and were in agreement as to the importance of measuring PA and want more education relating to PA. Members of this group also had the highest total minutes of activity per week.

DISCUSSION

This study is the first to investigate HPs awareness of and confidence in using measures of PA for people with IJDs across 4 European countries. Physical activity is an important part of the optimal management of people with IJDs[24-26]. Measurement of PA is increasingly of importance and confidence in such is important to ensure accurate and appropriate measurement[16] and monitoring of clinical progress and outcome. In addition to promoting PA among people with IJDs, HPs also need to be able to adequately measure PA as an outcome measure[16]. This survey has highlighted HPs current practice in measuring PA among people with IJDs and has identified areas for further training and development.

Our study highlights that the majority of HPs working with people with IJDs in four countries see the importance of measuring PA. However, confidence in using more objective measures of PA was low overall in this survey, with just a small group of physiotherapists, predominantly from Belgium and Sweden who are experienced in the field of rheumatology

most likely to use a body worn to PA measure in their patients. Lack of confidence in measuring PA is not uncommon among HPs. A survey of primary care physicians in Sydney found that less than 30% of primary care encounters involve PA assessment [27] with physicians usually indicating differing preferences for what instrument to use in practice to measure PA[28]. Barriers cited in this study by respondents to why they do not use body worn sensors were not having the equipment, the cost of the devices and difficulty interpreting the data from them. Similar barriers to measuring PA among HPs have been reported elsewhere[29].

Previous research has examined the self-report PA levels of rheumatology health professionals[11] and reported lower PA levels using the same score (total minutes of activity per week) compared to this study. Physiotherapists and nurses total minutes of activity per week were 863 and almost 1,000 minutes higher respectively than in the Hurkmans et al study. The SQUASH PA levels reported in this study are very high but reflective of the totality of activity that the respondents reported including light daily activities during work, getting to and from work and not just structured exercise, which are often not captured. The differences between our SQUAH results and that of the previous Dutch study[11] may be explained by greater awareness among HPs of the importance of regular PA for their own health in the intervening time between the two studies, the inclusion of different countries in this study and the use of different aggregate values in both studies.

The majority of respondents wanted further education on PA measurement and the majority would like this in an online format. Development of more tailored education programmes are preferable for changing health professionals practices[30]. To help identify if differences existed between countries, professions, place of work, rheumatology experience we used a statistical approach to determine if different groupings existed regarding use of PA measures. The three groups modelled using LCA showed that while a majority were aware of measures of PA respondents in the *reluctant* group are a priority for education as they had the lowest awareness of PA measures. The value of using LCA to generate classes of use of measures of PA in this study is in aiding the tailoring of further PA education, which may in turn enhance participant's confidence in measuring PA. Generic approaches to delivery of education can result in reduced uptake of the education with resultant lack of change in practice. Based on the results of this study people in the *reluctant* group should be targeted first as they do not report measuring PA as important and did not report an interest in further education on measuring PA. Members in the *reluctant* group are from all four countries (majority from

Belgium and Denmark, all three professions (highest physiotherapy) and are the longest qualified group, but working the least years in rheumatology. Their reluctance may be part formed by an assumption of expertise in this area based on length of experience in rheumatology and/or a view that not all health professionals need to be educated in measuring PA. An education programme for this group around measurement of PA would need to take a graded approach starting with a basic introduction to the value of PA measurement and the various methods of doing so in a clinical setting. This learning could then be contextualised to rheumatology incorporating case studies to allow for application of learning. Members of the *traditional* group are most likely to already use a basic form of PA measurement thus an intermediate level module focusing on the range of PA measures and how to interpret data from them would form the basis for their learning. Finally, the minority of respondents belonging to the *early adopters* group are most likely to already be using all methods of PA measurement – for this group a more advanced educational module could be developed incorporating theories of PA behavioural change and advanced PA measurement. These educational modules may also need to consider differing professional scopes of practice around PA measurement and management. The use of a statistical approach to develop groups to help target educational interventions has been used in other areas of practice including antibiotic use and resistance in Sweden[31] and nurses beliefs about caring for patients traumatic brain injury[32]. In this study the use of LCA to generate classes of use of measures of PA was valuable in helping to identify subgroups with similar scores who have different scores from the other subgroups[19].

Implications for practice

While measuring PA is reported as important by HPs in these four European countries there is not a concomitant high number of HPs measuring PA in practice. Measuring PA is important as engagement in PA is important for patients and has numerous health benefits. Thus it can become a routine outcome measure in practice. Encouraging practitioners to use some of the range of measures available to measure PA is important given the importance of PA in managing IJDs. To improve the use of PA outcome measures in practice it is necessary for HPs to improve their awareness of and confidence in using objective measures of PA.

Limitations

As with any survey respondents may have misinterpreted the questions with resultant inaccuracy in responses. The original survey was designed in English and translated into

Swedish, Danish, French and Flemish with final results being reported into English. Hence some understanding or interpretation may have been lost in translation and back-translation. We identified no changes in interpretability following translation; however, future studies should undertake a more rigorous process with regard to translation and back-translation and should undertake large scale cross cultural validity work prior to undertaking the final survey. Also, while the differences in samples from each country were large they were representative of the rheumatology HP membership of each country. Finally, response rates were estimates only for two countries as exact membership numbers for those countries were not available.

The SQUASH questionnaire has mixed evidence for its reliability and validity in patients with Ankylosing Spondylitis[33] and Total knee arthroplasty[34] and in non-clinical populations[22] [35] with one recent study identifying its considerable variation in test-retest reliability and validity among a multi-ethnic population in The Netherlands[36]. We would not recommend the use of this measure of self-report PA based on what we identified, but were unable to verify in the absence of an observational study, as over reporting of PA levels.

CONCLUSION

The majority of the rheumatology HPs reported that it is important to measure PA; however, levels of awareness and confidence are moderate to low about how to use, interpret and educate patients about more complex measures such as body worn devices. There is strong interest in further education around measuring PA. Three distinct sub-groups were identified allowing for targeted education and training for HPs to be developed in the future to improve knowledge and confidence in using PA measures.

COMPETING INTERESTS

No authors have declared conflicts of interest or competing interests

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RESEARCH REPORTING CHECKLIST

The following reporting checklist was used in the preparation of this manuscript – Good Practice in the conducting and reporting of survey research[21]

DATA SHARING STATEMENT

Individual participant data that underlie the results reported in this article, after deidentification (text, tables and appendices), immediately after publication for 3 years to any researchers who provide a methodologically sound proposal. Requests for data sharing should be directed to norelee.kennedy@ul.ie

CONTRIBUTORSHIP STATEMENT

N Kennedy, N Brodin, B Esbensen, B Nordren and T Swinnen were the original authors who submitted the grant, designed the study, oversaw the data collection and analysis in their countries, assisted with preparation of the paper, and read and commented on all drafts and agreed on the final manuscript. S McKenna, S Willems and N Hammer were research assistants who assisted with designing the survey, collecting the data, analysing the data and commented on manuscript drafts. A O'Neill undertook the substantive analysis of the data including the LCA and also commented on all manuscript drafts.

REFERENCES

1. Plasqui G. The role of physical activity in rheumatoid arthritis. *Physiology & behavior* 2008;94(2):270-75.
2. Metsios GS, Stavropoulos-Kalinoglou A, Sandoo A, et al. Vascular function and inflammation in rheumatoid arthritis: the role of physical activity. *Open Cardiovasc Med J* 2010;4(1):89-96.
3. Stavropoulos-Kalinoglou A, Metsios GS, Veldhuijzen van Zanten JJ, et al. Individualised aerobic and resistance exercise training improves cardiorespiratory fitness and reduces cardiovascular risk in patients with rheumatoid arthritis. *Ann Rheum Dis* 2013;72(11):1819-25. doi: 10.1136/annrheumdis-2012-202075
4. Hurkmans E, van der Giesen FJ, Vliet Vlieland TP, et al. Dynamic exercise programs (aerobic capacity and/or muscle strength training) in patients with rheumatoid arthritis. *Cochrane Database Syst Rev* 2009(4):CD006853. doi: 10.1002/14651858.CD006853.pub2
5. Tierney M, Fraser A, Norelee K. Physical activity in rheumatoid arthritis: a systematic review. 2012
6. Sokka T, Häkkinen A, Kautiainen H, et al. Physical inactivity in patients with rheumatoid arthritis: Data from twenty‐one countries in a cross‐sectional, international study. *Arthritis Care & Research* 2008;59(1):42-50.
7. Hootman JM, Macera CA, Ham SA, et al. Physical activity levels among the general US adult population and in adults with and without arthritis. *Arthritis Care & Research* 2003;49(1):129-35.
8. Haglund E, Bergman S, Petersson IF, et al. Differences in physical activity patterns in patients with spondylarthritis. *Arthritis care & research* 2012;64(12):1886-94.
9. Swinnen TW, Scheers T, Lefevre J, et al. Physical activity assessment in patients with axial spondyloarthritis compared to healthy controls: a technology-based approach. *PloS one* 2014;9(2):e85309.
10. Larkin L, Gallagher S, Fraser A, et al. If a joint is hot it's not the time: health professionals' views on developing an intervention to promote physical activity in rheumatoid arthritis. *Disability and Rehabilitation* 2016:1-8.
11. Hurkmans EJ, de Gucht V, Maes S, et al. Promoting physical activity in patients with rheumatoid arthritis: rheumatologists' and health professionals' practice and educational needs. *Clinical rheumatology* 2011;30(12):1603-09.
12. McKenna S, Kelly G, Kennedy N. FRI0585-HPR A Survey of Irish Physiotherapists' Current Practice in Promoting Physical Activity in Rheumatoid Arthritis. *Annals of the Rheumatic Diseases* 2014;73(Suppl 2):1206-07.

13. Tierney M, Fraser A, Purtill H, et al. Study to determine the criterion validity of the SenseWear Armband as a measure of physical activity in people with rheumatoid arthritis. *Arthritis Care Res (Hoboken)* 2013;65(6):888-95. doi: 10.1002/acr.21914
14. Semanik P, Song J, Chang RW, et al. Assessing physical activity in persons with rheumatoid arthritis using accelerometry. *Med Sci Sports Exerc* 2010;42(8):1493-501. doi: 10.1249/MSS.0b013e3181cfc9da
15. Sylvia LG, Bernstein EE, Hubbard JL, et al. Practical guide to measuring physical activity. *J Acad Nutr Diet* 2014;114(2):199-208. doi: 10.1016/j.jand.2013.09.018
16. Trost SG, O'Neil M. Clinical use of objective measures of physical activity. *British Journal of Sports Medicine* 2014;48(3):178-81. doi: 10.1136/bjsports-2013-093173
17. Ainsworth B, Buchholz SW. How to Assess Physical Activity in Clinical Practice and for Scholarly Work. *The Journal for Nurse Practitioners* 2017;13(1):14-20.e2. doi: https://doi.org/10.1016/j.nurpra.2016.06.020
18. Baker R, Camosso-Stefinovic J, Gillies C, et al. Tailored interventions to address determinants of practice. *Cochrane Database Syst Rev* 2015(4):CD005470. doi: 10.1002/14651858.CD005470.pub3
19. Kongsted A, Nielsen AM. Latent Class Analysis in health research. *Journal of physiotherapy* 2017;63(1):55-58. doi: 10.1016/j.jphys.2016.05.018 [published Online First: 2016/12/05]
20. Iversen MD, Eaton HM, Daltroy LH. How rheumatologists and patients with rheumatoid arthritis discuss exercise and the influence of discussions on exercise prescriptions. *Arthritis Rheum* 2004;51(1):63-72. doi: 10.1002/art.20168
21. Kelley K, Clark B, Brown V, et al. Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care* 2003;15(3):261-66. doi: 10.1093/intqhc/mzg031
22. Wendel-Vos GCW, Schuit AJ, Saris WHM, et al. Reproducibility and relative validity of the short questionnaire to assess health-enhancing physical activity. *Journal of clinical epidemiology* 2003;56(12):1163-69.
23. Domholdt E. Rehabilitation research: principles and applications: Elsevier Saunders. 2005
24. Veldhuijzen van Zanten JJCS, Rouse PC, Hale ED, et al. Perceived Barriers, Facilitators and Benefits for Regular Physical Activity and Exercise in Patients with Rheumatoid Arthritis: A Review of the Literature. *Sports Medicine* 2015;45(10):1401-12. doi: 10.1007/s40279-015-0363-2
25. Agca R, Heslinga SC, Rollefstad S, et al. EULAR recommendations for cardiovascular disease risk management in patients with rheumatoid arthritis and other forms of inflammatory joint disorders: 2015/2016 update. *Annals of the Rheumatic Diseases* 2016 doi: 10.1136/annrheumdis-2016-209775
26. Withall J, Haase AM, Walsh NE, et al. Physical activity engagement in early rheumatoid arthritis: a qualitative study to inform intervention development. *Physiotherapy* 2016;102(3):264-71. doi: https://doi.org/10.1016/j.physio.2015.07.002
27. Winzenberg T, Reid P, Shaw K. Assessing physical activity in general practice: a disconnect between clinical practice and public health? *British Journal of General Practice* 2009;59(568):e359-e67. doi: 10.3399/bjgp09X472818
28. Dutton SN, Dennis SM, Zwar N, et al. An explorative qualitative study on acceptability of physical activity assessment instruments among primary care professionals in southern Sydney. *BMC Family Practice* 2016;17(1):138. doi: 10.1186/s12875-016-0536-6
29. Huijg J, Gebhardt W, Verheijden M, et al. Factors Influencing Primary Health Care Professionals' Physical Activity Promotion Behaviors: A Systematic Review. *Int J Behav Med* 2015;22(1):32-50. doi: 10.1007/s12529-014-9398-2
30. Baker R, Camosso-Stefinovic J, Gillies C. Tailored interventions to overcome identified barriers to change: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev* 2010;3

31. Vallin M, Polyzoi M, Marrone G, et al. Knowledge and Attitudes towards Antibiotic Use and Resistance - A Latent Class Analysis of a Swedish Population-Based Sample. *PLOS ONE* 2016;11(4):e0152160. doi: 10.1371/journal.pone.0152160
32. Oyesanya TO, Thomas MA, Brown RL, et al. Nurses' Beliefs About Caring for Patients With Traumatic Brain Injury. *Western journal of nursing research* 2016;38(9):1114-38. doi: 10.1177/0193945916636629 [published Online First: 2016/03/10]
33. Arends S, Hofman M, Kamsma YPT, et al. AB0910 Validity and reliability of the IPAQ and squash to assess daily physical activity in patients with ankylosing spondylitis. *Annals of the Rheumatic Diseases* 2013;71(Suppl 3):690-90. doi: 10.1136/annrheumdis-2012-eular.910
34. Wagenmakers R, van den Akker-Scheek I, Groothoff JW, et al. Reliability and validity of the short questionnaire to assess health-enhancing physical activity (SQUASH) in patients after total hip arthroplasty. *BMC Musculoskelet Disord* 2008; 9.
35. Chinapaw MJ, Slootmaker SM, Schuit AJ, et al. Reliability and validity of the Activity Questionnaire for Adults and Adolescents (AQuAA). *BMC Medical Research Methodology* 2009;9(1):58. doi: 10.1186/1471-2288-9-58
36. Nicolaou M, Gademan MGJ, Snijder MB, et al. Validation of the SQUASH Physical Activity Questionnaire in a Multi-Ethnic Population: The HELIUS Study. *PLOS ONE* 2016;11(8):e0161066. doi: 10.1371/journal.pone.0161066

Supplementary data 1

Survey

UNIVERSITY of LIMERICK
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Irish Health Professionals in Rheumatology - awareness and views on Physical Activity measurement

Thank you for taking the time to open the link to this survey. This study aims to investigate the awareness and use of objective and subjective measures of physical activity in people with inflammatory arthritis, among Health Professionals in Rheumatology. Current practice in the management of patients with inflammatory arthritis emphasises the importance of assessing physical activity and aerobic capacity therefore, the information you provide will be extremely valuable and use in future research. The survey will also ask you a number of questions regarding sleep quality and disturbances and whether you discuss same with your rheumatology patients.

TAKING PART

Please read the following information and if you are happy to participate in the study then please continue to the questionnaire. It will take you approximately 15 minutes to complete.

BENEFITS & RISKS

There are no direct benefits to you in participating in this study. However, the information you will provide will be a good basis for the development of further educational and research opportunities to advance current practice in this area. There are no risks associated with your participation.

CONFIDENTIALITY

The questionnaire is anonymous and all data will be treated with the utmost confidence. Access to the raw data will be limited to the two investigators and the final report will not contain any identifying information.

COMPENSATION

There is no compensation associated with this study.

PARTICIPATION

Your participation in the study is purely voluntary and you are free to withdraw at any time, without having to provide a reason for doing so. At the end of the study all data will be analysed and a report on the findings will be carried out.

PERMISSION

Ethical approval for the study has been by the EHS Research Ethics Committee in the University of

Limerick. Approval number: 2015_09_02_EHS

FURTHER INFORMATION

Further information can be obtained from the study investigators Dr. Norelee Kennedy, Head of the Department of Clinical Therapies, University of Limerick (email: norelee.kennedy@ul.ie; tel: 061-213371) and/or Mr Sean McKenna, PhD Candidate, Department of Clinical Therapies, University of Limerick (email: sean.g.mckenna@ul.ie; tel: 087-2327341)

COMPLAINTS

If you have concerns regarding this study, please contact: Chairman, Education and Health Sciences, Research Ethics Committee, EHS Faculty Office, University of Limerick. Tel: (061)234101 Email: ehsresearchethics@ul.ie

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Demographics

* 1. Are you

- Male
- Female

* 2. What age category are you in?

- 18 to 24
- 25 to 34
- 35 to 44
- 45 to 54
- 55 to 64
- 65 to 74
- 75 or older

* 3. What is your profession?

- Physiotherapist
- Nurse
- Occupational Therapist
- Other (please specify)

* 4. How many years are you qualified?

* 5. How many years are you working within Rheumatology?

* 6. Where is your Place of Work?? (more than 1 choice is possible)

- [ ] Hospital - Part/time
- [ ] Hospital - Full/time
- [ ] Primary care (PCCC) - Part/time
- [ ] Primary care (PCCC) - Full/time
- [ ] Private Practice - Part/time
- [ ] Private Practice - Full/time
- [ ] Other (please specify)

* 7. On a monthly basis what is the percentage of people with inflammatory arthritis that you treat?

- ○ < 5%
- ○ 6-10%
- ○ 11-25%
- ○ 26-50%
- ○ 51-75%
- ○ 76-100%

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Irish Health Professionals in Rheumatology - awareness and views on Physical Activity measurement

Physical Activity Measurement

Physical Activity is important for people with Arthritis. While the measurement and monitoring of same can be a challenge, it has a number of essential uses. The following questions are concerned with the more popular ways in which Physical Activity is monitored. Better knowledge and understanding of patient's current use and barriers will guide the evidence base and future practice of health promotion. You will be asked questions on the following devices:-

SIMPLE BODY-WORN SENSOR
This type of device comes in one piece and measures your physical activity automatically. You wear it directly onto your body from where you can read the output immediately from the display of the device itself (e.g. pedometer, accelerometer, smartphone worn on your body).

COMPLEX BODY-WORN SENSOR
This type of device comes in multiple pieces and measures your physical activity automatically. You wear it directly onto your body and to read the output of your results you need a link to another device (e.g. watch with wireless link to a smartphone application or website, heart rate monitor with wrist band).

PAPER QUESTIONNAIRE
This is a paper survey with questions regarding the physical activities (e.g. walking) you performed over a certain time period (e.g. last week).

PAPER DIARY
This is a paper agenda where you can write down the physical activities (e.g. walking for an hour) you performed over a certain time period.

DIGITAL QUESTIONNAIRE
This is a digital survey on a smartphone, tablet or computer with questions concerning the physical activities (e.g. walking) you performed over a certain time period (e.g. last week)

DIGITAL DIARY
This is a digital agenda where you can digitally select/type in your physical activities (e.g. walking for one hour) mostly on an hour-to-hour or daily basis.

* 8. Do you think it is important to measure physical activity?

- ○ Yes
- ○ No

* 9. Why do you/don't you think it is important to measure physical activity?

* 10. Please rate your confidence in using each of the following devices/ways in monitoring physical activity? (0 is not confident and 10 is very confident)

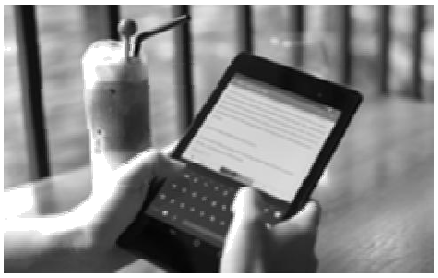
	0	1	2	3	4	5	6	7	8	9	10
SIMPLE BODY WORN SENSOR not linked to other devices (Pedometer/Accelerometer/Watch) 	○	○	○	○	○	○	○	○	○	○	○
COMPLEX BODY-WORN SENSOR linked to digital sources (Wireless/GPS) 	○	○	○	○	○	○	○	○	○	○	○
PAPER QUESTIONNAIRE 	○	○	○	○	○	○	○	○	○	○	○

0 1 2 3 4 5 6 7 8 9 10

PAPER DIARY

DIGITAL QUESTIONNAIRE (Smartphone; Tablet; Computer)

DIGITAL DIARY



* 11. Please rate your confidence in educating a patient with inflammatory arthritis in how to use each of the following devices/ways in monitoring physical activity? (0 is not confident and 10 is very confident)

	0	1	2	3	4	5	6	7	8	9	10
SIMPLE BODY-WORN SENSOR	○	○	○	○	○	○	○	○	○	○	○
COMPLEX BODY-WORN SENSOR	○	○	○	○	○	○	○	○	○	○	○
PAPER QUESTIONNAIRE	○	○	○	○	○	○	○	○	○	○	○
PAPER DIARY	○	○	○	○	○	○	○	○	○	○	○
DIGITAL QUESTIONNAIRE	○	○	○	○	○	○	○	○	○	○	○
DIGITAL DIARY	○	○	○	○	○	○	○	○	○	○	○

* 12. Please rate your confidence in interpreting data from each of the following devices/ways in monitoring physical activity, in a clinical setting? (0 is not confident and 10 is very confident)

	0	1	2	3	4	5	6	7	8	9	10
SIMPLE BODY-WORN SENSOR	○	○	○	○	○	○	○	○	○	○	○
COMPLEX BODY-WORN SENSOR	○	○	○	○	○	○	○	○	○	○	○
PAPER QUESTIONNAIRE	○	○	○	○	○	○	○	○	○	○	○
PAPER DIARY	○	○	○	○	○	○	○	○	○	○	○
DIGITAL QUESTIONNAIRE	○	○	○	○	○	○	○	○	○	○	○
DIGITAL DIARY	○	○	○	○	○	○	○	○	○	○	○

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Irish Health Professionals in Rheumatology - awareness and views on Physical Activity measurement

Current Practice

* 13. The following questions are in relation to SIMPLE BODY-WORN SENSOR

Do you use Simple body-worn sensors in your work with patients who have inflammatory arthritis?

- Yes
- No

* 14. Why do you/don't you use a Simple body-worn sensor with your inflammatory arthritis patients?

* 15. Are there any barriers to you in using a Simple body-worn sensor in your clinical setting?

- Yes
- No

16. If Yes, please choose from the following (Multiple answers are possible)

- [ ] I do not understand why using a simple body-worn sensor would be important
- [ ] I am not interested in using that type of device
- [ ] It feels impersonal
- [ ] It is too expensive
- [ ] I do not have access to proper equipment
- [ ] It takes too much time
- [ ] I do not know what to do with the results
- [ ] I do not believe that the results are accurate
- [ ] I do not have anyone to talk to about the results
- [ ] I have difficulties in operating the device
- [ ] Other (please specify)

* 17. What would make it easier for you to use a Simple body-worn sensor in your clinical setting?

* 18. The following questions are in relation to COMPLEX BODY-WORN SENSOR

Do you use Complex body-worn sensors in your work with patients who have inflammatory arthritis?

- ○ Yes
- ○ No

* 19. Why do you/don't you use a Complex Body-Worn Sensor with your inflammatory arthritis patients?

* 20. Are there any barriers to you in using a Complex body-worn sensor in your clinical setting?

- ○ Yes
- ○ No

21. If Yes, please choose from the following (Multiple answers are possible)

- [ ] I do not understand why using a complex body-worn sensor would be important
- [ ] I am not interested in using that type of device
- [ ] It feels impersonal
- [ ] I do not have access to proper equipment
- [ ] It is too expensive
- [ ] It takes too much time
- [ ] I do not know what to do with the results
- [ ] I do not believe that the results are accurate
- [ ] I do not have anyone to talk to about the results
- [ ] I have difficulties in operating the device
- [ ] Other (please specify)

* 22. What would make it easier for you to use a Complex body-worn sensor in your clinical setting?

* 23. The following questions are in relation to PAPER OR DIGITAL QUESTIONNAIRE

Do you use Questionnaires in your work with patients who have inflammatory arthritis?

- ○ Yes
- ○ No

* 24. Why do you/don't you use Questionnaires with your inflammatory arthritis patients?

* 25. Are there any barriers to you in using Questionnaires in your clinical setting?

- ○ Yes
- ○ No

26. If Yes, please choose from the following (Multiple answers are possible)

- [ ] I do not understand why using a questionnaire (Paper or Digital) would be
- [ ] important I am not interested in using that type of device
- [ ] It feels impersonal
- [ ] I do not have access to proper
- [ ] equipment It is too expensive
- [ ] It takes too much time
- [ ] I do not know what to do with the results
- [ ] I do not believe that the results are accurate
- [ ] I do not have anyone to talk to about the
- [ ] results Other (please specify)

* 27. What would make it easier for you to use Questionnaires in your clinical setting?

* 28. The following questions are in relation to PAPER OR DIGITAL DIARY

Do you use Diaries in your work with patients who have inflammatory arthritis?

- ( ) Yes
- ( ) No

* 29. Why do you/don't you use Diaries with your inflammatory arthritis patients?

* 30. Are there any barriers to you in using Diaries in your clinical setting?

- ( ) Yes
- ( ) No

31. If Yes, please choose from the following (Multiple answers are possible)

- [ ] I do not understand why using a diary (Paper or Digital) would be
- [ ] important I am not interested in using that type of device
- [ ] It feels impersonal
- [ ] I do not have access to proper
- [ ] equipment It is old-fashioned
- [ ] It is too expensive
- [ ] it takes too much time
- [ ] I do not know what to do with the results
- [ ] I do not believe that the results are accurate
- [ ] I do not have anyone to talk to about the
- [ ] results Other (please specify)

* 32. What would make it easier for you to use Diaries in your clinical setting?

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Irish Health Professionals in Rheumatology - awareness and views on Physical Activity measurement

Aerobic Capacity Testing

* 33. Please rate your familiarity with the following tests used in assessing aerobic capacity

	Very familiar	Somewhat familiar	Vaguely familiar	Never heard of
Bicycle Ergometer	○	○	○	○
Treadmill	○	○	○	○
Aerobic Capacity Tests i.e. Walking/Running	○	○	○	○

34. Please list any other aerobic capacity tests that you are familiar with and/or have heard of

* 35. Please rate your confidence in instructing your patients with inflammatory arthritis in performing aerobic capacity tests (0 is not confident and 10 is very confident)

	0	1	2	3	4	5	6	7	8	9	10
Level of Confidence	○	○	○	○	○	○	○	○	○	○	○

* 36. Please rate your confidence in interpreting the results from aerobic capacity tests (0 is not confident and 10 is very confident)

	0	1	2	3	4	5	6	7	8	9	10
Level of Confidence	○	○	○	○	○	○	○	○	○	○	○

* 37. Do you use aerobic capacity tests in your daily work with patients who have inflammatory arthritis?

○ Yes

○ No

38. If yes why do you use aerobic capacity tests?

39. If no why don't you use aerobic capacity tests? (Multiple answers are possible)

- [ ] I do not have time
- [ ] I do not have the proper Equipment
- [ ] I do not know how to perform such a test
- [ ] I do not know how to analyse the data
- [ ] My patients are in too poor condition
- [ ] I do not think it is important
- [ ] Other (please specify)

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Educational Needs

40. Would you be interested in further education around aerobic capacity measurement?

- Yes
- No

41. Would an online module on aerobic capacity measurement be of interest to you?

- Yes
- No

42. If No what alternative format would you prefer?

43. Would you be interested in further education around measuring physical activity?

- Yes
- No

44. Would an online module on physical activity measurement be of interest to you?

- Yes
- No

45. If No what alternative format would you prefer?

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Sleep

46. Do you discuss how many hours sleep your Inflammatory Arthritis patients get at night? (This may be different to the number of hours they spend in bed)

- ◯ Yes
- ◯ No

47. Why do you/don't you discuss the amount of hours sleep your patients get at night?

48. Have your patients mentioned any of the following in relation to their sleep? (more than 1 answer is possible)

- ☐ Taken prescribed or 'over the counter' medication to help sleep
- ☐ Cannot get to sleep within 30 minutes
- ☐ Wake up in the middle of the night or early morning
- ☐ Have to get up to use the bathroom
- ☐ Cannot breathe comfortably
- ☐ Cough or snore loudly
- ☐ Feel too cold
- ☐ Feel too hot
- ☐ Have had bad dreams
- ☐ Have pain
- ☐ Other (please specify)

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Current Physical Activity Levels

* 49. Please answer the following sections regarding your own Physical activities. Think about an average week in the past few months and indicate how many days per week; how much time on average and how strenuous this activity was for you. There are four questions under the headings:- COMMUTING; LEISURE; HOUSEHOLD and ACTIVITY AT WORK/SCHOOL

COMMUTING ACTIVITIES

	How many days per week?	Average time in minutes per day?	Intensity of activity
Walking to/from work or school			
Cycling to/from work or school			

* 50. LEISURE TIME ACTIVITIES

	How many days per week?	Average time in minutes per day?	Intensity of activity
Walking			
Cycling			
Gardening			
Odd jobs			
Sports 1			
Sports 2			
Sports 3			
Sports 4			

* 51. In relation to you answers regarding Sport above can you name the type

Sport 1	
Sport 2	
Sport 3	
Sport 4	

* 52. HOUSEHOLD ACTIVITIES

	How many days per week?	Average time in minutes per day
Light household work (e.g. cooking, washing dishes, ironing, childcare)		
Intense household work (e.g. scrubbing floors, walking with heavy shopping bags)		

53. ACTIVITY AT WORK/SCHOOL

	How many days of the week?	Average time in minutes per day
Light work (e.g. desk job, sitting/standing with some walking)		
Intense work (e.g. regularly lifting heavy objects at work)		

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The End

You have now reached the end of the Survey

Many thanks for taking the time to complete this Questionnaire

Please tick the 'Done' button to Submit

Supplementary data 2 – Latent Class Analysis – model selection and response probabilities

Model selection for LCA of physical measurement methods						
N class	G^2	df	AIC	BIC	ℓ	%
1	201.60	26	211.60	229.95	-814.64	100.0
2	36.66	20	58.66	99.03	-732.18	100.0
3	12.04	14	46.04	108.43	-719.87	100.0
4	6.37	8	52.37	136.78	-717.03	27.0

Response Probabilities for the 5 PA measurement methods for each Latent Classes			
	1	**2**	**3**
	n=91	**n=157**	**n=42**
Class membership probabilities	0.3466	0.4962	0.1572
Item response probabilities			
Use simple sensors, yes	0.4083	0.0438	0.7518
Use complex sensors, yes	0.1373	0.0104	0.7801
Use paper/digital questionnaires, yes	0.9363	0.2942	0.6741
Use paper/digital diaries, yes	0.5740	0.0949	0.6754
Use ACT, yes	0.3209	0.0647	1.0

Survey reporting checklist (based on Kelley et al (2003))

Reporting Item	Page number in manuscript
1.Explain the purpose or aim of the research, with the explicit identification of the research question	5, 6
2. Explain why the research was necessary and place the study in context, drawing upon previous work in relevant fields (the literature review).	5
3. Describe in (proportionate) detail how the research was done.	
a. State the chosen research method or methods, and justify why this method was chosen.	6
b. Describe the research tool. If an existing tool is used, briefly state its psychometric properties and provide references to the original development work. If a new tool is used, you should include an entire section describing the steps undertaken to develop and test the tool, including results of psychometric testing.	6
c. Describe how the sample was selected and how data were collected, including:	
i. How were potential subjects identified?	6
ii. How many and what type of attempts were made to contact subjects?	7
iii. Who approached potential subjects?	7
iv. Where were potential subjects approached?	Not applicable
V .How was informed consent obtained?	7
vi. How many agreed to participate?	Unable to determine – see page 7
vii. How did those who agreed differ from those who did not agree?	Unable to determine - see page 7
viii. What was the response rate?	Unable to determine - see page 7

4. Describe and justify the methods and tests used for data analysis.	7
5. Present the results of the research. The results section should be clear, factual, and concise.	7-16
6. Interpret and discuss the findings. This 'discussion' section should not simply reiterate results; it should provide the author's critical reflection upon both the results and the processes of data collection. The discussion should assess how well the study met the research question, should describe the problems encountered in the research, and should honestly judge the limitations of the work.	16-18
7. Present conclusions and recommendations.	18-19

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The researcher needs to tailor the research report to meet:

•The expectations of the specific audience for whom the work is being written.

•The conventions that operate at a general level with respect to the production of reports on research in the social sciences.

Ethics

Anyone involved in collecting data from patients has an ethical duty to respect each individual participant's autonomy. Any survey should be conducted in an ethical manner and one that accords with

BMJ Open

A survey across four European countries to determine rheumatology health professionals' awareness of physical activity measures in people with inflammatory joint diseases

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TITLE PAGE

A survey across four European countries to determine rheumatology health professionals' awareness of physical activity measures in people with inflammatory joint diseases

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Key words: health professional, inflammatory joint diseases, measurement, physical activity, survey

ABSTRACT

Objectives: The objectives of this study were to determine rheumatology health professionals (HPs) awareness of and confidence in using physical activity (PA) measures in people with inflammatory joint diseases (IJDs), their own self-reported PA levels and to identify HPs related educational needs.

Methods: Rheumatology HPs in Denmark, Sweden, Ireland and Belgium participated in an online survey. Descriptive statistics and latent class analysis (LCA) was undertaken (SPSS v21and SASv9.4) to describe data aggregates and range and to identify sub-classes of groups with respect to use of PA measures.

Results: Three hundred and twenty two (n = 322, 75% female) HPs responded from Denmark (n = 50, 15.5%), Sweden (n = 66, 20.5%), Ireland (n = 28, 8.7%), and Belgium (n = 178, 55.3%) and the majority of respondents (n = 286, 91.7%) reported it was important to measure PA in people with IJDs. Only 28.2% of HPs used simple body worn sensors to measure PA levels in their patients. The majority were interested in online education on measuring PA (82.9%).

LCA, used to generate classes of PA measures employed by HPs, revealed three distinct classes reflecting differences in self-reported PA levels, awareness of PA measures, further education requirements and professional background.

Conclusions: The majority of respondents reported that they considered measuring PA as important in people with IJDs; however, the majority lacked confidence in how to measure it. There was strong interest in further education around measuring PA. Three distinct respondent classes were identified to inform targeted education on how to measure PA.

Strengths and limitations of this study –

- First survey to examine how rheumatology health professionals in four European countries measure physical activity in their clinical practice and their confidence in doing so
- The use of latent class data analysis to identify sub-groups to aid tailoring of further education relating to physical activity measurement in clinical practice is novel in this field
- An overall response rate could not be calculated as two countries could not determine the total sample surveyed
- Translation of the survey, which was originally designed in English, may have inadvertently led to a reduction in face validity of the survey.

INTRODUCTION

Regular physical activity (PA) is associated with improvements in health-related outcomes, such as quality of life, aerobic fitness, and disease-related characteristics, including pain and stiffness in people with inflammatory joint diseases (IJDs) [1-4]. However, research has shown lower levels of PA in the arthritis population [5-9], thus better promotion of PA among people with IJDs is necessary[10]. Health professionals (HPs) are ideally placed to promote PA and its health benefits with their patients [11].

Previous studies have investigated attitudes and educational needs relating to health-enhancing PA among HPs in the Netherlands [12] and Ireland [13]. However, these studies focused on whether HPs valued PA for people with arthritis and did not focus on how to measure PA in this population. In order to promote PA and to determine if people with IJDs are engaging in PA, HPs need to be aware of how to measure PA. Accurate measurement of PA is important for clinical decision making and monitoring of changes in outcomes. The range and complexity of devices available to measure PA has increased in recent times [14-16]. These devices, while presenting an opportunity to measure PA more comprehensively, may be a barrier to PA measurement in practice due to their perceived complexity of use, cost, and availability in clinical practice. Yet, these devices are increasingly used by patients necessitating that HPs are confidently able to discuss PA measurement using them [17 18]. To inform education aimed at enhancing HPs knowledge of using PA measures in practice, it is first necessary to survey their current awareness of measuring PA.

Tailored interventions are preferable in changing HPs practices [19] and advanced analysis of HPs characteristics can assist with identifying subgroups for tailored education. Latent class analysis (LCA) is a statistical approach that allows for such identification of subclasses based on response patterns from the overall sample in a survey[20].

Thus the aim of this study was to determine rheumatology HPs awareness of and confidence in using PA measures in people with IJDs. A second aim was to identify sub-classes within this population to help tailor further education on use of PA measures for people with IJD.

METHODS

A survey reporting guideline[21] was used to guide reporting of this survey (Research checklist).

Design

A cross-sectional on-line survey design was used to allow a broad geographic distribution, convenience to respondents and guaranteed respondent confidentiality [22].

Sample

Rheumatology HPs in Denmark, Sweden Ireland and Belgium in Europe were invited to participate in an online survey. Participants were recruited to participate through their national rheumatology health professional association/group. The Denmark health professionals were recruited through the 'Danish Interdisciplinary Rheumatology Forum', 'Occupational Therapists in Rheumatology/Arthritis and Back Disorders' (Facebook group) and through the hospitals' rheumatology departments across the country. The Swedish health professionals were recruited through the Swedish Association of Physiotherapists Rheumatology Interest group, the Swedish Rheuma Forum groups for occupational therapists and nurses. In Ireland, recruitment was through the Irish Rheumatology Health Professionals Society and the Irish Society for Rheumatology in Ireland and in Belgium, recruitment was through the Belgian Health Professionals in Rheumatology and Belgian Royal Society for Rheumatology in Belgium. Health professionals in this study included all health professionals working in rheumatology including medical, nursing and allied health professionals. Separate ethical approval was granted by each participating country's research ethics committees.

Survey

The study steering group developed an online survey following review of previously used questionnaires to measure PA among HPs[12 13]. The questionnaire (supplementary file 1) was divided into sections*: demographic profile; PA measurement; Aerobic capacity testing, educational needs. As previous studies have noted that some HPs' own physical activity levels may have an influence on how they advise their patients about being physically active [23 12], a measure of HPs own PA was included. The Short Questionnaire to Assess Health Enhancing Physical Activity (SQUASH)[24] was chosen based on its previous use with rheumatology HPs[12] and its short completion time. The SQUASH contains 11 questions on physical activity related to commuting activities, leisure time and sports activities, household activities, and activity at work and school and is reported to have acceptable reliability

(overall reproducibility: r = 0.58) and validity (correlation with an activity monitor for the total activity score was r= 0.45)[24].

*Parts of the survey on barriers to measurement and aerobic capacity testing will be reported in future papers.

In this study the total score used was the total minutes of activity per week was used as it incorporates frequency and duration of all included activities.

To ascertain face validity of the questionnaire used in this study, discussions were organised in each country by the country representative and up to four other HP´s, to cover the different professional groups. These debriefings were held in order to explore whether the constructs surveyed within each questionnaire reflected the aims under study (i.e. to identify missing or problematic questions/constructs) and were understandable in each language. No issues relating to conceptualisation in any language following translation were identified. The questionnaire was translated into each country's main language(s). Data was then back-translated where necessary and the final results presented in English.

Data Collection

The questionnaire was conducted online through SurveyMonkey, KI Survey or SurveyXact. In each country the chairperson for each relevant HP association was contacted requesting permission for their group's members to participate. When this permission was granted the chairperson acted as gatekeeper by sending the email containing the study information, survey link and researcher details to their group's members. The first page of the survey contained detailed information on the study and consent was implied if the respondent continued past this page to complete the survey. Reminders were sent to members, via the chairperson, at one month post the initial email three weeks apart.

Data Analysis

Descriptive statistics of the demographic profile were derived from the data. Categorical data were described as counts and percentages. Continuous data that approximated a Gaussian distribution were described as means and standard deviations, otherwise the continuous data was described as medians and interquartile ranges. Differences between the demographic variables were tested using chi-square tests and ANOVA test where appropriate. Latent class analysis (LCA)[20] , a probability-based model, was used to generate classes of use of measures of PA. A number of latent class models, with 1 class up to 4 classes, were compared and two model fit indexes, Akaike information criterion (AIC)[25] and Bayesian information criterion

(BIC)[26], were used to identify the optimal number of latent classes. The model with the smallest AIC and BIC indicates the best fitting model. Data analysis was carried out using the (SPSS v21, IBM USA) and SAS (v 9.4, SAS Institute, USA).

RESULTS

A total of 322 HPs responded to the survey, with country and socio-demographic profiles provided in Table 1. The overall response rate for the survey could not be calculated, as exact membership numbers were not available in each country. On an individual country basis, the response rates were available for Ireland (65%) and Sweden (25%) only.

Table 1 Demographic profile of respondents[§]

	Variable	Count (%)
Country	Denmark	50 (15.5)
	Sweden	66 (20.5)
	Ireland	28 (8.7)
	Belgium	178 (55.3)
Gender	Female	243 (75.5)
	Male	79 (24.5)
Age	18-24	7 (2.2)
	25-34	54 (16.8)
	35-44	81 (25.2)
	45-54	89 (27.6)
	55-64	87 (27.0)
	65-74	4 (1.2)
Profession	Occupational Therapist	30 (9.3)
	Physiotherapist	242 (75.2)
	Registered Nurse	42 (13.0)
	Others*	8 (2.5)
Place of Work	Hospital Part-time	60 (18.6)
	Hospital Fulltime	94 (29.2)
	Private Part-time	18 (5.6)
	Private fulltime	104 (32.3)
	Primary part-time	1 (0.3)
	Primary fulltime	3 (0.9)
	Mixed Place of Work	26 (8.1)
	Other	16 (5.0)
Patients treated with arthritis - %	<5%	97 (30.1)
	6-10%	63 (19.6)
	11-25%	33 (10.2)
	26-50%	25 (7.8)
	51-75%	26 (8.1)
	76-100%	76 (23.6)
	Other	2 (0.6)

Important to measure PA (n=312)	Yes	286 (91.7)
	No	26 (7.3)
Want further PA education (n=258)	Yes	226 (87.6)
	No	32 (12.4)
Want online further education on PA (n=258)	Yes	214 (82.9)
	No	44 (17.1)
SQUASH - (total minutes per week) Mean(sd)		3,874 (2,231.0)

*Others – Podiatrists, rheumatologists, social worker, pharmacist

§ total n = 322

Measuring Physical Activity

When asked about the importance or not of measuring PA in people with IJDs the majority (n=286, 91.7%) stated it was important while 26 HPs (8.3%) said measuring PA was not important (Table 1). Of those stating it was not important to measure PA (n = 26), the majority (n=24, 92%) were physiotherapists (10% of overall physiotherapy sample), from Belgium (n = 21, 80.8%), were mostly older aged (55-65) (n = 11, 42%) with only country differences statistically significantly different (p=0.006) (Table 2).

Table 2 Demographic profile of respondents' views on importance of measuring physical activity§

		Important to Measure			
		No (n=26)	**Yes (n=286)**	**p-value**	**Effect size**
		Count (%)	**Count (%)**		
Age	18-24	1 (3.8)	4 (1.4)	0.247	0.146
	25-34	3 (11.5)	49 (17.1)		
	35-44	4 (15.4)	75 (26.2)		
	45-54	6 (23.1)	82 (28.7)		
	55-64	11(42.3)	73 (25.5)		
	65-74	1 (3.8)	3 (1.0)		
Gender	Female	16 (61.5)	222 (77.6)	0.065	0.105
	Male	10 (38.5)	64 (22.4)		
Country	Denmark	5 (19.2)	45 (15.7)	0.006*	0.199
	Sweden	0 (0.0)	66 (23.1)		
	Ireland	0 (0.0)	27 (9.4)		

	Belgium	21 (80.8)	148 (51.7)		

§ total n = 312 as 10 respondents did not answer this question

The majority of HPs (n = 226 (87.6%)), wanted further education on PA measurement (Table 1). There was strong interest in online education with the majority of respondents who answered yes to wanting further education (n=214, 82.9%) interested in this online format.

Respondents were most confident using, educating about and interpreting data from simple body worn sensors (pedometers, simple accelerometers, smartphone apps) and paper questionnaires/diaries and least confident using, educating about and interpreting complex body worn sensors (sensors that collect multiple data on one device) and digital diaries and questionnaires (PA surveys on phones for example) (Table 3). Physiotherapists were likely to use all sensors compared to occupational therapists and nurses, whereas occupational therapists and nurses were most likely to use paper / digital questionnaires (Table 4).

Table 3 Descriptives of confidence in using, educating about and interpreting physical activity measures[#]

	Simple body worn sensor **Median (IQR)**	**Complex body worn sensor** **Median (IQR)**	**Paper questionnaire** **Median (IQR)**	**Paper diary** **Median (IQR)**	**Digital questionnaire** **Median (IQR)**	**Digital diary** **Median (IQR)**
Confidence in using	7.0 (7.0)	4.0 (8.0)	7.0 (7.0)	8.0 (6.0)	3.5 (7.0)	3.0 (6.0)
Confidence in educating	5.0 (9.0)	2.0 (7.0)	8.0 (7.5)	6.0 (9.0)	2.0 (7.0)	2.0 (7.0)
Confidence in interpreting	6.0 (9.0)	3.0 (7.0)	7.0 (7.0)	6.0 (8.0)	4.0 (8.0)	3.0 (7.0)

[#]Confidence scores legend

Possible score range 0-10 – 0 = not confident, 10 = very confident

Table 4: Health professionals' confidence in using, educating about and interpreting physical activity measures by profession[# §]

	Occupational Therapist (n=30)	Physiotherapist (n= 242)	Registered Nurse (n=42)	Others* (n=8)
	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)
Confidence in using PA measures by profession				
Simple	5.0 (3.5)	7.0 (7.0)	5.0 (9.0)	5.5 (6.25)
Complex	3.5 (6.0)	5.0 (8.0)	2.0 (5.0)	1.0 (8.5)
Paper Q.	8.0 (3.0)	7.0 (7.0)	8.0 (8.0)	6.5 (7.25)
Paper D.	8.0 (4.25)	6.0 (8.0)	6.0 (8.0)	5.0 (7.25)
Digital Q.	5.0 (4.25)	3.0 (6.0)	5.0 (7.5)	5.0 (5.5)
Digital D.	5.0 (4.0)	2.0 (6.0)	3.0 (7.0)	5.0 (5.0)
Confidence in educating patients to use PA measures by profession				
Simple	5.0 (6.5)	6.0 (9.0)	1.0 (5.0)	2.0 (2.0)
Complex	4.0 (5.5)	4.0 (8.0)	0.0 (4.0)	1.0 (2.75)
Paper Q.	8.0 (2.5)	8.0 (8.0)	5.0 (10.0)	6.5 (6.0)
Paper D.	8.0 (4.5)	6.0 (9.0)	5.0 (10.0)	5.5 (5.25)
Digital Q.	6.0 (5.0)	2.0 (7.0)	2.0 (9.0)	5.0 (4.75
Digital D.	5.0 (5.5)	2.0 (7.0)	2.0 (8.0)	5.0 (4.75)
Confidence in interpreting results from PA measures by profession				
Simple	6.0 (5.0)	7.0 (9.0)	2.0 (6.0)	1.0 (2.25)
Complex	4.0 (6.0)	4.0 (8.0)	0.0 (2.5)	0.0 (0.5)
Paper Q.	9.0 (3.0)	7.0 (7.0)	7.0 (10.0)	4.0 (7.0)
Paper D.	8.0 (4.0)	5.0 (8.25)	6.0 (9.0)	4.0 (7.0)
Digital Q.	6.0 (4.0)	3.0 (8.0)	3.0 (7.5)	2.0 (5.25)
Digital D.	5.0 (4.0)	2.0 (7.0)	2.0 (7.0)	2.0 (5.25)

*Others – Podiatrists, rheumatologists, social worker, pharmacist

§ total n = 322

#**Confidence scores legend**

Possible score range 0-10 – 0 = not confident, 10 = very confident

Abbreviations

Simple - Simple body worn sensor

Complex - Complex body worn sensor

Paper Q - Paper questionnaire

Paper D - Paper diary

Digital Q - Digital questionnaire

Digital D - Digital diary

Physiotherapists reported greater confidence in using, educating about and interpreting simple and complex body worn devices, which was statistically significant for confidence in using simple devices ($p<0.005$), educating patients about simple devices ($p=0.003$) and interpreting simple devices only ($p=0.023$) (Table 4).

Physical Activity levels

The SQUASH questionnaire was used to measure HPs own PA levels. The mean total minutes of activity per week for the whole sample was 3,874.2 (sd 2,231.0) minutes (table 5).

Table 5 Respondents own physical activity levels (SQUASH[#]) demographics[§]

		SQUASH Mean (sd)	p-value	Eta-squared
Sex	Female (n=183)	3859.1 (2205.6)	0.841	0.000
	Male (n=49)	3931.1 (2345.7)		
Age	18-24 (n=3)	6286.7 (2737.3)	0.062	0.045
	25-34 (n=36)	4717 (2088.3)		
	35-44 (n=64)	3576 (2348.1)		
	45-54 (n=67)	3720.9 (2076.7)		
	55-64 (n=60)	3725.5 (2248.2)		
	65-75 (n=2)	4223.0 (229.1)		
Country	Denmark (n=41)	3781.5 (1478.5)	<0.000*	0.248
	Sweden (n=46)	2881.3 (1385.8)		
	Ireland (n=27)	1662.9 (914.6)		
	Belgium (n=118)	4808.7 (2390.5)		
Profession	Occupational Therapist (n=16)	3118.1 (2029.6)	0.361	0.014
	Physiotherapist (n=180)	3986.6 (2219.2)		

	Registered Nurse (n=31)	3759.7 (2388.6)		
	Others** (n=5)	2959.0 (2193.1)		

**Others – Podiatrists, rheumatologists, social worker, pharmacist

§ total n = 232 as not all respondents completed SQUASH data

total minutes of activity per week

Latent Class Analysis

Latent class analysis was used to generate classes of use of measures of PA. Models with one through four latent classes were compared in order to select a model of activity levels. The BIC suggests that the 2-class solution was superior (BIC = 99.03) while the AIC suggests the 3-class solution (AIC = 46.04). An examination of both the two- and three-class models suggested that the 3-class model had greater parsimony (supplementary file 2). The membership probabilities and the item response probabilities for the 3-class LCA solution are presented in supplementary file 2 while the association between the classes and the socio-demographics are shown in Table 6.

- Class 1 – *traditional group* - accounted for 34.66% of individuals. People in this class had a high probability of using paper/digital means to measure PA, were mainly from Belgium, Sweden and Ireland, tended to be older and had lower years' experience working in rheumatology than Class 3 and greater years' experience in rheumatology than Class 2. They also had the lowest total minutes of activity per week.

- Class 2 – *reluctant group* - resulted in the highest class membership probability, 49.62%. People in this group tended not to use any method of measurement, were older, had the shortest experience working in rheumatology, but the longest years working overall, were mainly nurses and from Belgium and Denmark and had a greater group membership who do not want further education about PA. This group's PA levels were higher than Class 1 but lower than class 3.

- Class 3 – *early adopters* - accounted for 15.72% of the sample and can be categorised as those who use all methods to measure PA. This groups members were mainly physiotherapists from Belgium and Sweden who were working in rheumatology longer than Class 1 and 2 members and were in agreement as to the importance of measuring PA and want more education relating to PA. Members of this group also had the highest total minutes of activity per week.

Table 6: Association between latent classes and socio-demographics

		Class 1 (*Traditional*) (n=91) Count (%)	Class 2 (*Reluctant*) (n=157) Count (%)	Class 3 (*Early Adopters*) (n=42) Count (%)	P-value	Effect Size[a]
Country	Denmark	9 (9.89)	40 (25.48)	1 (2.38)	<0.001*	0.276
	Sweden	32 (35.16)	17 (10.83)	17 (40.48)		
	Ireland	12 (13.19)	14 (8.92)	0 (0.0)		
	Belgium	38 (41.76)	86 (54.78)	24 (57.14)		
Gender	Female	71 (78.02)	126 (80.25)	30 (71.43)	0.467	0.073
	Males	20 (21.98)	31 (19.75)	12 (28.57)		
Age	18-24	1 (1.10)	3 (1.91)	0 (0.0)	0.741	0.109
	25-34	14 (15.38)	26 (16.56)	8 (19.05)		
	35-44	26 (28.57)	36 (22.93)	14 (33.33)		
	45-54	25 (27.47)	52 (33.12)	9 (21.43)		
	55-64	25 (27.47)	37 (23.57)	10 (23.81)		
	65-74	0 (0.0)	3 (1.91)	1 (2.38)		

Profession	Occupational Therapist	14 (15.38)	12 (7.64)	1 (2.38)	0.001*	0.195
	Physiotherapist	63 (69.23)	112 (71.34)	41 (97.62)		
	Registered Nurse	14 (15.38)	27 (17.20)	0 (0.0)		
	Other	0 (0.0)	6 (3.82)	0 (0.0)		
Place of work	Hospital part-time	22 (24.18)	25 (15.92)	11 (26.19)	0.344	0.164
	Hospital full-time	26 (28.57)	51 (32.48)	11 (26.19)		
	Private part-time	2 (2.20)	11 (7.01)	2 (4.76.)		
	Private full-time	25 (27.47)	49 (31.21)	13 (30.95)		
	Primary care part-time	0 (0.0)	0 (0.0)	1 (2.38)		
	Primary care full-time	2 (2.20)	1 (0.64)	0 (0.0)		
	Mixed practice	9 (9.89)	11 (7.01)	3 (7.14)		
	Other	5 (5.49)	9 (5.73)	1 (2.38)		
Important to measure	No	2 (2.20)	20 (12.74)	0 (0.0)	0.001*	0.213
	Yes	89 (97.80)	137 (87.26)	42 (100.0)		
PA Education	No	5 (5.62)	25 (18.94)	2 (5.41)	0.005*	0.203
	Yes	84 (94.38)	107 (81.06)	35 (94.59)		

ACT Education	No Yes	8 (8.99) 81 (91.01)	31 (22.96) 104 (77.04)	3 (8.57) 32 (91.43)	0.009*	0.191
Years qualified	Median (IQR)	20 (17)	24 (18)	20.5 (17)	0.996	<0.001
Years Rheumatology	Median (IQR)	12 (13)	9 (20)	16 (21)	0.015*	0.030
SQUASH	Total minutes of activity per week, Mean (SD)	3626.67 (2439.94)	3949.98 (21.28.98)	4274.36 (1995.48)	0.33	0.01
*statistically significant relationship [a]Cramer's V effect size used for categorical variables, otherwise eta-squared is used						

ACT – Aerobic capacity testing

PA – physical activity

SQUASH – Short QUestionnaire to ASsess Health enhancing physical activity

DISCUSSION

This study is the first to investigate HPs awareness of and confidence in using measures of PA for people with IJDs across four European countries. Physical activity is an important part of the optimal management of people with IJDs[27-29]. In addition to promoting PA among people with IJDs, HPs also need to be able to adequately measure PA as an outcome measure[17].

Our study highlights that the majority of HPs working with people with IJDs in four countries see the importance of measuring PA. However, confidence in using more objective measures of PA was low overall in this survey, with just a small group of physiotherapists, predominantly from Belgium and Sweden who were experienced in the field of rheumatology most likely to use any body worn sensor to PA measure in their patients. Lack of confidence in measuring PA is not uncommon among HPs. A survey of primary care physicians in Sydney found that less than 30% of primary care encounters involve PA assessment [30] with physicians indicating differing preferences for what instrument to use in practice to measure PA[31].

Previous research has examined the self-report PA levels of rheumatology health professionals[12] and reported lower PA levels using the same score (total minutes of activity per week) compared to this study. Physiotherapists and nurses total minutes of activity per week were 863 and almost 1,000 minutes higher respectively than in the Hurkmans et al study. The SQUASH PA levels reported in this study are very high but reflective of the totality of activity that the respondents reported including light daily activities during work, getting to and from work and not just structured exercise, which are often not captured. The differences between our SQUASH results and that of the previous Dutch study[12] may be explained by greater awareness among HPs of the importance of regular PA for their own health in the intervening time between the two studies, the inclusion of different countries in this study and the use of different aggregate values in both studies.

The majority of respondents wanted further education on PA measurement and the majority would like this in an online format. Development of more tailored education programmes are preferable for changing health professionals practices[32]. To help identify if differences existed between countries, professions, place of work and rheumatology experience we used a statistical approach to determine if different groupings existed regarding use of PA measures. The three groups modelled using LCA showed that while a majority were aware of

measures of PA, respondents in the *reluctant* group are a priority for education as they had the lowest awareness of PA measures. The value of using LCA to generate classes of use of measures of PA in this study is in aiding the tailoring of further PA education, which may in turn enhance participant's confidence in measuring PA. Generic approaches to delivery of education can result in reduced uptake of the education with resultant lack of change in practice. Based on the results of this study people in the *reluctant* group should be targeted first as they do not report measuring PA as important and did not report an interest in further education on measuring PA. Members in the *reluctant* group were from all four countries (majority from Belgium and Denmark, all three professions (highest physiotherapy) and were the longest qualified group, but working the least years in rheumatology. Their reluctance may be part formed by an assumption of expertise in this area based on length of experience and/or a view that not all health professionals need to be educated in measuring PA. An education programme for this group around measurement of PA would need to take a graded approach starting with a basic introduction to the value of PA measurement and the various methods of doing so in a clinical setting. This learning could then be contextualised to rheumatology incorporating case studies to allow for application of learning. Members of the *traditional* group were most likely to already use a basic form of PA measurement thus an intermediate level module focusing on the range of PA measures and how to interpret data from them would form the basis for their learning. Finally, the minority of respondents belonging to the *early adopters* group were most likely to be already using all methods of PA measurement – for this group a more advanced educational module could be developed incorporating theories of PA behavioural change and advanced PA measurement. These educational modules may also need to consider differing professional scopes of practice around PA measurement and management. The use of a statistical approach to develop groups to help target educational interventions has been used in other areas of practice including antibiotic use and resistance in Sweden[33] and nurses beliefs about caring for patients traumatic brain injury[34]. In this study the use of LCA to generate classes of use of measures of PA was valuable in helping to identify subgroups with similar scores who have different scores from the other subgroups[20]. Further research using qualitative methods would build on these findings to explore educational needs among respondents within each sub-group.

Implications for practice

While measuring PA was reported as important by HPs in these four European countries there is not a concomitant high number of HPs measuring PA in practice. Measuring PA is important as engagement in PA is important for patients and has numerous health benefits. Thus, it can become a routine outcome measure in practice. Encouraging practitioners to use some of the range of measures available to measure PA is important given the importance of PA in managing IJDs. To improve the use of PA outcome measures in practice it is necessary for HPs to improve their awareness of and confidence in using objective measures of PA.

Limitations

As with any survey, respondents may have misinterpreted the questions with resultant inaccuracy in responses. The original survey was designed in English and translated into Swedish, Danish, French and Flemish with results being reported into English. Hence, some understanding or interpretation may have been lost in translation and back-translation. We identified no changes in interpretability following translation; however, future studies should undertake a more rigorous process with regard to translation and back-translation and should undertake large scale cross cultural validity work prior to undertaking the final survey. Some information on the benefits of physical activity measurement provided in the introduction to the questionnaire and some questions may have had a leading effect on respondents.

Also, respondents were largely physiotherapists, occupational therapists and nurses, thus the results cannot be considered to be reflective of the views of other rheumatology HPs including rheumatologists. Rheumatologists are an important group to consider when examining how to promote PA[35] thus further research is needed to determine their awareness of PA measures in people with IJDs. Finally, response rates were estimates only for two countries as exact membership numbers for those countries were not available.

The SQUASH questionnaire has mixed evidence for its reliability and validity in patients with Ankylosing Spondylitis[36] and Total knee arthroplasty[37] and in non-clinical populations[24] [38] with one recent study identifying its considerable variation in test-retest reliability and validity among a multi-ethnic population in The Netherlands[39]. We would not recommend the use of this measure of self-report PA based on what we identified, but were unable to verify, in the absence of an observational study, if over reporting of PA levels occurred. Respondents were not asked to detail if their work and home was an urban or rural location, which limited the interpretation of the SQUASH data.

CONCLUSION

The majority of the rheumatology HPs reported that it was important to measure PA; however, levels of awareness and confidence were moderate to low about how to use, interpret and educate patients about more complex measures such as body worn devices. There was strong interest in further education around measuring PA. Three distinct sub-groups were identified allowing for targeted education and training for HPs to be developed in the future to improve knowledge and confidence in using PA measures.

COMPETING INTERESTS

No authors have declared conflicts of interest or competing interests

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RESEARCH REPORTING CHECKLIST

The following reporting checklist was used in the preparation of this manuscript – Good Practice in the conducting and reporting of survey research[21]

DATA SHARING STATEMENT

Individual participant data that underlie the results reported in this article, after deidentification (text, tables and appendices), immediately after publication for 3 years to any researchers who provide a methodologically sound proposal. Requests for data sharing should be directed to norelee.kennedy@ul.ie

CONTRIBUTORSHIP STATEMENT

N Kennedy, N Brodin, B Esbensen, B Nordren and T Swinnen were the original authors who submitted the grant, designed the study, oversaw the data collection and analysis in their countries, assisted with preparation of the paper, and read and commented on all drafts and agreed on the final manuscript. S McKenna, S Willems and N Hammer were research assistants who assisted with designing the survey, collecting the data, analysing the data and commented on manuscript drafts. A O'Neill undertook the substantive analysis of the data including the LCA and also commented on all manuscript drafts.

REFERENCES

1. Plasqui G. The role of physical activity in rheumatoid arthritis. *Physiology & behavior* 2008;94(2):270-75.
2. Metsios GS, Stavropoulos-Kalinoglou A, Sandoo A, et al. Vascular function and inflammation in rheumatoid arthritis: the role of physical activity. *Open Cardiovasc Med J* 2010;4(1):89-96.
3. Stavropoulos-Kalinoglou A, Metsios GS, Veldhuijzen van Zanten JJ, et al. Individualised aerobic and resistance exercise training improves cardiorespiratory fitness and reduces cardiovascular risk in patients with rheumatoid arthritis. *Ann Rheum Dis* 2013;72(11):1819-25. doi: 10.1136/annrheumdis-2012-202075
4. Hurkmans E, van der Giesen FJ, Vliet Vlieland TP, et al. Dynamic exercise programs (aerobic capacity and/or muscle strength training) in patients with rheumatoid arthritis. *Cochrane Database Syst Rev* 2009(4):CD006853. doi: 10.1002/14651858.CD006853.pub2
5. Tierney M, Fraser A, Norelee K. Physical activity in rheumatoid arthritis: a systematic review. 2012
6. Sokka T, Häkkinen A, Kautiainen H, et al. Physical inactivity in patients with rheumatoid arthritis: Data from twenty‐one countries in a cross‐sectional, international study. *Arthritis Care & Research* 2008;59(1):42-50.
7. Hootman JM, Macera CA, Ham SA, et al. Physical activity levels among the general US adult population and in adults with and without arthritis. *Arthritis Care & Research* 2003;49(1):129-35.
8. Haglund E, Bergman S, Petersson IF, et al. Differences in physical activity patterns in patients with spondylarthritis. *Arthritis care & research* 2012;64(12):1886-94.
9. Swinnen TW, Scheers T, Lefevre J, et al. Physical activity assessment in patients with axial spondyloarthritis compared to healthy controls: a technology-based approach. *PloS one* 2014;9(2):e85309.
10. Austin S, Qu H, Shewchuk RM. Health Care Providers' Recommendations for Physical Activity and Adherence to Physical Activity Guidelines Among Adults With Arthritis. *Preventing Chronic Disease* 2013;10:E182. doi: 10.5888/pcd10.130077
11. Larkin L, Gallagher S, Fraser A, et al. If a joint is hot it's not the time: health professionals' views on developing an intervention to promote physical activity in rheumatoid arthritis. *Disability and Rehabilitation* 2016:1-8.
12. Hurkmans EJ, de Gucht V, Maes S, et al. Promoting physical activity in patients with rheumatoid arthritis: rheumatologists' and health professionals' practice and educational needs. *Clinical rheumatology* 2011;30(12):1603-09.
13. McKenna S, Kelly G, Kennedy N. FRI0585-HPR A Survey of Irish Physiotherapists' Current Practice in Promoting Physical Activity in Rheumatoid Arthritis. *Annals of the Rheumatic Diseases* 2014;73(Suppl 2):1206-07.
14. Tierney M, Fraser A, Purtill H, et al. Study to determine the criterion validity of the SenseWear Armband as a measure of physical activity in people with rheumatoid arthritis. *Arthritis Care Res (Hoboken)* 2013;65(6):888-95. doi: 10.1002/acr.21914
15. Semanik P, Song J, Chang RW, et al. Assessing physical activity in persons with rheumatoid arthritis using accelerometry. *Med Sci Sports Exerc* 2010;42(8):1493-501. doi: 10.1249/MSS.0b013e3181cfc9da
16. Sylvia LG, Bernstein EE, Hubbard JL, et al. Practical guide to measuring physical activity. *J Acad Nutr Diet* 2014;114(2):199-208. doi: 10.1016/j.jand.2013.09.018
17. Trost SG, O'Neil M. Clinical use of objective measures of physical activity. *British Journal of Sports Medicine* 2014;48(3):178-81. doi: 10.1136/bjsports-2013-093173

18. Ainsworth B, Buchholz SW. How to Assess Physical Activity in Clinical Practice and for Scholarly Work. *The Journal for Nurse Practitioners* 2017;13(1):14-20.e2. doi: https://doi.org/10.1016/j.nurpra.2016.06.020
19. Baker R, Camosso-Stefinovic J, Gillies C, et al. Tailored interventions to address determinants of practice. *Cochrane Database Syst Rev* 2015(4):CD005470. doi: 10.1002/14651858.CD005470.pub3
20. Kongsted A, Nielsen AM. Latent Class Analysis in health research. *Journal of physiotherapy* 2017;63(1):55-58. doi: 10.1016/j.jphys.2016.05.018 [published Online First: 2016/12/05]
21. Kelley K, Clark B, Brown V, et al. Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care* 2003;15(3):261-66. doi: 10.1093/intqhc/mzg031
22. Domholdt E. Rehabilitation research: principles and applications: Elsevier Saunders. 2005
23. Iversen MD, Eaton HM, Daltroy LH. How rheumatologists and patients with rheumatoid arthritis discuss exercise and the influence of discussions on exercise prescriptions. *Arthritis Rheum* 2004;51(1):63-72. doi: 10.1002/art.20168
24. Wendel-Vos GCW, Schuit AJ, Saris WHM, et al. Reproducibility and relative validity of the short questionnaire to assess health-enhancing physical activity. *Journal of clinical epidemiology* 2003;56(12):1163-69.
25. H. A. Factor Analysis and AIC. New York, NY: Springer Series in Statistics (Perspectives in Statistics). Springer, 1987.
26. Schwarz G. Estimating the Dimension of a Model. *Ann Statist* 1978;6(2):461-64. doi: 10.1214/aos/1176344136
27. Veldhuijzen van Zanten JJCS, Rouse PC, Hale ED, et al. Perceived Barriers, Facilitators and Benefits for Regular Physical Activity and Exercise in Patients with Rheumatoid Arthritis: A Review of the Literature. *Sports Medicine* 2015;45(10):1401-12. doi: 10.1007/s40279-015-0363-2
28. Agca R, Heslinga SC, Rollefstad S, et al. EULAR recommendations for cardiovascular disease risk management in patients with rheumatoid arthritis and other forms of inflammatory joint disorders: 2015/2016 update. *Annals of the Rheumatic Diseases* 2016 doi: 10.1136/annrheumdis-2016-209775
29. Withall J, Haase AM, Walsh NE, et al. Physical activity engagement in early rheumatoid arthritis: a qualitative study to inform intervention development. *Physiotherapy* 2016;102(3):264-71. doi: https://doi.org/10.1016/j.physio.2015.07.002
30. Winzenberg T, Reid P, Shaw K. Assessing physical activity in general practice: a disconnect between clinical practice and public health? *British Journal of General Practice* 2009;59(568):e359-e67. doi: 10.3399/bjgp09X472818
31. Dutton SN, Dennis SM, Zwar N, et al. An explorative qualitative study on acceptability of physical activity assessment instruments among primary care professionals in southern Sydney. *BMC Family Practice* 2016;17(1):138. doi: 10.1186/s12875-016-0536-6
32. Baker R, Camosso-Stefinovic J, Gillies C. Tailored interventions to overcome identified barriers to change: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev* 2010;3
33. Vallin M, Polyzoi M, Marrone G, et al. Knowledge and Attitudes towards Antibiotic Use and Resistance - A Latent Class Analysis of a Swedish Population-Based Sample. *PLOS ONE* 2016;11(4):e0152160. doi: 10.1371/journal.pone.0152160
34. Oyesanya TO, Thomas MA, Brown RL, et al. Nurses' Beliefs About Caring for Patients With Traumatic Brain Injury. *Western journal of nursing research* 2016;38(9):1114-38. doi: 10.1177/0193945916636629 [published Online First: 2016/03/10]
35. Iversen MD, Eaton HM, Daltroy LH. How rheumatologists and patients with rheumatoid arthritis discuss exercise and the influence of discussions on exercise prescriptions. *Arthritis Care & Research* 2004;51(1):63-72. doi: 10.1002/art.20168

36. Arends S, Hofman M, Kamsma YPT, et al. AB0910 Validity and reliability of the IPAQ and squash to assess daily physical activity in patients with ankylosing spondylitis. *Annals of the Rheumatic Diseases* 2013;71(Suppl 3):690-90. doi: 10.1136/annrheumdis-2012-eular.910

37. Wagenmakers R, van den Akker-Scheek I, Groothoff JW, et al. Reliability and validity of the short questionnaire to assess health-enhancing physical activity (SQUASH) in patients after total hip arthroplasty. *BMC Musculoskelet Disord* 2008; 9. http://europepmc.org/abstract/MED/18928545

38. Chinapaw MJ, Slootmaker SM, Schuit AJ, et al. Reliability and validity of the Activity Questionnaire for Adults and Adolescents (AQuAA). *BMC Medical Research Methodology* 2009;9(1):58. doi: 10.1186/1471-2288-9-58

39. Nicolaou M, Gademan MGJ, Snijder MB, et al. Validation of the SQUASH Physical Activity Questionnaire in a Multi-Ethnic Population: The HELIUS Study. *PLOS ONE* 2016;11(8):e0161066. doi: 10.1371/journal.pone.0161066

Supplementary file 1 – Survey

A survey of rheumatology health professionals' awareness and use of physical activity measurement

Demographics

Q 1. Are you – Male/ Female

Q 2. What age category are you in?

18 to 24

25 to 34

35 to 44

45 to 54

55 to 64

65 to 74

75 or older

Q 3. What is your profession?

Physiotherapist

Nurse

Occupational Therapist

Other (please specify)

Q 4. How many years are you qualified?

Q 5. How many years are you working within Rheumatology?

Q 6. Where is your Place of Work? (more than 1 choice is possible)

Hospital - Part/time

Hospital - Full/time

Primary care (PCCC) - Part/time

Primary care (PCCC) - Full/time

Private Practice - Part/time

Private Practice - Full/time

Other (please specify)

Q 7. On a monthly basis what is the percentage of people with inflammatory arthritis that you treat?

< 5%

6-10%

11-25%

26-50%

51-75%

76-100%

Physical Activity Measurement

Physical Activity is important for people with Arthritis. While the measurement and monitoring of same can be a challenge, it has a number of essential uses. The following questions are concerned with the more popular ways in which Physical Activity is monitored. Better knowledge and understanding of patient's current use and barriers will guide the evidence base and future practice of health promotion. You will be asked questions on the following devices:-

SIMPLE BODY-WORN SENSOR

This type of device comes in one piece and measures your physical activity automatically. You wear it directly onto your body from where you can read the output immediately from the display of the device itself (e.g. pedometer, accelerometer, smartphone worn on your body).

COMPLEX BODY-WORN SENSOR

This type of device comes in multiple pieces and measures your physical activity automatically. You wear it directly onto your body and to read the output of your results you need a link to another device (e.g. watch with wireless link to a smartphone application or website, heart rate monitor with wrist band).

PAPER QUESTIONNAIRE

This is a paper survey with questions regarding the physical activities (e.g. walking) you performed over a certain time period (e.g. last week).

PAPER DIARY

This is a paper agenda where you can write down the physical activities (e.g. walking for an hour) you performed over a certain time period.

DIGITAL QUESTIONNAIRE

This is a digital survey on a smartphone, tablet or computer with questions concerning the physical activities (e.g. walking) you performed over a certain time period (e.g. last week)

DIGITAL DIARY

This is a digital agenda where you can digitally select/type in your physical activities (e.g. walking for one hour) mostly on an hour-to-hour or daily basis

Q 8. Do you think it is important to measure physical activity?

Yes / No

Q 9. Why do you/don't you think it is important to measure physical activity?

Q 10. Please rate your confidence in using each of the following devices/ways in monitoring physical activity? (0 is not confident and 10 is very confident)

0 1 2 3 4 5 6 7 8 9 10

SIMPLE BODY WORN SENSOR not linked to other devices (Pedometer/Accelerometer/Watch)

COMPLEX BODY-WORN SENSOR linked to digital sources (Wireless/GPS)

PAPER QUESTIONNAIRE

PAPER DIARY

DIGITAL QUESTIONNAIRE (Smartphone, tablet)

DIGITAL DIARY

Q 11. Please rate your confidence in educating a patient with inflammatory arthritis in how to use each of the following devices/ways in monitoring physical activity? (0 is not confident and 10 is very confident)

0 1 2 3 4 5 6 7 8 9 10

SIMPLE BODY WORN SENSOR not linked to other devices (Pedometer/Accelerometer/Watch)

COMPLEX BODY-WORN SENSOR linked to digital sources (Wireless/GPS)

PAPER QUESTIONNAIRE

PAPER DIARY

DIGITAL QUESTIONNAIRE (Smartphone, tablet)

DIGITAL DIARY

Q 12. Please rate your confidence in interpreting data from each of the following devices/ways in monitoring physical activity, in a clinical setting? (0 is not confident and 10 is very confident)

0 1 2 3 4 5 6 7 8 9 10

SIMPLE BODY WORN SENSOR not linked to other devices (Pedometer/Accelerometer/Watch)

COMPLEX BODY-WORN SENSOR linked to digital sources (Wireless/GPS)

PAPER QUESTIONNAIRE

PAPER DIARY

DIGITAL QUESTIONNAIRE (Smartphone, tablet)

DIGITAL DIARY

Q 13. The following questions are in relation to SIMPLE BODY-WORN SENSOR

Do you use Simple body-worn sensors in your work with patients who have inflammatory arthritis?

Yes No

Q 14. Why do you/don't you use a Simple body-worn sensor with your inflammatory arthritis patients?

Q 15. Are there any barriers to you in using a Simple body-worn sensor in your clinical setting?

Yes No

Q 16. If Yes, please choose from the following (Multiple answers are possible)

I do not understand why using a simple body-worn sensor would be important

I am not interested in using that type of device

It feels impersonal

It is too expensive

I do not have access to proper equipment

It takes too much time

I do not know what to do with the results

I do not believe that the results are accurate

I do not have anyone to talk to about the results

I have difficulties in operating the device

Other (please specify)

Q 17. What would make it easier for you to use a Simple body-worn sensor in your clinical setting?

Q 18. The following questions are in relation to COMPLEX BODY-WORN SENSOR

Do you use Complex body-worn sensors in your work with patients who have inflammatory arthritis?

Yes No

Q 19. Why do you/don't you use a Complex Body-Worn Sensor with your inflammatory arthritis patients?

Q 20. Are there any barriers to you in using a Complex body-worn sensor in your clinical setting?

Yes No

Q 21. If Yes, please choose from the following (Multiple answers are possible)

I do not understand why using a complex body-worn sensor would be important

I am not interested in using that type of device

It feels impersonal

I do not have access to proper equipment

It is too expensive

It takes too much time

I do not know what to do with the results

I do not believe that the results are accurate

I do not have anyone to talk to about the results

I have difficulties in operating the device

Other (please specify)

Q 22. What would make it easier for you to use a Complex body-worn sensor in your clinical setting?

Q 23. The following questions are in relation to PAPER OR DIGITAL QUESTIONNAIRE

Do you use Questionnaires in your work with patients who have inflammatory arthritis?

Yes No

Q 24. Why do you/don't you use Questionnaires with your inflammatory arthritis patients?

Q 25. Are there any barriers to you in using Questionnaires in your clinical setting?

Yes No

Q 26. If Yes, please choose from the following (Multiple answers are possible)

I do not understand why using a questionnaire (Paper or Digital) would be important I am not interested in using that type of device

It feels impersonal

I do not have access to proper equipment It is too expensive

It takes too much time

I do not know what to do with the results

I do not believe that the results are accurate

I do not have anyone to talk to about the results Other (please specify)

Q 27. What would make it easier for you to use Questionnaires in your clinical setting?

Q28. The following questions are in relation to PAPER OR DIGITAL DIARY

Do you use Diaries in your work with patients who have inflammatory arthritis?

Yes No

Q29. Why do you/don't you use Diaries with your inflammatory arthritis patients?

Q30. Are there any barriers to you in using Diaries in your clinical setting?

Yes No

Q 31. If Yes, please choose from the following (Multiple answers are possible)

I do not understand why using a diary (Paper or Digital) would be important I am not interested in using that type of device

It feels impersonal

I do not have access to proper equipment It is old-fashioned

It is too expensive

it takes too much time

I do not know what to do with the results

I do not believe that the results are accurate

I do not have anyone to talk to about the results Other (please specify)

Q 32. What would make it easier for you to use Diaries in your clinical setting?

AEROBIC CAPACITY TESTING

Q 33. Please rate your familiarity with the following tests used in assessing aerobic capacity

	Very familiar	Somewhat familiar	Vaguely familiar	Never heard of
Bicycle Ergometer				
Treadmill				
Aerobic Capacity Tests i.e. Walking/Running				

Q 34. Please list any other aerobic capacity tests that you are familiar with and/or have heard of

Q 35. Please rate your confidence in instructing your patients with inflammatory arthritis in performing aerobic capacity tests (0 is not confident and 10 is very confident)

0 1 2 3 4 5 6 7 8 9 10

Level of Confidence

Q 36. Please rate your confidence in interpreting the results from aerobic capacity tests (0 is not confident and 10 is very confident)

0 1 2 3 4 5 6 7 8 9 10

Level of Confidence

Q 37. Do you use aerobic capacity tests in your daily work with patients who have inflammatory arthritis?

Yes No

Q 38. If yes why do you use aerobic capacity tests?

Q 39.If no why don't you use aerobic capacity tests? (Multiple answers are possible)

I do not have time

I do not have the proper Equipment

I do not know how to perform such a test

I do not know how to analyse the data

My patients are in too poor condition

I do not think it is important

Other (please specify)

Educational Needs

Q 40. Would you be interested in further education around aerobic capacity measurement?

Yes No

Q 41. Would an online module on aerobic capacity measurement be of interest to you?

Yes No

Q 42. If No what alternative format would you prefer?

Q 43. Would you be interested in further education around measuring physical activity?

Yes No

Q 44. Would an online module on physical activity measurement be of interest to you?

Yes No

Q 45. If No what alternative format would you prefer?

Supplementary file 2 – Latent Class Analysis – model selection and response probabilities

Model selection for LCA of physical measurement methods						
N class	G^2	df	AIC	BIC	ℓ	%
1	201.60	26	211.60	229.95	-814.64	100.0
2	36.66	20	58.66	99.03	-732.18	100.0
3	12.04	14	46.04	108.43	-719.87	100.0
4	6.37	8	52.37	136.78	-717.03	27.0

Response Probabilities for the 5 PA measurement methods for each Latent Classes			
	1	**2**	**3**
	n=91	**n=157**	**n=42**
Class membership probabilities	0.3466	0.4962	0.1572
Item response probabilities			
Use simple sensors, yes	0.4083	0.0438	0.7518
Use complex sensors, yes	0.1373	0.0104	0.7801
Use paper/digital questionnaires, yes	0.9363	0.2942	0.6741
Use paper/digital diaries, yes	0.5740	0.0949	0.6754
Use ACT, yes	0.3209	0.0647	1.0

Survey reporting checklist (based on Kelley et al (2003))

Reporting Item	**Page number in manuscript**
1.Explain the purpose or aim of the research, with the explicit identification of the research question	5, 6
2. Explain why the research was necessary and place the study in context, drawing upon previous work in relevant fields (the literature review).	5
3. Describe in (proportionate) detail how the research was done.	
a. State the chosen research method or methods, and justify why this method was chosen.	6
b. Describe the research tool. If an existing tool is used, briefly state its psychometric properties and provide references to the original development work. If a new tool is used, you should include an entire section describing the steps undertaken to develop and test the tool, including results of psychometric testing.	6
c. Describe how the sample was selected and how data were collected, including: i. How were potential subjects identified? ii. How many and what type of attempts were made to contact subjects? iii. Who approached potential subjects? iv. Where were potential subjects approached? V .How was informed consent obtained? vi. How many agreed to participate? vii. How did those who agreed differ from those who did not agree? viii. What was the response rate?	 6 7 7 Not applicable 7 Unable to determine – see page 7 Unable to determine - see page 7 Unable to determine - see page 7

4. Describe and justify the methods and tests used for data analysis.	7
5. Present the results of the research. The results section should be clear, factual, and concise.	7-16
6. Interpret and discuss the findings. This 'discussion' section should not simply reiterate results; it should provide the author's critical reflection upon both the results and the processes of data collection. The discussion should assess how well the study met the research question, should describe the problems encountered in the research, and should honestly judge the limitations of the work.	16-18
7. Present conclusions and recommendations.	18-19