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Title

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Running title

Training preferences in neck and low back pain

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Abstract

Background

Neck pain (NP) and low back pain (LBP) are highly prevalent. Exercise therapy helps, but effect sizes and therapy compliance remain low. New approaches, such as client-centred therapy and technology use may play a role to improve therapy outcomes. To offer technology supported rehabilitation matching patient's goals, training preferences for rehabilitation and technology familiarity need to be known.

Purpose

This study aims to 1) inventory training preferences and motives, 2) evaluate whether these change during rehabilitation, and 3) evaluate familiarity with using technologies, in persons with NP/LBP.

Method

An exploratory cohort study was performed at the Jessa Hospital (Hasselt, Belgium). Semi-structured interviews were conducted based on the Neck Disability Index (NDI) or Roland-Morris Disability Questionnaire (RMDQ) to inventory training preferences, and questions were asked concerning the use of various mainstream technological devices.

Results

Persons with NP (n=40) preferred to train on 'lifting', 'prolonged sitting' and 'driving a car'. Persons with LBP (n=40) preferred to train on 'household activities', 'lifting' and 'prolonged walking'. Motives linked to these preferences were predominantly 'ability to work' and 'ability to do free time occupations'. Preferences of both groups shifted in ranking but remained the same during rehabilitation. Participants were familiar with the surveyed technologies.

Conclusion

Persons with NP or LBP prefer to train on exercises supporting the improvement of everyday life skills. They use technologies in their professional and personal life, which may lower the threshold for the adoption of rehabilitation technologies.

Keywords: low back pain, neck pain, training preferences, technology use, client-centred care

Introduction

Musculoskeletal disorders such as neck pain (NP) and low back pain (LBP) are highly prevalent. NP has a lifetime prevalence of 23.1% [1] and up to 85% of the persons in well-developed countries encounter an episode of acute LBP during their life [2]. In 12% of the population, LBP results in long-term disability and it is responsible for the highest global disability rates compared to any other condition [3]. Together, NP and LBP account for the main cause of sick leave from work [4]. It is expected that this socio-economic burden will further expand in the next decades and will increase the strain on our healthcare system [5].

Multidisciplinary exercise therapy is advocated as the most effective treatment for both persons with NP and persons with LBP [6-9]. However, rehabilitation outcomes with regard to the improvement of pain and disability are rather low [6,8,10]. One of the factors that can be responsible for low rehabilitation outcomes is poor patient compliance to therapy [6,11,12] due to a lack in motivation to fulfil the rehabilitation program [13-15].

Literature suggests that client-centred care [16,17], consisting of individual goal setting, is an effective way to increase patient motivation and compliance to rehabilitation [18-22]. Also new training approaches such as technology-supported rehabilitation have the potential to further enhance patient motivation and training effects, by increasing exercise variability and by giving feedback on exercise performance and on progress [23,24]. Technology-supported rehabilitation can even support a client-centred approach by offering exercises (e.g. through video- or avatar instructions, or through games) that match patient specific goals [23,25].

To enable client-centred care in technology-supported rehabilitation it is paramount to identify the activities that patients prefer to train on, so that exercises in support of these training preferences can be implemented into different technological training solutions [26]. Also, In order to offer the right context for the training environment, personal motives for choosing certain training preferences should be inventoried. When personal motives are linked to treatment goals, these motives can further enhance rehabilitation [27]. Furthermore, it is important to identify whether training preferences change over time, for example because of changes in the patient's physical abilities during the course of treatment. The latter is necessary in order to assess whether technology-supported training programs should offer a different range of exercises during the course of therapy [28]. Finally, to implement technology in the rehabilitation context, it is useful to know how familiar patients are with the use of common technologies [29].

Therefore the aims of this study are: (1) to identify the training preferences and the associated motives of persons with NP and persons with LBP, (2) to evaluate whether training preferences change during 8 weeks of rehabilitation, and (3) to evaluate the familiarity with the use of technologies.

Methods

Study design

This study was an exploratory cohort study. It was approved by the medical ethical committees of Jessa Hospital and of Hasselt University (Hasselt, Belgium).

Participants

Participants were recruited from the Department of Physical Medicine and Rehabilitation of the Jessa hospital. They were selected by the physiotherapists according to the following inclusion criteria: 1) medical diagnosis of NP or LBP, 2) + 18 years old, 3) no other orthopaedic problems. Patients were excluded from the study if a surgical intervention had taken place at the neck or low back in the last 6 months. Potential participants who showed interest, received an information booklet including a study protocol and an informed consent form, which needed to be signed and returned to the researcher.

Rehabilitation program

Participants followed the standard rehabilitation program (16 weeks, 2 visits/week, 2 hours/visit) at the Jessa Hospital supervised by the physiotherapists. The NP program comprised of standard exercise therapy for the neck and shoulder region, manual therapy, and active posture training. The LBP program consisted of aerobe exercise therapy, posture correction, breathing control, and stabilization exercises. In addition to both programs, therapists provided written home exercises that were to be performed for minimum 20 minutes on a daily basis. Also, educational courses concerning posture and the prevention of overloading were provided during one session for persons with NP and during five sessions for persons with LBP.

Procedure

At the start of the rehabilitation program (T_{start}), demographic characteristics, a questionnaire concerning the disorder (Neck Disability Index (NDI) [30] for NP and Roland Morris Disability Questionnaire (RMDQ) for LBP [31]), questions on training preferences/motives, and a questionnaire regarding the technology use of the patient were administered. The participants

filled in the questionnaires in the presence of the interviewer in a separate room at the hospital site after oral explanation of each questionnaire. The interviewer was a researcher that was not involved in the rehabilitation process. The researchers were not blinded for the study objectives. After eight weeks of standard rehabilitation (T_{8wk}), which is half way through the patient's total rehabilitation period, the questions concerning the disorder and questions on training preferences/motives were repeated to evaluate possible changes of initial preferences.

The identification of training preferences

A semi-structured interview was conducted based on activities stated in the Neck Disability Index (NDI) for patients with NP and activities stated in the Roland Morris Disability Questionnaire (RMDQ) for patients with LBP. The NDI [30] measures to what extent neck problems affect daily activities. It contains ten items (pain intensity, self-care, lifting, reading, headache, concentration, work, driving a car, sleep, and leisure) with a score between 0 (= no limitation/disability) and 5 (= highest limitation/disability). The total NDI score is a sum of these ten items with a range from 0 to 50, whereby a higher score indicates higher limitation/disability. The RMDQ [31] contains 24 dichotomous items (Yes/No) that evaluate to which extent activities of daily life activities of low back pain patients are affected. The total RMDQ score is the sum of all rated questions with Yes (= 1) and No (= 0). The RMDQ has a range between 0 (= no limitation/disability) and 24 (= maximal limitation/disability). To identify the skill training preferences, the method previously reported by Timmermans et al. (2009) and Lemmens et al. (2014) was used [32,33]. After rating the NDI/RMDQ, patients were asked to add five activities outside the given questionnaires that they would like to train and/or improve on. From the total list (NDI/RMDQ items and additional activities), patients were asked to highlight the five most preferable training activities and rank them according to a descending preference level. The highest ranked activity was given a score of 5, the least important activity was given a score of 1 (see figure 1). The interviewer then asked the patient what his/her motive was to choose those activities as training preferences by using laddering method techniques [34].

Questionnaire on technology use

A short questionnaire regarding the technology use of the patient was conducted (see Appendix 1). This questionnaire, inspired by the approaches taken in human-computer interaction and user-centred design of interactive systems [35,36], queried the participants' technology use. The aim of the questionnaire was to get insights in patients' technology familiarity and to estimate technology acceptance. The questionnaire contained questions about which devices (laptop/computer, tablet, smartphone, mobile phone, and mp3-player) were used at which frequency (never, monthly, weekly, daily), for which purpose (personal, work), and for which application (communication, searching information, watching movies, listening to music, social networks). The technologies/media mentioned in the questions (e.g. mobile devices, video players, social media and games) were the main technologies/media considered to support and motivate patients in preparing and performing their training sessions and following their progress.

Data analysis

A statistical analysis (SPSS) was performed for following patient characteristics: age and gender (Independent samples T-test), and duration of the disorder (Pearson Chi-square test). Previous rehabilitation was reported descriptively. The answers on the questions: "Which activities do you want to train on most?" and "Which roles do you want to improve on when you prioritize this training activity?" were analyzed qualitatively through open coding (one observer). A total skill training preference score (TPS) was obtained through summation of the scores of all participants together that had been attributed to each skill. A total motive score (TMS) was obtained through summation of the scores of all participants together that had been attributed to each motive. Subsequently the skills and motives were ranked according to descending average skill training preference/motive displays, for both the NP group and the LBP group of participants. The answers on technology use were analysed descriptively.

Insert Figure 1 about here

Figure 1: Schematic presentation of the training preference identification procedure

Results

Demographics

In total, 40 persons with NP and 40 persons with LBP were recruited. The two groups were comparable in age, gender and stage of the disorder (Table 1). No significant differences ($p<0.05$, 95% CI) between the groups were noted for these characteristics. A majority of the patients were female (64%) and in a chronic stage of the disorder (74%). Persons with NP had an average disability score of 18.0 within a measurement range from 0-50 (=36% disability) and persons with LBP had an average disability score of 11.0 within a measurement range from 0-24 (=46% disability).

Insert Table 1 about here

Study drop outs

In total, 27 persons with NP and 21 persons with LBP followed the rehabilitation program for 8 weeks after their initial assessment (Tstart) and were able to be measured at T_{8wk}. 13 persons with neck pain (32.5%) and 19 persons with low back pain (47.5%) dropped out during the course of these 8 weeks. One person (LBP) dropped out due to a knee pathology that was not associated with the current rehabilitation. One person (NP) dropped out due to language related problems. No data concerning the cause of drop out for the other participants was available as these persons where no longer involved in rehabilitation (noncompliance was defined as being absent from the hospital for more than 2 weeks during rehabilitation).

Training preferences

In total 33 (T_{start})/29 (T_{8wk}) different activities were reported by persons with NP and 26 (T_{start})/21 (T_{8wk}) different activities for persons with LBP. An overview of the 10 highest ranked training preferences for each group before (T_{start}) and during rehabilitation (T_{8wks}) is shown in Table 2 (full list see Appendix 2). The most preferred training activity for persons with NP was ‘lifting loads’ and the most preferred training activity for persons with LBP was ‘household related activities’. The most preferred activities did not change between the first interview (T_{start}) and after eight weeks of rehabilitation (T_{8wk}).

For persons with NP, the subsequent three highest ranked training activities (= prolonged sitting, driving a car and household related activities) stayed the same and only the initially mentioned activity 'hair care' (ranked 10th at T_{start}) was replaced by 'prolonged standing' at T_{8wks}. The remaining activities stayed listed in the top 10 but shifted places. For persons with LBP, only the most preferred activity 'household related activities' remained the same at T_{8wks}. All the other activities remained listed in the top 10 at T_{8wks} but shifted places, except from 'driving a car', which was replaced by 'putting on socks'.

In general, similar activities were preferred by persons with NP as by persons with LBP. Seven of the 10 activities in both groups were the same for T_{start} as well as T_{8wks}. However, although the preferred activities were similar, the ranking of each activity in both groups was very different. Also, some specific activities were only listed in one group, e.g. persons with NP listed 'above head movements', 'hair care' and 'reading' as training preferences, whereas low back patients preferred to train 'prolonged standing', 'gardening/chores' and 'bending/kneeling/turning for reaching'. Notable was the high rating of 'household related activities' and 'lifting loads' in both groups in both T_{start} and T_{8wks}.

A sub analysis was performed in which only complete cases (i.e. participants that completed all measurements) were screened to account for differences in results due to missing T_{8weeks} data of dropped out patients (see Appendix 3). Only minor changes in ranking were observed and the general results shown above were highly comparable. A second sub analysis was performed in which persons acute/subacute NP or LBP were compared with persons with chronic NP or LBP. This sub analysis also showed only minor changes in the ranking of the first five activities. No new activity preferences came forwards in the top 10.

Insert Table 2 about here

<u>Motives for training with regard to life roles</u>

In total 11 (T_{start})/9 (T_{8wk}) motives were reported by persons with NP, and 10 (T_{start})/9 (T_{8wk}) motives for persons with LBP (cf. Appendix 3 for the full list). An overview of the 5 highest ranked motives for each group are shown in Table 3. 'Being able to work' and 'being able to perform free time occupations' were the predominant life roles for both persons with NP and persons with LBP at both T_{start} as well T_{8wk}, although they were in different places in both groups.

The life roles of persons with NP remained similar during rehabilitation. ‘Being a good partner’ and ‘being able to maintain the personal household’ shift a few places, and ‘being a care provider’ was replaced by ‘stimulating self-efficacy and being independent’. In persons with LBP three life roles remained on the same ranking, and only ‘having a social life’ was replaced by ‘stimulating self-efficacy and being independent’.

Insert Table 3 about here

Technology use

Frequency of technology use

Similar results were noted in both groups with regard to the frequency of usage of various technologies (Table 4). Almost all persons used a computer/laptop (92.5%) of which >60% used it daily. A smartphone was more often used than a mobile phone in both groups. Each of the participants used at least one of the two devices (smartphone or mobile phone). More persons with LBP used a smartphone (65%, of which 60% even used it daily) compared to persons with NP (55% daily use). However, more persons with NP used a tablet (65% compared to 55% for persons with LBP). An mp3 player for both groups was the least used technology (some patients mentioned that an mp3 player was no longer needed because of similar functions on their smartphone which could explain the low displayed usage of an mp3 player). In total, 76% (persons with NP) and 78.5% (persons with LBP) of the answers displayed some kind of use of the described technology and it is noteworthy that almost no ‘not familiar’ answers were given (2.0% in persons with NP and 1.0% in persons with LBP).

Insert Table 4 about here

Purpose of technology use

Technology use was higher for personal purposes (>90%) than for work purposes (~10-55%) in all devices (Table 5). A computer/laptop was the most used technology (>50%) in the work setting in both persons with NP and LBP. Persons with NP used the smartphone or mobile phone regularly for work purposes (33.3% for smartphone and 44.4% for mobile phone). Persons with LBP showed slightly lower results for the use of both devices (30.8% and 35.3%). An Mp3 player was almost solely used for personal purposes in both groups.

Insert Table 5 about here

Technology applications

An overview of the applications that the patients use the technology for is shown in Table 6. Almost all persons used the computer/laptop for communication and information search (>90%). In addition, more than half of the patients in both groups used it to access social networks. A considerable amount of persons (40-50%) also listen to music on the computer/laptop. Persons who used a tablet applied it for communication, information search, games, and social network (all >35%). The smartphone was highly used (>65%) for several purposes, including communication, information search and social network. The mobile phone was only used for communication purposes as this is its only function. The Mp3 player was always used to listen to music.

Insert Table 6 about here

Discussion

Exercise therapy is an important part of rehabilitation for persons with NP and LBP [8,9]. However, therapy effects are small [8,10] and patients show poor compliance [12]. Client-centred training has been advocated to improve motivation and compliance [18,22] and the use of technology in rehabilitation may further enhance motivation during training [25]. In order to allow for technology-supported training to offer client-centred training approaches, training preferences of patients need to be known in order to implement exercises that match those training preferences.

The first aim of this study was to identify training preferences and related motives of persons with NP and persons with LBP. The most preferred activity was 'lifting loads' for persons with NP and 'household related activities' for persons with LBP. The top 10 activities mostly take place during work and household tasks or free time occupations. Walsh et al. asked persons with chronic LBP to report activities that were perceived as most difficult during daily functioning [37]. Seven out of the 15 most stated answers (e.g. 'walking', 'sitting' and 'driving') were directly comparable to outcomes in the current study, suggesting that training preferences of persons with LBP are in line with activities that are effectively perceived as a major difficulty. Training preferences can also be related to functional ability affecting activities shown in the LBP ICF core set [38]. This set recognizes the functional impact of LBP on activities such as 'lifting loads', 'walking' and 'prolonged postures'[38]. The link between these studies suggests that persons with LBP prefer to train on specific activities that are found to be difficult and that limit the functional ability of the affected person the most. For NP, an ICF core set is not yet available. With regards to motives, both groups highly valued 'being able to work' and 'being able to perform free time occupations'. Persons with NP also attributed high value to 'being a care provider' and 'being a good partner' which shows a less self-indulged mind set, whereas in persons with LBP 'being able to maintain the personal household' seems more important, reflecting a main focus on the own care setting. All these motives are situated on activity/participation level and show the importance patients attach to being able to normally interact with their close relatives and direct surroundings. As the importance of 'being able to perform normal daily activities' was also seen in persons with stroke [32] and CP [33], the assessment of motives for rehabilitation of patients while constructing functional therapy is magnified.

The second aim of this study was to evaluate whether training preferences and motives change during rehabilitation. This information is crucial to construct technological systems that can

incorporate a variety of training settings to meet changing preferences and that can be adaptable during the rehabilitation process. Balaam et al. used various technological settings (e.g. tablet pc, sensors, etc.) that could be adapted to the individual training preferences to motivate stroke patients to rehabilitate at home [28]. It was found that an individualized training should be adjusted as the rehabilitation process is proceeding since the needs and wishes of the patients changed during the rehabilitation depending on physical, psychological and environmental demands[28]. However, whether training preferences change during the rehabilitation process in persons with musculoskeletal diseases has not yet been studied. Overall the 10 preferred training activities in both groups stayed similar (>90%) from T_{start} to T_{8wk}, but most of the top 10 preference activities changed position in the list (60% for NP and 90% for LBP). The largest shift was seen in 'lifting loads' in persons with LBP, which shifted from rank 2 at T0 to rank 8 at T2. As this is an activity that is specifically trained by most patients following the general rehabilitation program at Jessa Hospital, the authors assume that patients might have improved on this activity more than on other individual preferences that were not included in the rehabilitation program. These results show that persons might change the order of importance of their preferences and therefore change their priorities for the rehabilitation process. NDI in persons with NP and RMDQ in persons with LBP improved significantly after 8 weeks of therapy (not shown in results) which could have been a factor influencing the training preferences. A post hoc sub analysis was also conducted to investigate differences in persons with acute/subacute NP/LBP and chronic NP/LBP. This analysis showed no major differences in the training preferences of chronic patients. Outcomes of subacute patients were more variable between T0 and T2, however this may be due to low sample size in the subacute group (n=7 in acute/subacute NP and n=5 in acute/subacute LBP). With regards to motives, persons with NP showed a shift in their life roles from partner/parent to personal care/recreation, which implies that their priority starts with helping others around them but later on leads to more personal oriented motives and thus a higher focus on themselves. The main life roles of persons with LBP on the other hand stayed practically unchanged. In both groups, work is stated as one of the most important motives. Previous research already stated that being able to work again can function as a factor of wellbeing and life satisfaction [39].

The third and last aim was to identify the technology use of patients with MSDs. Most patients were familiar with different kinds of technologies. A computer/laptop and smartphone were the most regularly used devices. Technologies were almost always used within personal settings, which is promising for future technology-mediated rehabilitation studies and it could make

implementation of technology in clinical and home-based rehabilitation settings more feasible. With respect to the purposes, most patients used applications that support communication, information search and social networks. The patients' perceived trustworthiness and expertise in the use of these devices and applications can enhance their credibility, which is an advantage when introducing persuasive technology in a rehabilitation program [40]. However, the remaining challenge will be to offer suited applications that successfully support and motivate patients to train.

Limitations

Although specific results are shown in this study, some limitations should be taken into account. Firstly, both patient groups mainly consisted of persons with chronic pain (26 persons with chronic NP (65%) and 33 persons with chronic LBP (82.5%)). However also persons with acute and subacute disorders were recruited. Future research could focus exclusively on one of these subgroups to further specify results and investigate impact and progression of preferences of different disorder phases. Secondly, this study showed a high number of drop outs. The researchers conducting this study had no insight or influence on the rehabilitation progress itself and consequently could not foresee patients dropping out in between moments of testing. These dropout rates are in line with other studies stating that adherence to a NP/LBP rehabilitation program can be very low [12,13]. However, conclusions were made on group level to guide the possible improvement of future technology supported rehabilitation set ups as a whole. A sub analysis, based on only the results from persons that completed the study, did not reveal differences in training preferences or ranking. Thirdly, patients weren't always able to identify 5 specific personal training preferences (in 6% of the interviews). In this case, only the displayed activities were ranked. Lastly, during the compilation of the life roles, the patients were asked to only tell the most important life role attached to their displayed activities (i.e. top-of-mind answers where noted), while sometimes more than one role was applicable. The secondary life roles were not inventoried.

Conclusion

Persons with LBP and persons with NP prefer to train on activities that limit their functional ability during daily tasks. The underlying motives linked to these activities are predominantly ‘being able to work and ‘being able to perform free time occupations’. Although the most preferred activities don’t change during the course of rehabilitation, a change in ranking of training preferences takes place. This emphasizes the need for technologies with specific training settings that are either extensive for each pathology or can be adjusted during training programs. Persons with LBP and persons with NP have adopted technologies in their daily life, paving the way for the use of these technologies for rehabilitation purposes.

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Declaration of interest

The authors report no declaration of interest.

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Tables

Table 1: Overview of patient characteristics at the start of the study

Variable		**NP (n=40)**	**LBP (n=40)**	***significance level***
Age in years (mean ± SD)		43 ± 13.3	44 ± 13.7	p=0.680
Gender	**Male (%)**	13 (32.5)	16 (40.0)	χ=0.485
	Female (%)	27 (67.5)	24 (60.0)	
Phase of the disorder	**Acute (%)**	2 (5.0)	1 (2.5)	χ=0.545
	Subacute (%)	9 (22.5)	6 (15.0)	
	Chronic (%)	26 (72.5)	33 (82.5)	
Disability score (mean ± SD)		NDI: 18.0 ± 5.7	RMDQ: 11.7 ± 4.7	-

Abbreviations: NP = neck pain, LBP = low back pain, SD = standard deviation, NDI = Neck Disability Index, RMDQ = Roland-Morris Disability Questionnaire.

Table 2: Overview of training preferences and total preference scores for both groups at T_{start} and T_{8wk}

	Tstart (n=40)			T8wk (n=27)		
NP	**R**	**Activity**	**TPS**	**R**	**Activity**	**TPS**
	1	Lifting loads	64	1	Lifting loads	63
	2	Prolonged sitting	56	2	Prolonged sitting	43
	3	Driving car	55	3	Driving a car	39
	4	Household related activities	51	4	Household related activities	32
	5	Prolonged walking	47	5	Cycling	25
	6	Above head movements/reaching	35	6	Sport specific movements	24
	7	Sport specific movements	27	7	Above head movements/reaching	20
		Cycling	25	8	Prolonged walking	19
	9	Reading	24	9	Prolonged standing	17
	10	Hair care	24	10	Reading	16
	Total skill preference score sum		588	Total skill preference score sum		303
LBP	**T_{start} (n=40)**			**T_{8wk} (n=21)**		
	R	**Activity**	**TPS**	**R**	**Activity**	**TPS**
	1	Household related activities	83	1	Household related activities	43
	2	Lifting loads	77	2	Prolonged walking	42
	3	Prolonged walking	61	3	Gardening/chores	32
	4	Cycling	58	4	Bending/kneeling/turning for reaching	26
	5	Prolonged standing	39	5	Cycling	24
	6	Bending/kneeling/turning for reaching	37	6	Prolonged sitting	24
	7	Gardening/chores	36	7	Prolonged standing	22
	8	Sport specific movements	36	8	Lifting loads	21
	9	Driving a car	29	9	Sport specific movements	17
	10	Prolonged sitting	28	10	Putting socks/shoes on	12
	Total skill preference score sum		559	Total skill preference score sum		390

Abbreviations: NP = neck pain, LBP = low back pain, TPS = total skill training preference score, R = ranking.

Table 3: Overview of training motives and total preference scores

	T_{start} (n=40)			T_{8wk} (n=27)		
NP	**R**	**Life role**	**TMS**	**R**	**Life role**	**TMS**
	1	Being able to work	168	1	Being able to work	161
	2	Being able to perform free time occupations	136	2	Being able to perform free time occupations	103
	3	Being a care provider	70	3	Being able to maintain the personal household	36
	4	Being a good partner	54	4	Stimulating self-efficacy and being independent	26
	5	Being able to maintain the personal household	54	5	Being a good partner	20
LBP	T_{start} (n=40)			T_{8wk} (n=21)		
	R	**Life role**	**TMS**	**R**	**Life role**	**TMS**
	1	Being able to perform free time occupations	176	1	Being able to perform free time occupations	114
	2	Being able to work	141	2	Being able to work	57
	3	Being able to maintain the personal household	62	3	Being able to maintain the personal household	50
	4	Being a care provider	40	4	Stimulating self-efficacy and being independent	36
	5	Having a social life	37	5	Being a care provider	16

Abbreviations: NP = neck pain, LBP = low back pain, R = ranking, TMS = total motive score.

Table 4: Overview of frequency of technology use in both groups

	N (%)	Not familiar	Never	Seldom	Few times a month	Few times a week	Daily
NP (n=40)	**Computer/laptop**	1 (2.5)	2 (5.0)	2 (5.0)	5 (12.5)	5 (12.5)	25 (62.5)
	Tablet	1 (2.5)	13 (32.5)	7 (17.5)	2 (5.0)	2 (5.0)	15 (37.5)
	Smartphone	0 (0.0)	16 (40.0)	1 (2.5)	1 (2.5)	0 (0.0)	22 (55.0)
	Cell phone	0 (0.0)	22 (55.0)	1 (2.5)	1 (2.5)	4 (10.0)	12 (30.0)
	Mp3 player	1 (2.5)	25 (62.5)	6 (15.0)	4 (10.0)	1 (2.5)	3 (7.5)
LBP (n=40)	**N (%)**	**Not familiar**	**Never**	**Seldom**	**Few times a month**	**Few times a week**	**Daily**
	Computer/laptop	0 (0.0)	2 (5.0)	4 (10.0)	1 (2.5)	7 (17.5)	26 (65.0)
	Tablet	1 (2.5)	17 (42.5)	4 (10.0)	2 (5.0)	5 (12.5)	11 (27.5)
	Smartphone	0 (0.0)	14 (35.0)	0 (0.0)	0 (0.0)	2 (5.0)	24 (60.0)
	Cell phone	0 (0.0)	23 (57.5)	0 (0.0)	0 (0.0)	1 (2.5)	16 (40.0)
	Mp3 player	1 (2.5)	27 (67.5)	9 (22.5)	2 (5.0)	0 (0.0)	1 (2.5)

Abbreviations: NP = neck pain, LBP = low back pain

Table 5: Overview of purpose of usage of technology

	N (%)	Amount of use	Personal	Work
NP	**Computer/laptop**	36	35 (94.6)	19 (51.4)
	Tablet	26	24 (92.3)	6 (23.1)
	Smartphone	24	22 (91.7)	8 (33.3)
	Cell phone	18	18 (100.0)	8 (44.4)
	Mp3 player	14	14 (100.0)	1 (7.1)
LBP	N (%)		**Personal**	**Work**
	Computer/laptop	38	35 (92.1)	21 (55.3)
	Tablet	22	21 (95.5)	3 (13.6)
	Smartphone	26	24 (92.3)	8 (30.8)
	Cell phone	17	17 (100.0)	6 (35.3)
	Mp3 player	12	12 (100.0)	1 (8.3)

Abbreviations: NP = neck pain, LBP = low back pain

Table 6: Overview of applications of technology devices

	N (%)	Communi-cation	Information search	Play games	Listen music	Watch movies	Social network
NP (n=40)	**Computer/laptop**	34 (91.9)	34 (91.9)	8 (21.6)	15 (40.5)	13 (35.1)	19 (51.4)
	Tablet	15 (57.7)	17 (65.4)	10 (38.5)	8 (30.8)	9 (34.6)	12 (46.2)
	Smartphone	24 (100.0)	16 (66.7)	6 (25.0)	10 (41.7)	4 (16.7)	16 (66.7)
	Cell phone	19 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Mp3 player	1 (7.1)	1 (7.1)	1 (7.1)	14 (100.0)	1 (7.1)	1 (7.1)
LBP (n=40)	N (%)	**Communi-cation**	**Information search**	**Play games**	**Listen music**	**Watch movies**	**Social network**
	Computer/laptop	33 (86.8)	36 (94.7)	10 (26.3)	18 (47.4)	12 (31.6)	21 (55.3)
	Tablet	12 (54.5)	17 (77.3)	13 (59.1)	3 (13.6)	5 (22.7)	12 (54.5)
	Smartphone	25 (96.2)	18 (69.2)	7 (26.9)	14 (53.8)	5 (19.2)	16 (61.5)
	Cell phone	17 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Mp3 player	0 (0.0)	1 (8.3)	0 (0.0)	11 (91.7)	0 (0.0)	0 (0.0)

Abbreviations: NP = neck pain, LBP = low back pain

Figures

Figure 1: schematic presentation of the training preference identification procedure