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Are physiotherapists adhering to quality indicators for the management of knee osteoarthritis? An observational study

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Abstract

Background: Osteoarthritis (OA) is a common musculoskeletal condition that often leads to pain, stiffness and disability. Physiotherapy plays an important role in the management of knee OA, however we hypothesize discordance between physiotherapists' practice and existing guideline recommendations.

Objectives: This study aimed to measure physiotherapists' guideline adherence for knee OA. Additionally, determinants for guideline adherence at the professional and organizational level were explored, to find clues for improvement.

Method: A survey was performed among Belgian physiotherapists. Guideline adherence was measured with a set of 9 quality indicators, developed for the Belgian primary healthcare system, applicable for physiotherapists and extracted from evidence-based guidelines. Treatment modalities that do not contribute to high quality care were also examined.

Results: 284 Physiotherapists responded to the survey. Compliance to the quality indicators varied between 27% and 98%. Quality indicator compliance above 80% was found for: education on the importance of exercise, delivering functional and strength exercise therapy, patient tailored exercise program, instruction of patients in appropriate exercises and referral for sports activities after therapy. Quality indicator compliance less than 50% was found for: education on the importance of weight loss, providing self-management strategies, spreading treatment session over longer periods and regular evaluations of the exercise therapy. For treatment modalities that do not contribute to high quality care, massage (49%) and cold application (24%) were most frequently applied.

Conclusions: This study showed large variations in adherence to quality indicators in OA management by physiotherapists. Improvement strategies should focus on quality indicators related to long-term treatment options.

Keywords

Physiotherapy, osteoarthritis, guideline adherence, decision making, exercise therapy

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1. Background

Osteoarthritis (OA) is a chronic joint disease that often leads to pain, stiffness and disability, and is mainly present in its predilection for low extremity joints such as knees and hips (Johnson and Hunter, 2014). Risk factors for knee OA can be divided into three categories: genetic, constitutional and biomechanical (Silverwood et al., 2015). Patients with OA seem to struggle significantly with comorbidities and even have a higher risk of death compared to the general population (Gronhaug et al., 2015; Nuesch et al., 2011). Progression of the disease typically results in joint failure and joint replacement surgery, as the OA disease process cannot be stopped nor cured yet. To date, leading international guidelines pay close attention to rehabilitation in an early stage to decrease pain, improve functional impairment and educate self-management strategies (Fernandes et al., 2013; Hochberg et al., 2012; McAlindon et al., 2014; National Institute for Health and Care Excellence, 2015). Although exercise therapy by PTs is crucial in this initial management, physical therapy is overall underutilized.

It is undeniable that evidence-based clinical guidelines are important to improve health care and that all healthcare providers are challenged to make their clinical decisions not only on experience but also on published literature (Sackett et al., 1996; Alcantara et al., 2015). However, a performance gap between theory as described in evidence guidelines and daily practice is often seen (Grol and Grimshaw, 2003). Some studies have also indicated discrepancies between daily practice by PTs and guideline recommendations for knee OA management (Roddy et al., 2005). For example, a study among PTs in the UK showed that 99% used exercise therapy for patients with knee OA, but 62% stated not to supervise the exercises during follow-up sessions (Holden et al., 2008). Exercise, weight management, strength training and self-management are considered to be core treatment options for all patients with knee OA (Fernandes et al., 2013; Hochberg et al., 2012; McAlindon et al., 2014; National Institute for Health and Care Excellence, 2015). However, PTs commonly use several forms of manual therapy, electrotherapy, massage, thermotherapy and acupuncture as well. These treatment modalities do not necessarily contribute to high quality care, are not recommended by guidelines or should only be used in conjunction with core treatment modalities. In a Norwegian study massage was used by 56% of the interviewed PTs (Jamtvedt et al., 2008). A study in the UK showed that exercise treatment was often supplemented with modalities of electrotherapy (66%), manual therapy (64%) or acupuncture (60%) (Walsh and Hurley, 2009).

Adherence to guidelines can be assessed with quality indicators. These are measurable elements in the diagnostic and therapeutic process and preferable systematically derived from guidelines (Campbell et al., 2002; Jansen et al. 2010; Wollersheim et al., 2007). A set of 21 quality indicators for the management of knee OA was extracted from evidence based international guidelines and developed for the Belgian primary healthcare system (Grypdonck et al., 2014). Nine of these quality indicators are applicable for physiotherapeutic management. In the Flemish region of Belgium we hypothesize a gap between guideline adherence and daily practice. In order to improve guideline adherence, determinants that can influence current care need to be defined. Determinants can be identified on the patient, the professional or the practice level. Until now, little is known about

possible determinants that influence knee OA management from the physiotherapeutic perspective, particularly on a professional and organizational level.

Therefore, the aim of this study was to measure PTs' adherence to optimal knee OA care by using the Belgian set of evidence-based quality indicators. Additionally, variation in guideline adherence was explored by analyzing determinants of PTs' care at professional and organizational level.

2. Methods

2.1 Setting and study population

This descriptive observational study was conducted among PTs in the Flemish region of Belgium. This region is located in the northern part of Belgium with more than six million inhabitants. A convenience sample of Flemish PTs, members of the largest PT organization in Belgium (AXXON), was recruited for a web-based questionnaire. For two consecutive weeks an advertisement for this study was published in their weekly newsletter. An incentive in terms of a weekend gift voucher was used to reach a broad audience. Access to the questionnaire was provided after information about the study protocol and consent. The study was described in accordance with the STROBE recommendations for observational studies (von Elm et al., 2007).

2.2 Questionnaire design

The web-based questionnaire (Appendix A) was designed using multiple-choice questions that included: (1) PTs characteristics, such as age, gender, years of experience, work setting, and number of monthly new patients; (2) PTs management of knee OA.

The questions to evaluate PTs management of knee OA were based on: (1) nine quality indicators from the Belgian set of evidence based indicators applicable to PTs management of knee OA (Grypdonck et al., 2014); (2) a list of commonly used treatment options that do not necessarily contribute to high quality care. Based on these nine quality indicators (listed in Table 2), questions were formulated regarding education, weight loss, exercise therapy, patient tailored programs, self-management interventions, exercise instruction, follow-up treatment and referral for sports' activities after physiotherapeutic sessions (Appendix B). In addition, twelve commonly used treatments that do not contribute to high quality care or should only be used in conjunction with the core treatment were listed in the questionnaire: acupuncture, balneotherapy, massage, taping, thermotherapy (cold and warmth application) and different types of electrotherapy (Transcutaneous electrical nerve stimulation (TENS), interferential therapy, ultrasound, laser, neuromuscular electrical stimulation (NMES), pulsed short wave). All questions on the use of treatment modalities had to be answered on a four point Likert type scale: 'never', 'sometimes', 'usually' and 'always'. PTs characteristics were used to investigate possible determinants of current care at a professional and organizational level. A draft version was screened on completeness and clarity by 11 PTs and finally adapted, based on their comments. Completing the questionnaire took less than 10 minutes.

2.3 Statistical analysis

2.3.1 Current Care

Descriptive statistics, with frequency distribution and percentages, were used to measure PTs' characteristics. The categorical data for the questions regarding treatment options were

dichotomized by allocating '0' points to the answers 'never' and 'sometimes', and '1' point to 'usually' and 'always'. Subsequently, the answers from the questions regarding treatment options were used to calculate the quality indicators (Appendix B). Quality indicator scores were calculated by representing the number of answers '1' in the numerator and the total number of eligible answers in the denominator. Thus, the quality indicator score represented the number of PTs who adhered to the quality indicators. Benchmarks for good adherence to the quality indicators were chosen and were set at > 80% for good adherence and < 50% for low adherence.

2.3.2 Possible determinants in current care

Correlation between possible determinants at professional and organizational level and the adherence to quality indicators was explored with binary logistic regression. The following PTs' characteristics were used as independent variables: age, gender, years of experience, work setting, and number of new patients with knee OA that were treated each month. The answers for work setting were reduced to solo versus non-solo practice for the logistic regression. Univariate logistic analyses were performed to study correlations between independent variables and the following dependent variables: quality indicators and commonly used treatments that do not contribute to high quality care. Before performing the multivariate regression, the independent variables were tested for collinearity. In this model Pearson's correlation coefficient ($r=0.985$, $p<0.001$) showed a linear relationship between the variables age and years of experience, consequently only years of experience was used for corresponding dependent variables in the multivariate regression. The multivariate logistic regression, with enter model, was performed for all characteristics with p -value < 0.10 in the univariate analysis. The level of statistical significance was set at p -value ≤ 0.05 for all final analyses. Thus, odds ratios (OR) were calculated to describe the association between PTs' characteristics and quality indicators or commonly used treatments. The results were analyzed in SPSS (IBM SPSS Statistics for Windows, Version 23. Armonk, NY: IBM Corp.)(Field, 2015).

2.4 Ethical approval

This study was approved by the Medical Ethical Committee of the University Hospital in Leuven on 13th July 2012 (S54497, Belgian number B322201214707).

3. Results

3.1 Characteristics study population

In total 284 PTs completed the survey between May and July 2012: 155 men (55%) and 129 women (45%) participated (Table 1). The mean age was 45.7 years (range from 23 to 75 years). To see if the study population was representative, age and gender were compared with the 16.151 registered PTs in the Flemish region of Belgium in 2012: female PTs and participants in the age group of 35 to 49 years were underrepresented in this study; PTs were overrepresented in the age group of 50 to 64 years (Somer, 2012). The majority of PTs in Belgium works in a non-hospital setting. In this study, the PTs in a non-hospital setting worked individual (57%), with one colleague (21%) or in group (20%).

3.2 Physiotherapeutic current treatment

Compliance to the evidence-based quality indicators varied between 27% and 98% (Table 2). The quality indicator scores were more than 80% for: education about the importance of exercise, exercise therapy concerning functional and strength training, providing patient tailored exercise

therapy, instruction and evaluation of patients in appropriate exercises and referral for sports after therapy. Quality indicator scores were particularly low (<50%) for the following treatments: education about the importance of weight loss, providing self-management interventions and regular evaluations of exercise therapy.

Compliance to the evidence-based quality indicators also varied between PTs. They spent most of their education time on instructing patients about the importance of exercises (95.4%). Less education time was spent on advising on appropriate footwear (56.7%), importance of weight loss (49.1%) or the use of aids and devices (67.0%). Consistently, 53.5% of the PTs encouraged overweight patients to lose weight. Exercise therapy was suggested for patients with knee OA, including at least muscle strengthening, aerobic, functional exercises. This could be combined with range-of-motion exercises in case of range-of-motion restrictions. The different types of exercise therapy carried out, ranged between 74.1% and 88.8%. Spreading treatment sessions over longer periods with lower frequencies in the later stages of the exercise program and regular evaluation of patients, at least on a yearly base, reached compliance of 35.9% and 26.8% respectively.

In addition, twelve treatments that were not recommended to high quality care or should only be used next to core treatments were investigated (Graph 1). The average performance ranged between 0% for acupuncture to 49% for massage. In total, two of these non-recommended treatment modalities were applied for more than 20%: massage (49%) and thermotherapy with cold application (24%).

3.3 Determinants of current care

Female PTs scored higher than their male colleagues for the quality indicators concerning education to use aids and devices (OR 1.87, 95%CI: 1.09-3.20) and education to use appropriate footwear (OR 1.83, 95%CI: 1.10-3.03). NMES, a modality not necessarily contributing to high quality care in OA was applied more by female PTs (OR 2.34, 95%CI: 1.08-5.10). PTs working only in solo practices were more likely to perform massage (OR 1.75, 95%CI: 1.05-2.92) than their colleagues working in group practices. Older PTs were more likely to give education about use of aids and devices (OR 1.08, 95%CI: 1.02-1.06), education on appropriate footwear (OR 1.03, 95%CI: 1.01-1.05) and encourage to lose weight (OR 1.07, 95%CI: 1.04-1.11). However, older PTs were also more likely to use warmth application, a treatment that does not contribute to high quality care, (OR 1.03, 95%CI: 1.00-1.07) and were less likely to deliver aerobic exercises (OR 0.97, 95%CI: 0.94-0.99) compared to younger PTs. PTs, who monthly treated less than 3 patients with knee OA, were less likely to use balneotherapy (OR 0.16; 95%CI: 0.04-0.75) and NMES (OR 0.34, 95%CI: 0.16-0.74) than their colleagues who treated 3 or more patients with knee OA a month. PTs with less than 10 years of experience were more likely to educate about importance of weight loss (OR 2.66, 95%CI 1.01-6.97) and deliver exercise therapy with range-of-motion exercises (OR 6.90, 95%CI: 1.67-28.56).

4. Discussion

This study assessed PTs' adherence to the management of established knee OA by using a Belgian set of evidence-based quality indicators. The adherence to the quality indicators ranged between 27% and 98%. Good adherence to the quality indicators was set at > 80% and was achieved for: education about the importance of exercises, different types of exercise therapy, a patient tailored exercise program, the instruction in appropriate exercises and the referral to regular community and sports

activities after supervised exercise. In contrast, most quality indicators related to long-term follow-up scored lower than 50%: education on the importance of weight loss, regular evaluations to make the switch to an autonomous exercise program, self-management interventions and the spread of treatment sessions over longer period. Additionally, massage and cold applications were the most frequently used treatment options that did not contribute to high quality of care or should only be used in conjunction with core treatment options. Gender, age, years of experience and work setting were significant determinants of knee OA care at the professional and practice level.

This study showed that PTs attached great importance to exercise therapy, since the quality indicator scores above 80% are all related to delivering exercise therapy (Mourad et al., 2008; Wennekes et al., 2011; Wittink et al., 2011). This result was in line with self-reported questionnaires performed in the UK and Norway, in which PTs provided exercise therapy, respectively in 99% and 98% of patients with knee OA (Holden et al., 2008; Jamtvedt et al., 2008). In our study a distinction was made between different types of exercise therapy. PTs appeared to prefer functional and strength training above aerobic exercises. Although some guidelines state that no exercise regime is superior, there is more and more consensus that exercise therapy should consist of a combination of different types of exercises to optimize the goals of the conservative treatment (Grypdonck et al., 2014; McAlindon et al., 2014; National Institute for Health and Care Excellence, 2015).

In this study quality indicators particularly related to long-term follow-up scored lower than 50%. Adherence to quality indicators concerning the spread of treatment sessions and periodic evaluations scored low, with respectively 36% and 27%. This is in line with a study in the UK in which only 34% of the patients was offered follow-up after discharge (Holden et al., 2008). The lack of facility to provide follow-up, indicated that barriers for guideline adherence should be investigated not only on a patient or healthcare professional level. For example, in the Belgian Health Insurance system physiotherapy is currently only reimbursed on doctor's prescription and the sessions are limited in amount and time. Consequently, the PT has less autonomy to spread treatment sessions or to perform periodic exercise evaluations because reimbursement of the treatment is then not assured for the patient. A previous Belgian study already indicated 'the lack of autonomy and authority to decide on patients' treatments' as an important obstacle for PTs to perform evidence-based practice (Hannes et al., 2009). It was of note that social, organizational, financial and political factors also had to be taken into account to describe barriers that could influence PTs' guideline adherence (Grol et al., 2005). A Swedish study described that 90% of the participating PTs considered evidence-based practice necessary, but they experienced lack of time, poor availability and limited access to guidelines as the most important barriers for adherence (Bernhardsson et al., 2014). This study showed that adherence to self-management and education about importance of weight loss was low as well. This may hamper desirable long-term effects for the conservative management of knee OA. A Canadian study showed that PTs experienced lack of knowledge and experience as an important barrier to emphasize on weight loss (You et al., 2012). Although, the importance of self-management strategies was emphasized in all guideline strategies for OA management, the question could be raised whether this quality indicator should be specifically attributed to PTs. To maximize adherence, the available multidisciplinary guidelines for knee OA management should clearly define which healthcare professional should take primary responsibility for quality indicators concerning long-term treatment options such as self-management, education and weight loss. This pressure should not only be placed on the shoulders of the PTs, but a broad range of primary healthcare

professionals (e.g. dieticians, occupational therapists, psychologists, chiropractic, pain specialists, etc.) should be involved to achieve these long term quality indicators.

This study considered possible determinants for high quality care. The main determinant in current physiotherapeutic care appeared to be the years of experience of the PT. PTs with less than 10 years of experience were more likely to educate about importance of weight loss and to deliver more exercise therapy with range-of-motion exercises. These educational skills are possibly more explicitly addressed since the academic training program for PTs was reformed from a four-year to a five-year program in Belgium in 1999, and the importance of evidence based rehabilitation was incorporated into the program. Secondly, we assumed that group practices, in comparison with solo practices, could have been an important determinant for high quality care on organizational level. In contrast to volume-outcome relationships found in hospital settings, there was only limited evidence that indicated a positive relationship between quality of care and practice size or caseload in primary care settings (Casalino, 2006; Kelly et al., 2014; Saxena et al., 2007). These studies showed no conclusive difference in providing high quality care between solo and group practices. Albeit, in this study the assumption was made that treatments that do not contribute to high quality care, would be more common in solo practices. Nevertheless, only massage was performed more frequently in solo practices, but the work setting in solo versus non-solo practices appeared not to be an important determinant for high quality physiotherapeutic care. To our knowledge, studies on physiotherapeutic determinants on organizational level are limited. Future studies could investigate the number of reimbursed treatment sessions, physiotherapy in early stage knee OA, the necessity of doctors' referral and patients' beliefs in exercise and weight control as possible determinants for feasible and successful physiotherapeutic treatment.

A major strength of this study is that current physiotherapeutic care was assessed with a set of evidence-based quality indicators (Grypdonck et al., 2014). There were several sets of quality indicators available to evaluate the conservative management of patients with knee OA (Grypdonck et al., 2014; Osteras et al., 2015; Peter et al., 2013). To our knowledge, this study was the first to assess physiotherapeutic care for knee OA with a set of quality indicators combined with a list of commonly used treatments that do not contribute to high quality of knee OA care. This study also had some limitations. The recruitment by advertisement in a national magazine for approximately 3900 PTs did not allow a personalized approach. Because of this convenience sampling it could be if only PTs interested or with specific experience in knee OA responded. The chance of winning a gift voucher was offered to attract a broad range of PTs and not only those with specific interests for knee OA. Secondly, using questionnaires and a self-reporting system may have overestimated the compliance with recommended treatments by social desirability (Adams et al., 1999). Self-report of practice could be a threat to validity because healthcare professionals could over report expected treatment options and minimize bad practice. Though, despite possible overestimation of the appropriate treatment, guideline adherence varied greatly in this study. Adherence was similar to studies with case vignettes, recording forms or patient interviews (Ganz et al., 2006; Rutten et al., 2006).

In conclusion, this study combined a set of process quality indicators and commonly used treatments to evaluate PTs' adherence in the management of knee OA. Adherence to the quality indicators varied greatly between 27% and 98%. Quality indicators related to exercise therapy scored high in contrast to most indicators related to long-term follow-up. Also PTs continued to employ treatments

that do not contribute to high quality care, time that should be spent on education and exercise therapy. Improvement strategies should focus on quality indicators related to long-term treatment options. In addition, understanding of barriers for optimum adherence is essential to develop well-targeted strategies.

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Table 1. Characteristics of the participating physiotherapists.

Characteristics of study population(n=284)	No. (%) [‡]
Age, yr, mean $\pm$ SD	45.7 (11.7)
Age, group, yr	
20-34	66 (23.4%)
35-49	86 (30.5%)¥
50-64	124 (44.0%)*
≥ 65	6 (2.1%)¥
Gender	
Female	129 (45.4) ^µ
Male	155 (54.6) ^µ
Setting	
non-hospital setting: individual practice	163 (57.4)
non-hospital setting: duo practice	60 (21.1)
non-hospital setting: group practice	56 (19.7)
Retirement home	25 (8.8)
Hospital	16 (5.6)
Rehabilitation center	18 (6.3)
Experience, yr, median, range	26 (1-45)
Monthly new patients with knee OA, median, range	2 (0-100)
Note SD = standard deviation ‡ Unless stated otherwise * Study population overrepresented in comparison with PTs in Flemish region of Belgium ¥ Study population underrepresented in comparison with PTs in Flemish region of Belgium µ In the Flemish region of Belgium 9.727 (60.2%) female PTs and 6.424 (39.8%) male PTs were registered in 2012.	

Table 2. Physiotherapists' adherence to quality indicators for knee osteoarthritis care. In this study 284 physiotherapists completed the questionnaire.

Quality indicators (QI) on knee osteoarthritis care applicable for physiotherapists:	Quality indicator score	
	Numerator/Denominator	%*
1. If a patient has knee OA, he should be given information access and education about the objectives of treatment and the importance of changes in lifestyle, exercise, pacing of activities, weight reduction and other measures to unload the damaged joints		
• Education about the use of devices (cane, stick, ...)	189/282	67.0
• Education about the importance of weight loss	138/281	49.1
• Education about the importance of exercises / moving	270/283	95.4
• Advice on appropriate foot wear and bracing	160/282	56.7
2. If a patient with knee OA is overweight, then he should be encouraged to lose weight and maintain his weight at a lower level	152/283	53.5
3. a. If a patient has knee OA, then exercise therapy should be prescribed, including at least muscle strengthening, aerobic exercises and functional exercises		
• Aerobic exercises	219/284	77.1
• Functional exercises	248/283	87.6
• Strength training	230/259	88.8
b. If a patient has knee OA, the exercise therapy has to be combined with range-of-motion exercises in case of range-of-motion restrictions	209/282	74.1
4. If a patient with knee OA is following exercise therapy , then the content and intensity of the exercise program should be tailored to the patients' individual goals in terms of limitations of activity and restrictions of participation	268/277	96.8
5. If a patient with knee OA is following exercise therapy, then the exercise therapy should be combined with education / self-management interventions to improve patients' mental and physical performance to alleviate pain.	98/281	34.9
6. If a patient has symptomatic knee OA, then he has to be referred to a physical therapist for instruction of the patient in appropriate exercises , for motivation of the patient to implement exercise and adhere to exercise and to evaluate the performance.	271/279	97.1
7. If a patient with knee OA is following exercise therapy, then the treatment sessions should be spread over longer periods with lower frequencies in the later stages of the exercise program to facilitate the transition from exercise therapy to independent exercising and maintaining sufficient level of physical activity.	102/284	35.9
8. If a patient with knee OA is following exercise therapy, then regular evaluations by the physiotherapist are necessary. To make the switch-over from a supervised to an autonomous program an evaluation session should be performed every three months in the first year, every six months in the second year and once a year afterwards .	76/284	26.8
9. If a patient with knee OA is following exercise therapy, then he should be referred to regular community and sports activities after a period of supervised exercise.	279/284	98.2
Note: * The quality indicator score is calculated by representing the number of physiotherapists adhering to the quality indicator in the numerator and the total number of eligible answers in the denominator.

Graph 1. Number [%] of treatment modalities that are only adjacent to core treatment modalities

Highlights in bullet points:

- PTs adherence to quality indicators for knee OA varied between 27% and 98%.
- High adherence was measured for quality indicators related to exercise therapy.
- Non-appropriate treatments, like massage and cold therapy, are frequently employed.
- Future improvement strategies should focus on long term treatment options.

Questionnaire: Are physiotherapists adhering to quality indicators for the management of knee osteoarthritis? An observational study

1. Personal details and background information

With the following questions, we would like to know some background information.

1. What is your date of birth?

date DD MM YYYY
 / /

2. What is your gender?

- ☐ male
☐ female

3. In what type of practice do you work?

- ☐ ambulant practice: solo
☐ ambulant practice: duo
☐ ambulant practice: group
☐ nursing home
☐ hospital
☐ orthopedic rehabilitation centre
☐ community health centre

4. How many years have you worked as a physiotherapist?

5. How many new patients with knee osteoarthritis do you see every month?

Questionnaire: Are physiotherapists adhering to quality indicators for the management of knee osteoarthritis? An observational study

Treatment options for knee osteoarthritis

The following questions involve treatment options that you would apply for patients with knee osteoarthritis.

6. Can you indicate in the following table if you use the following treatment options (listed alphabetically). For every treatment option you can indicate how often you use it (never= for no patient with knee osteoarthritis, always= for all patients with knee osteoarthritis)?

	never	sometimes	mostly	always
a. Acupuncture	☐	☐	☐	☐
b. Aerobic exercises (e.g. biking, running, swimming, ...)	☐	☐	☐	☐
c. Teaching exercises to continue at home	☐	☐	☐	☐
d. Advice on weight loss	☐	☐	☐	☐
e. Advice on appropriate footwear and/or bracing	☐	☐	☐	☐
f. Balneotherapy (passive hydrotherapy)	☐	☐	☐	☐
g. Education about the use of devices (cane, stick, ...)	☐	☐	☐	☐
h. Education about the importance of weight loss	☐	☐	☐	☐
i. Education about the importance of exercises / moving	☐	☐	☐	☐
j. Neuromuscular electrical stimulation (NMES)	☐	☐	☐	☐
k. Evaluation of exercises that were practiced at home	☐	☐	☐	☐
l. Functional exercises (for patients with functional restrictions in daily life activities)	☐	☐	☐	☐
m. Interferential therapy	☐	☐	☐	☐

	never	sometimes	mostly	always
n. Short wave therapy – Ultra short wave therapy – Radar therapy	☐	☐	☐	☐
o. Cold application	☐	☐	☐	☐
p. Strength training (e.g. quadricepstonification); eccentric exercises	☐	☐	☐	☐
q. Strength training: closed chain exercises	☐	☐	☐	☐
r. Strength training: isometric exercises	☐	☐	☐	☐
s. Strength training: isotonic exercises	☐	☐	☐	☐
t. Laser therapy	☐	☐	☐	☐
u. Massage	☐	☐	☐	☐
v. Passive exercises: improve mobility (capsular and myogenic) by mobilization, manual therapy, traction, postural improvement	☐	☐	☐	☐
w. Selfmanagement: education and supporting interventions to improve patients' skills and confidence to manage their health problems (e.g. motivational interviewing, mindfulness, ...)	☐	☐	☐	☐
x. Taping	☐	☐	☐	☐
y. TENS (Transcutaneous electrical nerve stimulation)	☐	☐	☐	☐
z. Ultrasound	☐	☐	☐	☐
aa. walking training	☐	☐	☐	☐
bb. warmth application	☐	☐	☐	☐

Other treatment modalities not mentioned in this table (please specify maximum 3 additional options)

7. Can you indicate to what extent the following factors influence your choice for a specific treatment plan (never= for no patients with knee osteoarthritis, sometimes, usually, always = for all patients with knee osteoarthritis)?

	never	sometimes	mostly	always
a. The treatment prescription of the physician	☐	☐	☐	☐
b. The diagnosis of the physician	☐	☐	☐	☐
c. The diagnosis of the physiotherapist	☐	☐	☐	☐
d. The functional performance of the patient	☐	☐	☐	☐
e. The motivation of the patient	☐	☐	☐	☐
f. The objectives of the patient	☐	☐	☐	☐
g. The wish of the patient	☐	☐	☐	☐

Other (please specify)

8. How often do you treat patients with knee osteoarthritis when they do not have acute symptoms (flares of pain and/or motion restriction)?

- ☐ More than 3 times a month
- ☐ Between 2 and 3 times a month
- ☐ Maximum once a month
- ☐ I do not treat patients with knee osteoarthritis when they do not have acute symptoms

9. Do you evaluate patients with knee osteoarthritis at least once a year (aside from periods with acute symptoms)?

- ☐ yes
- ☐ no

Remarks

10. Do you advise patients with knee osteoarthritis to practice sports or to stay active after they finished their exercise therapy?

☐ yes

☐ no

If yes, please specify

Appendix B: calculation of the quality indicators and frequently used treatment options

Appendix B1. Quality indicators and corresponding questions

Quality indicators on knee osteoarthritis care applicable for physiotherapists:	Corresponding Question(s)
1. If a patient has knee OA, he should be given information, access and education about the objectives of treatment and the importance of changes in lifestyle, exercise, pacing of activities, weight reduction and other measures to unload the damaged joints <ul style="list-style-type: none"> • Education about the use of devices (cane, stick, ...) • Education about the importance of weight loss • Education about the importance of exercises / moving • Advice on appropriate foot wear and bracing 	6.g 6.h 6.i 6.e
2. If a patient with knee OA is overweight, then he should be encouraged to lose weight and maintain his weight at a lower level	6.d
3. a. If a patient has knee OA, then exercise therapy should be prescribed, including at least muscle strengthening, aerobic exercises and functional exercises <ul style="list-style-type: none"> • Aerobic exercises • Functional exercises • Strength training 	6.b 6.l 6.p/6.q/6.r/6.s
b. If a patient has knee OA, the exercise therapy has to be combined with range-of-motion exercises in case of range-of-motion restrictions	6.v
4. If a patient with knee OA is following exercise therapy , then the content and intensity of the exercise program should be tailored to the patients' individual goals in terms of limitations of activity and restrictions of participation	7.d/7.e/7.f/7.g
5. If a patient with knee OA is following exercise therapy, then the exercise therapy should be combined with education / self-management interventions to improve patients' mental and physical performance to alleviate pain.	6.w
6. If a patient has symptomatic knee OA, then he has to be referred to a physical therapist for instruction of the patient in appropriate exercises , for motivation of the patient to implement exercise and adhere to exercise and to evaluate the performance.	6.c/6.k
7. If a patient with knee OA is following exercise therapy, then the treatment sessions should be spread over longer periods with lower frequencies in the later stages of the exercise program to facilitate the transition from exercise therapy to independent exercising and maintaining sufficient level of physical activity.	8
8. If a patient with knee OA is following exercise therapy, then regular evaluations by the physiotherapist are necessary. To make the switch-over from a supervised to an autonomous program an evaluation session should be performed every three months in the first year, every six months in the second year and once a year afterwards .	9
9. If a patient with knee OA is following exercise therapy, then he should be referred to regular community and sports activities after a period of supervised exercise.	10
Note: The quality indicator scores of the physiotherapists were calculated with answers to questions six to ten of the questionnaire. The first five questions of the questionnaire involved characteristics of the study population. For the statistical analysis the categorical data were dichotomized (by adding the value 0 to answer options 'never' and 'sometimes'; by adding the value 1 to answer options 'mostly' and 'always').	

Appendix B2. Frequently used treatment options that do not necessarily contribute to high quality care and corresponding question

Frequently used treatment options that do not contribute to high quality of care	Corresponding question
Acupuncture	6.a
Balneotherapy	6.f
neuromuscular electrical stimulation (NMES)	6.j
Interferential therapy	6.m
Pulsed short wave	6.n
Cold application	6.o
Laser therapy	6.t
Massage	6.u
Taping	6.x
Transcutaneous electrical nerve stimulation (TENS)	6.y
Ultrasound	6.z