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Published in:
Physiotherapy (United Kingdom)

DOI (link to publication from Publisher):
10.1016/j.physio.2021.03.004

Publication date:
2021

Document Version
Publisher's PDF, also known as Version of record

Physiotherapy 112 (2021) 96–102

The prevalence of serious pathology in musculoskeletal physiotherapy patients – a nationwide register-based cohort study

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Abstract

Introduction Musculoskeletal conditions are the single largest contributor to years lived with disability worldwide. Most musculoskeletal conditions can be managed in primary care, but for a small proportion of these patients the symptoms are caused by serious pathology. Although the general practitioner usually performs initial screening for serious pathology, evaluation and treatment by physiotherapists are often part of the treatment pathway. It is however unclear, how many patients in primary care physiotherapy have symptoms caused by serious pathology.

Objective To estimate the prevalence of neoplasm, cauda equina syndrome, spinal fracture, infection and inflammatory pathology among patients referred for musculoskeletal physiotherapy.

Methods The study was a nationwide register-based cohort study. The authors identified all referrals for primary care musculoskeletal physiotherapy in the Danish National Health Insurance Service Register from 2014 to 2017. Records of hospital contacts were extracted from the Danish National Patient Register within 180 days from first physiotherapy contact, identifying all diagnoses of serious pathology. Prevalence estimates of the serious pathology categories were reported.

Results A total of 1 568 704 courses of treatment were included in the analysis. The overall prevalence of serious pathology was 2.30%. The prevalence of neoplasm was 2.11%, cauda equina syndrome 0.01%, fractures 0.13%, infections 0.01% and inflammatory pathology 0.06%. Higher prevalence's were observed among patients with a previous history of serious pathology, aged above 50 and with comorbidites.

Conclusions Although serious pathology among patients referred by the General Practitioner to musculoskeletal physiotherapy is rare, the present study found an overall prevalence of serious pathology which exceeded the guideline endorsed prevalence estimates.

Keywords: Serious pathology; Prevalence; Primary care; Physiotherapy; Musculoskeletal conditions

Introduction

Musculoskeletal conditions are the single largest contributor to years lived with disability worldwide [1]. These conditions are typically characterized by pain and disability, which may have substantial consequences for the affected individual causing reduced ability to work or limited participation in social activities [2]. Most of the musculoskeletal conditions are considered benign and non-specific. However, a small proportion of patients with musculoskeletal conditions have an undiscovered serious pathology causing their symptoms [3]. Previously, serious pathology among patients with musculoskeletal disorders have mainly focused on spine

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https://doi.org/10.1016/j.physio.2021.03.004
0031-9406/

specific pathologies, such as spinal malignant neoplasms, fractures, cauda equine syndrome, spinal infections and axial spondyloarthritis [4,5]. Early identification of these serious pathologies is of great importance because they necessitate timely and correct diagnosis and treatment, which cannot be provided in primary care settings [3].

Initial screening for these serious pathologies is primarily described in spine specific guidelines [3–5], but it is important for all musculoskeletal conditions. It is commonly acknowledged, that serious pathology in the group of patients with musculoskeletal conditions is rare. Historically the prevalence of serious pathology has been investigated in populations with spine specific conditions, and a more general prevalence in the group of patients with musculoskeletal conditions is yet to be estimated. European guidelines suggests that 1% of LBP patients in primary care have a serious pathology causing their musculoskeletal symptoms [3,4]. Of these serious pathologies, fractures and malignancy are most common, while cauda equina syndrome and spinal infections are less common with an estimated prevalence of 0.04% and 0.01% respectively [6].

Although the initial screening for serious pathology in primary care is usually performed by the General Practitioner (GP), direct access for physiotherapy treatment is increasingly being implemented. Also, other healthcare providers may play a central role in the treatment pathway. In Denmark, GP's acts as gatekeepers into the healthcare system, meaning most patients with musculoskeletal conditions seek their GP, who then examine and refer the patient to appropriate treatment. Often this treatment will include primary care physiotherapy. While screening for signs and symptoms of serious pathologies is also part of the physiotherapy guidelines, no studies have yet investigated how many patients diagnosed with serious pathology have been treated in primary care physiotherapy. Thus, the objective of this study was to estimate the prevalence of neoplasm, cauda equina syndrome, spinal fractures, infections and inflammatory pathology in patients referred for musculoskeletal physiotherapy treatment.

Methods

Design and registers

The study was a nationwide register-based cohort study. The present study builds on data from two healthcare registries; (1) The Danish National Health Insurance Service Register (NHSR), which contains daily information on physiotherapy interventions received in private primary care since 1990 with the exception of self-paid therapy without reimbursement [7], and (2) the Danish National Patient Register (NPR) [8], which includes information on hospital diagnoses and contact dates for all in- and outpatient contacts to hospitals in Denmark. In NPR there is a primary diagnosis and up to several secondary diagnoses describing each patient's individual course of treatment. Diagnoses are coded using the International Classification of Diseases and Related Health Problems (ICD-10) system [9]. The study was reported as recommended in the RECORD checklist (extended STROBE checklist) [10].

Population

In Denmark, national healthcare registries provide individual-based records of contact to the healthcare system for the entire population [11]. In the present study all records of referrals for musculoskeletal physiotherapy treatment between 1.1.2014 and 31.12.2017 were identified through the NHSR. Each referral with a contact to the physiotherapist represented a *course of treatment* in the study meaning the study population consists of observations (courses of treatment) and the individual patient could be represented by several courses of treatment during the study period. The first contact date had to be within 365 days from the referral date, and each course of treatment had a follow up period of 180 days from first contact date. The study was approved by the Danish Data Protection Agency (No. 1-16-02-41-19). Under Danish law, this study did not need ethics approval (Act on Research Ethics Review of Health Research Projects, October 2013) [12].

Serious pathology

All records of primary hospital diagnosis within 180 days from first contact with the physiotherapist was obtained from NPR, identifying all diagnoses of serious pathology in the study population. Each diagnosis represented a case and patients could potentially be diagnosed with more than one serious pathology in the study period. The authors included five categories of serious pathology (Table 1). The categories primarily represent spine specific pathologies (cauda equina, spinal fractures, spinal infections and inflammatory diseases of the spine), but the authors chose to broaden the neoplasm category so that it not only included spinal malignant neoplasms but also other malignant neoplasms (cancer) as well as benign neoplasms (covering benign neoplasm, in situ neoplasm and neoplasms of uncertain or unknown behaviour) according to ICD-10.

Statistical analysis

The flow of observations was described and descriptive characteristics of the cohort were presented. Period (180 days) prevalence proportions of serious pathology were calculated and presented as prevalence estimates with 95% confidence interval (95% CI). The period prevalence refers to the proportions of patients who had been diagnosed with a serious disease during the period of 180 days.

Sensitivity analysis was performed on the prevalence proportions by including both primary and secondary ICD-10 diagnoses from DNPR. Prevalence estimates were calcu-

Table 1
Categories of serious pathology.

Category	Definition	ICD-10	Specification
Neoplasms	Malignant neoplasms are cancerous tumours, an abnormal growth that can grow uncontrolled and spread (metastasize) to other parts of the body.	DC00-DC96	Malignant neoplasms
	In situ neoplasm is a premalignant state in which the growth of the tumour has not spread to surrounding or distant tissue in the body.	DD00-DD09	In situ neoplasm
	Benign neoplasms are noncancerous growths in the body. Unlike cancerous tumours, they don't spread (metastasize) to other parts of the body.	DD10-DD36	Benign neoplasms
	Neoplasms which are currently benign but have characteristics that make it possible for the tumour to become malignant.	DD37-DD48	Neoplasms of uncertain behaviour
Cauda Equina	Cauda equina syndrome occur when the nerve roots of the cauda equina are compressed and disrupt motor and sensory function to the lower extremities and bladder.	DG834	Cauda Equina syndrome
Fracture	Fractures of the vertebra not related to high impact injuries	DM484	Fatigue fracture of vertebra
		DM485	Collapsed vertebra
		DM80	Osteoporosis with pathological fracture
Infection	Spinal infections occur when bacteria, fungi, or viruses invade the spinal tissues.	DA17	Tuberculosis of nervous system
		DA180	Tuberculosis of bones and joints
		DM49	Spondylopathies in diseases classified elsewhere
		DM86	Osteomyelitis
Inflammatory	Inflammatory diseases related to the spine and vertebra	DM023	Reiter's disease
		DM072	Psoriatic spondylitis
		DM081	Juvenile ankylosing spondylitis
		DM45	Ankylosing spondylitis
		DM46	Other inflammatory spondylopathies

lated only including each patient's first course of treatment, thereby changing the cohort from observations to individual patients. For the categories neoplasm, fracture and inflammatory pathologies, prevalence estimates were calculated and presented stratified into previously diagnosed with a similar pathology or not. For each of these categories, the following characteristics were presented: (1) *Gender*, (2) *age* divided into <50/≥50 years of age at first contact to physiotherapist and (3) *comorbidity* based on the revised Charlson comorbidity index [13,14] using ICD-10 diagnoses from the DNPR the last 10 years. The original scale from 0–24 were divided into 0 (no comorbidity) and >0 (comorbidity).

All statistical analyses were performed using STATA version 15.0 (StataCorp LP, College Station, TX, USA).

Results

A total of 1 708 474 first appointments to a physiotherapist were made in the study period. Of these, 130 887 courses of treatment were excluded because the patient had more than one active course of treatment. Additional 8753 courses of treatment were excluded because the patient died ($n = 7368$) or migrated ($n = 1385$) within 180 days from first contact to the physiotherapist. A further 130 courses of treatment were excluded because of missing data on age and gender. Hence, the study population consisted of 1 568 704 courses of treatment. The study population was characterized as presented in Table 2.

The prevalence of neoplasm was 2.11%, of which 1.13% was malignant neoplasms. The prevalence of cauda equina syndrome was 0.01%, fractures 0.13%, infections 0.01% and inflammatory diseases of the spine 0.06%. Changing the included diagnoses to both primary and secondary diagnoses had little impact on the estimated prevalence, changing the *any serious pathology* estimate to 2.60% (data not shown). Only including the first course of treatment for each patient did not change the estimated prevalence ($n = 1\,101\,948$).

Table 3 presents prevalence estimates of neoplasms, fracture and inflammatory pathology. In all of the pathology categories, there was a lower prevalence among patients who had not been diagnosed with a similar pathology previously. Among those not previously diagnosed, patients over the age of 50 or patients with co-morbidity had higher prevalence estimates in the neoplasm and fracture pathology categories. In the inflammatory pathology category only minor differences in prevalence estimates were detected.

Table 2
Characteristics of study population ($n = 1\,568\,704$).

Gender, *n* (%)		
Female	993 959	(63)
Male	574 745	(37)
Age, mean (SD)	51	(19)
CCI (0–24), *n* (%)		
0	1 357 039	(87)
1–24	211 795	(13)
Course of treatment, median [IQR]		
Days from referral to first treatment	8	[2 to 19]
Treatment days in course of treatment	5	[3 to 10]
Prevalence of serious pathology, % (95%CI)		
Neoplasm	2.11	(2.10 to 2.13)
Cauda equina	0.01	(0.00 to 0.01)
Fracture	0.13	(0.12 to 0.13)
Infection	0.01	(0.01 to 0.01)
Inflammatory	0.06	(0.06 to 0.07)
Any serious pathology	2.30	(2.28 to 2.32)

Abbreviations: CCI, Charlson Comorbidity Index; CI, Confidence Interval; IQR, Inter Quartile Range; *n*, number of observations; SD, Standard Deviation.

Discussion

This is the first study to estimate the prevalence of serious pathology among patients with musculoskeletal conditions treated in primary care physiotherapy. The overall prevalence of serious pathology was 2.30%. The prevalence of neoplasm was 2.11%, of which 1.13% was malignant neoplasms. The prevalence of cauda equina syndrome, fractures, infections and inflammatory pathology of the spine was 0.01%, 0.13%, 0.01% and 0.06% respectively. When previously diagnosed patients were excluded, the prevalence of malignant neoplasm, benign neoplasm, fracture and inflammatory pathology was 0.64%, 0.80%, 0.10% and 0.05% respectively.

Strengths and limitations

A major strength of the study is, that the included cohort represents all patients seen in primary care physiotherapy because of musculoskeletal conditions, thus no bias due to selection was present. However, patients who died or migrated within 180 days from their first physiotherapy contact were excluded. Because the study estimated prevalence of serious (and possibly fatal) pathologies, patients might have died from neoplasms, for example, which means the estimated prevalence could be underestimated. Also, the authors have no information about possible diagnoses in patients who migrated. Nevertheless, taking into account the relatively few patients that were excluded, the possible underestimation would probably be small. Also misclassifications of serious pathology could have occurred. Although the NPR is based on ICD-10 diagnoses, which enables transparent categorizations of serious pathology, patients could initially present with a suspected serious pathology, but eventually be diagnosed with another condition. If the initial diagnosis is not correctly amended, afterwards, there is a risk of misclassifications which would result in an overestimated prevalence. This potential misclassification is however thought to be small. To avoid such misclassifications in the neoplasm category, the authors could have used the Danish Cancer Registry (DCR) [15]. In the DCR only verified diagnoses of cancer (malignant neoplasms) are recorded. However, the DCR does not contain information on benign neoplasms. The authors chose to include both benign and malignant neoplasms, as the initial distinction between symptoms of malignant or benign neoplasm can be very difficult. The symptoms will often depend on the location but more general symptoms (such as fatigue, loss of appetite or fever) may also occur in any type of neoplasm. This possible overestimation would, however, still be based on a suspicion of serious pathology which means the patient should be referred to further evaluation in secondary care. Furthermore, as benign neoplasms also can severely affect the patients' general health status the detection of overall symptoms of neoplasms and timely referral are important. If the physiotherapist has even a vague suspicion that the patient might have a serious pathology the physiotherapist should send the patient back to the GP for further investigation.

In the NHSR it is not possible to extract reasons for referrals, meaning the authors cannot categorize the musculoskeletal conditions into specific diagnostic groups. It however seems plausible, that the prevalence of spine specific serious pathologies, such as fractures and cauda equina syndrome, are higher among patients with spine specific conditions. Unfortunately, this hypothesis could not be investigated in the present study.

Interpretation of the results

To our knowledge, this is the first study investigating the prevalence of serious pathology in primary care patients with a wide range of musculoskeletal conditions as compared to spine specific conditions. The neoplasm estimate of 2.11% is the largest contributor to the overall estimate of 2.30%. This indicates that screening for serious pathology in physiotherapy practise perhaps could benefit from concentrating more on screening for neoplasm. Also the results as expected showed, that excluding patients with a previous diagnose in the same pathology category resulted in significantly smaller prevalence estimates. The authors however chose to include the previously diagnosed patients in the estimates as this is very important information for the physiotherapist to consider when screening patients for serious pathologies. This may be most important for the neoplasm or fracture category, as it could indicate a relapse of disease or the presence of osteoporosis. Surprisingly, the prevalence of spinal fractures was only 0.13% which is significantly lower than previously reported estimates of around 4%. This could be explained by the broad range of musculoskeletal conditions included in our sample as compared to previous studies including spine related disorders only. Moreover, as our population was referred to physiotherapy it is likely that some fractures have been picked up in the initial screening by the GP. The over-

Table 3
Prevalence of neoplasm, fracture and inflammatory pathology within 180 days from first treatment date divided into courses of treatment with no previous diagnosis and previously diagnosis.

	No previous diagnosis			Previously diagnosed		
	Observations (*n*)	Prevalence (%)	CI 95%	Observations (*n*)	Prevalence (%)	CI 95%
Malignant neoplasm						
Overall[a]	1 451 923	0.64	(0.63 to 0.65)	116 781	7.26	(7.11 to 7.41)
Gender						
Female	915 969	0.61	(0.59 to 0.62)	77 990	6.45	(6.28 to 6.62)
Male	535 954	0.69	(0.67 to 0.72)	38 791	8.89	(8.61 to 9.18)
Age						
<50	685 545	0.13	(0.12 to 0.14)	23 304	3.63	(3.39 to 3.88)
≥50	766 378	1.10	(1.07 to 1.12)	93 477	8.16	(7.99 to 8.34)
Comorbidity						
No	1 298 554	0.49	(0.48 to 0.50)	58 368	1.55	(1.45 to 1.65)
Yes	153 369	1.90	(1.83 to 1.96)	58 413	12.97	(12.69 to 13.24)
Benign neoplasm						
Overall[a]	1 451 923	0.80	(0.78 to 0.81)	116 781	3.93	(3.82 to 4.04)
Gender						
Female	915 969	0.86	(0.84 to 0.88)	77 990	3.79	(3.66 to 3.93)
Male	535 954	0.69	(0.57 to 0.72)	38 791	4.21	(4.01 to 4.41)
Age						
<50	685 545	0.47	(0.58 to 0.61)	23 304	4.24	(3.98 to 4.50)
≥50	766 378	1.09	(1.06 to 1.11)	93 477	3.85	(3.73 to 3.98)
Comorbidity						
No	1 298 554	0.74	(0.73 to 0.76)	58 368	4.71	(4.54 to 4.89)
Yes	153 369	1.23	(1.18 to 1.29)	58 413	3.15	(3.01 to 3.29)
Fracture						
Overall[a]	1 558 255	0.10	(0.10 to 0.11)	10 579	3.89	(3.53 to 4.28)
Gender						
Female	984 763	0.13	(0.12 to 0.14)	9196	3.96	(3.57 to 4.38)
Male	573 362	0.05	(0.05 to 0.06)	1383	3.47	(2.57 to 4.58)
Age						
<50	708 677	0.00[b]	(0.00 to 0.00)	172	23.25	(0.63 to 58.47)
≥50	849 448	0.18	(0.17 to 0.19)	10 407	3.92	(3.56 to 4.31)
Comorbidity						
No	1 350 228	0.08	(0.07 to 0.08)	6811	3.83	(3.39 to 4.32)
Yes	208 027	0.24	(0.22 to 0.27)	3768	4.01	(3.40 to 4.68)
Inflammatory						
Overall[a]	1 563 938	0.05	(0.04 to 0.05)	N/A[c]		
Gender						
Female	991 140	0.04	(0.03 to 0.04)	N/A		
Male	572 671	0.06	(0.05 to 0.07)	N/A		
Age						
<50	706 530	0.06	(0.05 to 0.06)	N/A		
≥50	857 281	0.04	(0.03 to 0.04)	N/A		
Comorbidity						
No	1 353 102	0.04	(0.04 to 0.05)	N/A		
Yes	210 836	0.06	(0.05 to 0.07)	N/A		

Abbreviations: CI: Confidence Interval.
[a] Malignant and benign neoplasm: diagnosed with any type of neoplasm 0–3 years prior date of first contact; fracture: diagnosed with a similar fracture in the period 1/1-2004 until date of first contact.
[b] Rounded to two decimals.
[c] N/A: Not applicable as this is a group of chronic patients.

all prevalence of both malignant and benign neoplasm was markedly reduced, when only looking at courses of treatment where the patient had not previously been diagnosed with neoplasm. In the fracture category the change was more modest. Prevalence estimates of inflammatory pathology among patients previously diagnosed with a similar pathology was omitted, as this is a group of lifelong chronic diseases making prevalence estimates less useful.

Among patients with LBP it has been acknowledged, that approximately 1% have an undiscovered serious pathology [3,4,16,17]. This estimate is however based on relatively old and small studies and more recent evidence suggests that the prevalence of serious pathology among primary care LBP patients may be as high as 6% [18]. Unfortunately, previously conducted studies in this field are all

challenged by small study populations resulting in inaccurate or missing estimates because few or none of the participants were diagnosed with the specific serious pathologies [6,19]. Nevertheless, the results of the present study suggest, that the previously acknowledged estimate may be too low. All the included patients in the present study had been referred by the GP, meaning the GP had screened for serious pathology as a natural part of their consultation. Despite that, 2.30% of the patients were diagnosed with serious pathology within 180 days from their first contact. Although the authors cannot assume that all of these patients would have had symptoms of serious pathology, it remains certain that the physiotherapists cannot solely rely on the initial screening from the GP, because these serious conditions may cause symptoms that develop over time.

Generalisability of the results

The external validity of the study is considered excellent, as the study was based on Danish national healthcare registries, which covers the total Danish population. Because of the study power and completeness of the Danish healthcare registries, the prevalence of different categories of serious pathologies form a very robust and accurate estimation in the group of patients with musculoskeletal conditions treated in primary care physiotherapy. It should however be taken into account, that the population of patients with musculoskeletal conditions may vary significantly between countries as a result of different healthcare systems and treatment pathways. Also, the prevalence of serious pathology in a population is of course affected by the prevalence of etiological factors like for example tuberculosis in the studied population.

Conclusion

The prevalence of serious pathology among patients referred by GPs to musculoskeletal physiotherapy was 2.30%. This means, that although serious pathology is rare, it is more frequent than the guideline endorsed prevalence estimates suggests.

Contribution of the paper

- The study is the first to estimate the prevalence of serious pathology in a group of patients referred by the general practitioner to primary care physiotherapy with a broad range of musculoskeletal disorders.
- The study is based on Danish Healthcare Registries, with a large data set, limited risk of bias and excellent generalisability of the results.

Ethical approval

The study was approved by the Danish Data Protection Agency (No. 1-16-02-41-19). Under Danish law this study did not need ethics approval (Act on Research Ethics Review of Health Research Projects, October 2013) [12].

Availability of data and materials

The study dataset from which the authors have reported findings in this paper cannot be assessed by other researcher according to Danish regulations. Access to similar data can be applied through Statistics Denmark.

Funding

The study was supported by the Practise Research Foundation of Danish Physiotherapists, The Association of Danish Physiotherapists, The General Practice Research Foundation of Central Denmark Region, the Regional Hospital West Jutland, the Health Research Foundation of Central Denmark Region and Aarhus University.

The funders had no involvement in the design, conduct or reporting of this study.

Conflict of interests

The authors declare that they have no conflict of interests.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.physio.2021.03.004.

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