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Impact of physiotherapy access on health-related quality of life following hip fracture: an observational study on 30 752 hip fractures from the Norwegian Hip Fracture Register 2014–2018

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ABSTRACT

Objectives The main objective of this study was to investigate the characteristics of patients receiving private community physiotherapy (PT) the first year after a hip fracture. Second, to determine whether utilisation of PT could improve health-related quality of life (HRQoL).

Methods In an observational cohort study, 30 752 hip fractures from the Norwegian Hip Fracture Register were linked with data from Statistics Norway and the Norwegian Control and Payment of Health Reimbursements Database. Association between covariates and utilisation of PT in the first year after fracture, the association between covariates and EQ-5D index score and the probability of experiencing 'no problems' in the five dimensions of the EQ-5D were assessed with multiple logistic regression models.

Results Median age was 81 years, and 68.4% were females. Most patients with hip fracture (57.7%) were classified as American Society of Anesthesiologists classes 3–5, lived alone (52.4%), and had a low or medium level of education (85.7%). In the first year after injury, 10 838 of 30 752 patients with hip fracture (35.2%) received PT. Lower socioeconomic status (measured by income and level of education), male sex, increasing comorbidity, presence of cognitive impairment and increasing age led to a lower probability of receiving postoperative PT. Among those who used PT, EQ-5D index score was 0.061 points ($p<0.001$) higher than those who did not. Correspondingly, the probability of having 'no problems' in three of the five dimensions of EQ-5D was greater.

Conclusions A minority of the patients with hip fracture had access to private PT the first year after injury. This may indicate a shortcoming in the provision of beneficial post-surgery rehabilitative care reducing post-treatment HRQoL. The findings underscore the need for healthcare policies that address disparities in PT access, particularly for elderly patients, those with comorbidities and reduced health, and those with lower socioeconomic status.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Large register-based cohort study on 30 752 patients with hip fracture.
⇒ Individually linked data from three national registers.
⇒ 59.1% of the patients completed the patient-reported outcome measure questionnaire.
⇒ Attrition and selection bias in follow-up studies on this patient population.

INTRODUCTION

Contemporary management of hip fractures extends beyond the initial surgical intervention, encompassing postoperative training and rehabilitation, both playing a pivotal role in restoring the patient's function and quality of life.[1–5] Dyer *et al*, in a review of cohort studies, showed that more than half of the patients experienced a deterioration from their pre-fracture function.[6] Thus, it is important to optimise postoperative care to minimise the consequences of the hip fracture.[7 8]

Physiotherapy (PT) is a core component of postoperative care for patients with hip fracture.[3] Exercise-based interventions, gait training, and strength and balance exercises may promote functional recovery, reduce pain and improve overall health-related quality of life (HRQoL).[9] According to a recent Cochrane Review, mobility strategies after discharge led to a small, but clinically meaningful increase in mobility and walking speed compared with controls. The authors concluded that training of gait, balance and functional tasks is particularly effective.[1] British[10] and Australian[11] evidence-based guidelines and the Norwegian consensus-based guideline for interdisciplinary treatment of hip fractures[12] all advocate rapid mobilisation and access to PT to enhance rehabilitation.

Socioeconomic status is a potent determinant of healthcare disparities, with

disadvantaged population groups facing greater challenges in accessing necessary medical care, including PT services.[13 14] Income, education and place of residence can significantly impact an individual's ability to access timely and appropriate healthcare services.[15] Investigating how socioeconomic and other determinants relate to PT access for patients with hip fracture may provide valuable insights into the equity and efficiency of healthcare systems. Such knowledge can guide rehabilitation policies, prevention strategies and hip fracture guidelines to ensure that all individuals, regardless of their socioeconomic status, have equal access to the rehabilitative care they need.

The objectives of this study were: (1) to characterise patients receiving PT after a hip fracture including the socioeconomic factors' association with access to PT, and (2) to determine whether utilisation of PT was associated with improved HRQoL after hip fracture.

METHODS

This is a national retrospective cohort study of prospectively collected data from three national registers: the Norwegian Hip Fracture Register (NHFR), Statistics Norway (SN), and the Norwegian Control and Payment of Health Reimbursements Database (KUHR). The patient's unique national ID number was used to link up individual data from these sources.

The NHFR: patients and outcomes

Since 2005, hip fractures (International Classicfication of Disease, 10th edition, diagnose codes S72.0–S72.2) operated on in Norwegian hospitals have been registered in the NHFR.[16] Patients with hip fracture reported to the NHFR in the years 2014–2018 formed the basis of this study. Patients treated with a total hip arthroplasty (THA) are recorded in the Norwegian Arthroplasty Register and subsequently imported to the NHFR. Data from the NHFR were used to identify patients and to retrieve baseline information (sex, age, American Society of Anesthesiologists (ASA) class and presence of cognitive impairment).

Completeness of reporting of hip fractures to the NHFR is evaluated regularly. The figures relevant to our dataset were 88%/86% completeness for osteosynthesis, 95%/92% for hemiarthroplasty and 88%/94% for THA in 2015–2016/2019–2020, respectively.[17] The date of death was retrieved from the National Population Register and linked to the NHFR.

An invitation to report patient-reported outcome measures (PROMs) data was sent from the NHFR to all living patients 4 months postoperatively. The PROMs included a validated Norwegian translation of the EQ-5D-3L, which covers five dimensions of HRQoL: mobility, self-care, usual activities, pain/discomfort, and symptoms of anxiety and depression.[18] There are three response categories for each dimension: level 1 (indicating no problems or best state), level 2 (indicating some problems or intermediate state) and level 3 (indicating severe problems or worst state).[18] In this study, we grouped the patients into those with no problems (level 1) versus patients with some or severe problems (levels 2+3) for each of the five dimensions.

EQ-5D-3L index scores were generated from a large European population.[19] The scores range from 1 (indicating the best possible state of health) to −0.217 (indicating a state of health worse than death), while 0 indicates a state of health equal to death. Minimal important difference (MID) for EQ-5D-3L scores was set at 0.05 points, based on the study of Jehu *et al*.[20] The cover letter encouraged support by a proxy respondent in cases where the patient was unable to fill in the questionnaire. No reminders were sent to non-respondents. Responses were available from 18 171 (59.1%) patients.

SN: demographics and socioeconomic status

We obtained individual socioeconomic data (household income, highest completed level of education and living status) from SN. Patients living in a healthcare facility were excluded, and the remaining patients were dichotomised into living alone or cohabiting. Depending on the household income in the year prior to injury, the patients were ranked in three equally sized groups: low (€0–20 446 (income in Norwegian krone recalculated to € based on rate of exchange per 19 April 2024)), medium (€20 446–36 325) and high income (€36 327–3 361 108). Educational status was categorised into three levels according to the International Standard of Classification of Education[21]: low (lower secondary education), medium (upper secondary to short-cycle tertiary education) and high (bachelor's level or higher).

The SN Centrality Index (CentInd) categorises municipalities based on travel time to workplace and service functions.[22] The index has six levels where 1 is used for the most central municipalities, while 6 equals the least central. It is based on aggregated population data in SN and is regularly updated. There is a strong covariation between the size of a municipality's population and its CentInd. A total of 163 (46%) Norwegian municipalities are classified as small and peripheral, but only 6.7% of Norway's population lives in these municipalities. The CentInd was used as a potential surrogate marker for the number (density) of potential physiotherapists in a community.

The KUHR: utilisation of PT

Non-hospital PT care in Norway is provided by municipal health services, including physiotherapist services, or by private physiotherapists working either in private clinics or as free-standing enterprises in municipalities. The KUHR contains information on all reimbursement claims sent from private physiotherapists which have been refunded by the state. Claims from all certified private physiotherapists and manual therapists treating patients from 1 January 2014 to 31 December 2019 were identified and data on PT utilisation 12 months before and after the fracture were extracted.

By 31 December 2019, the NHFR had compiled data on 41 635 fractures admitted from 1 January 2014 to 31 December 2018. Patients deceased before 4-month follow-up (n=5286) and patients living in healthcare facilities (n=4215) were excluded. Patients suffering from a contralateral hip fracture <6 months after the primary operation (n=553), patients with missing information on ASA class (n=434) and those with pathological fractures (n=398) were also excluded, leaving 30 752 fractures in 29 810 patients for analyses (online supplemental figure 1).

Statistical analysis

Categorical variables are presented with descriptive statistics as absolute numbers and percentages. Utilisation of PT is presented as median treatment sessions per patient with an IQR. The numbers of PT sessions per day for the patient group in the year prior to the incident fracture and sessions per day in the year after surgery were calculated.

A multiple logistic regression model was used to analyse the association between demographic and other variables and utilisation of PT in the first year after surgery. All variables were included in the model. ORs are presented with 95% CIs. The level of significance was set at 5% in all analyses.

The first PROM was administered by the NHFR 4 months postoperatively.[23] We introduced a 30-day 'wash-out' period after surgery. This was due to a presumption, based on UK data[24] and a consensus among orthopaedic surgeons, that a substantial proportion of older adults with hip fractures have some form of institutional rehabilitation stay in the first few weeks after the fracture, during which there will be no visits to non-institutional private physiotherapists. Consequently, the analyses for assessing the association between PT utilisation (yes/no) and HRQoL were limited to patients observed 31–120 days (4 months). PT given beyond this period was excluded in these analyses, as there is no reason to believe that PT given at 120–360 days could have any effect on the 4-month EQ-5D results.

A multiple linear regression model was used to assess the association between PT received and the 4-month EQ-5D-3L index scores. Each increment in the covariates resulted in a corresponding estimated change in the EQ-5D-3L index score (presented with 95% CI). In addition, for each of the five dimensions in EQ-5D, the patients were grouped into those with no problems (level 1) and those with some or severe problems (levels 2 and 3). Logistic regression models were used to assess the association between utilisation of PT and the probability of being in the 'no problems' (level 1) group compared with the 'some or severe problems' group (levels 2+3). The analyses were adjusted for all covariates.

The analyses were performed using SAS/STAT for Windows V.8.3 (SAS Institute). The STrengthening the Reporting of OBservational studies in Epidemiology guidelines were followed.[25]

Patient and public involvement

A user representative from the investigation institution, Nordland Hospital, was appointed to the project. Mai-Helen Walsnes is a representative from the Elderly Council in Nordland County. She was involved in the conceptualisation of the project and has been continuously updated on the progress since 2019 when the project started. We are grateful for useful insights and perspectives that have improved our project.

RESULTS

Baseline population characteristics are presented in table 1. The median age was 81 years (IQR 70–82), and 68.4% were females. Most patients with fracture (57.7%) were classified as ASA risk classes 3–5. Median household income was €29 862 (as of April 2024) (IQR €19 305–43 301), 52.4% lived alone, and 85.7% had a low or medium level of education.

Utilisation of PT

In the first year after injury, 35.2% (10 838) of the patients with fracture used PT and completed 269 854 sessions. Median PT sessions per patient were 20 (IQR 6–34) (online supplemental figure 2). In days 31–120 post-surgery, 8762 out of 30 752 patients with hip fractures (28.5%) received PT, with a total of 95 821 PT sessions and a median number of treatment sessions per patient of 10 (IQR 5–16), ranging from 1 to 50. The proportion of patients receiving PT post-surgery decreased with increasing age, with higher comorbidity (ASA grade) and with cognitive impairment (table 1), whereas cohabiting patients and those with a high educational level and high income had higher PT utilisation.

The temporal distribution of PT sessions is shown in figure 1. The maximum number of treatment sessions (1260) was at 65 days post-surgery, declining gradually to 1100 sessions per day at 120 days and 500 sessions at 1 year. Median baseline PT utilisation was 348 sessions per day (IQR 302–394).

Factors associated with utilisation of PT the first year after hip fracture

The association between PT utilisation and patient characteristics is illustrated in figure 2. Male sex, increasing comorbidity, presence of cognitive impairment and increasing age led to a lower probability of having postoperative PT in the first year post-surgery.

Only 8.9% of patients above 90 years received PT, compared with 53.8% of patients below 65 years (OR=0.17; 95% CI 0.15 to 0.19; p<0.001). Higher comorbidity reduced the likelihood of having PT, with an OR of 0.53 (95% CI 0.47 to 0.61, p<0.001) for ASA 3 patients versus ASA 1 patients. Increasing household income and higher level of education were both associated with a higher probability of receiving PT. Patients in the highest household income group were twice as likely to receive PT as those in the lowest income group (OR 2.01; 95%

Table 1 Population demographics and utilisation of physiotherapy (PT)

		All		PT 0–365 days		PT 31–120 days		Respondents at 4 months	
		(n=30 752, 100%)		(n=10 838, 35.2%)		(n=8762, 28.5%)		(n=18 171, 59.1%)	
		n	% of total	n	% (row)	n	% (row)	n	%
Sex									
	Female	21 043	68.4	7280	34.6	5855	27.8	12 409	59.0
	Male	9709	31.6	3558	36.6	2907	29.9	5762	59.3
Age in years									
	<65	3474	11.3	2133	61.4	1870	53.8	2076	59.8
	65–74	5842	19.0	3128	53.5	2635	45.1	3834	65.6
	75–79	4363	14.2	1851	42.4	1492	34.2	2762	63.3
	80–84	5689	18.5	1746	30.7	1328	23.3	3358	59.0
	85–89	6433	20.9	1357	21.1	995	15.5	3603	56.0
	>90	4951	16.1	623	12.6	442	8.9	2538	51.3
ASA									
	1	1344	4.4	902	67.1	829	61.7	999	74.3
	2	11 661	37.9	5310	45.5	4431	38.0	7635	65.5
	3	16 142	52.5	4330	26.8	3305	20.5	8774	54.4
	4–5	1605	5.2	296	18.4	197	12.3	763	47.5
Cognitive impairment									
	0	25 857	84.1	10 413	40.3	8452	32.7	16 234	62.8
	1	4895	15.9	425	8.7	310	6.3	1847	37.7
Living status									
	Alone	16 105	52.4	4342	27.0	3323	20.6	8683	53.9
	Cohabiting	14 647	47.6	6496	44.4	5439	37.1	9488	64.8
Household income									
	Low	10 250	33.3	1941	18.9	1695	16.5	5286	51.6
	Medium	10 251	33.3	3299	32.2	2715	26.5	6006	58.6
	High	10 250	33.3	5598	54.6	4352	42.5	6879	67.1
Educational level									
	Primary	12 715	41.3	3619	28.5	2834	22.3	6857	53.9
	Secondary	13 642	44.4	5122	37.5	4172	30.6	8357	61.3
	Tertiary	4395	14.3	2097	47.7	1756	40.0	2957	67.3
Centrality Index									
Most central	1	5207	16.9	1726	33.1	1374	26.4	3083	59.2
	2	7206	23.4	2411	33.5	1940	26.9	4361	60.5
	3	7786	25.3	2772	35.6	2228	28.6	4623	59.4
	4	5933	19.3	2186	36.8	1788	30.1	3491	58.8
	5	3224	10.5	1203	37.3	994	30.8	1844	57.2
Least central	6	1396	4.5	540	38.7	438	31.4	769	55.1

PT used in the first year (0–365) and in the first post-surgery period (31–120). Response rates for 4-month PROM questionnaire.
ASA, American Society of Anesthesiologists; PROM, patient-reported outcome measure.

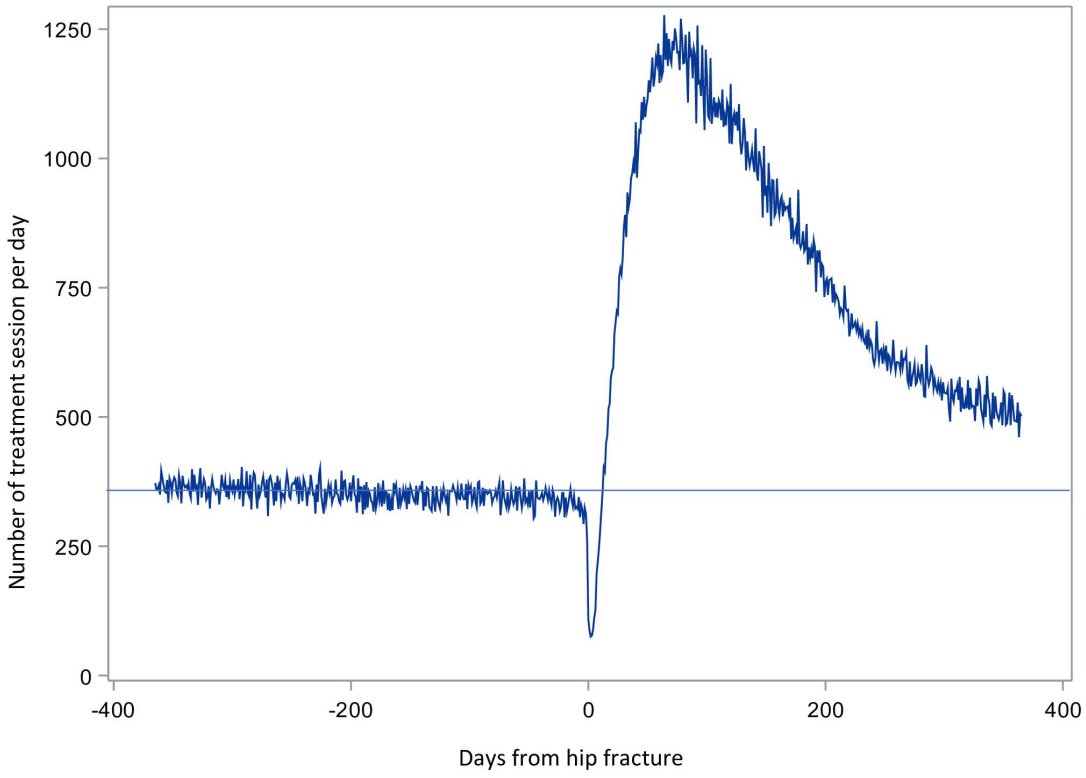

Figure 1 Number of physiotherapy treatment sessions per day 1 year before and after the hip fracture. Line represents the daily number of physiotherapy treatment sessions 1 year before and after the hip fracture. Horizontal line represents baseline median utilisation of physiotherapy.

CI 1.81 to 2.24; p<0.001). A high level of education also increased utilisation of PT compared with a low level (OR 1.65; 95% CI 1.51 to 1.79; p<0.001). Patients living in the less central areas had higher odds of using PT. Patients living in municipalities with CentInd 6 had 68% higher odds of having PT than those in municipalities with CentInd 1 (OR 1.68; 95% CI 1.46 to 1.94; p<0.001).

Association between covariates and EQ-5D-3L index score

Utilisation of PT was associated with an increase of 0.061 points (p<0.001) in the EQ-5D-3L index score. Both increasing ASA class and presence of cognitive impairment were associated with a significant negative impact on the index score, with a reduction of 0.076 points (p<0.001) per incremental increase in ASA class and a reduction of 0.183 points (p<0.001) with the presence of cognitive impairment. We found no association between the CentInd and EQ-5D-3L index score. The association between covariates and EQ-5D-3L index score at 4 months is summarised in table 2.

Association between PT and EQ-5D-3L dimensions

The associations between the utilisation of PT and the probability of having no problems (level 1) for each of the five EQ-5D-3L dimensions are presented in table 3. PT was associated with significantly better performance in self-care (OR 1.6; p<0.001), daily activities (OR 1.3; p<0.001), and symptoms of anxiety and depression (OR 1.4; p<0.001). For the pain and discomfort dimension, patients receiving PT were less likely to have no problems (level 1; OR 0.9, p<0.001).

DISCUSSION

In this large register study with 30 752 included fractures, we found that in the immediate postoperative period (31–120 days), only 28.5% of the patients received PT, increasing to 35.2% the first year. Utilisation of PT was not distributed equally: higher age, increasing comorbidity and lower socioeconomic status were all significantly associated with a lower probability of receiving PT. PT was associated with an improved HRQoL, expressed as a higher EQ-5D index score and higher probability of having no problems in three of the five EQ-5D dimensions. Inequity in access potentially decreased HRQoL for patients with lower socioeconomic status.

The utilisation of PT in the first year after surgery was not equally distributed among the patient population. Factors such as higher age, increasing comorbidity and lower socioeconomic status were significantly associated with a lower probability of receiving PT. The socioeconomic gradient in access to PT is supported in the systematic review by Braaten *et al*.[15] This finding indicates disparities in access to rehabilitation services, highlighting potential barriers that some population groups face in obtaining necessary care.

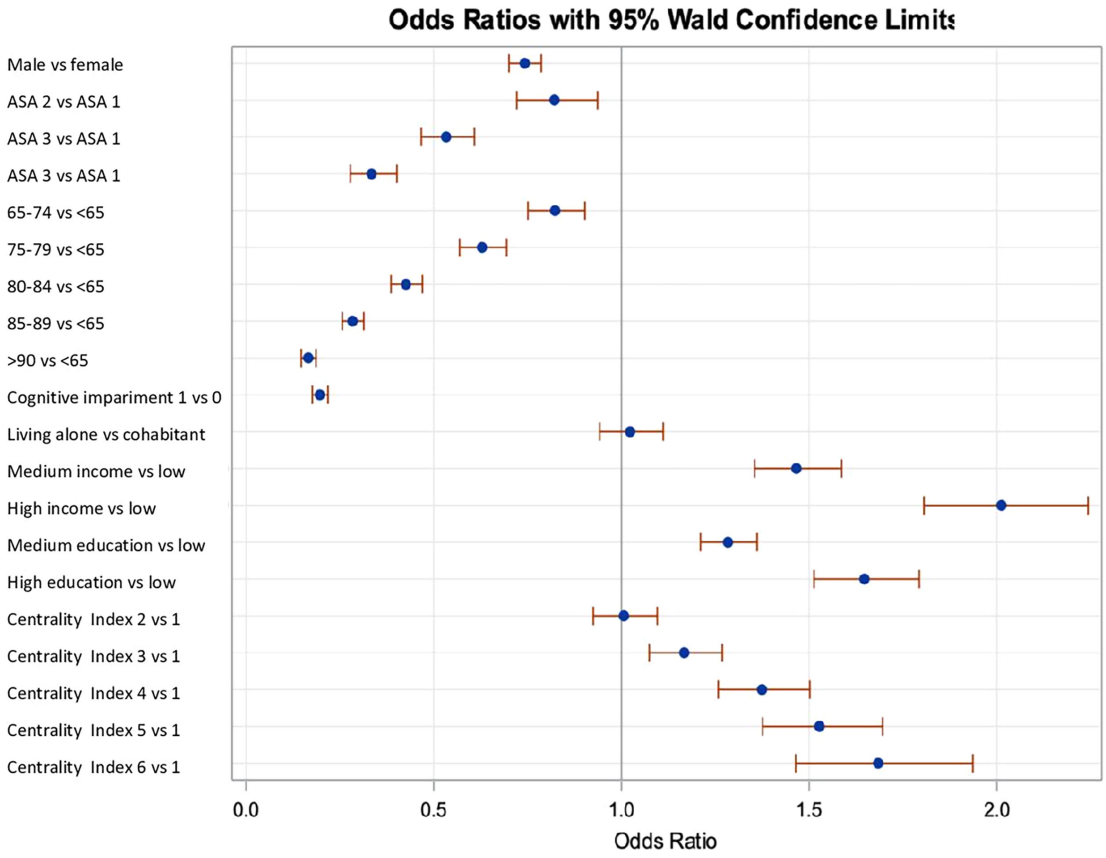

Figure 2 Covariates' association with utilisation of physiotherapy. Multiple logistic regression model, all covariates included. Cognitive impairment as reported by surgeon at surgery. Income is household income divided in three equally sized groups, Centrality Index categorises municipality by proximity to higher order function—1 is most central and 6 is least central. ASA, American Society of Anesthesiologists.

Table 2 Multiple linear associations between covariates and EQ-5D-3L index score in 18 752 included patients

	Estimate (beta)	95% CI	P value
Physiotherapy	0.061	0.052 to 0.069	<0.001
Sex	−0.194	−0.010 to 0.006	0.640
Age	−0.012	−0.015 to −0.009	<0.001
ASA class	−0.076	−0.082 to −0.070	<0.001
Cognitive impairment	−0.183	−0.196 to −0.171	<0.001
Living status	−0.013	−0.025 to −0.002	0.030
Household income	0.015	0.007 to 0.022	<0.001
Level of education	0.015	0.010 to 0.021	<0.001
Centrality Index	0.002	−0.001 to 0.005	0.160

Multiple linear regression model assessing the association between the covariates and utilisation of physiotherapy. One-increment change in category of covariate is associated with a corresponding change in beta value.
ASA, American Society of Anesthesiologists.

Regarding the CentInd, our study shows a gradient of higher utilisation of PT in the less central areas. This contrasts with our hypothesis that it is easier to access physiotherapists in more central areas. We need information on physiotherapist density in relation to geographical

Table 3 Adjusted associations between PT utilisation and reporting 'no problems' in each of the EQ-5D dimensions in a multivariate logistic regression analysis in 18 752 included patients

	OR	95% CI	P value
Mobility	1.08	1.00 to 1.17	0.060
Self-care	1.60	1.49 to 1.72	<0.001
Usual activities	1.29	1.20 to 1.39	<0.001
Pain and discomfort	0.93	0.86 to 0.99	0.040
Anxiety and depression	1.43	1.33 to 1.54	<0.001

Multivariate logistic regression analysis adjusted for age, sex, cognitive impairment, living status, income, education and centrality.
PT, physiotherapy.

areas/municipalities to fully explore this research question. Such data are currently unavailable in Norway.

In a systematic review, McDonough *et al*[9] stated that the frequency and duration of interventions varied widely across the studies, which makes it difficult to ascertain the optimal dose of PT, and the authors therefore call for more research. Auais *et al*[26] showed a significant impact on functional capabilities among patients with hip fracture receiving extensive exercise rehabilitation up to a year following the injury. In our study, we found that there was some basic PT activity in the year before the hip fracture, but a rapid increase in the use of PT after the fracture with maximum utilisation after about 2 months, followed by a marked decline. We note that the maximum PT activity was achieved quite early, but the duration of treatment seemed short for a large proportion of the patients. We have not found comparable data in the literature. This leads to the question of underutilisation of a potentially useful rehabilitation measure for these patients. In a review, Fairhall *et al*[1] pointed at insufficient evidence from randomised controlled trials to establish the best PT treatment strategies. Population and register-based studies with large numbers of patients may provide useful additional information in the scientific knowledge base.

Patients who received PT demonstrated an improved HRQoL, with an improvement of EQ-5D-3L index score above the MID.[20] Several reviews conclude that PT improves patients' strength, balance, gait, tendency to fall and other functional measures.[1 3 27] These findings corroborate with our study in that PT was associated with a higher probability of patients having 'no problems' in three of the five EQ-5D-3L dimensions. It is thus likely that the PT interventions positively influenced specific aspects of patients' lives, potentially improving mobility, self-care and other dimensions. It would therefore seem reasonable that HRQoL measured by EQ-5D is also improved by PT. To our knowledge, this has not previously been presented in a large national hip fracture population.

Most studies reporting on utilisation of PT and HRQoL are clinical studies with a limited number of patients.[1] No other hip fracture registers routinely collect PROMs from the patients. Accordingly, there are no comparable population register data. Data on utilisation of PT provide new and important knowledge that can be used to improve care and outcomes for this group of patients. In addition, the study has a long observation period of 1 year before and 1 year after the fracture, giving a comprehensive overview of PT utilisation after the fracture. Unfortunately, we did not have available information on the quality and content of the PT received. Due to the study design, we have only assessed the association between covariates and the utilisation and effect of PT and have not proven causality. The response rate for the PROM questionnaire was 59.1%, which might have introduced some selection bias.[23] This is, however, to our knowledge, the largest available PROM data source for this patient population.

The unexpectedly low proportion (35.2%) of patients receiving non-hospital PT stands in contrast to national and international hip fracture treatment guidelines,[10 11] and furthermore, a substantial body of evidence supports the use of PT as an integral part of optimal care.[1 3–5] This raises the question of the representativeness and completeness of the PT utilisation data. Norway does not have information sources detailing non-hospital activity in community/municipal care facilities (all publicly financed). Accordingly, one might suspect a substantial under-reporting of PT utilisation. However, we would argue that this is not the case; approximately 10% of older adults with hip fracture occur in inpatient care facilities, and few of these employ physiotherapists. A wash-out period was introduced in the analyses to reduce bias due to short-term care in municipal facilities. Consequently, we conclude that a potential under-reporting of PT utilisation is likely to have occurred but is of minor importance. In support of this notion, a small Norwegian clinical study found a median number of PT sessions comparable with the present data.[28]

In conclusion, in this large observational study, we found that only a minority of the patients had access to PT in the year after hip fracture, potentially indicating a gap in the provision of post-surgery rehabilitative care. Access to PT has consequences for these patients' HRQoL, and we have documented a significant socioeconomic gradient. Initiatives promoting equal and sufficient access to rehabilitation services could improve overall health outcomes for patients recovering after a hip fracture. The findings underscore the need for healthcare policies that address disparities in PT access, particularly for older individuals, those with multiple health issues and those with lower socioeconomic status.

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Contributors CK, ES, J-EG and OS conceptualised and designed the study methods. CK facilitated and formally analysed the data. CK, ES, J-EG, KT, BU and OS

contributed to the analytical strategy. CK and OS drafted the original manuscript. All authors participated in the review and editing of the final manuscript and revision. CK has the overall author responsibility and act as guarantor.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval The project was approved and exempted from the duty of confidentiality (REK 2018/1955) by the Northern Norway Regional Committee for Medical and Health Research Ethics. In accordance with the EU General Data Protection Regulation (GDPR), a data integrity assessment was conducted. The NHFR has a licence from the Norwegian Data Protection Authority (reference numbers 2004/1658-2 SVE/-, issued on 3 January 2005).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. Due to the nature of the research and the use of confidential data, we do not have permission to distribute supporting data. The original data were made available from the Norwegian Hip Fracture Register (NHFR), the Norwegian Control and Payment of Health Reimbursements Database (KUHR), the Norwegian Patient Registry (NPR) and Statistics Norway under licence for the current study, and with an exemption from the duty of confidentiality for involved researchers (granted by the Regional Committees for Medical and Health Research Ethics (REK)) for data from NHFR, KUHR and NPR, and by Statistics Norway for their data. However, any researcher with approval of an exemption from professional secrecy requirements for the use of personal health data in research from the REK would be able to create an almost identical (updated) dataset by applying to NHFR, NPR, KUHR and Statistics Norway. The corresponding author can provide insight into data and clarify analytical questions on demand.

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