Arch Physioter 2026; 16: 116-129
ISSN 2057-0082 | DOI: 10.33393/aop.2026.3586
ORIGINAL RESEARCH ARTICLE

Frontline agreement in diagnosis and treatment for musculoskeletal dysfunctions. A prospective, randomized, controlled study

Birol Zeybeker[1,2], Roger Hilfiker[3], Amir Tal[1]

[1]Bern University of Applied Sciences, Health, Physiotherapy, Bern - Switzerland
[2]Bethesda Hospital, Therapy and Training Center, Basel - Switzerland
[3]Physiotherapy Tschopp & Hilfiker, Brig-Gils - Switzerland

ABSTRACT

Introduction: Due to shortages of general practitioners and increasing emergency department (ED) presentations for non-urgent musculoskeletal conditions (MSKDs), Advanced Physiotherapy Practice (APP) roles have been implemented internationally. However, this model remains novel in Switzerland. This study evaluated agreement in diagnosis, treatment, and discharge decisions between physiotherapists and resident physicians compared with senior physicians as the reference standard in the ED of Bethesda Hospital Basel (BSAG).

Methods: A randomized controlled trial was conducted from October to December 2023. Patients presenting musculoskeletal complaints without evidence of serious pathology were allocated to either an intervention group managed by physiotherapists or a control group receiving standard care by resident physicians. Clinical decisions from both groups were reviewed by senior physicians. Agreement was assessed using Cohen's Kappa (κ) and Gwet's AC1 statistics.

Results: A total of 102 patients were included (mean age 52 years, SD 16.3; 61% female; 51% with low back pain). Physiotherapists demonstrated good to excellent agreement with senior physicians for diagnosis (κ = 0.72-0.96; AC1 = 0.73-0.97) and management (κ = 0.69-0.88; AC1 = 0.71-0.89). Residents showed high agreement for diagnosis (κ = 0.85; AC1 = 0.86) and perfect agreement for management (κ = 1.00; AC1 = 1.00). No adverse events occurred. Patient satisfaction was higher in the physiotherapy group (mean 4.79 vs. 4.19/5).

Conclusion: Experienced physiotherapists demonstrated high agreement with senior physicians in diagnosing and managing MSKDs in the ED. APP appears safe and may improve patient satisfaction without increasing adverse events.

Keywords: Advanced practice physiotherapy, Diagnostic & management, Emergency department, Musculoskeletal disorders, RCT

What is already known about this topic?

- *Direct Access Physiotherapy without physician referral shows comparable health outcomes, higher patient satisfaction, lower costs, and fewer return visits compared to the traditional medical model for musculoskeletal disorders.*

What does the study add?

- *This study confirms some of these findings and additionally identifies the necessary expertise and clinical experience required to take on this role in the musculoskeletal emergency department at Bethesda Hospital Basel.*

Introduction

The FMH (Swiss Medical Association) warns of increasing gaps in basic care for the Swiss population (1). On the one hand, there is an increase in part-time work, while on the other, Switzerland is heavily dependent on foreign specialists. Almost 40% of the medical profession comes from abroad (1). Another problem is the decreasing number of general practitioners (GPs). Their density has remained at 0.8 full-time equivalents per 1,000 inhabitants for several years, which is below the recommended level of 1 (1). The authors of this paper consider the constellation of constantly rising patient numbers and the increasing shortage of specialists (2,3) to be a threat to the Swiss healthcare system. This situation is thought to contribute to prolonged waiting times for medical care in Switzerland (4). One observed consequence

Received: May 7, 2025
Accepted: May 21, 2026
Published online: June 30, 2026

This article includes supplementary material

Corresponding author:
Birol Zeybeker
email: birol.zeybeker@bethesda-spital.ch

of this situation is an increase in consultations in emergency departments (ED) for non-urgent musculoskeletal conditions (MSKD) (5,6). EDs should primarily focus medical care on urgent and potentially life-threatening acute conditions rather than on non-urgent musculoskeletal disorders. Non-urgent musculoskeletal disorders include conditions affecting the soft tissues and surrounding structures (e.g., tendinopathy, chronic non-specific low back pain, neck pain, osteoarthritis, or myofascial pain syndromes) that do not result from an acute or instantaneous event such as a fall or slip (7). For this subgroup, a visit to a GP office or other facilities (i.e., physiotherapy with direct access) would be sufficient (8).

In response to this growing challenge, changes in basic medical care are needed, and new care models should be evaluated. In 2013, the Federal Office of Public Health (BAG) in Switzerland commissioned a study on the possible inclusion of highly qualified non-medical professionals in primary healthcare (9). Highly qualified professionals are, by definition, people who have in-depth knowledge, specific skills, and experience in a particular field (10). In general, the term refers to individuals who have formal education, advanced knowledge, and expertise in their field of work. These professionals can perform a variety of complex tasks and solve problems based on their specialized knowledge and qualifications (10).

This task shift requires an expansion of the responsibilities of non-medical healthcare professionals. These include clinical specialization, the ability to make diagnoses, order imaging, prescribe medication, and the possibility of direct access (DA) to these services (11,12). Direct access describes a healthcare model in which patients can seek assessment and management by a physiotherapist without first obtaining a referral from a medical practitioner. This approach allows physiotherapists to function as first-contact practitioners for MSKDs within their defined scope of practice (World Physiotherapy, 2019) (13). Although further training is a prerequisite for these roles, they are not regulated (9).

International literature documented the role of physiotherapy in emergency departments (ED–PT) very well. ED–PT treats MSKD with low urgency in primary as well as secondary care and plays a significant role in patient education (14). Furthermore, data from the studies by Kunz (2020) (15) and Winteler et al. (6) suggest that ED–PTs order fewer imaging examinations compared to other ED staff. Further observational data indicate that the use of ED–PT leads to shorter overall waiting times, treatment time, and length of stay in the ED (16-20). Data from various RCTs suggest that there is no difference in patient-related outcomes (18,21) or treatment costs (18,21) when ED–PT services are provided compared to those provided by physicians. An unpublished pilot study at the ED of Bethesda Hospital Basel (BSAG) showed that residents and PT achieved a high agreement in diagnosis, treatment, and discharge recommendations (i.e., management) between both parties. Taken together, these findings suggest that physiotherapists with appropriate advanced training (e.g., advanced physiotherapy practitioners—APP) could assume direct care of patients with MSKDs in the ED (6). This role would be undertaken under medical supervision, defined as the availability of senior emergency physicians for consultation, clinical oversight within established governance structures, and escalation of care in cases of diagnostic uncertainty or clinical deterioration.

To our knowledge, there are no published RCTs investigating the effect of direct care of MSKD and early physiotherapy intervention in patients with MSKD in an ED in Switzerland.

To fill this knowledge gap, the aim of this RCT was to investigate outcomes, such as agreement in diagnosis, treatment, and discharge planning (i.e., management) between physiotherapists (PTs) and resident physicians (RPs), with assessments reviewed by senior physicians (SPs) in patients with non-urgent MSKD. A secondary, exploratory objective was to examine whether the level of clinical experience and training of ED physiotherapists (ED–PTs) was associated with agreement in diagnosis, management, and discharge planning when compared with senior physicians. In addition, patient satisfaction was compared between patients managed by ED–PTs and those managed by resident physicians (usual care).

Materials and methods

Study design and settings

We conducted a single-centre, randomized controlled feasibility trial to assess the practicality and preliminary effects of this care model. Prior to the study, a four-week pilot was conducted to assess whether the implemented procedures and workflows operated as planned and to identify any operational issues prior to full implementation of the study protocol. The study was conducted between 03.10.23 and 23.12.23 in the ED of the BSAG, Northwestern Switzerland, with the approval of the local Ethical Committee ("EKNZ – Ethikkommission Nordwest und Zentralschweiz", Study ID: 2023-01399; Approval 03.10.2023), and was retrospectively registered in a public trial registry (NCT-07443098).

The investigators (ED–PT and RP) examined patients with MSKD who were referred by telephone via their GP or who had referred themselves. Senior physicians (i.e., attending physicians with full specialist certification and supervisory responsibility, corresponding to consultant-level physicians in the UK healthcare system) from the Bethesda Hospital supervised the entire project.

Outcomes

The primary outcome was agreements using Kappa (κ) and Gwet's AC1 (AC1) statistics on diagnosis and follow-up recommendations between ED–PT, residents (= control group), and senior physician. The secondary outcome was patients' satisfaction with the care that they had received, Influence of the physiotherapy treatment on symptoms (Numeric Rating Scale), and the type of applied interventions.

Selection of participants

The intervention was conducted Monday to Friday between 11:00 a.m. and 5:00 p.m. to align with periods of highest availability of APPs and senior physician supervision, and to ensure appropriate clinical governance during the initial implementation phase. This time window also

corresponds to peak presentations of patients with MSKDs in the ED of BSAG, while avoiding overnight periods characterized by reduced staffing and increased clinical acuity.

Patients aged 18-79 years presenting with non-serious MSKDs were eligible for inclusion if they reported pain intensity between 3 and 7 on a 0-10 numeric rating scale (NRS), where 0 indicates no pain, and 10 indicates the worst imaginable pain. Exclusion criteria were major trauma, fracture, systemic signs (e.g., fever, profuse sweating without cause), progressive neurological deficit (i.e., severe sensory alteration or weakness), cauda equina syndrome with bladder or bowel dysfunction, progressive deterioration of the general condition, patient in severe distress (e.g., heart attack), allergic reaction with/without skin rashes, and acute mental illness (psychological condition). Patients who were unwilling/unable to give consent or not capable of making their own judgment were also excluded. Patients who met the inclusion criteria and gave their written informed consent were included.

Selection of physical therapists

Following the recommendations of Lähteenmäki et al. (22), eight physiotherapists were purposively selected by the principal investigator based on predefined eligibility criteria, including advanced musculoskeletal training, clinical experience, and practice in extended scope roles. The aim was to include physiotherapists with sufficient expertise to safely deliver the intervention while capturing variability in levels of competence and clinical experience. For exploratory subgroup analyses, physiotherapists were classified a priori based on years of clinical experience: PT_1 (>15 years), PT_2 (6-10 years), and PT_3 (4-5 years). Table 7 in the appendix shows the characteristics of the eight ED–PT. Eligibility criteria for participating physiotherapists, including professional qualifications and required clinical experience, were predefined and assessed by the principal investigator in collaboration with the head of the physiotherapy department. Two senior clinicians were involved in the assessment process, and eligibility was confirmed based on documented qualifications and employment records.

The participating physiotherapists were scheduled on a rotational basis to provide care during the intervention period.

Over a recruitment period of approximately three months, they were responsible for the initial assessment, clinical examination, and management of patients presenting with non-serious MSKDs in the ED of BSAG. Clinical supervision was conducted under the direction of the head physician of the Department of Rheumatology and Pain Medicine at Bethesda Hospital and included medical governance, oversight of clinical decision-making, and availability for escalation when required. This supervisory role was undertaken by a rheumatology specialist because, at the time of the study, responsibility for ED supervision fell under the Department of Rheumatology and Pain Medicine.

Selection of resident physicians

Resident physicians were required to have completed medical school and to have three to four years of clinical experience, including training in internal medicine, as well as a minimum of four months' experience in an acute care setting specializing in rheumatology and pain medicine.

Procedure in the Emergency Department

In accordance with standard practice at BSAG, all patients presenting to the ED were initially triaged by an expert nurse with advanced training in intensive or intermediate care. This triage process, which is part of routine ED care, was used to identify patients requiring immediate or urgent medical attention and to direct non-urgent patients to the ED waiting area.

For this study, the triage nurse additionally screened patients for potential eligibility based on predefined inclusion and exclusion criteria. Eligibility screening was limited to identifying potentially suitable patients and did not involve clinical decision-making regarding diagnosis or management.

Patients who met the inclusion criteria were informed about the study and provided written informed consent prior to participation. The informed consent document explicitly stated that participants would be randomly allocated to assessment and management by either an ED–PT or a resident physician. Final eligibility was confirmed after consent had been obtained. Following consent, participants were randomly allocated to either the ED–PT or RD group. Figure 1 illustrates the patient flow and the associated decision-making steps.

Randomization

Several months prior to study initiation, the first author prepared the randomization sequence using a free computer-based randomization program (Online; 08/2023) and assembled the sealed, opaque envelopes used for allocation concealment.

Patients were randomized into two groups: ED–physiotherapy (intervention) and a resident group (control). As the minimum qualification level required for physiotherapists to perform this role has not yet been clearly established, participating physiotherapists were classified a priori into three subgroups based on predefined criteria related to years of clinical experience and level of postgraduate training (see Table 7 in the appendix). This classification was performed by the study team prior to recruitment and did not involve randomization or allocation of patients. Randomization resulted in a 3:1 ratio of primary care by ED–PT (intervention group, 3 subgroups): residents (control group). The authors aimed to achieve a possible homogeneous distribution of patients across all four subgroups.

Blinding

Blinding was not feasible in this study, as the presence of both the physical therapist and the resident physician and the senior physician was required during the assessment to ensure the accurate implementation and interpretation of the intervention. The complexity of the intervention, coupled with ethical considerations regarding patient safety, rendered blinding impractical in this context.

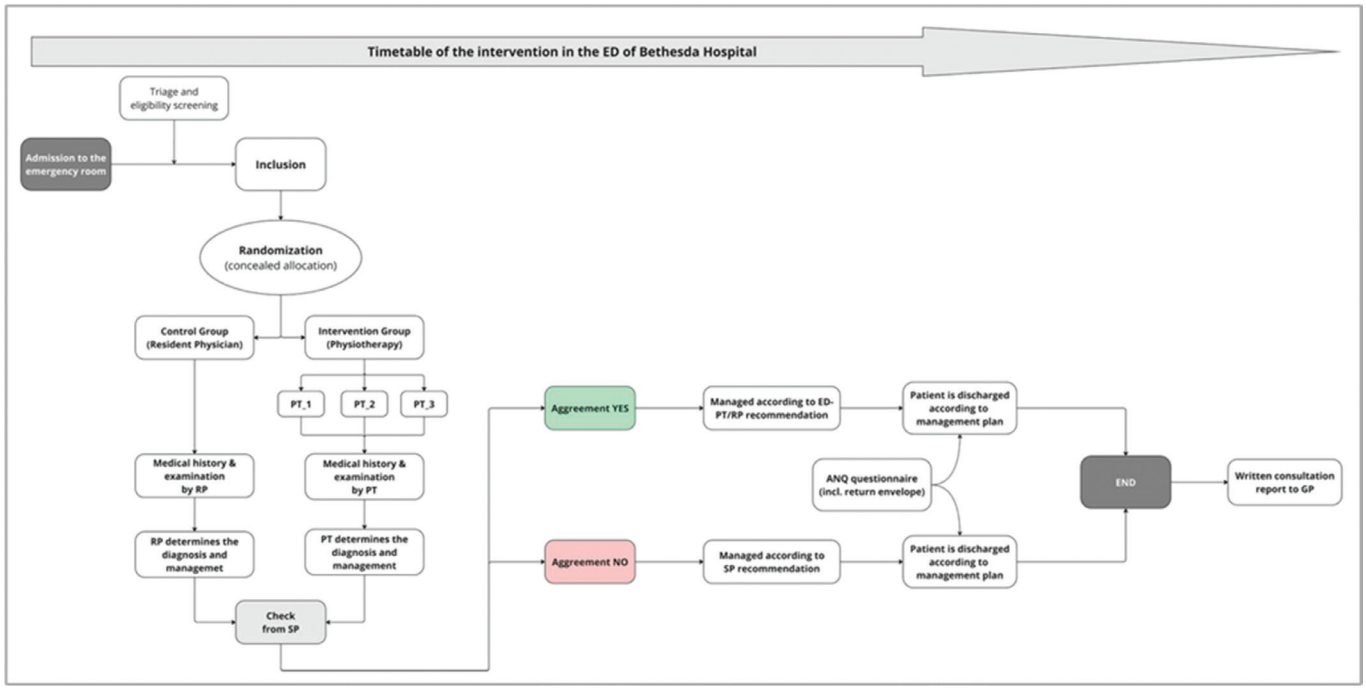

FIGURE 1 - Procedure and timeline of the Direct-Physio-Study.
PT_1= physiotherapist > 15 years clinical experience; PT_2 = physiotherapist 6-10 years clinical experience; PT_3 = physiotherapist 4-5 years clinical experience; PT = physiotherapy; RP = resident physician; SP = senior physician; ED–PT = emergency department physiotherapist; GP = general practitioner.

2 Groups

Intervention: ED – physiotherapist group

All patients included in the ED–PT groups (3 subgroups) underwent an assessment of the patient's medical history by the ED–PTs, including a personal check for possible red flags. Red flag screening was conducted using a standardized assessment form (23,24) to identify potential non-musculoskeletal causes of symptoms. The screening questionnaire was completed and signed by both the patient and the ED–PT. Patients in whom red flags were identified were excluded from the study prior to randomization. As an additional safety measure, all cases were subsequently reviewed by a senior physician, ensuring the detection of any missed pathology.

After exclusion of red flags, the ED–PT conducted the initial clinical assessment, including physical examination, established a provisional diagnosis, and formulated a management and discharge plan. All data were documented on a Case Report Form (CRF). Prior to discharge, this plan was reviewed and confirmed during an on-site consultation with a senior physician, with confirmation documented as a yes/no decision on the same CRF. The senior physician retained final medical responsibility for the discharge decision. After discharge, a written report for the GP was the end of the ED consultation.

Control: resident physician group

Resident physicians (RPs) performed the initial clinical assessment and proposed a diagnosis and management plan, which were reviewed and approved by a senior physician prior to discharge, in accordance with standard ED procedures at BSAG. The same predefined clinical workflow was applied in both groups (RP resp. ED–PT).

Adverse Events

Safety was monitored throughout the study period. Adverse events were defined as any unintended harm, clinical deterioration, or unexpected medical complication occurring during the ED stay and documented in the patient record. The occurrence of adverse events was recorded descriptively for both groups on the same CRF.

Measurement

The investigators collected patient-related data such as age, gender, body region of the complaints, medical history that led to presentation at the ED, smoking status, physical activity, vital signs, and a problem-specific physiotherapy intervention in the ED. ED–PTs and residents used the collected data from medical history and physical examination to formulate a diagnosis, treatment, and discharge plan. All forms (clinical assessment form, screening questionnaire) were stored in the BSAG's own Clinic Information System under the patient's case number (FID). Patients' personal data (name, date of birth) were coded (pseudo-anonymized) for the study team.

Diagnostic categories, management, and discharge plan

For this study, nine diagnostic categories for extremities and spinal disorders were created based on the systematic

review by Matifat et al. (25), which analyzed patients with MSKD (e.g., including patients with closed limb fractures, nontraumatic spinal pain, and soft tissue conditions), who were related to acute usual care provided by physical therapists or Extended Scope Practitioners in the ED.

Diagnostic categories were spondylalgia, herniated disc, myofascial pain syndrome, impingement syndrome, a neural problem (radiculopathy or entrapment), degenerative changes (e.g., osteoarthritis), bruises, contusions, or soft tissue injuries such as ligament injury, other causes, and combinations of the above-mentioned problems.

Management plan categories included: discharge after treatment; discharge after treatment with medication; discharge after treatment with an outpatient physiotherapy prescription; discharge after treatment with both medication and an outpatient physiotherapy prescription; discharge for further clarification (e.g., fast-track medical imaging or interventional therapy, defined as injection-based treatments such as local infiltrations); and hospitalization. Patients in the first four categories were discharged back to their primary care physician (GP).

Assessment of patient satisfaction

At the end of the consultation, before discharge, patients received a questionnaire to rate their satisfaction with the consultation. Researchers conducted the survey in written form. The ANQ-questionnaire [Nationaler Verein für Qualitätsentwicklung in Spitälern und Kliniken (ANQ)] is a standardized tool that is used to measure patient satisfaction in acute somatic care in Switzerland. Five answers were available for each question, which were rated on a bipolar five-point Likert scale (five = excellent/always; one = bad/never). Reliability and validity of the patient satisfaction questionnaire were assessed using established psychometric methods as reported in the instrument validation study from Köhn et al. (26) Reliability was evaluated using Rasch model–based reliability indices and item fit statistics, demonstrating stable measurement properties. Validity was assessed through qualitative content validation (cognitive interviews and expert review), construct validation (confirmatory factor analysis and Rasch modelling), and differential item functioning analyses. Differential item functioning analyses indicated no relevant bias across age, sex, or language groups. Taken together, these measurement properties support the use of the questionnaire as a valid and reliable tool for assessing the intended outcomes.

Assessment of Pain Intensity Change

Change in symptoms after physiotherapy intervention in the ED was determined using the NRS (Numeric Rating Scale). For this purpose, the pain scale was assessed at the beginning and upon discharge from the ED. The effect of treatment was assessed as the difference between the NRS at the beginning and the NRS at the end of the ED stay.

Data Management and Data Entry

Two independent research staff members, who had no role in patient recruitment, clinical management, or outcome assessment, independently transferred data from the case report forms (CRFs) into Excel as part of a double data entry process. The data set was stored in the secure environment of the Bern University of Applied Sciences (BFH).

Statistical analysis

Sample size calculation

Sample size was calculated based on the agreement between the senior physician and either the physiotherapist or the resident physician (2 raters). Each patient was rated once by the senior physician and once by one of the other raters. Calculation was conducted using Online, for a power of 80%, an alpha of 0.05 (two-sided). According to the results of an unpublished feasibility study in the ED of BSAG, the expected kappa was set at 0.75. A minimal acceptable Kappa was set at 0.5. The definitive sample size calculation resulted in 106 patients, inclusive of a 10% drop out rate. No dropouts were expected as the participants were already present for outcome measures.

Primary data analysis

Statistical analysis was performed using the statistical program R-Studio (version 2023.06.2, different packages such as “irr”, “ggplot2”, and” tidyverse”). Normality of continuous variables was assessed using visual inspection of histograms and Q–Q plots, as well as the Shapiro–Wilk test.

We used Cohen’s Kappa (κ) and Gwet’s AC1 (AC1) with 95% confidence intervals (CI) to assess interrater agreement for diagnosis and follow-up recommendations between ED–PTs and residents. κ is widely used but can be affected by prevalence and marginal distribution issues, potentially leading to paradoxically low values despite high observed agreement. Therefore, AC1 was additionally calculated as a more robust measure that is less sensitive to these effects, providing a complementary and more stable estimate of agreement. The strength of agreement (κ) between the two raters (ED–PT vs. senior physician, resp. resident vs. senior physician) was interpreted according to the guidelines of Landis and Koch (27) and the recommendations of Sim and Wright (28). κ: ≤ 0 = poor, 0.01-0.20 = slight, 0.21-0.40 = fair, 0.41- 0.60 = moderate, 0.61-0.80 = substantial and 0.81-1.00 = almost perfect.

A generalized linear regression model was used to examine the association between clinician experience and agreement with the senior physician on diagnosis and follow-up recommendations. The outcome variable was agreement with the senior physician (reference standard), coded as a binary variable (agreement vs. no agreement). The exposure variable was clinician group, defined according to years of clinical experience and professional background (PT_1: >15 years; PT_2: 6-10 years; PT_3: 4-5 years; resident physicians).

Differences between clinician subgroups were estimated using a bootstrap resampling approach to account for non-normality and unequal group sizes. A total of 1,000 bootstrap samples were generated with replacement, and 95% confidence intervals were derived from the empirical bootstrap distribution.

The influence of primary care by the PT (care yes/no) on satisfaction was investigated using ordinal regression.

Confounders (e.g., age and gender) were controlled for all regressions. A two-sided p-value of < 0.05 was considered statistically significant.

Results

A total of 260 patients were screened for eligibility between October 2023 and December 2023 in the evaluation of a new care model in the ED of BSAG. Overall, 158 patients were excluded (outside study time, not meeting inclusion criteria, and declined to participate), resulting in 102 patients being randomized. Seventy-eight patients were allocated to the "intervention" group (ED–PT), and 24 patients were assigned to the control group (residents). Figure 2 describes all the steps (flow chart) performed in the study. All 102 randomized patients were analyzed in the allocated group (intention-to-treat analysis). No missing data were observed in this study, ensuring the completeness and integrity of the dataset. No adverse events were documented in either group during the study period.

Baseline characteristics

ED–PT or residents assessed 40 men (39%) and 62 women (61%) on the ED of the Bethesda Hospital during the study. The average age of the patients was 52 years (Range 20-79 years, SD 16.3). The presenting complaints of these patients were acute, worsening, or immobilizing pain in the spine, sacroiliac joints (SIJ), and/or extremities. The pain was most frequently localized in the lower back [low back pain (LBP)] (51%). Around 19% of patients complained of neck pain and/or headaches. The remaining 30% had complaints in the thoracic spine (8%), SIJ (9%), or extremities (14%). Table 1 summarizes the complete overview of the demographic data of our sample.

Agreement on diagnosis and management by subgroups (n = 102)

The agreement in the diagnosis and management between ED–PT or residents and senior physicians is expressed using κ and AC1 with a 95% CI (Table 2).

Both values indicate substantial to perfect interrater reliability. These values are both statistically significant and clinically relevant.

Regarding treatment recommendations and discharge plans (i.e., management), there was a stronger deviation in the agreement between the PT_1 group and senior physician (κ = 0.69 [0.51;0.87]; AC 1 = 0.71 [0.53;0.90]). Differences were mainly related to medication prescriptions and referrals for further investigation, including imaging where indicated (Table 3).

In our retrospective analysis of this subgroup (8 out of 102), we utilized the radiologist's diagnosis as the reference standard to evaluate the diagnostic capabilities of the senior physician and the ED–PT. In the MRI reports for these eight patients, no red flags were noted that the ED–PT would have missed due to examination rejection.

Medication was prescribed in 16.7-40.9% of cases, while referrals for further investigations ranged from 12.5-21.2%

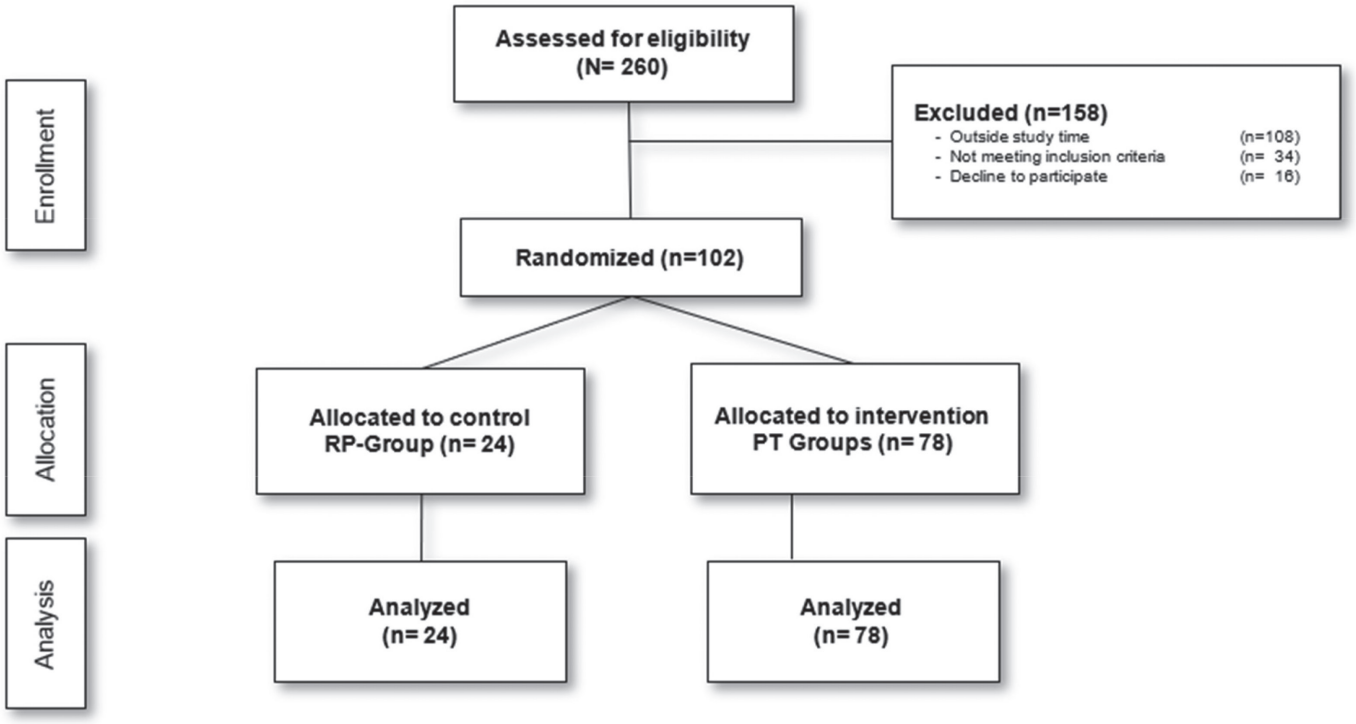

FIGURE 2 - Consort 2010 flow diagram: direct-physio trial.
MSK = musculoskeletal; RP = Resident Physician; ED–PT = Emergency Department Physical Therapist.

TABLE 1 - Baseline characteristics.

		Control	Intervention		
	Overall (n = 102)	**RP (n = 24)**	**PT_1 (n = 33)**	**PT_2 (n = 22)**	**PT_3 (n = 23)**
Age, Mean [SD]	52 [16.29]	52 [20–79]	47 [24–78]	51 [21–77]	59 [20–78]
Female, Sex n [%]	62 [61]	18 [75]	20 [61]	12 [55]	12 [52]
Physical Activity Vital Sign, Median [IQR]	150 [111, 192]	159 [111, 199]	150 [119, 180]	113 [90, 166]	165 [116, 193]
Numeric Rating Scale (Start), Median [IQR]	7 [6, 7]	7 [6, 7]	7 [6, 7]	7 [6, 7]	7 [6, 7]
BMI (in kg/m²) Median [IQR]	27 [25, 30]	26 [24, 30]	26 [24, 29]	28 [26, 33]	29 [26, 30]
Smoker, n [%]					
- No	72 [70.6%]	19 [79.2%]	20 [60.6%]	14 [63.6%]	19 [82.6%]
Surgery lasts 3 months, n [%]					
- No	102 [100%]	24 [100%]	33 [100%]	22 [100%]	23 [100%)
Major Injuries last 3 months, n [%]					
- No	102 [100%]	24 [100%]	33 [100%]	22 [100%]	23 [100%]
Medication prior to visit to the ED, n [%]					
- Yes	102 [100%]	24 [100%]	33 [100%]	22 [100%]	23 [100%]
Localization of Symptoms, n [%]					
- Cervical Spine	19 [19]	4 [17]	6 [18]	3 [3]	6 [27]
- Thoracic Spine	8 [8]	1 [4]	3 [9]	2 [6]	2 [9]
- Lumbar Spine	52 [51]	13 [54]	16 [49]	13 [40]	10 [45]
- Sacro-Iliac Joint	9 [9]	2 [8]	0 [0]	3 [9]	4 [20]
- Upper Extremities	4 [4]	1 [4]	2 [6]	0 [0]	1 [5]
- Lower Extremities	10 [10]	3 [13]	6 [18]	1 [3]	0 [0]

Tab 1: n = number of patients, RP = Resident Physician, PT_1= physiotherapist > 15 years clinical experience, PT_2 = physiotherapist 6-10 years clinical experience, PT_3 = physiotherapist 4-5 years clinical experience.

across groups. The general agreement of the PT_2 and PT_3 subgroups was almost perfect (κ = 0.88 [0.73; 1.00]; AC1 = 0.89 [0.74; 1.00] and κ = 0.83 [0.64; 1.00]; AC1 = 0.84 [0.66;1.00] respectively). The best agreement (κ & AC1 = 1.00 [1.00; 1.00]) was in the resident group. The recommendations for hospitalization of the ED–PT differed only minimally compared to those of the senior physician. Here, too, the residents had the best agreement with the senior physician.

Patient satisfaction with care in the emergency department

The survey (ANQ questionnaire) showed that 97% of the patients were very satisfied with their care or rated it as excellent. Most patients found the quality of treatment by the residents to be particularly good (60%) or even excellent (29%), with a mean of 4.19, SD 0.61 on a 5-point Likert scale. Patient satisfaction with the quality of assessment and treatment provided by physiotherapists was high (mean 4.79, SD 0.38 on the same scale). Eighty-one percent of respondents found this to be excellent, 17% particularly good. Table 4 summarizes the findings from the satisfaction questionnaire.

Alleviation of symptoms through physiotherapeutic interventions

Physiotherapy resulted in symptom relief in 99% of patients. The mean reported improvement was approximately 60%. Thirty-one patients were discharged from the ED with minimal or no pain (80-100% symptom relief).

Figure 3 illustrates the percentage change in symptoms (0-100%) following direct physiotherapy intervention, where 0% indicates no change and 100% indicates complete pain relief. Patient education (n = 102) was the most frequently applied intervention, followed by manual mobilization (n = 52) and trigger point treatment (n = 52). A home exercise program was prescribed in 43 cases, while all other interventions were used less frequently (n = 2-8).

Symptom relief was analyzed in relation to the immediate therapeutic intervention delivered in the ED. As both groups received physiotherapy treatment, this analysis reflects the short-term effect of direct treatment in the ED rather than a between-group comparison. Accordingly, outcomes are presented descriptively and not stratified by randomized group allocation.

TABLE 2 - Agreement in diagnosis by subgroups (Kappa and Gwet's AC 1)

Subgroups	Recommendation ED–PT resp. RP (%)	Recommendation SP (%)	Gwet's AC1 [95% CI]	Cohen's κ [95% CI]
PT_1 (>15 years clinical experience)				
Diagnostic Task				
- Spondylogenic	4 / 33 (12.1%)	4 / 33 (12.1%)	0.97 [0.90;1.00]	0.96 [0.89;1.00]
- Disc (Intervertebral)	0 / 33 (0.0%)	0 / 33 (0.0%)		
- Myofascial	11 / 33 (33.3%)	10 / 33 (30.3%)		
- Impingement	2 / 33 (6.1%)	2 / 33 (6.1%)		
- Neural	3 / 33 (9.1%)	4 / 33 (12.1%)		
- Degenerative (e.g., osteoarthritis)	1 / 33 (3.0%)	1 / 33 (3.0%)		
- Contusions & Bruises	1 / 33 (3.0%)	1 / 33 (3.0%)		
- Other	2 / 33 (6.1%)	2 / 33 (6.1%)		
- Combinations	9 / 33 (27.3%)	9 / 33 (27.3%)		
PT_2 (6-10 years clinical experience)				
Diagnostic Task				
- Spondylogenic	5 / 22 (27.3%)	5 / 22 (27.3%)	0.73 [0.51;0.96]	0.72 [0.51;0.92]
- Disc (Intervertebral)	0 / 22 (0.0%)	0 / 22 (0.0%)		
- Myofascial	5 / 22 (27.3%)	5 / 22 (27.3%)		
- Impingement	0 / 22 (24.2%)	0 / 22 (24.2%)		
- Neural	1 / 22 (21.2%)	1 / 22 (21.2%)		
- Degenerative (e.g., osteoarthritis)	0 / 22 (0.0%)	0 / 22 (0.0%)		
- Contusions & Bruises	0 / 22 (0.0%)	0 / 22 (0.0%)		
- Other	0 / 22 (0.0%)	0 / 22 (0.0%)		
- Combinations	8 / 22 (36.4%)	8 / 22 (36.4%)		
PT_3 (4-5 years clinical experience)				
Diagnostic Task				
- Spondylogenic	1 / 23 (4.3%)	1 / 23 (4.3%)	0.95 [0.85;1.00]	0.94 [0.82;1.00]
- Disc (Intervertebral)	1 / 23 (4.3%)	1 / 23 (4.3%)		
- Myofascial	12 / 23 (52.2%)	12 / 23 (53.2%)		
- Impingement	0 / 23 (0.0%)	0 / 23 (0.0%)		
- Neural	2 / 23 (8.7%)	3 / 23 (13.0%)		
- Degenerative (e.g., osteoarthritis)	2 / 23 (8.7%)	2 / 23 (8.7%)		
- Contusions & Bruises	1 / 23 (4.3%)	1 / 23 (4.3%)		
- Other	0 / 23 (0.0%)	0 / 23 (0.0%)		
- Combinations	4 / 23 (17.4%)	3 / 23 (13.0%)		
Resident Physician				
Diagnostic Task				
- Spondylogenic	3 / 22 (13.6%)	2 / 22 (9.1%)	0.86 [0.70;1.00]	0.85 [0.69;1.00]
- Disc (Intervertebral)	1 / 22 (4.5%)	1 / 22 (4.5%)		
- Myofascial	5 / 22 (22.7%)	6 / 22 (27.3%)		
- Impingement	0 / 22 (0.0%)	0 / 22 (0.0%)		
- Neural	3 / 22 (13.6%)	2 / 22 (9.1%)		
- Degenerative (e.g., osteoarthritis)	3 / 22 (13.6%)	2 / 22 (9.1%)		
- Contusions & Bruises	2 / 22 (9.1%)	2 / 22 (9.1%)		
- Other	0 / 22 (0.0%)	1 / 22 (4.5%)		
- Combinations	7 / 22 (31.8%)	8 / 22 (36.4%)		

Tab 2: ED–PT = emergency department physiotherapist; RP = resident physician; SP = senior physician; CI = confidence interval, PT = physiotherapy; med. = medication, PT_1= physiotherapist > 15 years clinical experience, PT_2 = physiotherapist 6-10 years clinical experience, PT_3 = physiotherapist 4-5 years clinical experience.

TABLE 3 - Agreement in management by subgroups (Kappa and Gwet's AC 1)

Subgroups	Recommendation ED–PT resp. RP (%)	Recommendation SP (%)	Gwet's AC1 [95% CI]	Cohen's κ [95% CI]
PT_1 (>15 years clinical experience)				
Treatment & management plan				
- Discharge after treatment	9 / 33 (27.3%)	9 / 33 (27.3%)		
- Discharge after treatment with medication.	0 / 33 (0.0%)	3 / 33 (9.1%)		
- Discharge after treatment with outpatient PT	9 / 33 (27.3%)	7 / 33 (21.2%)	0.71 [0.53;0.90]	0.69 [0.51;0.87]
- Discharge after treatment with medication. & outpatient PT	8 / 33 (24.2%)	5 / 33 (15.2%)		
- Discharge for further clarification	7 / 33 (21.2%)	8 / 33 (24.2%)		
- Hospitalization	0 / 33 (0.0%)	1 / 33 (3.0%)		
PT_2 (6-10 years clinical experience)				
Treatment & management plan				
- Discharge after treatment	4 / 22 (18.2%)	4 / 22 (18.2%)		
- Discharge after treatment with medication.	0 / 22 (0.0%)	1 / 22 (4.5%)		
- Discharge after treatment with outpatient PT	3 / 22 (13.6%)	2 / 22 (9.1%)	0.89 [0.74;1.00]	0.88 [0.73;1.00]
- Discharge after treatment with medication. & outpatient PT	9 / 22 (40.9%)	8 / 22 (36.4%)		
- Discharge for further clarification	4 / 22 (18.2%)	4 / 22 (18.2%)		
- Hospitalization	2 / 22 (9.1%)	3 / 22 (13.6%)		
PT_3 (4-5 years clinical experience)				
Treatment & management plan				
- Discharge after treatment	3 / 23 (13.0%)	3 / 23 (13.0%)		
- Discharge after treatment with medication.	0 / 23 (0.0%)	0 / 23 (0.0%)		
- Discharge after treatment with outpatient PT	10 / 23 (43.5%)	8 / 23 (34.8%)	0.84 [0.66;1.00]	0.83 [0.64;1.00]
- Discharge after treatment with medication. & outpatient PT	5 / 23 (21.7%)	6 / 23 (26.1%)		
- Discharge for further clarification	3 / 23 (13.0%)	4 / 23 (17.4%)		
- Hospitalization	2 / 23 (8.7%)	2 / 23 (8.7%)		
Resident Physician				
Treatment & management plan				
- Discharge after treatment	4 / 24 (16.7%)	4 / 24 (16.7%)		
- Discharge after treatment with medication.	4 / 24 (16.7%)	4 / 24 (16.7%)		
- Discharge after treatment with outpatient PT	5 / 24 (20.8%)	5 / 24 (20.8%)	1.00 [1.00;1.00]	1.00 [1.00;1.00]
- Discharge after treatment with medication. & outpatient PT	6 / 24 (25.0%)	6 / 24 (25.0%)		
- Discharge for further clarification	3 / 24 (12.5%)	3 / 24 (12.5%)		
- Hospitalization	2 / 24 (8.3%)	2 / 24 (8.3%)		

Tab 3: ED–PT = emergency department physiotherapist; RP = resident physician; SP = senior physician; CI = confidence interval, PT = physiotherapy; med. = medication, PT_1 = physiotherapist > 15 years clinical experience, PT_2 = physiotherapist 6-10 years clinical experience, PT_3 = physiotherapist 4-5 years clinical experience.

Influence of training and clinical experience on the concordance of diagnosis and follow-up recommendations (Regression analysis)

The influence of education (degrees) on agreement in diagnosis, analyzed by subgroups, did not show a statistically significant difference between the ED–PT and residents. Nevertheless, it should be noted that PTs with more than 15 years of experience (PT_1 group) have thirteen times higher odds of making the correct diagnosis than the resident group (OR 13.21 [0.82-392.46], p = 0.077). Although the point estimate suggested a strong association (OR 13.21), the wide confidence interval [0.82-392.46] and p-value of 0.077 indicate that the result was not statistically significant. Those results are shown in the Appendix (Table 5).

Regarding the influence of years of clinical experience on agreement with management recommendations, no statistically significant differences were observed between the predefined physiotherapy subgroups. A statistically significant

TABLE 4 - Patient satisfaction with the "new" care model in the ED of BSB

Statement	Mean	SD	5 (%)	4 (%)	3 (%)	2 (%)	1 (%)	0 (%)
How would you rate the quality of treatment by the doctors (RP)	**4.19**	**0.61**	29.41	59.81	10.78	0.00	0.00	0.00
How would you rate the quality of the treatment by the physiotherapist	**4.79**	**0.45**	81.37	16.67	1.96	0.00	0.00	0.00
• Subgroup PT_1	**4.79**	**0.48**	81.82	15.15	3.03	0.00	0.00	0.00
• Subgroup PT_2	**4.77**	**0.43**	77.27	22.73	0.00	0.00	0.00	0.00
• Subgroup PT_3	**4.78**	**0.52**	82.61	13.04	4.35	0.00	0.00	0.00
Could you ask questions?	**4.88**	**0.35**	89.22	9.80	0.98	0.00	0.00	0.00
Did you receive clear answers to your questions?	**4.88**	**0.35**	89.22	9.80	0.98	0.00	0.00	0.00
Has the purpose of the medication you should take at home been clearly explained to you?	**4.66**	**0.93**	79.41	15.69	1.96	0.00	0.00	2.94

Tab 4: SD = standard deviation.
Response scale: 5 = excellent / always; 4 = particularly good / most of the time; 3 = good / sometimes; 2 = less good/rarely; 1 = bad/never. The response option "0" indicates that the respective item was not applicable (e.g., no physiotherapist present, no resident physician present, or no medication prescribed).

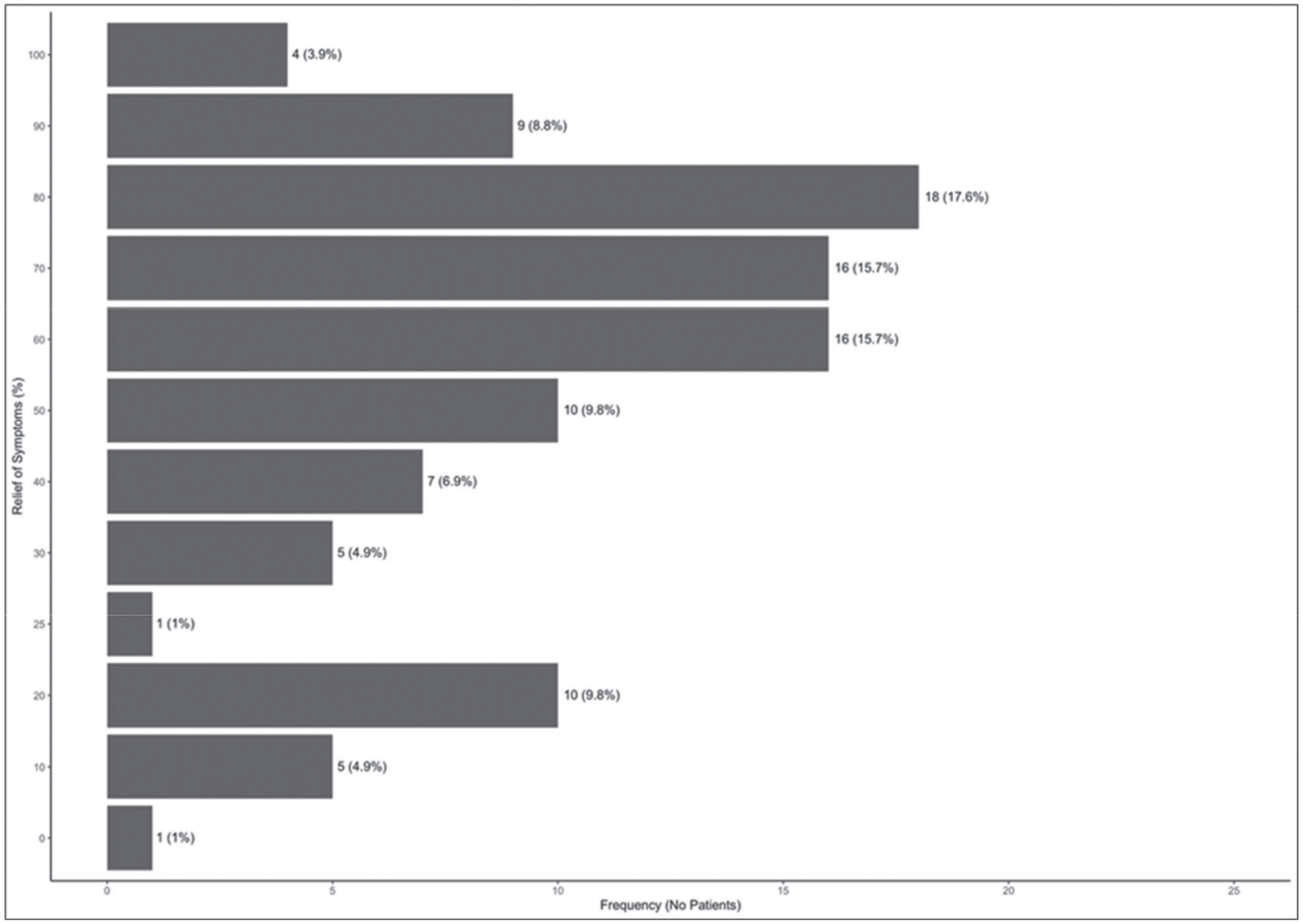

FIGURE 3 - Graphical overview of symptom relief through physiotherapeutic interventions in the ED.
The bar chart displays the frequency distribution of symptom relief percentages among patients. The x-axis represents the number of patients, while the y-axis denotes the percentage of symptom relief. Each bar corresponds to a different percentage, with labels indicating the count and proportion of patients experiencing each level of symptom improvement. Zero percent meant no change, 100% meant no more pain.

difference was identified between resident physicians and the PT_1 group (physiotherapists with >15 years of experience; p = 0.015), as shown in Appendix Table 6. No statistically significant differences were found between resident physicians and PT_2 or PT_3 (p = 0.336 and p = 0.164, respectively). No significant subgroup differences were observed in diagnostic agreement.

Discussion

The role of the Advanced Physiotherapy Practitioner (APP) is a relatively new topic in Switzerland (Swiss Advanced Physiotherapy) (11) and is still scarcely researched. To our knowledge, this is the first RCT examining the role of APPs in the primary care of patients with non-urgent MSKD in the ED within the country. In this RCT, 102 patients with non-urgent musculoskeletal complaints, who presented at the ED of BSAG, were randomized to receive an evaluation by either a physiotherapist or a resident physician. Here are the main findings of the RCT.

Diagnostic competences & treatment recommendation

The high diagnostic agreement (κ and AC1) between ED–PTs and the reference standards (residents) in this study confirmed the safe application of ED–PTs in the extended role. The successful identification of warning signs and the absence of documented adverse events during the study period are consistent with safe clinical practice by ED–PTs at BSAG. Similar observations were found in the study by de Gruchy et al. (17). In addition, the retrospective analysis of patients in whom examination was declined did not identify any missed red flags according to the radiological reference standard. However, given the small sample size and retrospective nature of this subgroup assessment, these findings should be interpreted cautiously and considered exploratory.

The various levels of education (degrees) among the selected eight physiotherapists showed no statistically significant difference in diagnostic performance compared to the residents. Similarly, the varying levels of clinical experience showed no statistically significant difference in diagnostics between the subgroups (Table 8).

Although no statistically significant difference was detected, the ED–PT-subgroup with more than 15 years of clinical experience showed higher odds of correct diagnosis compared with residents (OR = 13.21, 95% CI 0.82-392.46). The wide confidence interval, which included 1.0, indicates considerable imprecision; therefore, these findings should be interpreted cautiously. As previously mentioned, physiotherapists in the ED–PT role, particularly during the initial contact with non-urgent musculoskeletal disorders in the ED of Bethesda Hospital, demonstrated a high level of diagnostic agreement. However, increased variability was observed in the κ and AC1 agreement concerning treatment and discharge planning recommendations. Most discrepancies were related to medications and imaging investigations. In Switzerland, physiotherapists are not authorized to prescribe medication or independently order diagnostic imaging. Accordingly, in the ED–PT group, any medication or imaging was initiated based on recommendations made by the physiotherapist as part of the management plan. These recommendations were reviewed by the senior physician, who retained medical responsibility and, where appropriate, formally issued the prescription in accordance with institutional regulations. In our study, physiotherapists did not consider medication as a stand-alone treatment option. Analgesic medication was recommended only in conjunction with referral to outpatient physiotherapy, aiming to facilitate short-term symptom relief and enable early transition to active management, consistent with contemporary clinical practice recommendations (29).

Regarding diagnostic imaging, physiotherapists demonstrated a more cautious approach to MRI referral compared to the senior physician. These differences may, at least in part, reflect variations in professional training and clinical orientation. Health professionals' decision-making is shaped by their educational background and scope of practice, which may influence preferences for certain management strategies. Such professional orientation should be considered when interpreting interprofessional differences observed in this study.

Patient satisfaction

Patient satisfaction has increasingly become a focal point of research in recent years. In addition to delivering high-quality therapy and treatment, it represents a primary objective for healthcare providers (30). Characteristics that contribute to high patient satisfaction include the quality of care, the opportunity to ask questions, the clarity of answers, and the comprehensibility of prescribed measures. All these factors place significant demands on medical professionals, requiring advanced technical, social, and communicative competencies. However, determining the best method to acquire these competencies—whether through additional training and education or a master's program—was not the focus of this study and should be assessed with more research.

Our observations suggest that the minimum requirements outlined by the authors (refer to the technical competencies of the PT_3 subgroup) are adequate for the diagnostic assessment and treatment of musculoskeletal disorder patients in the ED of Bethesda Hospital.

The data analysis indicated that 97% of patients rated the tested model as excellent or very satisfactory. Furthermore, the evaluation of the ANQ questionnaire revealed no statistically significant differences between the ED–PT and the residents. This finding confirms that the initial assessment of musculoskeletal disorder patients in the ED by physiotherapists does not result in lower patient satisfaction. This observation aligns with findings from other research, which indicate that patients who initially encounter physiotherapists as their point of contact feel welcomed and trust their ability to accurately assess their concerns. (31-33).

An additional factor influencing patient satisfaction is the timely relief of pain, which is crucial during their visit to the ED, alongside the evaluation of their complaints. In this study, physiotherapy was able to sufficiently alleviate symptoms in 99% of patients. Thirty-one patients were discharged from the ED almost pain-free. Consistent with previous studies (31,34-36), this finding suggests clinically

meaningful short-term improvement. However, as disability, quality of life, healthcare utilization, and long-term outcomes were not assessed, no conclusions beyond symptom change can be drawn. Although earlier research indicates that early targeted intervention and patient education may reduce downstream healthcare use and disability (36-39), confirmation of such effects would require dedicated longitudinal studies (37-40).

Limitations of the study

- A potential limitation relates to the sequential assessment design. Patients were first evaluated by the ED–PT and subsequently by the senior physician. It cannot be excluded that information shared during the initial assessment influenced the subsequent physician consultation. This may have introduced information bias and could have affected the observed diagnostic agreement. However, restricting communication between patients and providers to prevent such influence was not considered feasible, as it would have interfered with routine clinical care and patient education.
- The Numeric Rating Scale (NRS) > 8/10, used as an exclusion criterion under the assumption that it might indicate a non-MSKD condition, turned out not to be a good predictor for this purpose. Nine patients were excluded from the study due to the severity of their symptoms and were assessed by the on-duty physician (resident physician). After completing their evaluation, these patients' symptoms were diagnosed as non-urgent MSKD. For this reason, the authors consider the NRS as a criterion for inclusion or exclusion to be unsuitable.
- Another potential limitation relates to the single-center design and the standardized internal training pathway of the participating physiotherapists. All PTs completed the same institutional education program before assuming their expanded role, which may limit the generalizability of the findings to settings with different training structures. In this study, years of clinical experience appeared to be a more relevant differentiating factor than formal training background, as variation in clinical decision-making was primarily observed between PTs with differing levels of professional experience. Most participating physiotherapists held advanced skills qualifications, which should be considered when interpreting transferability to other healthcare systems. While previous studies have reported comparable safety and effectiveness of PT-led care in MSK emergency settings (e.g., 6,25,37,41), the structured institutional training pathway and academic level of the ED–PTs in the present study may represent a contextual factor that should be considered when extrapolating these findings.
- Although the study was designed to compare diagnostic agreement, the professional background of the providers (physiotherapy vs. physicians) may have influenced management decisions. This potential professional orientation bias should be acknowledged when interpreting differences in treatment recommendations.
- Finally, the sample size calculation indicated that 106 patients were required, including a projected 10% dropout rate. Due to time constraints, 102 patients were included. As no dropouts occurred during the study period, the final sample exceeded the minimum required number of 96 participants to achieve 80% statistical power. Therefore, the study was adequately powered for the primary outcome. However, as blinding of patients and clinicians was not feasible in this clinical setting, the possibility of performance and information bias cannot be excluded. This should be considered when interpreting the findings.

Conclusion

In summary, the treatment of patients presenting to the ED with non-urgent musculoskeletal disorders (MSKD) can be effectively managed by experienced physical therapists in primary care. This study provided detailed reports on cases managed by physiotherapists in the ED and highlighted the role of APP as a valuable addition to the ED. The ED–PT managed patients independently under the supervision of senior physicians (on-call service). With the implementation of this service, residents could focus on managing patients with higher priority (e.g., Emergency Severity Index—ESI levels 1-3) or those requiring care that is more complex. Additionally, the new care model achieved a high level of patient satisfaction.

The patient care model presented in this study can be seen as a controlled precursor to a safe direct access approach. This is intended to ensure that the shortage of physicians does not lead to increasing overcrowding in EDs and that patients receive timely assessment and treatment.

Our study demonstrated that the expertise of well-trained and experienced physical therapists is sufficient to safely and effectively manage the primary care of non-urgent MSKD patients.

Considering the increasing number of physiotherapists training for the advanced practitioner role, it appears that there would be numerous opportunities, in different settings, for future comparative studies, which could ideally focus on longer-term outcomes than those conducted in this study.

Disclosures

Conflict of interest: None of the authors of this study has any relevant conflicts of interest, whether financial or otherwise.

Financial support: Bethesda Spital AG supported this study. The funding organization had no influence on the planning or execution of the study, including data collection, management, analysis, or interpretation. The funding organization was also not involved in the preparation of this manuscript and was not asked to review and/or approve the draft.

Authors' contributor role: BZ: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Writing – original draft; RH: Methodology, Formal analysis, Writing – review & editing; AT: Project administration, Supervision, Writing – review & editing

Data Availability Statement: The data are not publicly available due to institutional policies governing the handling of human subject data. Access to the dataset requires prior approval from the responsible ethics committee to ensure compliance with data protection and confidentiality regulations.

References

1. Hostettler S, Kraft E. FMH-Ärztestatistik. Die Schweiz muss mehr Ärztinnen und Ärzte ausbilden, wenn sie nicht weiter vom Ausland abhängig sein will. Das zeigt die Statistik. Was sie auch zeigt: die Medizinerinnen und Mediziner werden älter und arbeiten zunehmend in Teilzeit. Problematisch ist, dass es zu wenige Hausärztinnen und Hausärzte gibt. Schweiz Arzteztg. 2022. Online
2. Veit K. Was begünstigt den Fachkräftemangel? – Wissenschaft nachgefragt. physiopraxis. Juli 2020;18(07/08):12–3. CrossRef
3. Wunsch C, Buchmann M. Demografischer Wandel verschärft Fachkräftemangel. Die Volkswirtschaft; 2019:5. Online
4. Herzog A, Luster M, Keller Lang DI, et al. Emergency department overcrowding: first Swiss application of the Emergency Department Work Index and risk factors for overcrowding. Front Public Health. 2025;13:1691633. CrossRef PubMed
5. Vilpert S. Konsultationen in Schweizer Notfallstationen. Obsan Bulletin 2013. Neuchâtel: Schweizerisches Gesundheitsobservatorium. 2013. Online. (Accessed May 2025)
6. Winteler B, Geese F, Lehmann B, et al. Musculoskeletal physiotherapy in the Emergency Department – evaluation of a new physiotherapy service in a Swiss university hospital. physioscience. Juni 2022;18(02):69–76. CrossRef
7. Hales TR, Bernard BP. Epidemiology of work-related musculoskeletal disorders. Orthop Clin North Am. 1996;27(4):679-709. CrossRef PubMed
8. Dorsett M, Cooper RJ, Taira BR, et al. Bringing value, balance and humanity to the emergency department: the right care top 10 for emergency medicine. Emerg Med J. 1.2020;37(4):240–5. CrossRef PubMed
9. Künzi K, Jäggi J, Dutoit L. Aktueller Stand der schweizerischen Diskussion über den Einbezug von hoch ausgebildeten nichtärztlichen Berufsleuten in der medizinischen Grundversorgung: Aktualisierung des Obsan-Arbeitsdokuments 27. Schlussbericht. Bern: BASS AG; 2013. Available from: Online
10. Maudsley G, Strivens J. Promoting professional knowledge, experiential learning and critical thinking for medical students. *Med Educ*. 2000;34(7):535-544. CrossRef PubMed
11. Physioswiss. Advanced Physiotherapy Practice (APP) 2019 Online (Accessed May 2025)
12. Physioswiss. Positionspapier Swiss Advanced Physiotherapy Practitioner (Swiss APP) 2018 Online (Accessed May 2025)
13. World Physiotherapy. Direct access and patient/client self-referral to physical therapy. 2019. Online (Accessed May 2025)
14. Ferreira GE, Traeger AC, Maher CG. Review article: a scoping review of physiotherapists in the adult emergency department. Emerg Med Australas. 2019;31(1):43-57. CrossRef PubMed
15. Kunz SM. Agreement in diagnosis and treatment management between physiotherapist and physician for patients with musculoskeletal disorders: a pilot project [master's thesis]. Bern (CH): Bern University of Applied Sciences (BFH); 2020.
16. Bird S, Thompson C, Williams KE. Primary contact physiotherapy services reduce waiting and treatment times for patients presenting with musculoskeletal conditions in Australian emergency departments: an observational study. Journal of Physiotherapy. 2016;62(4):209–14. CrossRef
17. de Gruchy A, Granger C, Gorelik A. Physical therapists as primary practitioners in the emergency department: six-month prospective practice analysis. Physical Therapy. 2015;95(9): 1207–16. CrossRef
18. McClellan CM, Greenwood R, Benger JR. Effect of an extended scope physiotherapy service on patient satisfaction and the outcome of soft tissue injuries in an adult emergency department. *Emerg Med J*. 2006;23(5):384-387. CrossRef PubMed
19. Sayer JM, Kinsella RM, Cary BA, et al. Advanced musculoskeletal physiotherapists are effective and safe in managing patients with acute low back pain presenting to emergency departments. Aust Health Review. 2017;42(3):321–326. CrossRef
20. Taylor NF, Norman E, Roddy L, et al. Primary contact physiotherapy in emergency departments can reduce length of stay for patients with peripheral musculoskeletal injuries compared with secondary contact physiotherapy: a prospective non-randomized controlled trial. *Physiotherapy*. 2011;97(2):107-114. CrossRef PubMed
21. Richardson B, Shepstone L, Poland F, et al. Randomised controlled trial and cost consequences study comparing initial physiotherapy assessment and management with routine practice for selected patients in an accident and emergency department of an acute hospital. Emergency Medicine Journal. 2005;22(2):87–92. CrossRef PubMed
22. Lähteenmäki ML, Zabal AB, Eckler U, et al. Physiotherapy competencies for autonomous practice: recommendations for educational frameworks. Professional Issues Working Group. Obidos (Portugal): European Network of Physiotherapy in Higher Education (ENPHE); 2022. Online (Accessed May 2025)
23. Boissonnault WG, ed. Primary care for the physical therapist: examination and triage. 2nd ed. St. Louis, Mo: Elsevier/ Saunders; 2011. 418 S. Online (Accessed May 2025)
24. Lüdtke K, ed. Screening in der Physiotherapie: Das Flaggen-System – Warnsignale erkennen. 2. Aufl. Stuttgart: Georg Thieme Verlag KG; 2021. Online (Accessed May 2025)
25. Matifat E, Méquignon M, Cunningham C, et al. Benefits of musculoskeletal physical therapy in emergency departments: a systematic review. Physical Therapy. 1. September 2019;99(9):1150–66. CrossRef
26. Köhn S. Measuring patient satisfaction in acute care hospitals: nationwide monitoring in Switzerland. 2021;8.
27. Landis JR, Koch GG. An application of hierarchical kappa-type statistics in the assessment of majority agreement among multiple observers. Biometrics. 1977;33(2):363-374. CrossRef PubMed
28. Sim J, Wright CC. The kappa statistic in reliability studies: use, interpretation, and sample size requirements. *Phys Ther*. 2005;85(3):257-268. CrossRef PubMed
29. George SZ, Fritz JM, Silfies SP, et al Interventions for the Management of Acute and Chronic Low Back Pain: Revision 2021. Journal of Orthopaedic & Sports Physical Therapy. 2021;51(11):CPG1–60. CrossRef
30. Lorenz S. Die Prämedikationsambulanz: Analyse der Prozessqualität, Patientenzufriedenheit und Präoperativen Angst. Wiesbaden: Springer Fachmedien Wiesbaden; 2023. Available from: Springer Book Page. CrossRef
31. Goodwin RW, Hendrick PA. Physiotherapy as a first point of contact in general practice: a solution to a growing problem? Prim Health Care Res Dev. 2016;17(5):489-502. CrossRef PubMed
32. Mallett R, Bakker E, Burton M. Is physiotherapy self-referral with telephone triage viable, cost-effective and beneficial to musculoskeletal outpatients in a primary care setting? Musculoskeletal Care. 2014;12(4):251-260. CrossRef PubMed
33. Marks D, Comans T, Bisset L, et al. Substitution of doctors with physiotherapists in the management of common musculoskeletal disorders: a systematic review. Physiotherapy. 2017;103(4):341-351. CrossRef PubMed
34. Brooks G, Dripchak S, Vanbeveren P, et al. Is a prescriptive or an open referral related to physical therapy outcomes in patients with lumbar spine-related problems? J Orthop Sports Phys Ther. 2008;38(3):109-115. CrossRef PubMed

35. Holdsworth LK, Webster VS. Direct access to physiotherapy in primary care: now?—and into the future? Physiotherapy. 2004;90(2):64-72. CrossRef
36. Ludvigsson ML, Enthoven P. Evaluation of physiotherapists as primary assessors of patients with musculoskeletal disorders seeking primary health care. Physiotherapy. 2012;98(2):131-137. CrossRef PubMed
37. Desmeules F, Toliopoulos P, Roy JS, et al. Validation of an advanced practice physiotherapy model of care in an orthopaedic outpatient clinic. *BMC Musculoskelet Disord*. 2013;14(1):162. CrossRef PubMed
38. Downie F, McRitchie C, Monteith W, et al. Physiotherapist as an alternative to a GP for musculoskeletal conditions: a 2-year service evaluation of UK primary care data. Br J Gen Pract. 2019;69(682):e314–20. CrossRef PubMed
39. Leemrijse CJ, Swinkels IC, Veenhof C. Direct access to physical therapy in the Netherlands: results from the first year in community-based physical therapy. Physical Therapy. 2008;88(8):936–46. CrossRef
40. Oakley C, Shacklady C. The clinical effectiveness of the extended-scope physiotherapist role in musculoskeletal triage: a systematic review. *Musculoskeletal Care*. 2015;13(4):204-221. CrossRef PubMed
41. Godoy-Suter MD, Winteler BR, Schmitt KU, et al. The potential benefits of physiotherapy in the emergency department: views of patients and healthcare professionals/Der potenzielle Nutzen der Physiotherapie in der Notaufnahme: Ansichten von Patienten und medizinischem Fachpersonal. International Journal of Health Professions. 2024;11(1):86-98. CrossRef