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**Title: Physiotherapy and Rehabilitation Implementation in Intensive Care Units: A Survey**

**Study**

**Short title: Physiotherapy in Intensive Care Units**

**Authors:** <sup>1</sup>Aslıhan Çakmak, <sup>1</sup>Deniz İnal İnce, <sup>1</sup>Melda Sağlam, <sup>2</sup>Sema Savci, <sup>1</sup>Naciye Vardar Yağlı, <sup>1</sup>Ebru Çalık Kütükcü, <sup>1</sup>Cemile Bozdemir Özel, <sup>1</sup>Hazal Sonbahar Ulu, <sup>1</sup>Hülya Arıkan

**Institutions:** <sup>1</sup>Department of Physiotherapy and Rehabilitation, Hacettepe University, School of Health Sciences, Ankara, Turkey

<sup>2</sup>Dokuz Eylül University, School of Physical Therapy and Rehabilitation, İzmir, Turkey

**Address for Correspondence:** Aslıhan Çakmak, Hacettepe University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Turkey

**E-mail:** [aslihancakmak90@gmail.com](mailto:aslihancakmak90@gmail.com), [aslihancakmak@hacettepe.edu.tr](mailto:aslihancakmak@hacettepe.edu.tr)

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## Abstract

**OBJECTIVES:** Physiotherapy in the intensive care unit (ICU) improves patient outcomes. We aimed to determine the characteristics of physiotherapy practice and critical barriers toward applying physiotherapy in ICUs.

**MATERIALS AND METHODS:** A 54-item survey for determining the characteristics of physiotherapists and physiotherapy applications in the ICU was developed. The survey was electronically sent to potential participants through Turkish Physiotherapy Association network. Sixty-five physiotherapists (47F and 18M; 23–52 years; ICU experience:  $6.0\pm 6.2$  years) completed the survey. The data were analyzed using quantitative and qualitative methods.

**RESULTS:** The duration of ICU practice was  $3.51\pm 2.10$  h/day. Positioning (90.8%), active exercises (90.8%), breathing exercises (89.2%), passive exercises (87.7%), and percussion (87.7%) were the most commonly used applications. The barriers were related to physiotherapist (low level of employment and practice, lack of shift); patient (unwillingness, instability, participation restriction); teamwork (lack of awareness and communication); equipment (inadequacy, non-priority to purchase); and legal (reimbursement, lack of direct physiotherapy access, non-recognition of autonomy) procedures.

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**CONCLUSION:** The most common interventions were positioning, active, passive, and breathing exercises and percussion. Critical barriers toward physiotherapy are multifactorial and related to physiotherapists, patients, team, equipment, and legal procedures. Physiotherapist employment, service maintenance, and multidisciplinary teamwork should be considered for physiotherapy effectiveness in ICUs.

**KEYWORDS:** Physiotherapy, physical therapy, intensive care units

## **INTRODUCTION**

Physical therapy in the intensive care unit (ICU) has beneficial effects such as improving the quality of life, increasing bodily functions, improving peripheral and respiratory muscle strength, reducing hospital and ICU length of stay [1]. Physiotherapists take part in the management of patients with critical illness by focusing on immobilization/deconditioning and related complications (peripheral muscle weakness, joint stiffness, impaired exercise tolerance, physical inactivity), and respiratory conditions (atelectasis, secretion retention, and respiratory muscle weakness) to determine the objectives for an appropriate physiotherapy program [2].

There are various physiotherapy implementations in the ICU, including mobilization, positioning, percussion, vibration, manual hyperventilation, suctioning, coughing, inspiratory muscle training, and bed and breathing exercises [3]. These interventions can be fundamentally classified as chest physiotherapy and mobilization.

No studies have investigated the extent to which physiotherapy and rehabilitation should be applied in the ICUs in Turkey, as well as preliminary applications and barriers toward

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practicing physiotherapy in ICUs. Therefore, we aimed to (i) identify the characteristics of physiotherapy practice and (ii) determine barriers toward applying physiotherapy in ICUs in Turkey.

## **MATERIALS AND METHODS**

A 54-item survey for identifying the characteristics of physiotherapists and physiotherapy applications in the ICU, including closed- and open-ended questions, was developed. The survey was electronically sent to potential participants through Turkish Physiotherapy Association network. This study was an online survey study based on the voluntariness of the participants, and therefore, no ethics approval was required. Sixty-five physiotherapists (47F and 18M; 23–52 years; ICU experience:  $6.0\pm 6.2$  years) completed the survey. The data were analyzed using quantitative and qualitative methods.

The survey questions included the following: characteristics of physiotherapists (age, gender, highest level of education, working place, working experience, number of beds responsible for, multidisciplinary teamwork, satisfaction level with their place in the team, any additional training or courses to work in the ICU, in which ICUs are they currently working), diagnosis of patients who undergo physiotherapy and rehabilitation, how many sessions per day to apply chest physiotherapy techniques to a patient, physiotherapy and rehabilitation techniques used in the ICU, the five most used physiotherapy and rehabilitation techniques in the ICU, assistive devices in physiotherapy used in the ICU, performing suctioning (the technique to perform suction), physiotherapy and rehabilitation

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assessment methods for practical applications in the ICU, daily follow-up assessments, mobilization and mobilization techniques, upper extremity activities (passive/active-assistive/active/strengthening/daily life activities), communication with other disciplines, rehabilitation in invasive and noninvasive mechanically ventilated (invasive mechanical ventilation (IMV) and noninvasive mechanical ventilation (NIMV), respectively) patients, mechanical ventilation settings, weaning procedure, positioning, inhalation/aerosol treatment, acute changes after respiratory physiotherapy, rehabilitation practice in Turkey, barriers to physiotherapy practice in the ICU, and recommendations for increasing the effectiveness of physiotherapy in the ICU.

### **Statistical Analysis**

Statistical analysis was performed using Statistical Package for the Social Sciences for Mac version 20.0 (SPSS IBM.; Armonk, NY, USA), where  $p < 0.05$  was considered to be significant. Proportions were reported as counts and percentages. We have used content analysis to produce descriptive results clustered around themes. This method ensured the ability to analyze data across individuals. After draft preparation, the themes were refined. Two independent assessors analyzed the responses to open-ended questions in the process of content analysis [4]. The obtained results structured the themes. Inter-rater reliability of the coders was 0.90.

### **RESULTS**

The characteristics of physiotherapists working in the ICU were recorded and are presented in Table 1. The experience of physiotherapists in the ICU was  $6.01 \pm 6.17$  years. Out of the physiotherapists, 29 (44.6%) received additional training to work in the ICU, the mean

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duration of stay in the ICU was  $3.51 \pm 2.10$  h/day, 18 (27.7%) were working during the weekends, and 8 (12.3%) were working under the shift system. A majority of physiotherapists (55.4%) were working in a university hospital.

The main reasons for referral to physiotherapy were atelectasis (81.5%), pneumonia/lung infection (80%), acute respiratory failure (73.5%), post-operative cardiovascular surgery (62.5%), and chronic obstructive pulmonary disease—acute exacerbation (60%).

The physiotherapy techniques used in the ICU were classified according to the patients: all, NIMV, and IMV patients, as shown in Figure 1. Positioning (90.8%), active range of motion exercises (90.8%), breathing exercises (89.2%), passive range of motion exercises (87.7%), percussion (87.7%), mobilization (86.2%), vibration (86.2%), and postural drainage (86.2%) were the most commonly used physiotherapy applications in the ICU. The frequency of physiotherapy sessions per day was shown in Figure 2.

The assessment methods used in practical applications were presented in Figure 3. The most commonly used ones were oxygen saturation (95.4%), respiratory rate (90.8%), heart rate (89.2%), and blood pressure (89.2%). However, the use of assessment methods such as manual muscle test (35.4%), Medical Research Council (MRC) muscle test (13.8%), Physical Function in Intensive Care Test (PFIT) (1.5%), Barthel index (10.8%), and functional independence measurement (FIM) (9.2%) was relatively low.

The following five key themes on the barriers emerged from the theme analysis. 1. Related to the physiotherapist (low level of employment, lack of shift system, insufficient practical education, employee personal rights). 2. Related to the patient (unwillingness to be treated, unstable condition, participation restriction, lack of communication with patient's relatives).

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3. Related to teamwork (lack of awareness, inadequate communication). 4. Related to the equipment (lack of assistive equipment, non-priority to purchase equipment). 5. Related to legal procedures (reimbursement, lack of direct physiotherapy access by ICU specialists, non-recognition of professional autonomy).

### **Physiotherapists**

The scarcity in the workforce, lack of direct employment of physiotherapists in the ICU (e.g., service to other departments, in-outpatient care in addition to academic work), time inadequacy, lack of shift system, insufficient practical education, and problems with employee personal rights such as lack of adequate financial reward (e.g., circulating capital) were the main problems related to physiotherapy staffing. We defined these recommendations to resolve these issues.

Working system: Full-time/permanent physiotherapist employment in the ICU, ensuring the continuity of physiotherapy practice, ensuring optimal patient/bed/physiotherapist ratio, providing direct consultation from the ICU specialist, shift system for physiotherapists.

Education: Increasing the number of courses in ICU training during undergraduate physiotherapy training (mechanical ventilation, equipment, additional treatments, intensive care, etc.), providing senior/experienced physiotherapists for practice.

Other: The use of standardized outcome measures in the evaluation of physiotherapy efficacy, use of appropriate forms for data collection, data entry into the patient registration/monitoring system, providing specialization in intensive care.

### **Patient**

The prognosis and unstable condition of the patient, patient's inability to cooperate (e.g.,

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pain, incompatibility, sedation, delirium), additional links (e.g., ECG, arterial catheter), effects of surgical conditions (e.g., incision site), other problems (e.g., decubitus ulcers), restriction of active participation of the patient, and lack of communication with the patient were the main patient-related barriers toward physiotherapy practice.

### **Teamwork**

Lack of awareness and knowledge about physiotherapy, lack of information (e.g., shift system, assistant/medical team rotations), failure to initiate physiotherapy for patient at the right time; delayed notification (e.g., after intubation, after the occurrence of contracture), lack of communication, team support, and staff to assist in positioning/mobilization, non-recognition of the professional autonomy of physiotherapists, and problems related with the timing of the treatment (e.g., encountering behaviors that indicate discomfort if treatment is required after nursing care) were teamwork-related barriers. Increasing the level of knowledge and awareness of the contents of physiotherapy services of the team members (physicians, nurses, assistant staff, patient relatives), the place of physiotherapist in the team, authority and responsibilities, placement of a multidisciplinary team structure, better communication and coordination, initiating the participation of physiotherapists in visits, employing staff to assist in positioning/mobilization, providing scientific meetings, advanced training programs, and multicentered scientific studies were identified as possible solutions to teamwork-related problems.

### **Assistive devices/equipment**

The lack of assistive equipment and non-priority to purchase equipment/material were the primary barriers toward practicing physiotherapy in the ICU. Assistive equipment such as in-

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bed mobilization bicycles, free weights/elastic bands, and walkers must be provided for proper physiotherapy practice in the ICU.

### **Legal procedures**

Reimbursement problems related to health policies, lack of direct consulting for physiotherapy access by ICU specialists, and non-recognition of professional autonomy of physiotherapists were determined as barriers toward physiotherapy in the ICU.

Some of the critical barriers and possible solutions stated by the participants are illustrated in the following quotations:

“PT1: It is required to stay in the ICU for the entire day to enable adequate service. However, we are not staff physiotherapists in the ICU and we have other obligations in the ward, outpatients, and homecare. Therefore, I cannot benefit from circulating capital or additional financial opportunities like other professions such as nurses.”

“PT2: I think the lack of budget to provide new assistive equipment is responsible for the inadequate level of service with regard to physiotherapy in the ICU.”

“PT3: Increasing the employment of physiotherapists in the ICU may help to create an environment to share and discuss the clinical experiences and practical approaches in a multidisciplinary team.”

“PT4: To start working in the ICU without the presence of an experienced physiotherapist initially made me insecure related to my practical experience. Supporting education in this regard through undergraduate and post-graduate studies in specialization and participation in scientific meetings may support physiotherapy practice.”

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## DISCUSSION

Early rehabilitation interventions in the ICU may reduce physical and mental health complications with potential benefits such as improved muscle strength, physical function, and quality of life, and there is a reduction in healthcare costs and length of stay in the ICU [1,5-7].

We found that the most common interventions in the ICUs of Turkey were positioning, active range of motion exercises, breathing exercises, passive range of motion exercises, percussion, mobilization, vibration, and postural drainage. Regarding additional secretion clearance techniques such as vibration followed by manual lung hyperinflation, percussion, postural drainage/positioning, and mobilization were reported as the most frequent ones in a study conducted in ICUs in Australia and New Zealand [8]. Taito et al. [9] reported the current rehabilitation practices in the ICUs in Japan; the range of motion exercises, practicing sitting, and standing were frequently performed for patients undergoing mechanical ventilation, while respiratory muscle training and walking were occasionally performed. The same study revealed that the majority never performed neuromuscular electrical stimulation or used a cycle ergometer [9]. Our findings on rehabilitation practices in the ICUs were similar to this report.

The number of physiotherapists working in the ICU was  $1.75 \pm 1.53$ , while the daily time spent in the ICU was  $3.51 \pm 2.10$  h, daily number of patients was  $6.48 \pm 3.82$ , and the number of beds per physiotherapist was  $15 \pm 20.68$ . According to the core standards for ICUs, physiotherapy should be available 24 h a day, if required, depending on the patient's need, and the suggested staffing levels are one physiotherapist to four beds in order to provide

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both the respiratory management and rehabilitation components of care [10]. The recommendations on necessary requirements for ICUs reported one physiotherapist with dedicated training and expertise in critically ill patients should be available every five beds for level III care on a 7-day/weekly basis [11]. Our study demonstrated that physiotherapy staffing in the ICUs in Turkey lags behind in fulfilling these requirements.

Sedation and perception of physiological instability were reported as major barriers toward mobilization [12]. Our results support this finding with an unstable condition, and the inability to cooperate due to pain, incompatibility, sedation, and delirium were found to be barriers toward rehabilitation.

Intensive care referral-based rehabilitation interventions are safe and feasible when implemented in the context of a multidisciplinary team approach [6]. The lack of awareness and adequate communication among the team were identified as barriers toward rehabilitation.

Parry et al. [13] reported that the key barriers were diverse and include clinician and healthcare-system-related factors for the implementation of early rehabilitation in critical care. They also addressed the educational needs for multidisciplinary team members [13].

The possible solutions for the defined barriers recommended by the participants were related to the physiotherapist (employment, education), teamwork (awareness, communication, assisted personal, education), equipment, and legal procedures (employment, autonomy, reimbursement). The participants suggested that ensuring optimal patient/bed per physiotherapist ratio, increasing intensive care education in physiotherapy undergraduate education, using standardized outcome measures, and providing

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specialization in intensive care would improve barriers related to physiotherapists. The recommended teamwork-related solutions involved increasing knowledge and awareness of team members, placement of multidisciplinary structure in the workplace, better communication and coordination within the team, participation of physiotherapists in medical visits, providing additional staff to assist in positioning and mobilization, and organizing scientific meetings with the participation of professionals to discuss opportunities to improve health service. Equipment-related solution recommendations involved according priority toward purchasing assistive equipment such as bicycles for in-bed mobilizations, free weights/elastic bands, respiratory assistive devices, and mobilization aids such as walkers. Providing full-time physiotherapist employment in the ICU; support of physiotherapists in terms of authority, responsibilities, and professional autonomy; and arrangement of reimbursements were the possible solutions related to legal regulations by the participants.

One limitation of this study was the number of participants. Although this was a survey study, we collected data from the responses of a small number of physiotherapists. We believe that this was due to the fact that there is no obligation of physiotherapists to work in ICUs in Turkey with legal procedures. Therefore, this study was a preliminary investigation aimed at describing the current physiotherapy practices and barriers in the ICUs in Turkey, revealing the necessity of physiotherapists' employment in ICUs.

To conclude, the most common interventions in the ICUs of Turkey were positioning, active range of motion exercises, breathing exercises, passive range of motion exercises, percussion, mobilization, vibration, and postural drainage. Critical barriers toward

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physiotherapy implementations in the ICU are multifactorial and related to physiotherapists, patients, team, equipment, and legal procedures. To increase the effectiveness of physiotherapy in physiotherapist employment in the ICU, the continuity of physiotherapy services and multidisciplinary teamwork should be considered.

**Ethics Committee Approval:** This study was an online survey study based on the voluntariness of the participants, and therefore, no ethics approval was required.

**Informed Consent:** The participants were invited through online survey, which was fulfilled based on the voluntariness of the physiotherapist.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept – A.C., D.I.I., M.S., S.S.; Design – D.I.I., S.S., M.S.; Supervision – D.I.I., S.S., M.S., H.A.; Resources – A.C., D.I.I.; Materials – A.C., D.I.I.; Data Collection and/or Processing – A.C., C.B.O., H.S.U.; Analysis and/or Interpretation – A.C., N.V.Y., E.C.K.; Literature Search – A.C., C.B.O., H.S.U.; Writing Manuscript – A.C., D.I.I., M.S., S.S.; Critical Review – D.I.I., M.S., S.S., N.V.Y., E.C.K., H.A.

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presentation in European Respiratory Society (ERS) 2017 Annual Congress, September 09-13, 2017, Milan, Italy.

**Conflict of Interest:** The authors have no conflicts of interest to declare.

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**Table 1.** Characteristics of physiotherapists working in the ICU and questions related to daily activities in the ICU

<b>Variable</b>	<b>Mean±SD</b>	<b>Min-Max</b>
Age (years)	32.42±6.431	23-52
Experience as a physiotherapist (years)	10.05±6.61	1.5-30
Education level of physiotherapists		
Bachelor	23 (35.4%)	
Master	25 (38.5%)	
Doctorate	17 (26.2%)	
Additional training to work In ICU	29 (44.6%)	
Workplace		
University hospital	36 (55.4%)	
Education and research hospital	9 (13.8%)	
Private hospital	10 (15.3%)	
Public hospital	4 (6.2%)	
Oncology hospital	1 (1.5%)	
Gynecology and child diseases hospital	2 (3.1 %)	
Unspecified	3 (4.6%)	
ICU experience (years)	6.01±6.17	0-29
Daily time in ICU (hours)	3.51±2.10	0-8
Number of physiotherapists working in ICU (n)	1.75±1.53	0-8
Daily patient number (n)	6.48±3.82	1-20

Appointed bed number to a physiotherapist (n)

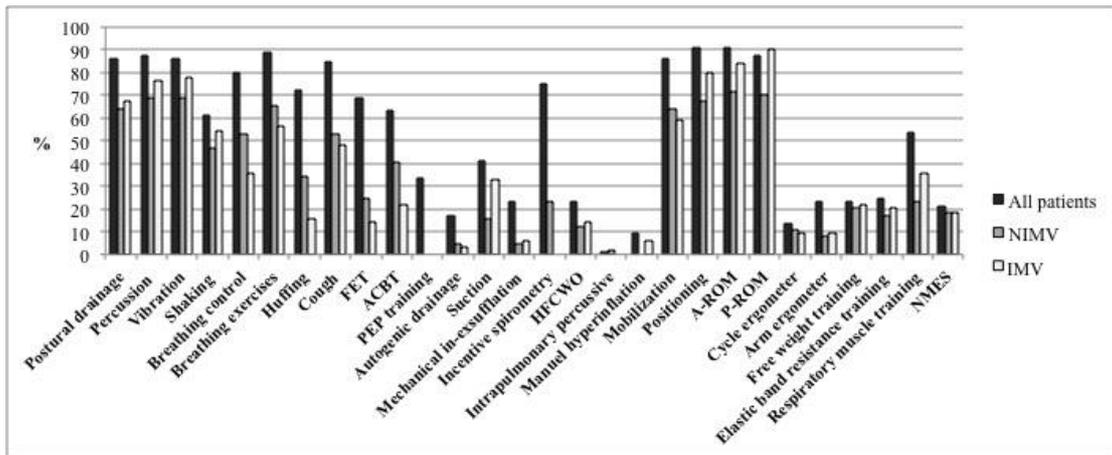
15±20.68

0-150

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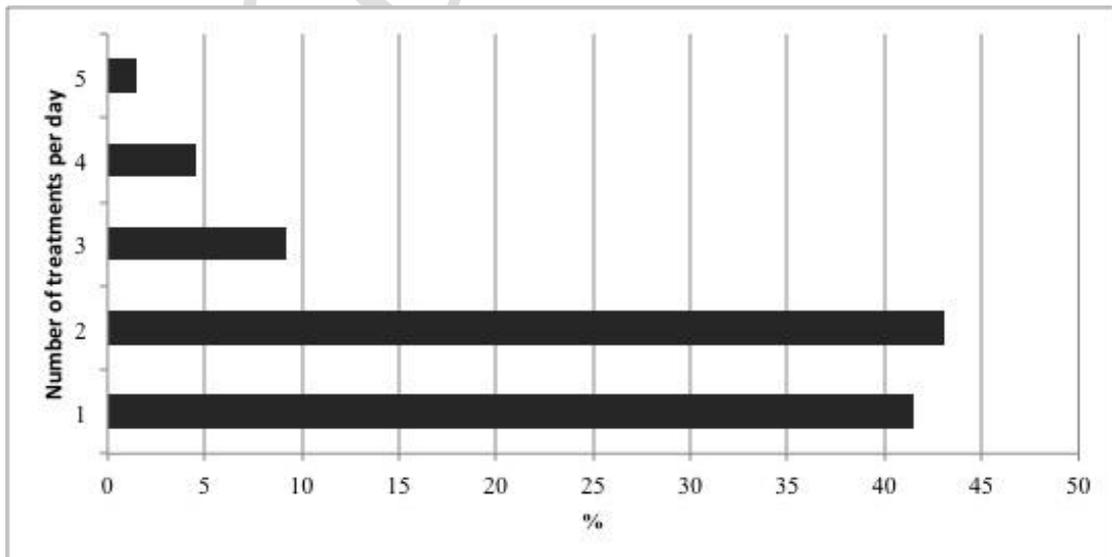
SD: standard deviation; ICU: intensive care unit; Min: minimum; Max: maximum

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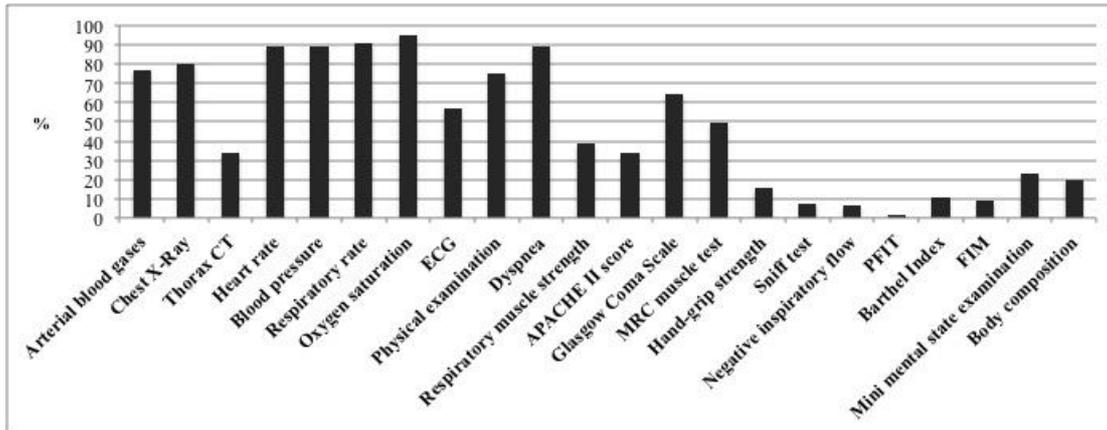


**Figure 1.** Physiotherapy techniques in ICU

NIMV: noninvasive mechanical ventilation; IMV: invasive mechanical ventilation; FET: forced expiratory technique; ACBT: active cycle of breathing technique; PEP: positive expiratory pressure; HFCWO: high frequency chest wall oscillation; A-ROM: active range of motion; P-ROM: passive range of motion; NMES: neuromuscular electrical stimulation



**Figure 2.** Frequency of physiotherapy sessions per day



**Figure 3.** Assessment methods used in ICU

Thorax CT: thorax computed tomography; ECG: electrocardiography; APACHE II: the acute physiology and chronic health evaluation; MRC Muscle Test: medical research council muscle test; PFIT: the physical function in intensive care test; FIM: the functional independence measure