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Knowledge and Early Mobilization Awareness of Extracorporeal Membrane Oxygenation (ECMO) Patients among Physical Therapists in Saudi Arabia: A Cross-Sectional Study

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ABSTRACT

Background: *Extracorporeal Membrane Oxygenation (ECMO) is a life-saving therapy that is increasingly used in patients with acute cardiac and respiratory failure. Although early mobilization has been found to be useful in critically ill patients, including those receiving ECMO, there is limited evidence of physical therapists' understanding of and preparedness to apply these interventions, particularly in Saudi Arabia.*

Aim of the study: *This study aimed to assess the level of knowledge and awareness regarding early mobilization of ECMO patients among Saudi-licensed physical therapists, and to identify the demographic and professional factors contributing to knowledge gaps.*

Methods: *This cross-sectional questionnaire study included 381 licensed physical therapists registered with the Saudi Commission for Health Specialties (SCFHS) at various Saudi hospitals. An online structured questionnaire was used to assess the participants' training history, early mobilization awareness, ECMO knowledge, and clinical experience. Chi-square tests, correlational analysis, and descriptive statistics were used to scrutinize the relationships between knowledge levels and demographic variables.*

Results: *The study involved 381 participants, mainly aged 30-39 (39.1%), with balanced gender distribution (53.5% males, 46.5% females), and most working in hospitals (61.9%). About 50.7% had high ECMO knowledge, 55.1% were aware of early mobilization benefits, and 49.9% felt very confident handling ECMO patients. Only 50.1% had received ECMO training, mainly online, while 92.2% wanted more training despite 65.6% reporting inadequate resources. Knowledge was significantly correlated with awareness ($r = 0.718$, $p<0.001$), age, education, and experience ($p<0.001$), but not gender ($p=0.951$). Age was strongly correlated with experience ($r = 0.552$) and education ($r = 0.583$).*

Conclusion: *This study identified significant ECMO-specific knowledge and early mobilization practice gaps among Saudi physical therapists, especially in non-hospital or less-experienced settings. These findings emphasize the critical need for specific educational programs and organizational assistance to improve ECMO patient outcomes through improved physical rehabilitation practical training.*

Keywords

ECMO, Early Mobilization, Knowledge, Awareness, Physical Therapists.

Introduction

Extracorporeal membrane oxygenation (ECMO) is a life support therapy used to treat acute respiratory and cardiac failure. It

provides essential circulatory and ventilatory support, serving as a bridge for organ recovery [1]. Over the past decade, the use of ECMO has significantly increased because of improved survival rates and expanded indications, including its use as a bridge to recovery or transplantation [2]. Patients receiving ECMO are often critically ill and may remain immobilized for long periods, leading to considerable physical deterioration. This deterioration is characterized by neuromuscular weakness and suboptimal functional recovery after treatment [3]. In the Kingdom of Saudi Arabia (KSA), the Ministry of Health (MOH) developed a nationwide ECMO program to improve services for patients on ECMO. The goal of this program was to enhance the care provided to patients with respiratory or cardiac failure [4]. Preventing deconditioning in critically ill patients principally depends on physical rehabilitation and mobilization efforts. Recent randomized controlled trials (RCTs) have demonstrated that progressive early mobilization of patients undergoing ECMO is both feasible and safe when conducted by a multidisciplinary team [5,6]. Additionally, meta-analyses and systematic reviews have indicated that early mobilization (EM) effectively reduces the incidence of acquired weakness in intensive care units (ICUs) [7,8]. However, several barriers hinder the implementation of early mobilization in clinical practice. These barriers include a lack of awareness, the absence of standardized guidelines, and concerns about potential adverse events related to early mobility in patients on ECMO. Furthermore, patients on ECMO, whether receiving venoarterial (V-A) or venovenous (V-V) support, are often considered too critically ill to be conscious or capable of mobilization [9]. These findings highlight the importance of early mobilization and rehabilitation as essential components in the management of patients on ECMO. Despite recognizing the benefits of early mobilization, patients on ECMO devices encounter significant challenges. Physical therapists play a critical role in overcoming these challenges by integrating rehabilitation practices into critical care settings [7]. Therefore, this study aimed to assess the knowledge and awareness of physical therapists working with patients on ECMO and to evaluate the extent of early mobilization implementation in this population. It seeks to identify existing gaps, enhance knowledge and awareness, and promote educational programs to ensure safe and improved outcomes in ECMO care.

Problem Statement

Despite the increasing use of extracorporeal membrane oxygenation (ECMO) for managing acute respiratory and cardiac failure, critically ill patients on ECMO are at high risk of physical deterioration due to prolonged immobilization. Although early mobilization (EM) has been shown to be feasible, safe, and effective in improving functional recovery and reducing ICU-acquired weakness, its implementation in clinical practice remains limited. Barriers such as lack of awareness, absence of standardized guidelines, and concerns about safety impede the adoption of early mobilization strategies, particularly in ECMO patients. In the Kingdom of Saudi Arabia, there is limited evidence regarding the knowledge, awareness, and practices of physical therapists concerning early mobilization in ECMO care. Addressing these gaps is essential to promote optimal rehabilitation strategies and improve patient outcomes in critical care settings.

Methods

Study design

This cross-sectional survey study aimed to assess knowledge and attitudes among approximately 400 licensed physical therapists in Saudi Arabia who were registered with the Saudi Council of Health Specialists (SCHS). The survey was conducted using an online structured questionnaire distributed via email and verified through social media accounts. Participants will be informed of the title, purpose, and benefits of the study. The primary investigator explained to the participants that participation in this study was completely voluntary and that they were reassured that they could withdraw at any time. Participants were informed that they were required to complete the questionnaire, which would not last for more than five minutes. All obtained information was considered confidential, and the survey link provided to the participants is displayed hear: https://forms.gle/skmT76KohytiRacg6.

Study Population

The target population included Saudi licensed physical therapists who were practicing in government or private hospitals and working with patients on ECMO. Participants were recruited using professional introductions, social media outreach, or direct contact with healthcare facilities.

Sample Size

The targeted sample size was estimated to be 384 therapists, based on a 95% confidence level and a 5% margin of error. The sample size was calculated using the following formula: $n = P(1-P) * Z\alpha^2 / d^2$. In this formula, - n = calculated sample size - Z = the z-value for the selected level of confidence $(1 - \alpha) = 1.96$, P = estimated prevalence of knowledge (assumed to be 0.50) - Q = (1 – P) = 0.50 - D = maximum acceptable error = 0.05 Thus, the estimated minimum sample size is given by $n = (1.96)^2 \times 0.50 \times 0.50 / (0.05)^2 = 384$.

Inclusion Criteria

- Licensed registered physiotherapists with the Saudi Commission for Health Specialties (SCFHS).
- One year of clinical, experience at least.

Exclusion Criteria

- Physiotherapists not licensed by the Saudi Commission for Health Specialties.
- Have less than one year of clinical experience.

Ethical Consideration

Ethical approval for this study was granted by the Research Ethics Committee (REC) at King Faisal Specialist Hospital and Research Centre in Saudi Arabia (RAC #2251163). Only individuals who met the inclusion criteria and agreed to participate were invited to complete the study.

Outcome Measures

Three core outcomes measures were used to identify the Physical therapists' knowledge, attitudes, and capability in managing ECMO patients:

I. Knowledge Assessment

Participants were examined for knowledge regarding ECMO, including terminology, clinical indications, and modes of support (Veno-venous and Veno-arterial), treatment duration, and risks. The participants' answers were scored and ranked based on four knowledge levels: very low, low, moderate, and high.

II. Early Mobility Awareness

This module assessed participants believe and knowledge with the early mobilization of ECMO patients. It was designed to recognize clinical benefits, understand optimal timing or initiation, and assess self-confidence in implementing mobility interventions in critical care settings.

III. Training and Education

Assessing the quantity and type of formal training in ECMO and early mobilization (e.g., workshops, webinars, in-job training), clinical experience with ECMO rehabilitation, frequency of interprofessional discussions, and perceived adequacy of institutional resources that enable early mobility practice.

Data Collection and Statistical Analysis

All Data were collected and analyzed using "SPSS" statistical software (version 27, IBM, Armonk, NY, USA). Chi-square tests, correlational analysis, and descriptive statistics were used to scrutinize the relationships between knowledge levels and demographic variables. The power analysis was set at 90%, and the significance level was $\alpha < 0.05$.

The Results

The demographic profile of the participants (n=381) showed diverse representations of physical therapists across various age groups, with the largest proportion falling within the (30-39) year range (39.1%, n=149), closely followed by the (20-29) year age group (21.3%, n=81). This suggests significant involvement of younger to middle-aged professionals in the survey. The older age groups, specifically those aged 40-49 years (21.3%, n=81) and 50-59 years (15.5%, n=59), also constitute a considerable segment, while those aged 60 and above represent a smaller fraction (2.9%, n=11). In terms of gender distribution, the study showed a near balance, with males comprising 53.5% (n=204) and females 46.5% (n=177), Table 1.

The results of this study revealed that the highest percentage of participants were from the central region, 29.1%, and the lowest percentage were from the western region 15.5%. The majority of the participants 61.9%, (n=236), were working in hospital sitting, 28.1% (n=107), were working in Rehabilitation Centers, and about 10% (n=38) were working in Home Health Care, (Table 2).

Table 1: Demographic Data.

Gender / Regions	Age group	(n)	Percentage (%)
	20–29	81	21.3
	30-39	149	39.1
	40-49	88	21.3
	50-59	61	15.5
	60 and above	11	2.9
Gender	**Male**	204	53.5
	Female	177	46.5

Table 2: Regional Distribution and Current Practice Percentages.

Regions	Number of participants (n)	Percentage (%)
Central	111	29.1
Southern	79	20.7
Northern	69	18.1
Eastern	63	16.5
Western	59	15.5
Current Practice Setting		
Hospital	236	61.9
Rehabilitation Center	107	28.1
Home Health Care	38	10

The results also showed that the highest level of education among the participants was bachelor's degree holders 49.1% (n=187), followed by master's degree 31.2% (n=119), and Doctorate 19.7%, (n=75), (Figure 1).

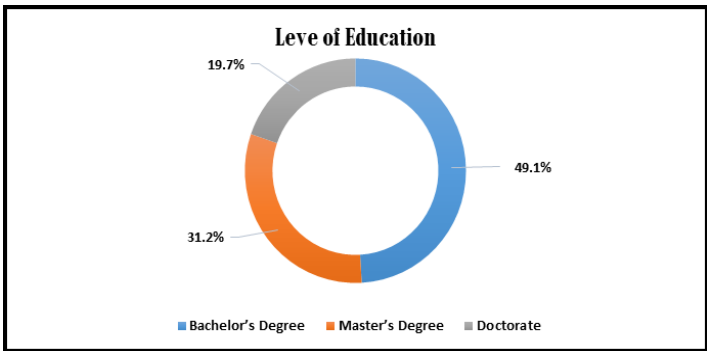

Figure 1: Level of education among participants.

Knowledge of ECMO

In Table 3 the results showed that among all the participants only 50.7% known to have a high knowledge about the fundamental meaning of the ECMO, its primary purpose, what is used for, how long it can be used, and its risk association. Contradictory, about 26% of the participants known to have very low knowledge about ECMO, and the rest were between moderate knowledge 15.7% and those with low knowledge were 7.6%. (Table 3 & Figure 2).

Table 3: Level and Percentage of Knowledge among Participants.

Knowledge Level	Participants (n)	Percentage (%)
Very low knowledge	99	26
Low Knowledge	29	7.6
Moderate knowledge	60	15.7
High knowledge	193	50.7

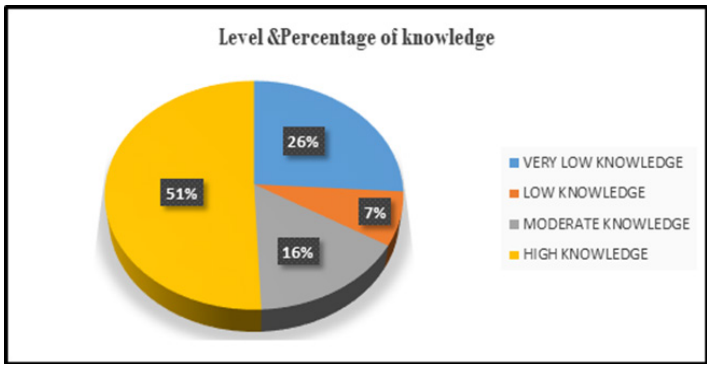

Figure 2: The Percentage of knowledge among participants.

Awareness of Early Mobilization (EM)

As displayed in Figure 3 the results of this study revealed that 55.1% of the participants were aware of the benefits of early mobilization (EM) in patients who received ECMO, whereas (44.9%) were not. The study also showed that 69.8% were aware of the importance of early mobilization for ECMO patients, while 30.2% of the participants were not. In addition, the results showed that 62.2% of the participants were aware of "when should early mobilization started" whereas, 37.8% were not aware.

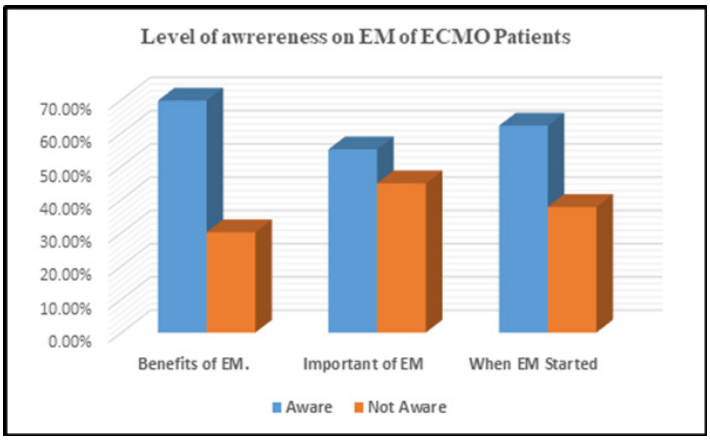

Figure 3: Level of awareness of EM for ECMO patients among Participants.

Clinical Experience and Training

The results of this study showed that 49.9% of the participants were "Very confident" in working with ECMO patients, 35.7% felt "Somewhat confident", whereas 14.4% were "Not confident" in dealing with ECMO patients (Figure 4). The study also found that almost identical results were observed between the participants who received specific ECMO or early mobility training 50.1% and those who did not 49.9%.

Regarding the types of courses and training received, the results showed that online courses were the most common, with 21.8% of participants taking them, followed by those who had a 'different method' of training at 21%, then those who received side job training at 7.3%, and the lowest percentage was for in-person workshops at 2.9%. However, the study indicated that 47% did not receive any kind of training or courses. Despite that, the majority of the participants, 92.2%, were interested in taking additional education and training courses to improve their confidence in dealing with ECMO patients, to implement the goals of early mobilization for this population. Additionally, the results showed that 65.6% of participants were not provided with adequate ECMO resources, whereas 34.4% reported having adequate resources.

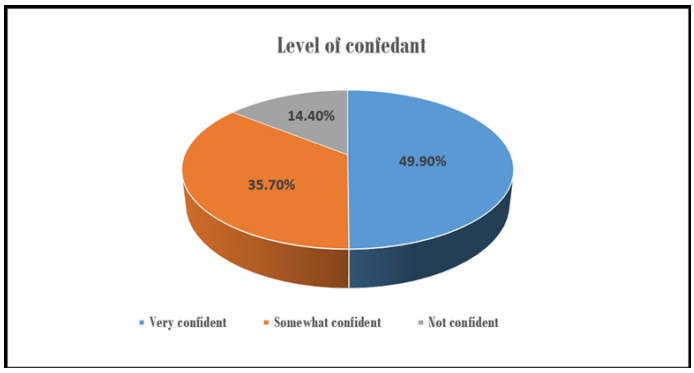

Figure 4: Level confident among participants in dealing with ECMO patients.

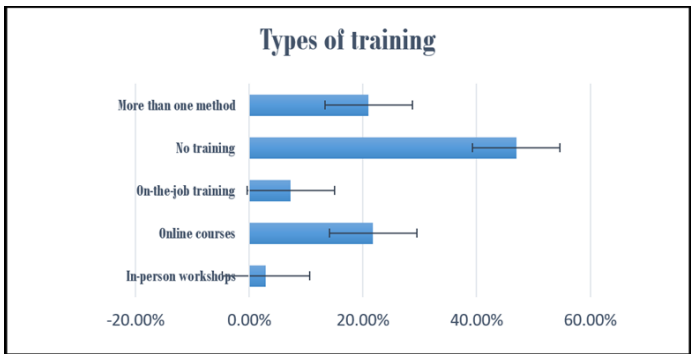

Figure 5: Percentage of type of ECMO training among participants.

In the summary of the Correlation Analysis for Knowledge, Awareness, and Demographic Variables, the study's results showed that there is a significant positive correlation between Knowledge and Awareness ($r = 0.718$, $p<0.001$). in addition, the results also showed a statistically significant correlation between participants' age, highest level of education, and years of experience ($p < 0.001$). Conversely, it revealed no significant correlation between gender and level of ECMO knowledge ($p = 0.951$). However, the findings indicated a statistically significant correlation between knowledge, current practical sitting, and region of residency ($p < 0.009$). Additionally, there is a statistically significant, positive correlation between Years of Experience and Knowledge ($r = 0.081$, $p = 0.05$). The results also showed a significant correlation between the Highest Level of Education and Knowledge ($r = 0.250$, $p<0.001$). Furthermore, there is a statistically significant correlation between Age and Years of Experience ($r = 0.552$, $p<0.001$), as well as between Age and Highest Level of Education ($r = 0.583$, $p<0.001$) Table 4.

Table 4: Correlation Analysis of Knowledge, Awareness, and Demographic Variables.

	Knowledge about ECMO	Level of Awareness on E.M	Age	Years of Experience	Highest Level of Education	Current region of residence in the KSA?
Awareness	.718**	1	.225**	0.073	.286**	0.034
	0	.	0	0.078	0	0.42
Age	.239**	.225**	1	.552**	.583**	.101*
	0	0	.	0	0	0.016
Years of Experience	.081*	0.073	.552**	1	.369**	0.071
	0.05	0.078	0	.	0	0.081
Highest Level of Education	.250**	.286**	.583**	.369**	1	.106*
	0	0	0	0	.	0.015
What is your current region of residence within the Kingdom of Saudi Arabia?	0.018	0.034	.101*	0.071	.106*	1
	0.665	0.42	0.016	0.081	0.015	.
Current Practice Setting	-.228**	-.241**	-0.078	0.016	-0.04	-0.043
	0	0	0.087	0.71	0.39	0.34

Discussion

In recent years, extracorporeal membrane oxygenation (ECMO) has continued to play a vital role in providing organ support for patients with cardiogenic shock or acute respiratory distress syndrome (ARDS), as well as serving as a bridge to transplantation [10]. Growing evidence and increasing awareness highlight the importance of physiotherapy in the care of patients on ECMO [11]. This study aimed to assess the level of knowledge and awareness regarding early mobilization of patients on ECMO among Saudi-licensed physical therapists and to identify the demographic and professional factors contributing to any knowledge gaps. A total of 381 participants were included in this study and were able to complete all the questionnaires to identify the potential factors that influence healthcare professionals' understanding and implementation of ECMO care in the Kingdom of Saudi Arabia. In the current study, the demographic data indicates that relatively young participants were digitally engaged cohort of physical therapists in Saudi Arabia, with a strong majority being registered professionals. The current study found that the knowledge assessment among many of the Saudi registered physiotherapists about understanding ECMO was introductory, and aligned with the increasing global awareness of this life-support modality [12]. However, the decline in answering some specific questions from the participants, such as duration of use, precise indications, could be due to the specialized level of knowledge of this information, which could only be known by the intensive care unit (ICU) specialists. This study showed a highly significant association between Age and Knowledge Level ($P<0.001$). Since the percentage of those with "Very Low Knowledge" was among the 20-29 age group (36.40%) and 30-39 age group (35.40%) age groups, this suggests that a substantial portion of the youngest professionals might start with very limited ECMO knowledge. The "High Knowledge" category was found to be significantly correlated to the middle age group" the 30-39 age group (37.30%) and 40-49 age group (26.90%) age groups. This may indicate that while younger professionals might start with lower knowledge, the middle age group appears to be a period of significant knowledge acquisition [13]. This is supported by Kidd and Hayden, who reported that younger adults are high novelty-seeking and exploratory learning behavior., and are more likely to engage in formal education and new skill acquisition, especially in adolescence and early adulthood. Intensive care unit-acquired weakness is a frequent consequence of critical illness, often leading to impairments in muscle strength, functional ability, and overall health-related quality of life [14,15]. In addition, other studies have reported that functional decline is directly related to the harmful effects of immobility in the ICU, leading to increased care costs, decreased quality of life, and post-discharge survival [16,17]. Physiotherapy is a key component of interdisciplinary care in the ICU, particularly for critically ill patients receiving organ support, such as mechanical ventilation or ECMO [15]. Several studies have shown that patients who undergo physiotherapy in the ICU recover more quickly and achieve better long-term outcomes, including reduced muscle weakness and improved quality of life [18,19]. A recent scoping review, which included a large cohort study, reported low rates of complications associated with early rehabilitation or mobilization during ECMO. Although research has shown that early rehabilitation or mobilization is feasible in high-volume centers, for the majority of ECMO patients, these activities are still predominantly limited to in-bed exercises [20-22]. An international cohort study conducted by Tonna et al. found that only 22% of patients receiving veno-venous (VV) ECMO reached some level of physical mobilization [16]. Therefore, the current study aimed to evaluate the level of awareness of early mobilization for ECMO patients among Saudi physiotherapists. The results of this study found that just over half (55.1%) of participants were aware of the benefits of early mobilization (EM) for ECMO patients, and 69.8% of them recognized its importance. Additionally, 62.2% of the respondents knew when early mobilization should begin, while a notable proportion of the respondents lacked awareness in these areas. Furthermore,

this study identified a strong correlation between knowledge and awareness. This suggests that individuals with greater knowledge of ECMO tend to have higher awareness of the importance of early mobilization (EM) practices, and vice versa, indicating that these two factors are closely linked and likely reinforce each other. This study indicated that 47% of the participants did not receive any training or courses. In addition, the majority of participants (92.2 %) were interested in taking additional education and training courses. These findings highlight the complex situation regarding participants' clinical experience and training related to ECMO. Although many participants reported feeling confident in managing ECMO patients, there was a noticeable lack of formal training, with more than half indicating that they had not received any specific training on ECMO or early mobilization. The training undertaken primarily consisted of online courses, suggesting either a preference for or easier access to virtual learning over more practical, hands-on formats, such as in-person workshops. Importantly, the very high interest in additional training reflects a strong awareness among healthcare professionals of the need to improve their knowledge and practical skills in this specialized area. The limited discussion of ECMO among colleagues also points to a gap in informal learning and peer knowledge exchange within clinical settings. Nonetheless, it is encouraging that most participants believed that their institutions provided sufficient ECMO-related resources, indicating a basic level of organizational support for this type of critical care. Overall, these results reveal a clear enthusiasm for professional growth in ECMO care, which could lead to significant improvements in competency and confidence if supported by well-designed and accessible training programs. Overall, the findings highlight the strong motivation for professional development in dealing with ECMO patients.

Conclusion

In conclusion, this study highlights a moderate level of knowledge and awareness about early mobilization in ECMO patients among Saudi physiotherapists. Although many participants were confident in managing ECMO patients, significant gaps in formal training were evident. Younger professionals tended to have lower knowledge levels, with mid-career therapists demonstrating a better understanding. Most participants expressed a strong interest in furthering their education and skill development. Limited informal knowledge exchange has also been observed in clinical settings. These findings emphasize the need for structured and accessible training programs to enhance professional competency in ECMO care.

Limitations of the Study

- The study was limited to licensed physical therapists registered with the Saudi Commission for Health Specialties (SCFHS), potentially excluding relevant insights from other healthcare professionals involved in ECMO patient care, or from physical therapists practicing outside Saudi Arabia.
- Additionally, the study primarily assessed knowledge and awareness without directly evaluating clinical performance or patient outcomes, which are critical in understanding the true impact of early mobilization practices.

Recommended Future Researches

- Future research that explore the actual clinical practices of physical therapists through observational or mixed-methods studies, including direct clinical audits or qualitative interviews, to gain deeper insight into the practical barriers and facilitators of early mobilization in ECMO settings. This would help to bridge the gap between theoretical knowledge and bedside practice.
- Expanding the scope of research to include multidisciplinary team perspectives including physicians, nurses, and respiratory therapists could provide a more comprehensive understanding of the collaborative challenges and opportunities in implementing early mobilization protocols for ECMO patients.
- Research that develop and validate standardized guidelines and competency frameworks tailored to the Saudi healthcare context, ensuring safe and effective early mobilization practices for ECMO patients across different hospital settings.

Practical Implications / Clinical Relevance

In Saudi Arabia, these findings have important clinical and organizational implications for physical rehabilitation and critical care services. As the use of extracorporeal membrane oxygenation (ECMO) expands, physical therapists must be well-trained and confident in delivering early mobilization protocols. The study highlights systemic gaps in mobilization awareness, ECMO knowledge, and access to education, underscoring the need for standardized, competency-based training tailored to the Saudi healthcare system.

Recommendations include incorporating ECMO-specific rehabilitation into undergraduate curricula, mandating continuing education, and requiring hands-on clinical practice for licensure. Early involvement of physical therapists in multidisciplinary ECMO teams is advised, given the benefits of early mobilization, such as reduced ICU-acquired weakness, shorter ICU stays, and better long-term recovery.

Overall, the study supports national policies that promote early rehabilitation, improved professional training, and organizational investments in resources and staffing. These steps aim to close the knowledge-practice gap, enhance patient safety, reduce healthcare costs, and align Saudi critical care rehabilitation with global best practices. The findings provide clear, evidence-based guidance for educators, healthcare regulators, and clinical leaders to improve ECMO care and patient outcomes.

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