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ORIGINAL RESEARCH

Long-Term Quality of Life Among Intensive Care Units Survivors

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Background: The long-term health-related quality of life (HRQoL) of intensive care unit (ICU) survivors is a key concern. This study investigates HRQoL among ICU survivors in Saudi Arabia, highlighting its importance for advancing healthcare and improving outcomes.

Methods: A cross-sectional study was conducted among ICU survivors and a control healthy group. Participants were aged ≥18 years, with ICU survivors discharged for at least six months excluding individuals with severe cognitive impairments or mental illness. The SF-36 questionnaire assessed HRQoL across eight domains, with data collected from a tertiary hospital in Riyadh. Statistical analysis included the Mann–Whitney *U*-test, the Fisher exact, and multiple linear regression.

Results: Data from 151 ICU survivors and 181 controls were analyzed. Chronic diseases were more common among ICU survivors (51.7% vs 23.8%, p=0.00). Independent of chronic diseases, ICU survivors had significantly lower scores in HRQoL. Prolonged ICU stays were associated with worse quality outcomes. Additionally, being discharged for ≥ seven months improved general health (p=0.05). ICU survivors displayed notably lower scores in physical functioning (65 [IQR 55] vs 80 [IQR 45], p=0.00), limitations due to physical health (25 [IQR 100] vs 100 [IQR 75], p=0.00), limitations due to emotional problems (33.33 [IQR 100] vs 66.67 [IQR 100], p=0.00), less social functioning (62.5 [IQR 50] vs 75 [IQR 38], p=7.00), more pain 67.5 [IQR 45] vs 80 [IQR 33] (p=0.00), and general health (55 [IQR 25] vs 65 [IQR 23], p=0.00).

Conclusion: ICU survivors experience significant HRQoL impairments exacerbated by prolonged ICU stays, highlighting the need for early and comprehensive rehabilitation services. The low utilization of these rehabilitation services suggests a need to provide access and quality for tailored early rehabilitation services to improve ICU survivors' long-term HRQoL.

Keywords: intensive care unit, survivors, Saudi Arabia, quality of life, post-intensive care syndrome

Introduction

Survival rates for critical illnesses and ICU stays have significantly improved due to advancements in critical care medicine.[1] However, post-ICU recovery is a major concern, as survivors often face persistent physical, cognitive, and psychological impairments lasting months to years.[2,3] These impairments are recognized as post-intensive care syndrome (PICS), associated with long-term disability in ICU survivors.[4,5] PICS is a condition that occurs after critical illness and ICU stays, presenting new or exacerbated physical, cognitive, and mental health issues.[6] These impairments can persist for extended periods, impacting the individuals after discharge. Symptoms commonly include muscle weakness, fatigue, memory loss, depression, anxiety, and post-traumatic stress disorder (PTSD).[7,8] These impairments are becoming widely recognized as associated outcomes of disability of ICU survivorship, which significantly diminishes quality of life.[5,9]

Factors contributing to PICS include mechanical ventilation, ICU-acquired weakness, and sedative use, all of which decrease health-related quality of life (HRQoL) post-ICU. Physical impairments often manifest as difficulty walking, decreased muscle strength, and muscle atrophy due to prolonged immobility.[6] Additionally, ICU patients frequently

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experience psychological stress, pain, delirium, and complex surgical interventions, leading to mental and cognitive impairments.[1] These can result in posttraumatic stress disorder (PTSD), depression, and anxiety,[2,10] with cognitive impairments affecting memory, judgment, and planning, significantly impacting daily functioning.[11]

The long-term impact of PICS on ICU survivors' HRQoL is profound, often resulting in decreased functional status.[6] Evidence suggests that interdisciplinary rehabilitation, during and after ICU hospitalization, can mitigate PICS effects.[12] While previous studies indicate poor quality of life in ICU survivors with PICS, most research focuses on specific patient groups and factors like demographics, disease severity, comorbidities, pain, and sleep disorders.[13,14]

Literature on the effects of PICS on quality of life in the general ICU population is limited. In Saudi Arabia, the healthcare system is transforming under Vision 2030, aiming to enhance healthcare quality and accessibility, and improve population health outcomes.[15,16] Understanding ICU survivors' long-term outcomes in this context is crucial for developing culturally and socio-economically appropriate interventions. This study assessed HRQoL among ICU survivors, exploring its associations with demographic and clinical factors to identify predictors of reduced HRQoL compared to healthy individuals.

Methodology

Study Design

This study was approved by the Institutional Review Board of King Abdullah International Medical Research Center (KAIMRC) (Approval No. [IRB/1267/22]). The study was conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

This cross-sectional study aimed to evaluate the quality of life among ICU survivors compared to a control healthy group from the general population had no history of chronic illnesses and had not been previously admitted to ICU. The study involved administering the Arabic version of the Short Form-36 (SF-36) questionnaire to both groups to assess various domains of HRQoL.[17,18]

Study Population

The study included two groups: ICU survivors, who had been admitted to the ICU and subsequently discharged, and a control healthy group from the general population who had not been admitted to the ICU, selected to serve as a baseline for comparison and to highlight the specific long-term impact of critical illness on HRQoL. Demographic factors were compared to assess baseline similarities and ensure the appropriateness of the control group as a comparator. This comparison also aimed to account for potential confounding factors that might influence quality of life outcomes.

Inclusion criteria were individuals aged 18 years and older who could provide informed consent. For ICU survivors, a minimum of six months post-ICU discharge was required to ensure stability in recovery. Exclusion criteria included cognitive impairment or severe mental illness that would interfere with completing the questionnaire, as well as refusal to participate.

Data Collection

Informed consent was obtained from all individual participants included in the study, with detailed information provided regarding the study's purpose, procedures, potential risks, and their right to withdraw at any time without any consequences. Data were collected from a National Guard Health Affairs Hospital in Riyadh, Saudi Arabia, between September and December 2024 through an online questionnaire distributed to all participants. Flyers were shared via social media channels to invite ICU survivors to participate. Additionally, phone calls were made to ICU survivors using contact information from their medical records. Convenience sampling and snowballing were employed to recruit participants for both groups. The Arabic version of the 36-Item Short Form Health Survey (SF-36) is a widely used self-administered questionnaire to evaluate HRQoL, validated and reliable with a Cronbach alpha score greater than 0.7 (reference). Test re-test.[18] The survey consists of 36 items covering eight domains of health: Physical Functioning, Role Limitations due to Physical Health, Role Limitations due to Emotional Problems, Energy/Fatigue, Emotional Well-being,

Social Functioning, Pain, and General Health. Scores range from 0 to 100, with higher scores indicating better perceived health status.

Demographic information collected included age, gender, educational status, marital status, and smoking status. Clinical information collected included the length of ICU stay, number of ICU admissions, presence of chronic diseases, duration post-ICU discharge, and whether rehabilitation was received post-discharge.

Statistical Analysis

Descriptive analysis was performed on the collected data variables. Non-parametric analysis, including medians and interquartile ranges (IQR), was used when the assumption of normal distribution was violated. The distribution of the data was assessed using the Shapiro–Wilk test, and since the data was not equally distributed, non-parametric methods were applied. Continuous variables were compared using the Mann–Whitney *U*-test, while categorical variables were compared using the Fisher exact test or chi-square test, as appropriate. Counts and percentages for categorical variables were reported for continuous variables.

To investigate the impact of ICU admission on quality of life while controlling for the presence of chronic diseases, we conducted multiple linear regression analyses. The dependent variables were the various quality of life domains. The main independent variable was ICU admission status (coded as 1 for ICU survivors and 2 for the general population). Chronic diseases (hypertension, diabetes, respiratory diseases, cancer, kidney disease, cardiovascular disease, and immunological disease) were included as covariates in the models. Regression analyses were also conducted to evaluate the impact of demographic factors (age, gender, marital status, smoking status, and educational level) and clinical factors (length of ICU hospitalization, number of ICU hospitalizations, months since ICU discharge, whether rehabilitation was received post-discharge, and the presence of chronic diseases) on the quality-of-life domains. The results were expressed as coefficients with corresponding p-values.

All analyses were performed using IBM SPSS Statistics Version 26 software. [GPower] was used to estimate the required sample size, ensuring sufficient power to detect significant differences in the outcomes.[19] The estimated sample size needed was 150 participants in both groups to ensure sufficient statistical power and minimize the risk of type I and type II errors, with a power of 0.8 and an alpha level of 0.05.

Results

The study included a total of 332 participants, comprising 151 ICU survivors and 181 control healthy group members. The median age and gender distribution were similar between the groups, although the gender difference showed close to significance (p=0.883).

Educational and marital status did not significantly differ between the groups. A notable difference was observed in smoking status, with a higher percentage of non-smokers in the ICU survivors group.

Among the ICU survivors, the length of ICU hospitalization varied, with approximately two thirds of patients had short ICU stays (0–7 days) and were hospitalized once.

Also, 64.9% had been discharged from ICU for more than 6 months. Only one-third of the ICU survivors reported receiving a form of rehabilitation post their ICU discharge. Chronic diseases were significantly more prevalent among ICU survivors (51.7% vs 23.8%, p<0.00). particularly respiratory, cardiovascular, and metabolic conditions (Table 1) and (Figure 1).

ICU survivors had significantly lower scores in physical functioning (65 [IQR 55] vs 80 [IQR 45], p=0.00), limitations due to physical health (25 [IQR 100] vs 100 [IQR 75], p=0.00), and limitations due to emotional problems (33.33 [IQR 100] vs 66.67 [IQR 100], p=0.00). The energy/fatigue domain showed similar scores between ICU survivors and the control group (45 [IQR 35] vs 50 [IQR 25], p=0.16). Emotional well-being scores were relatively close, with ICU survivors scoring 55 [IQR 30] compared to 60 [IQR 30] in the control group (p=0.08). For social functioning, ICU survivors scored lower (62.5 [IQR 50] vs 75 [IQR 38], p=7.00). Pain scores also indicated a significant difference, with ICU survivors scoring 67.5 [IQR 45] compared to 80 [IQR 33] in the control group (p=0.00). General health scores were lower for ICU survivors (55 [IQR 25] vs 65 [IQR 23], p=0.00), indicating a significant overall decline in HRQoL

Table 1 Demographic and Clinical Characteristics of ICU Survivors and Control Group

Variable	ICU Survivors (n=151)	ICU Survivors %	Control Group (n=181)	Controls %	Total (n=332)	Total %	P-Value
Age (years), (IQR)	42.5 (24)		44 (29)				0.883
Female	80	53%	115	63.5%	195	58.7%	0.066
Male	71	47%	66	36.5%	137	41.3%	
Educational level							0.276
Illiterate	1	0.7%	0	0%	1	0.3%	
Primary	12	7.9%	13	7.2%	25	7.5%	
Secondary	12	7.9%	14	7.7%	26	7.8%	
High School	60	39.7%	87	48.1%	147	44.3%	
Diploma	8	5.3%	2	1.1%	10	3%	
Bachelor	54	35.8%	61	33.7%	115	34.6%	
Postgraduate	4	2.6%	4	2.3%	8	2.4%	
Marital Status							0.359
Single	59	39.10%	61	33.7%	120	36.1%	
Married	92	60.90%	120	66.3%	212	63.9%	
Smoking Status							0.009*
Non-smoker	123	81.5%	166	91.7%	289	87.0%	
Current smoker	19	12.6%	13	7.2%	32	9.6%	
Previous smoker	9	6%	2	1.1%	11	3.3%	
Length of ICU Hospitalization							
0–7 days	94	62.3%					
8–30 days	43	28.5%					
>30 days	14	9.3%					
Received Rehabilitation	46	30.5%					
Times of ICU Hospitalization							
Once	103	68.2%					
More than once	48	31.8%					
Months of Post ICU Discharge							
≤6 months	53	35.10%					
>6 months	98	64.90%					
With chronic disease	78	51.70%	43	23.8%	151	45.50%	0.00*

Note: *P value significant at ≤0.05.

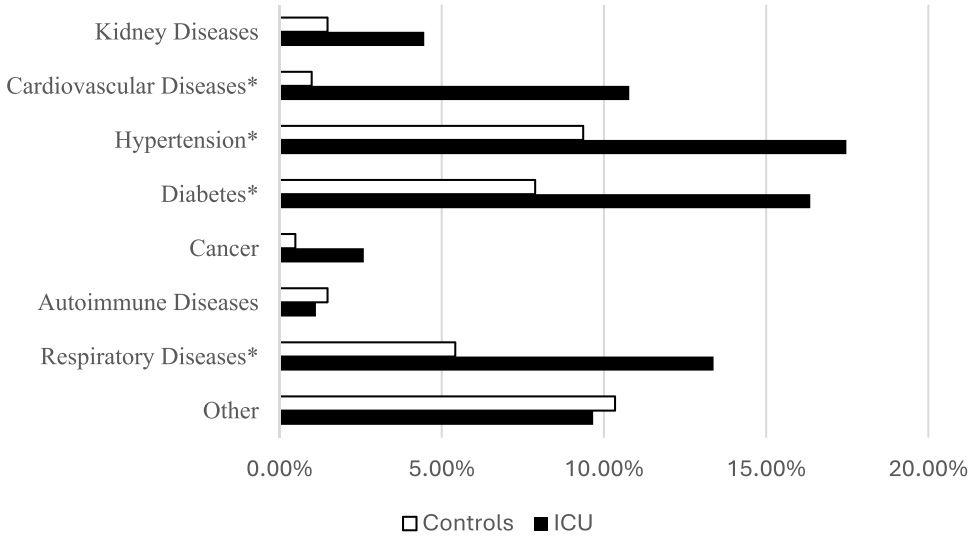

Figure 1 Comparison of Chronic Diseases between ICU Survivors and Controls. *P value significant at ≤0.05.

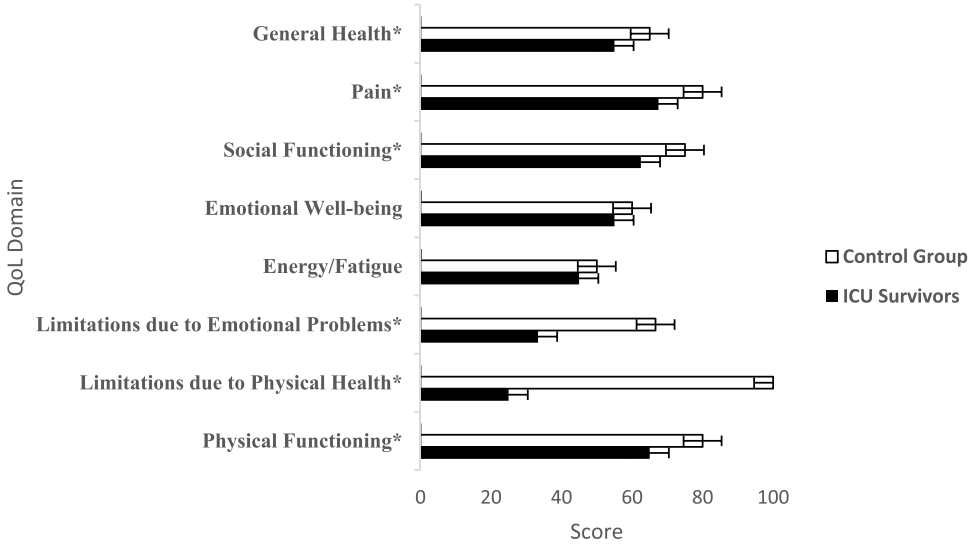

Figure 2 Differences in Quality-of-Life Domains between ICU Survivors and Controls, (* P value ≤ 0.05).

compared to the control group. Finally, differences were observed in Energy/Fatigue, Emotional Well-being, Social Functioning but not all statistically significant (Figure 2).

Additionally, the length of ICU hospitalization had a significant impact on HRQol. Longer ICU stays (8–30 days) were associated with significantly lower scores in physical functioning, role limitations due to physical health, and pain. Higher educational levels positively influenced outcomes in emotional limitations, general health, and pain. (Table 2)

Table 3 focuses on the quality of life in ICU survivors, controlling for chronic diseases. Significant positive associations were found between ICU admission and several quality of life indicators, including physical functioning (Coefficient = 22.39, $p < 0.001$), role limitations due to physical health (Coefficient = 29.94, $p < 0.001$), role limitations due to emotional problems (Coefficient = 15.08, $p = 0.002$), energy/fatigue (Coefficient = 8.79, $p < 0.001$), emotional well-being (Coefficient = 7.49, $p = 0.028$), social functioning (Coefficient = 13.52, $p < 0.001$), pain (Coefficient = 15.54, $p < 0.001$), and general health (Coefficient = 11.18, $p < 0.001$).

Also, regression analysis revealed several significant factors influencing HRQoL domains among ICU survivors. Higher educational levels were significantly associated with better outcomes in emotional limitation (coefficient 5.22,

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Table 2 Regression Coefficients for Quality-of-Life Influencing Factors

		Physical Functioning	Physical Health	Emotional Limitation	Energy/Fatigue	Emotional Well-being	Social Functioning	Pain	General Health
		Coefficient (p-Value)							
Age		**−0.04 (0.93)**	**−0.24 (0.57)**	**0.15 (0.74)**	**0.11 (0.80)**	**0.07 (0.88)**	**−0.07 (0.88)**	**−0.07 (0.88)**	**−0.2 (0.64)**
Gender (Male)		1.7 (0.45)	−1.11 (0.58)	0.89 (0.65)	1.35 (0.52)	0.68 (0.56)	0.94 (0.57)	0.73 (0.79)	1.92 (0.52)
Marital Status (Married)		−1.42 (0.48)	−1.88 (0.46)	−1.04 (0.52)	−1.43 (0.48)	−0.7 (0.56)	0.11 (0.94)	−0.07 (0.98)	−0.65 (0.68)
Smoking Status	**Current Smoker**	−2.47 (0.13)	−1.7 (0.72)	−2.86 (0.26)	−2.38 (0.15)	−2.49 (0.40)	−2.09 (0.21)	−1.28 (0.60)	−1.45 (0.15)
	Previous Smoker	−2.47 (0.13)	−1.7 (0.72)	−2.86 (0.26)	−2.38 (0.15)	−2.49 (0.40)	−2.09 (0.21)	−0.36 (0.90)	−1.45 (0.15)
Educational Level (Higher vs Lower)		2.84 (0.32)	1.15 (0.49)	5.22 (0.01)*	3.54 (0.04)*	1.51 (0.31)	1.12 (0.50)	1.39 (0.62)	2.56 (0.02)*
Length of ICU Hospitalization (8–30 days)		−13.22 (0.01)*	−13.12 (0.01)*	−19.29 (0.00)*	−9.33 (0.02)*	−6.89 (0.14)	−11.24 (0.03)*	−11.58 (0.01)*	−10.68 (0.00)*
No. of ICU Hospitalizations (More than once)		−3.92 (0.59)	−4.53 (0.57)	−1.46 (0.82)	−2.34 (0.68)	−2.94 (0.63)	1.35 (0.83)	−5.36 (0.34)	−2.66 (0.68)
Months of Post ICU Discharge (≥7 months)		6.48 (0.16)	6.18 (0.22)	5.95 (0.33)	7.98 (0.12)	4.69 (0.49)	9.66 (0.10)	7.73 (0.11)	12.88 (0.05)*
Chronic Diseases		−5.21 (0.01)*	−4.98 (0.012)*	−3.78 (0.015)*	−4.56 (0.014)*	−3.68 (0.019)*	−4.12 (0.016)*	−6.11 (0.001)*	−2.95 (0.013)*
Received Rehabilitation		2.85 (0.38)	1.66 (0.61)	2.37 (0.53)	3.52 (0.35)	0.97 (0.83)	5.23 (0.32)	3.16 (0.51)	5.83 (0.20)

Note: *Significant at p≤0.05.

Table 3 Regression Coefficients for Quality-of-Life In ICU Survivors Independent of Chronic Diseases

Quality of Life Indicator	Coefficient (ICU Admission)	p-Value
Physical Functioning	22.39	<0.001
Role Limitations Due to Physical Health	29.94	<0.001
Role Limitations Due to Emotional Problems	15.08	0.002
Energy/Fatigue	8.79	<0.001
Emotional Well-Being	7.49	0.028
Social Functioning	13.52	<0.001
Pain	15.54	<0.001
General Health	11.18	<0.001

Note: P value significant at ≤0.05.

p=0.01), energy/fatigue (coefficient 3.54, p=0.04), and general health (coefficient 2.56, p=0.02). Conversely, longer ICU stays were associated with significantly worse outcomes across multiple domains, including physical functioning (coefficient −13.22, p=0.01), physical health (coefficient −13.12, p=0.01), emotional limitations (coefficient −19.29, p=0.00), energy/fatigue (coefficient −9.33, p=0.02), social functioning (coefficient −11.24, p=0.03), pain (coefficient −11.58, p=0.01), and general health (coefficient −10.68, p=0.00). Additionally, being discharged for 7 months or more

showed a positive impact on general health with a coefficient of 12.88 and a borderline significant p-value (0.05). These findings highlight the complex interplay of educational attainment, ICU stay duration, and time since discharge on the HRQoL of ICU survivors.

Discussion

This study aimed to assess the HRQoL among ICU survivors, focusing on the impact of demographic factors, and clinical characteristics. The findings reveal significant impairments in various HRQoL domains among ICU survivors, underscoring the long-term consequences of critical illness and ICU hospitalization.

ICU survivors reported significantly lower median scores in several HRQoL domains, including physical functioning, role limitations due to physical health, social functioning, pain, and general health, independent of chronic diseases. These functional limitations among ICU survivors suggest that critical illness and prolonged immobility during ICU stay contribute to long-term physical impairments.[1] The notable role limitations due to physical health further highlight the lasting impact of ICU hospitalization on daily activities and overall functionality (Desai).

Emotional well-being and social functioning are also adversely affected, reflecting the psychological burden and social isolation often experienced by ICU survivors.[11,20,21] These findings are consistent with previous research highlighting the detrimental impact of PICS on mental and cognitive functions, ultimately diminishing the HRQoL of ICU survivors.[12] The findings also indicate that critical illness and ICU admission can have lasting negative effects on psychological health.[2,3,8,20] The persistent impairments in physical functioning and general health suggest that ICU survivors may face ongoing challenges in performing daily activities and maintaining overall well-being.[10,21,22]

The presence of chronic diseases, particularly respiratory and heart diseases, hypertension, and diabetes further exacerbated the negative impact on HRQoL. This emphasises the importance of personalized care plans that consider individual characteristics and comorbidities when addressing the needs of ICU survivors.[5,23–26]

The length of ICU stay was a significant predictor of reduced HRQoL across multiple domains. Patients with longer ICU stays exhibited markedly poorer outcomes compared to those with shorter stays. This finding is consistent with the literature suggesting that prolonged ICU stays are associated with greater muscle wasting, functional decline, and increased risk of PICS.[6] The duration since discharge also played a crucial role in the HRQoL of ICU survivors. Being discharged for seven months or more showed a positive impact on the general health domain. This emphasizes the notion that HRQoL after ICU discharge varies, with some functions improving shortly after discharge while others deteriorate and some eventually return to baseline values.[27]

Results also indicate that higher educational levels are significantly associated with better outcomes in emotional limitation, energy/fatigue, and general health. This aligns with existing literature suggesting that individuals with higher education have better health literacy, access to healthcare resources, and more robust coping mechanisms, which collectively contribute to improved health outcomes.[28]

Our research underscores the urgency for tailored interventions to address these impairments and enhance long-term outcomes for ICU survivors. A key observation from our study is the significant disparity in HRQoL between ICU survivors and the control group. This disparity aligns with the global trend of reduced HRQoL reported among ICU survivors, particularly those experiencing PICS.[13] The physical, mental, and cognitive impairments stemming from PICS undoubtedly contribute to this reduced quality of life. It is crucial to recognize the long-lasting nature of these impairments, as they can persist for months or even years after ICU discharge.[1,7]

In this study, rehabilitation services were only utilized by a minority of ICU survivors, which may have contributed to the lower HRQoL scores observed. Previous research has demonstrated the benefits of early rehabilitation and applying A-F bundle in improving physical health, reducing pain, and enhancing overall HRQoL for ICU survivors.[26,29] The low percentage of ICU survivors receiving rehabilitation services in our sample raises concerns about the application of critical care rehabilitation, accessibility of services post ICU discharge and the quality of rehabilitation these services provided to ICU survivors.

The significant impairments in HRQoL among ICU survivors emphasize the necessity for comprehensive early ICU rehabilitation care strategies. Saudi Arabian healthcare system's ongoing transformation[15,30] presents a unique opportunity to address the challenges faced by ICU survivors. The government's commitment to improving healthcare quality and accessibility aligns with the need for comprehensive rehabilitation interventions. Such intervention should focus on

early ICU mobility, identification and intervention for PICS, and incorporating interdisciplinary rehabilitation strategies that target physical, mental, and cognitive impairments.[31] Healthcare providers should consider implementing multi-disciplinary approaches that include physical rehabilitation, psychological support, and chronic disease management to address the diverse needs of ICU survivors. Additionally, targeted interventions for high-risk groups, such individuals with chronic diseases, may help mitigate the long-term consequences of critical illness and improve overall recovery outcomes.

Our study provides novel insights into HRQoL and rehabilitation service utilization among ICU survivors in Saudi Arabia, revealing significant disparities and underutilization that have not been previously documented in the region. Rehabilitation services for ICU survivors remain significantly underutilized, with studies reporting that only 10–20% of patients receive formal rehabilitation after discharge. The underuse of rehabilitation likely contributes to the poor long-term outcomes, including persistent disability and reduced HRQoL.[32,33]

In the context of Saudi Arabia's healthcare transformation, there is a valuable opportunity to develop targeted interventions that enhance the long-term well-being of ICU survivors. Future regional longitudinal studies are essential for establishing evidence-based guidelines to prevent the long-term effects of ICU admission, evaluate the effectiveness of rehabilitation interventions, and identify factors that influence HRQoL. Such studies will also help track changes in HRQoL over time and determine predictors of successful recovery in this population.

This study has a number of limitations that should be considered when interpreting the findings. The cross-sectional design limits the ability to infer causal relationships between ICU admission and quality of life outcomes. Additionally, the reliance on self-reported data for QoL measures may introduce response bias. Also, the control group was not matched to ICU survivors in terms of clinical variables such as comorbidities, which may affect the comparability of HRQoL outcomes.

Conclusion

This study highlights significant impairments in HRQoL among ICU survivors in Saudi Arabia. These impairments persist independently of pre-existing chronic conditions, underlining the long-term consequences of critical illness and ICU hospitalization. Chronic comorbidities such as respiratory diseases, hypertension, and diabetes exacerbated HRQoL declines, while prolonged ICU stays emerged as a key predictor of poorer outcomes. Notably, higher educational attainment was associated with better emotional and general health outcomes. These findings contribute to the limited data on ICU survivorship in Saudi Arabia and call for greater attention to ensure early rehabilitation and follow-up care become integral components of critical care recovery within the region's evolving healthcare system.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no competing interests related to this study.

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