Activities of Daily Living and Determinant Factors among Sepsis Survivors during Hospitalization: A Cross-Sectional Study

Udsaneyaporn Pollayut, Wimolrat Puwarawuttipanit, Warunee Phligbua, Yong Rongrungruang*

Abstract: Sepsis survivors are increasing in number, but unfortunately, they encounter limitations in performing activities of daily living during hospitalization. This study aimed to investigate the factors predicting activities of daily living among sepsis survivors during hospitalization based on the conceptual framework of the International Classification of Functioning, Disability, and Health. Adults who had survived for more than 48 hours after sepsis diagnosis and were admitted to general medicine units in a university hospital in Thailand were recruited by purposive sampling (N = 109). The instruments for data collection included a Demographic and Medical Information Questionnaire, a Sequential Organ Failure Assessment Scale, the Verran and Snyder–Halpern Sleep Scale, the Caring Professional Scale, and the Barthel Index Scale. Multiple linear regression was used to determine predictability.

Based on the findings, 45.9% of the sepsis survivors studied had dependent status. Age, sleep quality, and sepsis severity together accounted for 50.6% of the variability in the ADLs of the sepsis survivors during hospitalization. Nurses and multidisciplinary teams can apply the knowledge gained from the findings by enhancing and managing determinant factors to improve activities of daily living during hospitalization. Activities of daily living assessments at specific times and longitudinal studies should be considered for future studies.

Keywords: Activities of daily living, Healthcare personnel support, Sepsis, Severity, Sleep quality, Serum albumin, Survivors

Received 3 November 2024; Revised 10 January 2025; Accepted 11 January 2025

***Udsaneyaporn Pollayut**, RN, Graduate student, Master of Nursing Science Program (International Program) in Adult and Gerontological Nursing, Faculty of Nursing, Mahidol University, Bangkok 10700, Thailand. E-mail: udsaneyaporn.pol@student.mahidol.ac.th*

***Correspondence to: Wimolrat Puwarawuttipanit**,* RN, PhD, Associate Professor, Department of Medical Nursing, Faculty of Nursing, Mahidol University, Bangkok 10700, Thailand. E-mail: wimolrat.puw@mahidol.ac.th*

***Warunee Phligbua**, RN, PhD, Assistant Professor, Department of Medical Nursing, Faculty of Nursing, Mahidol University, Bangkok 10700, Thailand. E-mail: warunee.phl@mahidol.ac.th*

***Yong Rongrungruang**, MD, FRCP (T), Associate Professor, Department of Medicine, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand. E-mail: yong.ron@mahidol.ac.th*

Author contributions:

UP: Study design, literature review, methodology development, data collection, statistical analysis, data interpretation, initial and final draft, and visualization

WP: Conceptualization, study design, methodology development, data interpretation, writing discussion, writing (review and editing), final approval of the submitted version, and supervision

WPh: Study design, methodology development, statistical analysis, writing (review and editing), and supervision

YR: Methodology development, review and editing, and supervision

https://doi.org/10.60099/prijnr.2025.271797

Introduction

Sepsis survivors are a population that has been increasing globally due to improvements in clinical treatment and care, which promotes their survival. In the United States, more than 1.4 million people survive sepsis annually.[1] In Thailand, a university hospital revealed that 71.4% of patients admitted from 2012 to 2019 survived after septic shock, which was a large number.[2]

However, one of the significant problems among sepsis survivors is limitations in performing the activities of daily living (ADLs). Overall, 82.5% of sepsis survivors complain about an inability to perform routine tasks.[3] This limitation occurs during hospitalization, regardless of age and the unit of admission.[4] This issue affects health-related problems, leads to higher costs of care,[5] and causes extended dependent status after hospital discharge. Thus, exploring the predictive variables of limitations in ADLs could help healthcare providers detect the factors influencing ADLs and minimize further adverse consequences.

Review of Literature

Based on the literature review, many factors have been found to be related to limitations in ADL performance among sepsis survivors. However, most papers studied survivors after critical conditions, including sepsis. Previous literature studied the relationships between ADLs after hospitalization or basic physical activities, including walking, age, sex, race, education level, comorbidity, prior functional status, pressure ulcers, frailty, muscle strength, length of stay, length of intensive care unit (ICU) stay, or illness severity among sepsis survivors.[6-10] The association between ADLs during hospitalization and age, prior functional status, muscle strength, steroid use, ventilator use, or length of hospital stay has also been investigated among sepsis survivors.[4,11]

The International Classification of Functioning, Disability and Health [ICF] by the World Health Organization (WHO) in 2001 was developed to explain health, health-related status, consequences, and determinants in both individual and environmental aspects. The ICF comprises two major components: 1) functioning and disability, which consist of body function and structure combined with activity and participation, and 2) contextual factors, which consist of environmental and personal factors.[12]

The ICF framework was applied to guide this predictive study by defining serum albumin level as a musculoskeletal body structure related to movement. As a result, serum albumin was included in the part of the body structure in the framework. Sepsis severity was considered a physical function, and sleep quality was considered a psychological function. The researchers considered only ADLs as the outcome rather than activities and participation due to the context of hospitalization. For the contextual factors, this study investigated only the environmental factor defined as healthcare personnel support. On the other hand, personal factors were included in the ICF as an internal influencing factor affecting the person's attribution; however, they were not classified in the framework details. Additionally, personal factors such as age and sex were explored in the association and prediction of ADL performance among sepsis survivors.[4,6,10,11] This study included participants based on set criteria and did not limit age and sex to represent generalizability as population characteristics. Thus, age and sex could be potential confounders managed by statistical control.

Post-sepsis pathology leads to hypoalbuminemia due to the persistence of pro-inflammatory cytokines affecting hypothalamus regulation.[13] This can manifest as hypo- or hyperthermia and present with tachycardia or tachypnea, leading to higher energy consumption than usual to maintain hemostasis. Additionally, the confounding hypothalamus affects sickness behaviors, which can induce nutritional problems within a short

time.[14] These factors cause higher nutritional demand than supply, thereby leading to increased proteolysis. Patients with hypoalbuminemia might have a longer recovery period and delayed improvement in ADLs due to insufficiency in the muscle structure.

On the other hand, higher residual inflammation after sepsis induces a higher hypoperfusion resulting in neural cell dysfunction and decreased muscle strength among those with high severity.[15] In addition, sepsis-induced organ failure also affects mitochondrial dysfunction and inadequate energy for muscular function, which causes muscle weakness and muscle wasting.[16,17]

Hospitalized patients are impacted not only by their illness but also by the hospital environment. Patients admitted to general medical units have poor sleep quality during hospitalization, and contributing factors include hospital environments, nursing care interruptions, changing sleep behaviors, and health-related problems.[18] Poor sleep quality might cause fatigue after waking up and muscular problems, which affects ADL performance.

Sepsis survivors spend a lot of time with healthcare providers, mostly during hospitalization, though their family, friends, and spouses/partners are the most important support.[19] Although no previous studies demonstrated the correlation between support and ADLs among sepsis survivors, the correlation between support and physical-health-related quality of life, including regular activity, was found in human immunodeficiency virus survivors (adjusted coefficients 0.20; 95%CI: 0.01-0.37).[20] However, the support was general, social, and not specific to healthcare providers. As a result, exploring ADL predictors during hospitalization for these variables represents a gap in the knowledge in this area.

Study Aim

This study aimed to investigate the factors predicting ADLs among sepsis survivors during hospitalization.

Methods

Study Design: The research was a predictive study reported based on the standards of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE).

Sample and Setting: The target population consisted of patients aged ≥ 18 who had survived sepsis or septic shock based on the Sepsis-3 definition for more than 48 hours, were in the resolution phase, and had been admitted to a general medical unit at a university hospital in Thailand.

Sepsis-3 is defined as organ dysfunction due to an abnormal host response to infection.[21] Nonetheless, the systemic inflammatory response syndrome (SIRS) criteria generally indicate abnormal host response, which is the initial symptom of sepsis after infection. As a result, the inclusion criteria consisted of the following: 1) scoring less than two points on SIRS criteria; 2) understanding and communicating in the Thai language; 3) good consciousness; and 4) a Mini-Cog score of greater than three points for patients aged 60 years or over. Patients with confounding factors, including pregnancy, palliative care, total or partial limitations on ADLs, central nervous system and musculoskeletal disorders, major depressive disorder, schizophrenia, bipolar disorder, low blood pressure with inotrope requirement, and/or oxygen supplementary needs were excluded.

The sample size was calculated with the G*power analysis program (Version 3.1.9.7) with the power $(1-\beta)$ at 0.80, significant level (α) at 0.05, and effect size (f^2) at 0.12. A previous study depicted the association between serum albumin and ADLs with matrix correlation (Adjusted $R^2 = 0.103$).[22] A minimal sample size of 109 patients was required.

Ethical Considerations: The study received ethical approval from the Mahidol University Multi-Faculty Cooperative Institutional Review Board (Protocol Number: MU-MOU-IRB-NS 2022/97.0212). All study participants were provided with

a participant information sheet and signed informed consent forms.

Instruments: Permission to use the instruments was received before data collection. Cronbach's alpha coefficients were examined in a trial with 30 patients meeting the same criteria as the participants for the main study, and an agreement was made for the participants in the trial group to evaluate the reliability of study instruments as follows:

Screening Instrument

The Mini-Cog was developed by Borson et al.[23] to assess cognition among older adults. The instrument consists of three items, including repeating and remembering three words and drawing a clock. The total score is five points, and a total score of less than three points is interpreted as cognitive impairment. We screened sepsis survivors aged 60 years or older with the Thai version of the Mini-Cog.

Data Collection Instruments

The Demographic and Medical Information Questionnaire developed by the researchers consisted of the latest personal information, serum creatinine level, serum albumin level, serum lactate level, location of infection, and length of stay. The Sequential (sepsis-related) Organ Failure Assessment (SOFA) scale was included in this part and used to assess sepsis severity at the current diagnosis of sepsis. The SOFA scale was developed by Vincent et al.[24] to describe outcomes of organ dysfunction in critical patients. The SOFA comprised six items with four rating scales (one to four) for each item focused on respiration, coagulation, liver, cardiovascular system, central nervous system, and kidney function. Total scores ranged from 0 to 24; higher scores indicated worsening organ failure. The English version of the SOFA scale was used in this study.

The Verran and Snyder-Halpern (VSH) Sleep Scale was developed by Snyder-Halpern and Verran[25] to assess sleep quality. A linear scale from 0 to 10 defines different meanings based on each question. The instrument consists of 15 items with three dimensions (sleep disturbance, sleep effectiveness, and extra daytime sleep duration), for example, "How often did you wake when you sleep?" Total scores ranged between 0-150 and were divided into five levels in which higher scores were interpreted as higher sleep quality. This study used the Thai version translated by Rojjanakitti[26] to evaluate the current sleep quality of the participants. The Cronbach's alpha coefficient from a 30-participant trial was 0.96 and 0.97 from the actual study.

The Caring Professional Scale (CPS) was developed by Swanson[27] to assess patient-perceived care by healthcare providers. Responses to 18 items are rated on a 5-point Likert scale, indicating level one as "Yes or Definitely" and level five as "No or Not at all." The instrument focuses on knowing, being with, doing for, enabling, and maintaining belief, for example, being emotionally distant. Total scores range between 18-90 points, and the results are interpreted into three levels. A total score of 18 to 42 points means patient-perceived poor supporting care, but a total score of 67 to 90 points is defined as patient-perceived high supporting care from healthcare providers. The researchers applied the Thai version translated by Piyasiripan[28] to assess current healthcare personnel support. In the trial of 30 participants, Cronbach's alpha coefficient was 0.96; in the actual study, it was 0.96.

The Barthel Index (BI) was developed by Mahoney and Barthel[29] to evaluate functional capacity. The instrument contains ten items on feeding, transfer, grooming, toilet use, bathing, mobility, going upstairs, dressing, defecation, and urination. Each item determines the level of assistance differently. The total score for this questionnaire is 100 points divided into five levels of independent status: 1) absolutely dependent status is indicated as a total score of 0 to 20 points; 2) intensively dependent status is a total score of 21 to 45 points; 3) moderately dependent status is a total score of 46 to 70 points; 4) independent status is a total score of 71 to 90 points; and 5) absolutely independent status is defined as a total score of 91 to 100 points. The

researcher used the Thai version translated by MapiTM Research Trust[30] to assess ADL performance for this study. Cronbach's alpha coefficient for the BI was 0.91 from the trial and 0.94 from the actual study.

Data Collection: All participants provided written informed consent indicating their willingness to participate in the study, and one researcher collected data between March and September 2023.

Data Analysis: Frequency, percentage, range, mean, and standard deviation were used for descriptive analysis. Multiple linear regression was used to analyze the predictability of the independent and dependent variables. However, the potential confounders were included in the regression model for being controlled and used the third model of the stepwise approach. All assumptions were met, including the linearity, homoscedasticity of regression standardized residual, multicollinearity, and normality of the standardized residual. The researchers used the IBM SPSS statistical program (Version 25). The statistical significance level was set to 0.05.

Results

In total, the sample was 109 sepsis survivors, and those aged 60 years old and over accounted for 60.5%. Regarding the infection site, the respiratory system was the most common location, accounting for 49.5%. The median SOFA score representing sepsis severity was 7.00 points (IQR = 4.00–10.00). In terms of laboratory tests, the average scores for serum creatinine, serum albumin, and serum lactate were 0.91 mg/dL (IQR = 0.60–1.49), 2.80 g/dL (IQR = 2.50–3.20), and 1.40 mmol/L (IQR = 1.10–1.70), respectively **(Table 1).**

Table 1. Demographic and medical information of the sample (N = 109)

Demographic and medical information	Number	Percentage
Age (years) (Min = 23, Max = 94, Median = 65.00, IQR = 50.00–75.50)		
< 60	43	39.5
≥ 60	66	60.5
Sex		
Male	68	62.4
Female	41	37.6
Body mass index (kg/m^2) (Min = 13.89, Max = 61.64, Median = 22.83, IQR = 19.14–24.95)		
< 18.5 (underweight)	25	22.9
18.5–24.9 (normal)	57	52.3
25.0–29.9 (overweight)	17	15.6
> 29.9 (obese)	10	9.2
List of comorbidities (Selectable more than 1 answer)		
Hypertension	70	64.2
Cardiovascular diseases	68	62.4
Dyslipidemia	51	46.8
Diabetes mellitus type 2	47	43.1
Chronic kidney disease	40	36.7
Others	86	78.9
Source of infection (selectable more than 1 answer)		
Lower respiratory tract infection	54	49.5
Urinary tract infection	37	33.9
Catheter-related bloodstream infection	15	13.8
Gastrointestinal tract infection	7	6.4

Table 1. Demographic and medical information of the sample (N = 109) (Cont.)

Demographic and medical information	Number	Percentage
SOFA score (Min = 2.00, Max = 15.00, Median = 7.00, IQR = 4.00-10.00)		
0-3	18	16.5
4-7	43	39.4
8-11	36	33.1
12-15	12	11.0
Serum creatinine level (mg/dL) (Min = 0.29, Max = 10.94, Median = 0.91, IQR = 0.60-1.49)		
Male (n = 68)		
< 0.67 (low)	18	26.5
0.67-1.17 (normal)	29	42.6
> 1.17 (high)	21	30.9
Female (n = 41)		
< 0.51 (low)	8	19.5
0.51-0.95 (normal)	16	39.0
> 0.95 (high)	17	41.5
Serum albumin level (g/dL) (Min = 1.60, Max = 4.40, Median = 2.80, IQR = 2.50-3.20)		
< 3.5 (hypoalbuminemia)	95	87.2
3.5-5.0 (normal)	14	12.8
Serum lactate level (mmol/L) (Min = 0.50, Max = 3.50, Median = 1.40, IQR = 1.10-1.70)		
≤ 2 (normal)	100	91.7
> 2 (high)	9	8.3
Length of stay (days) (Min = 3.00, Max = 52.00, Median = 9.00, IQR = 6.00-18.00)		

Note. Min = Minimum, Max = Maximum, IQR = Interquartile range, SOFA = Sequential Organ Failure Assessment scale

Table 2 shows that the participants had acceptable sleep quality during hospitalization with a median total score of 63.00 points (IQR = 40.50-96.00). Moreover, the median CPS score for healthcare personnel support was 76.00 points, with an IQR from 67.00 to 89.00 The average BI score was 69.08 points, with an SD of 28.61. Independent status was found in 54.1% of participants, but 45.9% reported dependent status. Moreover, the participants had some limitations in ascending and descending stairs, walking on certain surfaces, moving to the bed, and returning at percentages of 72.5%, 68.8%, and 65.1%, respectively **(Table 3).**

Table 2. Sleep quality, healthcare personnel support, and activities of daily living (N = 109)

Variables	Possible range	Actual range	n (%)
Sleep quality			
Sleep quality level (Median = 63.00, IQR = 40.50-96.00)			
Very poor sleep quality	0-30	7-29	18 (16.5)
Poor sleep quality	31-60	31-60	34 (31.2)
Acceptable	61-90	61-90	25 (22.9)
Good sleep quality	91-120	91-120	20 (18.3)
Excellent sleep quality	121-150	121-139	12 (11.0)

Table 2. Sleep quality, healthcare personnel support, and activities of daily living (N = 109) (Cont.)

Variables	Possible range	Actual range	n (%)
Sleep quality in each domain			
Sleep disturbance (Mean = 30.05, SD = 17.86)	0-70	1-68	
Sleep effectiveness (Mean = 18.51, SD 10.32)	0-40	1-39	
Nap supplementation (Mean=19.14,SD=8.63)	0-40	2-40	
Healthcare personnel support			
Healthcare personnel support level (Median = 76.00, IQR = 67.00-89.00)			
Poor	18-42	0	0 (0.0)
Moderate	43-66	44-66	25 (22.9)
High	67-90	67-90	84 (77.1)
Activities of daily living			
ADLs level (Mean = 69.08, SD = 28.61)			
Absolutely dependent	0-20	0-20	10 (9.2)
Intensively dependent	21-45	25-45	16 (14.7)
Moderately dependent	46-70	50-70	24 (22.0)
Independent	71-90	75-90	31 (28.4)
Absolutely independent	91-100	95-100	28 (25.7)

Table 3. Descriptive information on activities of daily living (N = 109)

Assessment	Possible range	n (%)				Mean (SD)
		Dependent status	Partial dependent status	Partial independent status	Independent status	
1. Feeding	0-10	12 (11.0)	23 (21.1)	-	74 (67.9)	7.84 (3.43)
2. Moving from wheelchair to bed and return	0-15	4 (3.7)	20 (18.3)	47 (43.1)	38 (34.9)	10.46 (4.11)
3. Personal toilet	0-5	15 (13.8)	-	-	94 (86.2)	4.31 (1.73)
4. Getting on and off toilet	0-10	22 (20.2)	36 (33.0)	-	51 (46.8)	6.33 (3.89)
5. Bathing self	0-5	36 (33.0)	-	-	73 (67.0)	3.35 (2.36)
6. Walking on the level surface	0-15	13 (11.9)	14 (12.9)	48 (44.0)	34 (31.2)	9.72 (4.80)
7. Ascending and descending stairs	0-10	26 (23.9)	53 (48.6)	-	30 (27.5)	5.18 (3.60)
8. Dressing	0-10	12 (11.0)	36 (33.0)	-	61 (56.0)	7.25 (3.43)
9. Controlling bowels	0-10	7 (6.4)	13 (11.9)	-	89 (81.7)	8.76 (2.82)
10. Controlling bladder	0-10	39 (35.8)	12 (11.0)	-	58 (53.2)	5.87 (4.66)

The linear correlation between the independent variables and ADLs is shown in **Table 4.** The results show that serum albumin levels and sleep quality were significantly positively correlated with ADLs ($r = 0.254$ and $r = 0.533$, respectively). In contrast, age and sepsis severity were negatively correlated with ADLs with statistical significance ($r = -0.580$ and $r = -0.247$, respectively). Multiple linear regression analysis by the third model of the stepwise method accounted for 50.6% of the variance in ADLs and was explained by all predictors ($R^2 = 0.506$). When controlling another potential confounder, sleep quality and sepsis severity were significant predictors of ADLs ($B = 0.314$, $p < 0.001$ and $B = -1.406$, $p < 0.05$). **(Table 5)**

Table 4. Correlation between the independent and dependent variables (N = 109)

Variables	1	2	3	4	5	6	7
1. Sex	1.00						
2. Age	-0.064	1.00					
3. Serum albumin level	0.162	-0.275**	1.00				
4. Sepsis severity	-0.075	0.091	-0.285**	1.00			
5. Sleep quality	-0.071	-0.306**	0.267**	-0.089	1.00		
6. Healthcare personnel support	0.128	0.153	0.138	-0.194*	0.287**	1.00	
7. Activities of daily living	0.082	-0.580**	0.254**	-0.247**	0.533**	0.173	1.00

Note. *p < 0.05, **p < 0.01

Table 5. Multiple linear regression model predicting activities of daily living (N = 109)

Variables	B	S.E.	β	t	p-value	Collinearity tolerance	Statistic VIF
(Constant)	105.918	10.631	-	9.963	< 0.001	-	-
Age	-0.764	0.123	-0.448	-6.201	< 0.001	0.902	1.108
Sleep quality	0.314	0.060	0.381	5.278	< 0.001	0.903	1.108
Sepsis severity	-1.406	0.563	-0.172	-2.498	0.014	0.988	1.013

Note. B = Unstandardized coefficient, β = Standardized coefficient, R = 0711, R^2 = 0.506, Adjusted R^2 = 0.492, F = 35.809, p < 0.001

Discussion

In the ADL dimensions, the findings revealed that 53.2% and 46.8% of the participants were dependent on going to the toilet and maintaining urinary continence, respectively. Moreover, 35.8% reported urinary catheter retention, while 72.4% of males and females had high serum creatinine levels. The survivors had abnormal renal function during sepsis, even though the previous condition of chronic kidney disease was 36.7% in this study. Based on a literature review, acute kidney injury (AKI) is a predominant complication of sepsis due to the dysregulation of macro- and microvascular perfusion. This is consistent with previous findings reporting that 47.0%-60.0% of sepsis survivors exhibited AKI during hospitalization.[31,32]

This study's results demonstrated that 44.1% of all SOFA scores were at least eight points, reflecting high severity, and that some participants had been discharged from the ICU to general medical units. The pathology of ICU-acquired weakness included not only inflammation, alternative microcirculation, and mitochondrial dysfunction but also neuroendocrine dysfunction, mechanical ventilator use, and immobilization.[33] Higher sepsis severity can lead to more persistent inflammation, resulting in increased protein degradation.[15] The findings also revealed consistency in the correlation between SOFA scores and muscular problems, showing that a score of more than seven points on the SOFA scale was a risk factor for ICU-acquired muscle weakness among critical survivors (risk ratio, 2.03; 95% confidence interval: 1.02-4.12) and that presenting the SIRS criteria for more than three days during the first week of admission was a significant predictive factor for ICU-related weakness.[34]

Regarding the correlation between serum albumin and nutritional status, albumin is a type of protein molecule considered a micronutrient. It was reported that 10% of patients hospitalized with sepsis

had nutritional deficiencies between days 2 and 16.[35] Based on this finding, 87.2% of the participants had hypoalbuminemia. Nonetheless, 22.9% of those were underweight, and 11.0% had total dependent status in feeding. Although the participants could not perform feeding activities by themselves, they had no digestive problems that led to malnutrition. On the other hand, the mean hospital stay in this study was nine days. This was consistent with the remaining inflammatory mediators, including interleukin (IL)-6 and IL-8, and low serum albumin levels detected over 14 days after sepsis among patients aged > 65 years with chronic critical conditions.[36,37] The pathology of persistent inflammation, immunosuppression, and catabolism syndrome after sepsis causes a loss of serum albumin. In this study, serum albumin levels did not predict ADLs among sepsis survivors. Conversely, a prior study demonstrated that serum albumin was a predictive factor of poor ADL performance (BI < 60 points) at the time of hospital discharge among patients who contracted an infection in an emergency room (adjusted OR, 0.63; 95% CI: 0.41-0.99).[11] However, differences were found in the laboratory collection time compared to this study. Regarding this study's results, the proportion of ADLs was distributed normally. On the other hand, 87.2% of the participants demonstrated hypoalbuminemia, which skewed positively. This phenomenon happened due to the participants' characteristics. As a result, minimal variability in independent variables, distributive differences, and participant features might affect the correlation. Even though serum albumin level could not predict ADLs, it had a significantly weak negative correlation with sepsis severity and a weak positive correlation with sleep quality. Hence, nurses and multidisciplinary teams should consider monitoring and enhancing serum albumin to achieve normal levels, reduce sepsis severity, and promote sleep quality, which were found to be predictive factors of ADLs. Nonetheless, the ability to mediate those variables should be investigated for future study.

When interpreting these results in terms of subdomains of sleep quality, most participants suffered from sleep disturbance, sleep effectiveness, and nap supplementation, respectively. Previous studies reported poor sleep quality among sepsis survivors, including exhausted awakening, trouble falling asleep, and sleep disturbance.[3,5] The hospital environment is another factor that influences sleep quality among hospitalized patients. Noise occupied the highest percentage of the factors at 59.2%, followed by caring interruptions, uncomfortable beds, too much light, unfamiliar environment, daytime napping, and odors at 29.6%, 18.3%, 15.5%, 14.1%, 2.8%, and 1.4%, respectively, among patients who were admitted to general medical units.[18] Moreover, patients' health conditions influenced their sleep quality. Antecedent evidence has reported that the survivors were confronted with both physical and psychological problems, such as fatigue, insomnia, anxiety, fear, overthinking, or sadness, that interfered with their sleep after sepsis.[3,38,39] Poor sleep quality leads to decreased growth hormone levels and impaired muscle structure caused by protein synthesis dysfunction.[40] As a result, nursing administration, environmental modification, clinical care, symptom management, and sleep encouragement interventions should be emphasized to increase sleep quality and standardized nursing care to reduce sepsis severity and promote better ADL performance.

Sepsis survivors encounter limitations in ADLs due to the alternation of physical functions and structures associated with the pathology. Although the average score showed that the survivors received good support from healthcare providers, support also depended on other factors with greater influence over ADLs, such as health conditions. Although healthcare personnel support might encourage performing basic activities, it does not change the limitations of ADLs among sepsis survivors.

Although the findings indicated that females had a significant non-recovery rate in physical function after surviving critical illness,[6] 62.4% of the samples

in this study were males. However, sex was excluded from the regression analysis because the findings from correlation analysis revealed no significant association between gender and ADLs, sleep quality, or sepsis severity. This indicates that gender is unlikely to act as a confounder in this context. Meanwhile, older adults occupy the highest proportion of hospital admissions compared to the lower age group owing to the global rise of aging societies and vulnerability because older patients have more severe conditions and longer recovery periods when they get sick. In a literature review, antecedent studies revealed that age is related to ADLs among sepsis survivors during hospitalization.[4,11] This might affect ADL performance. Nonetheless, the degree of worsening physical function differs individually, and age was controlled as a confounder of the regression analysis.

Limitations

The primary limitation of the cross-sectional design is that, since exposure and outcome are assessed simultaneously, there is generally no evidence of a temporal relationship between the two factors. A purposive sampling method was used to select the participants; thus, the generalizability might have been confounded, even though this study included all adults who met the criteria. Another limitation was the one-time ADL evaluation during hospitalization. Thus, ADL assessments should be considered at specific times in longitudinal studies for future research to assess actual functional recovery in sepsis survivors.

Conclusions

Almost half of the sepsis survivors (45.9%) demonstrated dependent status. Most had limitations in activities related to the lower extremities, such as ascending and descending stairs, walking on certain surfaces, and moving to bed and returning. Sleep quality and sepsis severity were the determinants capable of co-predicting ADL performance during hospitalization.

Implications for Nursing Practice

The results can be fundamental knowledge for future research studies to explore other potential predictive factors of ADLs. Moreover, nurses and multidisciplinary teams can include ADL determinants in rehabilitation plans. Lastly, healthcare providers should carefully consider protocols to reduce sepsis severity and enhance sleep by reducing noise levels. Experimental studies using predicting factors that could positively impact ADLs during hospitalization should be considered in the future.

Acknowledgments

We would like to thank the participants and all the people involved in this research.

References

1. Sepsis Alliance. Sepsis survivors [Internet]. 2022 [cited 2022 Sept 27]. Available from: https://www.sepsis.org/sepsis-survivor-week
2. Permpikul C, Sivakorn C, Tongyoo S. In-hospital death after septic shock reversal: a retrospective analysis of in-hospital death among septic shock survivors at Thailand's largest national tertiary referral center. Am J Trop Med Hyg. 2021;104(1):395-402. doi10.4269:/ajtmh.20-0896.
3. Huang CY, Daniels R, Lembo A, Hartog C, O›Brien J, Heymann T, et al. Life after sepsis: an international survey of survivors to understand the post-sepsis syndrome. Int J Qual Health Care. 2019;31(3):191-8. doi10.1093:/intqhc/mzy137.
4. Ferreira NA, Lopes AJ, Ferreira AS, Ntoumenopoulos G, Dias J, Guimaraes FS. Determination of functional prognosis in hospitalized patients following an intensive care admission. World J Crit Care Med. 2016;5(4):219-27. doi10.5492:/wjccm.v5.i4.219.
5. Mostel Z, Perl A, Marck M, Mehdi SF, Lowell B, Bathija S, et al. Post-sepsis syndrome - an evolving entity that afflicts survivors of sepsis. Mol Med. 2019;26(1):6. doi.10:1186/s10020-019-0132-z.

6. Beumeler LFE, van Wieren A, Buter H, van Zutphen T, Bruins NA, de Jager CM, et al. Patient-reported physical functioning is limited in almost half of critical illness survivors 1-year after ICU-admission: a retrospective single-centre study. PLoS One. 2020;15(12):e0243981. doi: 10.1371/journal.pone.0243981.
7. Doungsuriya P, Chanruangvanich W, Chayaput P, Thosingha O. Factors predicting severity of physiological deterioration among sepsis patients in emergency department. J Thai Nurse Midwife Counc. 2021;36(3): 134-50. Available from: https://he02.tci-thaijo.org/index.php/TJONC/article/view/249655 (in Thai).
8. Miyamoto K, Shibata M, Shima N, Nakashima T, Tanaka R, Nakamoto K, et al. Incidence and risk factors of worsened activities of daily living status three months after intensive care unit discharge among critically ill patients: a prospective cohort study. J Clin Med. 2022;11(7):1990. doi: 10.3390/jcm11071990.
9. Puthucheary ZA, Gensichen JS, Cakiroglu AS, Cashmore R, Edbrooke L, Heintze C, et al. Implications for post critical illness trial design: sub-phenotyping trajectories of functional recovery among sepsis survivors. Crit Care. 2020;24(1): 577. doi: 10.1186/s13054-020-03275- w.
10. Turjeman A, Koppel F, Franceschini E, Yahav D, Dolci G, Babich T, et al. Risk factors for functional decline among survivors of Gram-negative bloodstream infection: a prospective cohort study. PLoS One. 2021;16(11): e0259707. doi: 10.1371/journal.pone.0259707.
11. Nakano H, Hashimoto H, Mochizuki M, Naraba H, Takahashi Y, Sonoo T, et al. Hypoalbuminemia on admission as an independent risk factor for acute functional decline after infection. Nutrients. 2020;13(1):26. doi: 10.3390/nu13010026.
12. World Health Organization. International classification of functioning, disability and health (ICF) [Internet]. 2001 [cited 2022 Sept 15]. Available from: https://iris.who.int/bitstream/handle/10665/42407/9241545429.df;jsessionid=5650A1C035FC82 93AB79F798D7FABB36?sequence=1
13. Walter EJ, Hanna-Jumma S, Carraretto M, Forni L. The pathophysiological basis and consequences of fever. Crit Care. 2016;20(1):200. doi: 10.1186/s13054-016-1375-5.
14. Le Thuc O, Stobbe K, Cansell C, Nahon JL, Blondeau N, Rovère C. Hypothalamic inflammation and energy balance disruptions: spotlight on chemokines. Front Endocrinol (Lausanne). 2017;8:197. doi: 10.3389/fendo.2017.00197.
15. Yoshihara I, Kondo Y, Okamoto K, Tanaka H. Sepsis-associated muscle wasting: a comprehensive review from bench to bedside. Int J Mol Sci. 2023;24(5):5040. doi: 10.3390/ijms24055040.
16. Hyatt HW, Powers SK. Mitochondrial dysfunction is a common denominator linking skeletal muscle wasting due to disease, aging, and prolonged inactivity. Antioxidants (Basel). 2021;10(4):588. doi: 10.3390/antiox10040588.
17. Wang W, Xu C, Ma X, Zhang X, Xie P. Intensive care unit-acquired weakness: a review of recent progress with a look toward the future. Front Med (Lausanne). 2020;7:559789. doi: 10.3389/fmed.2020.559789.
18. Dobing S, Frolova N, McAlister F, Ringrose J. Sleep quality and factors influencing self-reported sleep duration and quality in the general internal medicine inpatient population. PLoS One. 2016;11(6):e0156735. doi: 10.1371/journal.pone.0156735.
19. Apitzsch S, Larsson L, Larsson AK, Linder A. The physical and mental impact of surviving sepsis - a qualitative study of experiences and perceptions among a Swedish sample. Arch Public Health. 2021;79(1):66. doi: 10.1186/s13690-021-00585-5.
20. Logie CH, Wang Y, Lacombe-Duncan A, Wagner AC, Kaida A, Conway T, et al. HIV-related stigma, racial discrimination, and gender discrimination: pathways to physical and mental health-related quality of life among a national cohort of women living with HIV. Prev Med. 2018;107:36-44. doi: 10.1016/j.ypmed.2017.12.018.
21. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, et al. The third international consensus definitions for sepsis and septic shock (Sepsis-3). JAMA. 2016;315(8):801-10. doi: 10.1001/jama.2016.0287.
22. Wakabayashi H, Sashika H. Malnutrition is associated with poor rehabilitation outcome in elderly inpatients with hospital-associated deconditioning a prospective cohort study. J Rehabil Med. 2014;46(3):277-82. doi: 10.2340/16501977-1258.

23. Borson S, Scanlan J, Brush M, Vitaliano P, Dokmak A. The mini-cog: a cognitive ‹vital signs› measure for dementia screening in multi-lingual elderly. Int J Geriatr Psychiatry. 2000;15(11):1021-7. doi: 10.1002/1099-1166(200011)15:11<1021::aid-gps234>3.0.co;2-6.
24. Vincent JL, Moreno R, Takala J, Willatts S, De Mendonça A, Bruining H, et al. The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. On behalf of the Working Group on Sepsis-Related Problems of the European Society of Intensive Care Medicine. Intensive Care Med. 1996;22(7):707-10. doi: 10.1007/BF01709751.
25. Snyder-Halpern R, Verran, JA. Instrumentation to describe subjective sleep characteristics in healthy subjects. Res Nurs Health. 1987;10(3):155-63. doi: 10.1002/nur.4770100307.
26. Rojjanakitti P. Relationships between personal factors, environmental factors, and sleep quality in surgical patients after operation [dissertation]. [Bangkok]: Chulalongkorn University; 2001.
27. Swanson KM. Caring professional scale. In: Watson J, editor. Assessing and measuring caring in nursing and health science. Springer; 2000. pp. 203-6.
28. Piyasiripan K. Caring behaviors of nurses as perceived by patients in intensive care unit [master's thesis]. [Chiang Mai]: Chiang Mai University; 2002.
29. Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. Md State Med J [Internet]. 1965 [cited 2022 Oct 20];14:61-5. Available from: https://www.kcl.ac.uk/nmpc/assets/rehab/tools-bi-functional-evaluation-the-barthel-index.pdf
30. Mapi Research Trust. Barthel Index (Barthel Index) [Internet]. 2022 Jan [cited 2022 Dec 8]. Available from: https://eprovide.mapi-trust.org/instruments/barthel-index
31. Arshad A, Ayaz A, Rehman S, Ukrani RD, Akbar I, Jamil B. Progression of acute kidney injury to chronic kidney disease in sepsis survivors: 1-year follow-up study. J Intensive Care Med. 2021;36(11):1366-70. doi: 10.1177/0885066620956621.
32. Liang CC, Yeh HC, Chen PS, Kuo CC, Chiang HY. Sepsis-associated acute kidney injury and acute kidney disease: a 15-year cohort study of 4,226 adult sepsis inpatient survivors at a tertiary medical center in Taiwan. Open Forum Infect Dis. 2021;8(Suppl 1):S6-7. doi: 10.1093/ofid/ofab466.008.
33. Voiriot G, Oualha M, Pierre A, Salmon-Gandonnière C, Gaudet A, Jouan Y, et al. Chronic critical illness and post-intensive care syndrome: from pathophysiology to clinical challenges. Ann Intensive Care. 2022;12(1):58. doi: 10.1186/s13613-022-01038-0.
34. Yang T, Li Z, Jiang L, Wang Y, Xi X. Risk factors for intensive care unit-acquired weakness: a systematic review and meta-analysis. Acta Neurol Scand. 2018;138(2):104-14. doi: 10.1111/ane.12964.
35. McLaughlin J, Chowdhury N, Djurkovic S, Shahab O, Sayiner M, Fang Y, et al. Clinical outcomes and financial impacts of malnutrition in sepsis. Nutr Health. 2020;26(3):175-8. doi: 10.1177/0260106020930145.
36. Darden DB, Kelly LS, Fenner BP, Moldawer LL, Mohr AM, Efron PA. Dysregulated immunity and immunotherapy after sepsis. J Clin Med. 2021;10(8):1742. doi: 10.3390/jcm10081742.
37. Mankowski RT, Anton SD, Ghita GL, Brumback B, Darden DB, Bihorac A, et al. Older adults demonstrate biomarker evidence of the persistent inflammation, immuno suppression, and catabolism syndrome (PICS) after sepsis. J Gerontol A Biol Sci Med Sci. 2022;77(1):188-96. doi: 10.1093/gerona/glab080.
38. Gritte RB, Souza-Siqueira T, Curi R, Machado MCC, Soriano FG. Why septic patients remain sick after hospital discharge? Front Immunol. 2021;11:605666. doi: 10.3389/fimmu.2020.605666.
39. Umberger RA, Thomas SP. Survivor but not fully recovered: the lived experience after 1 year of surviving sepsis. Dimens Crit Care Nurs. 2019;38(6):317-27. doi: 10.1097/DCC.0000000000000381.
40. Elías MN, Munro CL, Liang Z, Calero K, Ji M. Sleep and intensive care unit-acquired weakness in critically ill older adults. Dimens Crit Care Nurs. 2019;38(1):20-8. doi: 10.1097/DCC.0000000000000335.

ปัจจัยทำนายความสามารถในการปฏิบัติกิจวัตรประจำวันของผู้ที่รอดชีวิตจากภาวะติดเชื้อในกระแสเลือด : การศึกษาแบบภาคตัดขวาง

อุษณียาภรณ์ พลยุทธ วิมลรัตน์ ภู่วราวุฒิพานิช วารุณี พลิกบัว ยงค์ รงค์รุ่งเรือง*

บทคัดย่อ: ผู้ที่รอดชีวิตจากภาวะติดเชื้อในกระแสเลือด เป็นกลุ่มประชากรที่มีจำนวนเพิ่มมากขึ้นอย่างต่อเนื่อง อย่างไรก็ตาม กลุ่มประชากรเหล่านี้ได้รับผลกระทบจากการเจ็บป่วย ทำให้ความสามารถในการปฏิบัติกิจวัตรประจำวันด้วยตนเองลดลง การศึกษาวิจัยนี้จึงมีวัตถุประสงค์เพื่อศึกษาความสามารถทำนายความสามารถในการปฏิบัติกิจวัตรประจำวันขณะเข้ารับการรักษาในโรงพยาบาลในผู้ที่รอดชีวิตจากภาวะติดเชื้อในกระแสเลือด ภายใต้กรอบแนวคิดของบัญชีสากลเพื่อการจำแนกการทำงาน ความพิการและสุขภาพ กลุ่มตัวอย่าง คือ ผู้ที่รอดชีวิตจากภาวะติดเชื้อในกระแสเลือดมากกว่า 48 ชั่วโมง ที่เข้ารับการรักษาในหอผู้ป่วยสามัญอายุรกรรมโรงพยาบาลมหาวิทยาลัยแห่งหนึ่งในประเทศไทยซึ่งถูกคัดเลือกโดยการสุ่มแบบเจาะจง จำนวน 109 ราย เครื่องมือที่ใช้ในการเก็บข้อมูล ประกอบด้วย ข้อมูลส่วนบุคคลและประวัติการเจ็บป่วยในปัจจุบัน แบบประเมินการล้มเหลวของอวัยวะ แบบประเมินคุณภาพการนอนหลับของเวอแรนและสไนเดอร์-ฮาลเพิร์น แบบประเมินการได้รับแรงสนับสนุนจากบุคลากรด้านสุขภาพ และแบบประเมินความสามารถในการปฏิบัติกิจวัตรประจำวันของบาร์เทล สถิติที่ใช้ในการวิเคราะห์ข้อมูล คือ การวิเคราะห์ถดถอยและสหสัมพันธ์เชิงเส้นพหุคูณ

ผลการศึกษาพบว่ากลุ่มตัวอย่างร้อยละ 45.9 มีภาวะพึ่งพา โดยอายุ คุณภาพการนอนหลับและความรุนแรงของภาวะติดเชื้อในกระแสเลือดสามารถร่วมกันทำนายความสามารถในการปฏิบัติกิจวัตรประจำวันขณะเข้ารับการรักษาในโรงพยาบาลของผู้ที่รอดชีวิตจากภาวะติดเชื้อในกระแสเลือดได้ร้อยละ 50.6 พยาบาลและทีมสุขภาพสามารถประยุกต์ใช้ความรู้จากการศึกษานี้ในการดูแลและจัดการปัจจัยทำนาย เพื่อส่งเสริมความสามารถในการปฏิบัติกิจวัตรประจำวันขณะเข้ารับการรักษาในโรงพยาบาล อย่างไรก็ตาม ในการศึกษาในอนาคต อาจพิจารณากำหนดช่วงการประเมินความสามารถในการปฏิบัติกิจวัตรประจำวันและศึกษาวิจัยแบบระยะยาวร่วมด้วย

Pacific Rim Int J Nurs Res 2025; 29(2) 343-355

คำสำคัญ: ภาวะติดเชื้อในกระแสเลือด ผู้รอดชีวิต ความสามารถในการปฏิบัติกิจวัตรประจำวัน ความรุนแรงคุณภาพการนอนหลับ ระดับอัลบูมินในเลือด แรงสนับสนุนจากบุคลากรด้านสุขภาพ

อุษณียาภรณ์ พลยุทธ *นักศึกษาปริญญาโท หลักสูตรพยาบาลศาสตรมหาบัณฑิต (หลักสูตรนานาชาติ) สาขาวิชาการพยาบาลผู้ใหญ่และผู้สูงอายุ คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล E-mail: udsaneyaporn.pol@student.mahidol.ac.th*
ติดต่อที่ : วิมลรัตน์ ภู่วราวุฒิพานิช *รองศาสตราจารย์ คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล E-mail: wimolrat.puw@mahidol.ac.th*
วารุณี พลิกบัว *ผู้ช่วยศาสตราจารย์ คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล E-mail: warunee.phl@mahidol.ac.th*
ยงค์ รงค์รุ่งเรือง *รองศาสตราจารย์คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล E-mail: yong.ron@mahidol.ac.th*