

Factors influencing health-related quality of life among post-sepsis patients at a university hospital in Bangkok Metropolitan Region

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ABSTRACT

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This study aimed to determine the predictive power of neutrophil-lymphocyte ratios (NLRs), comorbidities, fatigue, and social support over health-related quality of life among post-sepsis patients. The sample consisted of 157 purposively selected post-sepsis patients aged ≥ 18 years who had been treated at the internal medicine ward, Siriraj Hospital. The forms included personal information and illness history, NLRs, Charlson comorbidity index, piper fatigue scale, The multidimensional scale of perceived social support, and the Euro QOL EQ-5D-5L. The data were analyzed using descriptive statistics and multiple regression analysis. According to the analysis, the sample had a poor level of health-related quality of life scores ($\bar{x} = 0.298$, $SD = 0.424$). Multiple regression analysis showed that all independent variables were able to copredict health-related quality of life among post-sepsis patients at 69.3% ($R^2 = .693$, $F = 85.953$, $p < .01$). NLRs, fatigue, and social support contributed to health-related quality of life among post-sepsis patients with statistical significance ($\beta = -.131$, $p < .01$, $\beta = -.276$, $p < .05$, $\beta = -.580$, $p < .01$, $\beta = .099$, $p < .05$, respectively).

Keywords: health-related quality of life (HRQOL); sepsis survival; neutrophil-lymphocyte ratios (NLR); fatigue; comorbidity; social support

1. INTRODUCTION

The fast-track service model for sepsis was introduced under 1 hr. Bundle of Care (Levy et al., 2018) along with the development of an effective care system focusing on timely detection and treatment. As a result, the survival rate in patients with sepsis has increased. Based on studies in six countries from 2011 to 2019, the mortality rate decreased by 22.6% (Taj et al., 2022). In Thailand, the survival rates were 67.8% and 71.9% in 2018 and 2019 respectively (Strategy and Planning Division, Ministry of Public Health,

2019). Despite the higher survival rates, patients' health-related quality of life has decreased in all health dimensions (König et al., 2019; Nannan Panday et al., 2019). After hospital discharge, these survivors greatly suffer from physical and mental impairments that considerably affect their daily lives, lasting up to 60 months after the illness (Cuthbertson et al., 2013).

The neutrophil-lymphocyte ratio (NLR) indicates the severity of sepsis at a level that is comparable to other methods such as the acute physiology and chronic health evaluation (APACHE II), sequential organ failure assessment,

and simplified acute physiology score (SAPS II) (Velissaris et al., 2018). Sepsis together with high NLRs since hospitalization correlate with higher mortality rates (Heffernan et al., 2012; Hwang et al., 2017). Fatigue is the perception of post-sepsis patients concerning feelings of weakness, discomfort, exhaustion, and lack of motivation in daily life affecting their health-related quality of life (König et al., 2019). The rate for post-sepsis patients' feeling of fatigue during the 7-day post-sepsis period was as high as 46.1% (Huang et al., 2019), which affects their health-related quality of life (Poulsen et al., 2009).

Comorbidities represent a personal factor whereby post-sepsis patients with comorbidities have a statistically significant lower level of physical and mental quality of life than those without comorbidities (Erbs et al., 2019). Moreover, the presence of comorbidities in post-sepsis patients correlate with lower physical quality of life (Nannan Panday et al., 2019). Social support during hospitalization after surviving an illness affects long-term recovery in relation to daily life and is associated with daily living, including health-related quality of life after hospital discharge (Prescott and Costa, 2018). Post-sepsis patients often recognize the importance of family support as a refuge, enabling them to continue to live happily (König et al., 2019).

According to the literature review, the health-related quality of life of post-sepsis patients after hospital discharge has been extensively studied, but studies during the pre-discharge period are limited. This study aimed to investigate the factors influencing the health-related quality of life in post-sepsis patients who were being prepared for hospital discharge. These include rapid inspection and evaluation to find solutions in a timely manner, which will be useful in assessing nursing problems during the recovery phase before hospital discharge, increasing the quality of nursing care, and promoting the health-related quality of life.

2. MATERIALS AND METHODS

2.1 Study design and participants

This study was developed based on the revision of Wilson and Cleary's health-related quality of life conceptual model by Ferrans et al. (2005). Health-related quality of life is the perception of post-sepsis patients about the impacts of the disease and treatment on their daily life. The variables considered in this study included characteristics of the individual (comorbidities), biological and physiological factors and indicators of disease severity (NLR), symptom status (fatigue), and environmental factors (social support). This concept is related to biological, physiological, and social factors. Its holistic coverage of health dimensions makes it appropriate for studying the health-related quality of life of post-sepsis patients.

This was a predictive correlational study. The sample consisted of post-sepsis patients who had been admitted to the inpatient department, general internal medicine ward, at a university hospital in Bangkok, Thailand, from April to July 2022. The patient all had symptoms considered to not fit the diagnosis criteria according to the third international consensus definitions for sepsis and septic shock (sepsis-3) for ≥ 48 h before hospital discharge. This study was approved by the Institutional Review Board, Faculty of Nursing, Mahidol University, and the Faculty of

Medicine, Siriraj Hospital, Project Code (CoA No. IRB-NS2022/654.0802). Written informed consent was obtained from all patients.

The sample was selected by purposive sampling. The inclusion criteria were to have recovered from sepsis between 3 to 14 days before the study day; a physician's discharge order; good consciousness before hospital discharge; and an accurate perception of dates, times, and places during data provision. In cases where patients were aged ≥ 60 years, they had to have normal cognitive function with the ability to comprehend and communicate in Thai through listening, speaking, reading, and writing. The exclusion criteria were medical diagnosis of psychiatric and neurological disorders, such as schizophrenia and major depressive disorder, and comorbidities diagnosed by a physician as in the stage of end-of-life care, such as cancer, kidney disease, pregnancy, and COVID-19 with sepsis. The sample size was determined using the G*Power program version 3.1.9.4 (Faul et al., 2009). Predictive correlations were analyzed using multiple regression by setting the power of test at .80 and reliability at $(\alpha) = .05$. The effect size was chosen as per another study on correlations between comorbidities and health-related quality of life among post-sepsis patients, which was -0.27 (Poulsen et al., 2009), with the number of predictors at $k = 4$ variables, resulting in 157 subjects.

2.2 Outcome measurement

The researcher collected data in person. Written informed consent was obtained from all patients before data collection. Dementia screening was conducted among subjects aged >60 years using Mini-Cog, mini-cognitive assessment instrument (Borson et al., 2003; Trongsakul et al., 2015).

Data were collected through interviews and questionnaires using the demographic data record form consisting of age, sex, marital status, caregivers after hospital discharge, treatment rights, quick sepsis-related organ failure assessment (qSOFA), body mass index, laboratory results on the first hospital admission including albumin level, serum lactate level, diagnosis, location of infection, and NLR in the treatment records.

Health-related quality of life was assessed using Euro EQ-5D-5L (Pattanaphesaj et al., 2018), which consists of two parts. The first part contained five questions on five dimensions of health consisting of mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Scoring was based on how were problematic patients perceived these issues off "no problem," "minor problems," "medium problems," "major problems," and "most problematic." The total score ranged from -0.283 to 1, where 0 indicated death and 1 indicated the healthiest. Negative scores meant patients had a condition that was considered worse than death. The second part was a visual analog scale (VAS) with a score ranging from 0 to 100. A maximum score meant the best health imaginable and zero meant the worst health imaginable.

Comorbidities were assessed using the Charlson comorbidity index (CCI) (Charlson et al., 2007). The instrument consisted of 20 comorbidities and the use of one type of anticoagulants. In scoring, 1, 2, 3, or 6 points were awarded based on disease severity. Patients without comorbidities received a score of 0. The instrument had a score ranging from 0 to 39. High scores indicated severe comorbidities, while low scores indicated low-severity comorbidities.

Fatigue was assessed using the Piper fatigue scale (Reeve et al., 2012). The instrument contained 12 questions in four areas consisting of behavior and fatigue severity (3 questions), perceived meaning of fatigue (3 questions), feeling of personal physical and psychological fatigue (4 questions), and feeling of intellectual and emotional fatigue (2 questions). Each question was rated on a visual analogue scale. Responses for each question were indicated ranging from 0 to 10, with 0 indicating no feeling toward that message and ≥ 1 indicating increased feelings toward that message. Respondents with low scores had low fatigue, and those with high scores had higher fatigue.

Social support was assessed using the multidimensional scale of perceived social support (MSPSS) (Zimet et al., 1988). The instrument contained 12 questions divided into four questions on social support from family, four questions on social support from friends, and four questions on social support from significant others. Scores were measured on a seven-point Likert scale ranging from "highest agreement" to "highest disagreement." Low scores indicated low social support, and high scores indicated high social support.

The Euro QOL (EQ-5D-5L), Piper fatigue scale, and MSPSS were applied to 30 patients with similar characteristics to the participants in the present study using Cronbach's alpha coefficient formula. Cronbach's alpha coefficients were 0.930, 0.952, and 0.987, respectively.

2.3 Statistical analysis

Data were analyzed using the statistical package of Social sciences, version 25, with statistical significance set at .05. For the descriptive analysis, data were analyzed through frequency distribution, percent, maximum, minimum, mean, median, and standard deviation. Predictive power over health-related quality of life of NLRs, comorbidities, fatigue, and social support were evaluated using all enter multiple regression analysis.

3. RESULTS AND DISCUSSION

3.1 Demographic characteristics and history of illness and treatment

The sample consisted of 157 post-sepsis patients of which 56.1% were male. The mean age was 62.81 years (SD = 15.4).

Regarding data on the characteristics of illness with sepsis, a majority had a qSOFA score of 3 points (73.2%). All patients had been diagnosed with sepsis and septic shock (33.8%). The most frequent site of infection was the respiratory system (45.2%). The sample had body mass indices ranging from 18.5 to 22.9 (56.1%) and a length of hospital stay of 10–12 days (28%), with a mean of 9.97 days. Demographic data, data on characteristics of illness with sepsis, and laboratory results on the first hospital admission are described in (Table 1).

Table 1. Patient characteristics of the study population (n = 157)

| Characteristics | Value |
|---|--------------|
| Sex (Male) | 88 (56.1) |
| Age (years) | 62.81±15.4 |
| Married | 100 (63.7) |
| Caregiver assigned after hospital discharge | 155 (98.7) |
| Guaranteed universal health care (30 baht) | 69 (43.9) |
| qSOFA score | |
| 2 points | 42 (26.8) |
| 3 points | 115 (73.2) |
| Cause of infection | |
| Respiratory system | 71 (45.2) |
| Urinary system | 39 (24.8) |
| Gastrointestinal system | 18 (11.5) |
| Body mass index | 20.97 ± 3.05 |
| Length of hospital stay (day) | 9.97 ± 3.41 |
| Serum albumin level (g/dL) | 2.86 ± 0.47 |
| Hemoglobin level (g/dL) | 9.66 ± 1.88 |
| Serum lactate level (mmol/L) | 3.23 ± 1.52 |

Note: Values are presented as mean±SD, or by number and percentage. Laboratory results are based on records at hospital admission

3.2 NLRs, comorbidities, fatigue, and social support in post-sepsis patients

The sample of post-sepsis patients had a mean NLR of 41.03% (SD = 21.02), mean comorbidity score of 3.92

(SD= 2.995), a high mean fatigue level of 6.691 (SD = 2.048), and a medium social support level at a mean of 59.26 (SD = 16.171) (Table 2).

Table 2. Neutrophil-lymphocyte ratios, comorbidities, fatigue, and social support in post- sepsis patients (n = 157)

| Variable | Possible range | \bar{x} | SD | Minimum | Maximum |
|----------------|----------------|-----------|--------|---------|---------|
| NLR (%) | >10 | 41.03 | 21.02 | 4.62 | 86.00 |
| Comorbidity | 0–39 | 3.92 | 2.995 | 0 | 11 |
| Fatigue | 0–10 | 6.691 | 2.048 | 2.42 | 10.000 |
| Social support | 12–84 | 59.26 | 16.171 | 30 | 84 |

Note: NLR = neutrophil-lymphocyte ratio

3.3 Health-related quality of life in post-sepsis patients

The post-sepsis patients had health-related quality of life scores at a poor level (\bar{x} = 0.298, SD = 0.424), and the mean

EQ-VAS score for health was at 44.18. The sample's health-related quality of life in five dimensions (EQ-5D-5L) are described in (Table 3).

Table 3. Health-related quality of life in post-sepsis patients (n = 157)

| Variable | Possible range | \bar{x} | SD | Minimum | Maximum |
|-----------------------------------|----------------|-----------|--------|---------|---------|
| Five dimensional HRQOL (EQ-5D-5L) | -0.283-1 | 0.298 | 0.424 | -0.283 | 0.927 |
| Mobility | 0-0.307 | 0.176 | 0.101 | 0 | 0.307 |
| Self-care | 0-0.254 | 0.146 | 0.095 | 0 | 0.254 |
| Usual activities | 0-0.207 | 0.104 | 0.073 | 0 | 0.207 |
| Pain/discomfort | 0-0.266 | 0.141 | 0.106 | 0 | 0.266 |
| Anxiety/depression | 0-0.249 | 0.135 | 0.100 | 0 | 0.249 |
| EQ-VAS | 0-100 | 44.18 | 26.995 | 0 | 90 |

Note: NLR = neutrophil-lymphocyte ratio

According to the results from all enter multiple regression analyses, NLRs, comorbidities, fatigue, and social support copredicted health-related quality of life at 69.3 (R^2 = .693, F = 85.953, p < .01). Fatigue had the highest

significance in predicting health-related quality of life of post-sepsis patients, followed by comorbidities, NLRs, and social support (Table 4).

Table 4. Results of the all enter multiple regression analysis: predictors of health-related quality of life in post-sepsis patients (n = 157)

| | b | SE _b | β | t | p-value |
|----------------|-------|-----------------|---------|---------|---------|
| Constant | 1.207 | .126 | | 9.618 | .000** |
| NLR (%) | -.003 | .001 | -.131 | -2.816 | .006** |
| Comorbidity | -.039 | .007 | -.276 | -5.273 | .000** |
| Fatigue | -.120 | .011 | -.580 | -10.997 | .000** |
| Social support | .003 | .001 | .099 | 2.018 | .045* |

Note: SE_{est} = \pm .238, R = .833, R^2 = .693, Adjusted R^2 = .685, F = 85.953, * p < .05, ** p < .01

NLR = neutrophil-lymphocyte ratio; SE_{est} = standard error of estimate

In this study, post-sepsis patients were found to have a mean overall health-related quality of life score of 0.298 (SD = 0.424) and a mean health score (EQ-VAS) of 44.18 (SD = 26.995). These were poor levels, below the reference score criteria from previous studies (Honselmann et al., 2015; Hammond et al., 2020). This may be because the majority of the subjects were elderly, aged ≥ 60 years. Elderly patients generally have declining immune function (Iskander et al., 2013). This study conforms to the result of a previous study reporting that being elderly is associated with lower health-related quality of life post-sepsis (Rahmel et al., 2020; Puthucheariy et al., 2020; Oh and Song, 2021). Furthermore, the present study also found that patients who had survived severe sepsis had qSOFA scores of 3 (73.2%) and mean serum lactate levels of 3.23 mmol/L, which is higher than the normal criteria. These characteristics of disease severity predicted health-related quality of life among post-sepsis patients (Honselmann et al., 2015; Su et al., 2018). The sample had lengths of hospital stay at 10–12 days, in which a longer length of hospital stays reflected disease severity and complications requiring continual treatment with effects on health-related quality of life among post-sepsis patients (Honselmann et al., 2015).

Moreover, the study was conducted before hospital discharge, wherein health-related quality of life scores are

lower than those after hospital discharge. Returning to their families and environments with psychological and social support helps patients enjoy a better quality of life. When the dimensions of health-related quality of life were considered, most post-sepsis patients had significant mobility, bathing or dressing problems, and other effects on their daily living activities. A majority of the sample had pain or discomfort and felt anxious or depressed. This study conforms to the result of a previous study by Nannan Panday et al. (2019). Furthermore, health-related quality of life declined at all stages after discharge from an intensive care unit, including to a general patient ward and hospital discharge (Hofhuis et al., 2008).

According to the findings of this study, NLR, comorbidities, fatigue, and social support copredicted health-related quality of life as NLRs indicate the severity of sepsis. Previous studies have shown that sepsis patients with high NLRs from the time of hospital admission correlate with hospital mortality rates (Heffernan et al., 2012; Hwang et al., 2017; Ren et al., 2022). Moreover, high NLRs during sepsis usually lead to muscle weakness, causing fatigue and forcing these patients to cope with long-term disability after the illness (Aktürk and Büyükcavcı, 2017; Lee and Giuliani, 2019).

Fatigue is a result of damage to muscles and nervous systems during illness, reducing activities of daily living after

illness and leading to long-term disability (Rocheteau et al., 2015; Lee and Giuliani, 2019). Not only is fatigue a physical weakness, it is a perception of tiredness, weakness, discomfort, exhaustion, and lack of motivation in activities of daily living with effects on health-related quality of life (König et al., 2019). The findings were consistent with a study conducted to explore physical and psychological impacts among post-sepsis patients reporting significant fatigue and exhaustion with significant effects on quality of life in the sample (Apitzsch et al., 2021).

The post-sepsis patients had a mean comorbidity score of 3.92 (SD = 2.995) with a maximum score of 11. Comorbidities are a factor that increases sepsis severity, resulting in lower recovery rates. Consequently, the quality of life is also lower (Winters et al., 2010). This result conforms to the results of a previous study stating that CCI scores >3 in post-sepsis patient were associated with a decrease in physical quality of life. Furthermore, the presence of chronic obstructive pulmonary disease, heart failure, or diabetes mellitus in post-sepsis patients negatively correlated with health-related quality of life (Nannan Panday et al., 2019), with statistical significance.

Based on the present study, social support of post-sepsis patients was found to be at a medium level at a mean of 59.26 (SD=16.171). This indicated that post-sepsis patients with high social support from family, friends, the public healthcare system, and society tend to have a high quality of life. While in an intensive care unit or hospital, attachment and engagement with families is important. They have consequential effects on long-term recovery, while also being correlated with a better life and health-related quality of life post-hospital discharge (Prescott and Costa, 2018).

The limitation of this study was that it was a qualitative study that focused on post-sepsis patient only during the course of the study and before hospital discharge. This prevented identification of problems encountered after hospital discharge and comparison of quality of life over different periods. Longitudinal studies should be conducted on health-related quality of life with comparisons of quality of life over different periods to determine how to promote health-related quality of life among post-sepsis patients.

4. CONCLUSION

NLRs, comorbidities, fatigue, and social support can copredict health-related quality of life among post-sepsis patients. Nurses should assess health-related quality of life in patients after sepsis before hospital discharge in addition to recognizing the physical, psychological, and social impacts, promoting nutrition during hospitalization to enhance immunity in the fight against severe sepsis, providing physical rehabilitation to reduce the severity of fatigue symptoms, and supporting the social needs of patients to have better health-related quality of life.

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