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The association between posttraumatic stress symptoms and hope following intensive care unit discharge: Findings from a longitudinal cohort study

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ABSTRACT

Background: Hope is essential for mental health in general and for recovery following severe illness. However, the associations between posttraumatic stress symptoms (PTSS) and hope among intensive care unit (ICU) survivors has not been investigated.

Objectives: To assess hope at 3, 6 and 12 months after ICU admission and examine possible associations between hope and selected demographic data, clinical characteristics, and 3-month PTSS-levels among ICU patients.

Methods: ICU-patients from Norway self-reported on hope using Herth Hope Index. Data on demographics and clinical characteristics were collected from patient reports and medical records. PTSS were analysed 3 months after admission, using descriptive statistics and linear mixed model regression analyses.

Results: A total of 73 adult ICU survivors were included (male $n = 45$ (61.6%); median age 66 years [IQR: 51.0;74.0]). Median hope scores were 41, 40, and 42 at 3, 6 and 12 months, respectively. A clinically minor but statistically significant reduction in hope was registered at 6 months ($B = -1.24$; 95% confidence interval [CI]: -2.25, -0.23; $p = 0.016$). Lower levels of PTSS 3 months after admission ($B = -0.13$; 95% CI [-0.23, -0.03]; $p = 0.015$) and being employed before admission ($B = 5.87$; 95% CI [1.85, 9.88]; $p = 0.004$) were significantly associated with higher hope during the first year after admission. A small but statistically significant association was also found between higher hope and a more extended hospital stay ($B = 0.08$; 95% CI [0.00, 0.15]; $p = 0.042$).

Conclusions: Hope scores remained stable during the first year after ICU admission. Lower levels of PTSS at 3 months after admission, being employed prior to admission, and having longer hospital stay were associated with higher hope during the first year after admission. Given the small sample, more research in larger samples is needed to enhance the clinical relevance of these findings.

Introduction

Hope has been described as a basic human need and a multi-dimensional and future-oriented life force characterized by a confident

yet uncertain expectation of achieving a promising future.¹ To the individual, this expectation is realistically possible and personally significant.¹ Hope is essential to be able to cope with daily life when faced with an uncertain future, for example, when dealing with disease or

Abbreviations: ICU, intensive care unit; PTSS, post-traumatic stress symptom; HHI, Herth Hope Index.

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illness.^{2,3} Hope may interact with social and psychological dimensions of well-being, such as being satisfied with life, being attached to others, or being capable of overcoming obstacles such as when coping with difficulties.⁴

There have been several studies on the concept of hope.^{5,6} In a qualitative study of 20 patients with spinal cord injuries, hope served as a force for overcoming difficulties during different phases of the recovery process.⁷ Studies on hope in the general population found that hope may vary substantially, depending on the respondents' life situations and the tools used to quantify hope.^{8,9} In addition to the general population, hope has been studied in medical,¹⁰ surgical,¹¹ and psychiatric³ patient groups as well as family members of patients admitted to the intensive care unit (ICU).^{12,13} Studies emphasize that previous life experiences influence hope^{3,8} and that hope is essential for quality of life,^{3,5} mental health³ and recovery following illness.^{10,11} Studies reporting on hope among ICU survivors are scarce, with most relying on qualitative data.^{14–16} In one such study in which ICU patients were interviewed shortly after discharge from the ICU, the overarching theme 'hope at a crossroads' reflected the importance of the overall patient experience of hope in critical illness.¹⁴ There have been some quantitative studies on the levels of hope among ICU patients.^{17,18} In one, the Herth Hope Index (HHI, range: 12–48) mean score 3 months after ICU admission was 39 (standard deviation, [SD] = 5).¹⁷ In another, a mean score of 9 (SD = 2) was reported on a 1-item scale measuring hope from 1 (no hope) to 10 (filled with hope) 2 to 4 days after the ICU discharge.¹⁸ In both studies, the levels of hope were high. However, neither study reported the trajectory of hope during the first year after ICU admission.

Patients who are admitted to the ICU may have frightening recollections and delusions of being critically ill.^{19,20} In some cases, this may lead to post-traumatic stress symptoms (PTSS).²¹ PTSS is one of the most distressing mental health challenges among ICU survivors, with a prevalence of PTSS of 16% reported 3 months after ICU admission in a systematic review and meta-analysis.²² To our knowledge, no study has investigated whether the level of PTSS during recovery and rehabilitation in the first few months after ICU admission is associated with hope during the later months (i.e., 12 months after ICU admission).

Therefore, the aim of the present study was to assess hope at 3, 6, and 12 months after ICU admission and examine possible associations between hope and selected demographic data, clinical characteristics, and 3-month PTSS.

Methods

Study design

This longitudinal cohort study is part of a multi-center study named 'Symptoms, Vital Signs and Their Effects on Functioning and Quality of Life in Intensive Care Patients' [NCT03714230]. We published the results of possible predictive factors for PTSS at 3 months after ICU admission²³ and the association between specific groups of predictive factors and PTSS during a 1-year follow-up.²⁴ Patients or their proxies (caregivers) were informed and gave written consent until patients were competent enough to agree or disagree with study participation.

Setting and participants

Patients in this report were recruited from January to June 2020 at four ICUs (one medical, one surgical, one mixed and one medical high-dependency unit) in two hospitals in Norway. All ICUs provided advanced high-technological 24-hour intensivist-led care, where the patient-nurse ratio was 1:1. ICU patients ≥ 18 years were included if they received mechanical ventilation (MV) or continuous vasoactive drug infusions or continuous monitoring ≥ 24 h and could respond to the Herth Hope Index (HHI) 3 and at 6 or 12 months after ICU admission. The exclusion criteria were as follows: pre-defined cognitive deficits (e. g., dementia), an inability to read or write in Norwegian, re-admittance

to the ICU within 72 h, ICU admission because of organ preservation, or patients having no permanent address.

Ethical approval

The Regional Ethics Committee for Medical Research of South-East Norway (2017/990–1), hospital data security officers, and departmental leadership at each ICU approved the study. Study participation was voluntary according to the Helsinki Declaration²⁵ and participants could retract their consent at any time without reason.

Data collection

Demographic data (gender, age, educational level, civil status, and employment status before admission) were collected from the patients (or proxies if the patients were unable to self-report) as soon as possible after inclusion in the study. Data on *clinical characteristics* were collected from medical records and included type of ICU admission, comorbidity profile (Charlson Comorbidity Index [CCI]²⁶; range: 0–33), level of frailty (Clinical Frailty Scale [CFS]²⁷; range: 1–9), severity of disease (Simplified Acute Physiology Score [SAPS II]²⁸; range: 0–163), nurses' workload (Nine Equivalents of Nursing Manpower Use Score [NEMS]²⁹; range: 0–56 points per day), time spent on MV and length of hospital and ICU stay (days).

Posttraumatic stress symptoms (PTSS)

The patients self-reported PTSS on paper or electronic questionnaires 3 months after ICU admission. PTSS was measured by the Impact of Event Scale-Revised (IES-R)³⁰ (range: 0–88, with a higher score implying a higher symptom level). The IES-R has been previously validated for measuring adequate psychometric properties in physical trauma patients³¹ and acute lung injury patients.³² The IES-R has shown high inter-rater reliability³³ and high internal consistency ($\alpha = 0.96$).³⁴ In our study, internal consistency for all items in the IES-R 3 months after ICU admission was 0.95 (Cronbach's alpha).

Hope

The primary outcome was hope. The patients self-reported their levels of hope 3, 6, and 12 months after ICU admission using the HHI questionnaire³⁵ (range: 12–48, with a higher score indicating higher hope). The HHI contains 12 items scored from 1 (strongly disagree) to 4 (strongly agree). The HHI is a validated instrument originally developed to measure hope among acute, chronic, or terminally ill adults.³⁵ It has been widely used in diverse groups, such as patients with heart failure,¹⁰ ICU caregivers,¹³ and the general population.^{9,36} The HHI has satisfactory criterion validity ($r = 0.81–0.92$) in acutely, chronically, or terminally ill patients³⁵ and high internal consistency ($\alpha = 0.81$) in the general population.³⁶ We calculated the internal consistency of the HHI at 3 months after ICU admission using all 12 items (i.e., total score), and Cronbach's alpha was 0.91.

Statistical analyses

All data analyses were performed using Stata/SE 17 software.³⁷ Descriptive statistics were used for demographic and clinical data. Counts and percentages were used to describe prevalences and categorical variables. Continuous variables that were skewed are presented as medians with interquartile ranges (IQRs). Mean scores and SDs are reported to compare our HHI data with findings from other studies, such as data from general populations. For comparisons between pairs of variables with skewed distributions, we used the non-parametric Mann–Whitney Wilcoxon test. We used Pearson's chi-square test to compare pairs of categorical variables. The comparison analyses did not include the missing values described in Table 1. We used Cronbach's alpha to

Table 1

Characteristics of the responders (study sample, $n = 73$) and non-responders ($n = 156$) to the HHI questionnaire 3 and at 6 or 12 months after ICU admission.

Demographics and clinical characteristics	Study sample ($n = 73$)		Non-responders ($n = 156$)		P-value
	n	(%)	n	(%)	
Gender					0.864 ^a
Male	45	(61.6)	98	(62.8)	
Female	28	(38.4)	58	(37.2)	
Civil status					0.194 ^a
Married/partner	43	(74.1)	74	(64.3)	
Unmarried/divorced/widowed	15	(25.9)	41	(35.7)	
Missing ($n = 15$ vs. 41)					
Education level					0.444 ^a
Primary/secondary school	37	(63.8)	80	(69.6)	
College/university	21	(36.2)	35	(30.4)	
Missing ($n = 15$ vs. 41)					
Employment status					
Unemployed/on sick leave/with disability	10	(17.0)	34	(29.3)	
Full-time/ part-time	20	(33.9)	31	(26.7)	
Retired	29	(49.1)	51	(44.0)	
Missing ($n = 14$ vs. 40)					
Type of admission					0.021 ^{ab}
Non-surgical	49	(67.1)	130	(83.3)	0.006 ^{ab}
Elective surgery	8	(11.0)	8	(5.1)	0.107 ^a
Emergency surgery	16	(21.9)	18	(11.6)	0.040 ^{ab}
	Median	(IQR)	Median	(IQR)	
Age	66.0	(51.0; 74.0)	65.0	(51.5; 74.0)	0.918 ^b
Simplified Acute Physiology Score II (total score)	39.0	(32.0; 50.0)	42.0	(34.0; 53.5)	0.209 ^b
Nine Equivalents of Nursing Manpower Use Score (per day)	31.3	(25.3; 36.5)	32.0	(26.0; 37.5)	0.544 ^b
Missing ($n = 0$ vs. 1)					
Length of stay in hospital (days)	13.0	(5.9; 19.8)	9.4	(5.6; 15.6)	0.099 ^b
Length of stay in the intensive care unit (days)	2.9	(1.8; 5.8)	2.8	(1.8; 6.3)	0.562 ^b
Mechanical ventilation (days)	1.4	(0.6; 10.6)	1.5	(0.4; 6.3)	0.674 ^b
Missing ($n = 26$ vs. 56)					
Invasive ventilation (days)	1.5	(0.9; 10.8)	3.8	(1.6; 14.5)	0.328 ^b
Missing ($n = 50$ vs. 122)					
Non-invasive ventilation (days)	0.6	(0.2; 0.9)	0.5	(0.2; 1.0)	
Missing ($n = 60$ vs. 109)					0.595 ^b
Charlson Comorbidity Index (total score)	3.0	(1.0; 5.0)	5.0	(2.0; 7.0)	0.002 ^{ab}
Clinical Frailty Scale (total score)	2.0	(2.0; 3.0)	3.0	(2.0; 4.0)	<0.001 ^{ab}
Missing ($n = 20$ vs. 52)					
PTSS, anxiety, and depression at 3 months	Median	(IQR)	Median	(IQR)	
Impact of Event Scale-Revised	10.0	(3.0; 25.0)	14.0	(5.0; 33.0)	0.386 ^b
Missing ($n = 2$ vs. 113)					
Hospital Anxiety and Depression Scale-Anxiety	2.0	(0.0; 7.0)	3.0	(1.0; 6.0)	0.436 ^b
Missing ($n = 0$ vs. 111)					
Hospital Anxiety and Depression Scale-Depression	2.0	(1.0; 4.0)	3.0	(2.0; 5.0)	0.059 ^b
Missing ($n = 0$ vs. 111)					

Abbreviations: IQR = interquartile range; P-value = significance level. HHI = herth hope index. Missing = missing answers in each group. PTSS = posttraumatic stress symptoms.

* = significant with a P-value of < 0.05.

^a = Pearson's chi-square test.

^b = Mann-Whitney Wilcoxon test.

calculate the internal consistency of the HHI and IES-R items 3 months after ICU admission.³⁸

We used linear mixed models for repeated measures (LMM) with an unstructured covariance matrix to analyze the changes in hope over time.³⁹ To model the effect of time, we generated a time variable with three categories (one category for each assessment point). The 3-month hope score was used as reference value in all analyses. The unstructured covariance matrix used in the model allowed for an uneven distribution of measurement points across time. LMM is a family of very flexible statistical models and, when using an unstructured covariance matrix, no parametric structure is forced on the data, thus ensuring a good model fit. Using LMM for repeated measures addresses possible intra-patient dependencies, e.g., statistical dependencies, as the same patient was measured several times. This choice of statistical model did not require imputation of missing data.⁴⁰

First, PTSS, demographic, and clinical data were analyzed using a separate univariate LMM, with hope as the dependent variable. In all

such univariate LMMs, we also included interaction terms between each variable and time-variable hope. Supplementary Table 1 presents the results of the univariate analyses. Then, we included the variables which, in the univariate analyses, had a p-value < 0.05 in a multivariate model. In the multivariate model, variables with the highest p-values were removed before a new analysis model was run, and this process was repeated until four variables remained in the final model (Table 4) to avoid overfitting. As we were interested in absolute changes in hope over time, the results are expressed as regression coefficient (b) with 95% confidence intervals (CI). The estimates of regression coefficient beta can be interpreted as the effect of a one-unit change in a given variable on the overall levels of hope. P-values of < 0.05 were considered statistically significant for all analyses. All analyses are considered exploratory, so no correction for multiple testing was done.

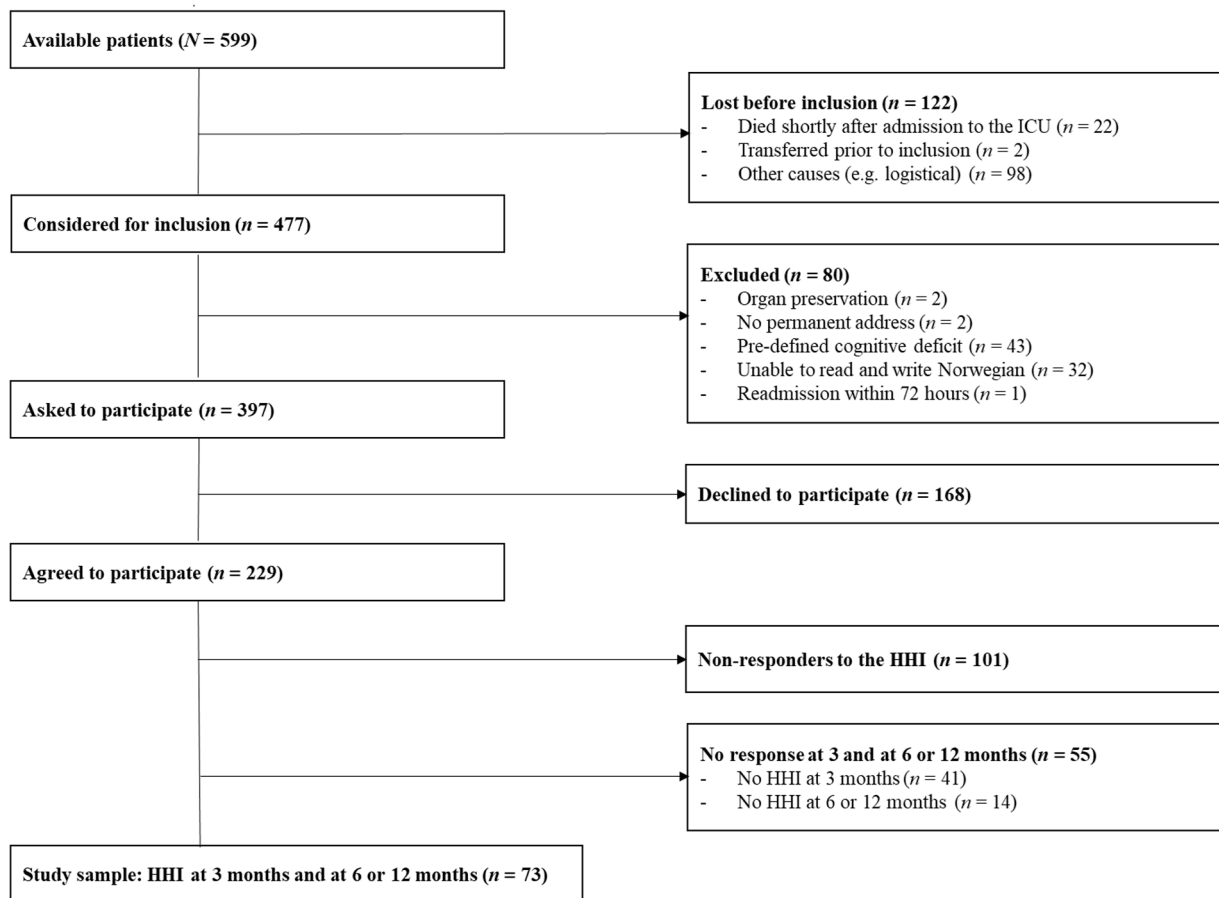


Fig. 1. Flow chart describing the recruitment process of the sample (n = 73).

Table 2
HHI scores of ICU survivors 3, 6 and 12 months after ICU admission.

	n	Median	IQR	Mean	SD
3 months	73	41.0	(36.0; 44.0)	39.3	(6.6)
6 months	64	40.0	(35.0; 44.0)	38.6	(7.1)
12 months	62	42.0	(35.0; 45.0)	40.5	(6.0)

Abbreviations: IQR = interquartile range; SD = standard deviation. HHI = herth hope index. ICU = intensive care unit.

Note: Herth Hope Index (HHI) range: 12.0–48.0.

Table 3
Scores for individual items on the HHI 3 months after ICU admission (n = 73).

	Individual items	Median	IQR	Mean	SD
1	I have a positive outlook toward life	4.0	(3.0; 4.0)	3.4	(0.8)
2	I have short- and/or long-term goals	3.0	(3.0; 4.0)	3.3	(0.7)
3	I feel all alone	4.0	(3.0; 4.0)	3.5	(0.7)
4	I can see possibilities in the midst of difficulties	3.0	(3.0; 4.0)	3.1	(0.8)
5	I have faith and that gives me comfort	3.0	(1.0; 3.0)	2.4	(1.2)
6	I feel scared about my future	3.0	(2.0; 4.0)	3.0	(0.9)
7	I can recall happy/joyful times	4.0	(3.0; 4.0)	3.6	(0.6)
8	I have deep inner strength	4.0	(3.0; 4.0)	3.4	(0.7)
9	I am able to give and receive care/love	4.0	(3.0; 4.0)	3.6	(0.6)
10	I have a sense of direction	3.0	(3.0; 4.0)	3.2	(0.8)
11	I believe that each day has potential	3.0	(3.0; 4.0)	3.3	(0.7)
12	I feel my life has value and worth	4.0	(3.0; 4.0)	3.4	(0.8)

Abbreviations: IQR = interquartile range; SD = standard deviation. HHI = herth hope index. ICU = intensive care unit.

Note: Scores range from 1 to 4, with a higher score indicating higher hope.

Results

We screened 599 available patients for eligibility, and 229 (38.2%) agreed to participate. Thus, the final study sample was comprised of 73 patients who were able to respond to the HHI questionnaire at 3, and at 6, or 12 months after ICU admission (Fig. 1).

Study sample

The median age of the study sample (n = 73) was 66.0 years (IQR: 51.0; 74.0), and 61.6% were males. The median time spent on MV was 1.4 days (IQR: 0.6; 10.6). The median SAPS II score was 39.0 (IQR: 32.0;

Table 4

Associations of PTSS, demographics and clinical characteristics with hope during the first year after ICU admission. Linear mixed model with repeated measures.

	B	95% CI	P-value
Impact of Event Scale-Revised (PTSS) – 3 months	–0.13	(–0.23, –0.03)	0.015*
Education level			
College/university	–0.15	(–2.88, 2.58)	0.915
(Ref: Primary/secondary school)	(1)		
Employment status**			
Full-time/part-time	5.87	(1.85, 9.88)	0.004*
Retired	2.62	(–1.05, 6.30)	0.162
(Ref: Unemployed/on sick leave/with disability)	(1)		
Length of stay in hospital (days)	0.08	(0.00; 0.15)	0.042*
Time variable – hope			
Herth Hope Index – 6 months	–1.24	(–2.25, –0.23)	0.016*
Herth Hope Index – 12 months	0.08	(–0.93, 0.878)	0.878
(Ref: Herth Hope Index – 3 months)	(1)		

Abbreviations: B = regression coefficient; Ref = reference group. CI = confidence interval. ICU = intensive care unit. PTSS = posttraumatic stress symptoms.

* = significant with P-value of < 0.05. ** = prior to ICU admission.

Note: The variables in this table were included in the final multivariate model.

50.0), and the median ICU stay was 2.9 days (IQR: 1.8; 5.8) (Table 1).

Non-Responders

The non-responders were those not part of the study sample due to an incomplete set of HHI registrations (see above) ($n = 156$). Compared with the study sample, a significantly lower proportion of non-responders were admitted to the ICU because of emergency surgery or other surgery. Conversely, a significantly higher proportion of the non-responders were admitted to the ICU for non-surgical reasons. The non-responders had higher comorbidity (CCI) scores and higher frailty (CFS) scores when compared with the study sample (Table 1).

Hope scores

The unadjusted median HHI score for hope at 3 months ($n = 73$) was 41.0 (IQR: 36.0, 44.0). At 6 months ($n = 64$), it was 40.0 (IQR: 35.0; 44.0). At 12 months ($n = 62$), it was 42.0 (IQR: 35.0; 45.0) (Table 2). The median 1-point lower HHI score 6 months after ICU admission was significantly lower than the HHI score 3 months post-ICU admission ($B = -1.24$; 95% confidence interval [CI]: –2.25, –0.23; $P = 0.016$) (Table 2). Table 3 shows the scores for the individual HHI items (item range: 1–4).

Associations between PTSS, demographics and clinical characteristics and hope during the first year after ICU admission

As shown in the univariate analyses, during the first year, no demographic variables except employment status were statistically significantly associated with levels of hope. However, the clinical variables (length of hospital stay, MV) were associated with hope during the first year (Supplementary Table 1 for further details). In the multivariate mixed model analyses, being employed before ICU admission ($B = 5.87$; 95% CI [1.85, 9.88]) having a more extended hospital stay ($B = 0.08$; 95% CI [0.00, 0.15]) and having lower levels of PTSS 3 months after ICU admission ($B = -0.13$; 95% CI [–0.23, –0.03]) were significantly associated with higher hope scores during the first year after ICU admission (Table 4).

Discussion

We found that hope remained almost unchanged during 12 month follow up. We also found that a lower 3-month level of PTSS, being employed before ICU, and having a more extended hospital stay were statistically significantly associated with higher hope scores during the first year after ICU admission.

HHI scores were lower at 6 months after ICU admission than the reference value (HHI score at 3 months). However, given the reduction in the hope score of only 1 point at six months, this result is probably not clinically relevant. Rather, this may be a random finding due to the statistical testing and the low number of patients. Nevertheless, the slight variation in our study's median hope scores on the HHI scale during the first year after ICU admission may indicate stability of hope in ICU survivors.

Our hope scores agree with those in a recent study, which reported a mean HHI score of 39 among ICU survivors 3 months after ICU admission.¹⁷ Furthermore, a study of patients who underwent elective cardiac surgery reported a slightly lower mean HHI score of 38 at three follow-up times post-surgery (3, 6 and 12 months).¹¹

A 2003 Norwegian general population^{8,9} reported a lower mean HHI hope score of 36 ($SD = 4$).⁸ In a similar Spanish study, the mean hope score was 37 ($SD = 6$).⁹ Interestingly, our hope scores were somewhat higher, with mean hope scores ranging from 39 to 41 (Table 2). We can speculate that these slightly higher levels of hope relate to having survived a critical illness. Survivors may have been in the process of moving from a state of despair and fear of dying to a situation of realistic expectations of resuming a meaningful life.^{41,42}

We can also speculate that a response shift phenomenon accounts for why the ICU survivors in our study reported higher hope scores than scores reported by the general population.^{8,9} According to this phenomenon, there is a change in how questions are understood when something is measured repeatedly over time, thus causing respondents to re-evaluate the meanings of the questions.^{43,44} This may be the case when individuals after the traumatic event of critical illness and admission to ICU answer questions about the time before the traumatic event.

It is also possible that our post-ICU population, for some reason, had higher levels of hope before their admission to ICU than the general population. We tried to elucidate this aspect by collecting data on pre-ICU levels of hope, but most of these data were proxy statements (data not shown). When testing these proxy data with patient-reported pre-ICU hope data from the same patients, there were significant disagreements, and these data had to be discarded from further analyses.

Regarding the HHI items, one observation was that the item 'I can recall happy/joyful times' and item 'I am able to give and receive caring/love' had the highest mean scores. In contrast, the item 'I have a faith that gives me comfort' had the lowest mean score. These findings agree with those of other studies on hospitalized patients with heart failure, where the item 'I can recall happy/joyful times' had the highest score.^{8,10} This may imply that recalling happy times or being aware of one's ability to receive or give care and love is not perceived as problematic by ICU survivors. The low scores for faith may be due to the

patients not having strong religious beliefs. They may also imply that some ICU survivors are focused not on faith but on other aspects of life during post-ICU recovery. The clinical relevance of our findings concerning hope may be that healthcare professionals can be aware that dimensions or meaning of hope can differ in ICU survivors during recovery. Such knowledge can be used during tailored follow-up treatment.

It should also be noted that during the study period (i.e., 3, 6 and 12 months after ICU admission), our respondents were in the recovery phase and may have been struggling with physical, cognitive or mental impairments.⁴⁵ Thus, this struggle may have influenced how they scored the items during the follow-up period. Future research could explore which ICU patients give the highest or lowest HHI scores, and to explore single-item responses on the HHI, such impairments must also be recorded concomitantly with hope levels in future research.

When we assessed the association of the 3-month level of PTSS with hope 3, 6, and 12 months after ICU admission, we found that lower levels of PTSS were significantly associated with higher levels of hope. This finding is consistent with a previous study on non-ICU trauma-exposed veterans, where good mental health was reported to be essential for hope.⁴⁶ In the same survey, fostering hope and cultivating emotional coping strategies were essential aspects of treating posttraumatic stress disorder (PTSD).

Although war veterans and ICU survivors have been exposed to different traumatic events (i.e., combat vs. critical illness), good mental health may be necessary for hope, regardless of the type of trauma. Post-ICU care tailored to improving mental health may be beneficial in fostering hope during the recovery period. However, the association of PTSS with hope in our study was of limited magnitude. For example, 10 points less on the IES-R scale resulted only in a 1.3-point rise on the HHI scale (i.e., a 2% change). More research is needed to explore the longitudinal relationship between PTSS and hope in ICU survivors.

Employment before ICU admission was associated with a higher level of hope during the first year after ICU admission. Employment was previously associated with higher hope in the general Norwegian population⁸ and in patients newly diagnosed with multiple sclerosis.⁴⁷ In our study, employment status prior to ICU admission was associated with about a 10% change on the hope scale. Other researchers have previously also found a link between employment status and hope among ICU patients after discharge: higher levels of hope 3 months after ICU discharge were associated with higher return to work levels 12 months after ICU stay.¹⁷ However, it should be noted that about half of our sample was employed/unemployed, while the other half were retired before ICU admission, a potentially impacting the findings.

Our finding that a more extended hospital stay is positively associated with hope has not been previously reported in ICU patients and seems counterintuitive. One explanation may be that people who have been in the hospital for a long time are significantly relieved to have survived and, therefore, are more hopeful. However, the magnitude and statistical strength of the association are minor (i.e., $P = 0.042$, 95% CI close to zero) and may result from the use of statistical tests.

Strengths and limitations

The longitudinal design of our study is a strength, as it allowed for repeated measures of hope. In addition, we examined the relationship between PTSS at 3 months and hope at 3, 6, and 12 months. To the best of our knowledge, this relationship has yet to be reported within the context of the ICU patient population. Furthermore, we used validated tools to measure hope and PTSS.

Our study sample was limited to 73 ICU patients, which may have reduced the statistical power and resulted in type II errors. Therefore, the findings need to be interpreted with caution, and the clinical impact of the statistically significant findings needs further analysis. We acknowledge that our sample size was limited; thus, further research with larger sample sizes is warranted. Further, our findings might not be

generalizable to all ICU patients but, rather, to patients who are relatively healthy before ICU admission (low degree of comorbidities and frailty) (Table 1). Another limitation and threat to external validity was the high number of patients ($n = 168$) who declined to participate in the study, decreasing generalizability. Finally, we did not have reliable pre-ICU data on our patients' mental health status and illnesses. As ICU admission is usually sudden and unexpected, such pre-ICU data in ICU patients are generally unavailable.

Conclusions

In this study, hope scores remained stable and fairly high during the first year after ICU admission. Lower levels of PTSS three months after ICU admission, being employed before ICU admission, and having a more extended hospital stay were associated with higher hope during this time. As these results are based on a small study sample, more research about hope and PTSS in larger samples is needed.

CRedit authorship contribution statement

Klara Friberg: Writing – review & editing, Writing – original draft, Resources, Investigation, Formal analysis, Data curation, Conceptualization. **Kristin Hofso:** Writing – review & editing, Methodology, Conceptualization. **Tone Rustoen:** Writing – review & editing, Project administration, Methodology, Conceptualization. **Johan Ræder:** Writing – review & editing, Methodology. **Milada Hagen:** Writing – review & editing, Methodology, Formal analysis. **Kathleen Puntillo:** Writing – review & editing, Methodology. **Brita Fosser Olsen:** Writing – review & editing, Supervision, Methodology, Investigation, Formal analysis, Conceptualization.

Declaration of competing interest

We, the authors, do not have any ethical conflicts or financial interests to disclose.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.hrtlng.2024.12.003.

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