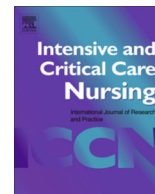




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## Research Article

## The psychological and HRQoL related aftermaths of extra corporeal membrane oxygenation treatment: A cross-sectional study



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## ABSTRACT

**Objectives:** To assess symptoms of post-traumatic stress disorder, anxiety, depression and health related quality of life in a sample of adult patients treated with veno-arterial extracorporeal membrane oxygenation.

**Design and setting:** This is a cross-sectional study. The population were all patients discharged (2008–2018) from a thoracic surgical intensive ward at a tertiary university hospital in Norway. A sample of 20 patients was recruited.

**Main outcome measures:** Symptoms of post-traumatic stress disorder were assessed using *Impact of Events Scale-Revised*, while symptoms of depression and anxiety were assessed using *Hospital Anxiety and Depression Scale*. *RAND 36-Item Short Form Health Survey* was applied to measure health-related quality of life.

**Results:** Symptoms of post-traumatic stress disorder were reported by 40% of the participants. Twenty percent reported symptoms of depression and anxiety. Compared to the general population, participants reported poorer health-related quality of life on all domains, and significantly worse on the domains physical function, general health and social function.

**Conclusion:** Patients in our study reported symptoms of post-traumatic stress disorder, anxiety, depression and impaired health-related quality of life following treatment with veno-arterial extra corporeal membrane oxygenation. Addressing possible emotional and psychological distress could represent a potential major improvement in health care provided to this group. Further research is needed to incorporate prophylactic methods, such as identifying vulnerable patients and implement corresponding interventions, into clinical practice.

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## Implications for clinical practice

- This study reports of impaired health-related quality of life and increased prevalence of self-reported symptoms of PTSD, anxiety and depression after veno-arterial extracorporeal membrane oxygenation treatment.
- Our findings, combined with prior research, illustrate the need for preventive clinical practice and follow-up from critical care nurses and other health care professionals.
- Patient-reported outcome data may contribute to the development of interventions that prevent long-term complications and improve overall health status after veno-arterial extracorporeal membrane oxygenation treatment.

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## Introduction

Veno-arterial extracorporeal membrane oxygenation (VA ECMO) is a highly effective therapy given to critically ill patients requiring temporary cardiac and/or respiratory support. Advances in ECMO technology, combined with reports of positive treatment outcomes, have led to increased use of ECMO the last decade (Mosier et al., 2015; Extracorporeal Life Support Organization, 2019). Among patients treated with ECMO, approximately 40 percent survives to discharge from hospital (Extracorporeal Life Support Organization, 2019). The majority of studies on long-term outcome of ECMO-treatment has focused mainly on survival rates and somatic health variables. However, the unique risk factors specifically associated with ECMO-treatment, can affect patients in a longer time span and on domains other than survival and “pure” somatic health, resulting in potential impaired quality of life and mental health for the survivors (Roll et al., 2018; Spangenberg et al., 2018). Research that increases knowledge about patient-reported outcomes, in this case following VA ECMO-treatment, may contribute to the development of measures that prevent long-term complications, and furthermore improves overall health status after discharge from hospital.

VA ECMO-treatment requires resource demanding intensive care and follow-up. Patients treated with VA ECMO have reported lower perceived quality of life than the general population (Mirabel et al., 2011; Muller et al., 2016; Corsi et al., 2017; Tramm et al., 2017). In addition, symptoms of post-traumatic stress disorder (PTSD), depression and anxiety seem prevalent (Mirabel et al., 2011; Chen et al., 2016; Muller et al., 2016; Corsi et al., 2017; Tramm et al., 2017). Based on this notion, the aim of this study was to describe health-related quality of life (HRQoL) and assess symptoms of post-traumatic disorder (PTSD), anxiety and depression in a sample of VA ECMO-treated patients. A second aim was to identify clinical and demographic factors associated with these patient perceived outcomes. We conducted a cross-sectional single center study to investigate the prevalence and correlation between reported symptoms of post-traumatic reactions, anxiety, depression and health-related quality of life in patients treated with VA ECMO at Haukeland University Hospital, Norway.

## Methodology

### Participants and data collection

Survivors after VA ECMO-treatment were identified from the hospital database and retrospectively analysed. All participants included in the study were 18 years or older and treated with VA ECMO at Haukeland University hospital during the period from 2008 to June 2018. A prerequisite was that all participants had to be fluent in Norwegian. Totally 108 patients were treated with VA ECMO during the inclusion period, 43 (40%) were still alive at the time of recruitment in January 2019. Of these, 13 did not fulfil the inclusion criteria due to treatment after cut-off point, lower age, unknown address or inability to understand Norwegian (Fig. 1). The participants were recruited through an invitation to take part in the study by postal mail. A reminder was sent to non-responders three weeks after the first invitation. The final response rate was 20 (67%) of the 30 eligible patients.

### Assessments

*Sample characteristics* such gender, age, marital status, children, and education level were provided by the participants, as well as working capacity and need for assistance in daily life before and after VA ECMO-treatment. *Clinical data* such as primary diagnosis

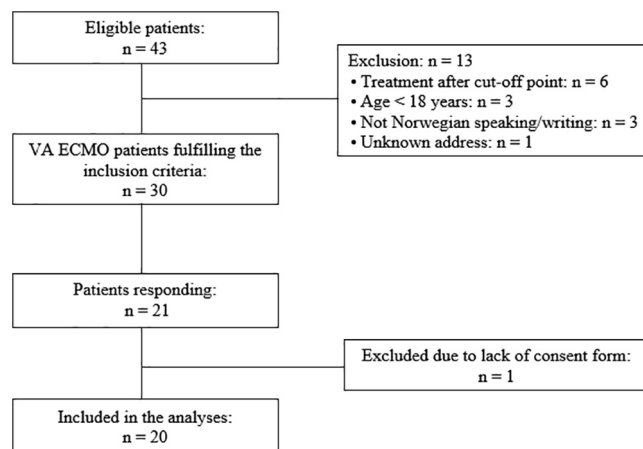


Fig. 1. Inclusion flowchart.

requiring ECMO-treatment, duration of ECMO-treatment, time lapse since ECMO, and finally if the intensive care unit kept diary during treatment on the patients behalf or not, were retrieved from the hospital databases.

*Post-traumatic stress disorder.* Symptoms of post-traumatic stress disorder (PTSD) were assessed using the Impact of Events Scale- Revised (IES-R). The instrument contains 22 questions with three different subscales that measure the intensity of fragmented and intrusive memory image (8 items), present autonomous hyperactivation (6 items) and avoidance behaviour (8 items). IES-R has a 4-point Likert scale (range 0–4) resulting in a possible score ranging from 0 (none) to 88 (Weiss, 2007). A total score higher than 33 (cut-off > 33) has been reported to indicate presence of probable severe PTSD (Creamer et al., 2003), while scores ranging from 24 to 32 indicate the possibility of moderate PTSD-symptomatology (McCabe, 2019).

*Anxiety and depression.* Symptoms of anxiety and depression were assessed using The Hospital Anxiety and Depression Scale (HADS). This is a 14-item questionnaire. Half of the questions aims to assess anxiety, whereas the other half assesses depression. The questionnaire uses a 4-point Likert scale (range 0–3) producing a minimum score of 0 (none symptoms of anxiety or depression) and a maximum score of 21 for each subscale, representing severe symptoms of either anxiety, depression or both (Folkehelseinstituttet, 2016). A subscale score of 8–10 indicates a possible need for further follow-up while a score of  $\geq 11$  is an indication of severe psychological distress, possible need for follow-up and treatment. On both dimensions combined, a HADS total score of  $\geq 15$  indicates need for closer follow-up and treatment (Zigmond and Snaith, 1983; Herrmann, 1997).

*Health-related quality of life (HRQoL).* HRQoL was measured using the RAND 36-Item Short Form Health Survey (RAND-36). This is a generic self-rating instrument identical to 36-item short-form health survey (SF-36), and it is translated into Norwegian in accordance with international guidelines for translating Patient Reported Outcome Measures (PROMs) (Folkehelseinstituttet, 2015). RAND-36 consist of eight domains: general health (GH), physical function (PF), mental health (MH), social function (SF), vitality (VT), bodily pain (BP), role physical (RP) and role emotional (RE). Answers on the domains were transformed into scale scores from 0 to 100, where higher score indicate better perceived HRQoL (Ware Jr and Sherbourne, 1992).

The instruments have shown satisfactory validated psychometric properties (Herrmann, 1997; Ware, 2000; Weiss, 2007; Eid et al., 2009; Folkehelseinstituttet, 2015).

RAND-36 scores from our patients were compared to Norwegian reference values on the SF-36. These reference values were

collected in a study of the perceived health related quality of life among the general Norwegian population (Jacobsen et al., 2018).

### Statistical analysis

Descriptive statistics include mean, standard deviation, median and min/max for numerical variables, and frequencies and percentages for categorical data, with 95% confidence intervals. Missing answers on two IES-R items from one participant were handled by averaging answers from the remaining 20 questions. This is in line with Creamer and colleagues' recommendations (Creamer et al., 2003).

Due to lack of symmetric distribution and limited number of participants, the associations between demographic and clinical variables and RAND 36, IES and HADS were analysed using the non-parametric correlation test Spearman's rho.

The internal consistency (Chronbach's alpha) of the self-reported questionnaires ranged from 0,602 on the RAND 36 General Health domain to 0,936 in the Role Emotional domain. Wilcoxon signed rank tests were applied to compare the RAND 36 scores reported by VA ECMO patients with age and gender matched expected SF-36 scores from the Norwegian general population data (Jacobsen et al., 2018). Multivariate analysis was not conducted due to the small sample size. All analyses were performed using the SPSS version 24 (IBM, Statistical Package for Social Sciences).

### Ethics

Informed written consents were obtained from all participants. Approval of the study was given by the Cardiac Unit and registered at the Data Protection Officer, both at Haukeland University Hospital. Ethical approval was obtained from the Regional Committees for Medical and Health Research Ethics south-east (REC approval No.: 2018/1872). A contingency plan was developed for those of the participants with severe symptom of PTSD, anxiety and depression. Return postage-paid envelopes were provided to participants. No other financial incentives were given.

### Results

Mean age of the participants was 57 years and 17 (85%) out of 20 participants were men. The main indication for VA ECMO was found to be post-cardiotomy heart failure, but a high proportion of other indications was also present (Table 1). Time lapse since treatment varied between 11 months and 10 years (mean 39.4 months), and duration of VA ECMO varied between 25 and 238 h (mean 101 h). In terms of vocational status only one participant who had been working prior to admission did not return to active labour following ECMO-treatment. Hence, the main reason not to return to active work was retirement due to age. All participants lived at home and the majority (78%) did not need practical or medical assistance from health care services or family in their daily life. Intensive care diary was provided to eight (40%) of the participants. Impaired mobility, visual impairment and pain in the back and lower extremity were complications reported by several of the participants.

Due to small sample size we were unable to observe significant associations between demographic factors, clinical factors and outcome measures.

Symptoms of PTSD were reported by 40% of the participants (IES- R  $\geq$  24) and 20% reported symptoms of severe PTSD (IES- R  $\geq$  33). Avoidance behaviour were the most frequently reported cluster of PTSD symptoms (Table 2). Twenty percent of the participants reported symptoms of anxiety and depression combined

**Table 1**

Demographic and clinical characteristics of the responders and non-responders treated with VA ECMO.

	Responders	Non-responders
<b>Male gender</b> , n (%)	17 (85)	10 (100)
Current age, mean (min-max)	57 (29-79)	46 (35-72)
<b>Indication VA ECMO</b>		
Post-cardiotomy	8 (40)	3 (30)
Acute Coronary Syndrome	5 (25)	2 (20)
Cardiomyopathy	3 (15)	4 (40)
Myocarditis	3 (15)	0 (0)
Hypothermia	2 (10)	1(10)
Other	1 (5)	0 (0)
<b>Educational level</b> , n (%)		
Primary/high school	14 (74)	
University level	5 (26)	
<b>Working pre-ECMO</b> , n (%)		
Working	12 (63)	
Not working	3 (16)	
Retired > 67 years	4 (21)	
<b>Working post-ECMO</b> , n (%)		
Working	8 (42)	
Not working	4 (21)	
Retired > 67 years	7 (37)	
<b>Living situation</b> , n (%)		
Home independent	14 (78)	
Home with help	4 (22)	
<b>Marital status</b> , n (%)		
Single	7 (39)	
Married/partner	11 (61)	
<b>ICU-diary</b> , n (%)		
Yes	8 (40)	
No	12 (60)	
<b>Time</b> , mean		
Hours on ECMO	101	
Months since ECMO	39	
<b>Time</b> , min-max		
Hours on ECMO	25-238	
Months since ECMO	11-128	

which indicates a possible need for further follow-up and treatment (HADS-AD scores  $\geq$  15). Scores on IES-R and HADS tended to be lower for participants where the time lapse since ECMO-treatment was longer ( $\geq$ 2,5 years).

RAND-36 HRQoL assessment results are reported in Table 3 and in Fig. 2. Compared to the age and gender matched control group, VA ECMO treated patients reported poorer health-related quality of life on all domains and significantly worse on the domains physical function, general health and social function. Notably, individual reporting on physical and emotional role was also substantially worse compared to the general population. Internal consistency assessed by Cronbach's alpha was found to be satisfying in all the instruments (Table 3).

### Discussion

Nearly half of the participants reported adverse posttraumatic symptoms. Additionally, outcomes on HRQoL are poorer compared to the general population and significantly lower on several domains. Comparisons to other studies is complicated given that our study includes patients treated with VA-ECMO regardless of treatment indications. Based on the heterogeneity this entails one could speculate that our group represents greater variation prior to VA-ECMO treatment compared to studies that include participants based on a specific diagnosis. This represents a possible weakness when comparing with other studies (Table 4).

**Table 2**  
Health-related quality of life and symptoms of anxiety, depression and post-traumatic stress disorder in patients treated with VA ECMO.

Form/Subscale	Number of questions	Total range	Mean (SD)	Median	95% CI	Cronbach's alpha
<b>RAND-36</b>						
PF	10	0–100	69,2 (26,6)	72,5	56,8–81,7	0,909
RP	4	0–100	57,5 (42,2)	62,5	37,7–77,3	0,883
BP	2	0–100	66,0 (21,8)	65	55,8–76,3	0,857
GH	5	0–100	62,0 (16,4)	60	54,3–69,7	0,602
VT	4	0–100	58,0 (20,9)	60	54,3–69,7	0,792
SF	2	0–100	74,3 (24,1)	75	63,1–85,7	0,733
RE	3	0–100	76,6 (20,6)	100	57,7–95,7	0,936
MH	5	0–100	79,2 (16,8)	84	71,3–87,1	0,832
<b>HADS</b>						
Anxiety	7	0–21	3,8 (4,2)	2	1,8–5,7	0,890
Depression	7	0–21	3,1 (3,1)	2,5	1,7–4,5	0,799
<b>IES-R</b>						
Intrusion	8	0–32	0,90 (0,69)	0,8	0,6–1,2	0,882
Hyperarousal	6	0–24	0,75 (0,63)	0,8	0,5–1	0,815
Avoidance	8	0–32	0,98 (0,65)	1,1	0,7–1,2	0,814

RAND-36: RAND 36-Item Short Form Health Survey.

PF = Physical function, RP = Role Physical, BP = Bodily pain, GH = General health, VT = Vitality, SF = Social function, RE = Role Emotional, MH = Mental health.

HADS: Hospital Anxiety and Depression Scale.

IES-R: Impact of events scale-Revised.

**Table 3**  
RAND 36, VA ECMO vs age-and gender-matched Norwegian population.

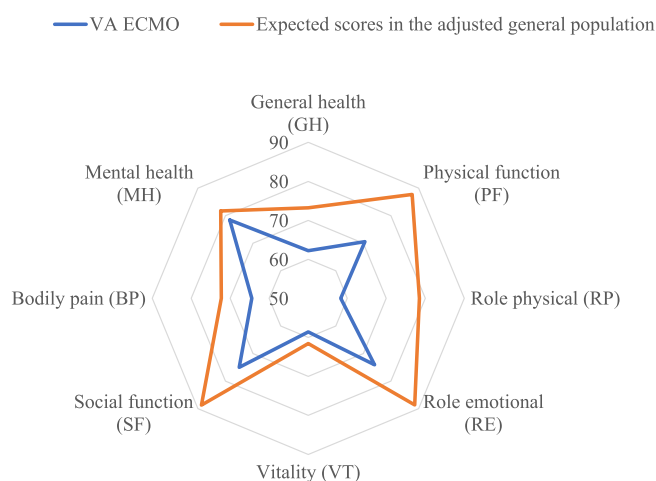
Rand 36	VA ECMO <sup>a</sup>	General population <sup>a</sup>	P-value <sup>b</sup>
PF	69,2 (26,6)	87,7 (5,1)	0,018*
RP	57,5 (42,2)	78,5 (8,8)	0,086
BP	66,0 (21,8)	72,3 (4,4)	0,247
GH	62,0 (16,4)	73,2 (1,4)	0,021*
VT	58,0 (20,9)	61,6 (3)	0,502
SF	74,3 (24,1)	88,7 (2)	0,016*
RE	76,6 (20,6)	88,6 (3,4)	1,0
MH	79,2 (16,8)	81,7 (2,9)	0,695

PF = Physical function, RP = Role Physical, BP = Bodily pain, GH = General health, VT = Vitality, SF = Social function, RE = Role Emotional, MH = Mental health.

<sup>a</sup> Mean scores (SD).

<sup>b</sup> Wilcoxon signed rank test.

\* p-value < 0,05.



**Fig. 2.** RAND 36 scores of VA ECMO patients compared with age-and gender matched expected scores from the Norwegian general population.

*Symptoms of PTSD, anxiety and depression following treatment*

The percentage of patients with moderate and high occurrence of PTSD-symptoms in our sample are considerably elevated com-

pared to a French study by Muller and colleagues (2016), who only found 5% in risk of PTSD. All participants in their study received VA ECMO following refractory cardiogenic shock, and the duration of treatment with VA ECMO was twice as long (8 days). However, distributions on gender, age and time since treatment were similar to our study, and do not explain the difference in the occurrence of PTSD-symptoms. A comparable finding to ours regarding the occurrence of PTSD-symptoms is reported in the French study by Mirabel et al. (2011) on patients treated with ECMO due to fulminant myocarditis. 27% of the patients included were found to be at high risk of developing PTSD. Our study found 20% at high risk, while 40% can be classified as having a moderate risk of developing PTSD. However, there are differences between the two samples. Duration of ECMO treatment were quadrupled (16,2 days) in the study by Mirabel and colleagues, their participants were on average 19 years younger and gender distribution was more equal compared to our study. Finally, high prevalence of PTSD symptoms is reported in a systematic study on general intensive care unit survivors, where the reported prevalence of “clinically significant” PTSD symptoms is 22% (Davydow et al., 2009). The authors conclude that high prevalence of PTSD-symptoms among ICU survivors negatively impacts survivor HRQoL. A contributing factor to the comparably high prevalence of reported symptoms of PTSD in our study may be related to different use of cut-off on IES-R. Both Mirabel and Muller applied a cut off  $\geq 30$ . Our study applied a diagnostic cut-off of  $\geq 33$ , which indicates the presence of possible severe PTSD (Creamer et al., 2003). For our purpose it was also desirable to identify those participants with the possibility of moderate PTSD-symptomatology, hence the inclusion of patients with scores > 22, as proposed by Stukalin et al. (2019). Notably, we had no knowledge of the participants’ mental health-status prior to ECMO-treatment. Nonetheless, symptoms of PTSD in our sample were quadrupled compared to the general prevalence in the Norwegian population (3.8% for men and 8.5% for women) (Heir et al., 2019).

PTSD is often accompanied by comorbid mental health problems such as depression and anxiety (American Psychiatric Association, 2013). Although case-mix differences make comparisons between studies difficult, our patients had similar or even better HADS scores than fulminant myocarditis patients rescued by VV or VA- ECMO (Mirabel et al., 2011) and patients treated with VA ECMO due to acute myocardial infarction (Muller et al., 2016).

**Table 4**  
Correlation<sup>a</sup> between demographic variables and IES-r, HADS and RAND-36.

	IES-R	HADT	HADA	HADD	PF	RP	BP	GH	VT	SF	RE	MH
Gender	-.340	-.246	-.210	-.295	.317	.139	.386	.159	.122	.012	-.030	.147
Age	-.060	-.071	-.132	.001	-.111	-.438	-.004	-.025	.140	-.025	-.091	.315
Marital status	-.187	-.332	-.379	-.300	.121	.092	-.225	.044	.110	.347	.308	.443
Education	-.089	-.072	-.162	.000	-.537*	-.793 <sup>†</sup>	-.457*	-.154	-.208	-.478*	-.160	.187
Working situation	.147	-.058	-.118	-.051	.223	.111	.259	.109	.167	.056	-.047	.141
Months since ECMO	-.067	-.049	-.008	-.074	.039	.018	-.252	.020	.051	.158	.205	-.065
Hours on ECMO	-.042	-.209	-.190	-.184	.137	.046	.035	.186	.478*	.304	.283	.474*
ICU Diary	-.089	-.072	-.162	.000	.249	.037	-.027	-.267	-.036	.036	.066	.223

IES-R: Impact of Event Scale- Revised.

HADS: Hospital Anxiety and Depression Scale. HADT: total score, HADA: anxiety, HADD: depression.

RAND- 36: Short Form Health Survey. PF = Physical function, RP = Role Physical, BP = Bodily pain, GH = General health, VT = Vitality, SF = Social function, RE = Role Emotional, MH = Mental health.

<sup>a</sup> Spearman's rho.

\* P < 0.05.

<sup>†</sup> P < 0.001.

However, the Norwegian study conducted by Ørbo et al. (2019) reported no symptoms of depression (above cut-off > 8). Notably, the different findings in our study compared to those of Ørbo and colleagues may be related to more equal gender distribution and younger participants in the latter study (mean age nine years lower). Furthermore, previous research indicates that anxiety is the most frequently reported mental health difficulty among VA ECMO survivors (Mirabel et al., 2011; Muller et al., 2016; Ørbo et al., 2019).

Reports on the effectiveness and usefulness of keeping intensive care diaries on behalf of the patients have highlighted potential benefits such as increased understanding of the treatment process they have received and subsequently being able to reconstruct memories from the course of treatment (Bäckman et al., 2010; Jones et al., 2010). Diaries were only completed and given to 40% of the patients in our sample. Concerning reported symptoms of PTSD, the group difference between patients with or without diaries is non-significant. This corresponds with prior research, reporting that the potential preventive effect of the development of post-traumatic reactions following intensive care is inconclusive (Ullman et al., 2015; McIlroy et al., 2019). Patients with the highest reported prevalence of PTSD symptomatology in our study were also the ones who kept diaries. This can possibly be related to a tendency towards keeping diaries on behalf of the patients perceived by the staff to have the most severe degree of pathology, or an interpretation of certain patients being more eligible to benefit from a diary than others. On the other hand, the participants who received a diary did report better mental health on RAND 36.

#### HRQoL after ECMO

RAND-36 was administered to assess HRQoL among VA ECMO survivors. Scores among our participants were higher on all domains compared to other studies reporting HRQoL after VA ECMO (Tramm et al., 2017; Ørbo et al., 2019), and similar to those reported by the group of Mirabel et al. (2011) fulminant myocarditis patients and the Australian study of HRQoL in both VA and VV ECMO patients, conducted by Roll et al. (2018). Nonetheless, most studies that have compared values from the general population to values reported among ECMO-treated patients, report impaired HRQoL in the latter group (Mirabel et al., 2011; Hsieh et al., 2016; Corsi et al., 2017; Roll et al., 2018; Spangenberg et al., 2018; Ørbo et al., 2019). This is consistent with our findings, when comparing our results with Norwegian reference values (Jacobsen et al., 2018). Substantial differences were found on domains measuring general health, role physical and emotional, physical and social function. This corresponds with findings reported by Roll et al. (2018) and Mirabel et al. (2011). The restriction of physical

function may be associated with adverse outcome. Impaired mobility, visual impairment and pain in the back and lower extremity are some of the complications reported in our study. This is consistent with former literature on the complication due to ECMO (Bartlett, 2016; Khorsandi et al., 2017; Mossadegh and Faulkner, 2017). According to the developers of SF-36, the physical and emotional problems in everyday living will be reflected on the domain social function (Ware Jr and Sherbourne, 1992). Our participants reported poor scores on this domain. Impaired social functioning is a possible outcome of the combination of impaired physical functioning and mental health difficulties (World Health Organization, 1999; American Psychiatric Association, 2013). The poor score on general health, both found in this study and similarly reported by Roll et al. (2018) and Ørbo et al. (2019), is a possible consequence of the reported symptoms of PTSD, anxiety, depression and impaired mobility combined.

The majority of our participants had VA ECMO access via a femoral artery. This can cause reduced circulation to the affected extremity. Mirabel et al. (2011) reports that 48% of the participants with femoral artery cannulation had paraesthesia or peripheral neurologic defect around or peripheral to the site of ECMO cannulation. We found that, despite reports of improved physical functioning over time (Tramm et al., 2017; Gerth et al., 2019), patients with the longest time lapse since VA ECMO in our sample reported the lowest scores on physical functioning. Recently treated patients were given a peripheral shunt when the arterial access was in the femoral artery. This may prevent physical complications through ensuring adequate circulation in the lower extremity and provide a possible explanation why patients treated before this change in clinical practice report impaired physical functioning. Impaired physical function may also be due to aging, and not related to VA ECMO itself. Age variations as well as other acquired diseases may also affect physical function. Despite the reported impairment in physical functioning, the majority of the patients were able to manage everyday living without the assistance of home nursing or family members.

A compelling finding in our study is the relatively good mental health status reported by our participants measured through RAND 36. However, one cannot rule out that distress following PTSD-symptomatology can be expressed through the poor scores on the domain emotional role functioning and, as previously mentioned, on social functioning.

#### Strengths and limitations

The main strength of our study is the findings which, combined with results from prior research, presents implications with potentially high clinical value for patients treated with VA ECMO. This

applies in particular to the possible benefit of being able to identify impaired quality of life, symptoms of PTSD, anxiety and depression among VA ECMO survivors and to recommend a corresponding development of psychological support during recovery.

Our study is not without limitations. Firstly, it is a single center study, consisting of a small, heterogeneous sample. This is an unfortunate but common problem when recruiting to studies of VA ECMO. Due to lack of data on HRQoL and mental health status prior to onset of VA ECMO-treatment, the result of this study could reflect pre-existing factors not linked to the aftermaths of the procedure. Furthermore, lack of raw-data from the reference study on HRQoL can be considered a possible bias.

## Conclusion

The major finding from this study is that nearly half of the patients in a sample of formerly VA ECMO-treated patients report the presence of PTSD symptoms. Although to a lower degree, reports of isolated depressive and anxiety symptoms, or the two combined, are also present. Compared to the general population, the participants have impaired HRQoL. Incorporating routines for identifying patients with known vulnerability for developing PTSD following VA ECMO-treatment, and the development of corresponding preventive measures, would possibly influence post-treatment mental health, perceived health-related quality of life and level of functioning.

## Funding Information

None.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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