How does health-related quality of life change over time in cancer survivors following an admission to the Intensive Care Unit? An integrative review.

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TITLE PAGE

Title: How does health-related quality of life change over time in cancer survivors following an admission to the ICU? An Integrative review.

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Abstract:

Background: Cancer survivors account for 15-20% of all Intensive Care Unit (ICU) admissions. In general ICU populations, patients are known to experience reduced Health-Related Quality of Life (HRQoL). However, little is known about HRQoL impacts among cancer survivors following a critical illness in ICU.

Objective: The aim of this study was to critically synthesise the evidence to further understand the impact of a critical illness and ICU admission in cancer survivors.

Methods: An Integrative review was conducted and reported according to the Systematic Review and Meta-Analysis (PRSIMA) guidelines. Three electronic databases were searched (Medline, CINHAL and EMBASE) using keywords and Boolean logic. Quality appraisal, data extraction, and a narrative synthesis were completed for all included studies by two reviewers.

Results: Eleven publications met inclusion criteria. HRQoL domains most frequently reported in cancer survivors after discharge from ICU included: physical function limitations, physical symptoms, and anxiety/depression.

Conclusions: HRQoL decreased immediately after the admission to ICU with a gradual increase in the three to 12 months following. Cancer survivors are vulnerable to physical limitations, pain, and social isolation after an admission to ICU.

Implications for Practice: Cancer survivors who have been affected by a critical illness are at risk of reduced HRQoL after an admission to ICU. This integrative review will help clinicians and researchers to develop patient centred models of care during the recovery of critical illness, which are currently lacking in service delivery.

Key words: cancer survivors, health-related quality of life, intensive care, integrative review

Introduction

Cancer survivors account for 15-20% of all Intensive Care Unit (ICU) admissions.[1-4] Cancer survivors are more susceptible to developing a critical illness requiring an admission to the ICU during the course of their disease directly attributed to treatment associated side effects, cancer related side effects,[1,4,5] post-operative management and for life sustaining interventions.[6 1-4] Cancer survivors have reported a number of unmet supportive care needs in routine service delivery without the complexity of recovering from a critical illness.[7-15] Furthermore, cancer survivors are at an increased risk of infection, heart disease, incontinence, lymphoedema, and gastro-intestinal problems due to cancer related treatments such as chemotherapy and surgery, thus, making them more suspectable to health-related quality of life (HRQoL) impairments.[16,17] Therefore, the impact of an ICU admission on the HRQoL among individuals with cancer could be hypothesised to be even greater than that of the general ICU population.[1,18,19]

Patients affected by cancer are increasingly surviving their admission to ICU due to improved treatments and quality of critical care.[20,21] Therefore, not only are mortality rates clinically important but also HRQoL considerations to inform models of rehabilitation cancer care. The general ICU population have reported symptoms of cognitive dysfunction, post-traumatic stress disorder (PTSD), depression, and physical impairments, all of which negatively impact the domains of HRQoL.[8,12,1] HRQoL is defined as the perceived impact of a medical condition or its treatment on an individuals' physical, emotional, and social wellbeing.[22] HRQoL related outcomes in cancer survivors with a critical illness is vital to enable clinicians to triage patients and make long-term healthcare decisions, however, the current literature is limited to specific malignancy groups and the age of the publication.[23] With the increasing number of cancer

survivors living through a critical illness, it is important to bring the research field up to date to understand the impact of a critical illness and ICU admission on the HRQoL in this patient population to inform clinical practice.

Existing studies have explored the HRQoL in cancer survivors following an admission to ICU. Two studies reported on patients with specific malignancies. One included participants with haematological malignancies[24] and the second study included participants who had undergone a transthoracic oesophageal cancer resection.[25] Other studies included patients with various malignancies but were subject to memory recall and non-response bias due to their study designs and small sample sizes.[4,23] Furthermore, the impact of socio-economic, demographic and pre-existing clinical factors and their impact on HRQoL were also not explored in any of the studies.[4,23-25] Several of the studies[23,25] also excluded the more critically unwell patients and therefore, currently researchers and clinicians do not fully understand the impact on HRQoL in the more vulnerable populations of cancer survivors. Existing studies have recommended the need for further research to understand the consequences of an ICU admission and critical illness on the HRQoL among cancer survivors.[1,21,26]

Despite cancer survivors making up a significant proportion of the ICU population; the HRQoL post critical illness in this population is not well described in the literature to inform future models of care and research directions.[27] Therefore, this integrative review aims to expand on the current evidence to identify the impact of an ICU admission on the HRQoL among cancer survivors. This review will help to identify those at high risk of HRQoL impairments to enable timely supportive care, inform models of care delivery and provide future directions for research.

This integrative review will address the following research question: How is the HRQoL impacted in cancer survivors who have survived a critical illness which required an admission to the ICU?

Methods

Design and Eligibility Criteria

This integrative review has been conducted and reported according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) Guidelines[28]. This review followed a priori protocol and is available upon request. Studies were included if they met the following inclusion criteria: (1) All adults (≥18 years) with a confirmed diagnosis of cancer irrespective of type or stage with an admission to ICU for over 24 hours; (2) Studies investigating HRQoL among cancer survivors following an admission to ICU; (3) All qualitative, quantitative and mixed methods studies irrespective of the research design; (4) Studies published in the English language. Commentaries and editorials were excluded from the review.

Selection of studies

The CINHAL (Ebsco), Medline (OVID) and Embase electronic databases were searched for all relevant publications. To increase inclusiveness, the reference list of all final articles was also examined for any relevant publications (Supplementary Table 1). The results of the electronic database search were then exported to Endnote X20 and imported to Covidence systematic review software. After de-duplication, screening of the titles and abstracts were done independently by two review authors (SR&CP). The retained publications were retrieved in full

text and reviewed against the eligibility criteria by both reviewers (SR&CP). Any disagreements were resolved by discussion and reason for exclusion detailed.

Data Extraction

Data extraction was undertaken by a single author (SR) and quality checked for accuracy by the second author (CP). The characteristics of the studies were extracted and included: study design, countries and institutions where the data were collected, participant demographics, clinical characteristics, sample sizes, loses and exclusions of participants, description of study outcomes related to the review research question and time points.

Quality Assessment

Methodological quality evaluation was conducted using the Mixed Methods Appraisal Tool (MMAT).[29] The MMAT consists of one qualitative appraisal tool and three quantitative appraisal tools. The qualitative appraisal tool consists of five sections which can be classified as 'yes', 'no' or 'unclear' with a section for reviewers comments.[29] The three quantitative appraisal tools are separated into 'Quantitative Randomised Controlled Trials', 'Quantitative Non-Randomised Controlled Trials' and 'Quantitative Descriptive Studies'. The three quantitative appraisal tools have the same response scoring conventions to the five questions.[29]

Data synthesis

A narrative synthesis with tabulation was used to combine the quantitative and qualitative data.[30] Firstly, data reduction was completed using the main outcome of the review question to categorise classifications.[30,31] Data reduction involved using the domains of HRQoL to develop subgroup classifications to enable sequential analysis of both the quantitative and qualitive data together.[31] Data was then extracted from the eleven publications and organised into tables.

Data comparison was then completed using an iterative approach to identify themes and relationships.[30,31] Both the tables and full-text publications were used during the data comparison stage to cluster and count common themes, discern unusual patterns and build a logical chain of evidence.[31] The final stage involved drawing conclusions to provide a formal account of the themes and patterns identified in step two.[30,31] All themes and relationships identified were verified with the primary data source. A record was kept throughout the data synthesis stage to increase rigor and aid in the process of analysis.[31]

Results

After duplications were removed, 1303 publications were retrieved from the database search (Figure). A total of 48 publications were reviewed in full and 37 publications were excluded with reasons. Eleven studies were included in the integrative review and the majority (10) were quantitative in design. Eight of the publications were prospective survey study designs, two were cross-sectional surveys and one was a phenomenological study. The results of the methodological quality appraisal are detailed in Table 1. Due to the nature of the study designs included in this review, non-response bias was high, and the majority of the studies did not provide evidence to indicate if their sample size was representative of the target population, placing those studies at risk of both type 1 and type 11 statistical errors. The studies were conducted in a number of countries and included; France/Belgium (n=2), China (n=1), Italy (n=1), United States of America (USA) (n=2), Brazil (n=1), United Kingdom (UK) (n=3) and the Netherlands (n=1) (Table 2). The sample sizes across the included publications ranged from 6 to 1011, with a total sample size of 2,944. Due to disparities in methodologies, outcomes, and data collection instruments a meta-analysis was not feasible for this review.

Impact on HRQoL

ICU interventions, environmental factors and outcomes

The median length of stay (LOS) in ICU was reported in nine (81%) of the included publications.[4,17,18,23-25,32-34] Median LOS in ICU ranged from two to six days. There was no association between ICU LOS and HRQoL ($p>.05$).[18,33-36] One study reported that repeat ICU admissions clinically reduced overall HRQoL scores.[36] Mortality rates in patients affected by cancer after an admission to ICU were reported in eight publications (72%) and ranged from 4.6% to 77% among the included studies.[4,18,23-25,32,34,37]

Commonly undertaken interventions and procedures in the ICU have the potential to affect the HRQoL in cancer survivors.[4,17,18,25,33,34] Invasive mechanical ventilation and use of vasopressors were found to be positively associated with a decrease in Mental Component Scores (MCS).[34] Sleep disturbance was also found to be positively correlated with length of dopamine infusion ($p=.049$).[33] Furthermore, the constant noise and light present in ICU also contributed to increased disruption to sleep in participants.[33] Arterial blood gas (ABG) puncture, central venous catheter (CVC) insertion, endotracheal suctioning and pressure area care were also reported as moderately to severely painful during an admission to ICU.[18] These results indicate that the interventions commonly undertaken in ICU and the overall clinical environment could negatively impact the HRQoL among cancer survivors.

The majority of studies reported demographic information on histopathological type and/or stage of cancer.[4,17,18,24,25,32-34,37] However, only five studies (45%) evaluated severity of disease and clinical outcomes after the admission to ICU.[4,23,24,34,37] Increased Sequential Organ Failure Assessment (SOFA) scores were positively correlated with worst HRQoL scores at three months

post the ICU admission.[23,34] The impact on HRQoL in relation to comorbidities, neo-adjuvant/adjuvant chemotherapy and radiation were infrequently reported across all included publications.[4,23,24,33] Although disease severity was found to be positively associated with reduced HRQoL in cancer survivors after an ICU admission,[23,34] it was not explored in all of the included studies and some caution should be taken in these findings.

Physical function

Decreased physical function in cancer survivors after an admission to ICU resulted in feelings of vulnerability and a lack of confidence, which impacted HRQoL.[17] Pain and nerve damage from cancer therapies and/or a critical illness were reported to have negatively impacted the mobility of patients with cancer after an ICU admission.[17] Patients with haematological malignancies were also found to have higher levels of physical problems after discharge from ICU.[23,24,34] These findings were consistent with Van Vilet et al[24] who identified that patients with haematological malignancies had greater difficulties with work and daily activities due to mobility problems after their ICU admission (p=.040). The majority of studies concluded that although physical function scores decreased immediately after ICU, the physical function scores returned to pre-ICU levels gradually between three months to a period of three years after the admission to ICU.[4,24,25,34,36]

Cognitive problems

Very few studies reported on the impact of critical illness recovery on the cognitive domain of HRQOL. Of the data available, studies included in this review reported minimal impact on cognitive function in cancer survivors following an admission to ICU.[4,24,32]

Social activities/ Limitations to usual activities

Following an ICU admission cancer survivors were at risk of social isolation.[34] A decline in social function after an admission to ICU was positively associated with an increased LOS,[25] repeat ICU admissions[36] and a diagnosis of a haematological malignancy.[23,24] Patients with a haematological malignancy one year after their admission to ICU were less likely to live alone and more likely to need additional help with everyday activities.[23] A decline in physical health was also found to have a negative effect on social function scores and therefore could potentially lead to social isolation.[24,36] Chiarchiaro et al[36] reported that social well-being scores were higher in patients who received help from a caregiver or a family member. Three of the studies found no significant decline in social functioning scores or disturbance to daily life activities over time after an admission to ICU.[32,34,37] Overall, patients affected by cancer are at risk of social isolation, negatively impacting their HRQoL.[23-25,36]

Physical well-being

Pain was the most common and troubling symptom reported among participants.[17,18,24,25,33,34] Significant levels of pain were reported in post-operative esophagectomy patients, with pain level scores returning to normal levels at six months after the ICU admission.[25,33] Likewise, Oeyen et al[23] reported statistically significant levels of increased pain in both the solid tumour and haematological patient group ($p<.001$). O'Gara et al[17] reported similar results with

participants conveying that pain continued to be a factor that affected overall HRQoL after discharge from ICU. Post-operative oesophagectomy patients also reported symptoms of dysphagia, reflux and shortness of breath up to two years after their discharge from ICU.[25,32] One study reported that after the ICU care episode, participants self-reported actions of increased physical activity and preventative health measures to try and gain control of their lives and their bodies.[17] In cancer survivors who have had an admission to ICU, physical well-being was most likely to be affected by symptoms of pain.[17,18,23,25,33]

Psychological well-being

Eight publications (72%) reported on the psychological well-being of cancer survivors after an admission to ICU.[17,18,23-25,32,34,36] Two studies reported no change in psychological well-being over time, however both studies measured different time periods and comparison groups.[24,32] Zhang et al[32] reported no statistically significant difference in irritability and nervousness at three-weeks, six-months and one-year post the ICU admission, however pre-ICU scores were not reported. Similarly, Van Vilet et al[24] also reported no significant change after a median of 15 months in MCS. Only one study identified PTSD with worsening MCS at the twelve-month period following ICU (p=.003).[34] A reoccurring theme of increased levels of stress related to reduced contact with family and friends both during their ICU stay and after discharge were also reported in three of the included studies.[17,18,34] Overall, psychological well-being generally improved over time in cancer survivors after an admission to ICU.[23,25,36]

Experiences of anxiety and depression were also reported in cancer survivors after their admission to ICU.[17] The Edmonton Symptom Assessment System (ESAS) reported that 15% to 75% of patients affected by cancer experienced symptoms of depression and anxiety after an admission to ICU.[18,34] Likewise, Yau et al[37] reported one participant with clinically significant

scores on the hospital anxiety and depression scale (HADS). The remaining studies found no change over time in symptoms of anxiety and depression when compared to baseline (pre-ICU) scores.[23,24,32] Importantly, the studies did not report if anxiety and depression scores were lower than the general population prior to the admission to ICU.[23,24,32] Four studies (36%)[17,18,34,37] reported a degree of anxiety and depression in patients affected by cancer after an admission to ICU and it is therefore, a potential area of concern in regards to the HRQoL in this patient population.

Financial Impact

Minimal evidence was revealed on the financial impact experienced by cancer survivors after an admission to ICU. Only one study used a standardised assessment tool to assess financial and employment status. The Quality of Life Questionnaire-Oesophageal Module (QLQ-OES24) concluded that there was no significant difference at three-weeks, six-months and one-year after ICU in regards to employment status ($p>.05$).[32] Yau et al[37] also reported no significant financial impact with five of the seven participants returning to their usual work duties after their admission to ICU.[37] Finally, O'Gara et al[17] reported that participants felt that some financial pressure did exist after being discharged from ICU but overall were grateful for their individual circumstances.[17,37]

Overall HRQoL

Ten (90.9%) of the 11 studies provided data in relation to overall HRQoL (Supplementary Table 2). Most of the studies reported a decrease in overall HRQoL scores directly after an ICU admission with a gradual increase in the three-to-12-months post the ICU admission.[4,23,25,32,34,36] Four studies[23,32,34,36] reported a gradual increase in HRQoL scores over time, however overall HRQoL scores did not return to baseline/pre-ICU admission scores. The remaining studies reported no change in HRQoL scores over time in patients with cancer who had been discharged from ICU.[17,24,33,37] The single qualitative study included in this review reported that patients articulated that their HRQoL was negatively impacted more by their cancer journey and treatment rather than the admission to ICU or the critical illness encounter.[17] Overall HRQoL improved over time after the initial decrease among the patients in the included studies, although scores did not consistently return to baseline levels scores prior to ICU.

Predictors/Correlations with HRQOL

Six studies (55%) explored clinical and demographic factors which predicted HRQoL in cancer survivors after discharge from ICU (Supplementary Table 3).[23-25,33,34,37] Oeyen et al[23] reported that one year after ICU discharge older age (p=.007), higher comorbidity scores (p=.04), and haematological malignancies (p=.01) were independently associated with negative HRQoL scores. Oeyen et al[23] also reported that poor QOL three months after an ICU admission was independently associated with the female gender (p<.001). A diagnosis of a haematological malignancy was also associated with lower physical health scores (p=.04).[24] Three months post ICU admission high SOFA scores and Charlson index scores were independently associated with

poor QOL and both negative MCS and Physical Component Scores (PCS).[23,34] Daily requests for hypnotics were also found to be an independent predictor of poor HRQoL after an admission to ICU (p=.022).[33] Ehooman et al[34] reported an underlying malignancy as a predictor for MCS impairment, disparately, Oeyen et al[23] found no association with underlying malignancy and HRQoL scores. Variables that did not have a statistically significant relationship with HRQoL included ICU LOS[25] and reason for ICU admission.[23] The studies included in this review used a combination of univariate and multivariate analysis to statistically analysis predictive variables of reduced HRQoL in cancer survivors after an admission to the ICU. In summary, there is limited evidence available on the predictive variables of reduced HRQoL after an admission to ICU in cancer survivors.

Discussion

This goal of this review was to identify how HRQoL is impacted in cancer survivors following an admission to ICU. This review has revealed that the HRQoL among cancer survivors is negatively impacted after an admission to ICU. Domains of HRQoL most frequently affected in cancer survivors included: ICU environmental factors, physical function, physical well-being and social isolation. Over time, domains of HRQoL decreased immediately after the initial admission to ICU with a gradual but variable increase in HRQoL scores at three to 12 months post the ICU admission. The results from this review are consistent with what is known in the literature about the impact of an ICU admission on cancer survivors, with important areas of patient care focus and future research directions further defined.

It is known in the literature that sleep disturbance during and after an ICU admission is common in critically unwell patients.[38-41] Similar to the findings in this review, environmental factors in ICU are known to negatively impact sleep.[41] The constant noise present in the ICU setting

frequently results in disturbed sleep.[41] Weinhouse et al[41] review reported that mean ICU noise levels range from 53 to 65 dB with 45 to 35dB at night being the recommended peak noise levels in ICU. Interestingly, Weinhouse et al[41] review highlighted the potential impact of sepsis on sleep disturbance, a finding not revealed in this review. Sepsis was found to decrease rapid eye movement (REM) sleep and result in the loss of normal circadian melatonin secretion.[41] The potential for sepsis to alter and disturb sleep is an important result with cancer survivors being more prone to sepsis than the general population[17] and warrants further investigation. Reduced levels of sleep in the ICU can also result in worsened clinical outcomes and delirium.[40] Therefore, it is important that sleep is optimised in the ICU environment to help prevent a reduction in the domains of HRQoL in cancer survivors during and after an admission to the ICU.

Davies et al[42] reported 53% of cancer survivors will experience pain, causing significant morbidity without the burden of a critical illness. Decreased mobility as a result of pain is well documented in patients affected by cancer[43,44] and the general ICU population.[45,46] The increased levels of pain after an admission to ICU could explain the reported physical impairments seen in this review. Whether the pain and mobility impairments reported in this review is a result of cancer related symptoms, the critical illness or a combination of both, remains unclear and warrants further research. It is crucial that pain management continues to be an area of focus to improve the HRQoL of cancer survivors who have had a critical illness.

Choi et al[47] longitudinal study found a correlation between the presence of caregivers in ICU with greater psychological and social support in survivors between two weeks and two months after an ICU admission. These results highlight the importance of support from family and friends during and after an admission to ICU. The studies in this review did not specifically

pertain to the relationship between social isolation and the presence of caregivers in the ICU setting. However, this review highlighted that cancer survivors specifically were at risk of social isolation and this has not been well described in the literature previously. Therefore, opportunities for family members to be actively involved in their loved ones' care should be of importance in the clinical care environment. Additionally, although not the aim of this review, family members of ICU patients have also reported symptoms of severe psychiatric stress and therefore, should be provided appropriate psychological support during and after an admission to ICU to ensure a holistic approach to care delivery.[48]

High levels of psychiatric stress are well documented the general population during and after an admission to ICU,[45,46] a finding inconsistent with this review. The low level of psychological distress reported in this review could indicate that individuals in this patient population have a higher level or threshold of emotional resilience,[36] or that pre-ICU levels of psychological distress are lower than the general ICU population. Importantly, anxiety and depression are known to exacerbate pain and result in reduced patient outcomes.[42] Therefore, the psychological well-being of this population should still be considered an area of concern. Further research is required to ensure that after an admission to ICU, cancer survivors are provided with timely psychological support where appropriate.

Cancer survivors are also at a significant risk of suffering from financial burden, with large out-of-pocket costs related to their cancer treatment and care.[49] The findings of this review suggest that any financial burden in cancer survivors is likely a result of their cancer diagnosis, rather than their episode of critical illness in the ICU. However, the evidence on the financial burden of cancer survivors who have been admitted to the ICU is limited and warrants further research to either confirm or disprove these findings.

Patients with a haematological malignancy are at an increased risk of a critical illness requiring an admission to ICU often due to infection in relation to bone marrow suppression.[17] Advances in cancer and intensive care treatments have enabled increased survival rates and a reduction of unfavourable outcomes in this patient population.[50] However, this review has emphasised that patients with a haematological malignancy may be prone to worst HRQoL scores after discharge from ICU than patients with solid tumours and the general ICU population. Importantly, further research is needed to tease any discernible differences in cancer types and outcomes related to HRQoL after an admission to ICU.

Overall, this review has provided detailed and valuable clinical insights into what factors affect HRQoL and how HRQoL changes during rehabilitation with implications for practice. HRQoL is considered a major outcome measure in both oncology and critical care,[21,23] but this review highlights that this area of cancer care is an emerging area of clinical and research focus.

Limitations

This review has some limitations worthy of comment. Some of the included studies were published over ten years ago and in a wide array of countries, which may limit contemporary clinical practice in ICU, cancer treatments, and in a social-cultural context. However, this review provides a comprehensive overview of the current state of the evidence. This review is also limited by the studies included with minimal evidence available on specific HRQoL domains, specifically “cognitive problems”. Studies not published in the English language were also excluded, potentially omitting relevant publications. However, a systematic and sensitive literature search was implemented. This review followed a clear and transparent process to promote rigour and reproducibility.

Implications for Nursing Practice and Future Research

This review has revealed a number of important areas for future nursing practice and research. Firstly, a limited number of studies have explored clinical and demographic factors which predict HRQoL domains and further research is needed to stratify those at the highest risk. Further research may also be warranted to assess the quality of the tools used to assess HRQoL in this patient population, as they varied greatly between each study in this review. Importantly, only one qualitative study examined the lived experience of patients affected by cancer after an admission to ICU, highlighting the need for further research to 'give voice' to this particular vulnerable patient population. This review also highlighted the potential need for ongoing supportive care in cancer survivors who have been discharged from ICU. Importantly, most cancer services internationally do not provide specific supportive care for cancer survivors who have survived a critical illness. Nursing staff are encouraged to use the information provided in this review to further improve on patient-centred care, particularly in the immediate period following the admission to ICU to help improve the HRQoL of cancer survivors.

Conclusion

HRQoL decreased immediately after an admission to ICU in cancer survivors with a gradual but variable increase in HRQoL scores between three to 12 months after discharge. A number of HRQoL domains were impacted by ICU environmental factors, physical limitations, pain and social isolation in cancer survivors after an admission to ICU. The affected domains of HRQoL warrant further research and considerable consideration by healthcare professionals in the care of cancer survivors during and after an admission to ICU to help improve their overall HRQoL.

Researchers and clinicians are encouraged to use the finding to inform person-centre models of care for cancer survivors following critical illness in ICU.

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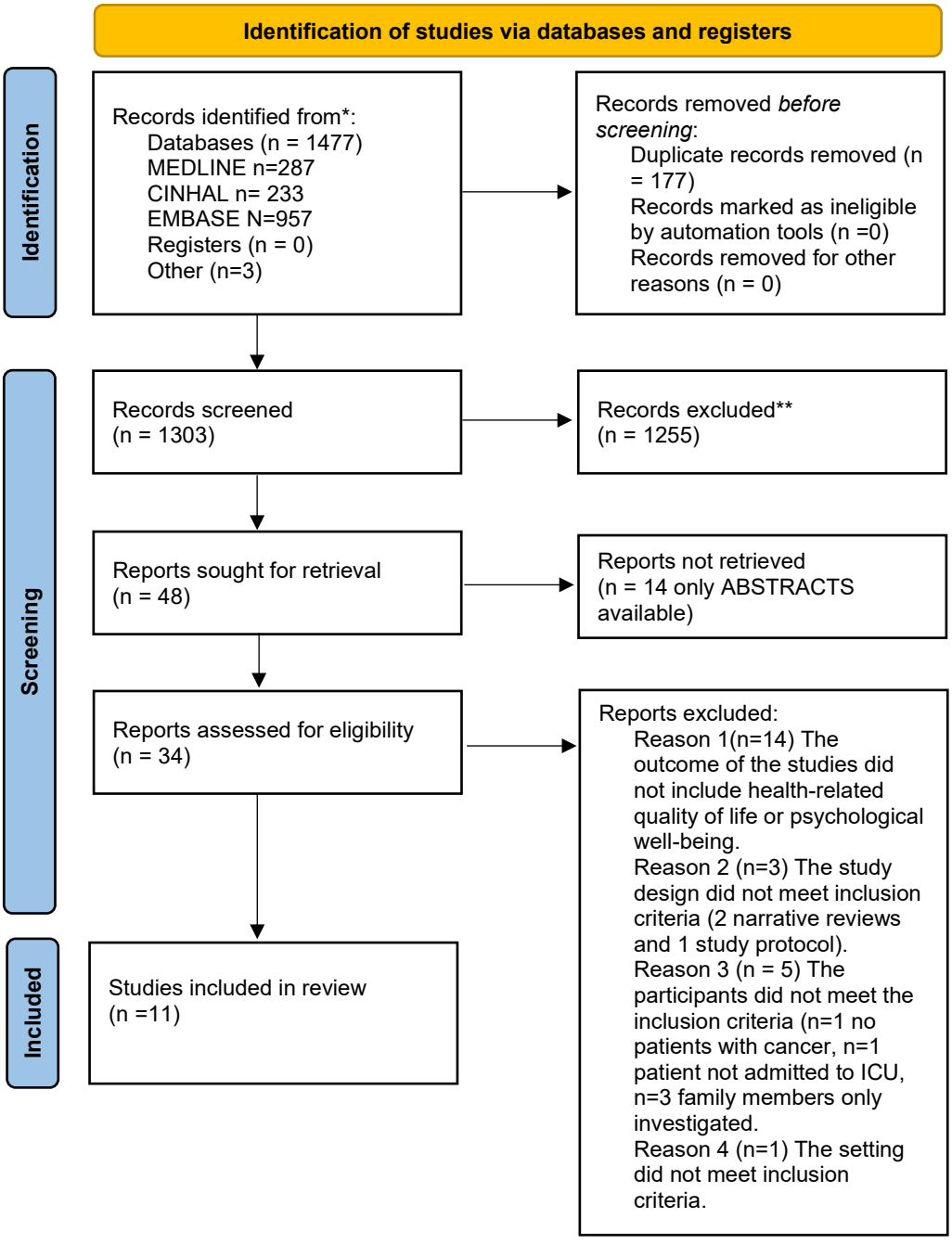
Figure: PRSIMA Diagram



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Table 1. Results of Methodological Quality Appraisal

Qualitative Study	**Item number of check list**						
	S1.	**S2.**	**1.1.**	**1.2.**	**1.3.**	**1.4.**	**1.5.**
O'Gara et al., 2018 [41]	Y	Y	Y	Y	Y	Y	Y
Item number check list key*: S1. Are there clear research questions, S2. Do the collected data allow to address the research questions, 1.1. Is the qualitative approach appropriate to answer the research question, 1.2. Are the qualitative data collection methods adequate to address the research question, 1.3. Are the findings adequately derived from the data, 1.4. Is the interpretation of results sufficiently substantiated by data, 1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation.							
Quantitative Descriptive Studies	**Item number of check list**						
	S1.	**S2.**	**4.1.**	**4.2.**	**4.3.**	**4.4.**	**4.5.**
Ehooman et al., 2019 [40]	Y	Y	Y	U	Y	N	Y
Zhang et al., 2011 [38]	Y	Y	Y	Y	Y	U	Y
Scarpa et al., 2014 [39]	Y	Y	Y	U	Y	U	Y
Nelson et al., 2001 [18]	Y	Y	U	U	Y	U	Y
Normilio-Silva et al., 2018 [7]	Y	Y	Y	Y	Y	Y	Y
Oeyen et al., 2013 [30]	Y	Y	U	U	Y	Y	Y
Cense et al., 2006 [29]	Y	Y	Y	U	Y	U	Y
Van Vilet et al., 2014 [11]	Y	Y	Y	U	Y	Y	Y
Chiarchiaro et al., 2013 [43]	Y	Y	U	U	Y	N	Y
Yau et al., 1991 [44]	Y	Y	Y	N	Y	N	Y
S1. Are there clear research questions, S2. Do the collected data allow to address the research questions, 4.1. Is the sampling strategy relevant to address the research question, 4.2. Is the sample representative of the target population, 4.3. Are the measurements appropriate, 4.4. Is the risk of non-response bias low, 4.5. Is the statistical analysis appropriate to answer the research question							

*Three levels of assessment quality scores

Low risk of bias (Green)
Unclear risk of bias (Yellow)
High risk of bias (Red)

Table 2: Overview of included studies

Author and Year	Purpose	Setting	Country	Sample size	Participants	Sampling	Response rate	Attrition	Design	Time points	Data collection tools
Ehooman et al., 2019 [40]	To assess post ICU HRQoL at three months and one year after ICU discharge and identify risk factors for QOL impairment in patients with a haematological malignancy.	Multi-centre: 17 University-affiliated centres-ICU	France and Belgium	n=1011 with n=732 ICU survivors and n=616 hospital survivors. n=118 non-survivors.	Patients with haematological malignancies who were admitted to participating ICUs for any reason. Demographics: ICU survivors Male n= 252 Female n=364	Convenience sample.	At three months n= 278 patients completed the SF-36, n=271 completed the HADS and n=269 completed the IES. At one-year n=176 completed the SF36.	Non survivors total n=183 Lost to follow up/didn't respond to questionnaire n=316.	Prospective observational multicentre study.	Questionnaires administered at 3 months and 1 year retrospectively after ICU admission.	SF-36 questionnaire, PCS and MCS oriented subscales, IES and HAD scale self-report instruments.
Zhang et al., 2011 [38]	To compare QOL differences in patients post a gastric tube reconstruction or whole-stomach reconstruction after oesophagostomy for cancer.	Single centre	China	n=104 patients. Demographics: Males n=81. Females n=23.	Patients undergoing oncological surgery for oesophageal cancer. Patients were admitted to the ICU post-operatively.	Convenience sample.	103 were followed up until death or the end of the study period.	One participant lost to follow up.	Prospective randomised single-centre study.	Questionnaires administered at 3 weeks, 6 months and 1-year post-operatively.	EORTC-QLQ-C30 and the QLQ-OES24 delivered over the three time points.
Scarpa et al., 2014 [39]	To identify patients and analyse the predictors of postoperative sleep disturbance/hypnotic administration after an oesophagostomy.	Single centre	Italy	n=62 Demographics: Males n=49 Females n=13	Patients presenting to the outpatient clinic with oesophageal cancer after their	Convenience sample.	Not reported.	Not reported.	Prospective observational study.	Questionnaires administered following neoadjuvant therapy, at hospital	EORTC QLQ-C30.

Author and Year	Purpose	Setting	Country	Sample size	Participants	Sampling	Response rate	Attrition	Design	Time points	Data collection tools
					hospital/ICU admission.					admission and discharge.	
Nelson et al., 2001 [18]	To characterise the symptom experience of patients with cancer admitted to the ICU.	Single centre	United States of America	n=100 Demographics: Males n=65 Females n=45	All patients with a diagnosis of cancer (past or present) who were admitted to a single MICU.	Convenience sample.	100% initially with >50% responding for entire ICU admission- no further information given.	Not reported.	Prospective analysis.	Daily symptom reports were taken during the participants ICU admission and followed up at 24 months post discharge.	Modified cognitive screen tool used for SUPPORT interviews, ESAS, Seven ICU environmental /routine factors and common medical symptoms were chosen by the researchers and patients were asked if they found theses stressful.
Normilio-Silva et al., 2016 [7]	To assess the HRQoL, QALY and long-term survival in patients with cancer admitted to ICU.	Multi-centre: two specialised oncology ICUs.	Brazil	n=792 Demographics: Males=58% Females= 42%	All adult patients with a diagnosed malignancy admitted to ICU.	Convenience sample.	n=788 patients over the entire period of the study.	Four patients lost to follow up (one after three months, three after 18 months).	Prospective Cohort.	Questionnaires administered at 0 days, 15 days, 3-, 6-, 12- and 18-months post ICU discharge.	ED-5D-3L, ECOG performance status, SAPS, CAM-ICU.

Author and Year	Purpose	Setting	Country	Sample size	Participants	Sampling	Response rate	Attrition	Design	Time points	Data collection tools
O'Gara et al., 2018 [41]	Explore haemato-oncology patients' perceived health-related quality of life post critical illness and how health-care professionals can provide long-term support.	Single centre: Specialist cancer tertiary referral centre.	United Kingdom	n=6 Demographics: Males n=4 Females n=2	Adult patients with a haematological malignancy who spent more than three days in ICU.	Convenience sample with the guidance of a clinical nurse specialist.	n=6.	One patient approached declined to participate.	Phenomenological interview study.	Interviews were conducted 3-6 months and 12-18 months after ICU discharge.	An interview guide designed by the authors with the aim to explore the phenomenon in depth. Interviews were digitally audio-recorded and transcribed afterwards.
Oeyen et al., 2013 [30]	To assess long-term outcomes of critically ill patients with a haematological or solid malignancy after ICU admission and identify indicators of the evolution of QOL after discharge.	Single centre: MICU and SICU.	Belgium	n=483 Demographics: haematological malignancy n=85 Solid tumours n=398 Male n=310 Female n=173	All adult patients with a solid or haematological malignancy as a direct or contributively cause for ICU admission. Patients in complete remission for over five years and patients who underwent cardiac surgery were excluded.	Convenience sample.	99% at admission, 75.8% at three months and 99.4% at one year.	199 non-survivors at one year and 2 lost to follow up.	Prospective observational cohort study.	Questionnaires administered at baseline, 3 months and 1 year post ICU discharge.	SF-36 questionnaire and the EQ-5D.
Cense et al., 2006 [29]	To describe and analyse the effects of prolonged ICU admission on QOL and	Single centre.	Netherlands-	n=109	Patients undergoing a transthoracic	Convenience. Participants were derived	92 patients were used	Five patients died. No	Prospective study.	Questionnaires administered pre-operatively,	MOS SF-20 and RSCL.

Author and Year	Purpose	Setting	Country	Sample size	Participants	Sampling	Response rate	Attrition	Design	Time points	Data collection tools
	survival in patients after oesophageal cancer resection.		Amsterdam	Demographics: ICU stay <5 days Male n=44 Female n=8 ICU >6 days Male n=45 Females n=7 ICU stay <2 days Male n=21 Female n=3 ICU stay >14 days Male n=17 Female n=2	resection with two-field lymphadenectomy.	from another randomised study that was ongoing.	for QOL analysis.	further information given.		5 weeks, 3, 6, 9, 12, 18, 24, 30 and 36 months.	
Van Vliet et al., 2014 [11]	To determine the long term self-reported HRQoL of patients being treated for a haematological disease who were admitted to ICU compared to the general ICU population and haematological patients who were not admitted to ICU.	Single centre.	United Kingdom	n=143 (not including general ICU population) Demographics: Haematology patients with an ICU admission:	Patients admitted for five days or more for treatment of a haematological malignancy. Survivors were divided into two groups depending on	Convenience sample.	79% of haematology patients with ICU admission, 85% of haematology patients without ICU admission and 71% of	23 non-responders in haematology ICU admission and without ICU admission group. 116 non-	Cross-sectional study design.	Questionnaires administered a median of 15 months after ICU discharge.	SF-36, PCS, MCS, CIS-fatigue, CFQ, HADS

Author and Year	Purpose	Setting	Country	Sample size	Participants	Sampling	Response rate	Attrition	Design	Time points	Data collection tools
				Male n=17 Female n=10 Haematology patients without admission to ICU: Male n=54 Female n=39 General ICU patients: Male n=72 Female n=77	whether or not they were admitted to ICU. A third group of general ICU patients were also included.		general ICU population.	responders from general ICU population.			
Chiarchiaro et al., 2013 [43]	To describe the functional, emotional, social and physical well-being of patients admitted to ICU with cancer, heart failure or COPD.	Single centre- ICU admission	United states of America	n=42 Demographics: Male n=24 Female n=18 Patients with cancer n=7 COPD n=17 CHF n=18	Patients with an estimated 50% 2-year survival with a diagnosis of either stage IV breast, colorectal, or prostate cancer and stage 111b or IV lung cancer, Congestive heart failure with left ventricular ejection fraction less	Convenience sample.	Not reported.	Not reported.	Cross-sectional cohort study.	Participants were selected from another longitudinal study and already had surveys administered before and after their ICU admission.	FACIT-G

Author and Year	Purpose	Setting	Country	Sample size	Participants	Sampling	Response rate	Attrition	Design	Time points	Data collection tools
					than 40% and COPD with a PCO2 greater than 46mmgh and at least one hospital/ED visit in the past year.						
Yau et al., 1991 [44]	To determine the QOL of patients discharged from hospital following an intensive care admission related to life threatening complications of a haematological malignancy.	Single centre	United Kingdom	n=92 found eligible for study. Demographics: Male n=58 Female n=34 Diagnosis: AML n=33 ALL n=23 CML n=1 CLL n=1 MM n=3 HL n=7 NHL n=21	All adults with a haematological malignancy admitted to a single ICU over a ten-year period.	Convenience sample.	n=7 participants involved in the study. Response rate not directly reported on.	n=71 (77%) patients died in hospital, of whom 60 died in ICU. 11 patients died on the ward. 9 patients alive 3 years after hospital discharge.	Prospective study.	Patients who were alive 1 year post ICU discharge were administered questionnaires.	NHP, HAD and PQOL.

Abbreviations: ICU, Intensive Care Unit; MICU, Medical Intensive Care Unit; SICU, Surgical Intensive Care Unit; HRQOL, Health Related Quality of Life; QOL, Quality of Life; SF-36, Short form 36 questionnaire; PCS, Physical Component Score; MCS, Mental Component Score; HADS, Hospital Anxiety and Depression Scale; IES, Impact of Event Scale; EORTC-QLQ-C30, European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire Core 30; QLQ-OES24, Quality of Life questionnaire- Oesophagus 24; ESAS, Edmonton

Symptom Assessment Scale; QALY, Quality-adjusted life years; ED-5D-3L, The Euro-Qual five Dimension three level; ECOG, Eastern Cooperative Oncology Group; SAPS, Simplified Acute Physiology Score; CAM, Confusion assessment method; MOS SF-20, Medical Outcome Studies Short Form-20; RSCL, Rotterdam Symptom Check List; CIS-fatigue, Checklist individual strength-fatigue; CFQ, Cognitive Failure Questionnaire; COPD, Chronic Obstructive Disease; CHF, Chronic Heart Failure; FACIT-G, Functional Assessment of Chronic Illness Therapy-General survey; SURPISE, The Study to Understand Risks, Priority and Issues at the End of Life; ALM, Acute myeloid leukaemia, ALL, Acute lymphatic leukaemia; CML, Chronic myeloid leukaemia; CLL, Chronic lymphatic leukaemia; MM, Multiple myeloma; HL, Hodgkin's lymphoma; NHL, Non-Hodgkin's lymphoma; NHP, The Nottingham Health Profile; PQOL, The Perceived Quality of Life Scale; ED, Emergency Department.

Supplementary Table 1: Example of electronic database searches

Database: MEDLINE		
Symbols used in this document:		
MH = Main Heading or “MeSH Heading”		
+ = Explodes the “MeSH Heading”		
“ ” finds a phrase		
Asterisk (*) = truncates stem of a word		
n5 = finds words within 5 words of each other		
? = wildcard that finds alternate spellings of a word		
Search #	**Search Terms/Strategy**	**# of Results**
#1	((health-related quality of life or health related quality of life or hrqol or well-being or quality of life or qol or quality of life psychosocial factors or (psychological well-being or psychological wellbeing or emotional health or emotional well-being or mental health or stress or critical care psychosocial factors or social support) or (depression or anxiety)) and (ICU or intensive care units or intensive care or intensive care unit or critical care or critical illness or critical care unit) and (cancer or oncological emergency or cancers or oncology patient or patients with cancer or oncology)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	528
#2	limit 1 to (english language and humans and "all adult (19 plus years)")	287

Database: Cumulative Index to Nursing and Allied Health Literature (CINAHL)		
Symbols used in this document:		
MH = Main Heading or “CINAHL Heading”		
+ = Explodes the “CINAHL Heading”		
“ ” finds a phrase		
Asterisk (*) = truncates stem of a word		
n5 = finds words within 5 words of each other		
? = wildcard that finds alternate spellings of a word		
Search #	**Search Terms/Strategy**	**# of Results**
#1	(MH "Quality of Life") AND (MH "Intensive Care Units") AND "(health-related quality of life OR health related quality of life OR hrqol OR well-being OR quality of life OR qol OR quality of life psychosocial factors) OR (psychological well-being OR psychological wellbeing OR emotional health OR emotional well-being OR mental health OR stress OR critical care psychosocial factors OR social support) OR (depression OR anxiety) AND (ICU OR intensive care units OR intensive care OR intensive care unit OR critical care OR critical illness OR critical care unit) AND	83, 263

	(cancer OR oncological emergency OR cancers OR oncology patient OR patients with cancer OR oncology)" Limiters- Full text; English language; Human; Language: English; Age Groups: All Adult. Expanders-Apply related words; Apply equivalent subjects Search modes-SmartText searching	
#2	(MH "Quality of Life") AND (MH "Intensive Care Units") AND ""((health-related quality of life or health related quality of life or hrqol or well-being or quality of life or qol or quality of life psychosocial factors or (psychological well-being or psychological wellbeing or emotional health or emotional well-being or mental health or stress or critical care psychosocial factors or social support) or (depression or anxiety)) and (ICU or intensive care units or intensive care or intensive care unit or critical care or critical illness or critical care unit) and (cancer or oncological emergency or cancers or oncology patient or patients with cancer or oncology)). Limiters- Full text; English language; Human; Language: English; Age Groups: All Adult; Special Interest: Critical Care Expanders-Apply related words; Apply equivalent subjects Search modes-SmartText searching	233

Database: EMBASE		
Symbols used in this document:		
MH = Main Heading or “MeSH Heading”		
+ = Explodes the “MeSH Heading”		
“ ” finds a phrase		
Asterisk (*) = truncates stem of a word		
n5 = finds words within 5 words of each other		
? = wildcard that finds alternate spellings of a word		
Search #	**Search Terms/Strategy**	**# of Results**
#1	((health-related quality of life or health related quality of life or hrqol or well-being or quality of life or qol or quality of life psychosocial factors or (psychological well-being or psychological wellbeing or emotional health or emotional well-being or mental health or stress or critical care psychosocial factors or social support) or (depression or anxiety)) and (ICU or intensive care units or intensive care or intensive care unit or critical care or critical illness or critical care unit) and (cancer or oncological emergency or cancers or oncology patient or patients with cancer or oncology)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	2569
#2	limit 1 to (human and english language)	2356
#3	2 and "adult" [Subjects]	957

Supplementary Table 2. Summary of HRQoL and psychological well-being

Author and year	Physical function/limitations	Cognitive problems	Social activities/Limitations to usual	Physical well-being	Psychological well-being	Depression and Anxiety	Financial impact	Overall HRQOL	Length of ICU stay	ICU interventions	Mortality
Ehooman et al., 2019	RP significantly increased (p=0.0004) over the three to 12 months following ICU admission. A decrease in functional capacity was found at 3 months following ICU but an increase was seen at 12 months. No significant difference in the PCS at three months and 12 months post ICU (p=0.38).	Not reported.	No significant difference in social functioning scores at 3- and 12-months post ICU (p=0.092).	No significant difference in bodily pain at three months and 12 months post ICU (p=0.051).	22 patients (8%) had a IES score greater than 35 points, a score indicating PTSD. The IES score was positively correlated with ICU length of stay (95% CI 0.02; 0.0026, p=0.0025). MH and MCS scores significantly decreased (p=0.003, p=0.006) from one to three months after ICU admission.	Three months after ICU admission 42 patients (15.5%) had an anxiety score >8 and 41 patients had a depression score >8. A score >8 is considered a clinical disorder.	Not reported.	23.5% of participants reported that their health in general was "much better now than one year ago" post ICU admission. 21.3% reported that their general health was "much worse than one year ago" 19.1% reported no change. Septic shock patients had significantly worst PCS, PF, RP, VT and SF sub cores when compared to haematological patients (p=0.007, p= 0.016, p=0.007, p=0.035, p=0.007).	On average patients who survived hospital had a median of 6 days in ICU.	Mechanical ventilation, Renal replacement therapy, vasopressors, and Sedation was associated with a negative MCS.	Mortality rate of 513 (50.7%) at 3 months.
Zhang et al., 2011	At 6 months and one year after ICU admission patients in the NGT group reported significantly	No significant difference in concentration scores at three	No difference in social function scores over the study period (P>0.05).	Patients in the NGT group reported significantly less reflux than those in the WS group at 3 weeks (p=	No significant difference in Irritability and nervousness over the study period (P>0.05).	No significant difference in anxiety levels over the study period (p>0.05).	No significance difference in employment status	Three weeks postoperatively QOL scores for all patients had dropped with an average score of 75 (p=0.44).	No statistically significant difference between the two groups and number of	Not reported.	13 of the 104 patients died, with an overall survival rate of 88%.

Author and year	Physical function/limitations	Cognitive problems	Social activities/Limitations to usual	Physical well-being	Psychological well-being	Depression and Anxiety	Financial impact	Overall HRQOL	Length of ICU stay	ICU interventions	Mortality
	better physical function than the WS group Role function (p=0.04; p=0.03).	weeks, 6 and 12 months (p=0.30, p=0.26, p=0.16).	No significant difference in daily life, patient's leisure time activities, family life and trouble sleeping over the study period (p>0.05).	0.03), 6 months (p=0.04) and one year (p=0.03) after ICU admission. Post-operative dysphagia and diet were significantly different at 6 months but not 3 three weeks or one year. There was no significant difference during the study period in patients' pain, appetite loss, food consumption, weight change, nausea and vomiting, diarrhoea and constipation (p>0.05).			and financial impact over the study period (P>0.05).	QOL increased in both groups over 6 and 12 months following the operation.	days spent in the ICU (p=0.34).		
Scarpa et al., 2014	Not reported.	Not reported.	Not reported.	Pain increased and sleep disturbance was	Not reported.	Not reported.	Not reported.	QOL remained relatively	Median number of	Median infusion lengths	Not reported.

Author and year	Physical function/limitations	Cognitive problems	Social activities/Limitations to usual	Physical well-being	Psychological well-being	Depression and Anxiety	Financial impact	Overall HRQOL	Length of ICU stay	ICU interventions	Mortality
				significant after surgery compared to at the time of diagnosis and after neo-adjuvant therapy (p=0.01 and p=0.001). Fatigue increased after surgery (p=0.07). Administration of hypnotics were positively associated with worse sleep disturbance in the post-operative period (0.008).				unchanged during the study. Hypnotic requirement during the patients' post-operative period was found to be positively associated with a significantly worse global QOL compared to patients who did not need them (p=0.007).	days n=2 (1-8).	Dopamine n=180 minutes Noradrenaline n=86 minutes Dobutamine n=8.5 minutes	
Nelson et al., 2001	Not reported.	Not reported.	Not reported.	75% of ESAS responders experienced pain, discomfort, anxiety, sleep disturbance and unsatisfied hunger/thirst-which was marked as moderate to severe. Dyspnoea was reported by 33%	73% of participants reported that the inability to communicate (specifically during intubation) as "severely stressful". 29% reported severe stress related to	Depression was reported as moderate to severe in 40% of ESAS responders.	Not reported.	Not reported.	Responders median number of days in ICU n=5 (1-23) Non-responders n=6 (0-34).	Over 60% of ESAS responders were mechanically ventilated. Moderate to severe pain was reported during ABG puncture, arterial catheter insertion, CVC insertions, ETT suctioning, PIVC insertion and	ICU mortality was 32% for patients with cancer and 20% for all other patients (with or without cancer). Overall a 55% mortality rate for the

Author and year	Physical function/limitations	Cognitive problems	Social activities/Limitations to usual	Physical well-being	Psychological well-being	Depression and Anxiety	Financial impact	Overall HRQOL	Length of ICU stay	ICU interventions	Mortality
				of respondents as moderate to severe.	limitations on visiting hours. 22% reported severe stress related to lights and room temperature in ICU. 16% reported severe stress related to noise.					turning in bed by 30-34 patients. Moderate to severe pain was also reported by 19-28 participants with an ETT, moving from bed to chair and NGT insertion/ in place. Mechanical ventilation and having an IDC were also reported as moderate to severely painful by 8 participants.	patients in this study.
Normilio-Silva et al., 2016	The simplified acute physiology score was statistically significant before critical illness (P<0.001) and at 15 days following ICU admission (P<0.001) but not at 3, 6, 12 and 18 months when	15% of patients experienced delirium.	Not reported.	Not reported.	Not reported.	Not reported.	Not reported.	Before ICU admission the ED-5Q measure was 0.47+0.43, 15 days after ICU admission 0.41+0.44, 90 days =0.56+0.42 6 months=0.60+0.41 12 months= 0.67+0.35 and 18 months= 0.67+0.35. 15 days after ICU admission the QOL	Median length of stay was 3 days.	Invasive mechanical ventilation was required more often for patients admitted under a surgical team comparted to a medical team. (p<0.001).	Just under 50% of participants survived to 12 months following admission to ICU.

Author and year	Physical function/limitations	Cognitive problems	Social activities/Limitations to usual	Physical well-being	Psychological well-being	Depression and Anxiety	Financial impact	Overall HRQOL	Length of ICU stay	ICU interventions	Mortality
	compared to baseline variables. The performance status score was statistically significant at all follow up periods when compared to baseline variables (p=<0.001).							of participants admitted for clinical reasons were poorer than the onset of the acute illness when compared to surgical and metastatic cancer patients. HRQoL overall improved for medical patients surviving to follow up when compared to baseline values.			
O'Gara et al., 2018	The physical effects of treatment were reported as leading to feelings of vulnerability and an inability to move on, impacting their QOL. Patients reported pain and neuropathy leading to difficulty in mobilisation possibly from	Not reported.	Not reported.	Pain and neuropathy were reported by patients.	Patients reported that the psychological effects on QOL remained a challenge after ICU admission.	Depression and anxiety were reported as long-term consequences of treatment in some patients.	Patients reported that financial pressure was present but overall, they were appreciative of what they had.	Participants felt that the critical illness did not impact their lives as much as cancer. Patients reported that cancer treatment overall improved their QOL. Patients overall felt that their ICU stay gave them a "second chance" and an opportunity to re-evaluate what	Two patients were admitted to ICU for 29 and 30 days. The other 4 patients were admitted between 3 and 6 days.	Some patients reported a fear of returning to ICU due to ongoing treatment and side-effects. Patients reported feeling well cared for and had overall positive feelings about their ICU experience.	Not reported.

Author and year	Physical function/limitations	Cognitive problems	Social activities/Limitations to usual	Physical well-being	Psychological well-being	Depression and Anxiety	Financial impact	Overall HRQOL	Length of ICU stay	ICU interventions	Mortality
	critical illness or cancer treatment.							QOL means to them. Patients reported feeling that they had a new appreciation for life and want to fulfill ambitions.			
Oeyen et al., 2013	Changes in mobility in the solid tumour group were significant over time (P=0.02). The PCS, PF and RP scores in the solid tumour group were significant over all time periods (p=<0.001).	Not reported.	Social functioning was significant over time in the solid tumour group (p=<0.001). Changes in usual activities for haematological patients were significant over time (p<0.001). Changes in self-care and usual activities for the solid tumour group were significant	Changes in pain were significant over time in the solid tumour group (p<0.001).	Mental health and role-emotional were significant in the solid tumour group over time (p=0.001). Vitality was significant over time in both the solid tumour and haematological group over time (P=<0.001, p=0.003).	Anxiety in the solid tumour group did not improve one year after ICU discharge.	Not reported.	Before ICU admission QOL was better in patients with solid malignancies and patients' who survived to hospital discharge when compared to non-survivors. Overall HRQoL decreased at 3 months after ICU discharge but improved after 1 year.	Median of three days.	Not reported.	41.2% at one year.

Author and year	Physical function/limitations	Cognitive problems	Social activities/Limitations to usual	Physical well-being	Psychological well-being	Depression and Anxiety	Financial impact	Overall HRQOL	Length of ICU stay	ICU interventions	Mortality
			over time (p=0.02).								
Cense et al., 2006	Physical function score was lower in patients with a longer stay in ICU (P<0.01) when compared to baseline scores. Physical domain scores significantly (p<0.01) increased 2.5 years after the operation.	Not reported.	The social function score was lower in patients with a longer stay (>14 days) in ICU (P<0.01). Activities of daily living scores declined immediately after the operation (p<0.01) but recovered after nine months.	Physical symptoms declined immediately after the operation (<0.01) but recovered to pre-operative levels 2.5 years later. Both patient groups had complaints of shortness of breath up until 2.5 years after the operation (P<0.01).	Three years after the operation mental health was significantly better than baseline (p<0.01). Psychological symptoms overall increased significantly after three years (p<0.01).	Not reported.	Not reported.	There was a significant (p<0.01) decline in all domains of the MOS SF-20 immediately after the operation, except for bodily pain which increased. All domains except for physical functioning and energy returned to preoperative levels after six months.	Median of 5.5 days in ICU. Overall, there was no difference in MOS SF-20 outcomes related to ICU length of stay (p<0.01).	Median of two days on the ventilator.	Five patients died in hospital and were not included in the analysis.
Van Vilet et al., 2014	General ICU patients reported a lower score on the PCS (<0.001).	Overall cognitive function was better in haematological patients admitted to ICU than the	Haematological patients admitted to ICU reported problems with work or other daily living activities (p=0.04).	There was no difference in fatigue scores between haematological patients admitted to ICU and haematological patients who were not.	No difference between haematological patients admitted to ICU and haematological patients who were not	No difference in depression and anxiety scores between all three groups.	Not reported.	The HRQoL was similar in haematological patients admitted to ICU and those who were not with almost all domains of the SF-36 not being statistically	A median of five days for haematology patients and four for the general ICU population.	Not reported.	Mortality was higher (76%) in patients admitted to ICU than not (45%) (p<0.0001).

Author and year	Physical function/limitations	Cognitive problems	Social activities/Limitations to usual	Physical well-being	Psychological well-being	Depression and Anxiety	Financial impact	Overall HRQOL	Length of ICU stay	ICU interventions	Mortality
		general ICU population (p=0.06).		Body pain was not statistically significant in either group.	admitted to ICU in MCS scores.			significant (except physical function).			
Chiarchiaro et al., 2013	Physical and functional well-being scores decreased after ICU admission but increased over the following six months to pre-ICU admission scores (P<0.001). The presence of caregivers/ support from relatives had minimal effect on functional well-being (P>0.05).	Not reported.	Social well-being scores declined in the six months following ICU admission (p=0.02). Patients with a caregiver had higher scores for social well-being throughout the study period, but it was not statistically significant (P>0.05).	Not reported.	Emotional well-being decreased after the ICU admission (95% CL, 18.0-20.7 shift p=0.006). Emotional well-being returned to pre-ICU levels five months after admission (p=0.08).	Not-reported.	Not-reported.	Functional and social well-being were significantly lower in patients with multiple ICU admissions 13.8 (95% CI, 8.2-19,4) when compared to patients with only one ICU admission 15.4 (95% CI, 8.8-18.5).	Not reported.	Not reported.	Not reported.
Yau et al., 1991	No physical limitations were reported.	Not reported.	None of the seven patients reported limitations in their daily activities.	Not reported.	Not reported.	Only one patient was considered to have a score high enough to indicate anxiety. No patient had a score high enough to indicate that they had depression- one	Five of the seven patients returned to full time work.	Most patients with a haematological malignancy reported a high level of satisfaction with their HRQoL. All patients expressed satisfaction with their family life and	Not reported.	Not reported.	71 patients died during the study period (77%).

Author and year	Physical function/limitations	Cognitive problems	Social activities/Limitations to usual	Physical well-being	Psychological well-being	Depression and Anxiety	Financial impact	Overall HRQOL	Length of ICU stay	ICU interventions	Mortality
						patient however had a borderline score.		the support they had received. The Nottingham health profile and QOL scale both represented an overall good QOL.			

Abbreviations: Quality of Life (QOL), Post Traumatic Stress Disorder (PTSD), Impact of Event Scale (IES), Narrow Gastric Tube (NGT), Whole Stomach reconstruction (WS) group, Arterial Blood Gas (ABG), Central Venous Catheter (CVC), Peripheral Intravenous Catheter (PIVC), Indwelling catheter (IDC), Nasogastric tube (NGT), Endotracheal tube (ETT), Mental Component Summary (MCS), Physical Component Summary (PCS,) Intensive Care Unit (ICU), Short Form survey (SF-36), Physical Functioning (PF), Role-physical (RP), Vitality (VT), Mental Health (MH), Mental Component Score (MCS)

Supplementary Table 3: Predictor Variables

Author and year	Demographic variables	Cancer variables	ICU variables	Comorbidities/other reported variables	Type of statistical analysis
Ehooman et al., 2019	Not reported.	Three months after an ICU admission the status of underlying malignancy and HSCT were associated with an MCS at a 20% level. Status of underlying malignancy remained independently associated with MCS impairment after multivariate adjusted model. No association with these variables and MCS and PCS at one year.	Three months after ICU discharge need for invasive mechanical ventilation, renal replacement, vasopressors, sedation, high SOFA score were associated with an MCS at a 20% level. SOFA scores remained independently associated with MCS impairment after multivariate adjusted model. No association with these variables and MCS and PCS at one year.	Three months after ICU discharge the Charlson Index was independently associated with PCS impairment at a 20% level. No association with these variables and MCS and PCS at one year.	Univariate analysis with multivariate adjusted model.
Zhang et al., 2011	Not reported.	Not reported.	Not reported.	Not reported.	Not reported.
Scarpa et al., 2014	Not reported.	Not reported.	Length of dopamine infusion was an independent predictor for sleep disturbance in ICU (p=0.049).	Daily request for hypnotics was an independent predictor for poor QOL (p=0.022). Fatigue was independently predicted by sleep disturbance (p=0.049). Emotional function was independently predicted by daily request of tramadol and benzodiazepines (p=0.004, p=0.399).	Multivariate analysis.
Nelson et al., 2001	Not reported.	Not reported.	Not reported.	Not reported.	Not reported.

Normilio-silva et al., 2016	Not reported.	Not reported.	Not reported.	Not reported.	Not reported.
O'Gara et al., 2018	Not reported.	Not reported.	Not reported.	Not reported.	Not reported.
Oeyen et al., 2013	At three months after ICU admission poor QOL was independently associated with the female gender (P<0.001) and older age (p=0.03). One year after ICU older age remained independently associated with poor QOL.	At three months and on year after ICU poor QOL was independently associated with a diagnosis of a haematological malignancy (p=0.01). Cancer status had no influence on long-term QOL.	At three months after ICU admission poor QOL was independently associated with high SOFA scores (p=0.04). Reason for ICU admission (surgical or medical) had no influence on long-term QOL.	At three months and one year after ICU poor QOL was independently associated with increased co-morbidity scores (p=0.001).	Multivariate regression analysis.
Cense et al., 2006	Not reported.	Not reported.	Long-term QOL was not associated with ICU LOS.	Not reported.	Univariate analysis.
Van Vilet et al., 2014	Not reported.	Haematological diagnosis was associated with lower physical health scores and PCS, affecting daily activities (p=0.04).	Not reported.	PCS was not independently associated with fatigue scores, CFQ and HADs.	Multivariate analysis of covariance.
Chiarchiaro et al., 2013	Not reported.	Not reported.	Not reported.	Not reported.	Not reported.
Yau et al., 1991	Not reported.	Not reported.	There was no correlation between APACHE scores and duration of long-term survival (r=0.1)	Not reported.	Regression analysis.

Abbreviations: Intensive Care (ICU), Mental Component Scores (MCS), Physical Component Scores (PCS), Hematopoietic stem-cell transplantation (HSCT), Sequential Organ Failure Assessment (SOFA), Quality of life (QOL), Length of Stay (LOS), Cognitive Failures Questionnaire (CFQ), Hospital Anxiety and Depression scale (HADS), Acute Physiology and Chronic Health Evaluation (APACHE).