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**Title:** Return to employment following critical illness and its association with psychosocial outcomes: a systematic review and meta-analysis

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## **Abstract**

**Background:** Patients who survive critical illness have well-defined physical, cognitive, emotional, and familial problems. However, the impact of these problems on survivors' ability to return to work and other financial outcomes are less clear.

**Objective:** To determine the financial and employment consequences of an intensive care stay, we performed a systematic review and meta-analysis.

**Data Source** We searched MEDLINE, Embase, and CINAHL (1970-2018). All study designs except narrative reviews, case reports, case control studies, and editorials were included. Included studies assessed financial outcomes in patients admitted to critical care, and their caregivers.

**Data Extraction:** Two reviewers independently applied eligibility criteria, assessed quality and extracted data. The primary outcome reported was return to employment among those previously employed. We also examined financial stress and the impact financial outcomes had on quality of life and psychosocial health.

**Data Synthesis:** From 5765 eligible abstracts, 51 studies were included, which provided data on 858 caregivers/family members and 7267 patients. Forty-two papers reported on patient outcomes and 11 papers on caregiver/family members. Two papers included data from both patients and caregivers/family members. Return to employment was the most commonly reported financial outcome for critical care survivors. The pooled estimate for return to employment—among those who were employed prior to critical illness—was 33% (95% CI: 21%-48%), 55% (95% CI: 45%-64%) and 56% (95% CI: 45%-66%) at 3, 6, and 12 months, respectively. Across the studies included in this review, there was a positive association with psychosocial health if patients returned to employment. This included improved health related quality of life and fewer depressive symptoms. With caregivers/family members, six studies reported changes to employment such as reduced hours and lost earnings.

**Conclusions:** Following critical illness, many patients who were previously employed do not return to work, even one year later. This new job loss is associated with worse health related quality of life amongst survivors and worse psychological function amongst survivors and caregivers/family members. More interventional research is required to understand how best to support employability after critical illness. PROSPERO (ID:CRD42018102360).

**Keywords:** Critically ill; Systematic Review; Return to employment; Financial strain; Caregivers.

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## **Background**

The number of patients surviving an admission to critical illness is increasing **(1)**. As a result, there is a growing body of research focused on understanding and improving the survivorship journey. This research has identified that in the months and years following critical illness, patients are known to experience physical, emotional and cognitive problems **(2-4)**. This group of signs and symptoms are commonly referred to as Post Intensive Care Syndrome (PICS) **(5)**. PICS is known to have a profound impact on the individual patient, with frequent rehospitalisation and overall increases in healthcare utilisation reported **(6)**. These issues also extend to family members, with Post Intensive Care Syndrome-Family (PICS-F) emerging as an important concept **(7,8)**.

Despite numerous studies examining the impact that PICS and PICS-F have on physical, emotional and cognitive functioning, less is known about the wider impact on the individual, especially the social manifestations. Social issues such as delayed return to employment and reduction in family income can have a significant impact on the individual, their family and society as a whole, yet there is a limited understanding of what this impact is **(9)**. There is a need to synthesise the evidence to understand if it can inform those providing care, and to identify and inform future research, including the potential for targeted interventions.

Therefore, we conducted a systematic review and meta-analysis of the impact of a critical care admission on return to employment among those employed prior to critical illness. We hypothesised that there would be a negative impact on return to employment following critical illness and there would be a significant financial burden associated with a period of critical illness for patients and their caregivers/family members.

## **Methods**

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist was followed for reporting this systematic review and meta-analysis **(10)**. The protocol was prospectively registered on PROSPERO (ID:CRD42018102360). The research question was formulated according to the Participants, Interventions, Comparisons and Outcomes (PICO) model: *P*-Patients and caregivers admitted to critical care; *I*- critical care, *C*- none, *O*- financial and psychosocial outcomes following critical illness **(Table One) (11)**.

Eligible studies included randomised controlled trials (RCTs) and observational studies, which reported on financial outcomes for patients and caregivers/family members following critical illness. Narrative reviews, editorials, case reports, and duplicate publications were excluded. We also excluded studies which were not peer reviewed, were in abstract form only or if the population were

not from an Intensive Care Unit (ICU). Only general ICU populations were examined within the context of this review. Specific disease pathways were excluded, for example cardiac patients (including isolated ECMO cohorts) and those admitted with a brain/head injury.

### *Search Strategy*

PROSPERO and the Cochrane Library were searched to ensure a previous systematic review of financial outcomes following critical illness was not published. We electronically searched MEDLINE In-Process & Other Non-Indexed Citations and MEDLINE (1946 to present via Ovid), Embase (1947-present), updated daily via Ovid, and CINAHL (1981 to present) via EBSCOhost in July 2018. Our search strategy, which was led by an experienced librarian (PC), cross-referenced financial outcomes and critical illness using appropriate subject headings and keywords (*Supplemental File One- Detailed Search Strategies*). Additional articles were identified from reference lists of eligible studies and personal files. The initial search was limited to human studies and the English Language. References were limited from 1970-2018.

### *Study Selection*

We included articles meeting the following criteria: (a) adult (>18 years) and their family who had experienced critical illness (b) inclusion of financial outcomes data from either patient or caregiver/family members. Each citation was independently reviewed for eligibility by two clinicians (JM and KH) via a review of titles and abstracts, and then full text articles. Disagreement regarding eligibility was resolved by MM.

### *Data Extraction*

Data was extracted independently by three authors, entered into a standardised form and independently cross-checked. If there were any discrepancies, TQ resolved disagreement by discussion and consensus. Data extracted included the following: author, year, location, study design, population, number of patients studied (total in study), gender, age, follow up time examined, number in employment pre-critical illness, return to employment; impact of financial outcomes on health-related quality of life and other financial outcomes. Outcomes were chosen a priori and were based on two domains: person-centred outcomes and impact on caregiver/family member. The primary outcome was return to employment (patient). Secondary outcomes included the impact of financial strain on health-related quality of life and the financial impact of critical illness on the caregiver/family member.

The studies included utilised different definitions of return to employment. For example, some studies regarded volunteering as a form of employment. For the purposes of this review, no restrictions were placed on the definition of return to employment—that is, we assumed that the authors utilised a measurement strategy relevant to their population. Studies also utilised different terminology for caregivers and family members. We considered patients and family members to have experienced ‘critical illness’ if the patient was cared for in an ICU.

#### *Assessment of quality*

The Newcastle-Ottawa Scale (NOS) was used to assess for study quality for cohort studies **(12)**. It consists of a nine-point scale with a maximum of four points allocated to population selection, two points for comparability and three points for outcomes. Studies who scored  $\geq 7$  were considered high quality; 4-6 moderate quality and less than 4, low quality. We assessed for risk of bias for the RCTs in this analysis using the Cochrane Risk of Bias Methodology **(13)**. Data on Risk of Bias is presented in *Supplemental Files Two and Three*.

#### *Data Analysis*

Reviewer agreement was measured with the Kappa statistic ( $\kappa$ ) and was interpreted according to Landis and Koch **(14)**. We pooled data from eligible studies for the primary outcome measure: return to employment for patients. Pooling of data was conducted at the three most commonly reported timeframes: three, six and 12 months. Longer term data were not included as there was wide variation in timeframes reported. Data were only pooled on return to employment data; if data on employment pre-critical illness were not available the study was not included in the meta-analysis. Caregiver/family member data were not pooled as there was no consistency in the reporting of any outcome measure.

We used the  $I^2$  statistic to evaluate inter-study heterogeneity. Heterogeneity was defined as  $I^2 > 50\%$ . Funnel plots were used to visually inspect for publication bias. R software package (R version 3.5.2, The R foundation for statistical computing, Vienna, Austria) was used for the statistical analysis. The meta-analytical method utilised a random effects model, a logit transformation and Clopper-Pearson Confidence Intervals (CI), to obtain an estimate of the effect size for the primary outcome (return to employment following critical illness) expressed as a pooled proportion, with 95% CI. The RCTs included in the meta-analysis, pooled the data across both arms of the RCT. We excluded qualitative studies from the meta-analysis.



## **Results**

### *Study Selection*

An initial search identified 8724 records. After duplicates were identified and removed, 5765 records were screened. After screening abstracts and titles, 107 full text articles were assessed. Three of these were papers from personal files of the authorship team. 37 articles did not meet the inclusion criteria and 17 reported on disease specific populations and thus were excluded. Two further studies were excluded as they were duplicate reports on identical populations and identical time points for financial outcomes that were otherwise included.

A total of 51 papers were included in this review (**15-65**). 42 papers reported on patient outcomes and 11 papers on caregiver/family members. Two papers included data from both patients and caregivers/family members (**35,37**). Four publications reported on the same population, however they described different data points and thus were included (**28-29,62, 65**).

Kappa for reviewer agreement on abstracts was excellent (0.87;  $n=107$ ;  $p<0.01$ ). One article was adjudicated by the third reviewer (MM) and was subsequently excluded. Details of this selection process are shown in **Figure One**.

### *Summary of Studies*

The characteristics of the included studies are summarised in *Supplementary Files Four and Five*. There was an international spread, with 21 (41%) studies being conducted in Europe, 16 (31%) in the USA, eight (16%) in Australia/New Zealand, three (6%) in Canada, one (2%) in South America, one (2%) in China and one (2%) in Israel.

The studies reported on 7267 patients and 858 caregivers/family members. Of the 51 studies included, 44 were cohort studies, three studies were qualitative and four studies analysed data from RCTs. Most studies collected data via structured, validated questionnaires. Thirty-one studies took place in a single centre; the remaining 20 took place across multiple sites.

The most commonly reported outcome in the studies analysed was return to employment; 35 studies reported on return to employment for patients and five for caregivers/family members. All other studies reported on a combination of financial stress and its impact on wellbeing. Follow-up time varied amongst the include studies. The majority of studies reported follow up between six and 12 months. The shortest follow-up time was two weeks and the longest was 72 months.

### *Study Quality*

The quality assessment of the included studies is shown in the Supplementary Information (*Supplemental Files Two and Three*). There were four randomised control studies included with a low risk of bias across all domains. The overall quality of the studies was poor with a mean (SD) NOS score of 3.5 (0.9) and a median of 3.5 (IQR 3-4). There were no studies with a score of 7 or above (i.e. ranking as high quality).

### *Return to employment*

For the purpose of the meta-analysis, only return to employment up to one year (12 months) was reported as these were the most frequently reported time points. People not in the labour force pre-ICU were not included as the purpose of the meta-analysis was to understand the change in employment status following ICU admission. We did not collect data on change in retirement status as this was not uniformly reported across the studies.

Twenty-two studies, therefore, were included in the meta-analysis; three studies reported return to employment at three months, 13 reported on return to employment at six months and 11 studies at 12 months (**Figure Two**). Three studies reported on multiple time points (**Figure Two**).

The number of patients analysed in the meta-analysis was 2356: 128 at three months, 1434 at six months and 1381 at 12 months (in three studies patients were analysed at multiple time points). Pooled estimates for return to employment following critical illness were 33% (95% CI: 21%-48%) at three months; 55% (95% CI: 45%-64%) at six months and 56% (95% CI: 45%-66%) at 12 months (**Figure Two**). There was evidence of heterogeneity across the studies: at three months  $I^2 = 60%$  ( $p=0.08$ ); six months  $I^2 = 90%$  ( $p<0.01$ ) and at 12 months  $I^2 = 92%$  ( $p<0.001$ ).

Alongside return to employment, studies in this review described the level of employment which patients returned to following critical illness; 17 studies reported that patients had to return to different types of employment, mostly with reduced professional activity and capacity. Only one study reported on predictors of return to employment; in this European prospective follow-up study, age, undergoing mechanical ventilation, gender (male), higher education, higher levels of optimism and medical disease category were independent predictors of return to employment (**39**). Kamdar et al (2018) reported that baseline Charlson Comorbidity Index, mechanical ventilation duration and hospital discharge to healthcare facility were associated with a longer time to return to work (**34**). Studies explored patient level reasons for changes in employment status; reasons included psychological factors such as Post Traumatic Stress Disorder, depression, and cognitive impairment, age as well as physical disability, memory loss and fatigue (**16, 24, 31, 40-42, 49, 55**).

### *Association of employment on other patient-reported outcomes*

Across the studies there was a positive association between psychosocial and return to employment. This included improved health related quality of life and fewer depressive symptoms (**19,33,39,45**). Similarly, those who did not return to work, or those consistently not in work reported worse physical and health related quality of life, as well as more frequent hospitalisations (**34**).

### *Interventions to improve outcomes*

Two studies specifically looked at the impact of an intervention on return to employment. Reid et al (2016) reported that patients who received augmented nutrition in the ICU setting in the pilot of the subsequently reported TARGET nutrition trial, were more likely to return to employment (**47, 66**). In a further nutritional study, there was no difference in return to employment following an enhanced nutritional programme for ICU patients (**40**).

### *Other financial outcomes (Patients)*

In a small number of studies, other financial outcomes were reported. One study described the predictors of financial stress, which included having children less than 10 years of age in the household (**35**). Overall, studies reported further negative financial consequences of an admission to critical care. For example, in one UK multi-centre study patients reported having to spend savings, borrow money, look to charity funding, or re-mortgage/sell house to pay for care requirements (**27**). A small number of studies also reported lost earnings, with disability being the primary factor for this. There was a wide variation in the lost earnings reported across the studies (**33,34,37,47**). For example, one study from 2018, reported mean lost earnings of USD\$180,221 (**34**), while another from 2016 reported lost earnings of £2,386 (Approx. USD\$3,100) (**37**). One European study also reported that the number of patients on government funded economic support also increased during the critical illness recovery period (**43**), while one American study reported that 23% of patients were receiving disability payments 18 months after critical care (**24**).

### *Caregiver/Family Member outcomes*

Eleven studies, which included data from 858 caregivers and family members, were included in this systematic review (**35,37,57-65**). Of the 11 studies, six reported data on employment following critical illness and 10 on other financial outcomes. One study specifically looked at the outcomes of bereaved relatives (**60**). Only three studies reported return to employment; in one study return to employment was 85% at a median of 34 days (**60**); another 95% at three months (**64**) and the final study reported return to employment in family members/caregivers as 85% at 12 months (**57**). A

further six studies reported changes to employment such as reduced hours, job changes and lost earnings (37,61-65). Five studies reported financial burden and stress for caregivers/family members (35,58,60,62,63). One study reported the impact that financial stress had on psychosocial outcomes; this demonstrated that experiencing financial stress had an impact on family/caregiver anxiety (35). This multicentre secondary analysis also demonstrated that in family members, financial stress was associated with lower levels of education, financial discomfort (baseline), emotional health and quality of life (35).

### *Qualitative Synthesis*

Three studies included in this review were qualitative in nature (15, 59, 60). These studies covered a number of aspects of recovery (from both a patient and caregiver/family member perspective). However, there was not enough data related to the financial elements of recovery across these studies to undertake a qualitative synthesis.

### **Discussion**

Our systematic review and meta-analysis, has demonstrated that return to employment after critical illness is a challenge for most patients; one associated with a significant negative financial impact for critical care survivors. These negative employment and financial impacts were seen across different countries with a range of social and health insurance programs, and were not restricted to the United States or nations with particularly generous social safety nets. We found that return to employment was associated with improved health-related quality of life for survivors and improved psychosocial outcomes.

Despite recent literature demonstrating the importance that patients place on returning to employment, there is little focus on this metric within interventional research in the critical care rehabilitation literature. As a result of this decrease in employment status, more patients required government funded support during the ICU recovery period. The low return to employment cited in this meta-analysis across three time points demonstrated that interventional research in this area is urgently needed. The skills that are needed to facilitate this element of recovery will not necessarily be found within the ICU team. As such, an integrated health and social care approach to rehabilitation will be required; the fact that this outcome (return to employment) has been measured in 2289 patients across 11 countries speaks to its feasibility. Moreover, it is a relatively common outcome, making it attractive from a statistical power perspective.

Patients who returned to work appeared to have better health related quality of life and mental health compared to those who did not. This is consistent with previous evidence which has

demonstrated that those in employment have a better quality of life **(67)**. Patients who are unemployed may be lonely, socially isolated and vulnerable due to lack of interaction which is often found in work related activities **(68)**. Therefore, by targeting return to employment, or meaningful activity for individuals following critical illness, we may begin to improve outcomes for this patient group. One small pilot study has been undertaken in this area to date, which demonstrated improved return to employment rates on a small scale **(69)**. More rigorously conducted research is required in this area. Clinicians must also understand how to improve quality of life in the event of patients being unable to return to employment. If this is the case, peer support might be a suitable mechanism to help recovery by acting as a substitute for some of the social interaction gained from employment **(70,71)**.

In this analysis, patients with a higher level of education seemed more likely to return to employment and thus have better psychosocial outcomes. This is consistent with recent work which has demonstrated that those with higher educational attainment were less likely to develop elements of PICS such as cognitive dysfunction **(72)**. While greater cognitive reserve is a plausible, additional considerations include a more robust social support network, greater health literacy and the ability to navigate medical infrastructure.

This meta-analysis also described the challenges that caregivers/family members face. Similar to patients, this group reported problems with employment and financial strain, which impacted upon housing and other basic needs. There is little interventional work which has specifically addressed caregiver/family member's needs following critical illness and even less examining ongoing support which may be needed during the critical illness itself **(73)**. Interventions tailored specifically for caregivers/family members are required to ensure that their needs are met appropriately. Although, this may appear costly, it may actually have longer term gain due to the potential reduction in the number of patients and caregivers/family members who require state support.

Our study has both strengths and weaknesses. As far as we can establish, it is the first systematic review to report patient level financial outcomes following critical illness. We have utilised established, rigorous systemic review procedures to assess and present this review. Its strengths lie in pooling information in an accessible manner, highlighting the heterogeneity of the information available in this recovery domain. Although the association between critical illness and poor financial outcomes is supported by our understanding around the patient recovery trajectory, it should be emphasised that almost all studies included in this review were observational in nature. Therefore, they may be prone to bias. Further, there was significant loss to follow up in many studies which again impacts on the reported results and it is unclear what role intermediate events

(e.g., hospital readmission) played in the relationship between an acute critical illness and inability to return to employment. Future research in this area could potentially link to other non-medical social, welfare datasets (for example the UK Department of Work and Pensions records); this would permit a complete understanding of patient outcomes and those who returned to work. This would resolve issues related to poor follow-up.

The broad range of outcomes reported reflects the heterogeneity of patients and research in this particular area. The lack of a definitive definition of what return to employment actually is, was also lacking with the studies included. Furthermore we did not collect data on those who undertook roles related to caregiving or those who were retired pre-ICU. Future versions of the core outcome measures set should consider adding specific reference to this variable and how data collection could be standardised. Finally, we included patients and caregivers who had been admitted to an ICU; there are international variations in the definition of ICU and indeed the case mix of patients admitted to these areas. Future research must also clarify these definitions to ensure that studies can be usefully generalised.

### **Conclusions**

Following critical illness, a large number of patients experience financial strain and reduced employment. The same challenge is also present for caregivers/family members, and is widespread across multiple health and social safety nets systems. This review has demonstrated that those patients who return to employment may have better health related quality of life and psychosocial outcomes. Further research is required to understand optimal rehabilitation to support return to employment and financial strain. Extending the concept of PICS to include the ability to return to key social roles, such as employment may be useful for future research.

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### **List of Abbreviations**

Confidence Interval: CI

Extracorporeal membrane oxygenation: ECMO

Intensive Care Unit: ICU

Newcastle-Ottawa Scale: NOS  
Population, Intervention, Comparisons and Outcomes: PICO  
Post Intensive Care Syndrome: PICS  
Post Intensive Care Syndrome-Family: PICS-F  
Preferred Reporting Items for Systematic Reviews and Meta-Analyses: PRISMA  
Randomised Control Trial: RCT

### **Ethics approval and consent to participate**

As this was a review of pre-existing literature, it did not fulfil the criteria for clinical research and did not therefore, require ethics approval.

### **Consent for publication**

Not applicable

### **Availability of data and materials**

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### **Competing interests**

The authors declare they have no competing interests

### **Author's contributions**

All authors have approved the submitted version

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