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Original research

Evaluation of a health and social care programme to improve outcomes following critical illness: a multicentre study

Philip Henderson,[1] Tara Quasim,[1,2] Martin Shaw,[1,3] Pamela MacTavish,[2] Helen Devine,[2] Malcolm Daniel,[2] Fiona Nicolson,[2] Peter O'Brien,[4] Ashley Weir,[4] Laura Strachan,[5] Lorraine Senior,[6] Phil Lucie,[7] Lynn Bollan,[8] Jane Duffty,[9] Lucy Hogg,[10] Colette Ross,[10] Malcolm Sim,[5] Radha Sundaram,[11] Theodore J Iwashyna,[12,13] Joanne McPeake [1,2]

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For numbered affiliations see end of article.

Correspondence to
Dr Philip Henderson, University of Glasgow, Glasgow, UK; philip.henderson@ggc.scot.nhs.uk

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ABSTRACT

Rationale At present, clinicians aiming to support patients through the challenges after critical care have limited evidence to base interventions.

Objectives Evaluate a multicentre integrated health and social care intervention for critical care survivors. A process evaluation assessed factors influencing the programme implementation.

Methods This study evaluated the impact of the Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE) programme. We compared patients who attended this programme with a usual care cohort from the same time period across nine hospital sites in Scotland. The primary outcome was health-related quality of life (HRQoL) measured via the EuroQol 5-dimension 5-level instrument, at 12 months post hospital discharge. Secondary outcome measures included self-efficacy, depression, anxiety and pain.

Results 137 patients who received the InS:PIRE intervention completed outcome measures at 12 months. In the usual care cohort, 115 patients completed the measures. The two cohorts had similar baseline demographics. After adjustment, there was a significant absolute increase in HRQoL in the intervention cohort in relation to the usual care cohort (0.12, 95% CI 0.04 to 0.20, p=0.01). Patients in the InS:PIRE cohort also reported self-efficacy scores that were 7.7% higher (2.32 points higher, 95% CI 0.32 to 4.31, p=0.02), fewer symptoms of depression (OR 0.38, 95% CI 0.19 to 0.76, p=0.01) and similar symptoms of anxiety (OR 0.58, 95% CI 0.30 to 1.13, p=0.11). There was no significant difference in overall pain experience. Key facilitators for implementation were: integration with inpatient care, organisational engagement, flexibility to service inclusion; key barriers were: funding, staff availability and venue availability.

Conclusions This multicentre evaluation of a health and social care programme designed for survivors of critical illness appears to show benefit at 12 months following hospital discharge.

Key messages

What is already known on this topic?

⇒ Post intensive care syndrome is well studied and describes the problems faced by survivors of critical illness. At present there is limited evidence describing effective treatments which may help mitigate the issues faced by survivors of critical illness.

What this study adds?

⇒ The implementation of an integrated model of health and social care, which supports survivors of critical illness, is feasible. Those who attended the Intensive Care Syndrome: Promoting Independence and Return to Employment programme, appeared to have improved health-related quality of life in comparison to critical care survivors who had not received the intervention.

How this study might affect research, practice or policy and what are the implications of this study?

⇒ Future research for critical illness survivors should focus on complex approaches, which combine health and social care.

INTRODUCTION

Survivors of critical illness can face significant challenges following discharge. These challenges are multifaceted and include new or worsening emotional, physical, cognitive and social problems.[1–5] Collectively known as post intensive care syndrome (PICS), these problems can lead to significant costs for the individual, the healthcare system and society.[6]

As a result of the COVID-19 pandemic, there has been an energised focus by critical care clinicians to create follow-up services.[7] Many of these services have been modelled on established programmes of work which include peer support and multidisciplinary teams (MDTs).[8 9] However, there is limited evidence for this type of intervention, with minimal data demonstrating the effectiveness of any care model, following critical care discharge.[10] As such, there is an urgent need for evaluation studies in this area.

This multicentre study aimed to evaluate whether an integrated health and social care intervention following critical illness had a measurable effect on

Health-Related Quality of Life (HRQoL) 1 year after hospital discharge. Specifically, using a contemporary control, we report the effects of this programme on HRQoL, emotional health and pain. An embedded process evaluation assessed factors influencing the programme implementation.

METHODS

Participants gave written informed consent to participate in the study before taking part.

Study setting

The study involved the expansion of the Intensive care Syndrome: Promoting Independence and Return to Employment (InS:PIRE) programme from a single intensive care unit (ICU), to four other ICUs throughout Scotland between 2016 and 2020.

Study design

We used a multicentre prospective cohort study design, with the aim of understanding the impact of the InS:PIRE programme on HRQoL for ICU survivors. We compared this intervention cohort with patients who had been admitted to ICU and had not received the intervention. We report a cohort study, as per the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.

A process evaluation was undertaken via inperson learning sessions which took place twice a year across the implementation and evaluation period (2.5 years). All sites were represented by members of the MDT at each learning session. Specifically details about barriers and facilitators to successful implementation were captured from a staffing and service perspective. These details were presented by individual teams at each learning session. TQ and JM analysed and interpreted these findings.

Intervention

The InS:PIRE programme is a complex intervention which has been described previously.[11] Briefly, all patients receive individual reviews with: (1) ICU doctor and nurse; (2) Pharmacist; and (3) Physiotherapist. These reviews offer a debrief of the ICU stay, an assessment of ongoing problems, goal setting and patient-directed recovery plans. Patients were considered to have completed the intervention if they received these three 'core' reviews. Clinical neuropsychology input is available at every site via group sessions and individual reviews as required. Peer support is embedded in the programme through the use of shared waiting areas, group sessions, and the presence of patient and caregiver volunteers further along the recovery trajectory.[12] Vocational (occupational) rehabilitation and support for caregivers is also integrated. Patients attend InS:PIRE longitudinally, initially attending for 5 weeks, with return appointments at 3 months and 12 months.

The intervention involved local community organisations, determined by local clinical teams. Specifically, financial and social care advice was available to patients, including advice on welfare benefits and housing.[13] These sessions were delivered through a combination of individual appointments, drop-in sessions or group discussions.

During the expansion of InS:PIRE, each new site conducted focus groups involving local ICU patients and caregivers. These groups ensured that the model was feasible and responsive to local care needs. The groups also helped establish and refine the outcome measures used.

Participants are invited between 4 weeks and 12 weeks after hospital discharge. Inclusion criteria were: patients receiving level 3 care (multiple organ support and/or invasive respiratory support) or more than 7 days of level 2 care (single organ support or postoperative care).[14] In contrast to the feasibility work from InS:PIRE, there was no upper age limit for inclusion. Exclusion criteria were any patient who was terminally ill, had suffered a traumatic brain injury or was an inpatient under psychiatric services. We provide further information and a conceptual overview in online supplemental material S1.

Intervention cohort

Five sites implemented the InS:PIRE programme as part of a quality improvement collaborative (*intervention cohort*) over 2 years. The intervention cohort were consecutively recruited to this study during the initial InS:PIRE programme attendance. Intervention cohort recruitment occurred between May 2016 to October 2018 (follow-up completed December 2019). Participants completed outcome measures at a preplanned 12-month follow-up. Participants were given the opportunity to complete questionnaires inperson or via telephone.

Usual care cohort

The usual care cohort were recruited by postal survey between 10 months and 16 months post hospital discharge, from eight hospitals in Scotland. These sites have the same patient case mix as the intervention cohort. Only sites which did not have any ICU follow-up services, at the time of recruitment, were included with the same inclusion/exclusion criteria as the intervention cohort. Patients from four of the control sites were included in the control group, before the site implemented the intervention. These patients received no follow-up care and were not invited to attend the intervention. Questionnaire packs and prepaid envelopes were sent to eligible patients. Reminder packs were sent for non-responders after 1 month.

Usual care cohort questionnaires were sent between June 2017 and March 2020. Although ethical approval was in place to continue beyond March 2020, the impact of the COVID-19 pandemic was unknown, and this study was closed to minimise any confounding effect.

Outcome measures

Health-related quality of life

The primary outcome of HRQoL at 1 year measured by EuroQol 5-Dimension 5-level dimension 5-level (EQ-5D-5L) was decided a priori.[15 16] This survey generates two summary measures of HRQoL. First, the health utility score summarises five domains (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) into a single number with 1.0 representing the best possible health, 0.0 representing a health state equivalent to death and negative values representing a state worse than death. The minimal clinically important difference (MCID) for this score is 0.08.[17 18] Second, the EuroQol Visual Analogue Scale records participants' self-rated health on the day of testing by marking on a continuous scale from 0 (worst health) to 100 (best health) with an MCID of 8%.[17 18]

Self-efficacy

Self-efficacy was measured to understand the mechanisms behind any changes in HRQoL. The General Self-Efficacy (GSE) Scale, which is a 10-item questionnaire generating a score with 31 levels (minimum 10 to maximum 40) was used to quantify these effects.[19 20]

Mental health outcomes

The Hospital Anxiety and Depression Scale (HADS) was used to evaluate mental health. HADS generates two separate seven-item scores; one for anxiety and one for depression.[21] The cut-offs for these scores are as shown in online supplemental material S2. For the purposes of this analysis, we defined anxiety and depression as a score of 8 or greater (≥8/21) in the respective subscores.[2 21] Both HADS and EQ-5D-5L have been recommended as core outcome measures in acute respiratory failure research.[22] Appropriate licensing requirements were in place.

Pain outcomes

The Brief Pain Inventory (BPI) short form was used to measure pain.[23] The BPI is summarised in online supplemental material S2. In this study, pain scores of intervention and usual care cohorts were compared, including: (average and worst scores), mean or summary pain interference (pain effects on life), pain interference on work and pain interference in enjoyment of life. The authors of BPI recommend that all scores are calculated as an average.

Baseline demographics

Comorbidity and in-hospital data were obtained via electronic medical records. The Scottish Index of Multiple Deprivation (SIMD) was used to define deprivation for each participant. SIMD is a relative measure of deprivation across geographically defined data zones in Scotland.[24] This is either given in deciles or quintiles; for the purpose of this analysis we chose quintiles to use fewer degrees of freedom in the modelling process thus allowing the inclusion of important clinical variables.

Statistical analysis

Wilcoxon rank-sum, Pearson χ^2 and Fisher's exact tests were used to analyse differences in baseline demographics between the cohorts. To evaluate the effect of the intervention in relation to usual care, multivariable regression was used. Linear regression was used to evaluate continuous variables (EQ-5D, GSE, BPI) and logistic regression for categorical outcomes (HADS-anxiety and HADS-depression). The effect of the intervention against the usual care cohort is reported as either an absolute change (continuous variables) or an OR for anxiety or depression. Relative increases are calculated as the estimated difference over the full range of the outcome measure.

Missing values were imputed with multivariate imputation by chained equations using 5 imputations and 30 iterations.[25] Analyses were carried out using R V.4.0.4.[26] A significance value of $p<0.05$ was used.

Models were created using domain knowledge, outputs from a recent expert consensus conference and previous evidence.[2 5 27–30] Covariates for adjustment were chosen before data analysis. All models were adjusted for: surgery at admission or in the first week of ICU; time from hospital discharge to follow-up; age; gender; ICU length of stay; Acute Physiology and Chronic Health Evaluation II (APACHE ll) Score; deprivation; history of harmful alcohol or drug use; pre-existing psychiatric diagnoses; and a pre-ICU history of chronic pain.

The final modelled effect estimates and standardised errors which were created with imputed data, were pooled using standard Rubin's rules. All estimated effect errors were generated in a robust manner using a sandwich estimator.

Sensitivity analyses

We undertook a sensitivity analysis using a propensity score matched cohort approach. Specific details alongside full results of this approach are presented in online supplemental material S3. The decision to match, and the matching approach was planned *a priori*. We propensity matched the intervention cohort with the usual care cohort, using nearest neighbour matching (calliper=0.1). Covariate balance was reviewed between the cohorts using Pearson's χ^2 test and the Mann-Whitney U Test. Covariates were iteratively included in the match until balance in the two cohorts was achieved. This process was completed before considering any outcome variables. The following covariates were included in the propensity score: surgery at admission or in the first week of ICU; time from hospital discharge to follow-up; age; hospital length of stay; advanced respiratory support; ICU length of stay; history of harmful alcohol or drug use; pre-existing psychiatric diagnoses. Once matching was complete the outcome measures underwent the same adjustment strategies used in the primary analysis of the unmatched cohorts.

A further sensitivity analysis using a mixed effects analysis, aimed to account for any clustering effects due to hospital site variation for the main outcome measure (HRQoL). This analysis measured the variability between hospital type (ie, large tertiary referral hospital or medium general acute hospital) (online supplemental material S4).

RESULTS

Baseline characteristics

Five hundred and seventy patients were invited to attend InS:PIRE; 253 attended and 206 patients consented to participate in the research study. Six patients died before 1-year follow-up and 63 were lost to follow-up. Thus, 137/200 (68.5%) patients who received the intervention completed outcome measures at 1 year (figure 1).

In the usual care cohort, 643 patients were screened; 191 were ineligible. As such, 452 were sent questionnaire packs, of which 115 (25.4%) were returned (figure 1). Details of responders and non-responders of the postal survey are described in online supplemental material S5.

The cohorts had a similar age (58.7 (IQR: 50.8–67.6) years *vs* 63.5 (IQR: 49.5–71.5) years), severity of illness (APACHE II: 20.0 (IQR: 15.0–25.3) *vs* 19.0 (IQR: 14.2–25.0)), time to follow-up (15.2 (IQR:13.2–16.5) months vs 15.9 (14.8–17.3) months), and there was a similar spread in both cohorts across the socioeconomic gradient. There was a difference in admission specialty profile as well as hospital and ICU length of stay across cohorts (table 1). To account for these imbalances, baseline demographics were adjusted for as outlined in the methods section. Modelling strategy details and outputs can be found in online supplemental material S6. A breakdown of missing variables is shown in online supplemental material S7.

Outcomes

Health-related quality of life

The intervention cohort demonstrated a 0.12 (95% CI 0.04 to 0.20, p=0.01) adjusted absolute increase (7.5% relative increase) in EQ-5D health utility scores at 1 year, in comparison to the usual care cohort (table 2). Patients in the intervention cohort also experienced an adjusted absolute increase in EQ-VAS of 11.88% (95% CI 5.91 to 17.86, p<0.001). The adjusted effects of the intervention compared with usual care on both EQ-5D summary scores as well as all other outcomes are summarised in figure 2.

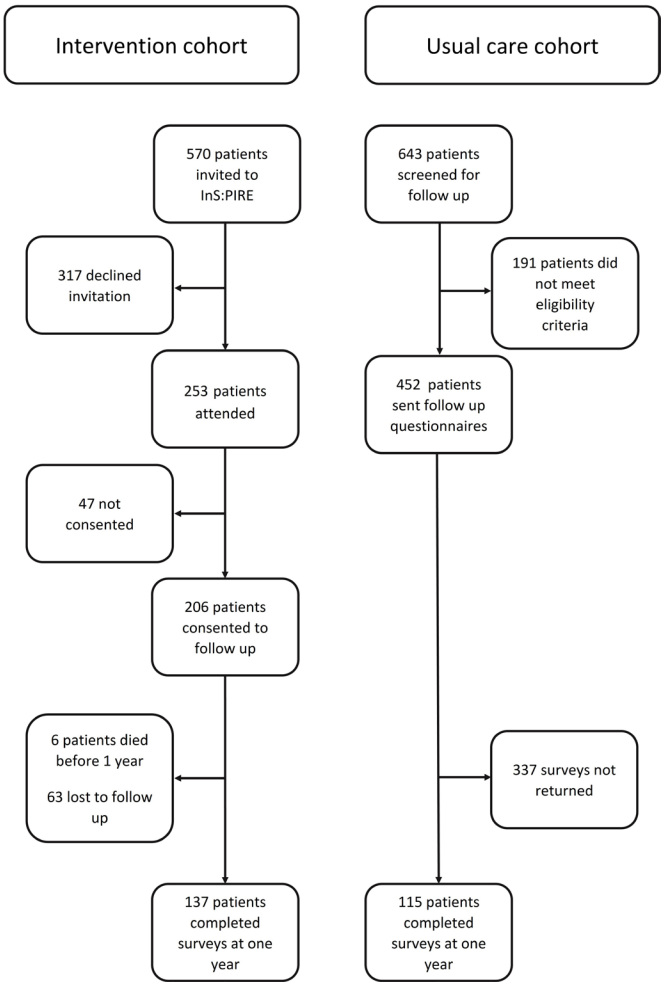

Figure 1 Recruitment flow chart. Patient flow and recruitment, intervention cohort and usual care cohort. InS:PIRE, Intensive Care Syndrome: Promoting Independence and Return to Employment.

Self-efficacy

The intervention cohort had an adjusted absolute increase in self-efficacy of 2.32 points (95% CI 0.32 to 4.31, p=0.02) resulting in a relative increase of 7.7% (table 2) at 12 months, in comparison to the usual care cohort.

Mental health outcomes

Defining anxiety or depression as a score of 8 or greater in HADS, the intervention cohort had a 62% adjusted odds reduction of screening for depression compared with the usual care cohort (OR 0.38, 95% CI 0.19 to 0.76, p=0.01) at 12 months (table 2). Odds of screening for anxiety at 1 year in intervention *vs* usual care was not significantly different (OR 0.58, 95% CI 0.30 to 1.13, p=0.11) in this analysis.

Pain outcomes

The number of patients reporting having had pain 'other than everyday kinds of pain' was 149/252 (59.1%) across both cohorts. Adjusted linear regression models demonstrated those in the intervention cohort had a 7.5% reduction in average pain score (single question) at 1 year compared with usual care (95% CI −1.50 to 0.00, p=0.05). No statistically significant differences were observed in the worst pain score, or the summary pain score. There was a 10% reduction in the interference of pain on enjoyment in life (95% CI: −1.89 to −0.11, p=0.03). All adjusted effects of the intervention on pain are described in table 2.

Table 1 Baseline characteristics for intervention and usual care cohorts (unmatched and unadjusted)

Demographic	Usual care cohort (n=115)	Intervention cohort (n=137)	P value
Age, years, median (IQR)	63.5 (49.5–71.5)	58.7 (50.8–67.6)	0.06
Gender, male (%)	67 (58.3)	73 (53.3)	0.43
Admitting specialty (%):			**0.03**
Medical	52 (44.8)	83 (60.6)	
Surgery	60 (52.2)	54 (39.4)	
ICU length of stay, median (IQR)	4.95 (2.5–9.5)	10.5 (6.9–17.3)	**<0.01**
Hospital length of stay, median (IQR)	18.0 (11.4–35.0)	30.5 (17.0–49.6)	**<0.01**
APACHE II Score, median (IQR)	19 (14.2–25.0)	20 (15.0–25.3)	0.28
Advanced respiratory support (%)	100 (87.0)	121 (88.3)	0.81
Complex cardiovascular support requiring multiple vasoactive drugs (%)	21 (18.3)	30 (21.9)	0.54
Renal replacement therapy (%)	19 (16.5)	32 (23.4)	0.21
Two or greater comorbidities (%)	54 (47.0)	60 (43.8)	0.41
Charlson Comorbidity Index (CCI) Score, median (IQR)	3 (1–4)	3 (1–4)	0.53
Pre-existing psychiatric diagnosis (%)	28 (24.3)	39 (28.5)	0.60
History of harmful alcohol or drug use (%)	15 (13.0)	25 (18.2)	0.33
Premorbid history of chronic pain (%)	15 (13.0)	18 (13.1)	0.91
Deprivation index, SIMD 2016 (%):			0.31
Quintile 1 (most deprived)	34 (29.6)	50 (36.5)	
Quintile 2	27 (23.5)	36 (26.3)	
Quintile 3	12 (10.4)	20 (14.6)	
Quintile 4	18 (15.7)	14 (10.2)	
Quintile 5 (least deprived)	21 (18.3)	17 (12.4)	
Time to follow-up, median months (IQR)	15.2 (13.2–16.5)	15.9 (14.8–17.3)	**<0.01**

Time to follow-up, months, from hospital discharge. For missing data, see online supplemental material S7.
ICU, intensive care unit; APACHE II, Acute Physiology and Chronic Health Evaluation II; SIMD, Scottish Index of Multiple Deprivation.

Sensitivity analysis: propensity score matching

We were able to successfully match almost two-thirds (65.2%) of the usual care cohort to the intervention cohort. The unadjusted outcome measure differences between the matched intervention and usual care cohort are presented in online supplemental material S8. The comparison of the matched demographics, alongside the adjusted effect of the intervention on the various outcome measures is shown in figure 3. The adjusted matched and unmatched analyses also demonstrated increased HRQoL and self-efficacy scores, and reduced rates of depression. A full description of propensity score matching, and results are shown in online supplemental material S3. Variance between hospital sites (cluster sensitivity analyses) were minimal for all models (online supplemental material S4). The effects across

Table 2 Effect of intervention at 1-year follow-up (unmatched)

Outcome measure	Adjusted estimate	P value	95% CI	Relative difference with intervention
EQ-5D summary scores				
Health utility score	0.12	**0.01**	0.04 to 0.20	7.5 %
EQ-5D VAS	11.88	**<0.001**	5.91 to 17.86	11.9 %
Generalised self-efficacy	2.32	**0.02**	0.32 to 4.31	7.7 %
Brief Pain Inventory Scores				
Summary (mean) pain score (across BPI)	−0.62	0.09	−1.35 to 0.11	6.2 %
Average pain score (single question)	−0.75	0.05	−1.50 to 0.00	7.5 %
Worst pain score (single question)	−0.59	0.16	−1.41 to 0.23	5.9%
Pain interference with enjoyment of life (single question)	−1.00	**0.03**	−1.89 to −0.11	10.0 %
Pain interference on normal work (single question)	−0.69	0.16	−1.66 to 0.28	6.9%
Mean pain interference summary	−0.73	0.07	−1.52 to 0.06	7.3%
Hospital anxiety and depression (HADS) ORs				
HADS depression	0.38	**0.01**	0.19 to 0.76	62 %
HADS anxiety	0.58	0.11	0.30 to 1.13	43 %

Effect of the intervention on quality-of-life outcome measures compared with usual care at 1-year follow-up. Linear regression models with absolute effects and scaled relative effects for: (1) EQ-5D, EuroQol five-dimension health state; (2) EQ-VAS: EuroQol Visual Analogue Scale; (3) Generalised self efficacy (GSE); (4) Summary (mean of all) pain scores: mean of four scores from brief pain inventory; (5) 'average pain'; (6) 'worst pain'; (7) 'least pain'; (8) 'pain right now'. All pain scores ranges=0–10. Logistic regression, with ORs for risk of screening for depression (HADS-depression ≥8/21) and anxiety (HADS-anxiety ≥8/21).
BPI, Brief Pain Inventory; HADS, Hospital Anxiety and Depression Scale; VAS, Visual Analogue Scale.

the different outcomes are summarised in online supplemental material S9.

Process evaluation

The process evaluation identified a number of facilitators and barriers to the implementation of this intervention (figure 4). Facilitators included a flexible approach to inclusion of key services. Every site included social and economic support but this could be provided by different services (ie, statutory community organisations, in-hospital financial services or local charities). This flexibility ensured that patients received the correct intervention in a manageable and sustainable way. Other facilitators included the introduction of the programme during the patient's inpatient stay and the inclusion of relatives. This ensured that the invitation to participate following hospital discharge did not come as a surprise. The use of volunteering coordinators within the hospital setting (available across many UK hospital trusts) also helped support the statutory processes required for volunteer inclusion.

Barriers were also described. First, finding an appropriate venue to host the programme was a challenge across most (80%) sites. However, teams adapted to this by using teaching hubs in hospitals, and community venues. A fundamental issue related to sustainability was the need for ongoing funding, following the cessation of research income. Engaging early with the National health Service (NHS) management structure and working to achieve broad NHS aims within the delivery of the programme helped achieve sustainability. For example, focussing on the use of health and social care integration and the person-centred care approach, helped highlight the wider benefits of the programme. Of note, all five sites involved in this evaluation have received ongoing funding for the InS:PIRE programme within their local health boards.

DISCUSSION

This multicentre study, evaluating a critical care recovery programme, has demonstrated a significant and clinically important difference in HRQoL for survivors of critical illness. To our knowledge, this is the first study internationally to report any enduring benefit from an outpatient intervention designed for ICU survivors.

Previous interventions targeting PICS have demonstrated isolated improvements, such as a reduction in post-traumatic stress disorder. However, benefits in overall HRQoL have remained elusive.[31–33] Existing strategies have largely focused on specific interventions, often with a single healthcare professional group or small MDT.[10] Few studies have targeted complex approaches combining the healthcare MDT with a recognition of the significant financial and social drivers of reduced HRQoL after critical illness. InS:PIRE differs from previous studies by bringing these concepts together. The MDT involved is not limited to the specific dimensions of PICS or new problems, but instead is directed by what is important to the patient.[34] In this way interventions are targeted to both the problems having the greatest impact on each patient's life and the solutions that patients are most motivated to pursue. Signposting to existing community organisations also allows patients to take an active role in improving their health, and with the guidance of the MDT, patients can improve their knowledge of the healthcare system and overall health literacy.

Peer support, a core component of the intervention, is important and valued by ICU survivors.[35] Peer support in InS:PIRE differs from other programmes, with support embedded in the wider intervention, as opposed to stand-alone 'self-help' groups. This ensures peer support reaches patients who may not have access to stand-alone interventions. All peer support programmes are likely to benefit from the normalisation of the shared lived experience. Recent evidence also hypothesised that peer support could have an impact on anxiety.[35] Interestingly, although anxiety was lower, there was not a significant difference in this symptom in the intervention cohort. More work is required to understand anxiety in survivors of critical illness, including optimal pathways for support.

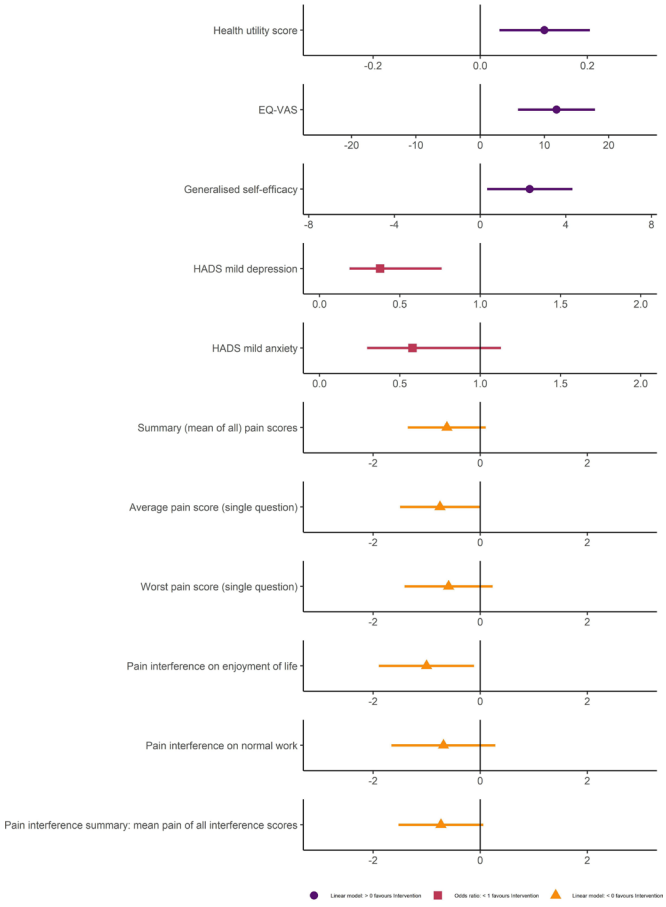

Figure 2 Forest plot (adjusted unmatched). Effect of the intervention on measured outcomes representing the absolute difference in scores (linear models) or risk of screening positive for the condition (ORs), 1 year after intensive care compared with usual care. Point estimate values (circle, square, triangle) and 95% CI. InS:PIRE, Intensive care Syndrome: Promoting Independence and Return to Employment; EuroQol Health Utility Score, absolute difference, taken from EuroQol 5-Dimension 5-level (EQ-5D-5L) 'crosswalk UK scores', range - 0.594 to 1.0; EuroQol Visual Analogue Scale (EQ-VAS), absolute difference, range 0 to 100; Generalised Self Efficacy: absolute difference, range 10 to 40; HADS: Hospital Anxiety and Depression Scale with individual component scores for anxiety and depression, odds risk ratios of screening positive for anxiety or depression; Brief pain inventory (BPI), absolute difference in pain scores, all scores range from 0 to 10, average (single component score), worst pain (single component score), and summary score (composite / mean score from four pain scores: 'average', 'worst', 'least' and 'pain right now'); Pain interference scores from BPI, absolute difference, scores range from 0 to 10, enjoyment in life (single component), work (single component), and summary pain interference (composite / mean score from seven interference components).

The lasting benefits from InS:PIRE are likely to come from the improvement in patient self-determination alongside an enhancement of the skillset required to navigate the health and social care systems. The InS:PIRE programme's longitudinal nature, offers patients the opportunity to incrementally increase independence and consolidate self-management skills. This is in direct contrast to previously tested interventions in this field which often offer a single appointment.[32]

The involvement of primary caregivers in the programme is also likely to have contributed to the lasting effects from InS:PIRE. Perhaps more significantly, there will have been direct effects on caregivers themselves which may benefit the entire family or care unit. Work which aims to assess the impact on caregivers and family members is ongoing.

Almost 60% of patients across the cohorts described pain at the time of assessment. InS:PIRE had a positive impact on some elements of pain (eg, interference with enjoyment of life); these improvements may be due to the targeted pharmacy management approaches which addressed pain management issues alongside the integrated physical rehabilitation services.[36 37] However, InS:PIRE did not consistently reduce pain across all domains of BPI. Further research is required into the underlying mechanisms alongside any potential mediators of pain.

A goal of this study was to understand whether a complex intervention, known to be successful at a single site, could be scaled up to other sites and clinical teams. Our process evaluation identified key barriers and facilitators to the implementation of InS:PIRE. The findings of this evaluation are consistent with previous evidence demonstrating funding, staff provision and organisational buy-in are key to the successful implementation of post-ICU care.[38] This evaluation has shown that complex interventions such as InS:PIRE are safe and feasible in the post-ICU discharge period and could be scaled up for future randomised controlled trials.

Limitations

The limitations of this study are notable. This study was not designed as a randomised controlled trial, therefore causality cannot be inferred. While there was substantial overlap in baseline characteristics between the intervention and usual care cohorts, as demonstrated by the propensity score matching analysis, patients were not randomly enrolled to either intervention or usual care. We have assessed the impact of this limitation by undertaking multiple sensitivity analyses.

This study was designed to assess the impact and effectiveness of the intervention as a whole. This has resulted in a unique study of a complex intervention for intensive care survivors but this approach lacks deeper understanding of the individual component effects. Further work is underway to gain a better understanding of the impacts of the individual programme components and their interactions.

The low return rates in the postal survey may have contributed to selection bias that was not fully addressed by the imputation, modelling or propensity score matching processes. Further, those who attended the InS:PIRE programme could have been more engaged with their health, thus we would have expected 'better' outcomes in this cohort. However, the spread across the socioeconomic gradient and the high proportion of patients with a history of alcohol excess and drug use who attended, would suggest that 'difficult to access' patients were included in the intervention. Additionally, like other studies in this field, over 30% of the intervention cohort were lost to follow-up, which may have influenced the results.[32] Data were not available on why patients declined to attend InS:PIRE which limits the ability to address modifiable factors to improve the uptake in this group. We opted to use imputation to account for the low rate of missing data in this analysis.

The multiple imputation approach utilised, attempted to quantify uncontrolled confounding variables. Despite this, there may have been unmeasured confounding factors not accounted for in this analysis, which could have influenced the reported results. Moreover, although the propensity matched analysis replicated the findings of the primary analysis (covariate adjustment), due to the lower propensity matched cohort size, there is a possibility that some differences

(A) Demographic	Usual care cohort (N = 75)	Intervention cohort (N = 75)	P value
Age, Years, Median (IQR)	59.8 (47.5 – 69.8)	59.5 (52.1-68.3)	0.75
Sex, Male (%)	48 (64.0)	39 (52.0)	0.14
Admitting specialty (%):			0.32
Medical	39 (52.0)	45 (60.0)	
Surgery	36 (48.0)	30 (40.0)	
Surgery at admission or within seven days of ICU (%)	26 (34.7)	26 (34.7)	1.00
ICU length of stay, Median (IQR)	7.2 (3.9—12.8)	8.3 (5.7—12.0)	0.16
Hospital Length of stay, Median (IQR)	22.0 (13.2—42.0)	23.0 (15.0—39.8)	0.68
APACHE II score, Median (IQR)	19 (15—25)	21 (16—26)	0.20
Advanced respiratory support (%)	64 (85.3)	66 (88.0)	0.63
Complex cardiovascular support requiring multiple vasoactive drugs (%)	17 (22.7)	17 (22.7)	1.00
Renal replacement therapy (%)	15 (20.0)	15 (20.0)	1.00
Two or greater comorbidities (%)	35 (46.7)	32 (42.7)	0.62
Charlson comorbidity index (CCI) score, Median (IQR)	3 (1—4)	3 (1—4)	0.87
Pre-existing psychiatric diagnosis (%)	24 (32.0)	18 (24.0)	0.28
History of harmful alcohol or drug use (%)	11 (14.7)	11 (14.7)	1.00
Pre-morbid history of chronic pain (%)	12 (16.0)	10 (13.3)	0.64
Deprivation index, SIMD 2016 (%):			0.63
Quintile 1 (most deprived)	26 (34.7)	27 (36.0)	
Quintile 2	18 (24.0)	20 (26.7)	
Quintile 3	8 (10.7)	11 (14.7)	
Quintile 4	12 (16.0)	6 (8.0)	
Quintile 5 (least deprived)	11 (14.7)	11 (14.7)	
Time to follow up, Median months (IQR)	15.4 (14.0—16.7)	15.6 (14.5—16.6)	0.40

(B) Outcome measure	Estimate (95% CI)	P value	Estimate and 95 % confidence interval
Health utility score	0.14 (0.05 to 0.22)	**0.003**	
EQ-VAS	12.30 (7.46 to 17.15)	**<0.001**	
Generalised self-efficacy	2.86 (1.24 to 4.47)	**0.001**	
HADS mild depression (odds ratio)	0.33 (0.17 to 0.65)	**0.002**	
HADS mild anxiety (Odds ratio)	0.59 (0.35 to 1.00)	0.05	
Summary (mean of all) pain scores	-0.80 (-1.43 to -0.17)	**0.02**	
Average pain score (single question)	-0.90 (- 1.59 to -0.21)	**0.01**	
Worst pain score (single question)	-0.70 (-1.33 to -0.06)	**0.03**	
Pain interference on enjoyment of life	-1.36 (-2.44 to -0.28)	**0.02**	
Pain interference on normal work	-0.88 (-1.84 to 0.07)	0.07	
Pain interference summary: mean pain of all interference scores	-0.97 (-1.75 to -0.18)	**0.02**	

Linear model: > 0 favours Intervention ■ Odds ratio: < 1 favours Intervention ▲ Linear model: < 0 favours Intervention

Figure 3 Propensity score matching panel. Demographic table (A): representative dataset of baseline characteristics after propensity score matching. ICU, intensive care unit; APACHE II, Acute Physiology and Chronic Health Evaluation II; SIMD, Scottish index of multiple deprivation; time to follow-up, months, from hospital discharge. Outcome measures table with splines (B): effects of intervention on all outcome measures alongside coefficient graph of effect size. Effect of intervention: absolute change in scores (linear models) and odds risk ratio of screening for the condition (anxiety or depression) 1 year after intensive care compared with usual care. Point estimate values (circle, square, triangle) and 95% CI. InS:PIRE, Intensive Care Syndrome: Promoting Independence and Return to Employment; EuroQol Health Utility Score, absolute change, taken from EuroQol 5-Dimension 5-level (EQ-5D-5L) 'crosswalk UK scores', range - 0.594 to 1.0; EuroQol Visual Analogue Scale (EQ-VAS), absolute change, range 0 to 100; Generalised Self-efficacy: absolute change, range 10 to 40; HADS: Hospital Anxiety and Depression Scale with individual component scores for anxiety and depression, odds risk ratios of screening positive for anxiety or depression; Brief pain inventory (BPI), absolute change in pain scores, all scores range from 0 to 10, average (single component score), worst pain (single component score), and summary score (composite/mean score from four pain scores: 'average', 'worst', 'least' and 'pain right now'); pain interference scores from BPI, absolute change, scores range from 0 to 10, enjoyment in life (single component), work (single component), and summary pain interference (composite/mean score from seven interference components).

may have not been detected. There are alternative approaches such as inverse probability weighting regression and propensity score regression, however, each approach has similar individual limitations.

We have not included a cognition outcome measure. This study was conceptualised and approved before the publication of the core outcome measure set for acute respiratory

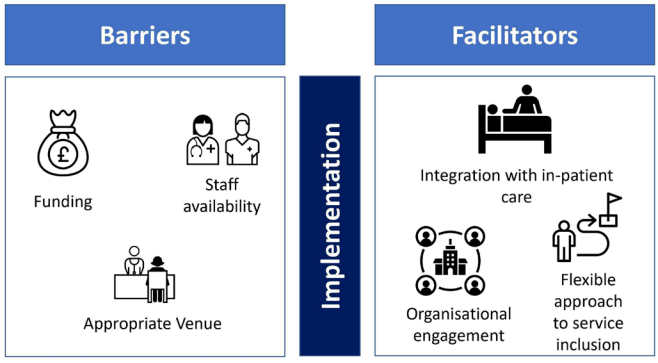

Figure 4 Key themes generated from the process evaluation, barriers and facilitators for intervention implementation.

failure research. Cognitive outcome measures were also not prioritised by our patient and family groups involved in the codesign of this study. Future work should address the impact, if any, of this intervention on cognition.[22]

CONCLUSION

This multicentre evaluation of a health and social care programme designed for survivors of critical illness, appears to show benefit for those that attend at 12 months following hospital discharge.

Author affiliations
[1]Academic unit of Anaesthesia, Critical Care, and Peri-operative Medicine, University of Glasgow, Glasgow, UK
[2]Department of Intensive Care Medicine, Glasgow Royal Infirmary, Glasgow, UK
[3]Clinical Physics, NHS Greater Glasgow and Clyde, Glasgow, UK
[4]Department of Anaesthesia and Intensive Care Medicine, University Hospital Crosshouse, Kilmarnock, UK
[5]Department of Intensive Care Medicine, Queen Elizabeth University Hospital, Glasgow, UK
[6]Department of Anaesthesia and Intensive Care Medicine, University Hospital Monklands, Airdrie, UK
[7]Department of Anaesthesia and Intensive Care Medicine, University Hospital Wishaw, North Lanarkshire, UK
[8]Department of Intensive Care Medicine, Adult Critical Care Unit, University Hospital Wishaw, North Lanarkshire, UK
[9]Department of Anaesthesia and Intensive Care Medicine, University Hospital Hairmyres, East Kilbride, UK
[10]Department of Intensive Care Medicine, Victoria Hospital, Kirkcaldy, UK
[11]Department of Intensive Care Medicine, Royal Alexandra Hospital, Paisley, UK
[12]Department of Pulmonary and Critical Care, Ann Arbor Health System, Ann Arbor, Michigan, USA
[13]Department of Internal Medicine, University of Michigan, Ann Arbor, Michigan, USA

Twitter Joanne McPeake @jomcpeake22

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ORCID iD
Joanne McPeake http://orcid.org/0000-0001-8206-6801

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Supplement 1: InS:PIRE intervention

Five week programme

During the first three weeks of the five-week programme, each patient and caregiver receive an individual appointment with either nursing and medical staff, the pharmacist and the physiotherapist (one per week over the first three weeks). These are deemed core outcomes and only patients who had received all three were included in the intervention cohort.

Nursing staff/medical staff appointment: Lay summary of the patient's critical care stay is given. Patients and their loved ones are given the opportunity to ask questions about the ICU experience and recovery. Personal goals are co-produced with staff and patients. These goals can be made in relation to any element of health and wellbeing. Patients and caregivers are also given the opportunity to visit the ICU.

Physiotherapy appointment: Full physical assessment is undertaken. A specific exercise programme is designed if appropriate. Onward referral to local organisations and exercise classes are made as needed.

Pharmacist appointment: All medicines reviewed in the context of the patient's past medical history and the ICU stay. Changes are made as needed, and any potential problems rectified. Primary care physicians are contacted about prescriptions as necessary.

Over the two final weeks, patients and caregivers have group sessions with their peers. Group sessions include: clinical psychology sessions which focus on coping skills and common reactions to recovery from critical illness (for example, low mood and anxiety) (1). Patients and caregivers are often (but not always) split for the psychology session. For those experiencing any issues with nutrition, the programme can refer patients to the dietician.

On the final week (and across the duration of the programme) there is access to information and support for the potential social problems which individuals may be experiencing (1). Information about community organisations is available. Linkage to carers support also available. Specific input from vocational rehabilitation for those wishing to return to the workforce can be accessed.

Each week there is also an education session available for patients and caregivers. Topics include sleep hygiene; pacing of activity and dietary advice. These sessions are very much directed by patients and caregivers and are undertaken as a group.

InS:PIRE was facilitated by a multi-professional team including a trained ICU Nurse, Physician, Physiotherapist and Pharmacist. A Consultant Clinical Psychologist provided psychological care and input as appropriate.

Peer support was developed by the patients and caregivers taking part. This was achieved through the generation of discussion at the group sessions and in waiting areas. Peer support was also fostered via patients and caregiver volunteers who were further along the recovery trajectory; they ran a social café area for participants[1].

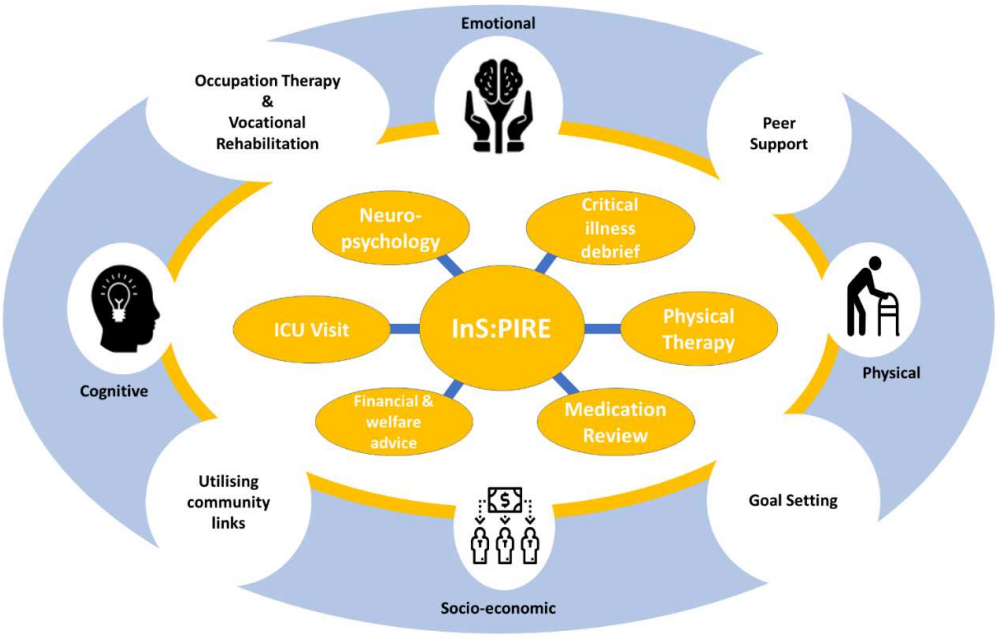

Figure S1: conceptual diagram of the InS:PIRE programme.

InS:PIRE: Intensive Care Syndreom: Promoting Independence and Return to Employment; ICU: Intensive Care Unit

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Supplement 2: Outcome measures descriptors

Outcome measures one year after ICU

Health Related Quality of Life (HRQoL)

The primary outcome for this study was HRQoL at one year measured by the EQ-5D-5L (EuroQol group 2009) [1,2]. This survey generates two measures of HRQoL. Firstly, the health utility score (EQ-HUS) summarises five domains (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) into a single number with 1.0 representing the best possible health, 0.0 representing a health state equivalent to death and negative values representing a state worse than death. The minimal clinically important difference (MCID) for this score is usually quoted as 0.08[3,4]. Secondly, EQ-VAS (EuroQol Visual Analogue Scale) records participants self-rated health on the day of testing by marking on a continuous vertical scale from 0 (worst health) to 100 (best health) with an MCID of 8%[3,4].

Self-Efficacy

Self-efficacy was measured using the General Self Efficacy Scale (GSE) which is a ten-item questionnaire generating a score with 31 levels (minimum 10 to maximum 40). MCID for GSE is not as well defined compared to EQ-5D-5L, however, for this study we used an MCID of 6%, representing an absolute change of 1.86, which corresponds to well established values for patients with chronic obstructive pulmonary disease[5-6].

Mental health outcomes

Hospital Anxiety and Depression Scale (HADS) was used to measure mental health at one-year post ICU. Comprising seven items each for anxiety and depression, HADS generates two separate scores for anxiety and depression from 0 to 21. Depression or anxiety are diagnosed with a cut off score of 8/21. Moderate and severe disease has cut off values of 11 and 15 respectively[7].

Pain outcomes

Pain has not been a traditional focus within PICS research, although this issue was frequently raised at clinics prior to this study and has been reported in pharmacy interventions. To evaluate the extent of pain after critical illness the Brief Pain Inventory (BPI) short form was used. This comprises four sections: experience of pain in previous 24 hours, with binary yes/no response; body areas where pain is experienced (pictorial summary); pain severity score, four items, each scored from 0 to 10; and pain interference score, seven items each scored from 0 to 10. Two summary scores can be generated as an average pain severity and average pain interference (each scored from 0 to 10). The usual ways to report this are summary values for worst pain, average pain, and pain interference. MCIDs for BPI are not well established, especially after critical care, however, for this study a change of 2/10 will be considered clinically significant, in keeping with other pain intervention, e.g. those for fibromyalgia[8-12]

Tool Utilised	Description	Ranges
EQ-5D 5L **(EuroQol: Quality of Life Group)**	Measurement of HRQoL comprising two sections: a 5-question descriptive component exploring health domains (each scored 1 to 5) and a visual analogue scale describing quality of life on the day of questionnaire completion. Descriptive component can be converted to a 5-digit sequence and then used to determine a Health Utility Score (HUS).	In EQ-5D evaluations, a HUS of 1 equates to the best health state possible, 0 with death and a negative HUS equates to a state worse than death. Based on previous literature, the Minimally Important Clinical Difference (MCID) for the HUS for critical care and the UK time-trade-off "tariff," is approximately 0.08.
Hospital Anxiety and Depression Scale (HADS)	The HADS questionnaire contains 14 statements relating to mood, with 7 questions relating to depression and 7 to anxiety.	Scale Interpretation (scored separately for anxiety and depression): 0-7: Normal 8-10: Mild 11-14: Moderate 15-21: Severe
Generalised Self-Efficacy	10 item psychometric scale designed to assess an individual's belief in their ability to cope with different situations. Specifically, it explores personal agency.	Scale: minimum 10 to maximum 40. In this study we used an MCID of 6%, representing an absolute change of 1.86.
Brief Pain Inventory (BPI)	On the BPI, patients record the severity of their pain over the previous 24 hours as worst, least, mean and current pain, on a 0 to 10-point numerical rating scale (where 0 = no pain and 10 = worst pain imaginable).	Developers of the tool recommend that all 4 items be used in a mean score. The optimal cut off points for pain severity using the BPI are as follows: 0 = no pain, 1-3 = mild pain, 4-6 = moderate pain, and 7-10 = severe pain.

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Supplement 3: Propensity score matching approach and adjusted outcome models

Propensity score matching methodology

After imputation with Multivariate Imputation by Chained Equations (MICE) propensity score matching was undertaken[1]. We propensity matched the participants in the InS:PIRE to the usual care cohort, using nearest neighbor caliper matching (caliper = 0.1)[2]. Covariate balance was reviewed between the InS:PIRE and usual care cohorts using Pearson's chi-squared test for categorical variables, and the Mann-Whitney U Test for continuous variables with baseline characteristic results described in **Figure 3** of the main paper. Covariates were iteratively included in the match until balance in the two cohorts was achieved. This process was completed before considering any outcome variables. The following covariates were included in the propensity score: surgery at admission or in the first week of ICU; time from hospital discharge to follow up; age; hospital length of stay; advanced respiratory support; ICU length of stay; history of harmful alcohol or drug use; pre-existing psychiatric diagnoses. We successfully matched almost two-thirds (65.2%) of the usual care cohort to the intervention cohort.

Once matching was complete the same outcome measures underwent the same modelling and adjustment strategies used in the primary analysis of the unmatched cohorts.

The following eleven tables summarise the completed models, with all covariates and intercepts.

Matched and adjusted tables

Health utility score model

Covariate	Effect estimate	P value	95% confidence interval
Intercept	0.79	**<0.001**	0.54 - 1.03
Intervention (InS:PIRE)	0.14	**0.003**	0.05 -0.22
Male gender	0.04	0.23	-0.03 - 0.12
ICU length of stay	-0.01	**<0.01**	-0.01 - 0.00
APACHE II score	0.00	0.56	-0.01 -0.01
Time to follow up (months)	-0.01	0.13	-0.02 - 0.00
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	0.00	0.94	-0.08 - 0.09
SIMD quintile 3	0.01	0.86	-0.11 - 0.13
SIMD quintile 4	0.14	0.02	0.02 - 0.25
SIMD quintile 5 (least deprived)	0.16	**<0.01**	0.07 - 0.25
Surgery at admission or within seven days of ICU	-0.02	0.69	-0.10 - 0.07
Charlson comorbidity index (CCI) score	0.00	0.61	-0.01 - 0.02
History of harmful alcohol or drug use	-0.12	0.06	-0.24- 0.00
Pre-morbid history of chronic pain	-0.11	0.16	-0.26 - 0.05
Pre-existing psychiatric diagnosis	-0.17	<**0.01**	-0.26 - -0.08

Health utility score: EQ-5D-5L quality of life indicator with range of -0.594 to 1.0.
Adjusted linear regression model.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions on outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

EuroQol Visual Analogue Scale score

Covariate	Effect estimate	P value	95% confidence interval
Intercept	64.92	**<0.001**	42- 87.84
Intervention (InS:PIRE)	12.30	**<0.001**	7.46 - 17.15
Male sex	-0.52	0.85	-6.16 - 5.13
ICU length of stay	-0.36	**<0.001**	-0.59 - -0.13
APACHE II score	0.13	0.57	-0.36 - 0.62
Time to follow up (months)	-0.34	0.41	-1.21 - 0.53
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	2.86	0.44	-4.84 – 10.56
SIMD quintile 3	0.63	0.87	-6.98 – 8.24
SIMD quintile 4	-0.36	0.94	-10.05- 9.34
SIMD quintile 5 (least deprived)	12.47	<0.001	5.66 - 19.24
Surgery at admission or within seven days of ICU	6.41	0.08	-0.92 - 13.75
Charlson comorbidity index (CCI) score	-0.62	0.47	-2.44 - 1.20
History of harmful alcohol or drug use	-7.68	**0.04**	-15.08 - -0.27
Pre-morbid history of chronic pain	-3.11	0.36	-9.93 - 3.71
Pre-existing psychiatric diagnosis	-11.18	**0.02**	-20.39 - -1.96

EuroQol Visual Analogue Scale score: Range 0 to 100. Adjusted linear regression model.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions on outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Generalised Self-Efficacy

Covariate	Effect estimate	P value	95% confidence interval
Intercept	26.71	**<0.001**	19.25 - 34.16
Intervention (InS:PIRE)	2.86	**0.001**	1.24 - 4.47
Male sex	0.37	0.63	-1.17 - 1.91
ICU length of stay	-0.02	0.60	-0.10 - 0.06
APACHE II score	-0.02	0.79	-0.15 - 0.11
Time to follow up (months)	0.04	0.80	-0.31 - 0.39
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	0.86	0.47	-1.59 - 3.32
SIMD quintile 3	0.86	0.50	-1.73 - 3.46
SIMD quintile 4	2.33	0.25	-1.91 - 6.58
SIMD quintile 5 (least deprived)	3.10	**0.01**	0.78 - 5.42
Surgery at admission or within seven days of ICU	1.08	0.32	-1.17 - 3.33
Charlson comorbidity index (CCI) score	0.45	**0.04**	0.01 - 0.90
History of harmful alcohol or drug use	-2.06	0.11	-4.63 - 0.50
Pre-morbid history of chronic pain	-0.11	0.95	-4.34 - 4.12
Pre-existing psychiatric diagnosis	-3.75	**<0.001**	-5.60 - -1.90

Generalised self-efficacy: range 10 to 40. Adjusted linear regression model.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions on outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Depression odds ratios: Hospital Anxiety and Depression Scale score (HADS)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	1.49	0.78	0.06 - 36.50
Intervention (InS:PIRE)	0.33	**0.002**	0.17 - 0.65
Male sex	0.97	0.93	0.45 - 2.09
ICU length of stay	1.02	0.16	0.99 - 1.06
APACHE II score	1.01	0.75	0.95- 1.07
Time to follow up (months)	1.01	0.84	0.88- 1.17
SIMD quintile 1 (most deprived)	1	NA	Reference quintile
SIMD quintile 2	0.80	0.62	0.30 - 2.09
SIMD quintile 3	0.40	**0.04**	0.17 – 0.98
SIMD quintile 4	0.72	0.53	0.24- 2.14
SIMD quintile 5 (least deprived)	0.08	**0.01**	0.01- 0.48
Surgery at admission or within seven days of ICU	0.33	**0.03**	0.12 - 0.89
Charlson comorbidity index (CCI) score	0.82	0.14	0.62 - 1.09
History of harmful alcohol or drug use	2.55	0.20	0.53 - 12.18
Pre-morbid history of chronic pain	0.64	0.49	0.15 – 2.74
Pre-existing psychiatric diagnosis	3.69	**0.02**	1.29 - 10.55

Hospital Anxiety and Depression Scale scores. Odds ratios of risk of screening positive for depression at one year. Depression defined as a component score of eight or greater. Adjusted logistic regression model.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions on outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Anxiety odds ratios: Hospital Anxiety and Depression Scale score (HADS)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	0.75	0.76	0.11 – 5.06
Intervention (InS:PIRE)	0.59	**0.05**	0.35 - 1.00
Male sex	0.61	0.14	0.31 - 1.20
ICU length of stay	0.99	0.57	0.96 - 1.02
APACHE II score	0.99	0.47	0.95 - 1.02
Time to follow up (months)	1.10	0.08	0.99 - 1.23
SIMD quintile 1 (most deprived)	1	NA	Reference quintile
SIMD quintile 2	1.06	0.86	0.55 - 2.05
SIMD quintile 3	0.82	0.69	0.13 - 2.18
SIMD quintile 4	0.27	0.10	0.05 - 1.42
SIMD quintile 5 (least deprived)	0.70	0.58	0.16 – 2.99
Surgery at admission or within seven days of ICU	0.42	0.14	0.12 - 1.44
Charlson comorbidity index (CCI) score	0.90	0.36	0.72 - 1.14
History of harmful alcohol or drug use	4.20	<**0.001**	1.63 - 10.80
Pre-morbid history of chronic pain	1.62	0.42	0.46 – 5.68
Pre-existing psychiatric diagnosis	1.95	0.08	0.91- 4.17

Hospital Anxiety and Depression Scale scores. Odds ratios of risk of screening positive for anxiety at one year. Depression defined as a component score of eight or greater. Adjusted logistic regression model.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions on outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Effects on Summary (mean) pain score

Covariate	Effect estimate	P value	95% confidence interval
Intercept	3.21	**<0.001**	1.65 - 4.77
Intervention (InS:PIRE)	-0.80	**0.02**	-1.43 - -0.17
Male sex	-0.41	0.17	-1.00 - 0.18
ICU length of stay	0.04	0.06	0.00 - 0.09
APACHE II score	-0.07	**<0.001**	-0.11 - -0.03
Time to follow up (months)	0.10	0.11	-0.03 - 0.23
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.08	0.84	-0.89- 0.74
SIMD quintile 3	-0.77	0.13	-1.77 - 0.23
SIMD quintile 4	-1.00	0.11	-2.27 - 0.26
SIMD quintile 5 (least deprived)	-1.72	**<0.001**	-2.50 - -0.93
Surgery at admission or within seven days of ICU	-0.40	0.30	-1.19 - 0.40
Charlson comorbidity index (CCI) score	0.16	**0.04**	0.01 - 0.31
History of harmful alcohol or drug use	0.94	0.08	-0.14 -2.03
Pre-morbid history of chronic pain	0.96	0.10	-0.20 - 2.12
Pre-existing psychiatric diagnosis	0.77	0.12	-0.23 - 1.77

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions on outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Effects on average pain score (single question from survey)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	3.14	**<0.001**	1.64 - 4.64
Intervention (InS:PIRE)	-0.90	**0.01**	-1.59 - - 0.21
Male sex	-0.28	0.35	-1.87 - 0.31
ICU length of stay	0.04	0.12	-0.01 - 0.09
APACHE II score	-0.06	**0.03**	-0.12 - - 0.01
Time to follow up (months)	0.11	**0.04**	0.01 - 0.22
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.21	0.63	-1.09 - 0.68
SIMD quintile 3	-0.94	0.08	-2.00 - 0.11
SIMD quintile 4	-0.86	0.17	-2.11 - 0.40
SIMD quintile 5 (least deprived)	-1.90	**<0.001**	-2.82 - -0.98
Surgery at admission or within seven days of ICU	-0.31	0.42	-1.10 - 0.48
Charlson comorbidity index (CCI) score	0.22	**0.02**	0.04 - 0.40
History of harmful alcohol or drug use	1.12	0.05	0.00 - 2.25
Pre-morbid history of chronic pain	0.56	0.34	-0.68 - 1.81
Pre-existing psychiatric diagnosis	0.38	0.40	-0.55 - 1.32

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions on outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Effects on worst pain score (single question from survey)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	4.29	<**0.001**	2.74 – 5.83
Intervention (InS:PIRE)	-0.70	**0.03**	-1.33 - -0.06
Male sex	-0.61	0.10	-1.33- 0.12
ICU length of stay	0.04	0.08	-0.01 - 0.09
APACHE II score	-0.09	**0.01**	-0.15 - -0.03
Time to follow up (months)	0.10	0.05	0.00 - 0.21
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.36	0.44	-1.29 - 0.58
SIMD quintile 3	-0.90	0.14	-2.10 - 0.31
SIMD quintile 4	-0.64	0.43	-2.38 - 1.09
SIMD quintile 5 (least deprived)	-1.75	**<0.001**	-2.84 - -0.65
Surgery at admission or within seven days of ICU	-0.49	0.26	-1.36 - 0.39
Charlson comorbidity index (CCI) score	0.18	0.05	0.00 - 0.35
History of harmful alcohol or drug use	1.16	**0.04**	0.04-2.28
Pre-morbid history of chronic pain	1.39	**0.03**	0.14 - 2.65
Pre-existing psychiatric diagnosis	1.11	0.05	0.00 - 2.22

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions on outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Effects on enjoyment in life: pain interference (single question from survey)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	4.22	**<0.001**	2.15- 6.28
Intervention (InS:PIRE)	-1.36	**0.02**	-2.44- -0.28
Male sex	0.15	0.70	-0.62 - 0.93
ICU length of stay	0.04	0.15	-0.02 - 0.10
APACHE II score	-0.05	0.13	-0.13 - 0.02
Time to follow up (months)	0.07	0.28	-0.07 - 0.21
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.23	0.68	-1.38 - 0.92
SIMD quintile 3	-0.71	0.27	-1.98 - 0.56
SIMD quintile 4	-1.75	0.06	-3.63 - 0.13
SIMD quintile 5 (least deprived)	-2.54	**<0.001**	-3.91 - -1.16
Surgery at admission or within seven days of ICU	-0.23	0.64	-1.28 – 0.81
Charlson comorbidity index (CCI) score	-0.05	0.62	-0.27 - 0.16
History of harmful alcohol or drug use	0.85	0.18	-0.41 - 2.10
Pre-morbid history of chronic pain	1.43	**0.01**	0.32 - 2.54
Pre-existing psychiatric diagnosis	1.80	**0.02**	0.35 - 3.24

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions on outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Effects on normal work: pain interference (single question from survey)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	3.74	**<0.001**	1.79 - 5.70
Intervention (InS:PIRE)	-0.88	0.07	-1.84 - 0.07
Male sex	-0.19	0.65	-1.03 - 0.65
ICU length of stay	0.05	0.10	-0.01 - 0.12
APACHE II score	-0.06	0.08	-0.13 - 0.01
Time to follow up (months)	0.08	0.12	-0.02 - 0.18
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.20	0.71	-1.29 - 0.89
SIMD quintile 3	-0.97	0.14	-2.28 - 0.34
SIMD quintile 4	-1.42	0.12	-3.25 - 0.41
SIMD quintile 5 (least deprived)	-2.80	<0.001	-3.89- -1.71
Surgery at admission or within seven days of ICU	-0.12	0.78	-1.02- 0.77
Charlson comorbidity index (CCI) score	0.18	0.16	-0.07 -0.43
History of harmful alcohol or drug use	0.68	0.45	-1.32 - 2.68
Pre-morbid history of chronic pain	0.92	0.25	-0.76 - 2.60
Pre-existing psychiatric diagnosis	1.97	**<0.001**	0.88 - 3.07

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions on outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Pain interference summary: mean pain interference (summary score)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	4.17	**<0.001**	2.54 - 5.79
Intervention (InS:PIRE)	-0.97	**0.02**	-1.75 - -0.18
Male sex	-0.13	0.69	-0.80 - 0.53
ICU length of stay	0.03	0.15	-0.01 - 0.08
APACHE II score	-0.06	0.05	-0.12 - 0.00
Time to follow up (months)	0.06	0.26	-0.05 - 0.16
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.35	0.50	-1.42 -0.72
SIMD quintile 3	-1.01	0.06	-2.08 -0.07
SIMD quintile 4	-1.64	0.06	-3.34- 0.07
SIMD quintile 5 (least deprived)	-2.48	**<0.001**	-3.51- -1.45
Surgery at admission or within seven days of ICU	-0.31	0.44	-1.12 - 0.51
Charlson comorbidity index (CCI) score	0.06	0.57	-0.14 - 0.25
History of harmful alcohol or drug use	1.04	0.09	-0.20 - 2.28
Pre-morbid history of chronic pain	1.31	0.07	-0.12 - 2.74
Pre-existing psychiatric diagnosis	1.55	**0.01**	0.53 - 2.57

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions on outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

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Supplement 4: Hospital site clustering analysis

As outlined in the main paper the intervention was conducted in five sites and the usual care group were recruited from four separate sites. To account for any variation between hospital types, a mixed effects analysis was used to account for the intra-site variation.

Hospital site spread

In the intervention cohort 71 (51.8%) participants had been treated in the large tertiary referral hospital delivering the intervention with the remaining 66 (48.2%) receiving the intervention from the four medium general acute hospitals. In the usual care cohort 70 (60.9%) participants were from the large tertiary referral hospital recruiting to usual care with the remaining 45 (39.1%) recruited from three medium general acute hospitals. The differences in spread between groups was not significant on assessment with Pearson's Chi-squared test.

Hospital site type	Usual care cohort	Intervention cohort	P value
			0.189
Medium general acute hospitals	45 / 115 (39.1%)	66 / 137 (48.2%)	
Large tertiary referral hospital	70 / 115 (60.9%)	71 / 137 (51.8%)	

Contingency table of hospital site type

Large tertiary referral hospital fixed effects were added to the previous multivariable regression model outlined in the main paper and supplement **S6,** with the reference being participants treated in an intensive care unit from a medium general acute hospital. The tables of these models with fixed effects are presented first. Tables with fixed and random effects, including the variance (standard deviation in intercept from hospital site) are presented after the standalone fixed effects models. The effects of hospital site is minimal on both fixed and random effects analyses.

Analysis with hospital site type, fixed effects

Health utility score model with hospital site fixed effects

Covariate	Effect estimate	P value	95% confidence interval
Intercept	0.76	**<0.001**	0.55 -0.98
Intervention (InS:PIRE)	0.12	**<0.001**	0.04 - 0.20
Large tertiary referral hospital	0.02	0.61	-0.06 – 0.10
Male sex	0.01	0.72	-0.06 - 0.09
ICU length of stay	0.00	**0.01**	-0.01 -0.00
APACHE II score	0.00	0.49	-0.01 - 0.00
Time to follow up (months)	0.06	0.26	-0.05 - 0.16
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.35	0.50	-1.42 -0.72
SIMD quintile 3	-1.01	0.06	-2.08 -0.07
SIMD quintile 4	-1.64	0.06	-3.34- 0.07
SIMD quintile 5 (least deprived)	-2.48	**<0.001**	-3.51- -1.45
Surgery at admission or within seven days of ICU	-0.31	0.44	-1.12 - 0.51
Charlson comorbidity index (CCI) score	0.00	0.93	-0.02 - 0.02
History of harmful alcohol or drug use	-0.09	0.08	-0.20 - 0.01
Pre-morbid history of chronic pain	-0.09	0.09	-0.20 - 0.01
Pre-existing psychiatric diagnosis	-0.17	**<0.001**	-0.26 - -0.08

Health utility score: EQ-5D-5L quality of life indicator with range of -0.594 to 1.0.

Adjusted linear regression model. All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. Large tertiary referral hospital fixed effects added to the previous multivariable regression model outlined in the main paper and supplement S6, with the reference being participants treated in an intensive care unit from a medium general acute hospital. NA: not applicable.

Mixed effects sensitivity analysis for hospital clustering

Health utility score model with hospital site, mixed effects: hospital type cluster analysis

Covariate	Effect estimate	P value	95% confidence interval
Intercept	0.76	**<0.001**	0.55 - 0.98
Intervention (InS:PIRE)	0.12	**<0.001**	0.04- 0.20
Large tertiary referral hospital	0.02	0.61	-0.06 - 0.10
Male sex	0.01	0.72	-0.06 - 0.09
ICU length of stay	0.00	**0.01**	-0.01 - 0.00
APACHE II score	0.00	0.49	-0.01 - 0.00
Time to follow up (months)	-0.01	**0.01**	-0.02 -0.00
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD Quintile 2	0.02	0.64	-0.07 - 0.12
SIMD Quintile 3	0.08	0.23	-0.05 - 0.20
SIMD Quintile 4	0.14	0.03	0.02 - 0.27
SIMD Quintile 5 (least deprived)	0.21	<0.001	0.10 - 0.32
Surgery at admission or within seven days of ICU	0.02	0.69	-0.06 - 0.09
Charlson comorbidity index (CCI) score	0.00	0.93	-0.02 - 0.02
History of harmful alcohol or drug use	-0.09	0.08	-0.20- 0.01
Pre-morbid history of chronic pain	-0.09	0.09	-0.20 - 0.01
Pre-existing psychiatric diagnosis	-0.17	**<0.001**	-0.26 - -0.08
Random effects	**Variance: random effects on intercept**		
Large tertiary referral and medium general acute hospital	1.61×10^{-06}		

Health utility score: EQ-5D-5L quality of life indicator with range of -0.594 to 1.0.
Adjusted linear regression model.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score;

time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. Large tertiary referral hospital fixed effects added to the previous multivariable regression model outlined in the main paper and supplement S6, with the reference being participants treated in an intensive care unit from a medium general acute hospital. Addition of hospital type cluster expressed as random effects on both large tertiary referral and medium general acute hospitals. NA: not applicable.

Supplement 5:
Comparison of eligible patients responding and not responding to the usual care postal survey

Demographic	Responders (N = 115)	Non-responders (N = 337)
Age, Years, Median (IQR)	63.5 (49.5 - 71.5)	53.7 (41.5 - 64.8)
Sex, Male (%)	67 / 115 (58.3)	207 / 336 (61.6)
Admitting specialty (%):		
Medical	53 / 115 (46.1)	208 / 336 (61.9)
Surgery	62 / 115 (53.9)	126 / 336 (37.5)
Other	0 / 115 (0.0)	2 / 336 (0.6)
Surgery at admission or within seven days of ICU (%)	50 / 106 (47.2)	112 / 329 (34.0)
ICU length of stay, Median days (IQR)	4.95 (2.5 - 9.5)	4.61 (2.21 - 9.14)
Hospital Length of stay, Median days (IQR)	18.0 (11.4 - 35.0)	17.0 (8.0 - 32.3)
APACHE II score, Median (IQR)	19 (14.2 - 25.0)	18 (14 - 24)
Advanced respiratory support (%)	100 / 112 (89.3)	301 / 334 (90.1)
Complex cardiovascular support requiring multiple vasoactive drugs (%)	21 / 112 (18.8)	39 / 336 (11.6)
Renal replacement therapy (%)	19 / 112 (17.0)	64 / 334 (19.2)
Deprivation index, SIMD 2016 (%):		
Quintile 1 (most deprived)	34 / 112 (30.4)	133 / 311 (42.765)
Quintile 2	27 / 112 (24.1)	75 / 311 (24.116)
Quintile 3	12 / 112 (10.7)	48 / 311 (15.434)
Quintile 4	18 / 112 (16.1)	27 / 311 (8.682)
Quintile 5 (least deprived)	21 / 112 (18.8)	28 / 311 (9.003)
Time from hospital discharge to first recruitment letter invitation, Median months (IQR)	13.9 (12.4 - 15.2)	13.6 (12.0 - 15.1)

IQR: Interquartile range; ICU: Intensive Care Unit; APACHE II: Acute Physiology and Chronic Health Evaluation Two; SIMD: Scottish Index of Multiple Deprivation. The usual care cohort was recruited by postal survey, 452 eligible patients were sent invitation letters alongside details of the study, consent forms, and the study questionnaires. Of these, 115 patient retuned completed surveys and consent forms (responders), and 337 did not return surveys (non-responders). Recruitment numbers are outlined in **Figure 1.**

Supplement 6: details of all adjusted, multivariable models used for primary outcomes
The following 11 tables describe the covariates and their effects for all outcomes models.

Health utility score model

Covariate	Effect estimate	P value	95% confidence interval
Intercept	0.79	**<0.001**	0.57 -1.10
Intervention (InS:PIRE)	0.12	**0.01**	0.04 - 0.20
Male sex	0.01	0.72	-0.07 - 0.10
ICU length of stay	0.00	**0.01**	-0.01 – 0.00
APACHE II score	0.00	0.53	-0.01 -0.00
Time to follow up (months)	-0.01	**<0.001**	-0.02 -0.00
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	0.02	0.70	-0.08 - 0.12
SIMD quintile 3	0.07	0.28	-0.06 - 0.19
SIMD quintile 4	0.14	**0.04**	0.01 - 0.26
SIMD quintile 5 (least deprived)	0.21	**<0.001**	0.11 -0.30
Surgery at admission or within seven days of ICU	0.02	0.69	-0.07 - 0.11
Charlson comorbidity index (CCI) score	0.00	0.95	-0.02 - 0.02
History of harmful alcohol or drug use	-0.09	0.11	-0.21 - 0.02
Pre-morbid history of chronic pain	-0.09	0.21	-0.24 - 0.05
Pre-existing psychiatric diagnosis	-0.17	**<0.001**	-0.27 - -0.07

Health utility score: EQ-5D-5L quality of life indicator with range of -0.594 to 1.0.
Adjusted linear regression model. All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation, five quintiles (SIMD), effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

EuroQol Visual Analogue Scale score

Covariate	Effect estimate	P value	95% confidence interval
Intercept	65.38	**<0.001**	49.57 - 81.19
Intervention (InS:PIRE)	11.88	**<0.001**	5.91 - 17.86
Male sex	-0.10	0.97	-5.76 - 5.55
ICU length of stay	-0.20	0.12	-0.46 - 0.05
APACHE II score	0.03	0.88	-0.38 - 0.44
Time to follow up (months)	-0.52	0.14	-1.23 – 0.18
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	4.56	0.22	-2.81 - 11.93
SIMD quintile 3	5.25	0.26	-3.93 - 14.44
SIMD quintile 4	1.43	0.76	-7.83- 10.69
SIMD quintile 5 (least deprived)	14.87	**<0.001**	6.52 - 23.22
Surgery at admission or within seven days of ICU	7.92	0.001	1.92 - 13.91
Charlson comorbidity index (CCI) score	-0.01	0.99	-1.35 - 1.32
History of harmful alcohol or drug use	-8.00	0.06	-16.33 - 0.34
Pre-morbid history of chronic pain	-4.40	0.26	-12.01 - 3.21
Pre-existing psychiatric diagnosis	-10.43	**<0.001**	-17.38 - -3.47

EuroQol Visual Analogue Scale score: Range 0 to 100. Adjusted linear regression model.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Generalised Self-Efficacy

Covariate	Effect estimate	P value	95% confidence interval
Intercept	29.49	**<0.001**	24.94- 34.03
Intervention (InS:PIRE)	2.32	**0.02**	0.32 - 4.31
Male sex	0.60	0.48	-1.06 - 2.26
ICU length of stay	-0.03	0.35	-0.10 - 0.04
APACHE II score	0.00	0.99	-0.13 - 0.13
Time to follow up (months)	-0.20	0.07	-0.42 - 0.02
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	1.22	0.33	-1.25- 3.69
SIMD quintile 3	3.04	**0.02**	0.45 - 5.63
SIMD quintile 4	2.63	0.08	-0.33 - 5.60
SIMD quintile 5 (least deprived)	3.62	**<0.001**	1.42 - 5.82
Surgery at admission or within seven days of ICU	1.73	0.05	0.03 - 3.43
Charlson comorbidity index (CCI) score	0.50	**0.02**	0.08 - 0.92
History of harmful alcohol or drug use	-2.44	0.10	-5.33 – 0.45
Pre-morbid history of chronic pain	-0.03	0.98	-2.90 - 2.84
Pre-existing psychiatric diagnosis	-3.16	**<0.001**	-5.24 - -1.08

Generalised self-efficacy: range 10 to 40. Adjusted linear regression model.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Depression odds ratios: Hospital Anxiety and Depression Scale score (HADS)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	0.82	0.83	0.13 - 5.09
Intervention (InS:PIRE)	0.38	**0.01**	0.19 - 0.76
Male sex	1.07	0.85	0.54 - 2.11
ICU length of stay	1.03	0.06	1.00 -1.06
APACHE II score	1.00	1.00	0.95 - 1.05
Time to follow up (months)	1.05	0.16	0.98 - 1.14
SIMD quintile 1 (most deprived)	1	NA	Reference quintile
SIMD quintile 2	0.69	0.38	0.31 - 1.57
SIMD quintile 3	0.31	**0.02**	0.11- 0.85
SIMD quintile 4	0.81	0.64	0.34 - 1.96
SIMD quintile 5 (least deprived)	0.14	**0.01**	0.03 - 0.63
Surgery at admission or within seven days of ICU	0.33	**<0.001**	0.17 - 0.65
Charlson comorbidity index (CCI) score	0.83	0.05	0.70 - 1.00
History of harmful alcohol or drug use	2.06	0.09	0.88 -4.81
Pre-morbid history of chronic pain	0.86	0.78	0.30 -2.49
Pre-existing psychiatric diagnosis	3.36	**<0.001**	1.67 - 6.79

Hospital Anxiety and Depression Scale scores. Odds ratios of risk of screening positive for depression at one year. Depression defined as a component score of eight or greater. Adjusted logistic regression model.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Anxiety odds ratios: Hospital Anxiety and Depression Scale score (HADS)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	0.93	0.96	0.18 - 4.82
Intervention (InS:PIRE)	0.58	0.11	0.30 - 1.13
Male sex	0.49	**0.03**	0.25 - 0.93
ICU length of stay	1.00	0.81	0.97 - 1.03
APACHE II score	1.00	0.90	0.96 - 1.5
Time to follow up (months)	1.07	0.06	1.00 - 1.15
SIMD quintile 1 (most deprived)	1	NA	Reference quintile
SIMD quintile 2	0.92	0.84	0.42 - 2.00
SIMD quintile 3	0.76	0.54	0.30 - 1.88
SIMD quintile 4	0.50	0.15	0.19 - 1.29
SIMD quintile 5 (least deprived)	0.50	0.14	0.20 - 1.27
Surgery at admission or within seven days of ICU	0.45	**0.02**	0.23 - 0.88
Charlson comorbidity index (CCI) score	0.87	0.12	0.73 - 1.04
History of harmful alcohol or drug use	3.37	<0.001	1.44 - 7.88
Pre-morbid history of chronic pain	1.19	0.72	0.47 - 2.98
Pre-existing psychiatric diagnosis	2.06	**0.04**	1.04 - 4.10

Hospital Anxiety and Depression Scale scores. Odds ratios of risk of screening positive for anxiety at one year. Depression defined as a component score of eight or greater. Adjusted logistic regression model.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Effects on Summary (mean) pain score

Covariate	Effect estimate	P value	95% confidence interval
Intercept	3.13	**<0.001**	1.38 - 4.89
Intervention (InS:PIRE)	-0.62	0.09	-1.35 - 0.11
Male sex	-0.28	0.42	-0.98 - 0.41
ICU length of stay	0.02	0.12	-0.01 - 0.05
APACHE II score	-0.06	**0.02**	-0.11 - -0.01
Time to follow up (months)	0.11	**<0.001**	0.05- 0.17
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.40	0.41	-1.35 - 0.56
SIMD quintile 3	-1.30	**0.04**	-2.52 - -0.08
SIMD quintile 4	-0.96	0.09	-2.09 - 0.16
SIMD quintile 5 (least deprived)	-2.24	**<0.001**	-3.10- -1.38
Surgery at admission or within seven days of ICU	-0.69	0.08	-1.47 - 0.09
Charlson comorbidity index (CCI) score	0.16	0.07	-0.01 - 0.34
History of harmful alcohol or drug use	1.18	**0.02**	0.18 - 2.17
Pre-morbid history of chronic pain	1.15	**0.01**	0.24 - 2.05
Pre-existing psychiatric diagnosis	0.53	0.21	-0.31 - 1.36

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Effects on average pain score (single question from survey)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	3.25	**<0.001**	1.42 - 5.08
Intervention (InS:PIRE)	-0.75	0.05	-1.50 - 0.00
Male sex	-0.22	0.56	-0.94 - 0.51
ICU length of stay	0.03	0.06	0.00- 0.06
APACHE II score	-0.05	**0.04**	-0.10 - 0.00
Time to follow up (months)	0.10	**<0.001**	0.03 - 0.17
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.39	0.44	-1.37 - 0.60
SIMD quintile 3	-1.30	**0.04**	-2.58 - -0.03
SIMD quintile 4	-0.80	0.20	-2.01 - 0.41
SIMD quintile 5 (least deprived)	-2.12	**<0.001**	-3.06 - -1.18
Surgery at admission or within seven days of ICU	-0.71	0.08	-1.50 - 0.09
Charlson comorbidity index (CCI) score	0.21	**0.04**	0.01 - 0.40
History of harmful alcohol or drug use	1.38	**0.01**	0.35 - 2.42
Pre-morbid history of chronic pain	0.80	0.09	-0.14 - 1.74
Pre-existing psychiatric diagnosis	0.26	0.56	-0.61 - 1.12

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Effects on worst pain score (single question from survey)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	4.64	**<0.001**	2.72 - 6.55
Intervention (InS:PIRE)	-0.59	0.16	-1.41 - 0.23
Male sex	-0.57	0.16	-1.38 - 0.23
ICU length of stay	0.03	0.14	-0.01 - 0.06
APACHE II score	-0.08	**<0.001**	-0.14 - -0.03
Time to follow up (months)	0.11	**<0.001**	0.04 - 0.17
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.59	0.26	-1.63 - 0.44
SIMD quintile 3	-1.60	**0.03**	-3.02- -0.17
SIMD quintile 4	-0.84	0.22	-2.19 - 0.51
SIMD quintile 5 (least deprived)	-2.36	**<0.001**	-3.42 - -1.30
Surgery at admission or within seven days of ICU	-0.91	**0.04**	-1.77 - -0.14
Charlson comorbidity index (CCI) score	0.16	0.14	-0.05 - 0.37
History of harmful alcohol or drug use	1.47	**0.01**	0.39 - 2.55
Pre-morbid history of chronic pain	1.31	**0.01**	0.29 - 2.33
Pre-existing psychiatric diagnosis	0.75	0.12	-0.18 - 1.68

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Effects on enjoyment in life: pain interference (single question from survey)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	4.23	**<0.001**	2.00 - 6.46
Intervention (InS:PIRE)	-1.00	**0.03**	-1.89 - -0.11
Male sex	0.41	0.37	-0.48- 1.31
ICU length of stay	0.03	0.16	-0.01 - 0.07
APACHE II score	-0.06	0.07	-0.12 - 0.00
Time to follow up (months)	0.09	**0.02**	0.01- 0.17
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.54	0.37	-1.72 - 0.65
SIMD quintile 3	-1.67	**0.02**	-3.12 - -0.22
SIMD quintile 4	-1.47	**0.04**	-2.87 - -0.07
SIMD quintile 5 (least deprived)	-3.14	**<0.001**	-4.20 - -2.07
Surgery at admission or within seven days of ICU	-0.80	0.09	-1.71 - 0.12
Charlson comorbidity index (CCI) score	-0.07	0.57	-0.30 - 0.17
History of harmful alcohol or drug use	1.03	0.10	-0.22 - 2.27
Pre-morbid history of chronic pain	1.32	**0.04**	0.09- 2.54
Pre-existing psychiatric diagnosis	1.11	**0.04**	0.05 - 2.17

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Effects on normal work: pain interference (single question from survey)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	4.23	<0.001	1.90 - 6.56
Intervention (InS:PIRE)	-0.69	0.16	-1.66 - 0.28
Male sex	-0.13	0.78	-1.08 - 0.81
ICU length of stay	0.04	0.10	-0.01 - 0.08
APACHE II score	-0.06	0.09	-0.12 - 0.01
Time to follow up (months)	0.08	0.09	-0.01 - 0.17
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.43	0.53	-1.77 - 0.91
SIMD quintile 3	-1.69	**0.03**	-3.21 - -0.17
SIMD quintile 4	-1.42	0.07	-2.94 - 0.11
SIMD quintile 5 (least deprived)	-3.24	**<0.001**	-4.47- -2.02
Surgery at admission or within seven days of ICU	-0.44	0.40	-1.45 - 0.25
Charlson comorbidity index (CCI) score	0.10	0.43	-0.14 - 0.33
History of harmful alcohol or drug use	1.00	0.16	-0.40 - 2.41
Pre-morbid history of chronic pain	1.06	0.10	-0.21 - 2.33
Pre-existing psychiatric diagnosis	1.43	**0.01**	0.29 - 2.57

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Brief Pain Inventory (short form):
Pain interference summary: mean pain interference (summary score)

Covariate	Effect estimate	P value	95% confidence interval
Intercept	4.05	**<0.001**	2.09 - 60.20
Intervention (InS:PIRE)	-0.73	0.07	-1.52 - 0.06
Male sex	0.03	0.94	-0.73 -0.78
ICU length of stay	0.03	0.07	0.00- 0.06
APACHE II score	-0.06	**0.04**	-0.11 - 0.00
Time to follow up (months)	0.08	**0.04**	0.00 - 0.16
SIMD quintile 1 (most deprived)	0	NA	Reference quintile
SIMD quintile 2	-0.65	0.22	-1.68 - 0.39
SIMD quintile 3	-1.80	**<0.001**	-3.03 - -0.57
SIMD quintile 4	-1.50	**0.01**	-2.71 - -0.30
SIMD quintile 5 (least deprived)	-2.91	**<0.001**	-3.79 - -2.04
Surgery at admission or within seven days of ICU	-0.60	0.15	-1.43 - 0.22
Charlson comorbidity index (CCI) score	0.00	0.98	-0.20 - 0.19
History of harmful alcohol or drug use	1.25	**0.02**	0.16 - 2.34
Pre-morbid history of chronic pain	1.37	**0.01**	0.36- 2.38
Pre-existing psychiatric diagnosis	1.07	**0.02**	0.18 - 1.96

Linear regression model: Brief Pain Inventory: score range 0 to 10.

All adjusted variables included in model: Intervention, Intensive Care Syndrome: Promoting Independence and Return to Employment (InS:PIRE), effects compared to the usual care cohort; male sex effects compared to female sex; Intensive Care Unit (ICU) length of stay, measured in days, effects per day; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, effects per point increase in score; time to follow up measured in months, effects per additional month from hospital discharge to follow up; Scottish Index of Multiple Deprivation (SIMD), five quintiles, effects are those compared to SIMD quintile 1 (most deprived); surgery at admission or within seven days of ICU, effects of having an operation around time of ICU admission compared to those not having operative management in this time frame; Charlson Comorbidity Index (CCI) score, effects per extra index point score; effects of specific comorbidity conditions of outcome compared to absence of the comorbidity: history of harmful alcohol or drug use, pre-morbid history of chronic pain, pre-existing psychiatric diagnosis. NA: not applicable.

Supplement 7: Breakdown of missing observations for each covariate
Missing data per covariate for baseline characteristics (Total 252 patients)

Covariate	Missing (%)
Baseline characteristics	
Age	1.2
Gender	0
Medical or surgical admission	1.2
Surgery at admission or within seven days of ICU	4.0
ICU length of stay	1.2
Hospital Length of stay	3.2
APACHE II score	3.2
Advanced respiratory support	1.2
Complex cardiovascular support requiring multiple vasoactive drugs	1.2
Renal replacement therapy	1.2
Two or greater comorbidities	2.0
Charlson comorbidity index (CCI) score	1.6
Pre-existing psychiatric diagnosis	2.0
History of harmful alcohol or drug use	2.0
Pre-morbid history of chronic pain	2.0
Scottish Index of Multiple Deprivation (SIMD) quintile	1.2
Time to follow up (months)	3.2
Days of advanced respiratory support	1.2
Days of basic cardiovascular support	1.2
Days of acute renal replacement therapy	1.2
Obesity	1.2

Covariate	Missing (%)
Baseline characteristics	
Cardiovascular comorbidity count	1.2
Respiratory disease comorbidity count	2
Other comorbidity count (Non-respiratory, non-cardiovascular)	2
Complete comorbidity count	1.2
Admitting specialty short version	1.2
Days of level 3 treatment / Intensive Care	2
Days of level 2 treatment / High Dependency	2
Admitting specialty long version	1.2
Organ system failing	1.2

ICU: Intensive care unit; APACHE II: Acute physiology and chronic health evaluation two; Level 3 care: advanced respiratory support (invasive mechanic ventilation) or multiple organ support; Level 2: single organ failure / support, complex nursing care, or complex post-operative care.

Missing data per covariate for outcome measures

Covariate	Missingness, Number (%) (N = 252)
Outcome measurements	
EuroQol 5 Dimension 5 Level (EQ-5D-5L) responses	
EQ-5D-5L mobility score	2 (0.79)
EQ-5D-5L self-care score	2 (0.79)
EQ-5D-5L usual activities score	2 (0.79)
EQ-5D-5L pain and discomfort score	2 (0.79)
EQ-5D-5L anxiety and depression score	2 (0.79)
EQ-5D-5L Visual Analogue Score	10 (3.97)
Hospital Anxiety and Depression Scale (HADS): Anxiety	
I feel tense or wound up	5 (1.98)
I get a sort of frightened feeling as if something awful is about to happen	4 (1.59)
worrying thoughts go through my mind	4 (1.59)
I can sit at ease and feel relaxed	4 (1.59)
I get a sort of frightened feeling like butterflies in the stomach	7 (2.78)
I feel restless as if I have to be on the move	8 (3.17)
I get sudden feelings of panic	9 (3.57)
Hospital Anxiety and Depression Scale (HADS): Depression	
I still enjoy the things I used to enjoy	3 (1.19)
I can laugh and see the funny side of things	6 (2.38)
I feel cheerful	4 (1.59)
I feel as if I am slowed down	7 (2.78)

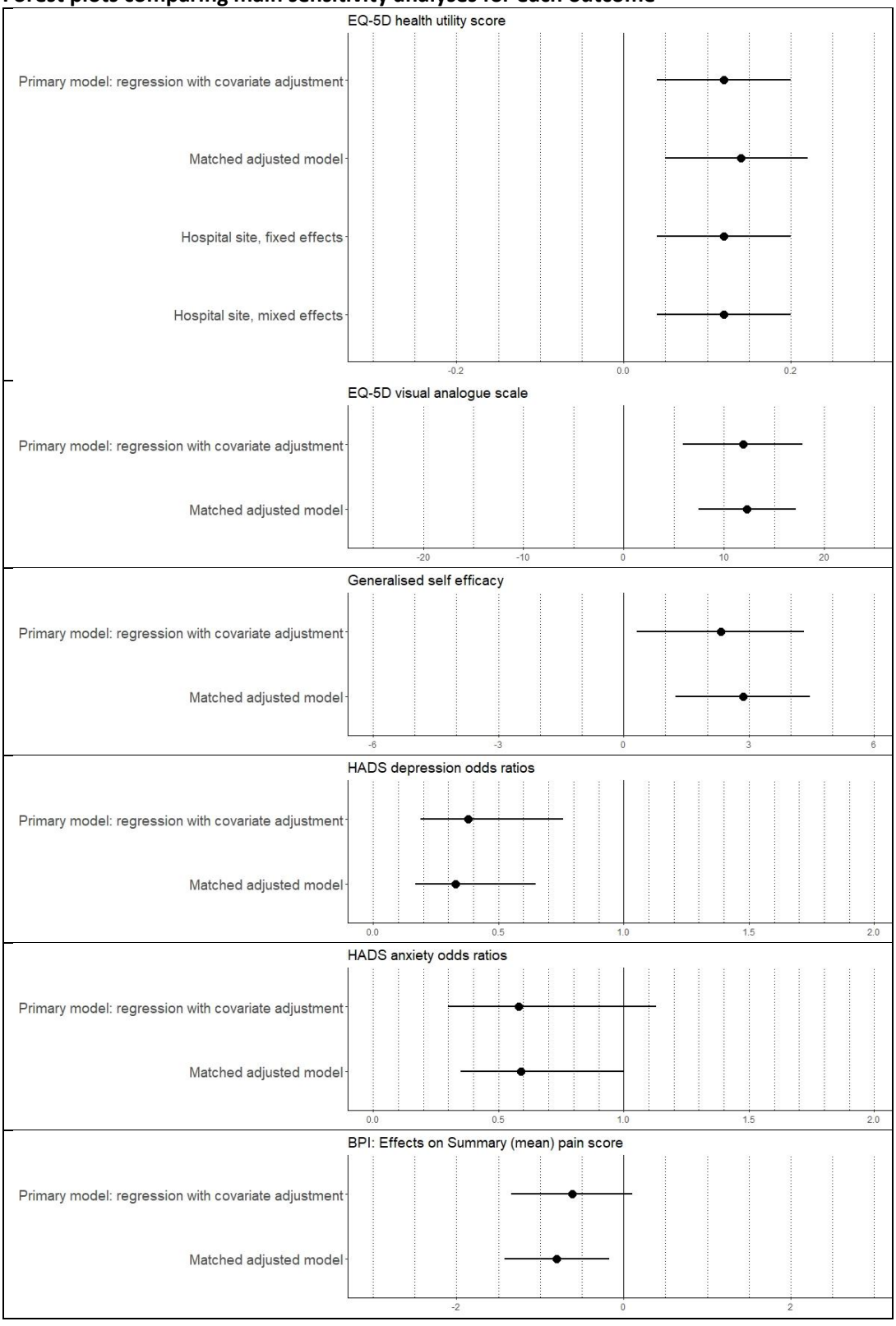
Covariate	Missingness, Number (%) (N = 252)
I have lost interest in my appearance	7 (2.78)
I look forward with enjoyment to things	9 (3.57)
I can enjoy a good book or radio or television programme	8 (3.17)
Generalised self-efficacy (GSE)	
I can always manage to solve difficult problems if I try hard enough	6 (2.38)
If someone opposes me I can find the means and ways to get what I want	9 (3.57)
It is easy for me to stick to my aims and accomplish goals	11 (4.37)
I am confident that I could deal efficiently with unexpected events	8 (3.17)
Thanks to my resourcefulness I know how to handle unforeseen situations	8 (3.17)
I can resolve most problems if I invest the necessary effort	10 (3.97)
I can remain calm when facing difficulties because I can rely on my coping abilities	9 (3.57)
When I am confronted with a problem I can usually find several solutions	8 (3.17)
If I am in trouble I can usually think of a solution	8 (3.17)
I can usually handle whatever comes my way	7 (2.78)
Brief Pain Inventory (short form)	
Have you had pain today?	29 (11.51)
Worst pain in past 24 hours	4 (1.59)
Least pain in past 24 hours	7 (2.78)

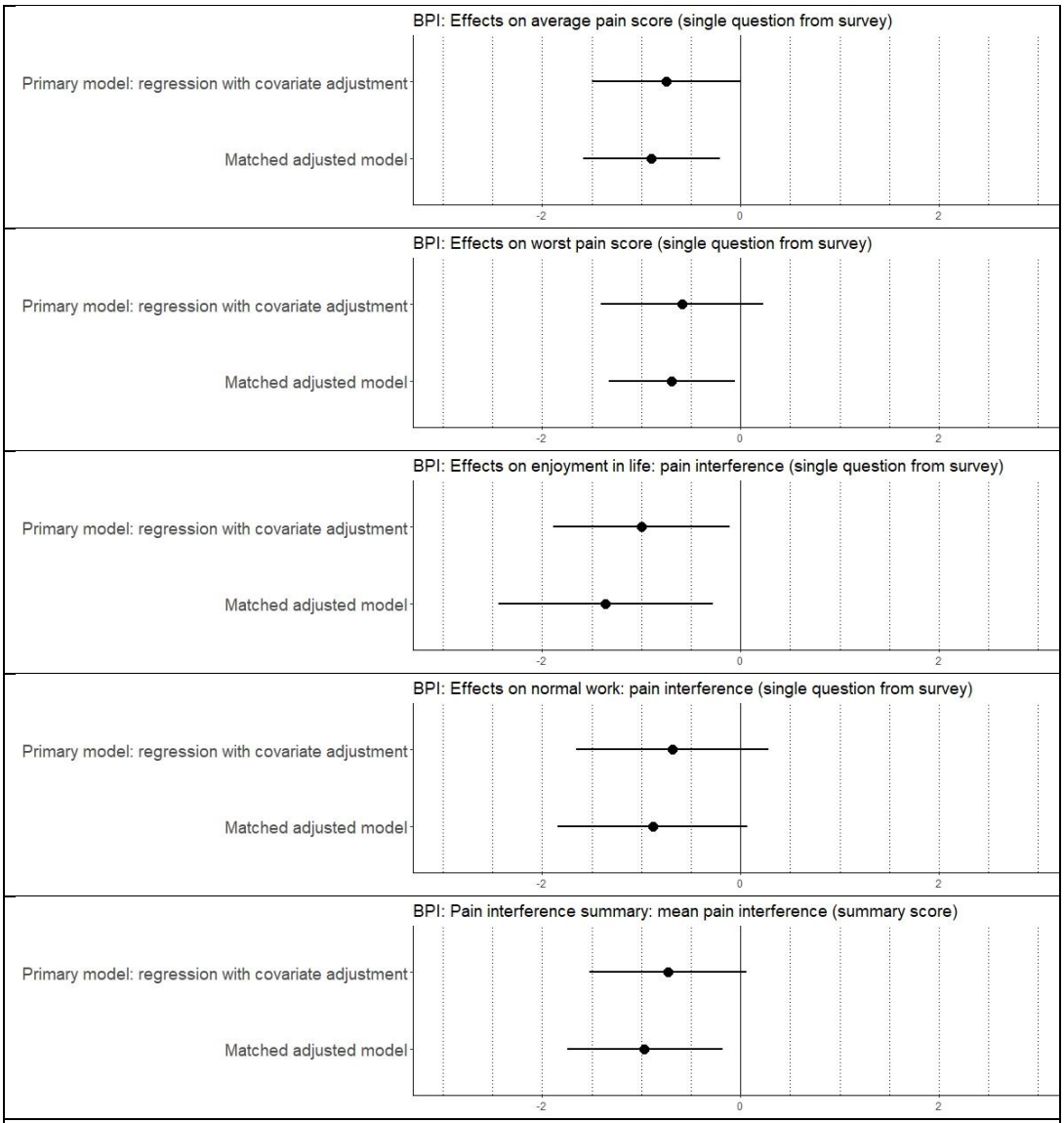
Covariate	Missingness, Number (%) (N = 252)
Average pain level	9 (3.57)
Pain right now	7 (2.78)
Pain interference with activity	14 (5.56)
Pain interference with mood	16 (6.35)
Pain interference with walking	18 (7.14)
Pain interference with normal work	17 (6.75)
Pain interference with relations with other people	15 (5.95)
Pain interference with sleep	16 (6.35)
Pain interference with enjoyment of life	16 (6.35)

Supplement 8 (Table 3): Unadjusted outcome measure differences between the matched intervention and usual care cohort

Outcome	Intervention (n=75)	Usual Care (n=75)	P value
EQ-5D Health utility score, median (IQR)	0.639 (0.542-0.791)	0.592 (0.225-0.792)	0.14
EQ-5D VAS, median (IQR)	70 (50-88)	55 (35.3-75)	**<0.001**
Generalized self-efficacy, median (IQR)	32 (28-35)	30 (22-34)	**0.02**
Summary (mean) pain score, median (IQR)	3 (0.29-5)	3.75 (1.25-6.5)	0.13
Average Pain Score measured (single question), median (IQR)	3 (0-6)	5 (1-7)	0.10
Worse pain score, median (IQR)	4 (0-7)	5 (2-8)	0.12
Pain interference with enjoyment of life, median (IQR)	3 (0-7)	5 (0-8)	0.09
Pain interference with normal work, median (IQR)	3 (0-8)	5 (1-9)	0.18
Mean pain interference summary, median (IQR)	3 (0-6)	4 (1-7)	0.12
HADS anxiety score, median (IQR)	7 (4-12)	8 (4-13)	0.32
HADS Anxiety: mild, moderate, or severe symptoms (%)	46.7	54.7	0.33
HADS depression score, median (IQR)	6 (3-10)	8 (4-13)	**0.02**
HADS depression: mild, moderate, or severe symptoms (%)	33.3	50.7	**0.03**

Supplement 9:
Forest plots comparing main sensitivity analyses for each outcome





Coefficient graph of effect size. Effect of intervention: absolute change in scores (linear models) and odds risk ratio of screening for the condition one year after intensive care compared to usual care. Estimate values (point) and 95% confidence interval. EQ-5D health utility score: EuroQol Health Utility Score, absolute change, taken from EuroQol 5-Dimension 5-level (EQ-5D-5L) 'crosswalk UK scores', range - 0.594 to 1.0; EuroQol Visual Analogue Scale (EQ-VAS), absolute change, range 0 to 100; Generalised Self Efficacy: absolute change, range 10 to 40; HADS: Hospital Anxiety and Depression Scale, individual component scores, odds risk ratios of having anxiety or depression; Brief pain inventory (BPI), absolute change in pain scores, all scores range from 0 to 10, average (single component score), worst pain (single component score), and summary score (composite / mean score from four pain scores: 'average', 'worst', 'least' and 'pain right now'); Pain interference scores from BPI, absolute change, scores range from 0 to 10, enjoyment in life (single component), work (single component), and summary pain interference (composite / mean score from seven interference components).