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Predictors of Posttraumatic Stress Disorder and Return to Usual Major Activity in Traumatically Injured Intensive Care Unit Survivors

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Abstract

Objective—To assess intensive care unit (ICU)/acute care service-delivery characteristics and pre-ICU factors as predictors of posttraumatic stress disorder (PTSD) and return to usual major activity after ICU admission for trauma.

Method—Data from the National Study on the Costs and Outcomes of Trauma was used to evaluate a prospective cohort of 1,906 ICU survivors. We assessed PTSD with the PTSD Checklist. Regression analyses ascertained associations between ICU/acute care service-delivery characteristics, pre-ICU factors, early post-ICU distress, and 12-month PTSD and return to usual activity, while controlling for clinical and demographic characteristics.

Results—Approximately 25% of ICU survivors had symptoms suggestive of PTSD. Increased early post-ICU distress predicted both PTSD and diminished usual major activity. Pulmonary artery

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catheter insertion (Risk Ratio (RR) 1.28, 95% Confidence Interval (95%CI) (1.05-1.57), $p=0.01$) and pre-ICU depression (RR 1.23, 95% CI (1.02-1.49), $p=0.03$) were associated with PTSD. Longer ICU lengths of stay (RR 1.21, 95% CI (1.03-1.44), $p=0.02$) and tracheostomy (RR 1.29, 95% CI (1.05-1.59), $p=0.01$) were associated with diminished usual activity. Greater pre-existing medical co-morbidities were associated with PTSD and limited return to usual activity.

Conclusions—Easily identifiable risk factors including ICU/acute care service-delivery characteristics and early post-ICU distress were associated with increased risk of PTSD and limitations in return to usual major activity. Future investigations could develop early screening interventions in acute care settings targeting these risk factors, facilitating appropriate treatments.

Keywords

stress disorder; posttraumatic; critical care; intensive care unit; risk factors; outcome assessment (health care)

Introduction

Every year, over half a million Americans are injured so severely that they require intensive care unit (ICU) hospitalization [1]. Patients who survive traumatic injuries have impairments in health-related quality of life (HRQOL) [2,3], and are at risk for developing posttraumatic stress disorder (PTSD) [4,5]. In addition, a recent systematic review suggests that survivors of general ICU hospitalization have a substantial prevalence of clinically significant PTSD symptoms [6].

However, previous studies of post-ICU PTSD have several limitations. Most had sample sizes less than 100 patients and were completed at one site; the largest published study of post-ICU PTSD was done in 5 sites and enrolled 304 patients [7]. Also, prior studies have yielded inconsistent results regarding whether ICU service-delivery characteristics, such as ICU length of stay (LOS), endotracheal intubation and mechanical ventilation, were associated with post-ICU PTSD [6,8]. These investigations have also not examined potential associations between many other ICU illness and service-delivery characteristics and long-term outcomes. Importantly, prior studies have rarely addressed the role that pre-ICU depression may have in the development of post-ICU PTSD [6,8]. In addition, prior investigations have not explored associations between pre-ICU factors, ICU and acute care illness and service-delivery characteristics with the ability to return to usual work or school activities.

The National Study on the Costs and Outcomes of Trauma (NSCOT) is the largest, multicenter investigation in the US to date that has followed PTSD symptoms after acute care treatment for physical injuries. The investigation enrolled patients from 69 hospitals [9]; in addition, it encompasses the largest cohort of trauma patients to survive ICU stays and to have follow-up of subsequent psychopathology and return to usual major activity. A previous report from this study ascertained that admission to an ICU following physical injury was independently associated with the development of symptoms suggestive of a diagnosis of PTSD 12 months post-injury [10].

The aim of the current investigation is to utilize the NSCOT study to extend beyond prior investigations by exploring the roles that ICU and acute care illness and service-delivery characteristics, as well as pre-ICU depression, medical co-morbidities, and early post-ICU distress, have in the development of PTSD symptoms and return to usual major activity one year after ICU stays. We hypothesized that ICU and acute care illness and service-delivery characteristics would be independently associated with elevations in post-ICU PTSD symptoms and limitations in post-ICU return to usual major activity, even when accounting for pre-ICU factors and early psychological distress.

Methods

Setting

The NSCOT was a multisite prospective cohort study designed to compare the long-term outcomes of care at trauma centers to care provided at non-trauma center acute care hospitals [9]. All level I trauma centers and large non-trauma center hospitals within US Metropolitan Statistical Areas were identified. Patients were enrolled from 69 hospitals. Eighteen of 27 (66.7%) level I trauma centers and 51 of 124 (40.8%) non-trauma center hospitals agreed to participate. Participating hospitals were located in California, Florida, Illinois, Indiana, Maryland, Massachusetts, Michigan, New Jersey, New York, North Carolina, Pennsylvania, and Washington. The study was approved by the institutional review boards of each participating hospital. Informed consent was obtained from all subjects prior to conducting NSCOT patient assessments.

Patient Population

Patients were recruited between July 2001 and November 2002. English- and Spanish-speaking patients between the ages of 18-84 were eligible if they arrived alive at participating hospitals and required treatment for moderate to severe injuries, as defined by at least one injury with an Abbreviated Injury Scale (AIS) score ≥ 3 (an injury severity level of serious or greater). Patients who were both intentionally injured (e.g., injured by physical assault) or unintentionally injured (e.g., motor vehicle accidents, on the job injuries) were eligible. The current investigation focused exclusively on the subsample of patients who survived ICU hospitalization for their trauma and were assessed for PTSD symptoms 12 months after injury. The NSCOT used a quota sampling strategy to ensure adequate representation of injuries and age strata across centers; therefore, not all eligible subjects were enrolled. Subjects were ineligible if they were 65 years of age or older and had a primary diagnosis of hip fracture, had a major burn, had treatment delays greater than 24 hours, or were incarcerated at the time of injury.

Measures

Data regarding acute care hospitalization was obtained via medical record review by trained nurse abstractors. Information on ICU and acute care illness and service-delivery characteristics, including endotracheal intubation, mechanical ventilation, ICU LOS, duration of mechanical ventilation, reintubation, blood product transfusion within the first 24 hours of hospitalization, tracheostomy, thoracotomy, receipt of paralytic agents at any point during hospitalization, pulmonary artery catheter (PAC) insertion, sepsis, acute respiratory distress syndrome (ARDS), cardiac arrest and multiple organ failure was abstracted, as was data regarding pre-injury medical co-morbidity and medication use. Severity of injury by body region was coded using the AIS, and the Injury Severity Score (ISS) was derived from the region-specific AIS scores [11].

Trained interviewers conducted telephone assessments at 3 and 12 months following hospital discharge. Demographic information (e.g., race-ethnicity, income, education, insurance status) and details regarding medical co-morbidities derived from medical record abstraction were supplemented by patient report at the 3-month interview. Self-report information on pre-injury health status and depression were obtained at the 3-month interview. Alcohol use was assessed via alcohol toxicology screens at the time of injury admission, chart documented ICD-9 alcohol abuse/dependence diagnoses, and a single item interview question that assessed binge-drinking behaviors in the 4 weeks pre-ICU admission [12]. Pre-ICU medical co-morbidities were appraised with the Charlson Co-morbidity Score [13].

Early Post-ICU Symptoms of Distress—The Medical Outcomes Study Short Form 36 (SF-36) [14] was administered at the 3-month post-injury interview; the current investigation used the 3-month mental health (MH) and bodily pain (BP) subscales of the SF-36 to ascertain the presence of considerable psychological and physical distress in the near-term following intensive care. Each subscale is scored from 0 to 100, with 100 equal to the best health and 0 equal to the worst health.

PTSD Symptoms—Symptoms suggestive of a diagnosis of PTSD were ascertained at the 12-month post-injury telephone interview with the civilian version of the PTSD Checklist (PCL) [15]. The PCL is a 17-item self-report Likert scale (1-5) questionnaire that assesses the three PTSD symptom clusters of arousal, intrusion and avoidance. The reliability and validity of the instrument has been established in trauma-exposed populations [16,17]. The PCL has been used extensively to assess PTSD in acute care settings [18,19]. It can be used to create an algorithm consistent with a diagnosis of PTSD by rating at least 1 intrusive, 3 avoidant, and 2 arousal symptoms, with a score of ≥ 3 as a symptom consistent with the diagnostic criteria. This algorithm was used to obtain PCL symptoms suggestive of a diagnosis of PTSD at 12 months following ICU hospitalization for injury.

Usual Major Activity—Usual major activity at pre-ICU baseline was derived from a single questionnaire item and was defined as whether or not a patient was working, being a student or homemaker, caretaking for another, or volunteering [20,21]. Return to usual major activity was ascertained at the 12-month post-injury telephone interview as a dichotomous outcome (Yes/No).

Statistical Analysis

As in previously published NSCOT reports, we employed 10 multiply-imputed data sets for all statistical analyses [9,10,22]. We created sampling weights based on a previously reported 2-step procedure [9,10,22]. We used adjusted Poisson regression analyses with robust error variance to estimate relative risks (RRs) and 95% confidence intervals (CIs); Poisson regression allows for the estimation of RRs for outcomes that are not rare [23].

We first used t-tests (two-tailed) and Chi-squared tests to assess for significant univariate associations between ICU and acute care illness and service-delivery characteristics (i.e., endotracheal intubation, mechanical ventilation, ICU LOS, duration of mechanical ventilation, reintubation, blood product transfusion, tracheostomy, thoracotomy, paralytic agents, PAC, sepsis, ARDS, cardiac arrest and multiple organ failure), pre-ICU clinical characteristics (i.e., pre-ICU medical co-morbidities, pre-ICU depression, pre-ICU alcohol misuse, injury severity), demographic factors (i.e., age, gender, race/ethnicity, education, household income, marital status) and 3-month SF-36 MH and BP subscale scores, and symptoms suggestive of a diagnosis of PTSD and return to usual major activity.

Next, we ran an initial Poisson regression that included design variables (i.e., age, gender, injury severity) chosen *a priori* that have been found to be important in injury research [19], as well as all demographic and clinical characteristics from the univariate analyses with p values ≤ 0.05 for either of the outcomes. For all subsequent analyses, we excluded variables not significant at the $p \leq 0.05$ level except for design variables. Then, we ran a model that included significant demographic and clinical characteristics along with ICU and significant acute care illness and service-delivery characteristics. Finally, we added 3-month post-ICU SF-36 MH and BP subscale scores into the regressions. We report the regression results from the final model as they pertain to the design variables, pre-ICU factors, ICU and acute care illness and service-delivery characteristics, and 3-month SF-36 MH and BP subscale scores. Analyses

were performed with the Stata statistical software program (Stata Corporation, College Station, TX, USA).

Results

Of the 5,043 patients eligible for the NSCOT, 1,906 that required ICU stays were included in the 12-month follow-up; using the NSCOT sampling and weighting approach, the reference population to which statistical inferences could be made was 4,890 patients (Figure 1). Table 1 summarizes the demographic and clinical characteristics of the patients that required ICU stays. Approximately 17% of enrolled ICU survivors had a pre-ICU history of depression, 20% had a pre-ICU history of alcohol abuse/dependence, and 10% had substantial pre-ICU medical co-morbidities (Table 1). Seventy-seven percent of ICU survivors were employed, a homemaker, a student, caretaking for another or volunteering prior to their injury.

At 12 months following an ICU stay for traumatic injury, approximately 25% of patients endorsed symptoms suggestive of a diagnosis of PTSD. In addition, only 44% of ICU survivors had returned to their usual major activities.

Univariate analyses revealed that pre-ICU depression, pre-ICU alcohol abuse/dependence, a pre-ICU Charlson Co-morbidity Score ≥ 2 , less than a college education, ICU LOS ≥ 5 days, ≥ 5 days of mechanical ventilation, receiving blood products in the first 24 hours of hospitalization, PAC insertion, and 3-month SF-36 MH and BP symptoms were significant predictors of symptoms suggestive of a diagnosis of PTSD 12 months following an ICU stay for traumatic injury. Pre-ICU alcohol abuse/dependence, medical co-morbidities, increased age, less than a college education, not engaging in usual major activity pre-ICU, intubation, mechanical ventilation, ICU LOS ≥ 5 days, ≥ 5 days of mechanical ventilation, tracheostomy, receiving blood products in the first 24 hours of hospitalization, PAC insertion, and 3-month SF-36 MH and BP symptoms were significant predictors of limitations in return to usual major activities. Female gender was protective against limitations in returning to usual major activity. Other ICU and acute care illness and service-delivery characteristics (e.g., sepsis, ARDS, multiple organ failure, thoracotomy, cardiac arrest and epidural analgesia) were not associated with PTSD symptoms or diminished usual activity in the univariate analyses.

In the adjusted models, PAC insertion was a significant predictor of symptoms suggestive of a diagnosis of PTSD 12 months post-ICU stay (Table 2). An ICU LOS ≥ 5 days and having a tracheostomy during the hospitalization were significant predictors of limitations in return to usual major activities 12 months after an ICU stay for traumatic injury (Table 3).

Discussion

This investigation of nearly 1,500 ICU survivors highlights that symptoms suggestive of PTSD occur in one-quarter one year after their ICU stay. The point prevalence of symptoms suggestive of a diagnosis of PTSD in this cohort is similar to the findings of studies of general ICU survivors [6]. In addition, less than half of the patients requiring ICU stays for traumatic injury returned to their usual major activity (i.e., work, school, homemaker, etc.) 12 months after hospital discharge.

The findings regarding predictors of PTSD and return to usual major activity corroborate and extend those of prior investigations [10,22]. As with prior analyses of the NSCOT data that focused on the prediction of 12-month PTSD in all trauma survivors, early psychological and physical distress symptoms predicted 12-month PTSD symptoms. However, above and beyond early post-ICU symptoms of distress, PAC insertion predicted PTSD symptoms, and a longer ICU LOS and having a tracheostomy were associated with limitations in return to usual major activity. To our knowledge, this study is the first large-scale investigation of ICU survivors to

find an association between PAC insertion and post-ICU psychiatric morbidity. PAC insertion in this sample could be a proxy for injury/illness severity, since PA catheterization is indicated in critically ill patients requiring intensive hemodynamic monitoring [24]. Furthermore, if PAC insertion represents greater illness/injury severity, then systemic inflammation could serve as an underlying pathophysiologic mechanism for the development of subsequent PTSD symptoms. Severe traumatic injuries are associated with activation of inflammatory cascades [25,26], and inflammation has been speculated to play a role in the etiology of post-ICU PTSD [27]. Moreover, critically ill patients are at greatly increased risk for delirium [28], and in-ICU delirium may confer vulnerability for post-ICU PTSD [6]. Since PAC insertion is an invasive procedure, it could represent an additional psychological trauma for the patient that may predispose to later psychopathology. Invasive procedures have been found to be associated with PTSD in pediatric intensive care survivors [29], and our findings suggest that a similar association may be true in adults.

Additionally, pre-ICU depression was a predictor of symptoms suggestive of a diagnosis of PTSD 12 months after hospitalization. This finding bolsters the evidence suggested in general ICU populations that pre-ICU psychopathology is an important risk factor for psychiatric morbidity months after ICU stays [6].

Substantial pre-ICU medical co-morbidities were found to be a risk factor for post-ICU PTSD in our cohort, an unsurprising finding as chronic medical illnesses are known to be associated with anxiety disorders [30-32]. Contrary to prior investigations of adult survivors of physical injuries [33,34], our investigation did not find female gender to be associated with an increased risk of developing PTSD symptoms following an ICU stay for traumatic injury. Also, to our knowledge, the current study is the first to demonstrate that female ICU survivors were more likely to return to usual major activity, in contrast to a prior study of physical injury survivors which found that women were less functional post-injury [35], and prior studies of ICU survivors which found no significant differences in function based on gender [36].

Several important limitations of the current study should be noted. First, many pre-ICU characteristics, including pre-ICU depression, were assessed retrospectively by patient report at the 3-month post-injury interview, potentially introducing bias due to current levels of distress and impairment. Second, the model used may have been overly conservative; including early post-ICU psychological and physical distress may have weakened the impact of analyses of other factors, such as pre-ICU depression or ICU and acute care service-related characteristics, on the outcomes. Third, the population described in this study is comprised entirely of survivors of traumatic injury, and although the outcomes were not influenced by injury severity, the study's findings may not be generalizable to other critically ill populations. Fourth, data on other ICU service-delivery characteristics of potential interest such as specific sedatives administered or exposure to corticosteroids was not collected in this study. Fifth, since a questionnaire, and not a structured or semi-structured diagnostic interview, was used to assess PTSD symptoms post-ICU, a diagnosis of PTSD could not be made, hence the use of the phrase, "symptoms suggestive of the diagnosis of," throughout to articulate that the level of symptoms reached the questionnaire threshold for probable diagnosis. Furthermore, post-ICU return to usual major activity was measured by a single general question, limiting the depth of understanding of this important functional measure. Finally, the multiple imputation method has limitations, as do all methods attempting to handle missing data [37].

In conclusion, patients surviving ICU stays for traumatic injury are burdened by substantial PTSD symptoms, and more than half do not return to usual major activity such as work or school 12 months after hospital discharge. ICU and acute care service-delivery characteristics such as PAC insertion may increase the risk of PTSD, and prolonged ICU LOS and having a tracheostomy may diminish usual major activity. Pre-ICU substantial medical co-morbidities

and pre-ICU depression may increase the risk of post-ICU PTSD. Patients surviving ICU stays for traumatic injury who meet these risk factor profiles should be identified early so that they can receive appropriate treatments if necessary, and future investigations should be geared toward early screening and preventive interventions in acute care settings that may avert the suffering caused by subsequent psychiatric morbidity and impairments in function.

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Figure 1. Flow chart for patients requiring ICU stays in the National Study on Costs and Outcomes of Trauma (NSCOT)

^a N = N (Weighted N)

Abbreviations (in alphabetic order): ICU = intensive care unit; PCL = PTSD Checklist.

Table 1
Demographic and clinical characteristics of NSCOT ICU survivors

	N (WN)	N%
Gender		
Male	1012(3457)	70.7
Female	469(1432)	29.3
Age; Mean(SD)	-	40.8(32.0)
Race/ethnicity		
Hispanic	214(776)	15.9
Non-Hispanic, white	958(3024)	61.9
African American	252(847)	17.3
Indian American	31(124)	2.5
Asian	26(118)	2.4
Education		
Less than high School	396(1303)	26.6
High school	514(1669)	34.1
College	365(1282)	26.2
Post graduate	206(636)	13.1
Household income		
<30K	526(1613)	33.0
30K-50K	335(1101)	22.5
50K-70K	243(859)	17.6
70K-100K	232(804)	16.4
100K or more	145(513)	10.5
Marital status		
Married/living with Partner	649(1948)	39.8
Not married	832(2941)	60.2
Pre-ICU Charlson Comorbidity Score		
0	1072(3677)	75.2
1	219(718)	14.7
≥ 2	191(494)	10.1
Pre-ICU Depression		
No	1243(4068)	83.2
Yes	238(822)	16.8
Pre-ICU Alcohol abuse/dependence		
No	1196(3910)	80.0
Yes	285(980)	20.0
Pre-ICU health status		
Excellent	529(1911)	39.1
Very good	461(1506)	30.8
Good	310(933)	19.1
Fair	150(457)	9.3
Poor	31(84)	1.7
Pre-ICU usual major activity		

	N (WN)	N%
Yes	1074(3763)	77.0
No	407(1126)	23.0
Injury mechanism		
Penetrating	155(616)	12.6
Blunt	1326(4273)	87.4
ICISS; Mean(SD)	1481(4890)	22.4(19.3)
ISS; Mean(SD)	1481(4890)	29.1(24.1)
Max AIS; Mean(SD)	1481(4890)	3.7(1.5)
Intubation^a		
No	965(3028)	61.9
Yes	516(1862)	38.1
Mechanical Ventilation in ICU		
No	728(2007)	41.0
Yes	753(2883)	59.0
Length of ICU (d); Mean(SD)	-	8.0(18.4)
Duration of mechanical ventilation (d); Mean(SD)	-	5.0(15.9)
ICU LOS (d)		
<5	822(2564)	52.4
≥ 5	659(2326)	47.6
Duration of mechanical ventilation (d)		
<5	1084(3375)	69.0
≥ 5	397(1515)	31.0
Reintubation	104 (393)	8.0
Blood product transfusion in the first 24 hours of admission	530 (1840)	35.8
Tracheostomy	172(669)	13.7
Surgical airway	119 (457)	9.3
Received paralytic agents at any point during hospitalization	415 (1715)	28.0
Pulmonary artery catheter insertion	220 (857)	17.5
Sepsis	115 (420)	8.6
Other^b	262 (928)	19.0

Abbreviations (in alphabetic order): AIS = Abbreviated Injury Score; d = days; ICISS = ICD-derived Injury Severity Score; ICU = intensive care unit; LOS = length of stay; ISS = Injury Severity Score; SD = standard deviation; WN = weighted N; “-”= not-applicable.

^aIntubation refers only to intubations performed at the hospital (i.e., ICU, emergency department) and does not include intubations performed in the field prior to arrival to the hospital.

^bOther refers to ICU illness and/or service-delivery characteristics that applied to < 5% of the cohort (i.e., multiple organ failure, ARDS, thoracotomy, cardiac arrest, epidural analgesia).

Table 2
Factors Associated with PTSD at 12 months in NSCOT ICU Survivors

	RR (95% CI)	SE	Z	P
Gender (female)	1.08 (0.77-1.51)	0.18	0.45	0.65
Age	1.00 (0.99-1.01)	0.004	0.10	0.92
ISS				
9-15	0.70 (0.40-1.22)	0.20	-1.25	0.21
≥ 16	0.68 (0.39-1.19)	0.19	-1.34	0.18
Pre-ICU Charlson Comorbidity Score				
1	1.00 (0.81-1.24)	0.11	0.03	0.98
≥ 2	1.38 (1.02-1.87)	0.21	2.08	0.04
Pre-ICU Depression	1.23 (1.02-1.49)	0.12	2.09	0.03
Pre-ICU Binge-Drinking	1.00 (0.95-1.06)	0.03	0.20	0.84
Intubation	1.19 (0.86-1.65)	0.20	1.04	0.30
Mechanical ventilation	0.74 (0.55-1.01)	0.11	-1.99	0.06
ICU LOS ≥ 5d	0.83 (0.67-1.03)	0.09	-1.71	0.09
Mechanical ventilation ≥ 5d	1.29 (0.92-1.82)	0.22	1.49	0.14
Reintubation	0.66 (0.40-1.06)	0.16	-1.72	0.09
Blood product transfusion	1.27 (0.98-1.65)	0.17	1.81	0.07
Tracheostomy	0.86 (0.61-1.21)	0.15	-0.86	0.39
Surgical airway	1.07 (0.71-1.62)	0.22	0.34	0.73
Received paralytic agents	1.23 (0.97-1.56)	0.15	1.73	0.08
Pulmonary artery catheter insertion	1.28 (1.05-1.57)	0.13	2.46	0.01
3-month SF-36 MH	0.96 (0.96-0.97)	0.005	-7.13	< 0.001
3-Month SF-36 BP	0.96 (0.95-0.97)	0.005	-6.96	< 0.001

Abbreviations (in alphabetical order): BP = SF-36 Bodily Pain subscale; d = days; ICU = intensive care unit; LOS = length of stay; MH = SF-36 Mental Health subscale; ISS = Injury Severity Score; PTSD = posttraumatic stress disorder; SF-36 = Medical Outcomes Study Short Form 36.

Table 3
Factors Associated with Limitations in Return to Usual Major Activity at 12 months in NSCOT ICU Survivors

	RR (95% CI)	SE	Z	p
Gender (female)	0.79 (0.71-0.87)	0.04	-4.48	< 0.001
Age	1.01 (1.00-1.01)	0.002	5.18	< 0.001
ISS				
9-15	0.78 (0.55-1.11)	0.14	-1.38	0.17
≥ 16	0.85 (0.64-1.12)	0.12	-1.15	0.25
Pre-ICU Charlson Comorbidity Score				
1	1.14 (1.01-1.30)	0.07	2.10	0.04
≥ 2	1.17 (1.01-1.36)	0.09	2.06	0.04
Pre-ICU Depression	1.03 (0.91-1.16)	0.06	0.50	0.61
Pre-ICU Binge- Drinking	1.00 (0.97-1.03)	0.01	-0.05	0.96
No pre-ICU usual major activity	1.49 (1.34-1.65)	0.08	7.46	< 0.001
Intubation	1.05 (0.89-1.23)	0.09	0.57	0.57
Mechanical ventilation	1.01 (0.84-1.22)	0.10	0.12	0.91
ICU LOS ≥ 5d	1.21 (1.03-1.44)	0.10	2.26	0.02
Mechanical ventilation ≥ 5d	0.94 (0.73-1.21)	0.12	-0.47	0.64
Reintubation	0.82 (0.64-1.05)	0.10	-1.53	0.13
Blood product transfusion	1.08 (0.99-1.17)	0.05	1.71	0.09
Tracheostomy	1.29 (1.05-1.59)	0.14	2.44	0.01
Surgical airway	1.03 (0.82-1.29)	0.12	0.25	0.80
Received paralytic agents	0.96 (0.84-1.09)	0.06	-0.62	0.54
Pulmonary artery catheter insertion	1.04 (0.90-1.20)	0.07	0.56	0.58
3-month SF-36 MH	1.00 (0.99-1.00)	0.002	-0.11	0.91
3-Month SF-36 BP	0.99 (0.98-0.99)	0.002	-7.23	< 0.001

Abbreviations (in alphabetical order): BP = SF-36 Bodily Pain subscale; d = days; ICU = intensive care unit; LOS = length of stay; MH = SF-36 Mental Health subscale; ISS = Injury Severity Score; SF-36 = Medical Outcomes Study Short Form 36.