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Su, Han
Thompson, Hilaire
Pike, Kenneth
et al.

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Research paper

Interrelationships among workload, illness severity, and function on return to work following acute respiratory distress syndrome

Han Su, PhD, RN [a, *], Hilaire J. Thompson, PhD, RN [a, b], Kenneth Pike, PhD [a], Biren B. Kamdar, MD [c], Elizabeth Bridges, PhD, RN [a], Megan M. Hosey, PhD [d, e, f], Catherine L. Hough, MD [g], Dale M. Needham, MD, PhD [d, e, f], Ramona O. Hopkins, PhD [h, i, j]

[a] School of Nursing, University of Washington, Seattle, WA, USA; [b] Harborview Injury Prevention and Research Center, Seattle, WA, USA; [c] Division of Pulmonary, Critical Care, Sleep Medicine and Physiology, University of California, San Diego, La Jolla, CA, USA; [d] Division of Pulmonary and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, MD, USA; [e] Outcomes After Critical Illness and Surgery (OACIS) Group, Johns Hopkins University School of Medicine, Baltimore, MD, USA; [f] Department of Physical Medicine and Rehabilitation, Johns Hopkins University School of Medicine, Baltimore, MD, USA; [g] Division of Pulmonary and Critical Care Medicine, Oregon Health & Science University, Portland, OR, USA; [h] Neuroscience Center and Psychology Department, Brigham Young University, Provo, Utah, USA; [i] Pulmonary and Critical Care Medicine, Intermountain Health Care, Murray, Utah, USA; [j] Center for Humanizing Critical Care, Intermountain Medical Center, Murray, Utah, USA

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ABSTRACT

Background: Inability to return to work (RTW) is common after acute respiratory distress syndrome (ARDS).
Objectives: The aim of this study is to examine interrelationships among pre-ARDS workload, illness severity, and post-ARDS cognitive, psychological, interpersonal, and physical function with RTW at 6 and 12 months after ARDS.
Methods: We conducted a secondary analysis using the US multicentre ARDS Network Long-Term Outcomes Study. The US Occupational Information Network was used to determine pre-ARDS workload. The Mini-Mental State Examination and SF-36 were used to measure four domains of post-ARDS function. Analyses used structural equation modeling and mediation analyses.
Results: Among 329 previously employed ARDS survivors, 6- and 12-month RTW rates were 52% and 56%, respectively. Illness severity (standardised coefficients range: −0.51 to −0.54, $p < 0.001$) had a negative effect on RTW at 6 months, whereas function at 6 months (psychological [0.42, $p < 0.001$], interpersonal [0.40, $p < 0.001$], and physical [0.43, $p < 0.001$]) had a positive effect. Working at 6 months (0.79 to 0.72, $P < 0.001$) had a positive effect on RTW at 12 months, whereas illness severity (−0.32 to −0.33, $p = 0.001$) and post-ARDS function (psychological [6 months: 0.44, $p < 0.001$; 12 months: 0.33, $p = 0.002$], interpersonal [0.44, $p < 0.001$; 0.22, $p = 0.03$], and physical abilities [0.47, $p < 0.001$; 0.33, $p = 0.007$]) only had an indirect effect on RTW at 12 months mediated through work at 6 months.
Conclusions: RTW at 12 months was associated with patients' illness severity; post-ARDS cognitive, psychological, interpersonal, and physical function; and working at 6 months. Among these factors, working at 6 months and function may be modifiable mediators of 12-month post-ARDS RTW. Improving ARDS survivors' RTW may include optimisation of workload after RTW, along with interventions across the healthcare spectrum to improve patients' physical, psychological, and interpersonal function.

1. Introduction

Patients with acute respiratory distress syndrome (ARDS) frequently experience high severity of illness with prolonged intensive care unit (ICU) stay together with long-lasting physical, cognitive, and psychiatric impairments.[1–3] These issues may contribute to delays with return to work (RTW), experienced by almost half of previously employed ICU survivors in the year following critical illness.[2–4]

Over the past decades, several models have been proposed to understand potential factors influencing RTW and the development of work disability.[5–7] RTW can be affected directly or indirectly by various factors, including medical status, function, and workload.[5–7] Function includes multiple domains, such as cognition, psychological, interpersonal, and physical domains. Similarly,

* Corresponding author at: Box 357266 Seattle, WA 98195-7266, USA. Fax: +206 543-4771.
E-mail address: rnhansu@gmail.com (H. Su).

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different jobs have different workloads across functional domains (cognitive, psychological, interpersonal, and physical functioning). For example, a carpenter requires a high physical workload, whereas a software developer requires a high cognitive workload. Many factors have been associated with RTW after ARDS, including age, gender, race, preadmission comorbidities, critical illness–related factors, and function after ARDS.[2,8] However, there is limited information on the interrelationships among these factors and their association with RTW.

Understanding modifiable risk factors for RTW and whether the relationships among these factors are directly or indirectly associated with post-ARDS employment is important for informing future interventions. In the present study, we aim to test the interrelationships of a specific functional domain in four separate longitudinal models (one each for cognitive, psychological, interpersonal, and physical function) along with its corresponding pre-ARDS workload, illness severity, and RTW at 6 and 12 months after ARDS using cross-lagged structural equation modeling (SEM) and mediation analyses (Supplementary eFig.). These models will be useful in demonstrating how the workload of an ARDS survivor (e.g., with a physically demanding job such as construction), patient illness severity, and physical function after are associated with each other to directly and/or indirectly affect RTW at 6 and 12 months.

2. Methods

2.1. Overview and participants

Data from the National Institutes of Health–funded ARDS Network Long-Term Outcomes Study (ALTOS) were used for this analysis. The ALTOS is a nationwide multicentre prospective cohort study that enrolled patients with ARDS from 43 hospitals in the US from 2008 to 2014.[9,10] Telephone-based assessments were used to evaluate participants' 6- and 12-month outcomes after ARDS. Participants in the ALTOS parent study were eligible for this analysis if they (i) reported full- or part-time employment before ARDS hospitalisation; (ii) did not die or retire during the follow-up period; (iii) had complete employment outcome data during follow-up; and (iv) had a job title that could be matched with the Occupational Information Network (O*NET) dataset. Institutional review boards of all participating study sites approved the ALTOS study, and informed consent was obtained from all study participants.

2.2. Demographic and illness-related variables

Demographic and illness-related variables were collected via chart review in the parent study. Demographic variables included age, gender, race, and ZIP code. Median household income was approximated from the individual's 5-digit ZIP code according to the 2006–2010 United States Census Bureau report.[11] The concept of illness severity was estimated from both ICU and ward/floor LOS lengths of stay (LOS) and by the Acute Physiology and Chronic Health Evaluation III (APACHE III) severity of illness score.[12]

2.3. Pre-ARDS workload

Pre-ARDS workload refers to the cognitive, interpersonal, psychological, and physical ability that a specific job requires to perform it. We matched participants' pre-ARDS job title with the O*NET, version 24.2[13] to estimate participants' pre-ARDS workload. The O*NET dataset contains skills rating for 968 occupations. Each occupation is measured by several descriptors. The O*NET system provides 21, 6, 2, and 9 descriptors to measure cognitive, interpersonal, psychological, and physical workload in each occupation, respectively (Supplementary eTable 1). Each descriptor is associated with an ordinal scale (range: 1–5), with higher values indicating a descriptor that is more critical to the job. For this analysis, we included all descriptors provided by the O*NET system in each workload domain. We used confirmatory factor analysis to determine which descriptors were included in the final models (see analysis section).

2.4. Post-ARDS function and employment outcome

Post-ARDS functional domains including interpersonal, psychological, and physical were measured using the Short Form 36 (SF-36) instrument's social functioning (SF), mental health (MH), and physical function (PF) subscales at 6 and 12 months after ARDS. SF, MH, and PF normalised subscales range from 0 to 100 (mean = 50, standard deviation [SD] = 10), a higher score indicating better status.[14] Cognitive ability was measured at 6 and 12 months after ARDS by the Mini-Mental State Examination (MMSE), with scores ranging from 0 to 30 and higher scores indicating higher cognitive function.[15] For this study, the employment outcome was binary (yes/no) at 6 and 12 months after ARDS follow-up based on self-report or proxy report using a previously developed questionnaire.[2,16,17]

2.5. Analysis

2.5.1. Structural equation modeling

Descriptive analysis of participants' characteristics and employment outcomes at 6 and 12 months after ARDS was conducted using IBM SPSS Statistics for Windows, version 26 (Armonk, NY: IBM Corp). We proposed four separate models (one each for cognitive, psychological, interpersonal, and physical domains) to test the interrelationships of each specific function and its corresponding pre-ARDS workload with illness severity and RTW at 6 and 12 months after ARDS. We used a cross-lagged SEM approach using maximum likelihood estimation to test these models in a longitudinal manner. SEM is a multivariate statistical analysis technique that combines factor analysis and multiple regression analysis. It is used to analyse the structural relationship between measured variables and latent constructs. The cross-lagged SEM models[18–21] allow for (i) assessment of the temporal effects of illness severity, preillness workload, and functional domain (i.e., cognitive) on RTW at 6 and 12 months; (ii) latent variables with multiple indicators; (iii) handling of unbalanced samples and missing data through full information maximum likelihood estimation; and (iv) one variable treated as outcome and predictor simultaneously.

We used confirmatory factor analysis to specify and test measurement models for the latent variable, such as illness severity, with its corresponding manifest or measured variables (indicators), such as APACHE III, ICU, and ward/floor LOS. The measurement model is the part of the SEM that examines the relationship between the latent variables and their measures. For the measurement model of pre-ARDS cognitive, interpersonal, psychological, and physical workloads, descriptors from the O*NET system were tested as previously described, (Supplementary eTable 1). Each measurement model was finalised based on acceptable model fit indices.[22,23]

Following development of the measurement models, four structural models were then specified and tested individually according to the proposed model of associations among illness severity, pre-ARDS workload, post-ARDS function, and post-ARDS RTW at 6 and 12 months. The structural model in SEM measures the relationship between latent variables. We adjusted for age, gender, race, and median household income in all models.[2] The goodness of fit of each measurement and structural models was

examined by the following indices: comparative fit index, the Tucker–Lewis index, root mean square error of approximation, and standardised root means square residual. The acceptable standards for these indices are comparative fit index>0.9, Tucker–Lewis index >0.9, root mean square error of approximation<0.08, and standardised root means square residual <0.08.[24,25]

2.5.2. Mediation analysis

To further examine the interrelationship among each variable, we conducted several mediation analyses. For 6-month RTW, we used post-ARDS function at 6 months as a mediator between pre-ARDS workload/illness severity and work at 6 months. For 12-month RTW, we used post-ARDS function at 6 and 12 months and work at 6 months as mediators between pre-ARDS workload/illness severity and work at 12 months. For each of the four models (i.e., cognitive, psychological, interpersonal, and physical function), we tested (i) the direct effect, (ii) the indirect effect (measured by the pathway that goes through the intermediary variables/mediators), and (iii) the total effect (the sum of direct and indirect effects) on each predictor and work at 6 and 12 months. Longitudinal SEM and mediation analyses were performed using Mplus, version 8 (Los Angeles, CA: Muthén & Muthén)[26] with the weighted least squares estimator using a probit link when the outcome was binary. Confidence intervals and p-values were estimated using bootstrap resampling with 10000 resamples.

2.6. Ethics approval

The university's institutional review boards of all participating sites approved this study.

3. Results

3.1. Participant characteristics

A total of 329 ARDS survivors were included in this study. Demographic characteristics, pre-ARDS workload, illness severity, and post-ARDS function and the employment status outcome for participants are presented in Table 1. RTW at 6 and 12 months after ARDS occurred in 52% (n = 171) and 55% (n = 182) of participants, respectively (Fig. 1).

Table 1
Baseline, illness-related factors, and post-ARDS function, and employment outcome data (N = 329)[a].

Demographics	
Female, N (%)	182 (55)
Age, mean (SD)	45 (13)
White race, N (%)	263 (80)
Illness-related variables, mean (SD)	
APACHE III	83 (26)
ICU LOS (days)	14 (10)
Ward/floor LOS (days)	8 (9)
Employment outcome, N (%)	
Working at 6 months	172 (52)
Working at 12 months	164 (56)
Post-ARDS function at 6 months,[b] mean (SD)	
Cognitive domain	26 (2)
Psychological domain	47 (13)
Interpersonal domain	43 (14)
Physical domain	41 (13)
Post-ARDS function at 12 months,[b] mean (SD)	
Cognitive domain	26 (2)
Psychological domain	47 (14)
Interpersonal domain	45 (13)
Physical domain	43 (13)

Abbreviations: APACHE III = Acute Physiology and Chronic Health Evaluation III; ARDS = acute respiratory distress syndrome; ICU = intensive care unit; LOS = length of stay; SD = standard deviation.
[a] % may not total 100% due to rounding.
[b] Post-ARDS function included cognitive, interpersonal, psychological, and physical domains measured by Mini-Mental State Examination, Short Form-36 (SF-36) survey social functioning, SF-36 mental health, and SF-36 physical function subscales, respectively. SF-36 is normalised with a mean = 50 and 1 SD = 10 points, with a higher score indicating better function. The MMSE score ranges from 0 to 30, with higher scores indicating better cognitive function.

3.2. Longitudinal SEM and mediation analysis

The standardised coefficients between each latent variable and its observed predictor variables are shown in eFig. 2, along with model fit indices for each measurement model. The standardised path results and model fit indices of structural models are summarised in Supplementary eFig. 1 and eTables 2-5. All measurement models and structural models fit the data well (Supplementary eFigs. 1 and 2). Values of standardised path coefficients (β) can generally be interpreted as follows: $\beta > 0.50$, large effect; $0.50 \geq \beta > 0.30$, medium effect; and $0.30 \geq \beta > 0.10$ small effect.[22] Positive coefficients indicate facilitators for RTW; negative coefficients denote barriers.

3.3. RTW at 6 months

Illness severity had a direct negative effect on RTW at 6 months in each of the cognitive ($\beta = -0.50$, $p < 0.001$), psychological ($\beta = -0.53$, $p < 0.001$), interpersonal ($\beta = -0.46$, $p < 0.001$), and physical ($\beta = -0.40$, $p < 0.001$) models (Fig. 2, Supplementary eFig. 1 and eTables 2-5). Function had a direct positive effect on work at 6 months in each of the psychological ($\beta = 0.42$, $p < 0.001$), interpersonal ($\beta = 0.40$, $p < 0.001$), and physical models ($\beta = 0.43$, $p < 0.001$), but not in the cognitive model ($\beta = 0.13$, $p = 0.17$) (Fig. 2, Supplementary eFig. 1 and eTable 2-5). In general, illness severity is the most critical factor affecting work at 6 months in all models, followed by psychological, interpersonal, and physical function at 6 months. Workload had a direct positive effect on work at 6 months only in the interpersonal model ($\beta = 0.22$, $p = 0.001$) (Fig. 2, Supplementary eFig. 1 and eTable 2-5).

3.4. RTW at 12 months

Work at 6 months had a direct positive effect on work at 12 months in the cognitive ($\beta = 0.79$, $p < 0.001$), psychological (0.76, $p < 0.001$), interpersonal ($\beta = 0.72$, $p < 0.001$), and physical models ($\beta = 0.75$, $p < 0.001$). Function at 12 months had a direct positive effect on work at 12 months in the psychological ($\beta = 0.33$, $p = 0.002$), interpersonal ($\beta = 0.22$, $p = 0.03$), and physical models ($\beta = 0.33$, $p = 0.007$; Fig. 3; eFig. 1 and eTables 3-5).

Illness severity had an negative effect on work at 12 months indirectly through work at 6 months in each of the cognitive ($\beta = -0.39$, $p = 0.008$), psychological ($\beta = -0.40$, $p = 0.03$), interpersonal ($\beta = -0.33$, $p = 0.05$), and physical ($\beta = -0.30$, $p = 0.05$) models (Fig. 4 pathway a; eFig. 1; eTables 2-5). Hence, the influence of illness severity on work at 12 months occurred via work at 6 months. Workload had a positive effect on RTW at 12 months indirectly through RTW at 6 months in the interpersonal model ($\beta = 0.16$, $p = 0.03$; Fig. 4 pathway b; eFig. 1; eTable 4). Function at 6 months had a positive effect on RTW at 12 months indirectly through RTW at 6 months in each of the psychological ($\beta = 0.32$, $p = 0.003$), interpersonal ($\beta = 0.29$, $p = 0.002$), and physical models ($\beta = 0.32$, $p < 0.001$; Fig. 4 pathway c; eFig. 1 and eTables 3-5). Furthermore, function at 6 months also had a positive effect on RTW at 12 months indirectly through function at 12 months in the psychological ($\beta = 0.23$, $p = 0.006$), interpersonal ($\beta = 0.12$,

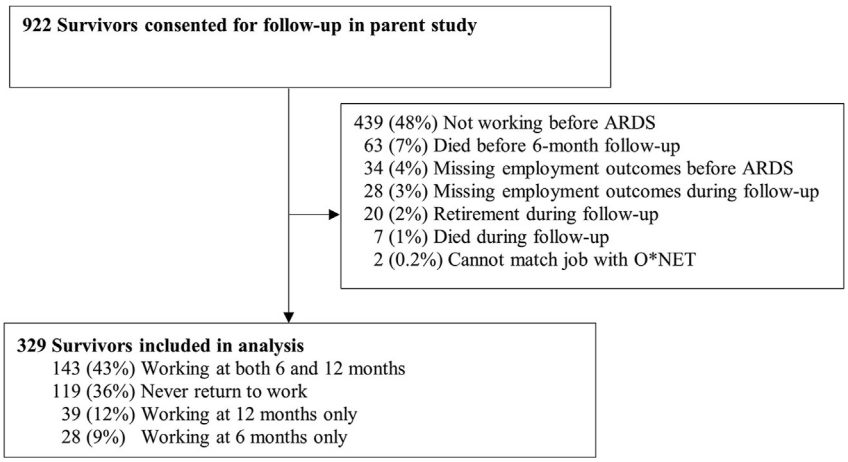

Fig. 1. Study participant flow chart. Abbreviations: ARDS = acute respiratory distress syndrome; O*NET= The US Occupational Information Network.

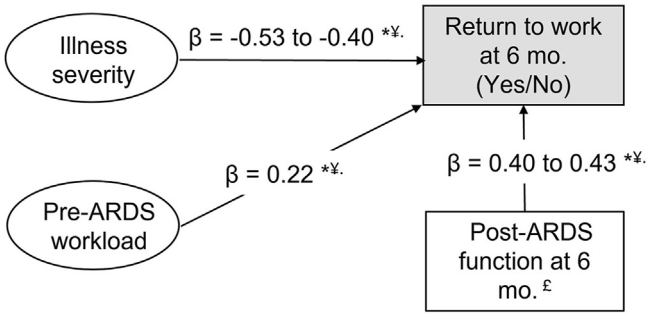

Fig. 2. Factors directly affecting return to work at 6 months. ¥. Illness severity had a direct negative effect (β = −0.53 to −0.40) on RTW at 6 months in all four models. Psychological, interpersonal, and physical function at 6 months had a direct positive effect (β = 0.40 to 0.43) on RTW at 6 months. Pre-ARDS workload (β = 0.22) had a direct positive effect on RTW at 6 months. £. Cognitive, interpersonal, psychological, and physical function was measured by Mini-Mental State Examination and Short Form-36 survey social functioning, mental health, and physical function domains, respectively. Cognitive, interpersonal, psychological, and physical workload was measured by the O*Net system. *p < 0.05. Structural equation models were used to evaluate the association among workload, illness severity, functional impairment, and RTW. All confidence intervals and p-value were estimated using bootstrap resampling with 10,000 resamples. All path coefficients were standardised. Oval shape in the figure represents latent variables, whereas rectangle shape represents manifest or measured variables. Abbreviations: ARDS = acute respiratory distress syndrome, mo. = months; RTW = return to work.

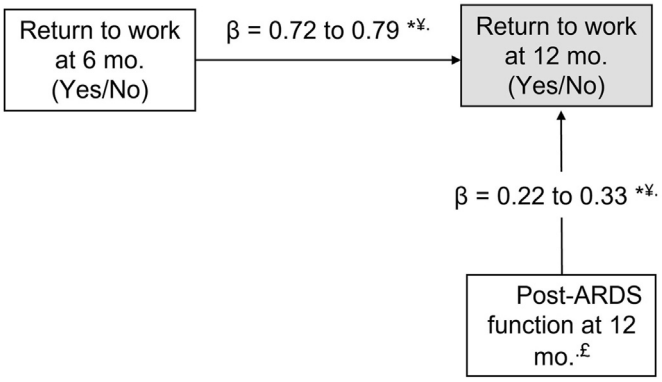

Fig. 3. Factors directly affecting return to work at 12 months. ¥. Return to work at 6 months had a direct positive effect (β = 0.72–0.79) on RTW at 12 months in each of the 4 separate models (i.e., separate cognitive, psychological, interpersonal, and physical models). Psychological, interpersonal, and physical function at 12 months had a direct effect (β = 0.22–0.33) on RTW at 6 months. £. Cognitive, interpersonal, psychological, and physical function was measured by Mini-Mental State Examination and Short Form-36 survey social functioning, mental health, and physical function domains, respectively. Cognitive, interpersonal, psychological, and physical workload was measured by the O*Net system. *p < 0.05. Structural equation models were used to evaluate the association among workload, illness severity, functional impairment, and RTW. All confidence intervals and p-value were estimated using bootstrap resampling with 10,000 resamples. All path coefficients were standardised. Oval shape in the figure represents latent variables, whereas rectangle shape represents manifest or measured variables. Abbreviations: ARDS = acute respiratory distress syndrome, mo. = months; RTW = return to work.

p = 0.04), and physical (β = 0.25, p = 0.01) models (Fig. 4 pathway d; eFig. 1; eTables 3-5).

The most critical factor that affects work at 12 months was work at 6 months, followed by psychological, interpersonal, and physical function at 6 and 12 months and illness severity. Furthermore, work at 6 months primarily mediated the effect between both illness severity and function at 6 months with work at 12 months.

4. Discussion

In this multicentre, longitudinal prospective study of 329 previously employed ARDS survivors, 48% and 44% did not RTW at 6- and 12-month follow-up, respectively. Working at 6 months was directly affected by illness severity and function at 6 months in each of the RTW models, with the exception of the cognitive model. In the three models (physical, psychological, interpersonal), working at 12 months was *indirectly* affected by illness severity and function at 6 months (mediated through work at 6 months) and *directly* affected by working at 6 months and function at 12 months. In the cognitive model, illness severity affected work *directly* at 6 months and *indirectly* at 12 months, whereas ability at 6 months only affected cognitive function at 12 months.

Consistent with previous studies in critical illness, injury, and illness populations, the present study revealed that higher illness severity, lower function, and not working during a prior follow-up period adversely affect subsequent employment.[3,8,19,27] Furthermore, the present study disentangled relationships between workload, illness severity, and function on RTW across 6- and 12-month follow-up. Our findings suggest that work status at 6 months and function at 6 and 12 months are potential targets for improving ARDS survivors' RTW at 12 months, given that those factors mediated many pathways. Thus, interventions targeting improving psychological, interpersonal, and/or physical ability at 6 and 12 months might facilitate ARDS survivors with a high job

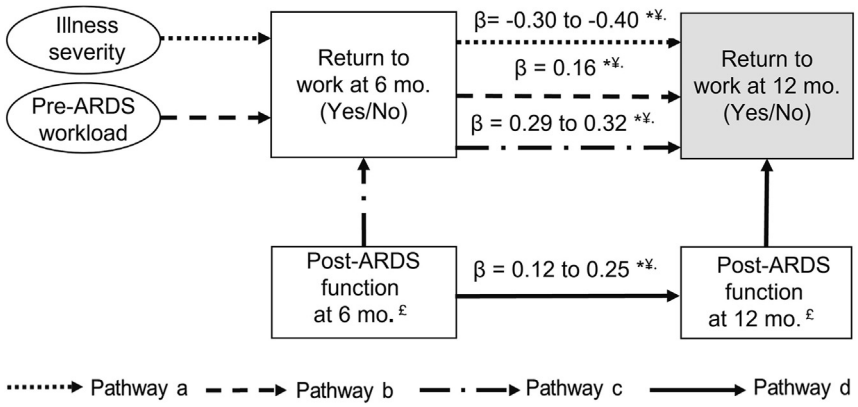

Fig. 4. Factors indirectly affecting return to work at 12 months. ¥. Pathway a: Illness severity had a negative effect (β = −0.30 to −0.40) on work at 12 months indirectly through work at 6 months in each of the 4 separate models (i.e., separate cognitive, psychological, interpersonal, and physical models). Pathway b: Pre-ARDS workload had a positive effect (β = 0.16) on RTW at 12 months indirectly through RTW at 6 months in the interpersonal model. Pathway c: Function at 6 months had a positive effect (β = 0.29 to 0.32) on RTW at 12 months indirectly through RTW at 6 months in each of the psychological, interpersonal, and physical models. Pathway d: Function at 6 months also had a positive effect (β = 0.12 to 0.25) on RTW at 12 months indirectly through function at 12 months in the psychological, interpersonal, and physical models. £. Cognitive, interpersonal, psychological, and physical function was measured by Mini-Mental State Examination and Short Form-36 survey social functioning, mental health, and physical function domains, respectively. Cognitive, interpersonal, psychological, and physical workload was measured by the O*Net system. *p < 0.05. Structural equation models were used to evaluate the association among workload, illness severity, functional impairment, and RTW. All confidence intervals and p-value were estimated using bootstrap resampling with 10,000 resamples. All path coefficients were standardised. Oval shape in the figure represents latent variables, whereas rectangle shape represents manifest or measured variables. Abbreviations: ARDS = acute respiratory distress syndrome, mo. = months; RTW = return to work.

workload in the corresponding domain RTW. Potential existing interventions for evaluation include cognitive-behavioural and other psychological interventions, as well as exercise and physical rehabilitation.[28,29] Importantly, collaborating with rehabilitation and occupational specialists, including occupational therapists, vocational rehabilitation specialists, job coaches, return-to-work coordinators, along with patients' workplaces (to help patients obtain meaningful accommodations for new impairments after illness), can assist with workforce participation.[30–32] Future studies should also focus on how to initiate RTW after critical illness, as well as what members of the healthcare team should be engaged in and lead these efforts.

In the ARDS population, illness severity affects RTW at both 6 and 12 months in all models. However, illness severity had a stronger negative effect on RTW at 6 months (β around −0.5) than at 12 months (β around −0.3). Additionally, illness severity is the most critical factor affecting work at 6 months, followed by function. Importantly, working at 6 months was the most crucial factor affecting work status at 12 months, followed by function at 6 and then at 12 months; however, there was only a 3% increase in percent working at 12 months from 6 months. These findings have implications for patient management. For example, the primary focus during the first 6 months after ARDS might involve detecting the presence of functional decline especially for survivors who have higher illness severity, followed by improving function. Early RTW interventions might be considered in this stage when feasible and appropriate. The 6- to 12-month post-ARDS period could maintain focus on recovery of function in each domain while also introducing multidisciplinary interventions to facilitate early RTW and partnering with employers to explore available accommodations.

As noted previously, being employed at the 6-month follow-up is the strongest predictor for RTW in ARDS survivors at 12 months in all models. Similar associations have been observed following traumatic brain injury; however, the association did not exist by 2 years after traumatic brain injury.[23] Instead, the odds of RTW decreased rapidly with an increasing duration of sickness-related absence from work.[33] In this regard, RTW can be perceived as proactive treatment.[34] Early RTW (<6 weeks), with work modification, has shown promising results (i.e., reducing sickness absence) in other patient cohorts (musculoskeletal conditions).[33,35–37] Thus, early RTW might be another intervention to improve longer-term employment outcomes in ARDS survivors. However, the optimal components, timing, and implementation of ARDS survivors' early RTW interventions still need further evaluation.

Compared to ARDS survivors with lower interpersonal workloads, individuals with jobs involving higher interpersonal workloads (i.e., professor, chief executive officer) had higher odds of working at 6 and 12 months after ARDS. A potential explanation for this finding is that jobs with high interpersonal workload are able to provide employees with more accommodations supporting RTW, such as flexible schedules, assistance from support staff, or flexibility in work assignments.[38] Additionally, preillness workload may be a marker for premorbid interpersonal, communication, or personality traits more conducive to successful RTW after illness, such as strong communication and interpersonal function ability skills, cognitive reserve, and mental flexibility.[38–40]

The present study has numerous strengths, including a multicentre sample of 329 previously employed ARDS survivors recruited from 43 hospitals across the US and a detailed evaluation of pre-ARDS workload and post-ARDS function in multiple domains. Moreover, we included all the variables measured at the different time points in a longitudinal model. However, our study also has potential limitations. First, in the cognitive model, we found no direct effect between cognitive ability and work at either 6 or 12 months. A potential explanation for this finding is that post-ARDS cognitive status has a very different recovery pattern compared to physical and psychological status.[41] A further explanation is that the agreement between MMSE and comprehensive neuropsychological test batteries for detecting cognitive impairment is only fair to moderate in ARDS survivors.[42] Furthermore, the variability in the MMSE score in the ALTOS study was relatively small (SD = 2, but range = 0–30) and, as such, may lack sensitivity as a single measure. Previous studies have recommended combining an additional measure of executive function to the MMSE to improve the detection of cognitive impairment.[43] Second, we used the SF-36 to measure physical and psychological function rather than performance-based outcome measurements. However,

the SF-36 PF[44] and MH subscales[45] have a high correlation with the 6-min walk and mental health symptoms measured by more specific instruments (i.e., Hospital Anxiety and Depression Scale and Impact of Events Scale). Third, we only studied ARDS survivors to 12 months; thus, we do not know whether the relationships identified hold after the first year of follow-up. Fourth, we analysed cognitive, psychological, interpersonal, and physical models independently. Thus, we may have underestimated the effect of function on RTW because we did not consider interaction effects and the resulting multidimensional disability in ARDS survivors. As such, we cannot determine the relative importance of each function related to RTW. These issues should be explored in future studies with even larger sample sizes to ensure adequate statistical power for such analyses. Fifth, as an observational study, we cannot make causal inferences between function and RTW measured, particularly in cross-sectional analyses in which they are measured at the same time. Thus, some of the psychosocial function may be related to the inability to work. However, no causality (i.e., an effect between function at 6 months and RTW at 12 months) was observed through our SEM models (eFig. 2). Thus, the inability to RTW might affect psychological function, but we could not detect a statistically significant association. Sixth, adjustments were made for age, gender, race, and median household income. Future studies could focus on these factors and identify specific subgroups or phenotypes with greatest benefit from interventions. Seven, we excluded patients who retired at 12 months of follow-up from this analysis. Some of them may have retired owing to health limitations, but we do not have information about why they retired. Finally, the O*NET system is developed for the US economy, which might not apply to other countries. The International Standard Classification of Occupations is an option to measure workload outside of the US.[32]

5. Conclusion

Work disability in the first year after ARDS impacts almost half of previously employed survivors. Illness severity and psychological, interpersonal, and physical function at 6 months had a large and medium effect, respectively, on work at 6 months, whereas work at 6 months and illness severity and cognitive, psychological, interpersonal, and physical function at both 6- and 12-month follow-up had a large and medium effect, respectively, on work at 12 months. Within those factors, work at 6 months, function at 6 and 12 months, and preillness workload may be modifiable mediators of post-ARDS employment outcomes at 12 months. Thus, designing and evaluating interventions focused on early RTW, enhancing function, and providing individually tailored work accommodations are important considerations for improving employment outcomes after ARDS.

Consent for publication

Not required.

Availability of data and material

The data that support the findings of this study are available from Dr. Dale M Needham, upon reasonable request.

Conflict of interest

None declared.

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CRediT authorship contribution statement

Han Su: Conceptualisation, Methodology, Writing – original draft, Formal analysis, Visualisation. **Hilaire J. Thompson:** Conceptualisation, Methodology, Writing – review & editing, Supervision. **Kenneth Pike:** Writing – review & editing, Formal analysis, Validation. **Biren B. Kamdar:** Writing – review & editing. **Elizabeth Bridges:** Writing – review & editing. **Megan M. Hosey:** Writing – review & editing. **Catherine L. Hough:** Writing – review & editing. **Dale M. Needham:** Writing – review & editing, Investigation, Conceptualisation, Resources, Supervision, Funding acquisition. **Ramona O. Hopkins:** Writing – review & editing, Investigation, Conceptualisation, Resources, Supervision, Funding acquisition.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.aucc.2022.01.002.

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