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Review paper

The effects of intensive care unit-initiated transitional care interventions on elements of post-intensive care syndrome: A systematic review and meta-analysis

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ABSTRACT

Objective: The aim of the study was to assess the effectiveness of intensive care unit (ICU)—initiated transitional care interventions for patients and families on elements of post-intensive care syndrome (PICS) and/or PICS-family (PICS—-F).
Review method used: This is a systematic review and meta-analysis
Sources: The authors searched in biomedical bibliographic databases including PubMed, Embase (OVID), CINAHL Plus (EBSCO), Web of Science, and the Cochrane Library and included studies written in English conducted up to October 8, 2020.
Review methods: We included (non)randomised controlled trials focussing on ICU-initiated transitional care interventions for patients and families. Two authors conducted selection, quality assessment, and data extraction and synthesis independently. Outcomes were described using the three elements of PICS, which were categorised into (i) physical impairments (pulmonary, neuromuscular, and physical function), (ii) cognitive impairments (executive function, memory, attention, visuo-spatial and mental processing speed), and (iii) psychological health (anxiety, depression, acute stress disorder, post-traumatic stress disorder, and depression).
Results: From the initially identified 5052 articles, five studies were included (i.e., two randomised controlled trials and three nonrandomised controlled trials) with varied transitional care interventions. Quality among the studies differs from moderate to high risk of bias. Evidence from the studies shows no significant differences in favour of transitional care interventions on physical or psychological aspects of PICS-(F). One study with a nurse-led structured follow-up program showed a significant difference in physical function at 3 months.
Conclusions: Our review revealed that there is a paucity of research about the effectiveness of transitional care interventions for ICU patients with PICS. All, except one of the identified studies, failed to

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show a significant effect on the elements of PICS. However, these results should be interpreted with caution owing to variety and scarcity of data.

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1. Background

There is growth in the number of patients surviving intensive care unit (ICU) admission, but they frequently face prolonged physical, cognitive, and psychosocial impairments, summarised as post-intensive care syndrome (PICS).[1] Notably, data before the coronavirus disease 2019 (COVID-19) pandemic already showed that 50% of ICU survivors experience new physical, mental, and/or cognitive problems. New research during the COVID-19 pandemic shows even more severe outcomes after ICU admission and endorses the need for patient- and family-centred strategies to help ICU survivors recover.[2] Not only ICU survivors suffer from PICS, but also up to 75% of the family members report psychological burden (so-called PICS-family [PICS-F]), such as anxiety, depression, or post-traumatic stress disorder (PTSD). PICS and PICS-F are a public health burden with socio-economic consequences.[3–5] PICS-(F) can manifest even years after an ICU event.

Delirium, duration of ventilation, gender, previous physical and mental health state, and negative ICU experiences are significant risk factors for PICS.[6–9] Most of these risk factors appeared also as important risk factors in a recently published large cohort study with 4700 patients. This study showed that pre-ICU physical, psychological, and/or cognitive health status are strongly associated with long-term problems of PICS. In more detail, male patients reported less frailty and fatigue than female patients, and patients with pre-existent anxiety had a higher chance of suffering from symptoms of depression and PTSD after ICU admission after 1 year.[9] Because of the wide range of variety in PICS problems, a strategy with an individually approach is preferred. To ensure continuity of care, guidelines advice coordination of patients' recovery pathway by healthcare professionals with appropriate competencies and frequently screening on elements of PICS during transitions of care settings across the continuum of critical illness and recovery.[8,10–12]

Transitions of care can be defined as 'a set of actions designed to ensure the coordination and continuity of health care as patients transfer between different locations or different levels of care within the same location".[13–15] Patients and their families experience complex transitions as complex, and need proper information and continuity of care during transitions in their recovery journey.[16–18] The first major transition during their journey is transfer from the ICU to the general ward and is accompanied by risks of physical deterioration and psychological complaints such as transfer anxiety.[14]

There is some knowledge about how to smoothen the journey to recovery. For example, preparation by informing patients and families, improving handovers, and investing in personalised care contributes to a safer and effective transfer.[19] Improving structured handovers and implementing ICU liaison nurses or transition programs seem promising interventions to improve continuity of care, reduce ICU readmission, and reduce the risks on the development of PICS and PICS-F.[20,21] A systematic review is not available for ICU-initiated interventions started within 1 month after ICU discharge and that liaise the transition between intramural and extramural healthcare organisations, defined as transmural care. Both ICU aftercare and follow-up services are varied worldwide and developed in order to help patients come to terms and understanding with their illness and if needed address goals.[22–24] Although these interventions can be beneficial to recovery, transition care interventions emphasise identification of patients' health goals and design and implementation of a streamlined individualised plan of care to strike for continuity of care across settings and between providers throughout episodes of acute illness.[25,26] Thus, to further build this knowledge on transitional care interventions for ICU patients and their families, systematically gained overall insight is needed into which ICU-initiated interventions are effective. Therefore, we performed a systematic review to answer the following research question: *"Which ICU-initiated interventions designed to improve the transition of care from to wards and home are effective to prevent elements of PICS and/or PICS-Ffor ICU survivors and their families?*

2. Method

We conducted a systematic review based on the Cochrane Handbook for Systematic Reviews of Interventions.[27] This systematic review is reported according to the Preferred Reporting Items for Systematic Review and Meta-Analyses statement and registered with PROSPERO (CRD42020136589; available via https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020136589).[28]

2.1. Database and literature search strategy

We searched for studies in biomedical bibliographic databases including PubMed, Embase (OVID), CINAHL Plus (EBSCO), Web of Science, and the Cochrane Library with the help of a clinical librarian. We used the following search terms: *Critical illness, Intensive Care Units, Critical Care Nursing, Trauma Care, Hospital Emergency Service, transitional care, transition care, continuity of patient care, rehabilitation, continuum of care, patient discharge, discharge planning, patient handoff, health care transition, patient dumping, patient-centered care, patient focus, person centered, family leave, family nursing, caregivers, adult.*

We included studies written in English conducted up to October 8, 2020. In addition, reference lists from the included studies were screened to identify any other relevant articles. We searched the www.clinicaltrials.gov/ website for ongoing or unpublished trials (see Appendix 1 for the search strategy)

Studies were eligible if they (i) had an experimental design (i.e., [non]randomised controlled trials [RCTs], stepped-wedge studies, interrupted time series analysis, and before—after studies), (ii) were published in English, (iii) included ICU patients and/or family members, and (iv) described at least one component of the transitional care model (TCM), initiated from the ICU for patients and/or family members.[26] In addition to this, eligible studies should report on at least one of the PICS-related physical, cognitive, or psychological outcomes.

Studies that described an intervention as ICU follow-up or aftercare, or an intervention for paediatric populations or patients who received end-of-life care who were admitted at the ICU were excluded. We used the definition of the United Kingdom (UK)

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National Institute for Health and Care Excellence (NICE) to define aftercare[12], as a golden standard on ICU aftercare and ICU follow-up care is lacking.[24] Aftercare according to the UK NICE criteria is scheduled 2 to 3 months after ICU discharge, whereas transitional care interventions should be initiated within 1 month after hospital discharge,and include PICS screening as per the recommendations of the Society of Critical Care Medicine (SCCM).[11]

2.2. Screening and selection process

Two reviews authors (L.C.M.V. and S.A.J.J.H.) independently selected potentially relevant articles based on titles and abstracts of the articles identified by the search using a free web and mobile app (http://rayyan.qcri.org). Full-text versions were obtained when the eligibility criteria matched or if further scrutiny was needed with regard to eligibility. Disagreement about study eligibility was resolved through consensus discussion or resolved by an arbiter (H.V.). All potentially relevant articles were retrieved in full-text and again independently screened by two team members (M.P.J.v.M. and S.A.J.J.H.) to check if the articles fulfilled the inclusion criteria. Disagreements were resolved through consensus, with a third person from the research team acting as an arbiter when agreement could not be reached (L.C.M.V.).

2.3. Quality appraisal

Three review authors (A.M.E., M.P.J.v.M., and S.A.J.J.H.) independently assessed risk of bias for each study using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions.[28] Again, we resolved any disagreements by discussion, or by involving another author (L.C.M.V.).

The revised Cochrane risk-of-bias tool for randomised clinical trials, version 2, was used to assess the risk of bias of randomised clinical trials and included the following domains: random sequence generation, allocation concealment, baseline imbalances, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective outcome reporting, and other sources of bias.[29]

For nonrandomised trials, Risk Of Bias In Non-randomized Studies of Interventions assessment tool 1 was used to assess the risk of bias.[30] Again, we resolved any disagreements by discussion or by involving another author (L.C.M.V.). We graded each potential risk of bias as high, low, or unclear. We summarised the risk of bias judgements across different studies for each of the domains listed.

2.4. Data extraction

Three review authors (A.M.E., M.P.J.v.M., and S.A.J.J.H.) independently undertook manual data extraction of the included studies. Therefore, we used a structured Microsoft Excel spreadsheet data extraction form to collect the following characteristics of the included studies: design; research methodology; setting; intervention type, categorised into the nine components of the TCM; and professionals who fulfilled a role in the interventions (e.g., ICU nurses or rehabilitations practitioners).[26] The nine components of the TCM are (i) screening, (ii) staffing, (iii) maintaining relationships, (iv) engaging patients and caregivers, (v) assessing/managing risks and symptoms, (vi) educating/promoting self-management, (vii) collaborating, (viii) promoting continuity, and (ix) fostering coordination.[26]

In addition to this, we collected primary outcome data of elements of PICS, measured in quantified scales: (i) physical impairments on pulmonary, neuromuscular, and physical function; (ii) cognitive impairments on executive function, memory, attention, and visuospatial and mental processing speed; and (iii) psychological outcomes on anxiety, acute stress disorder, PTSD, and depression.[4]

There are more than 250 unique instruments to evaluate ICU outcomes.[31] We defined for each outcome relevant outcome measures, with a selection of the most used validated measurement instruments as summarised by the .[11] We considered the following secondary outcomes as relevant: ICU or hospital readmission rates (in days), number of readmissions (within 30 days), length of stay (LOS; in days), healthcare consumption such as direct and indirect costs, and patient and family satisfaction (by self-reported numerical rating scales). Any differences were discussed and resolved by a fourth reviewer if required (H.V.).

In case of multiple time points at which the outcome was measured within a time frame (short-, middle-, long-term), the data of the last measurement were collected. Short-term follow-up was defined as 0 to 3 months, middle-term follow-up was defined as 3 to 6 months, and long-term follow-up was defined as 6 to 12 months.

2.5. Data analysis and synthesis

We used the program Review Manager (version 5.4; The Cochrane Collaboration, 2020) to analyse the data. For each primary outcome measurement, mean differences with 95% confidence intervals were estimated using random-effects models. Owing to inaccuracy, reported medians and interquartile ranges were not converted into means and standard deviations. If more than one outcome measurement was assessed for a given intervention, we conducted a meta-analysis. When there was any unacceptable clinical or statistical heterogeneity (i.e., I^2 higher than 75%), we presented the results descriptively.[27]

3. Results

3.1. Search results

The search strategy elicited 5052 articles after duplicates were removed. Thirty-nine full-text articles were reviewed by two review authors (M.P.J.v.M. and S.A.J.J.H.) to assess eligibility. For one article, no full text was available, and therefore, it was excluded. In total, five full-text articles fulfilled the inclusion criteria (see Fig. 1).

3.2. Characteristics of the included studies

The included studies had different study designs: two studies were RCTs,[32,33] one was a block intervention study,[34] one had a pretest–post-test control group design,[35] and one was a non-RCT.[36] Walsh et al.[32] and Bench et al.[33] published their study protocol separately.[37,38] The studies were conducted in Australia[34,35] and Western Europe[32,33,36] (see Table 1). All studies included adult ICU patients. The minimal LOS in the ICU ranged from 10 h up to 72 h. Only one study described duration of mechanical ventilation as an inclusion criterion.[32] Four studies investigated transitional care interventions in which families participated.[32–35] The other study was patient focused.[36]

3.3. Characteristics of the interventions under study

The transitional care interventions, ordered by the TCM, varied across the five studies.[26] An overview of the interventions can be found in Table 2. Two studies implemented an (personalised) information pack to prepare the transition from the ICU to a general ward provided by ICU nurses.[33,35] One study implemented ICU liaison nurses who communicated with ward staff, assessing ward staff skill mix and resources, preparing both the ICU and ward staff for patient transfer, and assessing bed status.[34] In one study, a

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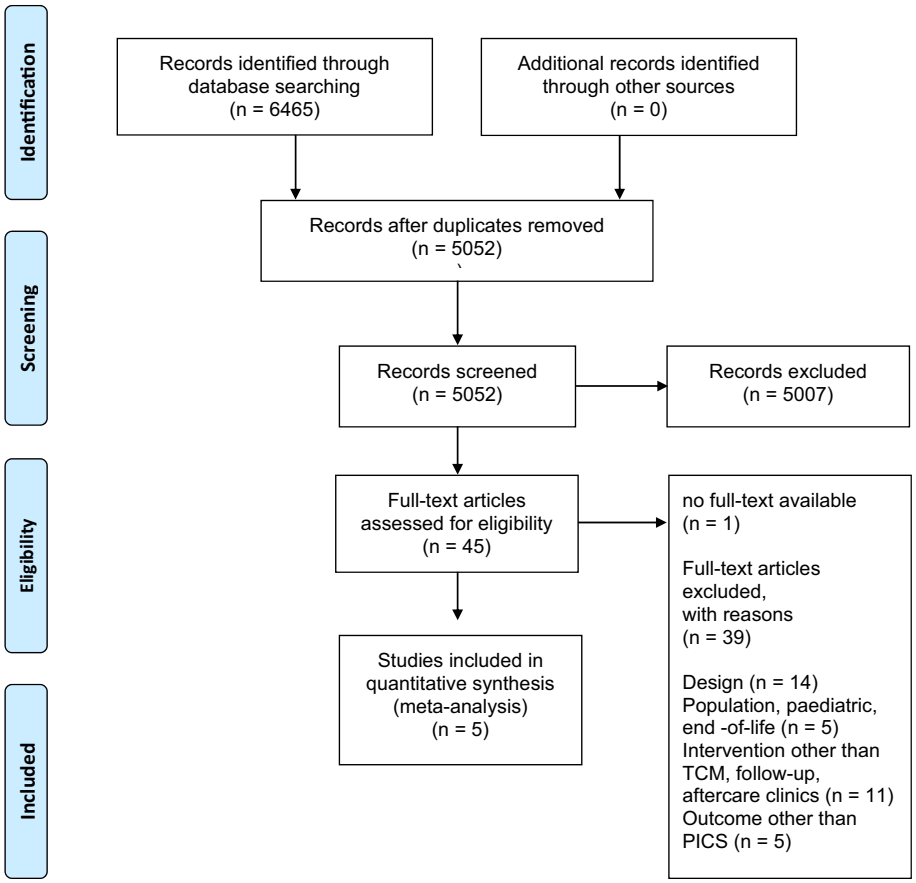

Fig. 1. Flow diagram of the search and screening and selection processes: PRISMA 2009 Flow Diagram[23]. TCM = transitional care model; PRISMA = Preferred Reporting Items for Systematic Review and Meta-Analyses.

rehabilitation assistant coordinated a highly individualised rehabilitation therapy plan in combination with a self-help ICU rehabilitation manual.[32] Another study provided a structured nurse-led follow-up until 3 months after ICU discharge, with (i) a booklet delivered at ICU discharge, (ii) ward visits from a ICU clinical nurse specialist, (iii) contact during the first week after discharge from the ward to home, and (iv) an appointment 3 months after discharge from the ICU.[36] All studies compared the interventions with care as usual.

3.4. Quality assessment

The overall risk of bias of both the RCTs was high,[32,33] and the overall risk of bias of the nonrandomised studies varied between moderate and serious (see Table 3 and more detailed judgement in Appendies 2 and 3).[34–36] In both RCTs, the randomisation process and report of the outcomes were adequate (see Appendix 2, Tables 1a–1f).[32,33] In addition to this, both RCTs did not describe possible deviations from the intended interventions explicitly. Two of three nonrandomised experimental studies scored an overall moderate risk of bias but scored a low risk of bias on most of the domains.[34,35] Only one nonrandomised study scored an overall serious risk of bias.[36] All three non-RCTs may have potential confounding of the effect of the intervention because of the nature of the interventions and the lack of baseline measurements (Appendix 3, Tables 1a–1i).[30,34–36]

3.5. Heterogeneity

Owing to heterogeneity of the studies with regard to outcome assessment, pooling was not possible on the primary outcomes (i.e., I^2 higher than 75%).[27] We were only able to pool data on readmissions, which was one of the secondary outcomes. All other results are reported from single studies.

3.6. Results of the study: primary outcomes

The primary outcome data are presented in Table 4.

3.6.1. Physical function and general health

Two studies[32,36] measured only physical function of the elements of PICS using the SF-36-V2[32] and 12-item Short-Form Health Survey (SF-12) Physical Component Summary (PCS) instruments on different time points (short-, middle-, and long-term).[39,40] Jonasdotitir et al.[36] only found a significant difference in physical function at 3 months after ICU discharge in favour of the structured nurse-led follow-up (MD = 10.00; 95% confidence interval [CI] = 0.48 to 19.52), but there were baseline imbalances between the study groups, and no differences were found at all other time points.[36] The overall SF-36 health score (General Health) did not show significant differences at 3 months (Mean Difference = −1.70; 95% CI = −8.10 to 4.70), 6 months (MD = −0.80; 95% CI = −7.85 to 6.25), and 12 months (MD = −0.50; 95% CI = −9.19 to 8.19).[36] In addition, Walsh et al.[32] reported no significant difference in the SF-12 PCS score, with an individualised rehabilitation therapy plan in combination with a self-help ICU rehabilitation manual compared with usual care at all time points.

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Table 1
Characteristics of the included studies.

First author (year)	Country	Study design	Setting	Clusters/participants	Participants at baseline (n)	Participants at follow-up, n (%)
Walsh et al.[32] (2015)	Scotland	Two-centre RCT	Acute care hospitals with a combined medical and surgical department (excluding cardiac surgery and paediatric critical)	*Clusters:* A single general critical care unit in each hospital *Patients:* Adult patients (aged >18 years) who received a least 48 h of continuous ventilation (via an endotracheal and/or tracheostomy tube) in the ICU and if they were considered to be fit for discharge.	Intervention: 120 (56%) Control: 120 (58%)	Intervention At 3 months: 118/120 (98%) At 6 months: 99/120 (83%) At 12 months: 94/120 (78%) Control At 3 months: 110/120 (92%) At 6 months: 90/120 (75%) At 12 months: 91/120 (76%)
Bench et al.[33] (2015)	England	Single-centre pilot cluster RCT	Teaching hospital with a combined medical and surgical ICU department	*Clusters*: Two ICUs within one hospital providing care for mixed medical, surgical, and trauma patients requiring level 2 (high dependency) or level 3 (intensive) care. Both units functioned as one department, staff rotated between units and patients were allocated based on the availability of a bed. *Patients:* Adult patients (aged >18 years) who spent at least 72 h in the ICU and who were declared medically fit for discharge to a general ward and a normative relative.	*Intervention UCCDIP:* 51 (in 36 clusters) (52% M) *Intervention ICUsteps:* 48 (in 31 clusters) (51% M) *Control Ad-hoc verbal info:* 59 (in 33 clusters) (53% M)	Intervention UCCDIP at hospital discharge or 28 days: 45 (88%) Intervention ICUsteps at hospital discharge or 28 days: 36 (75%) Control Ad-hoc verbal info at hospital discharge or 28 days: 48 (81%)
Chaboyer et al.[34] (2007)	Australia	Single-centre repeated before-and-after design study	Tertiary hospital with a combined medical and surgical ICU department	*Block design:* Four blocks were conducted on the one ICU, with each block lasting for 4-month duration. The first two blocks consisted of a control and intervention period, which were followed by a 1-month washout period. *Patients:* Adult patients (aged >18 years) who spent at least 72 h in the ICU and if they were able to provide consent and their family member	*Intervention* *Patients:* 53 (59% M) *Family members:* 48 *Control* *Patients:* 62 (58% M) *Family members:* 52	Intervention at the point of physical preparation for the transfer from the ICU to ward: 48 (91%) Control at the point of physical preparation for the transfer from the ICU to ward: 52 (84%)
Mitchell et al.[35] (2004)	Australia	Before-and-after design study	Tertiary referral hospital with a combined medical and surgical ICU department	*Cluster:* One ICU *Patients:* Adult patients (aged >18 years) who spent at least 10 h in the ICU and if they were able to provide consent	In total, 177 of which 162 completed the questionnaires *Intervention:* 82 (68% M) *Control:* 80 (74%)	In total: 162/177 (92%)—no details per group given.
Jónasdóttir et al.[36] (2017)	United Kingdom	Single-centre quasi-experimental Study	Tertiary hospital with a combined medical and surgical ICU department	*Clusters:* Two ICUs located in two separate buildings (buildings I and II) *Patients*: Adult patients (aged >18 years) who spent at least 72 h in the ICU and if they were able to provide consent	*Intervention* 83 (data reported at baseline: 73) (60% M) *Control:* 85 (data reported at baseline: 75) (64% M)	Intervention At discharge: 73/83 (88%) At 3 months: 68/83 (82%) At 6 months: 62/83 (75%) At 12 months: 56/83 = 67% Control At discharge: 75/85 (88%) At 3 months: 75/85 (88%) At 6 months: 69/85 (81%) At 12 months: 63/85 = 74%

ICU = intensive care unit; M = male; N = number; RCT = randomised controlled trial; UCCDIP = User-Centred Critical Care Discharge Information Pack.

Table 2
Description of interventions, comparisons, and outcomes.

First author (year)	Intervention	Components of the transitional care model	Comparison	Primary outcomes			Secondary outcomes					
				Patients' physical outcomes	*Patients' cognitive outcomes*	*Patients' psychological outcomes*	*Patients' quality of life*	*Patient satisfaction*	*Readmission*	*Length of stay*	*Healthcare consumption*	*Costs*
Walsh et al.[32] (2015)	Hospital-based physical rehabilitation and information provision delivered during the post-intensive care unit hospital stay by rehabilitation assistants plus a self-help ICU rehabilitation manual. Key differences with usual care were greater coordination, intensity, and frequency of individual rehabilitation therapies.	Staffing, maintaining relationships, engaging patients and caregivers, educating and promoting self-management	Usual care, rehabilitation by ward-based multidisciplinary teams plus a self-help ICU rehabilitation manual as recommended in UK guidelines.	√		√	√	√	√	√		√
Bench et al.[33] (2015)	(i) UCCDIP: Consisting of two booklets (one for the patient and one for the family) without opportunities to reflect/report on experiences or feelings. (ii) ICUsteps: Information booklet that covered the whole trajectory of critical illness from ICU admission to after hospital discharge, without opportunities to reflect/report on experiences or feelings	Educating, promoting self-managing	Usual care, containing of 'ad hoc' verbal ICU discharge information provided by a variety of healthcare professionals.		√	√				√		
Chaboyer et al.[34] (2007)	ICU liaison nurse intervention: Primarily focuses on the coordination of ICU patient transfer and liaison with ward staff. Tasks included communicating with ward staff, assessing ward staff skill mix and resources, preparing both the ICU and ward staff for patient transfer, and assessing bed status.	Staffing, maintaining relationships, engaging patients and caregivers, educating and promoting self-management, coordinating	Usual care			√			√	√		
Mitchell et al.[35] (2004)	Written brochure individualised by the bedside nurse to prepare families for patient transfer from the ICU	Engaging patients and caregivers; promoting continuity; educating/ promoting self-management.	Usual care			√				√		
Jónasdóttir et al.[36] (2017)	Structured nurse-led follow-up, consisting of four components for patients from ICU discharge to 3 months thereafter: (i) a booklet delivered at ICU discharge, (ii) ward visits, (iii) contact during the first week after discharge from the ward to home, and (iv) an appointment 3 months after discharge from the ICU.	Promoting continuity, educating/promoting self-management. Collaborating, assessing, and managing risks and symptoms	Usual care, patients and/or relatives received a booklet with printed, standardised information about the discharge from the ICU and the ward stay. If they needed continuing surveillance, they got ward visits from (ICU) clinical nurse specialists. After discharge from the general ward, they received no further ICU follow-up.	√					√	√		

ICU = intensive care unit; UCCDIP = User-Centred Critical Care Discharge Information Pack.

Table 3
Quality assessment per domain.

First author (year)	Quality assessment							
Quality assessment: summary of risk of bias (revised Cochrane risk-of-bias tool for randomised trials [RoB 2])[29]	Risk of bias arising from the randomisation process	Risk of bias due to deviations from the intended interventions (effect of assignment to the intervention)	Risk of bias due to deviations from the intended interventions (effect of adhering to the intervention)	Risk of bias in measurement of the outcome	Risk of bias in selection of the reported result	Overall risk of bias		
Walsh et al[32] (2015)	Low	Some concerns	Some concerns	High	Low	High		
Bench et al.[33] (2015)	Low	Some concerns	High	High	Low	High		
Quality assessment: summary of risk of bias (the Risk Of Bias In Non-randomized Studies of Interventions [ROBINS-I] assessment tool[30]	Bias due to confounding	Bias in selection of participants into the study	Bias in classification of interventions	Bias due to deviations from intended interventions	Bias due to missing data	Bias in measurement of outcomes	Bias in selection of the reported result	Overall bias
Chaboyer et al.[34] (2007)	Moderate	Low	Low	Low	Low	Moderate	Low	Moderate
Mitchell et al.[35] (2004)	Serious	Low	Low	Low	Low	Moderate	Moderate	Serious
Jónasdóttir et al.[36] (2017)	No Information	Low	Low	Low	Low	Moderate	Moderate	Moderate

3.6.2. Psychological outcomes

Psychological outcomes (i.e., anxiety and/or depression) of patients were reported in all five studies.[33–35] Only two studies reported also anxiety rates of family members.[34,35]

3.6.3. Anxiety

Four studies measured patients' anxiety; two studies[32,33] used the Hospital Anxiety and Depression Scale[41] and two studies[34,35] used the State-Trait Anxiety Inventory.[42] None of the studies reported significant differences in favour of the transitional care intervention compared with the control on short-term follow-up.[33–36] Only Walsh et al.[32] reported anxiety rates after 6 (mid-term) and 12 months (long-term) after ICU discharge, but again, no significant differences were found between the individualised rehabilitation therapy plan in combination with a self-help ICU rehabilitation manual compared with usual care. The study of Bench et al.[33] found no significant difference in anxiety scores using a User-Centred Critical Care Discharge Information Pack compared with a booklet published by ICUsteps and verbal ad hoc information. Chaboyer et al.[34] did not demonstrate a statistically significant beneficial effect from the liaison nurses in terms of anxiety scores between groups for either patients or family members. Mitchell and Courtney[35] showed no significant difference in favour of the intervention (MD = −3.70; 95% CI = −7.91 to 0.51), which consisted of an individualised brochure by the bedside nurse to prepare families for imminent patient transfer from the ICU.

3.6.4. Depression

Two studies measured depressive symptoms using the Hospital Anxiety and Depression Scale[41] and reported no significant differences on short-term outcomes (MD = 0.5; 95% CI = −0.7 to 1.6).[32,33] Walsh et al.[32] also reported no differences on mid-term (MD = −0.12; 95% CI = −0.6 to 0.4) and long-term outcomes (MD = −0.13; 95% CI = −1.6 to 1.3).

3.6.5. Symptoms of PTSD

Only Walsh et al.[32] reported symptoms of PTSD using a 17-item self-report measure, the Davidson Trauma Scale.[43]

An individualised rehabilitation process coordinated by a dedicated rehabilitation practitioner did not show a significant effect on short-term (MD = 0.5; 95% CI = −0.7 to 1.6), mid-term (MD = 5.0; 95% CI = −3 to 15.0), or long-term outcomes (MD = 0.0; 95% CI = 8.0 to 10.0).[32]

3.7. Results of the study: secondary outcomes

Data of secondary outcomes are presented in Table 5. All studies reported several secondary outcome measurements of this review, i.e., health-related quality of life (HRQOL)[32], patient satisfaction,[32] ICU readmission rates,[32,34,36] ICU LOS[32–36] hospital LOS[32–34,36] and heathcare costs.[32]

3.7.1. Health-related quality of life

Walsh et al.[32] measured HRQOL by using the Mental Component Summary scores of the .[39] HRQOL scores were unchanged in both groups over time by the intervention (PCS: MD = 0.1; 95% CI = −3.3 to 3.1; Mental Component Summary: MD = 0.2; 95% CI = −3.4 to 3.8).[32]

3.7.2. Patient satisfaction

Walsh et al.[32] used a nonvalidated satisfaction questionnaire (including nine different domains) that was developed for patients who are discharged from the ICU. Patients who received the transitional care interventions scored significantly higher on six of the nine domains of the satisfaction questionnaire.

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Table 4
Primary outcomes.

Physical function													
Follow-up	Measurement	Study	Time point	Intervention				Comparison				Results	
				Mean	SD	Median (IQR)	N	Mean	SD	Median (IQR)	N	MD	Significance
Short-term, 0–3 months	SF-36-V2 Physical function	Jónasdóttir et al.[36] (2017)	At ICU ward discharge	27.2	26.2	Not reported	71	26.2	20	Not reported	74	[−6.61 to 8.61]	Not Significance
	SF-36-V2 Physical function	Jónasdóttir et al.[36] (2017)	3 months after ICU discharge	54.4	31.5	Not reported	68	44.5	26	Not reported	75	10.00 [0.48, 19.52]	Significance
	SF-36-V2 General Health	Jónasdóttir et al.[36] (2017)	At ICU ward discharge	65.8	20.9	Not reported	70	67.5	18.1	Not reported	74	−1.70 [−8.10, 4.70]	Not Significance
	SF-36-V2 General Health	Jónasdóttir et al.[36] (2017)	3 months after ICU discharge	60.5	21.4	Not reported	68	58.9	19.8	Not reported	75	1.60 [−5.18, 8.38]	Not Significance
	SF-12 PCS	Walsh et al.[32] (2015)	3 months after ICU discharge	Not reported	Not reported	34 (26–44)	101	Not reported	Not reported	35 (26–44)	96	−0.1 [−3.3 to 3.1]	Not Significance
Middle-term, 3–6 months	SF-36-V2 Physical function	Jónasdóttir et al.[36] (2017)	6 months after ICU discharge	55.7	30.9	Not reported	62	56.3	25	Not reported	68	−0.60 [−10.32, 9.12]	Not Significance
	SF-36-V2 General Health	Jónasdóttir et al.[36] (2017)	6 months after ICU discharge	55.7	21.7	Not reported	62	56.5	19.2	Not reported	69	−0.80 [−7.85, 6.25]	Not Significance
	SF-12 PCS	Walsh et al.[32] (2015)	6 months after ICU discharge	Not reported	Not reported	38 (26–47)	84	Not reported	Not reported	33 (25–45)	80	−2.4 [−6.0 to 1.2]	Not Significance
Long-term, 6–12 months	SF-36-V2 Physical function	Jónasdóttir et al.[36] (2017)	12 months after ICU discharge	58.5	28.6	Not reported	56	56.1	27.5	Not reported	63	2.40 [−7.7]1, 12.51]	Not Significance
	SF-36-V2 General Health	Jónasdóttir et al.[36] (2017)	12 months after ICU discharge	54.8	25.5	Not reported	56	55.3	22.5	Not reported	63	−0.50 [−9.19, 8.19]	Not Significance
	SF-12 PCS	Walsh et al.[32] (2015)	12 months after ICU discharge	Not reported	Not reported	36 (28–51)	79	Not reported	Not reported	37 (27–46)	76	−2.0 [−5.9 to 1.9]	Not Significance

Psychological outcome																
Follow-up	Measurement	Study	Time point	Intervention 1[a]				Intervention 2[a]				Comparison				Results	
				Mean	SD	Median (IQR)	N	Mean	SD	Median (IQR)	N	Mean	SD	Median (IQR)	N	MD	Significance
Short-term, 0–3 months	Anxiety HADS, anxiety	Bench et al.[33] (2015)	In the ward, 5 days after ICU discharge	Not reported	Not reported	7 (17)	31	Not reported	Not reported	7.5 (19)	28	Not reported	Not reported	6 (19)	42		Not Significance
	HADS, anxiety	Bench et al.[33] (2015)	At hospital discharge or 28 days	Not reported	Not reported	7 (18)	17	Not reported	Not reported	6 (13)	8	Not reported	Not reported	5 (16)	13		Not Significance
	HADS, anxiety	Walsh et al.[32] (2015)	3 months after ICU discharge	Not reported	Not reported	7 (3–11)	98	.	.	.	.	Not reported	Not reported	6 (3–10)	87	0.2 [1.6–1.4]	Not Significance
	STAI, anxiety	Chaboyer et al.[34] (2007)	Before transfer from the ICU to ward	Not reported	Not reported	37 (18.5)	53	.	.	.	.	Not reported	Not reported	40 (21.6)	62		Not Significance
	STAI, anxiety Family	Chaboyer et al.[34] (2007)	Before transfer from the ICU to ward[b]	Not reported	Not reported	39 (16.7)	48	.	.	.	.	Not reported	Not reported	40.7 (26.8)	52		Not Significance

STAI, anxiety Family	Mitchell et al.[35] (2004)	Before transfer from the ICU to ward[b]	37.11	13.45	Not reported	82	.	.	.	.	41.24	13.21	Not reported	80	−4.13 [−8.24, −0.02]	Significance
STAI, anxiety Family	Mitchell et al.[35] (2004)	24 h after transfer from the ICU to ward[b]	37.72	13.92	Not reported	82	.	.	.	.	41.42	13.42	Not reported	80	−3.70 [−7.91, 0.51]	Significance
Depression																
HADS, depression	Bench et al.[33] (2015)	In the ward, 5 days after ICU discharge	Not reported	Not reported	6 (16)	30	Not reported	Not reported	6.5 (18)	28	Not reported	Not reported	7 (21)	40		Not Significance
HADS, depression	Bench et al.[38] (2015)	At hospital discharge or 28 days	Not reported	Not reported	6 (12)	17	Not reported	Not reported	4.5 (16)	8	Not reported	Not reported	7 (15)	13		Not Significance
HADS, depression	Walsh et al.[32] (2015)	3 months after ICU discharge	Not reported	Not reported	7 (4–9)	98	.	.	.	.	Not reported	Not reported	7 (3–10)	87	0.5 [−0.7 to 1.6]	Not Significance
HADS, total	Bench et al.[38] (2015)	In the ward, 5 days after ICU discharge	Not reported		12.5 (32)	30	Not reported	Not reported	16 (35)	28	Not reported	Not reported	14 (39)	40		Not Significance
HADS, total	Bench et al.[38] (2015)	At hospital discharge or 28 days	Not reported	Not reported	11 (27)	17	Not reported	Not reported	10 (23)	8	Not reported	Not reported	12 (23)	13		Not Significance
DTS	Walsh et al.[32] (2015)	3 months after ICU discharge	Not reported	Not reported	11 (0–31)	82	.	.	.	.	Not reported	Not reported	10 (2–22)	78	0.5 [−0.7 to 1.6]	Not Significance

Psychological outcome																
Follow-up	Measurement	Study	Time point	Intervention 1				Intervention 2				Comparison				Results	
				Mean	SD	Median (IQR)	N	Mean	SD	Median (IQR)	N	Mean	SD	Median (IQR)	N	MD	Significance
Middle-term, 3–6 months	HADS, anxiety	Walsh et al.[32] (2015)	6 months after ICU discharge	Not reported	Not reported	8 (3–11)	84	.	.	.	.	Not reported	Not reported	6 (3–11)	80	0.18 [0.7–0.4]	Not Significance
	HADS, depression	Walsh et al.[32] (2015)	6 months after ICU discharge	Not reported	Not reported	7 (3–10)	84	.	.	.	.	Not reported	Not reported	6 (2–10)	80	−0.12 [−0.6 to 0.4]	Not Significance
	DTS (PTSD)	Walsh et al.[32] (2015)	6 months after ICU discharge	Not reported	Not reported	28 (6–57)	84	.	.	.	.	Not reported	Not reported	29 (14–67)	80	5.0 [−13to 15.0]	Not Significance
Long-term, 6–12 months	HADS, anxiety	Walsh et al.[32] (2015)	12 months after ICU discharge	Not reported	Not reported	7 (3–12)	81	.	.	.	.	Not reported	Not reported	7 (4–10)	77	0.1 [−1.7 to 1.4]	Not Significance
	HADS, depression	Walsh et al.[32] (2015)	12 months after ICU discharge	Not reported	Not reported	7 (2–10)	81	.	.	.	.	Not reported	Not reported	6 (3–9)	77	−0.13 [−1.6 to 1.3]	Not Significance
	DTS (PTSD)	Walsh et al.[32] (2015)	12 months after ICU discharge	Not reported	Not reported	26 (7–59)	81					Not reported	Not reported	31 (6–58)	77	0.0 [−8.0 to 10.0]	Not Significance

ICU = intensive care unit; UCCDIP = User-Centred Critical Care Discharge Information Pack; HADS = Hospital Anxiety and Depression Scale; PTSD = post-traumatic stress disorder; DTS = Davidson Trauma Scale; STAI = State-Trait Anxiety Inventory; PCS = Physical Component Summary; SD = standard deviation; IQR = interquartile range.

[a] Intervention 1: UCCDIP; intervention 2: ICUsteps.

[b] STAI measured on family members.

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Table 5
Secondary outcomes.

Measurement	Study	Time point	Intervention 1				Intervention 2				Comparison				Results	
			Mean	SD	Median (IQR)	N	Mean	SD	Median (IQR)	N	Mean	SD	Median (IQR)	N	Mean Difference	Significance P value
ICU LOS																
ICU LOS	Bench et al.[33] (2015)	In days			7 (104)	51			6 (62)	48			6 (371)	59		0.24
ICU LOS	Chaboyer et al.[34] (2007)	In days			6	53							6	62		0.09
ICU LOS	Jónasdóttir et al.[36] (2017)	In days	15	12	.	73	.	.	.	.	28	25	.	75	-3.00 [−6.09, 0.09]	0.39
ICU LOS	Mitchell et al.[35] (2004)	In days	0.9	0	.	82	.	.	.	.	0.97	0	.	80		
			6													
ICU LOS	Walsh et al.[32] (2015)	In days			11 (6-18)	120							11 (6-18)	120		
Hospital LOS																
Hospital LOS	Bench et al.[33] (2015)	In days			21.5 (132)	51			16 (132)	48			22 (166)	59		0.25
Hospital LOS	Chaboyer et al.[34] (2007)	In days	.	.	18 (17)	53							15.5 (16)	62		0.57
Hospital LOS	Jónasdóttir et al.[36] (2017)	In days	35	40	.	73	.	.	.	.	41	44	.	75	−6.00 [−19.54 to 7.54]	0.06
Post-ICU and hospital LOS	Walsh et al.[32] (2015)	In days	11	6–22		119					10	6–23		119	0 [−2 to 2]	0.90

Measurement	Study	Time point	Intervention 1	Intervention 2	Control	RR (95% CI)
			N (%)	N (%)	N (%)	
Readmission rates[a]						
ICU readmission	Chaboyer et al.[34] (2007)	ICU readmission during the hospital stay	0 (0)		4 (6.5)	0.13 [0.01, 2.35]
ICU readmission	Jónasdóttir et al.[36] (2017)	ICU readmission within 48 h	0 (0)		0 (0)	
ICU readmission	Jónasdóttir et al.[36] (2017)	ICU readmission within 48–120 h	2 (2.8)		5 (6.6)	0.41 [0.08, 2.05]
ICU readmission	Walsh et al.[32] (2015)	ICU readmission during the hospital stay	1 (0.8)		7 (5.8)	0.14 [0.02, 1.14]

ICU = intensive care unit; SD = standard deviation; CI = confidence interval; RR = risk ratio; IQR = interquartile range; LOS = length of stay.
[a] Readmission rates are given in days.

3.7.3. ICU readmissions

Three studies reported the number of ICU readmission rates during the same hospital stay.[32,34,36] A significant reduction in the number of readmission rates was found in favour of a transitional care intervention (pooled risk ratio = 0.22, 95% CI = 0.07 to 0.70, $I^2 = 0\%$; see Fig. 2).

3.7.4. ICU- and hospital length of stay

All studies described the ICU LOS in days, and four studies described total hospital LOS.[32–34,36] For both outcomes, no significant differences in favour of the transitional care intervention were found.

3.7.5. Healthcare costs

Walsh et al.[32] reported the mean cumulative costs for the intervention group and control group. The intervention group showed a cost of £ 48.953, and the control group showed a cost of £ 49,057. They found no difference in mean quality-adjusted life years[44] between the intervention (mean = 0.54; standard deviation = 0.20) and usual care (mean = 0.54; standard deviation = 0.18) groups (mean difference: 0.00; 95% CI = −0.04 to 0.04).

4. Discussion

Evidence from currently available RCTs and nonrandomised experimental studies of varied methodological quality shows no significant differences in elements of PICS and PICS-F in favour of ICU-initiated transitional care interventions. In this review, we found a variety of transitional care interventions, but even studies that implemented multiple interventions did not show a positive effect on elements of PICS and PICS-F. Notably, none of the studies described cognitive impairment outcomes. Larger RCTs are therefore needed to demonstrate if and how transitional care interventions are able to decrease the components of PICS-(F). In this review, we only found significant reduction in readmission rates in favour of the transitional care interventions (i.e., intervention including at least one component of the TCM).[26]

Evidence for the most commonly described psychological impairments of PICS-(F) by patients and family, which are anxiety, depression, and PTSD, is lacking.[45] Nevertheless, physical rehabilitation, the use of diaries by ICU patients, and a patient- and family-centred care environment are promising interventions.[46–48] Furthermore, the provision of information by healthcare professionals and adequate communication seems pivotal for treatment of PICS-F.[49]

Transmural transitional care interventions remain underexposed in this review because collaboration between intramural and extramural health care organisations was seldom described. Currently provided ICU aftercare is not the same as transitional care, evidence of effectiveness of ICU aftercare is scarce, and guidelines are not available.[50] However, ICU aftercare and follow-up services can be beneficial to predict and recognise patients (at risk for) with PICS.[8,50] For trauma and cardiac populations, transmural interventions are effective in the form of care pathways, home visit programs, and structured telephone support (STS)in reducing hospital readmissions, reducing pain, improving functional status, and improving disease-specific HRQOL.[51,52] More evidence for transmural interventions for ICU patients and their families are needed as these are needed to prepare patients and especially family members returning to daily life at home in their possible role as a caregiver.

Although the currently described transitional care interventions in our review show no effect on PICS and PICS-F, we recommend that after the current COVID-19 crisis, further research on the multiple transitions for ICU patients should continue. Many

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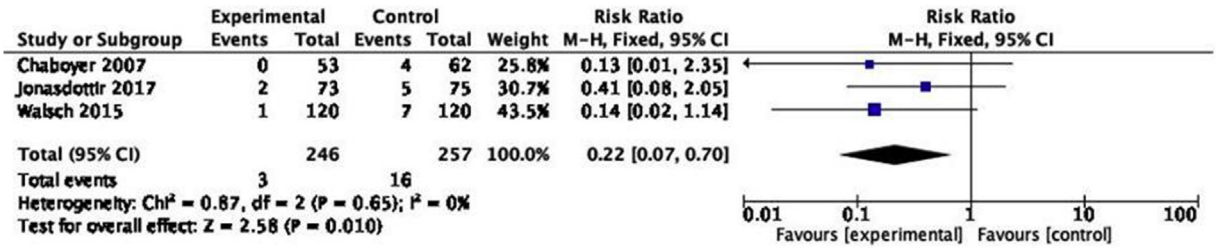

Fig. 2. Forest plot of pooled readmission rates. CI = confidence interval.

patients have gone through multiple transitions during this COVID-19 crisis, sometimes even between institutions in different countries, with limited visitation of family. This raises the question which role these multiple transitions play in the development of elements of PICS. Earlier studies from the post-Severe Acute Respiratory Sundrome (SARS) era show that patients develop long-term impairments such as fatigue, weakness, and depression.[53] Experts expect that higher rates of depression and PTSD are likely for patients and their families. Family members' needs in this population in a still-limited-care landscape confirm the need for good transition care. Family members should receive better information and guidance in preparing for a caregiver role that can last for years.[54]

4.1. Strengths and limitations

This review has some strength and limitations. A strength of this review is that we used a comprehensive sensitive literature search and that each stage of the review was conducted by at least two or three independent reviewers and the use of established tools for quality assessments. None of the studies was designed to examine elements of PICS as an outcome measure. Another strength is that we used the most used and validated instruments summarised by the SCCM.[11] However, we realise that there are many more instruments to evaluate ICU outcomes (more than 250).[31] Therefore, we may have missed some outcome data of PICS that were measured using other instruments.

Since the SCCM introduced the term PICS(-F) in 2012, there is growing awareness in the wide range of symptoms of ICU patients and their family.[4] We used PICS-(F) as an underpinning framework to which outcomes were mapped. The variety in elements of PICS suggests preferring an individual-based plan of care and giving guidance to patients and their families during their recovery pathway. Yet, transitional care interventions as defined by the TCM emphasise streamlined plans of care and continuity of care across settings and between professionals and are not primary focused on patient outcomes.[26]

None of the studies had previously selected a risk group for the development of elements of PICS which are important in the development of post-ICU problems,[8,9] which may influence the results. In addition, some studies had a very short ICU admission, and all studies had a relatively short follow-up, which means that possible complaints may not be measurable until later. Another factor that might influence the results of this review is that we included randomised and nonrandomised clinical studies, with some studies showing substantial differences in baseline characteristics.[34–36] The difficulty in an appropriate evaluation of complex interventions in RCTs such as a transitional care intervention includes implementation strategies and process evaluations.[55,56] We found substantial clinical heterogeneity that made pooling for primary outcomes unfeasible. At last, in this review, we used the definition of the TCM to define the interventions; however, it is possible we could have missed relevant studies that used other definitions.

5. Conclusions and recommendations

There is a general paucity of data on the effects of ICU-initiated transitional care interventions on the elements of PICS. Although none of the studies reported a positive effect on elements of PICS and PICS-F, there is still insufficient evidence to draw firm conclusions owing to the small number of studies available and the heterogeneity between the studies. Larger studies are needed as these studies confirm the burden of patients' and family's experiences on multiple aspects of PICS. A clear adapted framework or model may be helpful to share more evidence-based intervention strategies to offer continuity of care to ICU patients and families.

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Conflict of Interest

The authors declare that they have no conflict of interest.

CRediT authorship contribution statement

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Appendix A. Supplementary data

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