

## INPLASY

## Protocol for a systematic review and meta-analysis of rehabilitation interventions for post-extubation dysphagia in ICU patients

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Hu, N; Zhang, Q; Choi, SH.

**Corresponding author:**

Seong Hee Choi

shgrace@cu.ac.kr

**Author Affiliation:**

Department of Audiology and  
Speech-Language Pathology, Daegu  
Catholic University, Gyeongsan,  
South Korea.

**ADMINISTRATIVE INFORMATION**

**Support** - No financial support was received for this systematic review and meta-analysis.

**Review Stage at time of this submission** - Preliminary searches.

**Conflicts of interest** - None declared.

**INPLASY registration number:** INPLASY2026100024

**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 6 October 2026 and was last updated on 6 October 2026.

**INTRODUCTION**

**Review question / Objective** This systematic review and meta-analysis aimed to evaluate the effectiveness of rehabilitation interventions for post-extubation dysphagia (PED) in adult patients who had undergone invasive mechanical ventilation in the intensive care unit (ICU). Specifically, the review examined whether rehabilitation interventions, including indirect or direct swallowing training, oral care programmes, and neuromuscular or pharyngeal electrical stimulation, improve swallowing function and resumption of oral feeding and reduce aspiration, aspiration pneumonia, and other adverse events compared with routine care or attention control. Randomised controlled trials and non-randomised controlled studies were eligible for inclusion.

**Rationale** Post-extubation dysphagia (PED) is a common complication following invasive mechanical ventilation and is associated with aspiration, aspiration pneumonia, malnutrition,

dehydration, delayed oral intake, reintubation, prolonged hospitalisation, and adverse long-term outcomes. The mechanisms underlying PED are multifactorial and include mechanical injury to laryngeal structures, disuse atrophy of pharyngeal musculature, reduced laryngeal sensory input, and impaired coordination between respiration and swallowing. Various rehabilitation interventions have been used, including indirect muscle-strengthening exercises, direct ingestion training, oral care programmes, and electrical stimulation. However, the available evidence remains fragmented, with considerable variation in intervention approaches and outcome measures. A systematic review and meta-analysis was therefore undertaken to synthesise the available controlled evidence and quantify the effects of rehabilitation interventions on clinically relevant outcomes, including oral feeding, aspiration-related complications, and validated swallowing-function measures.

**Condition being studied** Post-extubation dysphagia (PED) in adult ICU patients following

invasive mechanical ventilation. PED is characterised by impaired swallowing after endotracheal intubation and extubation and may result from mechanical laryngeal injury, pharyngeal muscle disuse, impaired laryngeal sensation, and disrupted swallowing-respiratory coordination. It can lead to aspiration, aspiration pneumonia, malnutrition, dehydration, delayed resumption of oral intake, reintubation, prolonged hospitalisation, and increased mortality.

## METHODS

**Search strategy** A comprehensive literature search will be conducted from database inception to the present. The databases searched included PubMed, Embase, Web of Science, CINAHL, Scopus, Cochrane CENTRAL, CNKI, VIP, Wanfang, and SinoMed. ClinicalTrials.gov and the Chinese Clinical Trial Registry (ChiCTR) were also searched. Reference lists of relevant articles and reviews were manually screened for additional eligible studies. The search combined controlled vocabulary, including MeSH and database-specific thesaurus terms, with free-text terms. The principal concepts were: (1) dysphagia, deglutition disorders, swallowing disorders, and post-extubation dysphagia; (2) intensive care, mechanical ventilation, endotracheal intubation, and extubation; and (3) rehabilitation interventions, including swallowing training, swallowing rehabilitation, oral care, oral hygiene, neuromuscular electrical stimulation, and pharyngeal electrical stimulation. Boolean operators AND and OR were used as appropriate. Searches included English- and Chinese-language literature.

**Participant or population** Adults aged 18 years or older who underwent invasive mechanical ventilation with endotracheal intubation in an intensive care unit and were evaluated for or diagnosed with post-extubation dysphagia following extubation. Paediatric populations were excluded.

**Intervention** Rehabilitation interventions targeting swallowing function, including indirect swallowing or muscle-strengthening exercises, direct or bolus-based swallowing and ingestion training, structured swallowing rehabilitation programmes, oral care or oral hygiene programmes, neuromuscular electrical stimulation, pharyngeal electrical stimulation, and multimodal rehabilitation programmes combining these approaches.

**Comparator** Routine or usual care, standard post-extubation care, or attention control without the

specific rehabilitation intervention evaluated in the intervention group.

**Study designs to be included** Randomised controlled trials (RCTs) and non-randomised controlled studies, including quasi-experimental controlled studies, evaluating rehabilitation interventions for post-extubation dysphagia. Uncontrolled observational studies, case reports, narrative reviews, conference abstracts, protocols, unpublished reports, and duplicate publications were excluded.

**Eligibility criteria** Studies were eligible if they included adults ( $\geq 18$  years) invasively mechanically ventilated in an ICU; evaluated a rehabilitation intervention targeting swallowing function; included a routine-care, usual-care, standard-care, or attention-control comparator; reported outcomes related to oral feeding, aspiration, aspiration pneumonia, adverse events, or validated swallowing-function measures; and used a randomised or non-randomised controlled design. Studies were excluded if they were uncontrolled studies, case reports, narrative reviews, conference abstracts, study protocols, unpublished reports, duplicate publications, or studies involving paediatric populations.

**Information sources** Electronic information sources included PubMed, Embase, Web of Science, CINAHL, Scopus, Cochrane CENTRAL, CNKI, VIP, Wanfang, and SinoMed. ClinicalTrials.gov and the Chinese Clinical Trial Registry (ChiCTR) were searched for registered trials. Reference lists of retrieved articles and relevant reviews were manually screened to identify additional eligible studies. The final search will be conducted from database inception to the present.

**Main outcome(s)** The primary outcomes were: (1) resumption of oral feeding, defined as the proportion of participants able to resume oral intake following extubation; and (2) aspiration pneumonia, defined according to the clinical and radiological criteria used in the included studies. For dichotomous outcomes, pooled effects were expressed as risk ratios (RRs) with 95% confidence intervals (CIs). Outcomes were assessed at the post-intervention timepoints reported by the individual studies.

**Additional outcome(s)** Additional outcomes included aspiration; other adverse events such as food residue and overflow; swallowing function measured using validated scales, particularly the Gugging Swallowing Screen (GUSS) and

Functional Oral Intake Scale (FOIS); and instrumented swallowing measures including oral transit time (OTT), oropharyngeal transit time (OPTT), and oropharyngeal swallowing efficiency (OPSE). ICU and hospital length of stay and time to total oral intake were also extracted when reported. Dichotomous outcomes were summarised using risk ratios (RRs), and continuous outcomes using mean differences (MDs), with 95% confidence intervals.

**Data management** Two reviewers independently screened titles and abstracts against the eligibility criteria, with disagreements resolved by an independent third reviewer. A piloted standardised data-extraction form was used. Extracted information included study design, country, sample size, age, participant characteristics, intervention strategy, intervention duration, outcome measures, and treatment outcomes. Event counts and total sample sizes were extracted for dichotomous outcomes, and means and standard deviations for continuous outcomes. Median and interquartile-range data were converted where appropriate using established methods. Records were cross-checked to identify overlapping or duplicate study populations and prevent double counting.

**Quality assessment / Risk of bias analysis** Methodological quality was independently assessed by two reviewers using the Physiotherapy Evidence Database (PEDro) scale. Risk of bias was additionally evaluated using the Cochrane Risk of Bias 2.0 (RoB 2) tool for randomised controlled trials and ROBINS-I for non-randomised studies. Overall risk-of-bias judgements were categorised according to the respective tools. Certainty of evidence for each outcome was assessed using the GRADE approach, considering risk of bias, inconsistency, indirectness, imprecision, and publication bias, and was classified as high, moderate, low, or very low.

**Strategy of data synthesis** Continuous outcomes were synthesised using mean differences (MDs) with 95% confidence intervals (CIs), and dichotomous outcomes using risk ratios (RRs) with 95% CIs. Meta-analyses were conducted using DerSimonian–Laird random-effects models. Statistical heterogeneity was assessed using the  $I^2$  statistic and Cochran's Q test. Forest plots were used to display individual-study and pooled effect estimates. Where quantitative pooling was not appropriate or only one study reported an outcome, findings were summarised descriptively. Analyses were conducted in Python 3.11 using custom implementations of the DerSimonian–Laird

estimator. Funnel-plot asymmetry was not formally assessed because no outcome reached the threshold of ten eligible studies.

**Subgroup analysis** Three subgroup analyses were specified to explore potential sources of heterogeneity and variation in intervention effects: (1) study design, comparing randomised controlled trials with non-randomised controlled studies; (2) intervention modality, including structured swallowing training, oral care programmes, electrical stimulation, and multimodal rehabilitation; and (3) publication region. Subgroup analyses were conducted when sufficient studies and data were available.

**Sensitivity analysis** Leave-one-out sensitivity analyses were conducted for pooled outcomes to evaluate the robustness of the meta-analytic estimates and determine whether individual studies disproportionately influenced the overall effect or statistical heterogeneity. Each eligible study was sequentially removed from the meta-analysis, and the pooled effect estimate and heterogeneity statistics were recalculated.

**Language restriction** Studies published in English or Chinese were included.

**Country(ies) involved** China; South Korea.

**Other relevant information** The registration is being submitted to provide a transparent public record of the review methods and to clearly document the methodological framework used in the review.

**Keywords** post-extubation dysphagia; intensive care; swallowing rehabilitation; aspiration pneumonia; systematic review; meta-analysis.

**Dissemination plans** The findings of this systematic review and meta-analysis will be disseminated through publication in a peer-reviewed academic journal and may also be presented at relevant scientific or professional conferences. The review is intended to inform clinicians and researchers involved in intensive care, dysphagia management, speech-language pathology, and rehabilitation and to support the development of evidence-based rehabilitation strategies for post-extubation dysphagia.

**Contributions of each author**

Author 1 - Naixiao Hu - Conceptualisation, methodology, formal analysis, and writing – original draft.

Email: 2784211998@qq.com

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Author 2 - Qingsu Zhang - Investigation, and validation.

Email: 229716096@qq.com

Author 3 - Seong Hee Choi - Conceptualisation, supervision, writing – review and editing, and project administration.

Email: shgrace@cu.ac.kr