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Lung Ultrasound in Respiratory Therapy: A Targeted Narrative Update on Therapist-Led Assessment and Ultrasound-Informed Care

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Abstract

Objectives

To provide a targeted narrative update of evidence on lung ultrasound (LUS) and combined lung/diaphragm ultrasound relevant to respiratory therapy and physiotherapy practice in adults.

Methods

The systematic review by Lockstone et al., which searched five databases through April 18, 2023, served as the principal prior synthesis. A supplementary PubMed search was conducted on July 20, 2026, followed by supplementary web searching and citation tracking through August 27, 2026. Publications were narratively classified according to clinical effectiveness, reliability, implementation, and contextual evidence.

Results

The earlier systematic review included seven observational studies involving 299 adults. Diaphragm and lung ultrasound influenced physiotherapy diagnosis in 63.9% of patients, management in 16.8%, and treatment in 48.4% of cases. However, evidence for improvement in LUS scores following respiratory physiotherapy was of very low certainty. Subsequent publications examined therapist-led implementation, treatment positioning, LUS-informed chest physical therapy, retrospective clinical decision-making, and service-level evaluation. Professional surveys provided additional information on training and clinical adoption. Complementary reliability evidence demonstrated inter-rater agreement in scoring acquired LUS images. Methodological limitations, overlapping cohorts, and differences in operator roles restrict interpretation. Evidence of improved patient-important outcomes remains limited.

Conclusions

LUS may complement respiratory assessment and inform treatment selection and monitoring. Current evidence does not establish that LUS-informed respiratory therapy improves patient-centered outcomes. Implementation should involve structured education, supervised competency assessment, multidisciplinary integration, and appropriate governance. Prospective multicenter comparative studies are needed to establish clinical effectiveness.

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Keywords: Lung ultrasound, respiratory therapy, respiratory physiotherapy, point-of-care ultrasound, clinical decision-making.

1. INTRODUCTION

Lung ultrasound has become an established point-of-care imaging modality in acute and critical care because it can be performed at the bedside, repeated without ionizing radiation, and used to identify changes in pleural and pulmonary aeration. International evidence-based recommendations support standardized use of point-of-care LUS across several clinical scenarios.[1,2] Professional surveys show that respiratory therapists and physiotherapists are using LUS in clinical practice, although uptake and implementation remain variable. Reported barriers include limited formal certification and hands-on training, access to mentors and ultrasound equipment, and gaps in institutional policy and support.[3-5] Their practice already depends on repeated assessment of oxygenation, ventilation, respiratory mechanics, work of breathing, secretion burden, positioning, airway clearance, and ventilator liberation. LUS may add a real-time anatomical component to this assessment and potentially help clinicians target respiratory interventions more precisely.

Earlier reviews described LUS as a promising tool for physiotherapists and respiratory therapists. A 2019 review outlined the emerging role of LUS in respiratory therapy.[6] A broader 2022 systematic review found that LUS could alter diagnosis or management across clinical departments, although methodological heterogeneity limited certainty.[7] The most directly relevant evidence is the systematic review by Lockstone et al., which searched five databases to April 18, 2023, and identified seven observational studies involving 299 adults. Diaphragm/lung ultrasound changed physiotherapy diagnosis in 63.9% of patients, management in 16.8%, and treatment in 48.4%; LUS scores also improved after respiratory physiotherapy, although the certainty of evidence was very low.[8]

Since that search, additional publications have examined therapist-led implementation, treatment positioning, LUS-guided chest physical therapy, and service-level clinical integration. Complementary pre-cutoff evidence from Hansell et al. has also provided information on LUS scoring reliability. A 2025 scoping review documented the growth of therapist-related DLUS literature while emphasizing uncertainty regarding patient outcomes.[9] The present article therefore provides a targeted narrative evidence update focused on what subsequent publications add to the earlier systematic review and what remains uncertain.

2. REVIEW QUESTION AND OBJECTIVES

The primary review question was

In adults receiving respiratory care, what does subsequent clinical evidence add to the evidence that LUS or combined lung/diaphragm ultrasound can inform respiratory therapist or respiratory physiotherapy assessment, treatment selection, treatment monitoring, implementation, or ventilator-liberation decision-making?

The secondary objectives were to:

1. describe the clinical settings and populations represented in the subsequent literature;
2. distinguish therapist-acquired and therapist-interpreted ultrasound from ultrasound performed by other professionals and merely used to inform therapy;
3. distinguish clinical-effectiveness evidence from reliability, implementation, survey, scoping-review, and governance evidence;
4. identify relationships among companion publications and overlapping cohorts; and
5. identify evidence gaps relevant to responsible therapist-led implementation.

3. METHODS

3.1. REVIEW APPROACH

This article was designed as a targeted narrative evidence update rather than a de novo systematic review. A previously published systematic review by Lockstone et al. served as the principal prior synthesis because it directly addressed DLUS use in acute respiratory physiotherapy and provided a defined evidence base through April 18, 2023.[8] No new prospective protocol was registered for the present update. The purpose of the current update is not to reproduce an exhaustive systematic search of all potentially eligible literature. Instead, it is to identify important subsequent publications that contribute to understanding the clinical application, treatment selection, treatment monitoring, reliability, implementation, and governance of therapist-related LUS.

3.2. ELIGIBILITY FRAMEWORK

The eligibility criteria differed according to the evidential role of each publication. For clinical evidence, eligible studies involved adults in acute, critical-care, respiratory, postoperative, or hospital respiratory-care settings and examined lung ultrasound (LUS) or combined lung/diaphragm ultrasound in relation to respiratory therapy or physiotherapy assessment, treatment selection, treatment monitoring, or ventilator-liberation assessment. For contextual and implementation evidence, eligibility was based on relevance to respiratory therapists or physiotherapists, including LUS training, education, competency development, professional practice, implementation, measurement reliability, accreditation, or clinical governance. These publications included professional surveys, implementation reports, scoping reviews, systematic reviews, and professional frameworks, irrespective of whether they included an adult patient population.

Original clinical studies, service evaluations, implementation reports, reliability studies, surveys, reviews, and professional frameworks were considered and classified separately according to their evidential contribution.

Pediatric-only clinical studies, animal studies, simulation studies without clinical application, and publications without a clear relevance to respiratory therapy or physiotherapy were not included as central clinical evidence.

3.3. DEFINITIONS USED IN THE UPDATE

To avoid conflating different forms of ultrasound use, the following terminology was applied.

1. Therapist-led LUS was defined as ultrasound acquired and interpreted by a respiratory therapist or physiotherapist for the clinician's own respiratory assessment.
2. Therapy-guided LUS referred to LUS findings being used directly to select, modify, or monitor a respiratory intervention.
3. Therapy-relevant LUS referred to ultrasound performed by another professional but subsequently used to inform respiratory therapy decisions.

These categories were kept distinct because evidence generated by different operator groups cannot automatically be assumed to demonstrate therapist-led effectiveness.

3.4. INFORMATION SOURCES AND TARGETED SEARCH

The previously published systematic review by Lockstone et al. served as the principal prior evidence synthesis. That review searched PubMed, Embase, CINAHL, the Cochrane Central Register of Controlled Trials (CENTRAL), and Scopus from database inception to April 18, 2023.[8] For the present narrative update, a supplementary PubMed search was conducted on July 20, 2026. The literature search and supplementary identification of relevant publications continued through August 27, 2026. The search aimed to identify publications relevant to lung ultrasound (LUS), diaphragm ultrasound, and respiratory therapy or physiotherapy, including clinical assessment, treatment selection, treatment monitoring, implementation, reliability, and ventilator liberation.

The documented PubMed search strategy was

("lung ultrasound" OR "thoracic ultrasound" OR "lung ultrasonography" OR "point-of-care ultrasound" OR "diaphragm ultrasound" OR "diaphragmatic ultrasonography" OR "diaphragmatic excursion" OR "diaphragm thickening fraction")

AND

(physiotherapist* OR "physical therapist*" OR "respiratory therapist*" OR "respiratory therapy" OR "respiratory physiotherapy")

AND

(critical care OR intensive care OR mechanically ventilated OR atelectasis OR airway clearance OR positioning OR weaning OR treatment OR management).

Supplementary web searching and backward and forward citation chasing were used to identify relevant clinical, implementation, professional-practice, and training publications associated with the principal prior systematic review and related studies. The web-search platform and complete search histories were not retained, and complete details of PubMed filter settings were not available in the original search documentation. These supplementary methods were therefore treated as targeted evidence-identification approaches rather than as a fully reproducible systematic search.

The supplementary search did not repeat the five-database strategy used in the earlier systematic review. Contextual evidence concerning professional training, competency, implementation, accreditation, and governance was additionally identified through targeted searching and citation chasing. Publications providing direct clinical findings relevant to respiratory therapy or physiotherapy assessment, treatment selection, monitoring, or patient outcomes were selected for focused clinical discussion. Publications addressing professional practice, training, implementation, reliability, and governance were retained as contextual evidence and interpreted according to their respective study designs. Accordingly, this article should be interpreted as a targeted narrative update rather than an exhaustive systematic review.

3.5. STUDY IDENTIFICATION AND EVIDENCE CLASSIFICATION

The author responsible for the update identified and selected publications for relevance to the review question. Selection was based on the clinical population, ultrasound application, relevance to respiratory therapy or physiotherapy, study design, and contribution to the review question. The update principally considered post-cutoff publications while also incorporating directly relevant complementary pre-cutoff evidence where appropriate.

Publications were classified according to their principal evidential contribution:

1. Original clinical evidence: studies evaluating clinical assessment, treatment selection, treatment monitoring, or patient outcomes.
2. Implementation and service-evaluation evidence: reports describing clinical integration, feasibility, service development, or clinician-reported changes in practice.
3. Reliability and measurement evidence: studies evaluating inter-rater agreement, scoring consistency, or measurement feasibility.
4. Contextual evidence: surveys, scoping reviews, systematic reviews addressing related questions, and professional or governance frameworks.

These categories were used to prevent surveys, implementation reports, and reliability studies from being interpreted as equivalent to comparative clinical-effectiveness studies. Publications from the same underlying research program were mapped to their patient cohort where this relationship could be identified, to reduce the risk of treating companion reports as independent clinical evidence.

3.6. DATA EXTRACTION AND CRITICAL APPRAISAL

The author responsible for the update extracted information from the selected publications. Extracted items included publication year, study design, clinical setting, sample size, patient population, ultrasound operator, therapist involvement, clinical indication, intervention, comparator, allocation method where applicable, reported outcomes, relationship to the earlier evidence base, and principal methodological limitations. No independent second reviewer verified study selection or data extraction. The possibility of selection and extraction errors therefore cannot be excluded.

Critical appraisal was narrative and design-specific. Comparative clinical studies were considered in relation to allocation procedures, comparators, blinding, missing data, outcome specification, potential confounding, co-interventions, and statistical reporting. Reliability studies were assessed in relation to the measurement being evaluated, rater procedures, agreement methods, and repeated observations. Surveys and implementation reports were interpreted according to their sampling, self-reported outcomes, descriptive design, and ability to support inferences about clinical practice or patient benefit. No new pooled effect estimate or formal certainty-of-evidence grade was generated for the supplementary publications because of their methodological and clinical heterogeneity.

3.7. SYNTHESIS AND SUPPLEMENTARY EVIDENCE ASSESSMENT

A narrative synthesis was used to integrate the earlier systematic review with the selected subsequent publications. Quantitative findings were reported where available in the source publications, and clinical-effectiveness claims were distinguished from evidence of feasibility, reliability, implementation, and changes in clinical decision-making. Additional publications meeting the contextual or implementation scope were also assessed, including a retrospective physiotherapy-led implementation review and surveys of respiratory therapists and accredited physiotherapists. These publications contributed contextual evidence on implementation, professional practice, training, and governance but were not considered equivalent to comparative clinical-effectiveness studies. The resulting synthesis is intended to provide a transparent, clinically focused update rather than a comprehensive systematic review. The restricted supplementary search, single-reviewer selection and extraction, and possibility of missed publications remain important limitations.

4. RESULTS

4.1. EVIDENCE IDENTIFICATION AND RECONSTRUCTION

The systematic review by Lockstone et al. identified 7,436 records, of which 2,199 duplicates were removed. Following screening of 5,237 titles and abstracts and assessment of 213 full-text articles, seven observational studies involving 299 adults were included. This review provided the principal evidence base for the present narrative update.[8] A targeted supplementary search and citation-chasing process was undertaken to identify publications relevant to therapist-related lung ultrasound (LUS) published or indexed after the earlier review's search cutoff of April 18, 2023. The update focused on publications addressing clinical implementation, treatment selection, treatment monitoring, comparative clinical outcomes, measurement reliability, and professional practice.

The identified publications represented different evidence domains, including clinical studies, implementation reports, service evaluations, reliability investigations, and professional surveys. Their study designs, ultrasound operator roles, cohort relationships, and contributions to the present update are summarized in Table 1. These publications address distinct research questions and should not be considered equivalent or independent evidence of clinical effectiveness. In particular, the treatment-response, reliability, and positioning studies by Hansell et al. arose from the same 43-patient research program and should not be counted as independent patient cohorts.[10-12] The earlier systematic review remains the principal synthesis of evidence available through April 18, 2023.[8] The supplementary search was targeted rather than exhaustive; therefore, relevant publications may have been missed. The search strategy, publication-selection process, and associated methodological limitations are described in Section 3.

4.2. EVIDENCE FROM THE EARLIER SYSTEMATIC REVIEW

The systematic review by Lockstone et al. included seven observational studies involving 299 adults and provided the principal synthesis of evidence on diaphragm and lung ultrasound (DLUS) in acute respiratory physiotherapy. Ultrasound findings were associated with changes in physiotherapy diagnosis in 63.9% of patients, management in 16.8%, and treatment in 48.4%.[8] These findings indicate that ultrasound can influence clinical assessment and intervention decisions in the populations studied. However, changes in clinical decision-making should not be equated with improved patient outcomes. The review also reported a reduction in lung ultrasound (LUS) scores following respiratory physiotherapy, with a pooled mean difference of −2.31 (95% CI, −4.42 to −0.21). Nevertheless, the certainty of evidence supporting this treatment-response finding was rated very low, and six of the seven included studies were assessed as having a moderate risk of bias.[8] Differences in study methods and clinical populations further limit the strength and generalizability of the conclusions.

Overall, the earlier review supports the potential role of DLUS in informing respiratory physiotherapy assessment and detecting changes in lung aeration. However, it does not establish that ultrasound-informed decisions improve diagnostic accuracy, shorten respiratory-support duration, reduce complications, or improve other patient-important outcomes. Subsequent studies are therefore considered according to the specific research questions they address,

Table 1. Evidence map of the targeted narrative update

Publication	Design	Sample	Therapist/ operator role	Relationship to Lockstone review	Cohort relationship	Contribution to present update
Lockstone et al.[8]	Systematic review and meta-analysis	7 studies; 299 adults	Physiotherapists; DLUS	Principal prior synthesis	Multiple underlying studies	Established the pre-April-2023 evidence base regarding therapist-related DLUS and clinical decision-making
Hansell et al.[10]	Prospective cohort study	43 mechanically ventilated adults	Physiotherapist-acquired LUS	Already represented in the earlier evidence base	Same clinical program as[11,12]	Demonstrated short-term changes in LUS score following respiratory physiotherapy
Hansell et al.[11]	Reliability study	43 patients; 1,032 images	Physiotherapists	Complementary evidence; publication predates the cutoff	Same 43-patient cohort as[10, 12]	Evaluated inter-rater reliability of LUS scoring
Lockstone et al.[13]	Implementation report	No patient cohort	Physiotherapists	Subsequent publication	Not applicable	Described implementation of a physiotherapy-led LUS service, including training and governance
Hansell et al.[12]	Prospective cohort study	43 mechanically ventilated adults	Physiotherapist-selected positioning; LUS localization	Subsequent publication	Same 43-patient cohort as[10, 11]	Examined concordance between therapist-selected positioning and LUS-identified aeration loss
Chen et al.[14]	Prospective comparative study	100 mechanically ventilated ICU patients	Ultrasound acquisition: designated intensive-care nurse, with intensive-care physician collaboration/ support. Chest physical therapy: respiratory and rehabilitation therapists, with nursing support.	Subsequent publication	New cohort	Evaluated clinical outcomes associated with chest physical therapy guided by LUS findings compared with conventional chest physical therapy. LUS acquisition was performed by a designated ICU nurse with physician support; respiratory and rehabilitation therapists delivered the physical therapy intervention.
Swingwood et al.[15]	Prospective service evaluation	117 LUS scans	Seven accredited physiotherapists	Subsequent publication	New service cohort	Evaluated the influence of physiotherapy-led LUS on diagnostic uncertainty and intervention decisions
Hayward et al.[9]	Scoping review	133 studies	Physiotherapists, physical therapists, and respiratory therapists	Contextual evidence	Not a clinical cohort	Described growth and characteristics of therapist-related DLUS literature
Lau et al.[3]	International survey	320 ICU therapists from 30 countries	Physiotherapists, physical therapists, and respiratory therapists	Contextual evidence	Survey population	Described adoption, accreditation, training, and governance patterns
Lockstone et al. (2024)[16]	Retrospective implementation review	40 LUS scans	Physiotherapists	Subsequent implementation evidence	Service review; distinct from the earlier systematic review	Examined changes in physiotherapy management and medical decision-making after LUS implementation

Publication	Design	Sample	Therapist/ operator role	Relationship to Lockstone review	Cohort relationship	Contribution to present update
Mathew et al. (2024)[4]	Global cross-sectional survey	514 respiratory therapists from 22 countries	Respiratory therapists	Contextual evidence	Survey population; not a clinical treatment cohort	Described knowledge, attitudes, and practices relating to LUS
Hayward et al. (2026)[5]	UK national survey	168 respondents	Accredited physiotherapists	Contextual implementation evidence	Survey population; not a clinical treatment cohort	Examined training, implementation, access, and use of LUS

Abbreviations: DLUS, diaphragm and lung ultrasound; ICU, intensive care unit; LUS, lung ultrasound.

rather than being interpreted as confirmation of clinical effectiveness.

4.3. CLINICAL DECISION-MAKING

Swingwood et al. conducted a single-center service evaluation examining the integration of physiotherapy-led lung ultrasound (LUS) into routine clinical assessment. Across 117 LUS scans, clinicians reported reduced diagnostic uncertainty in 97% of assessments and modification of respiratory physiotherapy interventions in 76%. They also judged that potentially ineffective physiotherapy had been avoided in 73% of assessments.[15] These findings suggest that LUS may provide additional information that influences clinical reasoning and intervention selection in routine practice.

However, these outcomes were based on clinician-reported judgments rather than independently verified measures of diagnostic accuracy, treatment effectiveness, or patient benefit. The service evaluation did not include a control group, limiting the ability to determine whether the reported changes were attributable to LUS or whether they improved outcomes compared with conventional assessment. Furthermore, the 117 scans should not be interpreted as 117 unique patients unless this is explicitly confirmed by the study. The study therefore provides evidence of implementation and perceived clinical utility rather than proof of clinical effectiveness. Its findings support further evaluation of therapist-led LUS in routine respiratory care, using clearly defined patient-level outcomes and methods that account for repeated assessments where applicable.

4.4. MONITORING RESPONSE TO RESPIRATORY THERAPY

Hansell et al. evaluated 43 mechanically ventilated adults with suspected acute lobar atelectasis to investigate changes in lung ultrasound (LUS) findings following respiratory physiotherapy. The mean total LUS score decreased by 2.9 points (95% CI, −4.4 to −1.4), indicating a measurable change in ultrasound-assessed lung aeration following treatment. Changes in physiological measures, including tidal volume and auscultation score, were also assessed. However, the radiological atelectasis score and driving pressure did not change significantly, and the association between changes in LUS scores and radiological findings was weak.[10]

The reported change in tidal volume was 19 mL (95% CI, −7.4 to 44.5). Because this confidence interval includes zero, the result does not demonstrate a statistically significant change in tidal volume. Accordingly, the reduction in LUS score should be interpreted as evidence of a change in ultrasound findings rather than proof of improved respiratory physiology or patient outcomes. The earlier systematic review by Lockstone et al. also reported a pooled reduction in LUS scores, although the certainty of this evidence was rated very low.[8]

These findings suggest that serial LUS may help characterize short-term changes in lung aeration following respiratory interventions. Nevertheless, a change in an ultrasound score is not equivalent to demonstrated treatment effectiveness. Current evidence does not establish that changes in LUS scores consistently predict improved oxygenation, shorter mechanical ventilation, reduced ICU length of stay, improved functional recovery, or lower mortality.

Importantly, the treatment-response, reliability, and positioning publications by Hansell et al. arose from the same 43-patient research program and should not be interpreted as evidence from three independent patient cohorts.[10-12] Further studies should determine whether changes in LUS measurements correlate with clinically meaningful outcomes and whether incorporating serial LUS into respiratory therapy decisions improves care compared with conventional assessment.

4.5. POSITIONING AND TREATMENT SELECTION

Hansell et al. conducted a prospective cohort study involving 43 mechanically ventilated adults with acute lobar atelectasis to examine whether physiotherapist-selected treatment positions corresponded with lung ultrasound (LUS)-localized aeration loss. Only 4 of the 43 patients (9.3%) had a therapist-selected position that corresponded with the location of aeration loss identified by LUS.[12] The study also compared chest radiography (CXR) and lung auscultation with LUS as the reference method for localizing aeration loss. Across lung regions, auscultation sensitivity ranged from 16.7% to 97.4%, compared with 0% to 59.5% for CXR. CXR specificity ranged from 16.7% to 100%, whereas auscultation specificity ranged from 0% to 64.9%.

These ranges reflect variation in diagnostic performance across different lung regions and should not be interpreted as a single overall sensitivity or specificity estimate for either modality. Diagnostic performance varied across lung regions, with the highest true-positive rates reported in the lower lobes.[12]

These findings indicate that conventional bedside assessment and LUS may differ in their localization of regional aeration abnormalities. LUS may provide additional anatomical information when therapists consider positioning for respiratory physiotherapy. However, because LUS served as the reference method, the reported diagnostic-performance estimates describe agreement with that method rather than definitive accuracy against an independent gold standard.

The study did not establish that conventional positioning was harmful or that LUS-guided positioning improved oxygenation, respiratory mechanics, duration of mechanical ventilation, ICU length of stay, or other patient-important outcomes. The 9.3% finding should therefore be interpreted as a potential discrepancy in treatment targeting, rather than evidence of clinical harm or treatment benefit. Prospective comparative studies are needed to determine whether incorporating LUS into positioning decisions improves respiratory therapy outcomes.

4.6. LUS-GUIDED CHEST PHYSICAL THERAPY

Chen et al. conducted a prospective comparative study involving 100 mechanically ventilated intensive care patients, with 50 patients in each group, comparing lung ultrasound (LUS)-informed chest physical therapy with conventional assessment using auscultation and chest radiography.[14] The reported mean duration of mechanical ventilation was 7.03 ± 2.06 days in the LUS-informed group and 8.25 ± 1.97 days in the control group, representing a between-group difference of 1.22 days. Mean ICU length of stay was 11.62 ± 3.15 days and 13.67 ± 3.08 days, respectively, a difference of 2.05 days. Complications were reported in 3 of 50 patients (6%) in the LUS-informed group and 10 of 50 patients (20%) in the control group. Although these findings favor the LUS-informed approach, they require cautious interpretation.[14]

Several methodological issues limit confidence in the reported results. The published t statistic for ICU length of stay appears inconsistent with the reported group means, standard deviations, and sample sizes and could not be reconciled using the published summary data. This discrepancy should be acknowledged when interpreting the source-reported statistical findings. The allocation procedure also requires careful consideration. Although the article describes the use of a random-number table, it also states that allocation was based on odd or even ICU admission order. This inconsistency raises questions about the actual allocation process and whether group assignment was adequately concealed. Other limitations include uncertainty regarding missing-data handling, outcome prespecification, blinding, and the potential for false-positive findings arising from multiple comparisons.[14]

The operator roles further limit attribution of the findings specifically to therapist-led ultrasound. According to the study report, LUS acquisition was performed by a designated intensive care nurse in collaboration with an intensive care physician. Respiratory and rehabilitation therapists delivered chest physical therapy, with nursing support. The intervention is therefore more accurately characterized as multidisciplinary LUS-informed chest physical therapy rather than an exclusively therapist-led ultrasound strategy. Differences in treatment decisions, treatment intensity, operator experience, and other aspects of care may also have contributed to the observed results.[14]

Overall, this study provides preliminary comparative evidence of an association between LUS-informed chest physical therapy and shorter reported mechanical ventilation duration, shorter ICU length of stay, and fewer complications. However, uncertainty surrounding the allocation process and the statistical reporting discrepancy prevents definitive conclusions about the magnitude of benefit or the independent contribution of ultrasound guidance. Larger multicenter studies with transparent allocation procedures, standardized treatment protocols, prespecified outcomes, and appropriate control of co-interventions are needed to determine whether LUS-informed respiratory therapy improves patient-important outcomes.

4.7. RELIABILITY AND FEASIBILITY OF THERAPIST-PERFORMED LUS

Hansell et al. assessed inter-rater reliability in assigning lung ultrasound (LUS) aeration scores in 43 mechanically ventilated patients with suspected acute lobar atelectasis. LUS examinations were performed by a physiotherapist, and the acquired images were independently reviewed and scored by two physiotherapists. Across 1,032 images, the overall kappa coefficient was 0.685 (95% CI, 0.650–0.720), indicating substantial agreement between raters.[11] The publication reports a kappa statistic but does not specify whether it was weighted or unweighted. Importantly, this finding supports agreement in image interpretation and scoring but does not independently establish the reliability of image acquisition across different operators.

The study's sampling structure also warrants consideration. The 1,032 images were obtained from 43 patients and therefore represent repeated observations nested within patients rather than 1,032 independent patient-level observations. The reported agreement should be interpreted in the context of this sampling structure and the study's analytical methods. Furthermore, the raters had differing levels of LUS experience and accreditation, which is relevant when considering the applicability of these findings to clinicians with different levels of training.[11]

Inter-rater agreement is distinct from diagnostic accuracy and clinical effectiveness. The study did not establish whether LUS findings correctly identified pulmonary abnormalities against an independent reference standard, nor whether ultrasound-informed decisions improved patient outcomes. In addition, this reliability study arose from the same 43-patient research program as the related treatment-response and positioning publications and should

not be interpreted as evidence from an independent clinical cohort.[10-12] Overall, the study provides preliminary evidence of inter-rater agreement in LUS aeration scoring by physiotherapists. Further research should evaluate image-acquisition and image-interpretation reliability separately across operators, clinical settings, and levels of training, with transparent reporting of rater experience, competency requirements, agreement methods, and the handling of repeated measurements.

4.8. THERAPIST ADOPTION AND IMPLEMENTATION

Implementation reports, professional surveys, and scoping reviews provide complementary information about the adoption of lung ultrasound (LUS) in respiratory therapy and physiotherapy. These publications address service feasibility, clinical practice, training, and governance, but their findings should not be interpreted as equivalent to evidence of treatment effectiveness. Lockstone et al. described the establishment of a physiotherapy-led LUS service in a regional intensive care unit, emphasizing structured training, supervised scanning, governance, and ongoing professional support.[13] This implementation report illustrates how LUS can be incorporated into an existing clinical service, although it does not establish that implementation improves patient outcomes. A subsequent 2024 retrospective review by Lockstone et al. examined 40 physiotherapist-led LUS scans and their influence on clinical decision-making. Physiotherapy management changed following 11 of 40 scans (27.5%), while medical decision-making changed following 8 of 40 scans (20%).[16] These findings suggest that physiotherapy-led LUS may influence management decisions in intensive care. However, the study was retrospective and single-center, involved scans performed by one physiotherapist, and had incomplete reporting for some decision outcomes. Its findings should therefore be interpreted as evidence of clinical-decision impact rather than proof of improved patient outcomes.

Professional surveys provide additional information about current practice. In the international survey by Lau et al., 320 intensive care therapists from 30 countries participated, and 89 respondents reported using LUS. Among these 89 LUS users, 63 (71%) reported that their intensive care unit had no policy guiding therapist use of the technique, while 40 (45%) reported having no formal accreditation.[3] These results suggest potential gaps in governance and accreditation among respondents who used LUS, but they do not directly measure individual competence or demonstrate effects on patient outcomes. Mathew et al. conducted a global cross-sectional survey involving 514 respiratory therapists from 22 countries. Only 7% reported formal LUS certification, while 26.1% reported hands-on experience.[4] In a UK national survey of 168 accredited physiotherapists, Hayward et al. identified barriers to training and implementation, including limited access to mentors, protected scanning time, and suitable ultrasound equipment.[5] Together, these findings provide contextual evidence about workforce preparation and implementation constraints rather than clinical effectiveness.

The 2025 scoping review by Hayward et al. identified 133 studies involving physiotherapists, physical therapists, and respiratory therapists, illustrating the breadth of published research on therapist-related diaphragm and lung ultrasound.[9] However, publication volume and survey-reported uptake do not establish clinical effectiveness. These additional publications broaden the contextual evidence base but do not resolve uncertainty about patient-important outcomes. These studies support the importance of structured competency assessment, supervised practice, standardized documentation, and clear escalation pathways when LUS is introduced into respiratory therapy. Future implementation research should evaluate whether these arrangements improve the quality and consistency of clinical practice, while comparative clinical studies should separately determine whether ultrasound-informed decisions improve patient outcomes.

4.9. VENTILATOR LIBERATION

Lung ultrasound (LUS) and diaphragm ultrasound assess different aspects of respiratory function and may provide complementary information during ventilator-liberation assessment. Diaphragm ultrasound has been investigated for its ability to predict successful liberation from mechanical ventilation, particularly through measurements such as diaphragmatic excursion and thickening fraction. A 2023 systematic review and meta-analysis reported potentially useful diagnostic performance for these measurements. However, substantial heterogeneity across patient populations, measurement techniques, diagnostic thresholds, and weaning protocols limits the generalizability of the findings.[17] A 2026 systematic review by Cordeiro et al. examined the use of LUS during ventilator weaning and highlighted variability in the available evidence and the need for standardized assessment methods.[18] LUS may provide information about pulmonary aeration, while diaphragm ultrasound assesses diaphragmatic function. However, evidence supporting these individual applications does not, by itself, validate a combined LUS–diaphragm ultrasound strategy for predicting successful ventilator liberation.[19]

For respiratory therapists, ultrasound findings may be considered alongside spontaneous breathing-trial performance, respiratory mechanics, gas exchange, cough effectiveness, secretion burden, airway protection, neurological status, and overall clinical stability. Neither LUS nor diaphragm ultrasound should be used as a stand-alone determinant of extubation readiness. Furthermore, the cited reviews address the broader ventilator-liberation literature and do not establish that therapist-led ultrasound independently improves extubation success or other patient-important outcomes. Prospective studies are needed to determine whether standardized ultrasound-informed assessment adds predictive value beyond conventional clinical assessment and whether it improves clinical decisions or patient outcomes in respiratory therapy practice.

5. STRUCTURED CRITICAL APPRAISAL OF THE EVIDENCE

The subsequent literature provides a progressively broader picture of therapist-related LUS, but the evidential strength differs substantially between publications.

5.1. OVERALL INTERPRETATION OF THE EVIDENCE

The available evidence can be considered across three broad areas: clinical decision-making and implementation, measurement reliability and treatment responsiveness, and potential effects on patient-important outcomes.

First, evidence suggests that LUS can be incorporated into respiratory physiotherapy practice and may influence clinical decision-making. The systematic review by Lockstone et al. and the subsequent service evaluation by Swingwood et al. provide evidence of its potential clinical utility in this context.[8,15] However, changes in clinical decisions and clinician-reported assessments do not necessarily demonstrate improved diagnostic accuracy or patient outcomes. Second, the available evidence supports inter-rater agreement in LUS image scoring and the potential responsiveness of LUS scores to short-term changes following respiratory physiotherapy.[10,11] These findings support specific measurement and monitoring applications but do not independently establish the reliability of image acquisition across operators, diagnostic accuracy, or clinical effectiveness. Third, preliminary comparative evidence suggests that LUS-informed chest physical therapy may be associated with differences in mechanical ventilation duration, ICU length of stay, and complications. However, the 2025 comparative study by Chen et al. has important methodological limitations, including uncertainty surrounding allocation procedures and a discrepancy in the reported statistical analysis.[14] Consequently, the independent contribution of ultrasound guidance and the clinical significance of the reported differences remain uncertain.

The evidence is currently stronger for the potential clinical utility, implementation, and measurement applications of LUS than for its effectiveness in improving patient-important outcomes. Further well-designed multicenter comparative studies are required to determine whether incorporating LUS into respiratory therapy practice produces measurable clinical benefits.

6. CLINICAL IMPLICATIONS FOR RESPIRATORY THERAPISTS

Lung ultrasound (LUS) may provide additional anatomical information when integrated into respiratory assessment, but its clinical utility depends on the application, the available evidence, and the training and scope of practice of the operator. The studies reviewed in this article include therapist-led assessments, multidisciplinary clinical studies, implementation reports, and surveys of professional practice. These evidence types do not establish equivalent levels of clinical effectiveness. Accordingly, the potential applications discussed below should be interpreted according to the design and findings of the relevant studies. Evidence that LUS can characterize lung aeration, demonstrate changes in ultrasound scores, or influence clinical decisions does not, by itself, demonstrate improved patient outcomes. Where direct evidence from respiratory therapists is lacking, the proposed application is identified as a potential use or an area for future research rather than an established benefit.

6.1. ASSESSMENT OF WORSENING RESPIRATORY STATUS

In patients with worsening respiratory status, LUS may provide additional bedside information about pleural abnormalities, regional loss of aeration, and subpleural consolidation. These findings should be interpreted alongside oxygen saturation, respiratory rate, work of breathing, blood gas measurements, hemodynamic status, and other clinical findings. LUS may help characterize the distribution of pulmonary abnormalities and support further clinical assessment; however, ultrasound patterns should not be interpreted in isolation or assumed to establish a specific diagnosis without appropriate clinical correlation.[1,2] For respiratory therapists, LUS may serve as an adjunct to conventional respiratory assessment when monitoring changes in a patient's condition. However, the evidence reviewed in this article does not establish that therapist-led LUS assessment independently improves the recognition of deterioration or patient-important outcomes. Unexpected or concerning findings should be communicated through established multidisciplinary escalation pathways and interpreted within the clinician's scope of practice.

6.2. AIRWAY-CLEARANCE ASSESSMENT

LUS may help identify regional abnormalities in lung aeration and describe changes observed following airway-clearance interventions. However, changes in ultrasound findings should not automatically be interpreted as evidence of successful secretion clearance or improved clinical outcomes. The available evidence reviewed in this article does not establish that LUS-guided airway-clearance strategies improve treatment effectiveness or patient-centered outcomes. For respiratory therapists, LUS may be considered an adjunct to the assessment of patients undergoing airway-clearance interventions, alongside secretion burden, cough effectiveness, auscultation, respiratory mechanics, oxygenation, and the patient's clinical response.[8] Decisions about initiating, modifying, or discontinuing treatment should not be based on LUS findings alone. Further prospective studies are required to determine whether ultrasound-guided airway-clearance decisions provide measurable benefits compared with conventional assessment.

6.3. POSITIONING AND REGIONAL TREATMENT SELECTION

LUS may help identify regional loss of aeration and describe its distribution when considering patient positioning. In the positioning study discussed above, only 4 of 43 patients

Table 2. Structured critical appraisal of central publications

Publication	Design/sample	Ultrasound operator/ intervention provider	Comparator	Key numerical result	Key limitations	Appropriate inference
Lockstone et al.[8]	Systematic review and meta-analysis; 7 observational studies, 299 adults	Physiotherapists; diaphragm and lung ultrasound (DLUS), with operator roles varying across included studies	Varied observational designs	Changes in physiotherapy diagnosis: 63.9%; management: 16.8%; treatment: 48.4%.	Predominantly observational evidence; moderate risk of bias in 6/7 studies; heterogeneous methods; very-low-certainty treatment-response evidence.	Strongest prior synthesis; supports potential clinical utility and influence on decision-making, but does not establish clinical effectiveness.
Hansell et al.[10]	Prospective cohort; 43 mechanically ventilated adults	Physiotherapist-acquired LUS; respiratory physiotherapy intervention	Pre- and post-physiotherapy assessment	Mean total LUS score decreased by 2.9 points (95% CI, −4.4 to −1.4). Tidal volume change: 19 mL (95% CI, −7.4 to 44.5).	Single-center study; small sample; no randomized comparator; weak association between changes in LUS scores and radiological findings.	Supports short-term responsiveness of LUS scores following respiratory physiotherapy, but does not establish improved patient outcomes.
Hansell et al.[11]	Reliability study; 1,032 images obtained from 43 mechanically ventilated patients (repeated images nested within patients).	LUS performed by a physiotherapist; images independently reviewed by two physiotherapists	Independent image scoring by two physiotherapists	Overall kappa coefficient: 0.685 (95% CI, 0.650–0.720).	Image-based reliability assessment; does not evaluate inter-operator image-acquisition reliability or patient-important outcomes. Repeated images were obtained from 43 patients.	Supports inter-rater agreement in LUS image interpretation and scoring, not the reliability of image acquisition across different operators.
Hansell et al.[12]	Prospective cohort; 43 mechanically ventilated adults	Physiotherapist-selected positioning; LUS used to localize regional aeration loss	Conventional positioning assessment compared with LUS localization	Only 4 of 43 patients (9.3%) had a therapist-selected position that corresponded to the location of aeration loss identified by LUS.	Single-center study; small sample; LUS used as the reference method; no patient-important outcome endpoint.	Supports potential anatomical targeting using LUS, but does not establish improved outcomes from LUS-guided positioning.
Chen et al.[14]	Prospective comparative study; n=100 (50 per group)	LUS acquisition: designated ICU nurse with ICU physician collaboration/ support. Chest physical therapy: respiratory and rehabilitation therapists with nursing support.	Conventional assessment using auscultation and chest radiography	Mechanical ventilation: 7.03 ± 2.06 vs 8.25 ± 1.97 days. ICU stay: 11.62 ± 3.15 vs 13.67 ± 3.08 days. Complications: 3/50 (6%) vs 10/50 (20%).	Single-center study; limited sample size; lack of blinding; uncertainty regarding allocation concealment; conflicting descriptions of random-number-table allocation and odd/even ICU admission order; statistical reporting discrepancy for ICU length of stay; potential differences in operator experience and co-interventions.	Provides preliminary comparative findings favoring LUS-informed chest physical therapy. However, uncertainty regarding allocation procedures, statistical reporting, operator roles, and potential co-interventions limits confidence in the findings. Larger multicenter studies are required to establish whether the approach improves patient-important outcomes.
Swingwood et al.[15]	Prospective single-center service evaluation; 117 LUS scans; assessments performed by seven accredited	Seven accredited physiotherapists performed the assessments.	No control group	Diagnostic uncertainty reduced in 97% of assessments; interventions modified in 76%;	Single center; clinician-reported outcomes; no causal patient-outcome comparison	Supports feasibility and perceived clinical utility, but does not establish diagnostic accuracy or improved patient outcomes.

Publication	Design/sample	Ultrasound operator/ intervention provider	Comparator	Key numerical result	Key limitations	Appropriate inference
	physiotherapists.			potentially ineffective physiotherapy avoided in 73%.		
Lockstone et al.[13]	Implementation report; no patient cohort	Physiotherapists	Not applicable	No comparative numerical clinical outcome reported.	Implementation report; no comparative design or patient-outcome assessment.	Describes service development, structured training, supervised scanning, and governance; does not establish clinical effectiveness.
Lockstone et al.[16]	Retrospective implementation review; 40 LUS scans	Physiotherapist; scans performed by one physiotherapist	Before-and-after clinical decision-making assessment; no control group	Physiotherapy management changed in 11/40 scans (27.5%); medical decision-making changed in 8/40 scans (20%).	Retrospective, single-center review; one physiotherapist; missing reporting for some decision outcomes; no patient-outcome comparison.	Demonstrates potential influence on physiotherapy and medical decisions, but does not establish improved patient outcomes.
Mathew et al.[4]	Global cross-sectional survey; 514 respiratory therapists from 22 countries	Respiratory therapists	Not applicable	Formal LUS certification: 7%; hands-on LUS experience: 26.1%.	Self-reported survey; findings may not represent all respiratory therapists; does not directly assess clinical competence or patient outcomes.	Identifies gaps in formal certification and practical exposure; provides contextual evidence about training needs, not clinical effectiveness.

Abbreviations: CXR, chest radiography; DLUS, diaphragm and lung ultrasound; ICU, intensive care unit; LUS, lung ultrasound.

(9.3%) had a therapist-selected position that corresponded to the location of aeration loss identified by LUS.[12] This finding suggests a potential difference between ultrasound-localized abnormalities and positioning selected using conventional assessment; however, it does not establish that the selected positions were harmful or that LUS-guided positioning would improve treatment outcomes. For respiratory therapists, LUS may provide additional anatomical information when considering positioning strategies, but decisions should also account for the patient's oxygenation, hemodynamic stability, respiratory mechanics, clinical diagnosis, and tolerance of the proposed position. Current evidence does not demonstrate that LUS-guided positioning improves oxygenation, reduces ventilation duration or ICU stay, or accelerates recovery. Prospective comparative studies are needed to determine whether this approach offers clinically meaningful benefits.

6.4. MONITORING RESPONSE TO RESPIRATORY INTERVENTIONS

Serial LUS may help monitor changes in lung aeration following respiratory interventions. In the prospective treatment-response cohort discussed above, the LUS score decreased following physiotherapy.[10] This finding supports the potential use of LUS to detect short-term changes in ultrasound-assessed lung aeration. However, a reduction in LUS score should not, by itself, be interpreted as evidence of treatment success. Ultrasound findings should be considered alongside changes in oxygenation, respiratory mechanics, work of breathing, and other relevant clinical outcomes. The available evidence does not establish that LUS-guided monitoring improves patient-important outcomes or that changes in LUS scores consistently predict clinical recovery. For respiratory therapists, serial LUS may be a useful adjunct for documenting changes during treatment and supporting clinical reassessment. Further prospective studies are needed to determine whether incorporating LUS into treatment monitoring improves clinical decision-making or patient outcomes.

6.5. NON-INVASIVE VENTILATION AND HIGH-FLOW NASAL OXYGEN

Serial LUS may be investigated as an adjunct for monitoring patients receiving non-invasive ventilation (NIV) or high-flow nasal oxygen (HFNO). Changes in ultrasound findings could be assessed alongside respiratory rate, work of breathing, oxygen requirements, gas exchange, hemodynamic status, and the level of respiratory support. However, the evidence reviewed in this article does not establish that therapist-led LUS-guided management of NIV or HFNO improves treatment success, prevents intubation, reduces the duration of respiratory support, or improves other patient-important outcomes. These applications should therefore be considered potential areas for future research rather than established clinical benefits. Prospective studies should evaluate whether serial LUS measurements provide

additional predictive information, influence treatment decisions appropriately, and improve outcomes beyond conventional clinical assessment. Until such evidence is available, LUS findings should complement, rather than replace, established monitoring and escalation criteria.

6.6. VENTILATOR LIBERATION

Lung ultrasound (LUS) and diaphragm ultrasound assess different aspects of respiratory function and may provide complementary information during ventilator-liberation assessment. Diaphragm ultrasound can provide information about diaphragmatic function, whereas LUS can help characterize pulmonary aeration abnormalities.[17,18] However, evidence supporting these individual applications should not be interpreted as validation of a combined LUS–diaphragm ultrasound strategy for predicting successful liberation from mechanical ventilation.[19] For respiratory therapists, ultrasound findings may be considered alongside spontaneous breathing-trial performance, respiratory mechanics, gas exchange, cough effectiveness, secretion burden, airway protection, neurological status, and overall clinical stability. Neither LUS nor diaphragm ultrasound should be used as a stand-alone determinant of extubation readiness. Further prospective studies are needed to establish whether combined LUS and diaphragm ultrasound assessment provides additional predictive information beyond conventional ventilator-liberation assessment, and whether its use improves clinical decision-making or patient outcomes. These studies should also evaluate measurement reproducibility and the feasibility of therapist-led protocols. Until such evidence is available, ultrasound should remain an adjunct to established ventilator-liberation assessment rather than a replacement for comprehensive clinical evaluation.

7. TRAINING, SCOPE OF PRACTICE, AND GOVERNANCE

A therapist-led lung ultrasound (LUS) program should establish educational, competency, and governance requirements before clinicians undertake independent scanning. A proposed framework for point-of-care ultrasound by respiratory physiotherapists emphasizes the importance of clearly defined scope of practice, structured education, competency assessment, and clinical governance.[20] These principles may also inform respiratory therapist programs; however, their application should account for differences in professional roles, local regulatory requirements, and institutional policies.

Training should include ultrasound physics, probe handling, image optimization, lung and pleural anatomy, common LUS patterns, limitations of the technique, structured scanning protocols, documentation, recognition of unexpected findings, and appropriate escalation procedures. Competency should be demonstrated through supervised examinations and assessment against predefined criteria for both image acquisition and image interpretation. Assessment should include probe handling, image optimization, recognition of normal and abnormal patterns, interpretation in the clinical context, documentation, and appropriate escalation. Course attendance alone should not be considered evidence of independent clinical competence.

Young et al. described a lung ultrasound training curriculum for respiratory therapists, providing profession-specific evidence relevant to structured education and practical skill development.[21] Such training initiatives support the inclusion of theoretical instruction, supervised practical experience, and competency assessment within an educational pathway. However, completion of a short course alone should not be considered sufficient evidence of independent clinical competence.

A structured program should include:

- Formal theoretical education.
- Supervised scanning.
- Standardized scanning protocols.
- Assessment of image acquisition and interpretation.
- Documented competency requirements.
- Ongoing quality assurance.
- Access to experienced supervision.
- Defined escalation pathways.
- Periodic review of competency.

These proposed implementation components are consistent with the therapist-focused LUS framework and available evidence on training and supervision, although optimal competency standards and assessment requirements remain to be established.[20-22]

7.1. DOCUMENTATION

Each LUS examination should be linked to a clearly defined clinical question.

Documentation should include:

1. The clinical indication.
2. The anatomical regions examined.
3. Relevant LUS findings.
4. Limitations or technically difficult views.
5. Interpretation in the context of the overall clinical assessment.
6. The clinical action taken following the examination.

Unexpected or potentially significant findings should be communicated through an established multidisciplinary escalation pathway.

7.2. MULTIDISCIPLINARY INTEGRATION

Therapist-led LUS should be integrated into multidisciplinary respiratory care rather than developed as an isolated diagnostic service. The appropriate model will vary according to institutional structure, professional regulations, available expertise, and local governance. LUS should complement, rather than automatically replace, physician assessment, chest radiography, computed tomography, or other investigations when clinically indicated.

One practical model is an iterative clinical cycle:

Table 3. Potential applications of LUS within respiratory therapy practice

Clinical question	Potential contribution of LUS	Complementary assessment	Evidence interpretation	Supporting references
What may explain worsening oxygenation?	Identify regional loss of aeration, consolidation, interstitial patterns, pleural effusion, or other pleural abnormalities.	Oxygen saturation, work of breathing, blood gas measurements, hemodynamic status, and clinical examination.	Potential adjunct to clinical assessment; improved patient outcomes from therapist-led LUS are not established.	1,2,8
Is airway-clearance intervention indicated?	Characterize regional aeration abnormalities and assess ultrasound changes following treatment.	Secretion burden, cough effectiveness, auscultation, respiratory mechanics, and clinical response.	Potential application; evidence that LUS-guided airway clearance improves treatment success or patient outcomes remains insufficient.	8
Which patient position may be appropriate?	Identify and localize regional loss of aeration that may provide additional anatomical information when considering patient positioning.	Clinical status, oxygenation, hemodynamic stability, and tolerance of the proposed position.	Localization may be informative; improved outcomes from LUS-guided positioning have not been demonstrated.	12
Has lung aeration changed after treatment?	Compare pre- and post-intervention LUS patterns or scores.	Oxygenation, respiratory mechanics, work of breathing, and other relevant clinical outcomes.	Evidence supports detection of short-term ultrasound changes in the studied cohort; clinical benefit cannot be inferred from score changes alone.	8
How is respiratory status changing during NIV or HFNO?	Investigate serial changes in ultrasound patterns alongside changes in respiratory status.	Respiratory rate, work of breathing, gas exchange, oxygen requirements, and level of respiratory support.	Research application; therapist-specific comparative evidence demonstrating improved outcomes is limited.	No direct therapist-specific comparative evidence identified
Is the patient progressing towards ventilator liberation?	Assess pulmonary aeration using LUS; diaphragm ultrasound may provide complementary information about diaphragmatic function.	Spontaneous breathing-trial performance, respiratory mechanics, gas exchange, cough effectiveness, secretion burden, and airway protection.	Adjunctive information only. Diaphragm and lung ultrasound have been investigated in ventilator-liberation assessment; however, the available evidence does not establish a combined LUS–diaphragm ultrasound strategy as a stand-alone predictor of successful extubation.	17-19

Abbreviations: LUS, lung ultrasound; NIV, non-invasive ventilation; HFNO, high-flow nasal oxygen.

Define the clinical question → Perform LUS → Integrate findings with physiology and clinical examination → Intervene → Reassess → Escalate or modify treatment when appropriate.

8. STRENGTHS AND LIMITATIONS

The principal strength of this article is its focused clinical question and explicit separation of therapist-led or therapy-relevant LUS evidence from the broader general LUS literature. The targeted update incorporates post-cutoff publications addressing treatment selection, implementation, comparative therapy, and service evaluation. It also considers complementary pre-cutoff reliability evidence from Hansell et al., whose publication was available online in November 2022, before the earlier systematic review's search cutoff. This distinction ensures that measurement reliability evidence is not incorrectly presented as newly published post-cutoff evidence.[11] An additional strength is the explicit consideration of relationships between publications and their underlying patient cohorts. This is particularly relevant to the Hansell research program, in which the treatment-response, inter-rater reliability, and positioning publications involved the same 43-patient clinical population.[10-12] Recognizing this overlap reduces the risk of counting the same participants multiple times when interpreting the available evidence.

The principal limitation is that this article is a targeted narrative evidence update rather than a de novo systematic review. The supplementary search did not involve a simultaneous, comprehensive search across multiple databases such as PubMed, Embase, CINAHL, CENTRAL, and Scopus. Instead, the earlier systematic review was used as the principal prior synthesis, followed by targeted PubMed and web-indexed searches and citation chasing. Consequently, the update may not have identified all relevant publications, and the possibility of publication and selection bias cannot be excluded. A second limitation is the heterogeneity of the subsequent publications. The evidence includes prospective clinical studies, reliability research, implementation reports, service evaluations, surveys, scoping reviews, systematic reviews, and professional frameworks. These sources address different research questions and should not be combined as though they provide equivalent

evidence of clinical effectiveness. A third limitation concerns the generalizability of therapist-specific findings. Some ultrasound literature involves physicians, nurses, sonographers, or other professionals rather than respiratory therapists or physiotherapists. Findings from such studies may provide useful contextual information but cannot automatically be interpreted as evidence for therapist-led LUS.

Finally, the available clinical studies are generally small, frequently single-center, and heterogeneous in LUS protocols, treatment approaches, operator experience, comparators, and outcome definitions. The differences in study design and outcome measurement limit direct comparability across publications. Therefore, the findings of this targeted narrative update should be interpreted qualitatively rather than combined into a new quantitative synthesis.

9. FUTURE RESEARCH

Future research should move beyond demonstrating the feasibility of therapist-performed lung ultrasound (LUS) and determine whether incorporating ultrasound findings into respiratory therapy decisions improves clinically meaningful patient outcomes. Studies should distinguish between the ability to acquire and interpret ultrasound images, changes in clinical decision-making, and measurable improvements in patient outcomes. Prospective multicenter comparative studies should evaluate standardized LUS-guided treatment algorithms against conventional respiratory assessment.

Important research questions include:

1. Does LUS-guided airway clearance improve treatment success?
2. Does LUS-guided positioning improve regional aeration and oxygenation?
3. Can serial LUS identify early deterioration or failure of respiratory support?
4. Does LUS-guided respiratory therapy reduce the duration of mechanical ventilation?
5. Does combining lung and diaphragm ultrasound provide additional predictive information beyond conventional ventilator-liberation assessment, and can its use improve clinical decision-making or patient-important outcomes?
6. Does LUS-guided care reduce ICU length of stay or respiratory complications?
7. Does formal LUS competency training improve measurement reliability and clinical performance?

Future studies should prespecify the ultrasound operator, level of training, scanning protocol, scoring system, treatment algorithm, comparator, co-interventions, and primary outcomes. Patient-important outcomes should be prioritized, including duration of mechanical ventilation, ICU length of stay, treatment failure, escalation of respiratory support, complications, functional recovery, and mortality where appropriate. Studies should also clearly report whether multiple publications originate from the same underlying cohort. This will improve interpretation of the accumulating evidence and reduce the risk of double-counting participants. Implementation research should examine whether therapist-led LUS influences diagnostic investigations, treatment selection, multidisciplinary communication, resource utilization, and the avoidance of potentially unnecessary or ineffective interventions. Such studies should assess both implementation outcomes and patient-important clinical outcomes. Demonstrating that a service is feasible or changes clinician behavior is important, but does not by itself establish improved patient health.

10. CONCLUSION

Lung ultrasound (LUS) represents a potentially valuable adjunct to respiratory therapy, particularly for identifying regional loss of aeration, informing treatment selection, and monitoring short-term changes following respiratory interventions. The available literature suggests that therapist-performed or therapist-integrated LUS is feasible and can influence clinical assessment and decision-making. The earlier systematic review provides the principal synthesis of evidence in acute respiratory physiotherapy, while subsequent studies contribute additional findings on measurement reliability, implementation, positioning, treatment response, and service-level clinical integration.[8,10-16]

However, the evidence remains heterogeneous and is predominantly based on observational, single-center, or service-level studies. Current evidence is more supportive of the potential clinical utility of LUS than of its effectiveness in improving patient-important outcomes. Changes in clinical decisions do not necessarily indicate greater diagnostic accuracy or improved patient outcomes. Similarly, changes in LUS scores following treatment demonstrate changes in ultrasound-assessed lung aeration but do not independently establish treatment success.[8,10] Implementation of therapist-integrated LUS should therefore occur within a structured multidisciplinary framework that includes formal education, supervised competency assessment, standardized documentation, appropriate escalation pathways, and institutional governance. Professional scope of practice must remain consistent with local regulations and institutional policies.[20-22] Future research should prioritize prospective, multicenter comparative studies with standardized ultrasound protocols, transparent reporting of operator competency, and clearly defined patient-important outcomes. Such studies are necessary to establish whether incorporating ultrasound into respiratory therapy assessment and treatment decisions provides clinically meaningful benefits beyond conventional respiratory care.

CONFLICT OF INTEREST / COMPETING INTERESTS

The authors declare no conflicts of interest relevant to this work.

ETHICS APPROVAL AND CONSENT

This targeted narrative review did not involve human participants, animals, or identifiable personal data and therefore did not require ethical approval or informed consent.

THIRD-PARTY MATERIAL PERMISSIONS

No third-party material requiring permission has been reproduced in this manuscript.

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DATA AVAILABILITY

No original dataset was generated for this article. All information discussed and critically appraised in this targeted narrative review was derived from the published sources cited in the manuscript.

TRIAL REGISTRATION

This article does not report a clinical trial and therefore did not require trial registration.

PROTOCOL REGISTRATION

No prospective protocol was registered for this targeted narrative evidence update.

REPORTING GUIDELINES

This article is a targeted narrative evidence update rather than a systematic review or meta-analysis. PRISMA 2020 reporting guidelines were therefore not applicable. The methods used to identify, select, classify, and critically appraise the literature are described transparently in the Methods section.

AI TOOL USE DISCLOSURE

Artificial intelligence tools were used for language editing and formatting only. They were not used to make clinical or scientific judgments. All content, interpretations, citations, and references were reviewed and verified by the authors.

PUBLICATION AND PREPRINT DISCLOSURE

This manuscript, or a substantially equivalent version of it, has not been previously published, has not been posted as a preprint, and is not currently under consideration by another journal.

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Supplementary Table S1. Key publications identified after 18 April 2023

Publication	Year	Evidence category	Main contribution
Lockstone et al.[13]	2023	Implementation	Physiotherapy-led LUS service and governance
Chen et al.[14]	2025	Comparative clinical study	LUS-informed chest physical therapy
Swingwood et al.[15]	2026	Service evaluation	Influence of physiotherapy-led LUS on clinical decisions
Lockstone et al.[16]	2024	Retrospective implementation review	Changes in physiotherapy and medical decisions
Mathew et al.[4]	2024	Professional survey	Respiratory therapist knowledge, attitudes, and practices
Hayward et al.[5]	2026	Professional survey	Training and implementation among UK physiotherapists
Parada-Gereda et al.[17]	2023	Systematic review	Diaphragm ultrasound in ventilator weaning
Cordeiro et al.[18]	2026	Systematic review	LUS during ventilator weaning
Al Radaideh et al.[19]	2026	Systematic review	Combined diaphragm and lung ultrasound in ventilator liberation
Hayward et al.[9]	2025	Scoping review	Mapping of therapist-related diaphragm and lung ultrasound literature
Hansell et al.[12]	2025	Prospective cohort study	Concordance between therapist-selected positioning and LUS-identified regional aeration loss