

# Resume af protokolartikler

## Point-of-care focused lung ultrasound in emergency medicine: Protocol for a scoping review

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Resumé af afhandling

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### Introduction

Point-of-care focused lung ultrasound is a core competency in emergency medicine (1–4) that differs from consultative and comprehensive ultrasound (i.e., echocardiography and obstetric and radiographic ultrasound) (5, 6). “Point-of-care” comprises an exam performed at the patient’s bedside by the clinician, while “focused” refers to a “goal-directed” exam limited to specific binary questions (5, 7).

Meta-analyses of the diagnostic accuracy of point-of-care focused lung ultrasound have shown promising results for pneumothorax, pleura effusion, interstitial syndrome, pulmonary embolism, and pneumonia (8–12). During the COVID-19 pandemic, studies have shown that point-of-care focused lung ultrasound can diagnose and predict the severity of SARS-CoV-2 infection (13, 14). Also, with a symptom-based approach to evaluating dyspneic emergency department patients, point-of-care focused lung ultrasound has been shown to improve diagnostic accuracy (15–17). However, a meta-analysis on this patient population found that evidence of patient-relevant outcomes was lacking (18).

In general, a paucity of evidence on patient-relevant outcomes seems pivotal for the further implementation of point-of-care ultrasound (5, 19). In addition to this shortcoming, it appears that few randomized controlled trials have been published (20, 21). The patient relevance of the outcomes and the strength of the study design are two distinct study characteristics. To categorize studies according to the patient relevance of the outcomes, a hierarchical model was suggested by Fryback and Thornbury, which starts with the technical outcomes and peaks with the patient-centered or societal outcomes (22).

A methodological mapping of existing studies within a research field can guide future studies and systematic reviews (23). Therefore, the objective of this scoping review is to provide an overview of original research on point-of-care focused lung ultrasound in emergency medicine, with an emphasis on the study design and the patient relevance of the outcomes

## Methods

The proposed scoping review will be conducted in accordance with the Joanna Briggs Institute methodology for scoping reviews, and the reporting will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) statements (24, 25).

### Review questions

- Which study designs are used in original point-of-care focused lung ultrasound studies in emergency medicine, and what are the temporal trends?
- Which patient relevant outcomes are used in original point-of-care focused lung ultrasound studies in emergency medicine, and what are the temporal trends?
- Which methodological features are used, in terms of the sampling methods (convenience/consecutive), the diagnostic role of ultrasound (triage, add-on, or replacement), and the number of sonographers, the expertise of sonographers (training and experience), and the roles of sonographers (treating physicians or investigators)?

#### Hvad tilføjer dette studie?

- En metodisk kortlægning af eksisterende original forskning i point-of-care fokuseret lungeultral lyd i akutmedicin med særlig vægt på studie design og patient-relevansen af endemål

#### Hvad ved vi?

- Diagnostiske studier af point-of-care fokuseret lungeultral lyd har vist lovende diagnostiske resultater for pneumothorax, pleura effusion, interstitielt syndrom, lungeemboli og pneumoni

## Search strategy and eligibility criteria

We will search the PubMed/MEDLINE, EMBASE, Web of Science, Scopus, and Cochrane Library databases. The full search strategy has been created with the assistance of an affiliate research librarian (see Supplement I). The initial search will be repeated, and new studies will be screened immediately after the first data extraction to increase topicality. Additional studies will be identified by handsearching the bibliographies and citations of the articles proceeding to full-text screening.

We will include original quantitative studies on point-of-care focused lung ultrasound in adult emergency department patients (i.e., case-series, randomized controlled trials, and cohort, case-control, or cross-sectional studies). Point-of-care focused lung ultrasound is a multi-specialty discipline, and some studies may include physicians and patients from various departments. If no patients from the emergency department are included, such studies will not be considered in this review.

We will exclude studies in which a peer-reviewed, English manuscript is not available. Any reviews, protocols, meta-analyses, case studies, letters, conference abstracts, or exclusively qualitative studies will be excluded. Studies investigating comprehensive thoracic ultrasound (i.e., mediastinal lymph nodes, diaphragmatic movement, contrast-enhanced or procedural lung ultrasound) are beyond the scope of this review and will be excluded. Only studies in which physician-performed ultrasound is investigated will be included. Lastly, simulation studies will be excluded (i.e., simulated settings, simulator manikins, or simulated patients).

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## Study selection

After duplicate removal, two authors will screen the titles and abstracts independently and in duplicate. Then, the two authors will screen all potentially eligible studies in full text, independently and in duplicate. Any disagreements will be resolved via discussion between the two reviewers and the last author if needed. The final report will include a Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) diagram showing the number of studies remaining after each stage of the selection process, including the reasons for excluding full-text articles (26). We will use Covidence® (www.covidence.org) for the study selection and data extraction.

## Data extraction

The following data will be extracted: first author last name, year, countries included, number of sonographers, sonographer profession, sonographer specialty, sonographer expertise (years, number of scans, and course experience), sonographer role (i.e., treating physician or investigator), ultrasound modality, transducer, lung ultrasound protocol, ultrasound diagnostic role, sample size, study design, sampling method, blinding, intervention, comparator, golden standard, primary outcome measure, secondary outcomes, and patient relevance of the outcome.

First, data from 20 studies will be extracted independently, in duplicate, and discussed by three authors. Amendments to the data extraction instrument can be made based on this discussion. Then all data extractors will pilot the data extraction instrument on three studies and followingly, calibrate the extraction instrument in a final joint discussion. Duplicate data extraction, equally distributed among data extractors, will be performed on

a random sample of 20% of all included papers. From this independent duplicate data extraction, inter-observer variability measures will be presented. The data extraction on the remaining 80% of included studies will be performed by a single extractor. Because this is a scoping review, no bias assessment will be performed(25).

Whenever possible, the study design will be extracted verbatim. For the patient relevance of the outcome, the hierarchy proposed by Fryback and Thornbury will be applied to the primary study outcome in accordance with the examples presented in *Table 1*, adapted from Provenzale et al. (22, 27).

## Data synthesis

A narrative synthesis of all the included studies will be conducted, emphasizing the study designs and the patient relevance of the outcomes. Figures and charts will summarize time-related trends, method characteristics, and outcomes. All the data fields mentioned above will be tabulated in supplementary files.

## Dissemination

The results of this scoping review will be submitted for publication in an international peer-reviewed journal regardless of the findings. If any protocol amendments are necessary, they will be clarified in the final report.

### Hvordan kan det bruges i danske akutmodtagelser?

- Kortlægningen af studie designs og patient-relevans af endemål vil vejlede fremtidige studier og systematiske reviews i forsøget på at vejlede klinikere og patienter til den mest hensigtsmæssige brug af point-of-care fokuseret lungeultral lyd i akutmedicin.

Level 1	A study that assesses the technical quality of images.
Level 2	A study that correlates the presence or absence of, e.g., pneumothorax on computed tomography with its presence on point-of-care focused lung ultrasound.
Level 3	A study in which point-of-care focused lung ultrasound changed the probable diagnosis in patients.
Level 4	A study that shows that patients with a pathologic finding on point-of-care focused lung ultrasound were consequently given a different treatment more often than those in whom there was no pathology.
Level 5	A study that demonstrates that patients who underwent point-of-care focused lung ultrasound had a better clinical outcome (not just a more accurate diagnosis or more appropriate treatment).
Level 6	Societal efficacy might be demonstrated by a cost-effectiveness analysis.

*Table 1*

## Discussion and conclusion

This scoping review will provide a novel overview that cannot be synthesized or mapped in systematic reviews. The mapping of the study designs and the patient relevance of the outcomes will guide future studies and systematic reviews in the effort to advise clinicians on the most appropriate use of point-of-care focused lung ultrasound in emergency medicine. It will also contribute an overview of field-specific methodological and sonographer characteristics, enabling researchers to identify shortcomings to abandon and advancements to cultivate. The outlined review has some limitations. First, non-English-language and gray literature are omitted, although this may affect the degree of publication bias and narrow the range of methodological nuances. However, it is unlikely that their inclusion would contribute to studies at the upper end of Fryback and Thornbury's hierarchy. This decision is pragmatic since we expect that this review's broad scope and the tremendous research activity in the field will yield many studies for inclusion. Second, the limitation of scoping only studies of emergency department patients does not reflect clinical rationality in all contexts or settings, since emergency

departments' organization, nomenclature, and patient population vary considerably. We acknowledge that some potentially informative and relevant studies may be left out by this limitation. However, we regard this limitation as a potential strength and a necessity, since the emergency department setting involves some unique attributes regarding disease clarification, diagnostic process, acuity, and patient diversity. Third, we apply an unvalidated hierarchy (Fryback and Thornbury) to categorize the patient relevance of the outcomes (22). However, we are not aware of alternative hierarchies. Patient relevance constitutes an independent research field, and the development of hierarchies and definitions should be investigated in detail elsewhere with the involvement of patients and stakeholders; this is beyond the scope of this review. Finally, nonduplicate data extraction will be performed, which might moderate data extraction accuracy. Since no raw estimates will be extracted and no risk of bias assessment performed, we regard this limitation as a fair trade-off taking the expected massive number of included studies into consideration. Inter-observer measures from a duplicate process in 20% of included

studies will be performed to inform the potential impact of this decision.

In conclusion, this scoping review will provide an overview of original research in point-of-care focused lung ultrasound in emergency medicine, emphasizing the study design and the patient relevance of the outcomes. This will guide the design of future studies and systematic reviews in this field.

## Contributorship

Study design: All authors. Drafting of protocol: SHO. Revision of protocol for critically important intellectual content: All authors. Guarantor: SHO and JW. All authors approved the final version of the protocol.

## Conflicts of interests

None of the authors have any conflicts of interest to report.

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