

## Ultrasound in anesthesiology in the Nordic countries

### Protocol of an international survey on availability, frequency of use, operator training, and certification

Nielsen, Martine S.; Grejs, Anders M.; Nielsen, Anders B.; Konge, Lars; Brøchner, Anne C.

*Published in:*  
Acta Anaesthesiologica Scandinavica

*DOI:*  
10.1111/aas.14482

*Publication date:*  
2024

*Document version:*  
Final published version

*Document license:*  
CC BY

*Citation for pulished version (APA):*  
Nielsen, M. S., Grejs, A. M., Nielsen, A. B., Konge, L., & Brøchner, A. C. (2024). Ultrasound in anesthesiology in the Nordic countries: Protocol of an international survey on availability, frequency of use, operator training, and certification. *Acta Anaesthesiologica Scandinavica*, 68(9), 1279-1282. <https://doi.org/10.1111/aas.14482>

Go to publication entry in University of Southern Denmark's Research Portal

#### Terms of use




This work is brought to you by the University of Southern Denmark.  
Unless otherwise specified it has been shared according to the terms for self-archiving.  
If no other license is stated, these terms apply:

- You may download this work for personal use only.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying this open access version

If you believe that this document breaches copyright please contact us providing details and we will investigate your claim.  
Please direct all enquiries to [puresupport@bib.sdu.dk](mailto:puresupport@bib.sdu.dk)

## RESEARCH ARTICLE

# Ultrasound in anesthesiology in the Nordic countries—Protocol of an international survey on availability, frequency of use, operator training, and certification

Martine S. Nielsen<sup>1,2,3</sup>  | Anders M. Grejs<sup>4,5</sup>  | Anders B. Nielsen<sup>2,6</sup>  |  
Lars Konge<sup>2,7</sup>  | Anne C. Brøchner<sup>1,3</sup> 

<sup>1</sup>Department of Anaesthesiology and Intensive Care, Lillebaelt University Hospital, Kolding, Denmark

<sup>2</sup>Research Unit of Medical Education, Department of Clinical Research, University of Southern Denmark, Odense, Denmark

<sup>3</sup>Department of Regional Health Research, Region of Southern Denmark, Odense, Denmark

<sup>4</sup>Department of Intensive Care Medicine, Aarhus University Hospital, Aarhus, Denmark

<sup>5</sup>Department of Clinical Medicine, Aarhus University, Aarhus, Denmark

<sup>6</sup>Department of Anesthesiology and Intensive Care, Odense University Hospital, Svendborg, Denmark

<sup>7</sup>Copenhagen Academy for Medical Education and Simulation, Center for HR & Education, The Capital Region of Denmark, Copenhagen, Denmark

## Correspondence

Martine S. Nielsen, Department of Anaesthesiology and Intensive Care, Lillebaelt University Hospital, Sygehusvej 24, DK-6000 Kolding, Denmark.

Email: [martine.siw.nielsen@rsyd.dk](mailto:martine.siw.nielsen@rsyd.dk)

## Abstract

**Background:** Over the past decade, ultrasound utilization has increased within anesthesia and intensive care medicine, enhancing patient safety and diagnostic accuracy. However, the frequency of ultrasound usage and operator training in the Nordic countries remain unclear. This project aims to perform a survey on ultrasound availability, daily clinical use, and how ultrasound skills are trained and assessed, among anesthesiologists.

**Methods:** This online cross-sectional survey will include anesthesiologists from the Nordic countries. The survey will adhere to the CROSS checklist. Survey items will be developed based on a formative model with a conceptual model, consisting of three main parts, including demographics, ultrasound machines and use, and skills development and assessment. The clinical relevance of items will be secured by including anesthesiologists of various levels of experience in the development of the survey. Furthermore, experienced researchers in medical education will participate in the development, contributing with relevant medical educational perspectives. Data will be summarized using a non-parametric descriptive approach. A chi-squared test will examine relevant relationships between certain answers.

**Results:** Results will be published in a peer-reviewed journal and presented at relevant scientific conferences and meetings.

**Conclusion:** This study may find a high availability of ultrasound machines and frequent use in the clinical departments. Despite this expected daily use of ultrasound, missing standardized structured skills acquisition and assessment could be uncovered. The results of this study may contribute to mapping various aspects of clinical ultrasound and skills development for further use in research.

## KEYWORDS

anesthesiology, operator training, survey, ultrasound, ultrasound availability, ultrasound certification

## 1 | INTRODUCTION

Through the last decade, there has been a significant increase in the use of ultrasound. Implementation has been conducted in many specialities such as emergency medicine,<sup>1</sup> obstetrics and gynaecology,<sup>2</sup> anaesthesiology,<sup>3</sup> internal medicine,<sup>4</sup> radiology,<sup>5</sup> and cardiology.<sup>6</sup>

Much evidence supports ultrasound as an aid to traditional techniques, as it improves safety during medical procedures,<sup>7,8</sup> and may aid diagnostic accuracy.<sup>6,9</sup> Overall, this substantiates a generally positive attitude towards using ultrasound, and both ultrasound machines and handheld ultrasound devices are in rapid development reflecting the continuously increasing interest.

Ultrasound guidance may be considered an integral part of clinical anesthesia, as it is recommended as best practice in procedures such as central venous catheters<sup>10,11</sup> and regional anesthesia.<sup>12</sup> Furthermore, ongoing development of anesthesia-applicable protocols to standardize the use of focused examination, for example, Focused Assessment with Sonography for Trauma (FAST)<sup>13</sup> and Focus-Assessed Transthoracic Echocardiography (FATE)<sup>14</sup> is seen. To ensure adequate technical skills and interpretation, the development of simulation-based curricula and tests are also developed, both being important factors if the implementation of ultrasound is to be achieved.<sup>15-17</sup> However, as an introduction of new treatments, the implementation of ultrasound is a priority within the individual hospital's budget for equipment and training.<sup>18</sup> Consequently, ultrasound competes as an option against more conservative methods.

Although ultrasound is considered the best practice in some of the anesthetic procedures, and a useful component in others, the prevalence of ultrasound utilization in the Nordic countries and integration of standardized ultrasound curricula remain unknown. Surveying these factors may contribute to the further integration of ultrasound procedures and skills development in clinical practice.

## 2 | AIM

We aim to perform a survey on ultrasound availability, daily clinical use, and how ultrasound skills are trained and assessed, among anesthesiologists in the Nordic countries.

## 3 | METHODS

### 3.1 | Study design and participants

This study will be an online cross-sectional survey.

Participants will be anesthesiologists with different experience levels, working in a department of Anaesthesiology and Intensive Care in Denmark—including the Faroe Islands and Greenland, Finland,

Iceland, Norway, and Sweden. Inclusion will aim to include physicians from a broad range of hospital sizes.

### 3.2 | Survey development

The survey and final manuscript will be described following the CROSS checklist.<sup>19</sup>

A literature search will be conducted, to identify existing surveys covering the variables intended to be addressed in this project. Subsequently, the content of the questionnaire will be developed. Contributions from the population of interest will be secured by including anesthesiologists of various levels of experience in the development of the survey. Furthermore, experienced researchers in medical education will participate in the development, contributing with relevant medical educational perspectives.

Survey items will be developed guided by published literature, including recommendations such as using an appropriate unbiased vocabulary, using response anchors that emphasize the construct being measured,<sup>20</sup> and choosing relevant response options for each item. Finally, a pilot test will be conducted, by inviting participants of the target population to complete the survey via Research Electronic Data Capture (REDCap)<sup>21</sup> provided by the independent research support unit Open Patient Data Explorative Network (OPEN) as per the intended methodology.

The survey will be developed based on a formative model and in written English.

The survey's content will be developed on a conceptual model, consisting of three main parts, including demographics, ultrasound machines and use, and skills development and assessment.

Question variables will be answered using a mix of close-ended questions, dichotomic answers, and various Likert-type response anchors.

#### *Demographics:*

- Country you primarily work in (Denmark (including Greenland and The Faroe Islands), Finland, Iceland, Norway, or Sweden)
- Years as a physician
- Years working in anaesthesiology and/or intensive care medicine (e.g., <2 years, 2–5 years, or >5 years)
- Primarily working with: Intensive care medicine, anaesthetics, pain and palliation or pre-hospital care (multiple answers possible)
- Number of specialist-trained anesthesiologists in your department

#### *Ultrasound machine and use:*

- Number of ultrasound machines in your department
- How often is the ultrasound machine available when you need it? (Almost never, once in a while, sometimes, often, almost always)
- Indicate the type(s) of ultrasound machine(s) you use (pictures)
- Indicate the type(s) of ultrasound probe(s) you use (pictures)

- Which procedures do you perform using ultrasound? (multiple answers possible)
- How often do you use ultrasound in your clinical work? (never, less than monthly, monthly, weekly, daily)

#### *Skills development and assessment:*

- How did you learn the theoretical knowledge necessary to use ultrasound?
  - For example, In-person course, e-learning, congress, YouTube, other.
- How did you learn the practical skills?
  - For example, Clinical experience, simulation course, other.
    - Have you received an assessment of your competencies in ultrasound-assisted procedures—(y/n)
      - If yes, how?
    - Do you have any ongoing maintenance requirements to ensure the retention of competence in ultrasound-assisted procedures?—(y/n)
      - If yes, how?

*Additional comments on the use of ultrasound, if any:*

### 3.3 | Survey administration

Participants will be invited via email, in agreement with the chief physician of the relevant departments. Data will be obtained and kept through an online survey using REDCap.

Each participating department will receive a unique link, making it possible to track the answer percentage while still maintaining anonymity. An email reminder will be sent out 3 weeks following the initial invitation.

### 3.4 | Statistical analysis

Data will be analyzed in the latest version of R.<sup>22</sup> Data will mainly be analyzed and summarized using a non-parametric descriptive approach. A chi-squared significant test will examine relevant relationships between certain answers. All statistics will be considered at a significance level of  $p < .05$ .

### 3.5 | Ethics

A notification was sent to the regional Scientific Ethics Committee in the Region of Southern, which deemed the study exempt (case number S-20242000-87). The project is registered in the Internal Research Register in the Region of Southern Denmark (case number 24/22467).

Survey responses will be anonymized. All data will be handled and kept on a secure server hosted by OPEN. MSN will have access to the server, and logins will be tracked and supervised.

## 4 | DISCUSSION

In this study, it is anticipated to find a high availability of ultrasound machines in the clinical departments. Furthermore, increased use of ultrasound in clinical procedures compared to previous international surveys could be presented as this study's focus is on describing highly industrialized countries' ultrasound approach.<sup>23–26</sup> Despite this expected finding of increasing use, missing standardized structured skills acquisition and assessment could be uncovered. Previously described barriers against ultrasound training in anesthesia are a lack of trained providers, a lack of training opportunities, and a lack of simulation space.<sup>25</sup> This study may be able to accommodate whether these barriers also apply to Nordic countries by presenting how departments are oriented towards securing adequate competencies. The results of this study may contribute to mapping various aspects of clinical ultrasound and skills development for further use in research.

This study may have limitations such as self-reported data, which may not precisely reflect clinical practice. Furthermore, as survey participation is voluntary, only a selected population might contribute—risking an overrepresentation of physicians with strong opinions on the matter. A risk of a moderate response rate could also pose a possible limitation.

### AUTHOR CONTRIBUTIONS

MSN and ACB conceived the study. MSN and ACB drafted the manuscript. ABN, AMG, and LK all provided critical revisions to the manuscript. All authors read and approved the final version of the manuscript.

### FUNDING INFORMATION

There has been no financial support for this work that could have influenced its outcome.

### CONFLICT OF INTEREST STATEMENT

We wish to confirm there are no known conflicts of interest associated with this article.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### ORCID

Martine S. Nielsen  <https://orcid.org/0000-0002-5999-3372>

Anders M. Grejs  <https://orcid.org/0000-0002-8850-2982>

Anders B. Nielsen  <https://orcid.org/0000-0003-0315-7823>

Lars Konge  <https://orcid.org/0000-0002-1258-5822>

Anne C. Brøchner  <https://orcid.org/0000-0001-6453-6152>

### REFERENCES

1. Atkinson P, Bowra J, Lambert M, Lamprecht H, Noble V, Jarman B. International Federation for Emergency Medicine point of care ultrasound curriculum. *CJEM*. 2015;17:161-170.

2. Leonardi M, Murji A, D'Souza R. Ultrasound curricula in obstetrics and gynecology training programs. *Ultrasound Obstet Gynecol.* 2018;52:147-150.
3. Li L, Yong RJ, Kaye AD, Urman RD. Perioperative point of care ultrasound (POCUS) for anesthesiologists: an overview. *Curr Pain Headache Rep.* 2020;24:20.
4. Laursen CB, Clive A, Halifax R, et al. European Respiratory Society statement on thoracic ultrasound. *Eur Respir J.* 2021;57:2001519.
5. Clevert D-A, Nyhsen C, Ricci P, et al. Position statement and best practice recommendations on the imaging use of ultrasound from the European Society of Radiology ultrasound subcommittee. *Insights Imaging.* 2020;11:115.
6. Via G, Hussain A, Wells M, et al. International evidence-based recommendations for focused cardiac ultrasound. *J Am Soc Echocardiogr.* 2014;27(683):e1-e83.e33.
7. Gordon CE, Feller-Kopman D, Balk EM, Smetana GW. Pneumothorax following thoracentesis: a systematic review and meta-analysis. *Arch Intern Med.* 2010;170:332-339.
8. Mercaldi CJ, Lanes SF. Ultrasound guidance decreases complications and improves the cost of care among patients undergoing thoracentesis and paracentesis. *Chest.* 2013;143:532-538.
9. Lichtenstein DA, Mezière GA. Relevance of lung ultrasound in the diagnosis of acute respiratory failure: the BLUE protocol. *Chest.* 2008;134:117-125.
10. Randolph AG, Cook DJ, Gonzales CA, Pribble CG. Ultrasound guidance for placement of central venous catheters: a meta-analysis of the literature. *Crit Care Med.* 1996;24:2053-2058.
11. Troianos CA, Hartman GS, Glas KE, et al. Special articles: guidelines for performing ultrasound guided vascular cannulation: recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. *Anesth Analg.* 2012;114:46-72.
12. Sites BD, Spence BC, Gallagher J, et al. Regional anesthesia meets ultrasound: a specialty in transition. *Acta Anaesthesiol Scand.* 2008;52:456-466.
13. Bloom BA, Gibbons RC. Focused assessment with sonography for trauma. *StatPearls.* StatPearls Publishing Copyright © 2023, StatPearls Publishing LLC; 2023.
14. Nagre AS. Focus-assessed transthoracic echocardiography: implications in perioperative and intensive care. *Ann Card Anaesth.* 2019;22:302-308.
15. Smallwood N, Dachsel M. Point-of-care ultrasound (POCUS): unnecessary gadgetry or evidence-based medicine? *Clin Med (Lond).* 2018;18:219-224.
16. Nielsen MS, Clausen JH, Hoffmann-Petersen J, Konge L, Nielsen AB. Can virtual-reality simulation ensure transthoracic echocardiography skills before trainees examine patients? *Int J Med Educ.* 2022;13:267-273.
17. Pietersen PI, Konge L, Graumann O, Nielsen BU, Laursen CB. Developing and gathering validity evidence for a simulation-based test of competencies in lung ultrasound. *Respiration.* 2019;97:329-336.
18. Chui J, Lavi R, Hegazy AF, et al. Identifying barriers to the use of ultrasound in the perioperative period: a survey of southwestern Ontario anesthesiologists. *BMC Health Serv Res.* 2019;19:214.
19. Sharma A, Minh Duc NT, Luu Lam Thang T, et al. A consensus-based checklist for reporting of survey studies (CROSS). *J Gen Intern Med.* 2021;36:3179-3187.
20. Artino AR Jr, Gehlbach H, Durning SJ. AM last page: avoiding five common pitfalls of survey design. *Acad Med.* 2011;86:1327.
21. Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: building an international community of software platform partners. *J Biomed Inform.* 2019;95:103208.
22. R Core Team. *R: A Language and Environment for Statistical Computing.* R Foundation for Statistical Computing; 2023.
23. Fuzier R, Lammens S, Becuwe L, et al. The use of ultrasound in France: a point of view from experienced regional anesthesiologists. *Acta Anaesthesiol Belg.* 2016;67:9-15.
24. O'Brien EM, Guris RD, Quarshie W, Lin EE. The state of point-of-care ultrasound training in pediatric anesthesia fellowship programs in the United States: a survey assessment. *Paediatr Anaesth.* 2024;34:544-550.
25. Remskar MH, Theophanous R, Bowman A, et al. Current use, training, and barriers of point-of-care ultrasound in anesthesiology: a national survey of veterans affairs hospitals. *J Cardiothorac Vasc Anesth.* 2023;37:1390-1396.
26. Matava C, Hayes J. A survey of ultrasound use by academic and community anesthesiologists in Ontario. *Can J Anaesth.* 2011;58:929-935.

**How to cite this article:** Nielsen MS, Grejs AM, Nielsen AB, Konge L, Brøchner AC. Ultrasound in anesthesiology in the Nordic countries—Protocol of an international survey on availability, frequency of use, operator training, and certification. *Acta Anaesthesiol Scand.* 2024;68(9):1279-1282. doi:[10.1111/aas.14482](https://doi.org/10.1111/aas.14482)