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Factors Associated with Non-Use of Lung Ultrasound by Doctors in the Democratic Republic of Congo

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Abstract

Background: Despite the widespread use of lung ultrasound in clinical practice, there are no clear evidence-based guidelines for teaching lung ultrasound in the Democratic Republic of Congo (DRC). The aim of this study was to identify factors associated with the use of lung ultrasound by physicians in the DRC. **Methods:** Cross-sectional study, carried out online among 363 physicians in the DRC during the period from September to December 2024. Sociodemographic characteristics and those related to the performance of lung ultrasound were studied and analyzed using SPSS for Windows version 26 software. **Results:** Of the 363 physicians who responded to the questionnaire, 71% were men (sex ratio 3M/1F), with the majority in the 30 - 39 age bracket (59%). The frequency of non-use of lung ultrasound was 39.1%. Factors associated with non-use of lung ultrasound were low level of knowledge (aOR: 2.1 IC 95%: 1.6 - 3.8), usefulness of ultrasound (aOR: 3.2 IC 95%: 1.9 - 5.8), challenge of ultrasound (aOR: 3.1 IC 95%: 1.7 - 5.7) and low knowledge of the advantage over pneumothorax diagnosis (aOR: 2.3 IC 95%: 1.4 - 3.7). **Conclusion:** Pulmonary ultrasound is used little in the DRC, and this weakness is associated with the lack of knowledge about the tool and the constraint of tools on practicability and possession.

Subject Areas

Pediatrics

Keywords

Lung Ultrasound, Non-Use, Doctor, Democratic Republic of Congo

1. Introduction

Pulmonary ultrasound is a fundamental tool for the evaluation of patients with dyspnea and respiratory failure and is widely adopted by physicians working in several medical specialties, including intensive care, emergency, pulmonary and internal medicine [1]-[7]. Recently, attempts have been made to integrate lung ultrasound teaching into medical curricula, either as part of targeted ultrasound tasks, such as the detection of pleural effusion or pneumothorax or as part of a more comprehensive ultrasound curriculum in the event of a specialization in pulmonology [8]-[11].

Data from the Democratic Republic of Congo indicate that lung ultrasound is not a daily practice. Knowledge of this practice among doctors in the DRC would be an asset in improving patient management [12] [13]. The role of diagnosing pulmonary pathologies and referring cases to the appropriate services is crucial, and falls mainly to doctors. Indeed, a finding has been revealed in the DRC on the need for further training of physicians in pulmonary ultrasound in order to enable correct diagnosis, referral and management of pulmonary pathologies [14]. This study aims to identify factors associated with the non-use of pulmonary ultrasound.

2. Methods

This was an analytical cross-sectional study conducted online in the Democratic Republic of Congo during the period from September to December 2024. The study population consisted of all Congolese physicians living in the Democratic Republic of Congo. All Congolese doctors practicing in a hospital or in a program and having freely agreed in writing or orally to participate in the study were included. Foreign doctors and Congolese doctors living abroad were not included in this study. Doctors who failed to answer two-thirds of the questions in the questionnaire were excluded from the study.

Sampling was non-probability. Sample size was appropriate. The sampling method used enabled us to collect 363 participants. Data were collected from a questionnaire designed using a Gmail link to be sent to a doctor via WhatsApp whose telephone number we had. The recipient was asked to send the questionnaire to other doctors he or she knew, and so on. The questionnaire was put online and could be filled in by any Doctor in the DRC, and the links and QR code to access the study were distributed to correspondents via WhatsApp and to participants who expressed an interest in the study and answered the questions directly. Recruitment of participants was therefore mainly based on the "snowball effect". After validating consent, access to the questionnaire did not require identification, and responses were completely anonymous. The principal investigator was responsible for collecting the data via a confidentiality code.

The variables of interest were the sociodemographic characteristics of the physicians (age, sex, medical specialty, years of experience, classification of facilities, type of facility, having received specific training in lung ultrasound), knowledge

of the indications for lung ultrasound, use of ultrasound.

3. Statistical Analysis

Data were collected using Excel 2010, then exported to SPSS for Windows version 26 for analysis. Categorical variables were presented as absolute and relative frequencies. Proportions were compared using Pearson's chi-square test or Fischer's exact test. Determinants of lung ultrasound use were examined in a univariate model and were included in the logistic regression model when associated with the dependent variable in the multivariate analysis. Variables not contributing significantly ($P \geq 0.05$) were progressively excluded to obtain the final models. The adjusted odds ratios calculated were used to estimate the degree of association between the dependent variable and the independent variables. The value of $p < 0.05$ was taken as the threshold of statistical significance.

4. Results

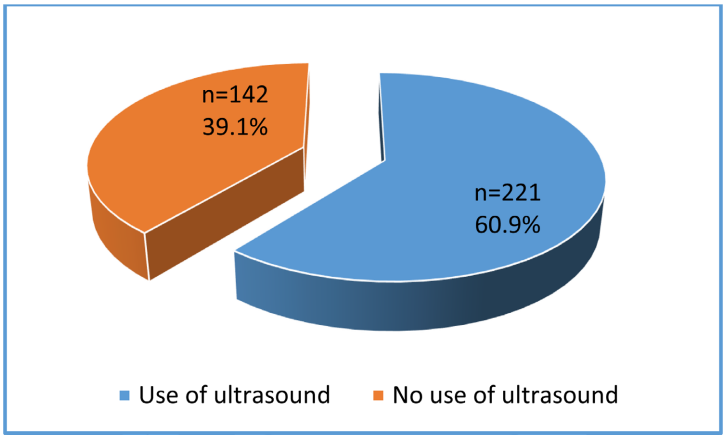

Figure 1. Proportion of physicians using lung ultrasound.

This figure shows that 221% or 60.9% of the doctors surveyed had already used lung ultrasound, compared with 142% or 39.1% who had never used it (Figure 1).

Table 1 shows that doctors who have used lung ultrasound are general practitioners (63%), followed by pediatricians and internal medicine specialists (13.1% and 8.1% respectively). Other characteristics (gender, age, year of experience, type of hospital attended) had no influence on the use of lung ultrasound.

Table 2 shows that the doctors who used lung ultrasound the most had a good level of knowledge of lung ultrasound (70%), they thought lung ultrasound was very useful or useful (54% and 38% respectively), lack of training was a barrier to the use of lung ultrasound (81%), they had at least 3 out of 5 confidence in lung ultrasound (31%, 26% and 17%), they thought that ultrasound equipment was not easy to find (68%), and that interpretation (49%), time (30%) and technique (14%) were challenges to the use of lung ultrasound (See Table 2).

Doctors who have used lung ultrasound believe it to be more reliable than those who have never used it (19.9% vs. 13.4%), although in significantly different

proportions in both cases, radiography was considered to be more reliable (46.2% vs. 64.8%). Compared with those who had never used it, they thought it was more useful in specific cases (73.8% vs. 57.8%), and they thought lung ultrasound had the advantage of being quicker than radiography, compared with those who had never used it (48.4% vs. 27.5%) (See Table 3).

Table 1. Sociodemographic characteristics of physicians using lung ultrasound.

Variable	Over all (n = 363)	No use of ultrasound (n = 142)	Use of ultrasound (n = 221)	p
Gender				0.092
Female	107 (29.0)	49 (35.0)	58 (26.0)	
Male	256 (71.0)	93 (65.0)	163 (74.0)	
Age				0.800
<30 years	108 (29.7)	45 (31.7)	63 (28.6)	
30 - 39 years	214 (59)	82 (57.7)	132 (59.7)	
40 - 49 years	30 (8.3)	12 (8.5)	18 (8.1)	
≥50 years	11 (3.0)	3 (2.1)	8 (3.6)	
Year of experience				0.500
<5 years	207 (57.0)	82 (58.0)	125 (56.6)	
5 - 10 years	128 (35.3)	50 (35)	78 (35.2)	
11 - 20 years	20 (5.5)	9 (6.3)	11 (5.0)	
>20 years	8 (2.2)	1 (0.7)	7 (3.2)	
Specialty				0.014
Anaesthesia and intensive care	9 (2.5)	0 (0.0)	9 (4.1)	
Surgery	8 (2.2)	2 (1.5)	6 (2.7)	
Gynecology	4 (1.1)	1 (0.7)	3 (1.4)	
General medicine	246 (67.8)	107 (75.3)	139 (62.9)	
Internal medicine	22 (6.1)	4 (2.8)	18 (8.1)	
Pediatrics	51 (14.0)	22 (15.5)	29 (13.1)	
Other	23 (6.3)	6 (4.2)	17 (7.7)	
Hospital				0.600
Health center	45 (12.4)	19 (13.4)	26 (11.7)	
Private hospital	69 (19.0)	28 (19.7)	41 (18.5)	
Public hospital	234 (64.5)	87 (61.3)	147 (66.5)	
Other	15 (4.1)	8 (5.6)	7 (3.2)	

Table 2. Physicians' knowledge and attitudes regarding the use of lung ultrasound.

Variable	Over all (n = 363)	No use of ultrasound (n = 142)	Use of ultrasound (n = 221)	p
Training				0.300
No	348 (95.9)	138 (97.2)	210 (95.0)	
Yes	15 (4.1)	4 (2.8)	11 (5.0)	
Level of knowledge				**<0.001**
Good	218 (60.0)	64 (45.0)	154 (70.0)	
Poor	145 (40.0)	78 (55.0)	67 (30.0)	
Opinion on ultrasound				**<0.001**
Useless	4 (1.1)	4 (2.8)	0 (0)	
Not very useful	56 (15.0)	40 (28.0)	16 (7.2)	
Useful	145 (40.0)	60 (42.0)	85 (38.0)	
Very useful	158 (44.0)	38 (27.0)	120 (54.0)	
Lack of training as a barrier				**0.011**
No	55 (15.0)	13 (9.2)	42 (19.0)	
Yes	308 (85.0)	129 (98.8)	179 (81.0)	
Cost as a barrier				0.300
No	216 (60.0)	89 (63.0)	127 (57.0)	
Yes	147 (40.0)	53 (37.0)	94 (43.0)	
Time as a barrier				0.700
No	338 (93.1)	133 (93.7)	205 (92.8)	
Yes	25 (6.9)	9 (6.3)	16 (7.2)	
Complexity as a barrier				0.400
No	279 (77.0)	106 (75.0)	173 (78.0)	
Yes	84 (23.0)	36 (25.0)	48 (22.0)	
Confidence level				<0.001
1 (not at all confident)	74 (20.4)	54 (38)	20 (9.1)	
2 (less confident)	63 (17.4)	25 (17.6)	38 (17.2)	
3 (little confident)	110 (30.3)	41 (28.9)	69 (31.2)	
4 (confident)	73 (20.1)	16 (11.3)	57 (2.8)	
5 (very confident)	43 (11.8)	6 (4.2)	37 (16.7)	
Ease of obtaining equipment				<0.001
No	272 (75.0)	121 (85.0)	151 (68.0)	
Yes	91 (25.0)	21 (15.0)	70 (32.0)	
Interpretation challenge				<0.001
No	211 (58.0)	99 (70.0)	112 (51.0)	

Continued

Yes	152 (42.0)	43 (30.0)	109 (49.0)	
Training Challenge				0.700
No	106 (29.0)	40 (28.0)	66 (30.0)	
Yes	257 (71.0)	102 (72.0)	155 (70.0)	
Technical challenge				**0.004**
No	272 (75.0)	118 (83.0)	154 (70.0)	
Yes	91 (25.0)	24 (17.0)	67 (30.0)	
Time challenge				**0.004**
No	327 (90)	136 (95.8)	191 (86.0)	
Yes	36 (9.9)	6 (4.2)	30 (14.0)	

Table 3. Opinion on the comparison between ultrasound and radiography according to use of lung ultrasound.

Variable	Over all (n = 363)	No use of ultrasound (n = 142)	Use of ultrasound (n = 221)	p
Reliability				0.003
Lung ultrasound	63 (17.4)	19 (13.4)	44 (19.9)	
both	106 (29.2)	31 (21.8)	75 (33.9)	
Chest X-ray	194 (53.4)	92 (64.8)	102 (46.2)	
Use both				<0.001
Specific cases	245 (67.5)	82 (57.8)	163 (73.8)	
Never	37 (9.9)	34 (23.9)	3 (1.3)	
Rarely	53 (14.6)	20 (14.1)	33 (14.9)	
Always	28 (7.7)	6 (4.2)	22 (10.0)	
Before speed				<0.001
No	217 (59.8)	103 (72.5)	114 (51.6)	
Yes	145 (40.2)	38 (27.5)	107 (48.4)	
Before exposure				0.2
No	63 (17.3)	20 (14.1)	43 (19.5)	
Yes	299 (82.7)	121 (85.9)	178 (80.5)	
Before effusion				0.076
No	174 (47.9)	76 (53.5)	98 (44.3)	
Yes	188 (52.1)	65 (46.5)	123 (55.7)	
before pneumothorax				0.700
No	299 (82.6)	115 (81.6)	184 (83.3)	
Yes	63 (17.4)	26 (18.4)	37 (16.7)	

Analysis of Table 4 showed that low level of knowledge, usefulness of ultrasound, confidence in ultrasound, challenge of ultrasound and low knowledge of the advantage of pneumothorax diagnosis were factors associated with non-use of lung ultrasound. After multivariate adjustment for these variables, low knowledge (aOR: 2.1 IC 95%: 1.6 - 3.8), usefulness of ultrasound (aOR: 3.2 IC 95%: 1.9 - 5.8), challenge of ultrasound (aOR: 3.1 IC 95%: 1.7 - 5.7), and low awareness of the advantage over pneumothorax diagnosis (aOR: 2.3 IC 95%: 1.4 - 3.7), were the factors independently associated with non-use of lung ultrasound among Doctors in the DRC.

Table 4. Factors associated with non-use of lung ultrasound.

Variable	Univariate analysis		Multivariate analysis	
	OR (IC 95%)	p	aOR (IC 95%)	p
Knowledge level				
Good	1		1	
Poor	1.9 (1.1 - 3.1)	**0.016**	2.1 (1.6 - 3.9)	**0.011**
Usefulness of ultrasound				
Yes	1		1	
No	3.4 (1.7 - 6.8)	**< 0.001**	3.2 (1.9 - 5.8)	**<0.001**
Trust in ultrasound				
Yes	1		1	
No	2.2 (1.3 - 3.7)	**0.002**	1.2 (0.7 - 1.8)	0.123
Time challenge				
Yes	1		1	
No	3.3 (1.2 - 8.5)	**0.016**	3.1 (1.7 - 5.7)	**0.001**
Recognition of advantage in pneumothorax diagnosis				
Yes	1		1	
No	2.1 (1.3 - 0.9)	**0.020**	2.3 (1.4 - 3.7)	**0.015**

5. Discussion

Given that ultrasound facilities are lacking in DRC healthcare facilities and are not available in all hospitals, the use of lung ultrasound is poorly perceived by physicians in the DRC. This study provides an in-depth look at the factors associated with non-use of lung ultrasound in the Democratic Republic of Congo. Experiences of lung ultrasound use may be hindered or facilitated by several factors related to the hospital environment, physician perception, tool characteristics and patient experience. The main facilitators of lung ultrasound implementation are related to local needs and the intrinsic characteristics of the technique.

In our study, there was a clear need for an affordable lung imaging technique using low-maintenance materials. This is consistent with the qualitative results of

studies conducted in Pakistan, Mozambique and Kenya [15] [16]. Lung ultrasound is integrated into clinical reasoning at the bedside and can speed up the first diagnostic referral, even when chest radiography is available. Lung ultrasound is thought to refine the clinical hypothesis or reduce doubts based on chest X-ray alone (for example, to characterize pleural effusions). This streamlining of workflow is consistent with the qualitative results previously obtained in a pediatric setting [15].

The absence of radiation also makes it an attractive technique for pregnant women and children [17]. Other physicians have the willingness and motivation to appropriate the technique, better prepare for technical procedures (e.g. pleural puncture), gain training and experience, and acquire confidence in interpretation. The factors identified in this study were low level of knowledge of the technique (aOR: 2.1), non-utility of lung ultrasound (aOR: 3.2), lack of time challenge (aOR: 3.1) and non-recognition of the benefit in diagnosing pneumothorax (aOR:2.3). Several studies have already identified several other factors, including the hospital environment and physician perception.

Lack of resources to renew and maintain devices hinders their successful long-term integration. Another study also showed that the absence of institutional goodwill, practical guidelines and protocols was an obstacle [16]. Lack of use of lung ultrasound is due to insufficient training or exposure to the technique, is also a major obstacle as shown in this study [16]. We did not observe any differences in perception between doctors with longer seniority and those with shorter seniority. This is probably related to the fact that doctors with long seniority had had very little exposure to ultrasound prior to the study.

There are some limitations and constraints that need to be considered when interpreting the results of this study. There is a selection bias, as the subjects in this study were drawn from the snowball sampling, and this could influence the different frequencies observed. As this was a cross-sectional study, it is not possible to establish a causal relationship, only an association.

6. Conclusion

The study assessed the use of lung ultrasound among doctors in the DRC. It showed that more than half of these doctors use lung ultrasound. Factors related to level of knowledge, confidence in lung ultrasound and usefulness/challenge are associated with non-use of lung ultrasound.

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Authors' Contributions

FMM conceptualized the research topic, FMM and ANN drafted the protocol,

ANN for the methods, prepared the submission for institutional review board approval, RKL, JNB, IKM ans MNM supervised the data collection and drafted the manuscript. ANN provided guidance for the statistical analysis. LPA provided content oversight for the manuscript. All authors read and approved of the final manuscript.

Availability of Data and Materials

The datasets analyzed during this study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

Written informed consent was obtained from all the participants and/or their legally acceptable representatives. Non-literate participants were accompanied by a literate peer of their choice. Participants under 18 years of age were accompanied by their parent or guardian. Their informed assents and consent from parent or guardian were requested and signed before the enrolment to the study. Participants had the right to provide consent or not and to withdraw from the study at any time during the interview, without having to provide a reason. The risks incurred by the participants in this study were supposed to be minimal, given that the vaccines used had already undergone clinical trials and been approved by scientists.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Laursen, C.B., Sloth, E., Lassen, A.T., Christensen, R.D., Lambrechtsen, J., Madsen, P.H., *et al.* (2014) Point-of-Care Ultrasonography in Patients Admitted with Respiratory Symptoms: A Single-Blind, Randomised Controlled Trial. *The Lancet Respiratory Medicine*, **2**, 638-646. https://doi.org/10.1016/s2213-2600(14)70135-3

[2] Pivetta, E., Goffi, A., Lupia, E., Tizzani, M., Porrino, G., Ferreri, E., *et al.* (2015) Lung Ultrasound-Implemented Diagnosis of Acute Decompensated Heart Failure in the Ed: A SIMEU Multi-Center Study. *Chest*, **148**, 202-210. https://doi.org/10.1378/chest.14-2608

[3] Perrone, T., Maggi, A., Sgarlata, C., Palumbo, I., Mossolani, E., Ferrari, S., *et al.* (2017) Lung Ultrasound in Internal Medicine: A Bedside Help to Increase Accuracy in the Diagnosis of Dyspnea. *European Journal of Internal Medicine*, **46**, 61-65. https://doi.org/10.1016/j.ejim.2017.07.034

[4] Mojoli, F., Bouhemad, B., Mongodi, S. and Lichtenstein, D. (2019) Lung Ultrasound for Critically Ill Patients. *American Journal of Respiratory and Critical Care Medicine*, **199**, 701-714. https://doi.org/10.1164/rccm.201802-0236ci

[5] Orso, D., Ban, A. and Guglielmo, N. (2018) Lung Ultrasound in Diagnosing Pneumonia in Childhood: A Systematic Review and Meta-Analysis. *Journal of Ultrasound*, **21**, 183-195. https://doi.org/10.1007/s40477-018-0306-5

[6] Boccatonda, A., Liberatore, I., Cocco, G., D'Ardes, D., Marinari, S. and Schiavone, C.

(2020) From an Abdominal Ultrasound to a Lung Disease Passing through the Diaphragm: A Case of Idiopathic Pulmonary Fibrosis. *Journal of Ultrasound*, **23**, 607-611. https://doi.org/10.1007/s40477-020-00445-y

[7] Boccatonda, A., Primomo, G., Cocco, G., D'Ardes, D., Marinari, S., Montanari, M., Giostra, F. and Schiavone, C. (2020) Not All Abolished Lung Sliding Are Pneumothorax: The Case of a Particular Lung Atelectasis. *Journal of Ultrasound*, **24**, 519-523.

[8] Lim, J.S., Lee, S., Do, H.H. and Oh, K.H. (2017) Can Limited Education of Lung Ultrasound Be Conducted to Medical Students Properly? A Pilot Study. *BioMed Research International*, **2017**, Article ID: 8147075. https://doi.org/10.1155/2017/8147075

[9] Steinmetz, P., Oleskevich, S., Dyachenko, A., McCusker, J. and Lewis, J. (2018) Accuracy of Medical Students in Detecting Pleural Effusion Using Lung Ultrasound as an Adjunct to the Physical Examination. *Journal of Ultrasound in Medicine*, **37**, 2545-2552. https://doi.org/10.1002/jum.14612

[10] Breitkreutz, R., Dutiné, M., Scheiermann, P., Hempel, D., Kujumdshiev, S., Ackermann, H., *et al.* (2013) Thorax, Trachea, and Lung Ultrasonography in Emergency and Critical Care Medicine: Assessment of an Objective Structured Training Concept. *Emergency Medicine International*, **2013**, Article ID: 312758. https://doi.org/10.1155/2013/312758

[11] Heiberg, J., Hansen, L., Wemmelund, K., Sørensen, A., Ilkjaer, C., Cloete, E., *et al.* (2015) Point-of-Care Clinical Ultrasound for Medical Students. *Ultrasound International Open*, **1**, E58-E66. https://doi.org/10.1055/s-0035-1565173

[12] Pietersen, P.I., Madsen, K.R., Graumann, O., Konge, L., Nielsen, B.U. and Laursen, C.B. (2018) Lung Ultrasound Training: A Systematic Review of Published Literature in Clinical Lung Ultrasound Training. *Critical Ultrasound Journal*, **10**, Article No. 23. https://doi.org/10.1186/s13089-018-0103-6

[13] Skaarup, S.H., Laursen, C.B., Bjerrum, A.S. and Hilberg, O. (2017) Objective and Structured Assessment of Lung Ultrasound Competence. a Multispecialty Delphi Consensus and Construct Validity Study. *Annals of the American Thoracic Society*, **14**, 555-560. https://doi.org/10.1513/annalsats.201611-894oc

[14] Di Pietro, S., Mascolo, M., Falaschi, F., Brambilla, W., Ruzga, R., Mongodi, S., *et al.* (2020) Lung-Ultrasound Objective Structured Assessment of Technical Skills (LUS-OSAUS): Utility in the Assessment of Lung-Ultrasound Trained Medical Undergraduates. *Journal of Ultrasound*, **24**, 57-65. https://doi.org/10.1007/s40477-020-00454-x

[15] Riaz, A., Cambaco, O., Ellington, L.E., Lenahan, J.L., Munguambe, K., Mehmood, U., *et al.* (2021) Feasibility, Usability and Acceptability of Paediatric Lung Ultrasound among Healthcare Providers and Caregivers for the Diagnosis of Childhood Pneumonia in Resource-Constrained Settings: A Qualitative Study. *BMJ Open*, **11**, e042547. https://doi.org/10.1136/bmjopen-2020-042547

[16] Kagima, J.W., Masheti, S.A., Mbaiyani, C.W., Munubi, A.Z., Ringwald, B., Meme, H.K., *et al.* (2021) Point of Care Ultrasound in Acutely Breathless Patients—A Qualitative Study of the Enablers and Challenges in a Teaching Hospital in Kenya. *Journal of the Pan African Thoracic Society*, **2**, 130-139. https://doi.org/10.25259/jpats_24_2021

[17] Suttels, V., Du Toit, J.D., Fiogbé, A.A., Wachinou, A.P., Guendehou, B., Alovokpinhou, F., *et al.* (2022) Point-of-Care Ultrasound for Tuberculosis Management in Sub-Saharan Africa—A Balanced SWOT Analysis. *International Journal of Infectious Diseases*, **123**, 46-51. https://doi.org/10.1016/j.ijid.2022.07.009