Can undergraduate paramedic students accurately identify lung sounds?

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Can undergraduate paramedic students accurately identify lung sounds?

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ABSTRACT

Introduction: The accurate identification of lung sounds during chest auscultation is a skill commonly used by healthcare clinicians, including paramedics, when assessing a patient's respiratory status. It is a necessary skill as it enables confirmation of a patient's respiratory condition and guides the paramedic to a provisional diagnosis and the implementation of appropriate management. The object of this study was to identify if undergraduate paramedic students from two Australian universities were able to interpret a variety of lung sounds accurately.

Methods: A prospective single-blinded observational study requiring 96 undergraduate paramedic students from two Australian universities to estimate the lung sounds of six audio files.

Results: The findings demonstrated variable accuracy in lung sound interpretation of the six audio files. The lung sound that contained a wheeze was most accurately interpreted, whereas coarse crackles were the least accurately interpreted. Monash University undergraduate paramedic students displayed similar lung sound interpretations to Charles Sturt University undergraduate paramedic students.

Conclusion: In this study undergraduate paramedic students from two Australian universities were found to be inaccurate at interpreting a variety of common lung sounds. The study has highlighted that a greater emphasis needs to be given to lung sound interpretation in undergraduate paramedic education programmes.

The accurate identification of normal and abnormal lung sounds during chest auscultation is a skill used by most healthcare providers, including paramedics, when assessing a patient. It is a necessary skill as it enables confirmation of a patient's respiratory condition and guides the paramedic in deciding the initial and ongoing management.

Chest auscultation is a simple assessment tool providing direct clinical information about lung structure and function that would otherwise be unobtainable.[1] Chest auscultation is taught to Monash University and Charles Sturt University undergraduate paramedics during their programme and is considered an important component of the overall systematic assessment of a patient. Chest auscultation is used initially to determine a patient's respiratory condition, whereas repeated auscultations during patient care may detect any deterioration or improvement in the patient's respiratory condition.[2]

Prehospital assessment of a patient relies on chest auscultation to direct treatment, as there are differences in medical treatment between the various respiratory diseases.[2 3] Receiving hospitals also rely on paramedics making an initial assessment of the patient's respiratory condition and to undertake appropriate treatment before arrival at the emergency department.[3]

There has been one previous prehospital study investigating paramedics' ability to determine accurately the various lung sounds in a non-moving vehicle. The study by Wigder *et al*[3] compared the ability of novice and experienced paramedics with emergency physicians to identify five common lung sounds accurately.

The object of this study was to identify whether undergraduate paramedic students from two Australian universities were able to interpret a variety of lung sounds accurately.

METHOD

Design

The study was a prospective single-blinded observational study. No exclusion participation criteria were applied.

Participants

This study utilised 96 students from two Australian universities. Thirty-five (36.5%) students were enrolled full time at Monash University, Victoria, Australia, in the Bachelor of Emergency Health degree course. The remaining 61 (63.5%) students were enrolled full time at the Charles Sturt University, New South Wales, Australia, in the Bachelor of Clinical Practice degree course. Participation in this study was voluntary. Ethics approval for the study was approved by the Monash University and Charles Sturt University Ethics Committees.

Materials

A Microsoft PowerPoint presentation was used to provide students with six lung sounds of varying aetiology that were randomly selected. The lung sounds were sourced from the Delmar's Heart and Lung Sounds for the EMS Provider CD-ROM.[4] All sounds were single channel (mono) at CD-ROM quality. Data collection forms were supplied to the students to record their estimations.

Procedure

Participants listened to the lung sounds in a small lecture theatre via stereo speakers and were asked to record their interpretation of each lung sound on their data collection forms. Each lung sound presented lasted for five breaths, followed by a short pause and then the next breath sound commenced automatically.

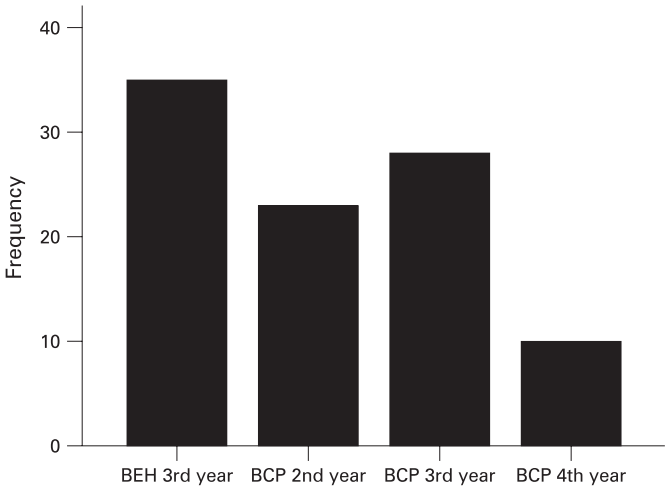

Figure 1 Course students enrolled in. BCP, Bachelor of Clinical Practice; BEH, Bachelor of Emergency Health.

Descriptive statistics were used to summarise the data with the t test used to compare differences between the universities. Sensitivity and specificity were used to define the interpretation accuracy for each audio file. Descriptive analysis and receiver operating characteristic curve analysis was undertaken using SPSS (version 15.0). Sensitivity and specificity analysis was undertaken using EpiCalc 2000 (version 1.02). All tests are two tailed unless otherwise stated. The results are considered statistically significance if the p value is less than 0.05, all confidence intervals are 95%.

RESULTS

Recruitment and participation in the study was undertaken at the conclusion of semester one (May) 2007. Of the 96 students involved in the study 67.7% were women and 32.3% were men, with 72% of students between 20 and 24 years of age. As demonstrated in fig 1, students (37%) were primarily enrolled in year 3 of the Bachelor of Emergency Health degree course, with the remainder enrolled in the Bachelor of Clinical Practice degree course.

Overall, the results demonstrated minimal accuracy in lung sound interpretation, see table 1. Audio file three (wheeze) was the lung sound with the greatest percentage of correct interpretations (52.1%). Whereas the fourth audio file (fine crackles) was the lung sound that was least correctly interpreted (2.1%). No adverse effects were noted during the study and no follow-up was undertaken for incomplete data collection form completion.

Monash University students were significantly better at estimating audio 1 and 2 (course crackles and stridor) than their Charles Sturt University counterparts, $p<0.001$ and $p<0.001$. There was no statistical difference in the results for the remaining sounds, audio sounds 3 to 6.

The area under the receiver operating characteristic curve was 0.513 (95% CI 0.456 to 0.57; $p = 0.654$, see fig 2).

DISCUSSION

This study has demonstrated that undergraduate paramedic students at two Australian universities have difficulty interpreting a variety of lung sounds that are commonly auscultated in the prehospital setting.

Even though we used undergraduate paramedic students there was still a large difference in the ability to identify a specific lung sound correctly compared with the prehospital study by Wigder *et al*[3] using novice paramedics. This could be due to the undergraduate students having a lack of supervised clinical experience compared with the "new" paramedics in the study by Wigder *et al*.[3] Moreover, it may mean that more education and training time needs to be spent on differentiating between the various lung sounds commonly heard in the prehospital environment. Undergraduate clinical placements in hospital emergency departments with supervised chest auscultation are currently limited, and perhaps should be investigated further as an option to consider in providing better linkage between theory and practice.

Wigder *et al*[3] also support this teaching method for paramedics, suggesting that emergency department physicians would be valuable educators for paramedics practising chest auscultation. Students already complete a variety of hospital-based placements, which could include rotations on respiratory wards, thus allowing students supervised time with patients to practise chest auscultatory skills. Zun and Downey[5] suggested that examining lung sounds with associated pathology and thus abnormal sounds would be more realistic in the health environment. They also thought that the assessment of abnormal sounds rather than just the presence of normal lung sounds would be more appropriate.[5]

Inaccurate lung sound interpretation may have been due to a lack of education in the classroom and on-road experience during student placements. Zun and Downey[5] found a significant difference in the ability to detect the presence/absence of lung sounds and the healthcare worker's number of years of experience. The current study only recruited undergraduate paramedic students who have had limited classroom and on-road experience (between 3 and 8 weeks). We would assume that with time and more experience, exposure to respiratory patients and clinical supervision, lung sound identification ability would improve.

Although further investigation into the educational process of lung sound identification needs to be conducted, we suggest some pedagogical improvements could be simply implemented. An interactive CD-ROM or website including lung sound audio files and self-review assessment questions could be used. Class time could be set aside to ensure the multimedia are being used,

Table 1 Lung sounds and responses

Audio file no	Actual lung sound	% Correct	Most common student interpretations	% of Student interpretations
1	Coarse crackles	7.3	Crackles	55.2
2	Stridor	22.9	Wheeze	58.3
3	Wheeze	52.1	Stridor	18.8
4	Fine crackles	2.1	Normal or crackles	20.8
5	Wheeze	8.3	Tachypnoea	26.0
6	Crackles	29.2	Normal or unsure	10.4

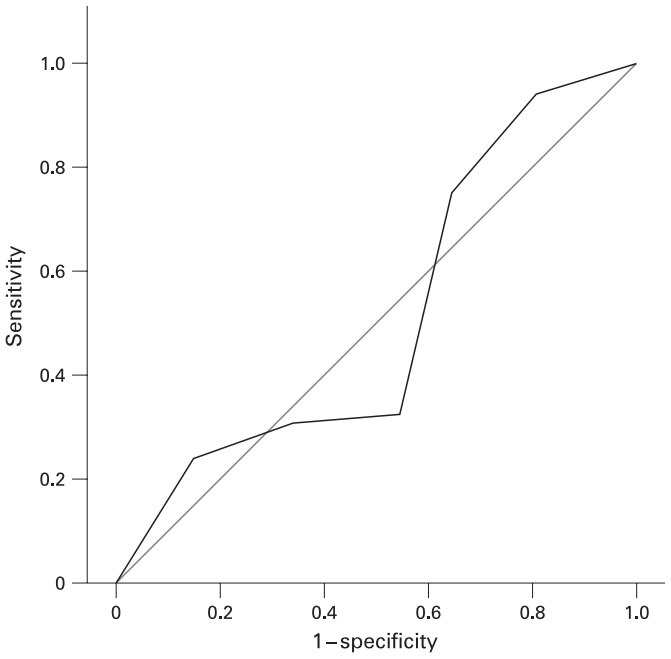

Figure 2 Receiver operating characteristic curve for the accuracy of lung sound estimations.

and related worksheets could be incorporated as a form of self and peer assessment. Furthermore, during on-road clinical rotations, which students already complete, it would be ideal for a supervising paramedic to spend time in the destination hospital/emergency department auscultating patients' chests with or without respiratory complaints.

Another explanation for the inaccurate lung sound interpretation findings may be because the participants had no further patient information or history. Wigder *et al*[3] highlighted that patient history influences chest auscultation, and that lung sound interpretation improved for all participants, especially paramedics, on the provision of patient history. During clinical rotations on emergency ambulance vehicles, students involved in the study have access to patient history in addition to auscultatory skills. Respiratory assessment in the field should rely on patient history, chest auscultation and clinical signs (eg, skin colour, respiratory rate, respiratory effort, pulse, conscious state and chest expansion).[2 3]

Table 2 Accuracy of lung sound estimations

Audio file no	Sensitivity (95% CI)	Specificity (95% CI)	p Value
1	0.06 (0.17 to 0.24)	0.81 (0.77 to 0.84)	<0.001
2	0.19 (0.12 to 0.27)	0.84 (0.8 to 0.87)	0.578
3	0.43 (0.34 to 0.52)	0.90 (0.87 to 0.92)	<0.001
4	0.02 (0.00 to 0.07)	0.8 (0.75 to 0.83)	<0.001
5	0.07 (0.03 to 0.13)	0.81 (0.77 to 0.84)	0.002
6	0.24 (0.17 to 0.33)	0.85 (0.82 to 0.88)	0.026

This study is potentially limited by several factors; first, by participants interpreting patients' lung sounds in a lecture room via stereo speakers rather than assessing patients in person. Finally, participants were limited by a five breath cycle in which to interpret each lung sound, which may not have been sufficient.

CONCLUSION

In this study we have identified that undergraduate paramedic students from two Australian universities are inaccurate at interpreting a variety of lung sounds commonly heard in the prehospital environment. This study has highlighted that a greater emphasis needs to be given to lung sound interpretation in undergraduate paramedic education programmes. The emphasis should be in both the classroom and while on clinical placement.

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Competing interests: None.

Ethics approval: Ethics approval for the study was approved by the Monash University and Charles Sturt University Ethics Committees.

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