POINT OF CARE ULTRASOUND UTILIZATION IN EMERGENCY MEDICINE BY HUE UNIVERSITY HOSPITAL PHYSICIANS, VIETNAM

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Abstract
Objectives: Emergency medicine (EM) is rapidly developing as a specialty in Vietnam and point of care ultrasound (POCUS) is currently taughtas part of formal EM curriculums. No studies have yet been published that assess POCUS usage or the need for specific POCUS applications in emergency departments in Vietnam. **Methods**: A survey was administered to 104 Vietnamese physicians attending a national emergency medicine symposiumabout their use of POCUS, prior POCUS training, attitudes about the utility of POCUS and need for further POCUS training, as well as their comfort level with POCUS in their clinical practice. Data was analyzed using logistic regression to identify factors associated with POCUS usage in Vietnamese emergency departments. **Results**:Increased access to ultrasound machines was significantly associated with increased POCUS usage, with "all the time" access (OR=92.9, 95% CI=7.15 – 1207.6, p=0.001)being more strongly associated than "sometimes" access (OR=41.4, 95% CI=4.08 – 419.8, p=0.002). Formaltraining did not increase POCUS usage (OR=1.39, 95% CI=0.38 – 5.06, p=0.62) and 50.0% of respondents who regularly used POCUS had no formal training. Women were less likely to report performing POCUS regularly (OR=0.12, 95% CI=0.03-0.71, p=0.017). There was no significant difference in physician preference or comfort for any single application of POCUS.POCUSwas used most frequently for right upper quadrantand renal studies and least frequently for deep venous thrombosisstudies. 98.0% of trainees and 96.3% of independently practicing physicians reported a desire for additional POCUS training. **Conclusions**: Regular access to ultrasound machines increases the frequency with which point of care ultrasound is used clinically in emergency departments in Vietnam. Those with formal training were equally likely to use POCUS as those without formal training. This finding may suggest the need for additional quality control measures to ensure that POCUS use and interpretation consistently meet safety and quality standards. Additional qualitative studies should be conducted to identify POCUS applications that are of most use to practitioners in Vietnam. The gender difference in self-reported POCUS usage may reflect reporting bias or actual differences in training or practice and warrants additional investigation in future studies.
Keywords: *Ultrasound, emergency medicine, Vietnam, POCUS*

1. INTRODUCTION

EM has developed significantly over the last 35 years and is expanding as a specialty worldwide(1, 2). Subspecialty development of EMhas occurred over 15 years with the first assessment of EM capacityin Vietnam published in 1997(3). Training and interest has evolved and the first national training symposium was started in 2010(4, 5). These symposia have continued annually and formed the basis for the launch of a formal Emergency Medicine Society in 2011.

Just as interest in formal emergency care has expanded worldwide so too has interest in effective, low-cost diagnostics to improve outcomes for emergently ill or injured patients. Radiographic tests are often difficult to obtain for emergency patients in lower middle income countries (LMIC) but can be central to emergent diagnosis (6, 7). Ultrasound is a cheap, effective and accurate diagnostic tool that is recognized to have a role inthe low-resource settings.(8, 9).It is also a modality that is highly operator dependent. Ultrasound has traditionally been performed

by formally trained ultrasonographers(10) who are frequently not available for emergency diagnostic testing. There is increasing interest in expanding the use of POCUS in LMICs(11-15) such that emergency providers may perform and interpret ultrasound testing for specific emergent conditions. Vietnamese physicians currently use ultrasound for a variety of applications(16-19), so the introduction of POCUS into EMtrainingis a reasonable extension of existing resources.

To date, no assessment of current POCUS utilization or training needs has been done in Vietnam.POCUS training has been a part of the Vietnam Emergency Medicine Symposia since 2010. At the 2012 Vietnam Emergency Medicine Symposium in Hue,Vietnamese physicians working in emergency departments in Vietnam were formally surveyed. The goal of this survey and of the following analysiswasto identify which training and logistical features were associated with POCUS usage, and to try to identify which, if any, modalities of POCUS were seen as most useful by Vietnamese physicians.

2. METHODS

A survey instrument about POCUS usage was developed by two US physicians, approved by an institutional review board at USC/Los Angeles County, and then translated into Vietnamese by a physician fluent in Vietnamese (see Appendix 1).

Thissurvey was administered in March 2012to 104 Vietnamese physicians and physicians-in-training attending a chest trauma skills workshop at the Emergency Medicine Symposium2012 in Hue, Vietnam.Participating physician consent was obtained verbally. The session from which the respondents were drawn was not focused on ultrasound in an attempt to obtain a representative sample of the general EM community in Vietnam. Respondents were queried about their age, gender, level of POCUS training, their access to an ultrasound machine in their primary clinical environment, their current usage of point of care ultrasound in their clinical practice, their comfort level with various applications of POCUS, and their interest in future ultrasound training. Attitudinal responses were normalized using a Likert scale.The five-part survey (Appendix 1)was administered by the investigators at the end of the workshop and assessed for completeness before respondents departed to limit missing variables. The answers were translated from Vietnamese into English for analysis. The data was entered into a database using Epidata 3.1 and then analyzed with STATA (StataCorp. 2011. *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP).

Age data was groupedinto categories for analysis.Those that reported zero years of independent practice or left the answer blank were labeled “Trainees” and those who reported one or more years of independent practice were labeled “Independent Practitioners” for analysis. Physicians who reported using POCUS at least once a week were defined as “POCUS users” and this was the outcome variable used for logistic regression analysis.

The chi-square test was used for statistical significance ofcategorical data. A p value of 0.05 was set as thethreshold for significance. Logistic regression was performed to look at the association between POCUS usage and access to ultrasound machines, training in POCUS, age, sex, and level of training. The Likert-style data was reported as median scores for comfort, frequency and utility of POCUS. The Skillings-Mack test for significance was used to analyze this non-parametric data with many missing variables.

3. RESULTS

Overall 104 of 104 (100%) physicians asked to participate completed and submitted their survey forms.

3.1. Demographics

A large number (48.0%, n=50) of thephysicians surveyed did not yet to practice independently, withthe majority still in post-graduate training. The demographic makeup of both trainees and independently practicing physicians are shown in Table 1. Amongst all the demographic trends assessed, only the age of the two groups wassignificantly different.

3.2. Training, Access and POCUS Utilization

Of the 104 respondents, 22 (21.2%)reported POCUS use one or more times a week and were defined as “POCUS users”. This usage wasthe categorical outcome variable of interest for the logistic regression model which controlled for ultrasound machine access, ultrasound training, career level, age, and sex as independent variables.

This regression analysis demonstrated that POCUS usage was positively associated with access to ultrasound machines and this association increased consistently with degree of access (no access:OR=1, occasional access: OR=41.4, p=0.002; regular access: OR=92.9, p=0.001)

(see Table 2). Formal ultrasound training was not significantly associated with increased POCUS usage (OR=1.39, p=0.62). Career level was also not associated with variable usage, as physicians in training were no more or less likely to perform POCUS than wereindependent practitioners (OR=0.55, p=0.44). There was no significant trend in POCUS use across age groups. However, physicians aged 40-49 stood out as significantly more likely to report POCUS usage (OR=43.73, p=0.003). Female gender was negatively correlated with self-reported POCUS usage(OR=0.12, p=0.017) (see Table 2).

3.3. Frequency/Utility/Comfort

Vietnamese Emergency Physicians in our study reported similar levels of comfort and utility with all of the US applications assessed in the survey and no single study was reported to be more useful (see Table 3). However, they did report statistically significant differences in the frequency of utilization of different applications(p=0.039). Ultrasound for DVT was conducted least frequently, while renal and RUQ POCUS wereperformed most frequently (see Table 3).

3.4. Attitudes towards Training

The attitude towards POCUS training was overwhelmingly positivewith 98.0% of trainee physicians and 96.3% of non-trainees desiring more POCUS training. Both groups similarly favored a combination of lecture and hands-on training sessions, and there was no statistically significant associationwith preferring Vietnamese language training (though current trainees trended towards reporting Vietnamese language training was not important: 22.0% versus 50.0%, p=0.09).

4. DISCUSSION

To date, nostudy of POCUS utilization in Vietnamese emergency departments has been published. As the first study to assess Vietnamese physicians' use and attitudes towards POCUS, oursurvey focused primarily on practitioner access to ultrasound machines, current practice patterns regarding POCUS use and interest in future training. The strongest positive predictor of increased ultrasound usage was ultrasound machine availability. The data showed not only that increasing ultrasound access significantly increased usage, but also scaled consistently with "all-the-time" access increasing POCUSusage even more than "sometimes" availability – perhaps indicating a linear relationship where use of POCUS in daily clinical practice increases when there is a regular and predictable availability of this diagnostic resource in the emergency department.

Our data suggests that formal POCUS training was not significantly associated with increased use. Physicians with formal ultrasound training were in fact not significantly more likely to perform POCUS than those without training. Not only was POCUS usage unaffected by formal training, but also 50% (n=11) of self-reported POCUS users had no formal ultrasound training.

These results taken together highlight the complicated nature of program development. Without providing machines, POCUS cannot be performed. However, introducing US machines into an ED will increase their use by both those with and without formal ultrasound training, which may not be desirable. Any efforts to develop POCUS capacity must marry the provision of US machines not only with training but also with some formal system of ongoing quality assurance and monitoring. A responsible POCUS program must ensure that these new imaging modalities are being used properly and that interpretations of POCUS results are reliable, both to increase patient safety and to limit unintended harms.

Age was not an independent predictor of POCUS usage. While middle-aged physicians had a higher likelihood of reporting POCUS use, no trend existed across age groups, and no plausible causative reason was found for an isolated increasein theintermediate age group. Male gender was a significant predictor of reported POCUS usage. While female physicians represented 1/3 of the respondents, very few reported POCUS use. Female gender was the only negative predictor of POCUS usage identified by our survey, with an adjusted OR=0.12 (95%CI 0.03 – 0.71, p=0.017). Several possible explanations exist for this trend. This may reflect reporting bias, with males being more likely to report themselves as POCUS users than females.It may instead reflect a genuine difference in the frequency which male and female physicians are currently using ultrasound.

Issues of gender and culture are always important to consider in program development and design of educational programs. This study was not designed to assess the causes of such gender differences and no further attempt at analysis has been made here. Further work is necessary to confirm any gender differences and to identify the causes for such differences in clinical practice in Vietnam. By extension, any

internationally developed training programs may need to be sensitive to these differing gender roles to effectively train both male and female physicians.

The survey questions about POCUS comfort and utilityfailed to identifyany single application as more or less appropriate to focus further trainings. It was hoped that the Vietnamese physicians would express a preference for one or more applications of US, allowing subsequent symposia to modify training to meet their needs. Focus groups and qualitative methods have been used in other international settings for needs assessment and curriculum development(13), and this would likely be the logical next step in Vietnam to design future teachingsessions.

The overall attitudes towards the ultrasound trainings were overwhelmingly positive. There was almost unanimous desire for more training, and more hands-on training. There was much less importance placed on this further training being given exclusively in Vietnamese, though some trainee and independent did prefer teaching in their native language.

4.1. Limitations

An attempt was made to survey a representative sample of Vietnamese emergency physicians but the sampling of EM practitioners in Vietnam was not randomized. Respondents were recruited from a non-ultrasound focused session in an attempt to obtainresponses from attendees with a representative distribution of prior ultrasound experience. The large number of trainee respondents was likely due to the symposium being hosted at the Hue Medical College. Furthermore, since this survey was not administered in the community, independent practitioners with the means or support to travel to a conference were likely over-represented. The number of respondents who self-reported as POCUS users was small (n= 22)and thislimited any subgroup analysis.

Our survey was limited by its lack of ability to capture any of the complex systems and administrative issues that are part of POCUS development. System-wide adoption of POCUS requires machines and training, but it also requires infrastructure development, quality assurance, policy change and inter-departmental cooperation(13, 20). Further studies would hopefully find ways to address administrative issues and input from formal radiology departments already running at many hospitals in Vietnam.

4.2. Future Directions

Developing a POCUS training program appropriate for Vietnam requires balancing a number of factors, and should start with a needs assessment. Research looking at the utility of POCUS in LMICs has shown OB/GYN imaging as the most likely to benefit patients in an emergency department setting, with traumatic and non-traumatic abdominal pain being of secondary importance(15, 21, 22). Vietnam, like every country, presents a unique political and medical milieu: social concerns exist about the role of prenatal ultrasound screening for sex selection(19, 23, 24) and regionally important infectious diseases are diagnosed via ultrasound(16, 17, 25-27). These concerns are not shared with other well-studied regions in Africa, nor even throughout Southeast Asia in general.

The overhead involved with any US program would typically mean that richer, urban areas would have more access to machines and studies. However, the relative scarceness of imaging availability in rural areas of Vietnam(28), and the strong performance of POCUS in resource limited settings, means that there may be indications for expanding or focusing the range of POCUS in rural areas to address this shortage of access(14, 29-32). Once established, ongoing issues regarding quality assurance, knowledge acquisition and retention, and infrastructure/machine maintenance must also be addressed, both in rural and urban settings(13, 33-35).

Though a series of obstacles exist for introducing POCUS into Vietnam in particular, and LMICs in general, the potential to expand the quality of care we can deliver in an emergency room setting is deeply important. In properly trained hands, POCUS can be a transformative technology bringing the possibility of life-changing and life-saving diagnostics to a segment of the world's population that currently is forced to live without(8, 9). The overwhelmingly positive responses to training reported herein suggest that Vietnamese physicians see this potential and that additional efforts to partner with them in ongoing training will improve their care and benefit their patients.

5. CONCLUSIONS

A survey was delivered to physicians providing emergency care in Vietnam, and showed that increased access to machines was positively associated with increased usage of POCUS.

Formal training did not increase usage, and half of self-reported POCUS users had no formal training. This finding suggests that systematic safety and quality development is likely needed in conjunction with training efforts. Female gender was negatively associated with POCUS usage. No single application of POCUS stood out as more useful or desirable for usage in Vietnam. Targeted qualitative studies should be conducted to explore gender as a barrier to usage and to identify POCUS applications that are most useful for practitioners in Vietnam.

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HM: Manuscript editing

Endnotes

None

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List of Abbreviations Used

POCUS: point of care ultrasound
EM: emergency medicine
LMIC: Lower middle income country
US: ultrasound
OR: odds ratio
FAST: focused assessment with sonography in trauma
RUQ: right upper quadrant
DVT: deep venous thrombosis
OB/GYN: obstetrics/gynecology

Competing Interests

None

Authors' Contributions

BR: Project development, data analysis, manuscript development
HV: Project development, translation, manuscript

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Illustrations and Figures

None

Tables

Table 1. Demographic Characteristics of Vietnamese Emergency Physicians

	Trainee (n=50)	Non-trainee (n=54)	p-value
Age, years (SD)	29.3 (±5.3)	36.3 (± 8.4)	
20-29 years old 30-39 years old 40-49 years old 50+ years old	64.0 (32) 28.0 (14) 8.00 (4) 0 (0)	22.2 (12) 37.0 (20) 33.3 (18) 7.4 (4)	0.00
Male gender, % (n)	48.0 (24)	72.2 (39)	0.16
Formal US training, % (n)	32.0 (16)	50.0 (27)	0.48
POCUS availability None % (n) Sometimes % (n) Always % (n)	 29.2 (14) 31.3 (15) 39.6 (19)	 48.2 (26) 18.5 (10) 33.3 (18)	0.11
Perform POCUS at least once a week, %	20.0 (10)	22.2 (12)	0.89

Table 2. Predictors of POCUS Usage amongst Vietnamese physicians working in the emergency department

Characteristics	Class	Crude OR	Adjusted OR	95% CI	p-value
Ultrasound machine access	Never	1	1		
	Sometimes	2.55	41.4	4.08 – 419.8	0.002
	All the time	2.32	92.9	7.15 - 1207.6	0.001
Ultrasound Training	No	1	1		
	Yes	1.41	1.39	0.38 – 5.06	0.62
Career Level	Current Trainee	1	1		
	Independent Practitioner	1.07	0.55	0.12– 2.51	0.44
Age Group	20-29	1	1		
	30-39	1.75	2.12	0.47 – 9.61	0.33
	40-49	3.67	43.73	3.65 – 523.5	0.003
	50 +	1.83	3.02	0.12 – 77.8	0.51
Sex	Male	1	1		
	Female	0.47	0.12	0.03 – 0.71	0.017

Table 3. Comparison of POCUS user opinions about the frequency, comfort and utility of a variety of applications

Modality	Median Frequency (1= Never perform to 5 = frequently perform)	Median Comfort (1= Very uncomfortable to 5 = very comfortable)	Median Utility (1= Not useful to 5 = very useful)
FAST	3 (IQR=1 – 5)	3 (IQR=3 – 4)	4 (IQR=3 – 5)
OB/GYN	2.5 (IQR=1 – 4)	3 (IQR=3 – 4)	5 (IQR=3 – 5)
Cardiac	3 (IQR=1 – 4)	3 (IQR=2 – 4)	4.5 (IQR=3 – 5)
RUQ	3.5 (IQR=1 – 5)	4 (IQR=3 – 4)	5 (IQR=3 – 5)
DVT	1 (IQR=1 – 2)	2 (IQR=2 – 3)	3 (IQR=3 – 5)
Pneumothorax	3 (IQR=1 – 4)	3 (IQR=3 – 4)	4 (IQR=3 – 5)
Renal	3.5 (IQR=1 – 5)	4 (IQR=3 – 4)	5 (IQR=3 – 5)
Peripheral IV	1.5 (IQR=1 – 3)	3 (IQR=2 – 3)	3 (IQR=3 – 5)
Central Access	1.5 (IQR=1 – 3)	3 (IQR=2 – 4)	3 (IQR=3 – 5)
p-value[1]	0.039	0.30	0.88

1: p-value is calculated by Skillings-Mack test for significant differences in non-parametric data from multiple responses