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Original Article

Despite The Long Learning Curve for Ultrasound, How Beneficial Is A 5-Day Basic Obstetric Ultrasound Training for Fetal Biometry

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Abstract

Objectives: To study the impact of a 5-day structured practical training in obstetric ultrasound scan on competence of ultrasound-naïve medical practitioners in fetal biometry. **Methods:** Assessment was by a purpose-designed objective competency scoring proforma consisting of four domains before and after a 5-day structured hands-on training in basic obstetric ultrasound. Scores were compared using paired t-test. The overall composite score was 16 and a score of 12 was considered as the minimum for competence**. Results:** There were 23 participants consisting of 10 Medical Officers, 10 Obstetricians and 3 Resident Doctors. The pre-training evaluation showed that virtually no participant achieved a competence score in any of the parameters. Following training, greater than 50% of participants had competence score in at least two of the four basic fetal biometric parameters. The post-training competency scores were significantly higher than the pre-course scores. Also, the variability of the post-course scores were lower except for the FL. The pre-training competency score was a significant predictor of the final score. **Conclusion:** A 5-day structured basic ultrasound scan workshop can impart competence on majority of ultrasound naïve medical practitioners in at least 2 basic fetal biometry domains while leading to improvement in all four biometry parameters.

Keywords: Competence in fetal biometry; Ultrasound training; Ultrasound competence; Basic fetal biometry.

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Introduction

Proficiency in obstetric ultrasound scan is essential for maximizing the proven benefit of this technology in improving maternal and perinatal outcome.[1] Achieving such proficiency hinges largely on the adequacy of training.[2] In contemporary times, there are varieties of training in terms of duration, content and certification. Ideally, sub-specialty fellowship programmes are the gold standard for training skilled Personnel especially in highly technical skills like ultrasonography. However, these long-term specialist fellowship trainings are hardly available in Low- and Middle-Income countries (LMICs).[3]

Ultrasound is known to have a long learning curve.[4,5] This creates an even greater challenge in many climes. While ultrasound machines may be available, appropriate and proficient use is still impeded by lack of dedicated time for training and dearth of trained personel to offer such training.[5-7] Other impediments to such programmes include the cost, availability as well as the institutional admission requirements. Most of the

established training programmes are in the high-income countries and entry requirements including registration for medical practice in these regions are quite stringent for professionals from LMICs.[8,9] Also, due to numerous competencies to be learnt in traditional training programmes, there is competition for the available time for training. It therefore becomes imperative to develop schemes that could enable competence in this skill within durations that are feasible and affordable in these various systems for optimal benefit.

The optimum time required to achieve competence in basic obstetric ultrasound scan is yet to be objectively determined.[10-12] However, it has been suggested that the introduction of short, intensive training programmes[2,13-15] with sufficient hands-on component could impart competence for basic obstetric ultrasound which has been shown to have benefit in the management of many routine obstetric cases.[16] Various programmes have employed different durations of training with reported success in attainment of competence by the trainees. Swanson et al employed a 2-week training duration with documented improved competence in ultrasound naïve trainees.[17] Some other studies have relied more on the number of itinerations of scanning sessions attempted as means of achieving competence.[18,19]

Enabudoso et al had reported the high impact of a 5-day ultrasound training programmes, using a subjective self-assessment of competence.[15,20] In the study, trainees reported a high level of satisfaction and confidence following the intensive ISUOG accredited course. A limitation of that report, however, is the subjectivity associated with such self-assessment, especially when a complementary, objective assessment of such trainees using predetermined criteria was not utilized. Many studies have reported the lack of correlation between the self-assessment of ultrasound skills and actual practical competence.[21] It is such realization that has led to this new study aimed at using objective measures to assess the impact of a 5-day hands-on training on the competence of ultrasound naïve healthcare professionals in basic obstetric ultrasound scan with special focus on fetal biometry.

Materials and Methods

This comparative analytical study was conducted as part of a training workshop in Fetal Medicine and Obstetric Ultrasound Scan in June 2019. The programme was conducted by an ultrasound training organization. Similar trainings had been conducted in the last six years under the auspices of the International Society of Ultrasound in Obstetrics and Gynaecology (ISUOG). The trainers included ISUOG-accredited trainers with vast experience in the practice and teaching of obstetric ultrasound scan. The trainees were practitioners including doctors, nurses/midwives and sonographers with interest in acquiring the skills of obstetric ultrasound.

The basic features of the training programme had been previously described[7]. In summary, it involved both theoretical and practical sessions, with at least 50% of the nine-hour daily course time dedicated to the practical sessions, in compliance with the recommendation by Nathan et al.[13] Prior to the commencement of the training workshop, the seven facilitators of the programme reached a consensus on the scoring frame based on the adaptation of the image competence guidelines by Abuhamad et al.[12] Three evaluators were then selected among the facilitators present who then underwent harmonization of their scoring scales using preexisting ultrasound images to create uniformity in the scores.

The women that were scanned were consenting obstetric patients with average weight (ranging between 50-90kg) and estimate gestational age of 18-26 weeks, with established clinical indications for ultrasound scan. These participating patients had the benefit of having the ultrasound scan done at no cost to them, and financial token was provided for their transportation back home along with a lunch pack.

A randomly selected representative sample of 23 trainees out of the total attendees of 57 who reported that they had never attended a didactic practical ultrasound training were evaluated for competence on the first day of the workshop, before any practical session was conducted. There were 10 medical officers, 10 obstetricians and 3 resident doctors. A questionnaire detailing the socio-demographic characteristics and the experience level in terms of years of medical experience was obtained. The selected participants were asked to perform a basic obstetric scan, after they had familiarized themselves with the knobology of the ultrasound machines under the supervision of the facilitators. They were then assessed on their technique of scanning, as well as on fetal biometry, including the Biparietal Diameter (BPD), Head Circumference (HC), Abdominal Circumference (AC) and Femur Length (FL). The facilitators offered technical assistance as necessary but offered no instructions or feedback.

The practical skill demonstrated was assessed by reviewing the scanned images based on 4 pre-identified specific tasks. These included: the correct identification of the structure of interest; the accuracy of the planes; the image optimization and the accurate placement of calipers. For each of the specific tasks, scores ranging from1 to 4 were awarded. A score of 1 represented an improperly done task; 2 represented the display of a skill that was classified as needing focused mentoring; 3 represented the requirement for minimal mentoring; while 4 implied that the trainee has demonstrated a skill adjudged as requiring no further mentoring. The composite scores, with a range of 4 to 16 were then obtained and recorded. A minimum score of 12 for each biometric parameter was adjudged as competence by the team of facilitators, in alignment with the recommendation of Abuhamad et al that a score of 75% be considered as the benchmark for competence.

After the five-day training, the same set of trainees was requested in a similar fashion to repeat the same tasks on similar patients. Each of the parameters was again scored using the Likert scale of 1 to 4 for the specific tasks. Thereafter, the various individual pre-training and the post-training scores along with the composite scores were compared and analysed using relevant statistical methods for the trends in the competency scores

Research approval, with protocol number ADM/E A/VOL. VII/14784 was obtained for this study. In addition, informed written consent was obtained from all the patients, while verbal consent was obtained from the participating health care personnel.

Results

Twenty-three ultrasound-naïve trainees participated in the study. Table 1 shows their baseline characteristics. Their ages ranged between 33 and 59 years with a mean (±SD) age of 42.5 ± 7.5 years. Medical officers (43.5%) and Obstetricians (43.5%) were more represented than resident doctors (13.0%). The mean (±SD) years of service of the health workers was 13.6 ± 8.2 years.

The number of trainees who had competence/non-competence scores (based on achieving a composite score of at least 12) at the pre-training assessment of the trainees for the different biometric parameters was BPD 0/23; HC 0/23; AC 0/23; FL 1/22. The corresponding number at the post training assessment was BPD 16/7; HC 16/7; AC 11/12; FL 10/13. This result

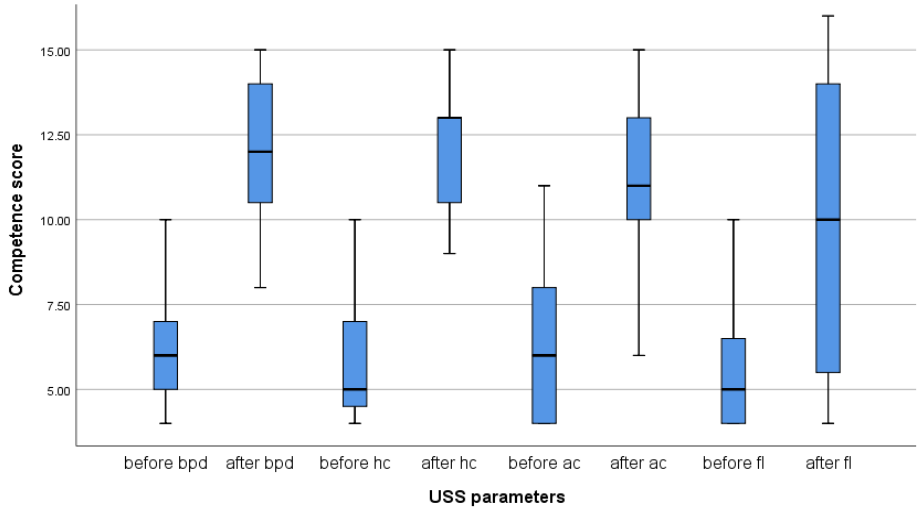

Figure 1: Box And Whisker Plot Showing the Competence Scores for Each Basic Fetal Biometric Parameter Before and After Training.

Boxes show the median and the 25th and 75th centiles. Whiskers show the range of scores for each parameter. bpd - Biparietal Diameter; hc – Head Circumference; ac – Abdominal Circumference; fl – Femur Length

Table 1: Baseline characteristics of the participants

Characteristics	**Frequency (%)** n = 23
Age (mean ± SD), years	42.5 ± 7.5
Years of service (mean ± SD)	13.6 ± 8.2
Cadre of Health worker	
Medical Officer	10 (43.5)
Resident doctors	3 (13.0)
Obstetrician	10 (43.5)

Table 2: Comparison of Before and After Competency Scores and Coefficient of Variation Across the Parameters

Parameters	Competence score [mean (SD)]		p-value**	Coefficient of variability	
	Before	After		Before	After
BPD	6.4 (1.7)	12.1 (2.0)	<0.001	0.26	0.16
HC	5.8 (1.7)	12.1 (1.8)	<0.001	0.30	0.15
AC	6.2 (2.1)	11.1 (2.4)	<0.001	0.34	0.21
FL	5.3 (1.7)	10.0 (4.3)	<0.001	0.33	0.43
Overall composite score*	23.6 (5.7)	45.3 (8.3)	<0.001	0.24	0.18

**all domain scores, **paired sample t-test*

Table 3: Predictors of the overall after training competence score

Predictor variables	Regression coefficient	Standard error	p-value
Constant	40.03	15.99	
Before competence score	0.752	0.313	0.028
Age (years)	-0.331	0.406	0.426
Years of Practice	0.149	0.371	0.693
Cadre of worker*			
Resident doctor	4.829	5.256	0.371
Obstetrician	-2.345	3.661	0.530

*reference category; medical officers

showed that virtually all the trainees lacked competence in all the parameters before training. However, there was post-training improvement with 70% of the trainees showing competence in BPD and HC, 48% in AC and 43% in FL.

Table 2 shows the pre-and post-course comparisons of the competence scores of the participants. Across all the four biometric parameters, the post-training competency scores were significantly higher than the pre-training scores. Also, the variability of the scores was lower in the post-course compared with the pre-course assessment scores across all the parameters except for the FL.

Fig 1 is a box and whisker plot depicting the distribution of the scores on the various biometric parameters by the trainees before and after the training. There were uniformly poor scores before training, but this improved after the training. The (HC) had the highest post-training median score with a small interquartile range. This was very closely followed by the BPD and the AC. The FL demonstrated the least scores and the widest spread.

Table 3 shows the predictors of the overall post-training competency scores. The only statistically significant predictor of the scores was the pre-course competency scores. A unit change in the pre-course competency score led to mean change of 0.75 points in the post-course scores. Age, years of practice and cadre of the health worker were not significant predictors of the post-course scores.

Discussion

This study shows that following didactic 5-day training in obstetric ultrasound scan for ultrasound-naïve participants, there is significant improvement in the basic fetal biometry competency scores, as well as the percentage of participants who achieved competence in terms of the scan images produced. It also shows that these scores vary with the pre-training competency score was the only significant predictor of the overall post-training competency score.

Adriaanse et al[21] had previously shown that there is a wide variation in the ultrasound learning capacity of trainees. This is also seen in this study with wide variation in the competence scores among trainees. The pre-course assessment depicted ultrasound-naivety in all the participants with competency scores less than 12 as well as highlighting the wide variation in the individual scores obtained.

There was however a reduction in the variation in the individual participants' scores following the post-course assessment. The variation was noticed to be least in BPD and HC following training showing that training helps to reduce the variation in competence while improving the individual as well as the median competency scores.

Tolsgaard et al[22] reported that there was a disparity in the learning rate of the various parameters in fetal ultrasound. This is in consonance with the finding in

this study that showed that the FL had the least competence score and also the widest disparity. It is opined that the femur poses more challenges in obtaining optimum image for assessment. This could be as a result of its having similarity to other long bones of the fetus and also the challenge it poses to new trainees in ultrasound in aligning the scanned image to give optimal horizontal views, through a combination of probe movements.

The finding that the pre-training score is a significant predictor of the post-training score is no surprise. That there is individual variability in scanning ability has already been stated.[21] The inherent ability of the individual towards certain skills is an important aspect of competence acquisition. This, as shown in this work, ranks higher than the professional qualification, duration of practice and age.

Despite the above, a 5-day training can create improvement in scanning skills and majority of the participants achieved competence in at least 2 fetal biometric parameters. For accurate gestational age assessment however, it is ideal to have a composite of at least the 4 basic fetal parameters.[23,24] An implication of this finding is the need to dedicate more time in the training for FL as this seems to pose challenge for majority of ultrasound naïve trainees following a 5-day training session. It should also be noted that proficiency is attained following consistency in practice. Therefore, while the competence score may just be the beginning, the trainees must be encouraged to scan more. Swanson et al[17] showed that remote mentoring and assessment of images produced improved proficiency for their trainees. This is achievable with widespread internet facilities and provides avenue for on-going mentoring with the consequent improvement in practice.

A limitation of this study is the fact only short-term competence has been assessed. It does not imply "clinical competence" which is acquired usually in the workplace under real life clinical scenarios. Nevertheless, competence as assessed here is a necessary initial step to acquiring long term proficiency. On the flip side, a strength of this study is the fact that it has used an objective scale to assess competence albeit for a duration that appears feasible in many LMIC settings. Despite the short comings of this short duration, the module could be repeated multiple times following intervals that enable clinical practice in-between. In addition, as stated, remote mentoring could help consolidate the competence.

Implication For Clinical Practice

A clinical implication of this study especially in ultrasound training in fetal biometry is that a properly structured and conducted 5-day practical workshop in basic obstetric ultrasound can lead to improved competence in fetal biometry measurement, thereby contributing to the development of the required critical manpower, especially in developing climes with absence of more established training programmes. More time must however be dedicated for teaching in Femur Length during such trainings.

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Conflict of interest - None

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