«How low can we go? »

Developing a course in obstetric-gynaecologic ultrasound for medical students.

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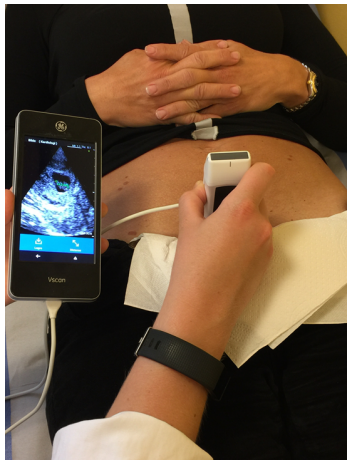

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Abstract

Background: Point-of-care ultrasound investigations (POCUS) are increasingly used in primary healthcare. The University of Bergen, Norway introduced ultrasound teaching for medical students during 2017. Based on the Scholarship of teaching and learning (SoTL) principles we aimed to develop, implement and evaluate an obstetric-gynaecologic ultrasound course in the medical school curriculum.

Summary of work: A scoping literature search and stakeholders' discussion (obstetric-gynaecologist, general practitioners and medical students) identified relevant obstetric-gynaecologic POCUS examinations. A pilot-study where a fourth-year medical student tested three selected procedures using the handheld ultrasound apparatus available at the Medical Skill Centre, investigated number of examinations needed to gain proficiency.
A validation-study using abdominal handheld ultrasound evaluated the feasibility in confirming vital intrauterine pregnancy during first trimester.
The course set-up was developed encompassing two weeks with lectures, practical apparatus instructions (knobology) but most important supervised patient examinations supplemented with not obligatory out of campus unsupervised training. Online literature and videos supplemented the teaching. Students should present in plenary selected recordings of their examinations and a brief ultrasound-related oral presentation, encouraging collaborative learning. Course evaluation included pre- and post-test (multiple choice questions: MCQ), practical test performing selected examinations and students' oral/written feedback.

Summary of results: Bladder volume measurements, third trimester fetal position evaluation and first trimester detection of vital intrauterine pregnancy were identified as the most relevant investigations.
The pilot testing suggested a minimum of 5 supervised examinations sufficient for learning bladder volume and fetal position evaluation. The minimum gestational week the handheld ultrasound apparatus could be used for early pregnancy vitality examination, was deemed undetermined.

In the validation-study, two fourth-year medical students examined 100 first trimester pregnant women. They identified that from gestational week 7 vitality could be detected with 79% positive and 100% negative predictive value.
Two courses were attended by 15 (in 2020) and 12 (in 2021) fifth- and sixth-year medical students. Three professors and three additional teachers were specifically affiliated with the course, in addition to clinical staff performing routine patient examinations.
The MCQ results increased from median 65% correct pre-course (95% confidence interval (CI) 56-77) to median 91% post-course (95% CI 91-100, $p<0.001$ Wilcoxon Sign-Ranked-test). All students performed a minimum of 5 examinations per modality: median 8.5 bladder volume measurements, 8.5 early pregnancy vitality determinations and 12 fetal position examinations. At course-end 26 of 27 students considered themselves capable of performing these examinations. Of 15 students randomly selected to demonstrate a modality, all succeeded. Students deemed the course as interesting and very engaging but with a substantial workload.

Discussion and Conclusion: We have developed a two-week course in obstetric-gynaecologic POCUS using a handheld device. Using student active, collaborative learning medical students achieved theoretical and practical skills in measuring bladder volume, determine last trimester fetal position and confirming early pregnancy vitality. The course is labour intensive, both for students and teachers. The main limitation in number of course participants is the availability of sufficient patients for first trimester investigations. Ultrasound simulators with relevant modules installed might mitigate this.

Take-home messages: Bladder volume measurements, early pregnancy vitality and fetal position determination is suitable for a medical school ultrasound curriculum.

Introduction

Point-of-care ultrasound investigations (POCUS) is ultrasound examinations performed patient near (bedside) by routine attending physicians rather than specialists trained in radiology/imaging techniques. To accommodate for easy mobility, apparatuses are usually small, even pocket-sized, rather than large high-end stationary machines used in specialized settings. POCUS is increasingly used in emergency ward settings (1) as well as primary healthcare (2, 3)

The University of Bergen, Norway hosts a Medical Skill Centre to facilitate medical students learning of specific procedures and attain skills specified in the medical curriculum. Instruction is provided by teachers in a group setting or training may be performed individually alone or co-supervised by student facilitators. The skill training equipment may also be used outside the skill centre facility, when courses are set-up in the clinic to encompass use on actual patients.

As appointed board leader for the Medical Skill Centre from 2015 Trovik has been responsible for acquiring relevant equipment for skill training according to the new curriculum (MED2015). Ultrasound apparatuses were deemed highly needed, and in addition to two high-end stationary machines, 10 handheld small apparatuses were attained late 2017. We aimed for these to be used in multiple settings: illustrating anatomy during different organ blocks, basic radiology teaching but also ultrasound use in different specialities. In the MED2015 teachers are encouraged to develop elective (not compulsory) courses from their specific field of medicine that could be attended by students wanting to attain deeper knowledge in a subject of particular interest.

As a consultant in gynaecology, Trovik was familiar with gynaecologic and obstetric ultrasound. Gynaecologists most often use vaginal ultrasound for early pregnancy or pelvic organ investigations, while obstetricians use abdominal high-end ultrasound apparatuses for late (second or third trimester) obstetric ultrasound. Primary physicians more often use small ultrasound apparatuses without a vaginal probe. Could we teach obgyn procedures using these small hand-held devises available at the Medical skill centre? In developing an

elective obgyn ultrasound course, how should the curriculum be constructed to facilitate learning in the best possible way?

In developing this course, we wanted to implement the principles highlighted by Felten in the Scholarship of teaching and learning (SoTL) (4): having focus on the student's learning, grounded in context, methodologically sound, conducted in partnership with students and finally make it appropriately public.

The primary aim of this study was thus to develop, implement and evaluate an obstetric-gynaecologic ultrasound course in the medical school curriculum for the University of Bergen.
The secondary aims were to identify obgyn POCUS procedures
- useful in general practice or as interns starting hospital training
- that could be taught using small handheld apparatuses
-suitable for medical students to learn during a two-week course

Methods

Informal discussions with stakeholders (fellow obstetricians-gynaecologists, primary physicians and medical students) identified possible methods of interests to implement in a course.

A fourth-year medical student (Torgeir Tundal) applied for a summer scholarship 2017 with the aim of performing a scoping literature search regarding technical/practical use of handheld ultrasound for the procedures initially identified. He would also pilot performing the selected procedures using the handheld ultrasound apparatus from the Medical skill centre (Vscan extend®, GE Healthcare, Trondheim, Norway, figure 1). He received limited instruction by the study principal (Trovik) and the routine clinical hospital staff and registered in a logbook the results/ease of his consecutive examinations to determine if/when he considered himself able to perform these procedures with reasonable confidence.

Figure 1. Ultrasound machines being recharged before a morning session.

Two other fourth-year medical students (Cecilie Sira and Judith Krossøy Pedersen) performed a validation study during 2018 testing if handheld ultrasound could determine vitality in a cohort of 100 early pregnant (first trimester) women. After supervised training by the study principal (performing the investigations together) the students were responsible for including patients and performed the majority of investigations themselves. This study was conducted according to the Regional Ethics Committee's recommendations (REK 2017/2030), and all women gave written consent.

During autumn 2019 a two-week course curriculum was developed in collaboration with the three students and two additional ob-gyn professors whom, in addition to the three project students, would be responsible for teaching during the course. We aimed for a short practical (knobology) introduction, a minimum of plenary lectures but a maximum of practical sessions with supervised real-life practice of the three ultrasound procedures supplemented with not mandatory out of campus unsupervised training. Written and online visual (video) learning materials were identified or developed. We also wanted to include

the course students in active teaching: demonstrating cases/videos of their own examinations and contribute with short plenary oral presentations. Formative feedback/assessment should be provided directly by instructors during skill training and by feedback from teachers and peers during plenary presentations.

To assess the amount of practical training received, the students should log consecutively each self-performed examination. To evaluate the attainment of theoretical knowledge a pre- and post-course multiple choice questionnaire (MCQ) was prepared. In testing practical skills, we aimed to test each student randomly selected to perform one of the three modalities at course end. Course evaluation as an anonymous written evaluation form (questionnaire) would be supplemented by an oral plenary evaluation at course end.

The course has been conducted twice: January 2020 and January 2021. A summary of the course development and results was presented at the Association for Medical Education in Europe (AMEE) congress August 2021 and in October 2021 as a poster presentation during the Research day; a joint venture hosted by the Department of Obstetrics and Gynecology Haukeland university hospital – the University of Bergen - Western Norway University of Applied Sciences.

Statistical analyses have been performed using Statistical Packages for the Social Sciences (SPSS) version 22.0, IBM, Chicago, USA. When assessing learning curves the patient series reported in the pilot study were divided in tertiles (first 1/3 of series, middle and last) if > 25 patients and halves if <25 patients investigated. Categoric variables have been compared by Chi-square test or Fischer's exact test as appropriate. Pairwise comparisons were done by Wilcoxon Sign-Ranked-test. Continuous variables have been compared using Mann-Whitney U-test.

Results

Informal discussions with fellow gynaecologists at the Department of obstetrics and gynaecology, Haukeland University hospital, primary care physicians affiliated with the University of Bergen and students affiliated with the Medical skill centre, University of Bergen identified three modalities as most relevant to include in the course curriculum:

assess bladder volume, determine fetal position (transverse lay, breach or head down) in second half of pregnancy and confirm early pregnancy vitality (visualize intrauterine fetal heart beats at first trimester/12 weeks of pregnancy).

Bladder volume measurement

During the summer student scholarship the literature search determined ultrasound bladder volume measurements as useful, although usually investigated by specific portable bladder ultrasound machines ("bladder scanners") (5). The Vscan apparatus include algorithm for bladder volume assessment, measuring the bladder using two planes. VScan bladder measures has been assessed to be comparable to traditional ultrasound measurements (6). Handheld ultrasound for bladder distension measurement has been incorporated in a course for medical students at the Norwegian University of Science and Technology (NTNU) (7).

At the initial practical introduction/knobbology in using Vscan, Tundal received instruction in bladder volume measurements. After performing five examinations comparing his handheld measures to the clinic's "bladder scanner" he could correctly identify the bladder and assess a volume as less or over 100ml (one measurement used in the clinic to assess sufficient bladder emptying).

Third trimester fetal position evaluation

Handheld ultrasound used by experienced sonographers has been shown to yield perfect agreement of fetal position compared to the investigation using high-end machines (8). Using a portable, small (but not handheld/pocket sized) ultrasound apparatus this modality has been tested in use by first-year medical students after a 12 hour course (9).

Tundal received supervision by obstetricians performing routine pregnancy consultations. After his 20 consecutive logged examinations, he had correctly identified fetal position in 16/20. Three of the four undeterminable were among the first 10 examinations. Although the number of correct identification increased from 7/10 (70%) to 9/10 (90%) after 10 examinations, this was not statistically significant ($p=0.582$ Fisher's exact test). The main

obstacle to identify the cephalic position was in late pregnancy if the head was deeply embedded in the pelvis. Thus Tundal's evaluation was that after 8-10 examinations he felt reasonable competent in assessing fetal position.

First trimester detection of vital intrauterine pregnancy

POCUS examinations in early pregnancy has been described for emergency medicine (10) and primary care (2) but studies describing use of handheld apparatuses were sparse (11, 12), none defining the lower gestational week limit when fetal vitality (heart beats) could reasonably be determined. We identified no studies using handheld ultrasound in teaching for medical students.

Tundal performed 39 early pregnancy examinations, 3 patients with a miscarriage and 36 with vital intrauterine pregnancy. All three pathological pregnancies were correctly confirmed as non-vital. Of the 36 healthy pregnancies 9 were in week 5 and 6 and only one (11%) was identified with fetal heart beats using the handheld ultrasound. For pregnancies from week 7 and higher a significantly higher proportion 15/27 (56%) were correctly identified as vital (p=0.006, Fisher's exact test).

In Tundal's pilot cohort the proportion of pregnancies confirmed as vital was not significantly different when comparing tertiles according to increasing experience across the series: all vital pregnancies 4/13 (31%), 6/11 (55%) and 6/12 (50%) (p= 0.488, Fisher's exact test) or those with a minimum gestation age of 7weeks: 3/9 (33%), 5/9 (56%), 7/9 (78%) (p=0.101 Fisher's exact test). Tundal thus assessed that after approximately 10 examinations a reasonable skill was attained.

Validation study of first trimester detection of vital intrauterine pregnancy

The reasonable lower gestational week limit to confirm vital intrauterine pregnancy (visualize heartbeats) needed to be confirmed in a proper designed validation study, which was applied for and conducted in 2018. In this validation-study, two fourth-year medical students (Cecilie Sira and Judith K Pedersen) examined 100 first trimester pregnant women of which 86 were healthy, normal pregnancies and 14 were pathological (miscarriage or tubal pregnancy). The regional ethical committee consented to the inclusion of women applying for termination of pregnancy, provided proper information and voluntary consent.

The first 13 examinations were performed with the supervision of Trovik, after which they performed the majority of investigations themselves. They identified that from gestational week 7 vitality could be detected with 79% positive and 100% negative predictive value (13). Comparing investigations performed by the senior investigator (experienced in gynaecologic ultrasound) she confirmed vitality in 18 of 19 healthy pregnancies investigated (95%) compared to 37 of 48 in the student investigated group (77%), not statistically significant different (p=0.156 Fischer's exact test).

Developing the course set-up

Tundal drafted a two-weeks course set-up at the end of his summer scholarship. Starting with introductory lectures regarding these three modalities and practical apparatus instructions (knobology) training but most important supervised patient examinations in the clinic. During autumn 2019 discussions including the students and two other ob-gyn professors (Elham Baghestand and Cathrine Ebbing) finalized the program.

The initial knobology-instruction would be conducted while students performed bladder volume measurements on each other, later they would have specific training sessions for this, and some students would follow the urotherapist in her consultations, including measurement of residual urine.

Early pregnancy investigations were to be performed in the gynaecologic out-patient department where women are consulted regarding pregnancy complications (bleeding, hyperemesis and termination of pregnancy), or those admitted to the gynaecological hospital ward. Here the course teachers (mainly professor Trovik or students Sira and Pedersen) would be responsible for instructing two students sharing one apparatus.

Fetal position assessment would be performed in the obstetric outpatient clinic and in the ultrasound/fetal medicine outpatient clinic, student pairs would be supervised by routine staff (obstetricians and midwives) and study-student Tundal and professors Ebbing and Baghestan.

Students should register consecutively in their log-book (without any patient identification) each examination performed regarding which modality was used. Videos/pictures illustrating different investigations were similarly saved on each ultrasound machine.

Lectures would be conducted mainly by the three professors regarding the three modalities, general ultrasound technical and safety information, pregnancy dating and broader lectures exemplifying ultrasound use in gynaecology and obstetrics.
Lecture notes ("handouts") and online links to literature and videos accessible from course start would promote blended learning.
To increase student activity 1-2 days would accommodate self-study: students should prepare a short oral plenary presentation in an ultrasound-related subject and in a different session present selected recordings of their examinations.
Multiple choice questions (MCQ) were prepared to be performed before course start and at the end to evaluate the attainment of theoretical knowledge. A final score of at least 60% was set for passing the course. We aimed for each student to perform 10 examinations of each modality but set a minimum of 5 to pass.
We aimed for a practical test where students at last course day would randomly be assigned to perform one of the three modalities.
A course evaluation form for the students to fill out anonymously was developed. An oral feedback session at course-end was also scheduled.

Course conduction and evaluation

Two courses were attended by 15 (in 2020) and 12 (in 2021) fifth- or sixth-year medical students (a prerequisite was that they had completed the ordinary obgyn curriculum during 9th semester). The three study students were largely substituted by three other teachers at the 2021 course. The general set-up is provided in figure 2.

Figure 2. Course set-up regarding lectures and skill training

Time	4.01	5.01	6.01	7.01	8.01
8.30-9.00	Introduction MCQ pre-course		Dating of pregnancy	POCUS	
9.00-11.30	Early pregnancy Bladder volume	SKILL training			
11.30-12.30	Fetal position				CASE H*, I, J
12.30-15.00	SKILL training				
15.00-16.00		Safety	CASE present A, B, C	D, E, F, G	First week summary
WEEK 2					
	11.01	12.01	13.01	14.01	15.01
8.30-9.00	CASE present K, L, M, N				Student A, H, J, K
9.00-11.30	SKILL training				
11.30-12.30	Obstetrical sonography	Gynaecological sonography			
12.30-15.00	SKILL training				MCQ post-course Evaluation
15.00-16.00		Student oral J, L, D, G	E, F, I,M	N, B, C	

Lectures

Skill training: see figure 3 for specification

Case presentation: students presenting three selected cases they have investigated

Student oral: a short oral presentation of a self-selected ultrasound-related subject

POCUS: point-of care ultrasound *Each student is represented by a letter

Skill training

Students were originally scheduled as pairs but due to corona restrictions in 2021, with the exception of early pregnancy examinations (as case load would otherwise be too limited), single students would attend a patient consultation, see figure 3.

Figure 3. Skill session set-up for 2021, each student is represented by a letter

Location	4.01	5.01	6.01	7.01	8.01	11.01	12.01	13.01	14.01	15.01
Gyn EP	A, B	H, I	C, D	J, K	E, F	L, M	G, N	A, B	H, I	C,D
Obstetric	C	J	A	H	D	I	B	F	E	M
Student practice	H,I,J,K L,M,N	A,B,C,D E,F,G	I, M	B, C	J, L	E, D	H, L	E, N	G, A	F
Gyn emergency	D	K	F	N	M	G	A	I	J	B
Obstetric	E	L	B	I	G	J	C	K	L	J
SELF-STUDY			J	D, G	I	B, C	J, K	H	B, D	G
Urotherapy			E, G		C, B			M, L		K,N
Fetal-medicine	F	M	K	L	A	H	E	D	C	I
SELF-STUDY			L	E, F	N	A, F	I, M	C	N, K	L, H
Gyn ward			N	A	H	K	F	J	M	E
Obstetric	G	N	H	M	K	N	D	G	F	A

Training in early pregnancy vitality determination

Training in fetal position determination

Training in bladder volume measurement

Gyn: gynaecological, EP: early pregnancy consultation, mainly termination of pregnancy

Student practice: students training by measuring bladder volume on each other

In addition to the scheduled training students wanted to use the ultrasound apparatuses unsupervised out of campus. This was accommodated and 19 of the 27 students used this possibility. Overall students reported of median 8 days of personal practise performance (95% confidence interval (CI) 8-9, this was significantly higher in 2020: median 9 days 95% CI 8-10 while in 2021 median 7.5 (95% CI 7-8, $p<0.001$ Mann-Whitney U-test). In spite of this the number of examinations each student performed were not significantly different these two years with total median 30.5 examinations (95% CI 26-34) specified as median 8.5 bladder volume assessments (95% CI 7-10), fetal position determination median 12 (95% CI

10-14) and early pregnancy investigations median 8.5 (95% CI 7-11). All students performed a minimum of 5 examinations per modality as set for a pass mark but not all reached our aim of at least 10 examinations. At course end 2020 all students randomly performed one of the three modalities and was evaluated by a teacher, all passed. This examination was not conducted in 2021 due to corona restrictions.

The MCQ results increased from median 65% correct pre-course (95% CI 56-77) to median 91% post-course (95% CI 91-100, $p<0.001$ Wilcoxon Sign-Ranked-test).
Thus, all students by far fulfilled the 60% pass criterion.
At course-end, 26 of 27 students considered themselves capable of performing these three examinations.
Both at the anonymous written and the plenary oral evaluation students deemed the course as interesting and very engaging but with a substantial workload. Nether students nor teachers considered it possible to increase the number of students, mainly due to available patients for early pregnancy examinations. Students requested to lend the ultrasound apparatus for use in their upcoming placement in general practice.

The process of this course development has been presented in part as an electronic short oral (on demand) presentation at the online AMEE conference august 2021 # SCOD14.2.9 (8547).

Discussion

We have developed and conducted an elective (non-compulsory) course in point-of care obstetric-gynaecologic ultrasound for medical students. With an emphasis on skill training students acquired theoretical and practical knowledge in confirming first trimester vital intrauterine pregnancy, determining fetal position in late pregnancy and measure bladder volume.

Having focus on the student's learning

We aimed for a course that should enable the students to learn why (indications) and how (practical performance) of three selected gynaecologic-obstetric ultrasound procedures. Alignment of course aims with theoretical and practical skill teaching, continuous direct

feedback from teachers while supervising (formative feedback) as well as summative feedback at course-end all focused on their learning. After the first week a summary of each student's practical skill performance (modality and numbers) was conducted, possibly modifying the skill placement the following week to cover missing parts. Feedback from students were used to overcome any bottlenecks/obstacles encountered during the course.

Grounded in context

The initial discussions with stakeholders (obstetric-gynaecologists, primary care physicians and students) highlighted three relevant ultrasound modalities. These examinations have been shown to be in line with what GPs deem essential as POCUS ultrasound. Lokkegard et al performed a needs assessment including 45 Nordic GPs in a Delphi process. Out of 30 investigated scanning modules/ultrasound procedures measuring bladder volume was prioritized as number one, determining living intrauterine pregnancy as number three and fetal position as number four (14).

But could these examinations be learnt using small handheld machines?

Andersen et al has described a course of handheld ultrasound for 5th year medical students (7) including detecting "hydronephrosis and bladder distension". No other ob-gyn procedures were included. After 9 hours course the 30 students used their handheld apparatus during 5 months of general practice placement. Bladder volume measurement were not specifically reported in their paper but acceptable organ presentation was stated as obtained for >93% of 307 renal system investigations. Third trimester fetal position using small ultrasound apparatuses have been demonstrated to be possible to learn even first-year medical students (9). As we identified no studies where handheld ultrasound investigating early pregnancy had been used by non-experts, our validation study (13) where two medical students performed the majority of investigations could be considered a piloting of this teaching.

After conducting our ultrasound course, we may conclude that also early pregnancy investigations are possible to teach medical students and as such validates that all three course modalities are grounded in context.

The course has had far more applicants than possible to accommodate. The students taking the course have rated it as interesting and recommendable. This is somewhat in contrast to an evaluation of a mixed-methods POCUS program for post-graduates in emergency

medicine training; of the modalities included in their course the students reported least interest in learning early pregnancy assessment (15). Our medical curriculum is aiming for attaining competence as residents starting in training in hospital or primary health care rather than postgraduates, and the medical students considered our course to be highly relevant.

Conducted in partnership with students

This course has been developed and conducted with students through all phases: students have been actively involved in initial discussions, literature search, piloting the learning/use of the handheld machines, validating the early pregnancy identification, course set-up and contributing as teachers. The course-students have evaluated the course and when they suggested incorporating use of the hand-held machines unsupervised out of campus, this possibility was incorporated.

Methodologically sound

The teaching aimed at providing initial basic theory of ultrasound technique/safety and indications for the three modalities and corresponding instruction in practical use of the apparatus as a bare minimum before actual clinical skill training. Lectures were aimed to encourage interaction with the students, having a small group (maximum 15 students) eased this communication. Active learning activities such as short polls, discussing cases accompanied by video/ultrasound demonstrations was included in lectures to increase interaction. Skill training was initial in groups of maximum eight students, thereafter maximum two students per teacher/patient examination. This eased direct supervision and teacher formative feedback and, particularly for the early pregnancy investigations, ample time in between patients for discussions/dialogue between teacher-students.
Literature (handouts or online links) and video links were available for students to read/view/prepare before, between and after lectures/skill sessions. Although, except for the preparation of their oral presentation, no specific out-of campus course preparation instructions were given, thus blended learning was not really incorporated in this course. All students had more than one skill session with each modality, enabling to repeat skill training they had been exposed for days earlier. Meeting different teachers at different skill sessions possibly exposed students to different teaching patterns. Students preparing for case

presentations would repeat their knowledge regarding procedures/indications and by attending case presentations, including photo/video presentations students would be exposed to more examinations than they could perform personally. Repetition is a significant aspect in the learning process.

In preparing for their oral presentation, each student could deepen their knowledge in one ultrasound subject, and disseminated this to their peers, one way of flipped-classroom teaching. Pairwise skill training, preparation of case presentation and oral presentation is one example of think-pair-share activity, encouraging discussion and peer guided, collaborative learning.

Methodologically soundness should also apply to the SOTL method used to evaluate the course-outcome. According to Institute for the Scholarship of teaching and learning (ISoTL), the University of British Columbia (Resource Hub | ISOTL (ubc.ca)) the most common methods is surveys and questionnaires. We used a questionnaire administered to the students at course end, answered anonymously. This was supplemented by a plenary group discussion, also at course end. The group encompassed all students and thus group size was larger than recommended and questions not structured as recommended for a focus group interview.

Make it appropriately public

The course development has been presented in part at the online AMEE conference August 2021, as poster presentation in a multi-institutional research day in Bergen October 2021 and this thesis is also to be publicly available through the BORA-platform.

But this project has not been without pitfalls. In due time before the summer scholarship period an application was sent to the Regional ethics committee, applying for consent to start the validation study (testing handheld ultrasound in detecting intrauterine pregnancy). Due to long handling time in the committee, approval was not received until autumn 2017, at which time Tundal had finished his scholarship. Thus, the validation study had to be conducted by another set of students. Although this delayed the process, we truly benefitted from more student involvement.

Although the covid epidemic reduced course-student number temporarily, the main obstacle in conducting the course is limited case load of early pregnant patients to investigate: a maximum of 5 scheduled patients per day at the early pregnancy outpatient clinic, and first and last day of course students are only available after/before lunch respectively.
If we should increase number of course participants we either need to spread the course skill training over longer time (increased teacher work load) or we need simulators (mannequins for ultrasound training) with proper software installed.

Future prospects

We have started a pilot study where three students were allowed to bring the ultrasound apparatus out of campus for use during placement in general practice. If positive results from this extension, we may continue this on a larger scale after the upcoming obgyn ultrasound course January 2022.

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Conclusion

We have developed a two-week course in obstetric-gynaecologic POCUS using a small handheld device. Using student active, collaborative learning medical students achieved theoretical and practical skills in measuring bladder volume, determine last trimester foetal position and confirming early pregnancy vitality.

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