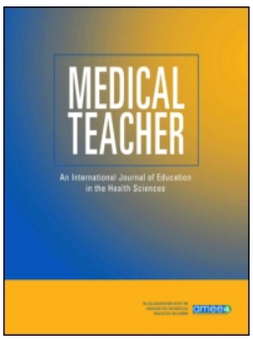

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TWELVE TIPS

# Twelve tips on how to establish a new undergraduate firm on a critical care unit

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**ABSTRACT**

**Background:** Little is known about undergraduate teaching in critical care unit (CrCU) and many undergraduate curricula lack placements in CrCU.

**Aims:** To describe how our CrCU succeeded in developing a novel placement for Year 3 undergraduate medical students.

**Methods:** Particular emphasis was placed on a robust timetable incorporating a variety of activities, a dedicated and thorough induction, and a mix of teaching methods such as formal and informal, consultant-led, and skills. Services allied to CrCU were also utilized.

**Results:** Our new firm has exceeded all expectations and, based on student feedback, received the "Firm of the Year" award for several years in succession. It now serves as a model of undergraduate teaching in our hospital.

**Conclusions:** Educationalists and intensivists should work together to unlock the full potential of this rich learning environment. Professional societies in critical care medicine should take the opportunity to develop more interest in undergraduate medical education.

## Introduction

The Critical Care Unit (CrCU) is a unique clinical environment not only regarding the wide variety of patients, presentations, and interventions but also in its meticulous, holistic, and investigative approach to patient management. There is emphasis on physiology and pathophysiology and on multidisciplinary team work. A CrCU should thus be a rich learning environment for undergraduate medical education, and it is surprising how little attention undergraduate education on CrCU has received in the literature. Reports of institutional experience with undergraduate teaching in critical care are as rare as suggestions on how to make the most efficient yet safe use of this unique learning environment (Qutub 2000; Beckers et al. 2005; Whereat & McLean 2012; Kumar et al. 2013).

Some authors have voiced great enthusiasm (Civetta & Varon 1995; Rogers et al. 1995), while others have cautioned (Marik & Kaufman 1995). Beckers et al. (2005) from Germany reported on an initiative of teaching emergency skills to undergraduates but their approach did not focus on CrCU. Whereat and colleagues in a survey in CrCUs in Australia reported that a quarter of hospitals did not incorporate critical care into undergraduate education (Whereat & McLean 2012), a situation that may be mirrored elsewhere (Garcia-Barbero & Such 1996; Qutub 2000). We also agree with Smith et al. (2007) who suggested that care of the acutely ill patient is under-represented in undergraduate medical education, especially in critical care (Fessler 2012).

Here, using the "twelve tips" approach, we aim to describe how we have successfully set up a new Year 3 placement for six medical students on a 24-bedded CrCU within a large UK teaching hospital. Our report is based on nine years of single center experience with continued evaluation, feedback, and improvement. We also provide a brief review of the relevant literature but focus on practical tips to make this a safe, achievable, and educationally rewarding proposal.

## Tip 1

### *Establish a dedicated "education team" on CrCU*

After realizing the potential of CrCU for undergraduate teaching, our first task was to put together a team to successfully overlook, organize, and deliver the teaching. The team comprises a balanced mix of senior and junior CrCU doctors and professionals with help from the undergraduate team. We were also keen to involve senior and ward nurses early on. The CrCU nurses are now a cornerstone of our placement although they do not have an educational qualification as such. We also rely on their constant help from the educational governance point of view, i.e. when it comes to supervising the undergraduates at the bedside at all times. Our aim was further helped by agreeing with CrCU management to employ dedicated "Education Fellows" who, apart from their clinical work in CrCU, have a specific job role which focuses on medical education. Their tenure of one year not only allows them to improve their clinical expertise but also makes first step toward an educational career and obtain an educational qualification. Such qualifications are becoming increasingly more valued and this is reflected by recent calls for all medical educators to attain such qualifications in order to ensure good practice (GMC 2009; GMC 2011; DoH 2014). None of the other team members have a formal educational background

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Supplemental data for this article can be accessed here.

or qualification. The placement lead is one of the full-time intensivists and has time for this role in the job plan. He receives further support with annual educational appraisals with the Year 3 Associate Dean. All members in this team have one thing in common – a genuine desire for teaching, learning, and development, and we feel that this is one major factor in pushing the firm from "good" to "outstanding". It is also important to think how to motivate the team. For us the single most important factor in this regard has been to establish a system of Teaching Awards based on student feedback (Newton et al. 2016). The CrCU team has won the award for best Year 3 placement for most years, and all team members, including the CrCU nurses, enjoy the annual awards ceremony.

## Tip 2

### *Invest in a detailed induction and define learning objectives*

As part of the induction, students are introduced to the department and the staff on the unit. The aim is to make them feel part of the clinical team and to familiarize the students with the working pattern and etiquettes on CrCU. We also wrote a detailed induction booklet (Online Supplementary Document 1) which not only details structure and timetable as well as learning objectives but also outlines CrCU etiquette and professionalism. The learning objectives are only broadly outlined in this induction booklet. One reason is that we felt there was such a rich learning environment on CrCU that we did not want to be too prescriptive for these students, many of whom were new to the clinical workplace. In addition, specific learning objectives for Year 3 are covered in great detail in the student handbook and the skills curriculum for Year 3. Students are also encouraged to define their own learning objectives during the induction meeting i.e. when they first arrive on CrCU. We send the induction booklet out in advance so that students arrive on CrCU with some knowledge of the clinical area. Students are also taken through the daily routine and the electronic documentation. We also give them a brief explanation of key equipment, just so that they understand discussions during the ward round for example around ventilator settings (Figure 1). We also recognize the risk that students might get carried away by all the interesting things they see on CrCU, and not focus on their curriculum. To this end, staff (particularly theatre anesthetists) are regularly emailed with a list of suggested teaching topics and procedures to ensure adherence with the Year 3 curriculum and prevent them from teaching critical care medicine.

**Figure 1.** Year 3 student group and CrCU consultant during teaching of equipment and ventilator settings in week 1 of their placement.

## Tip 3

### *Incorporate variety in the timetable*

Our team devised a timetable for the students (see Table 1), which aims to strike a balance between the curriculum, the learning opportunities and processes on CrCU, and the limited clinical experience of the Year 3 undergraduates. The timetable includes formal and informal teaching, much of it consultant led. It also features practical sessions, for example on airway management (Figure 2) as well as sessions in theatres. We also took great care not to overwhelm the already busy CrCU workplace with too many students, and so we developed a rotating timetable which meant a maximum of four students would be present on the CrCU, whilst the rest would be allocated to learning environments outside of the CrCU. Students are also given the option to participate in CrCU night shifts where they shadow the registrar on call, and those who have taken this opportunity have commented on it being an invaluable learning experience.

## Tip 4

### *Utilize CrCU handover as a learning opportunity*

Roughton and Severs (1996) have previously identified deficiencies with handover and we feel that there is hardly a better environment to observe good handover than CrCU. Partaking in handover also makes the students feel part of the team. We provide students with a handover sheet and encourage them to listen out for patients who are both interesting and relevant to their learning needs. In allocating patients, we aim to strike a balance between relevance to learning objectives and avoiding too complex or acutely unstable patients. Allowing students to have a handover sheet consisting of confidential patient information does however raise some concerns regarding confidentiality, and we are asking for handover sheets back from students before they leave the CrCU, and also placing confidential waste bins close to the exit.

## Tip 5

### *Establish daily student-led patient review*

Structured patient review is a typical routine for medical staff on CrCU, and students are given one patient during handover, who they follow throughout the day. They are also encouraged to undertake a patient review on their own, in the presence of the nurse assigned to the patient and while a CrCU trainee acts as a "go-to" person for guidance. Prior to examining the patient, the student will read the electronic information and then present the case to the assigned trainee as a "practice-run". This helps to develop confidence and raises further opportunities for learning. We have found this process extremely helpful to give students a sense of participation and ownership. Practicing a structured routine of patient review also prepares students for the busy clinical workplace. Acutely unstable patients are excluded from this teaching format and we generally use a much higher degree of supervision in sicker patients.

Table 1. Sample timetable which is provided to the students for every week. PBL denotes problem-based learning.

| | AM | PM |
|---|---|---|
| Mon | 09:00 Induction - (Led by Education Supervisor) (Critical Care Seminar Room, next to stairs in basement, between CrCu and Theatres – all students) | 14:00–16:00 Induction (Led by Education lead on the CrCU/ Education Fellow) (Seminar room - all students) |
| Tues | PBL | 14:00–16:00 Clinical Intelligence (CrCU Seminar room, 6 students) |
| Wed | 08:00 Critical Care Unit<br>08:45 Theatre 1<br>Student: 1 Theatre: Sharoe Green 3 Dr X<br>Student: 2 Theatre: 4 Dr X<br><br>08:00 Outreach, 1 Student: 3 | 3:15 Theatre<br>Student: 1 Theatre: Sharoe Green 3 Dr X<br>Student: 2 Theatre: 4 Dr X<br>Student: 2 Theatre: 4 Dr X |
| Thurs | 08:00 Critical Care Unit<br>08:45 Theatre<br>Student: 4 Theatre: 7 Dr X | 14:00–16:00<br>Teaching led by: DrX<br>Topic: Imaging (CXR etc) |
| Fri | 08:00 Critical Care Unit<br>08:45 Theatre<br>Student: 5 Theatre: Sharoe Green 2 Dr X<br>Student: 6 Theatre: 2 Dr X | Teaching Program in Undergrad Center |

Figure 2. Year 3 students practicing airway management on a manikin.

## Tip 6

### *Establish dedicated teaching ward rounds*

We were fortunate to be able to provide a dedicated consultant-led educational ward rounds where students have the opportunity to present their patients. Opportunities are almost always taken to treat the student presentation as a "case-based discussion". Students find these "educational" ward rounds extremely useful. This also ensures that students learning experience is not limited to their allocated patient but that they benefit from the other students' experience as well. This aspect of the teaching program attracts consistently positive feedback from the students and is also greatly enjoyed by the consultants. We propose that many medium-sized or large CrCUs will have members of staff who can accommodate a short educational ward round in their daily work.

## Tip 7

### *Utilize task-based learning*

Task-based learning is an educational strategy where students are assigned appropriate tasks in order to develop and generate learning opportunities. For instance, a student can be given the task of venepuncture having practiced this in the skills lab and following sign off by the skills team. Further learning points can include: indications for the procedure, consent, appropriate technique, and site to use, correct documentation/labelling, and then the task is further followed up by learning about interpretation of test results and differential diagnoses. Other common topics include Arterial Blood Gas (ABG) sampling, cannulation, and ECG interpretation. Incorporating practical skills into the teaching is of great importance particularly when there is evidence that some medical graduates feel unprepared with some of the practical skills required as a foundation doctor (Illing et al. 2008; Goldacre et al. 2010; GMC 2011).

## Tip 8

### *Provide short didactic teaching sessions which are relevant to the curriculum*

In our timetable, two didactic teaching afternoons a week are provided. These are shared between the consultants, educational fellows, and other trainees. Fundamental curricular-based topics are included, such as "Acute Coronary Syndrome/Chest Pain and Heart Failure", "ECGs and Arrhythmias", "ABGs and Respiratory Failure", "Chest X-rays", and "Haematological Malignancies and Anaemia". Another session on "Clinical Examinations" is also organized for students to practice their examination skills. A final session is left "free" for students to come up with ideas to address any additional learning needs. The learning sessions kept relatively basic to cater for students at the start of their clinical years, and they are all aligned to the Year 3 curriculum. We also ensure this during our regular meetings with the placement lead and great care is taken to ensure that the teaching does not drift off into specialized topics of intensive care medicine.

## Tip 9

### *Include sessions in the operating theatre to teach skills*

To ensure variety and avoid high numbers of undergraduates on a busy CrCU, we have incorporated sessions in the Operating Theatres in the timetable. Students typically

shadow a consultant anesthetist during their normal working day. This provides one-to-one consultant tutorship focused around the theatre environment and especially cardio-respiratory physiology. Students comment on this as a highlight in their timetable especially as they are given opportunities to undertake practical procedures such as venepuncture.

## Tip 10

### *Utilize the critical care outreach team*

In our institution, the CrCU outreach team serves as a bridge between the CrCU and the peripheral wards. This team of experienced CrCU nurses is distinct from the cardiac arrest team but instead sees acutely unwell patients on the peripheral wards who may later on require Intensive Care. Their role is not only to triage patients as to their need for CrCU input but also regarding the appropriateness of treatment escalation. The outreach team also provides input for patients following discharge from CrCU to avoid readmission to CrCU. By shadowing the outreach team, students are exposed to the understanding of levels of care as well as recognition of acutely ill patients. Occasionally, students may also witness cardiac arrest or near arrest even though cardiac arrests are usually handled by the hospital's dedicated cardiac arrest team. All Year 3 students are formally trained and signed off in Basic Life Support at the start of Year 3. However in our experience, they will usually observe during a cardiac arrest, not least because for some of them, this is the first encounter with a rapidly deteriorating patient and with death and dying. We strongly recommend that institutions reflect on the role of their students in this situation and provide guidance for undergraduates and clinicians. Later on in Year 5, students are invited to actively participate in resuscitation during their placement in Accident and Emergency and with the cardiac arrest team. Experiencing this scenario as an observer offers an invaluable experience that often comes with the sudden reflection on professionalism and on their future responsibilities as junior doctors.

## Tip 11

### *Foster a culture of multi-professional and peer learning*

The atmosphere on CrCU is often busy and active due to the many different health-care professionals and disciplines present, all of which aim to provide a holistic service to patients. Disciplines that provide regular input on CrCU include surgery and neurosurgery and most medical specialties, especially cardiology and respiratory medicine. We encourage students to observe the crucial and delicate connections between different specialties and professionals, and how they co-operate and rely on one another to help fulfill their roles for the patient. Students are also encouraged to shadow other health-care professionals such as nurses, physiotherapists, pharmacists, and the nutrition team. Such collaboration has been shown to improve skills and attitudes, especially in acute care (Milzman et al. 2014). We also encourage students to present cases to each other with regard to topics they have seen on ICU. One could also consider extending such presentations to their younger peers, i.e. Year 3 students presenting typical ICU cases to students in the pre-clinical years and link the content to pre-clinical learning objectives in, for example pathophysiology or anatomy. Although such an approach was not feasible for us due to the fact that our campus lacks students in their pre-clinical years, it may be worth considering for other institutions. Taken together, this approach has helped to establish a team ethos of multi-professional and peer learning and teaching.

## Tip 12

### *Gain regular constructive feedback*

We encourage students to give informal feedback throughout the placement. In addition, focus groups with a member of the educational team take place at the end of the placement, and detailed feedback is obtained across different categories along with recommendations for future practice and an overall score. We were extremely pleased to see our CrCU placement prized with the "Firm of the Year" award (Newton et al. 2016) for being the best firm for learning, with average overall scores of 4.6–4.9 (5 being excellent). A member of the CrCU team also received a "Junior Doctor Teacher of the Year" award which further compounds the idea of having dedicated education roles to help organize and deliver teaching. We also make an effort to encourage trainee participation in teaching sessions by adding further incentives such as a certificate for the portfolio. Rewarding enthusiastic teachers/tutors like this is a useful tool in recruiting new trainees to teach, and it also encourages trainees to undertake informal teaching opportunities with students on the unit.

## Future aims

### *Simulation training*

Our trust boasts a superb simulation suite which can be utilized further by our department and incorporated in this placement. We are now working on incorporating simulated training sessions for students to add another dimension to their learning experience (Good 2003; Murray 2005; Murray 2006) and help with skills such as team working, situational awareness, and leadership (Quince et al. 2014).

### *Consultant-led ward rounds*

As mentioned previously, the focused consultant ward rounds where students are taken on a separate ward round by a consultant, (to review only the patients which were seen by them in the morning), are found to be extremely beneficial for the students. We are working on incorporating more of these as they are not occurring as often as we would like.

### *Student perceptions and professionalism*

The success of our CrCU placement deserves further thought. What exactly do the students enjoy so much during this placement? Is it the variety of cases, or the sheer activity on a busy CrCU or the simple fact that the staffing ratio is different from a peripheral ward? It would be equally interesting to study how and through which overt

or hidden messages CrCU influences students professionalism.

### End of life care and ethics

Obvious topics include consent, escalation, or limitation and withdrawal of treatment. Breaking bad news and confirmation and certification of death are also commonly encountered on CrCU. Students are also introduced to the challenge of determining reversible disease processes from irreversible disease and dying. Formal teaching in this area may also be beneficial for students and so we aim to incorporate some of these topics in the timetable.

## Conclusions

Nine years ago an increased number of Year 3 undergraduates prompted us to establish a new firm on our CrCU. There was considerable skepticism regarding the appropriateness of a placement on CrCU for students at the very start of their clinical years. Clearly, CrCU can seem daunting to a relatively junior medical student, given the detail and depth of its "specialist" nature and the equipment used. Some colleagues also voiced concerns regarding patient safety. We acknowledged that work on CrCU is by its very nature often fast paced and hectic and that it would require a very structured approach to provide high-quality teaching. Finally, we were very clear that for many Year 3 undergraduates CrCU would provide their first encounter with death and dying which might lead to emotional distress and therefore require good support.

However, we also identified many advantages to teaching on the CrCU. First, CrCU is an ideal setting to learn about physiology and pathophysiology covering topics such as cardiac output, oxygen delivery, and acid–base balance. There are also unique opportunities to see how interventions (inotropic drugs, changes in ventilator settings) influence physiology. Second, we felt that there is hardly any clinical workplace that can rival CrCU in terms of being controlled, structured, and safe. Patients will have a named and experienced nurse, which should make easy to enforce clinical and educational governance. Third, CrCU teaches the students clinical reasoning and lateral thinking and the art of formulating management plans, and few clinical environments feature a similar degree of multidisciplinary and multi-professional input.

The CrCU environment also encourages a holistic approach and prompts the students to reflect on ethical issues, and we propose that learners at the start of their clinical years benefit from doing so in an environment that is as controlled and structured as that of a CrCU. We also feel that CrCU is a very suitable environment for a first encounter with death, dying, and grief. CrCU staff are actually extremely experienced in helping relatives during this process and, together with our educational staff, support students in a way that would not be possible elsewhere.

Our experience in producing and implementing an undergraduate teaching program on the CrCU has been immensely positive, and from the feedback received it continues to be successful. This is also evidenced by the fact that our new firm won the best firm award, based on student feedback and scores, for several years in succession. We were surprised by quite how much our Year 3 undergraduates loved Critical Care and suggest that, contrary to widely held belief, CrCU is actually a great learning environment for undergraduates even in their early years.

There are not only parallels but also differences between our experience on CrCU and previous work on our Medical Admissions Unit (MAU) (Nazir et al. 2014). An obvious parallel is that both environments are very busy, a fact that probably underlies some of the skepticism we faced initially. We propose that banning students from busy environments is unnecessary and denies them valuable learning opportunities. Key to success is a carefully designed induction to make them feel part of the team, establishes ground rules, and defines learning objectives. It is helpful to those designing curricula or CrCUs considering undergraduate teaching that the Acute Care Undergraduate Teaching (ACUTE) Initiative in the UK has suggested core competencies in acute care for undergraduates (Perkins et al. 2005). Revisiting the learning objectives with students throughout the rotation is also very important in order for effective teaching to take place.

The importance of feedback cannot be overstated, and our current situation reflects the end product of almost a decade of continued development and improvement. A caveat about our work and its success is that it may not be easily transferable to all CrCUs worldwide. In this regard, the concept of a "closed" CrCU (with anesthetists/intensivists as permanent staff and other specialties visiting) competes with that of an "open" unit where there is more in-reach and decisions by these specialties. We speculate that a more "open" concept of CrCU could be more challenging educationally since it would hamper continuity and mentoring. In our unit, most intensivists are also anesthetists which made it easy to establish the link to theatres.

Another pitfall we have encountered is patient consent. Consent is sought routinely from patients with capacity, and students also are not put into a situation where they may feel uncomfortable, such as examining comatose patients (Doyal 2001; Hicks et al. 2001; Woodall 2001). We speak to family members about their views and document this. The CrCU is unique in this regard, and in that many patients are unable to provide consent to their participation in teaching. We were surprised to discover that neither the literature nor any of the relevant societies in the specialty have considered this issue or provided guidance. The situation also differs from that in anesthesia where consent can be obtained in advance. In general, however, the majority of patients do allow for medical student involvement (Santen et al. 2005), which provides immense educational benefit (GMC 2005; BMA 2008). It could be argued that most CrCU patients do not have a choice as to which hospital they attend, and if they did then student involvement would unlikely be a key factor in their decision-making. An in-depth discussion is beyond the scope of this article, but we encourage a balanced debate of this topic between educationalists and intensivists with the aim of formulating guidelines.

In summary, we would like to encourage others to follow our example and consider opportunities for undergraduate education on their CrCU. It is also clear that participating in undergraduate education will enable intensivists to recruit high achievers among the students into their specialty. Professional societies and medical schools should consider

how CrCU can be incorporated into curricula and whether further guidelines are required in this respect.

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## Disclosure statement

The authors declare no conflict of interest.

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