What are the clinical skills levels of newly graduated physicians? Self-assessment study of an intended curriculum identified by a Delphi process

Anne Mette Moercke & Berit Eika

Objective To compare and contrast the learned and an intended curricula of practical clinical skills across the three Danish medical schools.

Context The three Danish medical schools had comparable discipline-based curricula with 3 years of mainly basic science and 3½ years of mainly clinical education. Danish physicians work as pre-registration house officers (PRHOs) for 1½ years after graduation.

Methods An anonymous questionnaire listing 210 practical clinical skills was mailed to 226 newly graduated Danish physicians. They were asked if they could meet the minimum level for each of the skills listed as identified by a previous Delphi study.

Results The response rate was 80%. None of the responders met the minimum of all the 210 skills. Only 8% (14) met the minimum level for at least 90% (189) of the skills. On average the responders met the minimum of 74% (155) of the skills. More than 90% of the responders mastered basic history and examination skills. The responders did not meet 28 medical emergency procedures.

Conclusions We found that the learned curriculum of clinical skills constituted 75% of the intended curriculum. Those responsible for pre- and postgraduate medical education should be aware of the discrepancy between expected and learned curriculum. We discuss the role of experts in the process of defining the core curriculum.

Keywords Education, medical/*methods; curriculum; *clinical competence; Delphi technique; Denmark.

Medical Education 2002;36:472–478

Introduction

A model to evaluate a clinical skills training curriculum was suggested by Remmen in his 1999 thesis.¹ The curriculum is described as an ‘intended curriculum’, a ‘curriculum in action’, and a ‘learned curriculum’. The intended curriculum is the part of the curriculum that is found desirable and put on paper. The curriculum in action consists of the teaching of the students, and the learned curriculum is what students actually learn. If there are considerable discrepancies between any of these three ‘curricula’ the education is neither effective nor efficient.

Curriculum committees usually design the intended curriculum. Lately, however, consensus methods such as the Delphi method have been applied to the curriculum design process. The Delphi method uses iterated questionnaires distributed to an expert panel to reach consensus or explore disagreements between the experts on a given topic. The questionnaire is changed between rounds to incorporate the answers given. The moderator who collects and analyses the responses knows the participants, but each expert’s answers are anonymous to the rest of the panel and in publication. This has the advantage of enabling each participating expert to express views freely. In addition it is a flexible method and is not subject to geographical constraints.²

In 1999 we conducted a Delphi study in Denmark with the purpose of suggesting a curriculum of practical clinical skills in undergraduate and pre-registration medical education.³ The expert panel included 46 Danish physicians engaged in medical education representing the specialities of internal medicine, surgery, orthopaedics, general medicine, gynaecology-obstetrics...
The Delphi panel attached a skills level to each skill. The skills levels defined and used were as follows:

- **Level 0: DO NOT KNOW**  
  Definition: You do not know the procedure

- **Level 1: KNOW PRINCIPLE**  
  Definition: You have read about or been told how the procedure is done

- **Level 2: OBSERVED**  
  Definition: You have seen another person perform the procedure

- **Level 3: SUPERVISED**  
  Definition: You have done the procedure with guidance of another person

- **Level 4: MASTER**  
  Definition: You have done the procedure correctly on your own

- **Level 5: EXPERIENCED**  
  Definition: You have done the procedure correctly so many times that you feel both competent and confident about it

The Delphi panel found 3 skills irrelevant to medical students, 12 skills expected to be known only in principle and the remaining skills distributed evenly between the skills levels ‘observed’ (level 2), ‘supervised’ (level 3) and ‘master’ (level 4). Only skills relating to the general physical examination and history taking and simple diagnostic and therapeutic skills were attached to the skills level 4, ‘master’. The Delphi panel reached consensus that skills level 5 (‘experienced’) should not be the minimum competence level of any practical clinical skills during undergraduate training, but should be postponed until postgraduate training. The results of the Delphi study can be found in the form of a proposed checklist at www.medu.au.dk. These checklists are known to Danish curriculum developers and teachers, but teachers at the medical schools have not been formally asked to cover the list of skills derived from the Delphi panel.

The purpose of the present study was to assess the degree of overlap between the intended curriculum of clinical skills as previously identified by the Delphi panel and the learned curriculum at the 3 Danish medical schools.

**Context**

There are 3 medical schools in Denmark at the Universities of Aarhus, Copenhagen and Odense. These 3 schools all had traditional discipline-based curricula with approximately 3 years of mainly basic science and about 3½ years of mainly clinical education. The medical schools’ curricula were comparable with minor variations. The clerkships included medicine (9–10 weeks), surgery including orthopaedics (8–10 weeks), general practice (4 weeks), gynaecology-obstetrics (4 weeks), psychiatry (4–5 weeks), paediatrics (4 weeks), anaesthesiology (2 weeks), neurology (2 weeks), neurosurgery (1–2 weeks), dermatology (0–2 weeks), oncology (0–2 weeks), clinical biochemistry (1–2 weeks), radiology (0–1 week) and otolaryngology (0–1 week). There were no formal assessments during the clerkships and there was no examination in anaesthesiology. Undergraduate medical education is followed by 1½ years as a PRHO equally divided between internal medicine, surgery, and general practice. For the past decade there has been an increasing shortage of physicians in Denmark, opening up possibilities for medical students in their final years to work as paid locums for junior doctors. There are ongoing curriculum reforms at the Danish medical schools and in the postgraduate medical education.

**Methods**

At the end of July 2000 a questionnaire was mailed to the 226 physicians who had graduated from the 3 Danish medical schools that summer. Enclosed were an introductory letter, a set of instructions, the questionnaire, and a stamped reply envelope.
The questionnaire listed 210 practical clinical skills. For each skill the minimum skills level identified in the Delphi study was listed.³ For each skill the newly graduated physician was asked to answer the question: ‘Can you meet the minimum level for the skills listed? If yes, write √. If no, write the skills level you have reached.’ The four relevant skills levels from the Delphi study were applied in this survey and explained to the physicians in the questionnaire instructions. Finally the physicians were asked to indicate their gender, university of graduation, and whether they had worked as locum for a junior doctor prior to graduation.

The answers were made anonymous. One reminder was sent. Envelopes were numbered to ensure that non-responders could be contacted by E-mail or telephone. Data were collected from August 4th to October 31st 2000.

Data were analysed using the Access data base programme and SPSS. Statistical significance was calculated using χ² test or Anova followed by a student’s T-test. Level of statistical significance: \( P < 0.01. \)

**Results**

Of 226 newly graduated physicians, 180 (80%) returned the questionnaire. There was no significant difference in the response rates concerning gender or university. Of the 180 responders, 59% (104) had worked as locum for a junior doctor prior to graduation, with no significant difference in gender or university.

There was no significant gender difference. We found that responders who had worked as locums before graduation met more minimum skills levels than those without working experience, however the difference was not significant \( (P < 0.03). \)

On average respondents met the minimum of 74% (155) of the skills. None of the respondents met the minimum of all 210 skills. Only 8% (14) of the physicians met the minimum of at least 90% (189) of the skills.

Fig. 1 shows the percentage of respondents who met the minimum of the skills levels. For example, 150 of the skills were met by 60% of respondents and 100 of the 210 skills were met by 80%.

Fig. 2 shows that the majority of those skills set by the Delphi panel at level 3 (‘supervised’) and level 2 (‘observed’) were not acquired \( (P = 0.01). \) The level with the greatest number of skills not acquired was level 3 (‘supervision’) with 57 skills; this is 40% of the total number of skills not acquired at the minimum required level. More than 90% of the newly graduated physicians answered that they mastered the skills related to the general physical examination and history taking, including palpation of pulse, measurement of blood pressure, measurement of temperature, frequency of breathing, examination of peripheral perfusion, examination of vision, auroscopy, anterior rhinoscopy, palpation of the thyroid, lymph node examination, auscultation of heart and lungs, examination of the breasts, abdominal and rectal examination, examination of the large joints, spine and pelvis and recording of

![Figure 1](image-url)
findings. More than 90% of the newly graduated physicians answered that they had mastered the skills related to the general neurological examination, insertion of an intravenous cannula (venflon), dipstick tests of urine and assisting in the operating theatre. Finally more than 90% – under supervision – had tried manual mask ventilation, arterial blood gas sampling, venous blood sampling, testing for neck stiffness and gynaecological examination. In particular, the respondents did not meet 4 groups of skills: medical emergency procedures (27 skills), casualty procedures (22 skills), gynaecology and obstetrics (19 skills), and general practice procedures (35 skills). Table 1 gives examples of these procedures and the percentage of respondents not meeting the minimum of these skills. A substantial proportion of respondents had not observed procedures regarded as common and essential. For example, 10% (18) of respondents had never seen CPR, 26% (48) had never seen closed reduction of dislocation of a fracture, 40% (73) had never seen a joint injection and 27% (49) had never seen a bone marrow aspiration.

Discussion

Methodology

This study was based on self-assessment in the form of a mailed questionnaire. Self-assessment is often used in assessing clinical competence. One of the main benefits of self-assessment is its low cost, making it preferable to the widely-used but costly and time-consuming methods of assessing clinical skills such as the Objective Structured Clinical Examination and the use of standardised patients. In this study the choice of self-assessment methodology enabled us to assess the clinical skills level of a whole national graduating class of medical doctors.

In general, the validity of self-assessed performance is found to be low or moderate. Woolliscroft et al. found that the bottom quartile of students consistently rated their knowledge and skills higher than their peers. One potential explanation for this observation, which was supported by Gordon, was that low achievers might evaluate themselves on their potential or ideal performance rather than on their actual performance. High achievers on the other hand may hold themselves to more stringent standards. Board and Mercer found that confidence far outweighed actual clinical experience, thus supporting Woolliscroft and Gordon’s hypotheses. For example, only 48% of the students Board and Mercer studied had successfully performed manual bag and mask ventilation of the lungs more than four times, but as many as 73% felt confident in doing so. Stewart et al. explored the relationship between confidence and competence in self-assessment, and found that confidence was not necessarily based on known level of competence. This could be a reason for the inconsistent findings in studies of self-assessment. In this study we intended to reduce the validity problem of self-assessment by asking the physicians specifically about their competence and not about their confidence. We did not study the actual performance of the newly graduated doctors, however, but asked them if they had performed, seen or knew the principles of the procedures.
### Table 1
Examples of skills in which more than 10% of the recently graduated physicians did not meet the required minimum. Number of respondents not meeting required minimum of the particular skill is listed as a percentage of the 180 respondents and (absolute number).

<table>
<thead>
<tr>
<th>Level</th>
<th>Emergency procedures</th>
<th>Casualty procedures</th>
<th>Gynaecology-Obstetrics</th>
<th>General practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have not mastered the Procedure</td>
<td>Securing patient airways 22% (41)</td>
<td>Sterile dressing 33% (60)</td>
<td>Urine pregnancy test 19% (35)</td>
<td>Exam. of inguinal hernia 18% (33)</td>
</tr>
<tr>
<td></td>
<td>Suction in nose and throat 42% (76)</td>
<td>Simple wound suturing 15% (28)</td>
<td>Apgar scoring 33% (60)</td>
<td>Exam. of male genitalia 12% (23)</td>
</tr>
<tr>
<td></td>
<td>Applying an oxygen mask 26% (48)</td>
<td>Removing sutures 13% (25)</td>
<td>Examining newborn 21% (39)</td>
<td>Transillumination of scrotum 55% (99)</td>
</tr>
<tr>
<td></td>
<td>CPR 37% (67)</td>
<td>Ophthalmoscopy 23% (42)</td>
<td></td>
<td>Urethral swab 64% (116)</td>
</tr>
<tr>
<td></td>
<td>Bladder catheterisation 41% (74)</td>
<td>Visual acuity examination 16% (30)</td>
<td></td>
<td>Urine microscopy 65% (118)</td>
</tr>
<tr>
<td></td>
<td>Subcutaneous injection 36% (66)</td>
<td></td>
<td></td>
<td>Exam. of varicose veins 34% (62)</td>
</tr>
<tr>
<td></td>
<td>Intramuscular injection 34% (62)</td>
<td></td>
<td></td>
<td>MonoSpot, RapidStrep 26% (47)</td>
</tr>
<tr>
<td>I have never tried the procedure under supervision</td>
<td>Assessing level of consciousness 15% (8)</td>
<td>Estimation of intraocular pressure 37% (68)</td>
<td>PAP smear 34% (62)</td>
<td>Remove cerumen w/ curette 60% (108)</td>
</tr>
<tr>
<td></td>
<td>Apply a cervical collar 72% (131)</td>
<td>Eversion of upper eye lid 22% (40)</td>
<td>Cervical swab 31% (57)</td>
<td>Ear irrigation 42% (76)</td>
</tr>
<tr>
<td></td>
<td>Endotracheal suction 44% (80)</td>
<td>Removing contact lens 61% (110)</td>
<td>Wet smear microscopy 61% (111)</td>
<td>Anoscopy 74% (134)</td>
</tr>
<tr>
<td></td>
<td>Endotracheal intubation 40% (73)</td>
<td>Rinsing eye 55% (99)</td>
<td></td>
<td>Proctoscopy 76% (137)</td>
</tr>
<tr>
<td></td>
<td>Bag ventilation (tube) 18% (34)</td>
<td>Administrating eye med. 13% (24)</td>
<td>Estimating pelvis 65% (117)</td>
<td>Wound culture 45% (82)</td>
</tr>
<tr>
<td></td>
<td>Peak flow measurement 12% (22)</td>
<td>Applying eye bandage 62% (112)</td>
<td>Fundul measurement 32% (59)</td>
<td>Wound care 51% (93)</td>
</tr>
<tr>
<td></td>
<td>Haemostasis 48% (87)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Performing an ECG 30% (55)</td>
<td>Applying ACE bandage 40% (73)</td>
<td></td>
<td>ESR measurement 55% (99)</td>
</tr>
<tr>
<td></td>
<td>Defibrillation 43% (78)</td>
<td>Local nerve analgesia 51% (92)</td>
<td></td>
<td>Blood sugar measurement 11% (21)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Haemoglobin measurement 29% (53)</td>
</tr>
<tr>
<td></td>
<td>Setting up an IV drip 11% (21)</td>
<td>Local analgesia 27% (50)</td>
<td>Estimating progression of labour 22% (41)</td>
<td>Capillary blood sampling 16% (30)</td>
</tr>
<tr>
<td></td>
<td>Setting up a blood transfusion 54% (98)</td>
<td>Treating minor burns 60% (108)</td>
<td>Normal vaginal delivery 57% (104)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dropping a nasogastric tube 57% (103)</td>
<td>Wet to dry dressing 35% (63)</td>
<td>Clear newborn’s airway 68% (124)</td>
<td>Urine culture 56% (101)</td>
</tr>
<tr>
<td></td>
<td>Administrating nebuliser treatment 44% (79)</td>
<td></td>
<td></td>
<td>Culture sensitivities 31% (57)</td>
</tr>
<tr>
<td></td>
<td>Intravenous injection 25% (45)</td>
<td></td>
<td></td>
<td>Sending sample to lab. 36% (66)</td>
</tr>
<tr>
<td></td>
<td>Setting up a medicine pump 70% (127)</td>
<td></td>
<td></td>
<td>Prep/microscop. fungal swab 76% (138)</td>
</tr>
</tbody>
</table>
Results

In this study the learned curriculum of clinical skills constituted approximately 75% of the intended curriculum previously identified by a Delphi expert panel. It was made explicit in the Delphi process that the task of the panel was to identify the minimum acceptable level and not the ideal standard for an undergraduate medical curriculum of clinical skills. With only three quarters of an intended curriculum met, we face the question: Is the intended curriculum over-ambitious and unrealistic? As pointed out by Tyler 40 years ago, experts contributing to the design of a curriculum often think that they have to answer the question: 'What should be learned at the basic level of education to enable the learner to work at a more advanced level within your field later?'. Instead the question to be answered is: 'How can your subject add to the education of learners who are not to become experts within your field?' Experts representing a top-down approach in the curriculum design process might have difficulties distinguishing ideal learning objectives from realistic objectives.

Even if unrealistic, the skills levels expressed in the Delphi consensus study are good indicators of the expectations that meet the newly graduated physicians starting their first PRHO posts. It is important that those responsible for the initial phase of the postgraduate medical education recognize the gap between the expectations (intended curriculum) and the skills levels achieved (learned curriculum) and take the necessary actions to bridge the gap.

In the present study approximately 80% of the skills belonging to the categories 'supervised' (level 3) and 'observed' (level 2) were not met (Fig. 2). Observation represents exposure. Previous studies have shown that medical schools cannot rely on clerkship experiences alone to provide adequate skills training. Some of the skills identified by the Delphi panel as learning objectives (like CAG and bronchoscopy) are not performed at all teaching departments and could be taken out of the undergraduate curriculum. Other skills such as cardio-pulmonary resuscitation are essential skills that should be mastered by every student. If a curriculum cannot provide sufficient exposure to essential procedures, other means of education such as skills laboratories and simulations should be considered. It has also been shown that checklists have a potential value for increasing exposure to practical procedures, if given with advice about the skills levels to be achieved.

The responders in particular did not meet the skills level ‘supervised’ (level 3).

Osborn et al. showed that residents who were more closely supervised (by being directly observed and observing their physician more often) during continuity clinic experience, gained primary care skills more rapidly than those supervised by reporting back to the physician. The lack of supervision of practical clinical skills gives cause for concern; we need further research and discussion to determine what implications this may have to the quality of the clerkships.

Our findings that the students did not master medical emergency procedures are consistent with other surveys. For example, 43% of the responders have never tried to perform a defibrillation (Table 1). These responders will all start their pre-registration year without further training. They will then be in the front line in Accident and Emergency departments. Without proper knowledge and performance of life saving clinical skills, the newly graduated physician is not able to meet this challenge without the risk of jeopardizing patient safety and the physician’s self-esteem.

Three other groups of skills were not met by many of the responders (casualty procedures, gynaecology and obstetrics, and procedures mainly learned in general practice). It could be argued that learning these important procedures could be postponed until the pre-registration years. However, it must be recognised that the intended curriculum and the learned curriculum overlap poorly in these fields.

Perspectives

This study revealed a gap between the intended curriculum and the learned curriculum. In recent years much of the emphasis in medical education has been put on identifying core curricula and forming clearly-stated educational objectives. Educational objectives are often identified by a curriculum committee and then disseminated to teachers under the assumption that goals, learning objectives and checklists are agreed upon by developers, teachers and students alike. This method of implementing educational objectives views the teachers as passive co-operators and thus represents a top-down curriculum design process. However, curriculum developers should be aware that teachers do not necessarily share the goals they set, resulting in poor implementation of intended curricula. Posner discusses this question and describes curriculum implementation using a collaborative approach. The collaborative approach implies that curriculum change is guided by a set of beliefs about teaching and learning, and not by a set of pre-specified objectives. Teachers and students are viewed as people with their own set of purposes and beliefs, who are active participants in their own...
development. According to this perspective teachers and students should participate in the decisions that affect the conditions under which they must work.

Curriculum designers might consider supplementing traditional curricula committees with processes that favour a collaborative, or bottom-up, approach to designing core curriculum objectives. This could include conducting surveys or focus groups with medical students, PRHOs, clinical teachers and nurses in order to understand why, how and where the gaps in the curriculum arise. Other methods for designing curriculum using more of a bottom-up approach could include results from participant observation of clerkships or action research. Many recommendations have previously been made regarding improvement of the skills training in undergraduate medical education, and there is now a better understanding of how students could be more efficiently trained.10,11,13,16 -There is still some resistance, however, to these recommendations, and we have to find out why in order to implement new initiatives in undergraduate training.

Contributors

AMM contributed substantially to conception and design, data collection, analysis and interpretation, drafted the paper and had final approval of this version. BE contributed substantially to conception and design, analysis and interpretation, critical revision of the paper, and had final approval of this version.

Funding

This project was funded by the Unit of Medical Education, University of Aarhus, Denmark.

References

1 Remmen R. An Evaluation of Clinical Skills Training at the Medical School of the University of Antwerp. Antwerpen: University of Antwerp; 1999.

Received 8 February 2001; editorial comments to authors 10 May 2001; accepted for publication 10 September 2001

© Blackwell Science Ltd MEDICAL EDUCATION 2002;36:472–478