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# New Paradigm in Training of Undergraduate Clinical Skills: the NEPTUNE-CS project at the Split University School of Medicine

Clinical skills' training is arguably the weakest point in medical schools' curriculum. This study briefly describes how we at the Split University School of Medicine cope with this problem. We consider that, over the last decades, a considerable advancement in teaching methodologies, tools, and assessment of students has been made. However, there are many unresolved issues, most notably: (i) the institutional value system, impeding the motivation of the teaching staff; (ii) lack of a strong mentoring system; (iii) organization, timing, and placement of training in the curriculum; (iv) lack of publications pertinent to training; and (v) unwillingness of patients to participate in student training. To improve the existing training models we suggest increased institutional awareness of obstacles, as well as willingness to develop mechanisms for increasing the motivation of faculty. It is necessary to introduce changes in the structure and timing of training and to complement it with a catalog, practicum, and portfolio of clinical skills. At Split University School of Medicine, we developed a new paradigm aimed to improve the teaching of clinical skills called "Neptune-CSS," which stands for New Paradigm in Training of Undergraduate Clinical Skills in Split.

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## BACKGROUND

The majority of authors dealing with medical curricular reform agree that substantial progress in the training of clinical skills is still to be achieved. Clinical skills' training that is well organized and executed is one of the most important components of a modern medical curriculum. Despite marked improvements in medical education, in-hospital hands-on training remains the weakest point in many curricula (1-9). The "art of teaching" is still to be recognized as an important professional skill that needs to be properly mastered and permanently improved, alongside with clinical competencies and research activities. Unfortunately, teaching is quite often regarded as a less important academic activity, particularly when the time and effort invested into teaching is compared with those put into clinical work and research activities (10,11).

Today, mastery of a significant number of rather complex clinical skills cannot be achieved during undergraduate training; this task appears to be shifted to residency programs, which certainly is not a preferable option (12,13). In our previous publications, we have compared a traditional and a contemporary clinical skills training program to identify the most important advances and to identify principal obstacles resistant to changes (14,15). Diligent efforts of hundreds of scholars, combined with the introduction of advanced technology, have resulted in substantial changes in the methodology of clinical skills training. Still, when dealing with clinical skills, as well as medicine in general, it is good to always bear in mind that technology is only a tool (9,16).

Major obstacles affecting the progress of clinical teaching are (Box 1): (i) the institutional value system, impeding the motivation of the teaching staff; (ii) lack of a strong mentoring system; (iii) organization, timing, and placement of training in the curriculum; (iv) lack of publications pertinent to training; and (v) unwillingness of patients to participate in student training.

## INSTITUTIONAL VALUE SYSTEM

In most university hospitals, teaching is strongly influenced by the institutional value system: while research accomplishments and generation of clinical revenues are rewarded, excellence in teaching is often neglected. Clinical faculty members who are willing to serve as teachers and mentors are under permanent pressure to be "clinically productive," which is just another euphemism referring to the amount of revenues generated.

| BOX 1. Major impediments to clinical skills training |
|---|
| Institutional value system |
| Non-existent rules of conduct for faculty |
| Insufficient teaching staff motivation |
| Non-existent mentorship system |
| Structure and organization of training |
| Inflexible curriculum |
| Fixed schedule for hands-on practice |
| Inappropriate training dynamics |
| Missing tools |
| Catalogue of clinical skills |
| Practicum of clinical skills |
| Portfolio (logbook) of acquired clinical skills |
| Inadequate patient participation and cooperation |

Substantive reform of institutional values will be possible only if there is strong willingness of hospital management to support the educational mission. All teaching hospitals should develop an internal set of acts and regulations that will support teaching with adequate financial input and career promotion mechanisms. At the same time, the mechanisms for the control of the teaching process, regular assessment and evaluation of teaching staff, including students' anonymous surveys, should be defined (17-21). In the long run, this novel approach could be looked at as a sound investment: without outstanding teaching, one can hardly expect highly competent physicians, upon which the flow of hospital revenues depends.

It may be possible to introduce "credits" for good teaching practice. Over the past decades, the requirements of lifelong learning and continuous medical education have become an inseparable part of every physician's professional life. A similar principle may be applied to education, such that every member of the teaching staff would need to collect credits for successful teaching and for research and publications related to medical education.

## MENTORSHIP

The essential prerequisite in clinical training is "a meaningful, ongoing relationship between faculty and students" (22). Unfortunately, mentorship in the majority of today's teaching hospitals and medical schools is "either fragile or does not exist, and the progressive advancement of student competencies is not well guided across the curriculum…" (23). We believe, as argued in recent literature, that mentorship has to be reestablished to ensure adequate

observation, supervision, and mentoring of students' professional development (8,17-21,24-27).

Students should be introduced, at the beginning of their course, to a competent mentor who will instruct, coach, monitor, and assess their level of proficiency in clinical skills, to rate the performance of students to determine whether they are trained well enough to apply for the official examination. In order to provide a sufficient number of competent mentors in a medical school, it is necessary to create a well-organized and carefully structured network of teachers who will cooperate across clinical specialties through "interdisciplinary ownership of the clinical curriculum" (28).

In the proposed scheme, the mentor would be an experienced clinician, competent and able to organize and manage a large network of clinical instructors, composed of preceptors, residents, tutors, technicians, and nurses. The mentor must be a senior person with sufficient clinical experience. The other members of the network will be responsible for instructing the student in specific segments of clinical curriculum. At the end of a predefined period, such as at the end of each academic year, an independent assessor should perform an overall assessment of students' competency. The results achieved by students would reflect the quality of the mentor's work and serve, in addition to the teaching credits and other criteria, as a reliable basis for his or her academic promotion and advancement.

## ORGANIZATION OF CLINICAL TRAINING

In most medical schools, curriculum is traditionally divided in two parts, preclinical and clinical. Consequently, clinical skills are generally taught in senior years of the course and students should master a large number of skills over a short period of time.

This problem can be at least partially solved if training of simple skills starts early in the curriculum, at the very beginning of the course. The instructions should start with the simplest tasks of patient care, such as positioning patients in bed, proper cleaning and skin care, and control of antiseptic measures. Gradually, the complexity of the training would increase leading to the acquisition of more demanding skills. If such a curriculum were adopted, students, their mentors, and clinical instructors would have more time for clinical training, which would be organized in several phases (Table 1).

TABLE 1. Phases of clinical skills training

| Phase | Activities |
|---|---|
| 1 | Rationale of clinical skills |
| 2 | Training in a clinical skills laboratory |
| 3 | Demonstration of skills in a clinical setting |
| 4 | Execution of skills in a clinical setting |
| 5 | Final assessment of proficiency |

In the first phase, the clinical skills instructor would explain the rationale for the procedure, introduce the equipment, instruments and materials, and present the procedure in detail. It is not necessary for all the instructors to be physicians: many skills can be mastered with the assistance of preceptors, nurses, and technicians.

In the second phase, the instructor would practice a skill with students in the Clinical Skills Laboratory on mannequins, models, or in virtual reality. At the end of this phase, the instructor would inform each student's mentor and confirm with his signature that the student had mastered the skill well enough to be allowed to practice it in the real environment.

In the third phase, the clinical instructor would introduce the same skill in a clinical setting, first showing to students the complete procedure, and finally allowing them to execute the tasks and procedures under his supervision.

Finally, during the final assessment, the senior assessors would have an opportunity to re-evaluate the students "portfolio of acquired skills," estimate the students' level of competency, and affirm that a skill in question has been completely mastered.

In order for the proposed model to succeed, students should have regular meetings with their mentors to reflect on their achievements, "diagnose" the state of their competencies, and set further learning goals. Evidence shows that portfolios improve planning and monitoring of education by combining external assessment, self-assessment, and mentoring. They enable students to develop more challenging learning goals than is customary in traditional medical education (29).

## SCHEDULING BED-SIDE TEACHING

Rigid scheduling of training is another factor to blame for poor training results. A programmed schedule of clinical practice very often does not match with

the availability of appropriate clinical cases for demonstration, and even the simplest demonstrations are sometimes not possible for myriad reasons. Standardized patients cannot solve these problems even if they are very talented actors, since they cannot be subjected to painful procedures such as venous punctures, lumbar taps, or rectal examinations. This problem can partly be solved by using a flexible schedule that can be adapted to changing circumstances. We suggest that students and their instructor plan the schedule of in-hospital activities together. The priority should be to master a specific skill, not master it at a specific time.

## CATALOGUE OF KNOWLEDGE AND CLINICAL SKILLS

The principal goal of this catalog is to clarify some of the dilemmas confronting medical students at the beginning of their study, such as "What is expected of me?; Where is the line between necessary knowledge and desirable supplementary knowledge?; and How can I be confident that I am a competent doctor?"

The Catalogue of Knowledge and the Clinical Skills not only lists the knowledge and skills that a competent graduate should possess, but it also classifies these skills in relation to their significance. Such catalogues allow students to know exactly what is expected of them and teachers can also use them when planning their teaching.

Within the framework of a curriculum reform project sponsored by the Trans-European Program for Co-operation in Higher Education in Central and Eastern Europe (Tempus), we created the The Catalogue of Knowledge and Clinical Skills for use at the Faculties of Medicine in Bosnia and Herzegovina (30) in collaboration with 13 medical schools from 8 European countries (30).

## PRACTICUM OF CLINICAL SKILLS

Composition of an all-inclusive practicum of clinical skills is another crucial step in clinical skills training. To execute a skill, a student should understand its importance, be aware of both indications and contraindications for the procedure, and know which instruments, materials, and equipment are necessary for its successful completion. Many essential details that are not explained in textbooks should be covered: for example, how to explain the procedure to the patient, how to position the patient, what kind of anesthesia needs to be applied, or how to handle the specimens for analysis. The procedure should be described in a step-by-step manner, with appropriate comments on anatomy and physiology, as well as warnings on possible complications and their management. In 2007, we published the first edition of the Practicum of Clinical Skills (31), in which we tried to apply all of the abovementioned concepts and principles.

## PORTFOLIO (LOGBOOK) OF ACQUIRED CLINICAL SKILLS

It has long been observed that assessment drives learning. If we care that medical students become skillful practitioners and sensitive and compassionate healers, we must employ all instruments we have today at our disposal: self-assessment, peer evaluations, written assessments of clinical reasoning, standardized patient examinations, oral examinations, and sophisticated simulations. Most importantly, all results of the learner's work should be duly noted in portfolios. Rigorous assessment has the potential to inspire learning, influence values, reinforce competence, and reassure the public (29).

Permanent follow-up of a student's progress during clinical skills acquisition is a prerequisite to building a competent physician. Therefore, we propose that students receive a logbook at the beginning of their training (called a "Portfolio of Acquired Clinical Skills"). In this logbook, all skills that are essential to the practice of contemporary medicine should be listed and classified. Having the Portfolio in possession, students will know from day one what to expect and what are the "must-have" skills if they aspire to becoming competent medical graduates. Clear guidelines on the purpose, contents, and organization of the training are essential. No less importantly, students would be able to plan in advance and set their own pace individually. As previously discussed, every acquired skill should be assessed by clinical instructors, first in a virtual and subsequently a real-world setting. When a particular skill is mastered, this would be duly noted and acknowledged with the instructor's signature. The concept of combining formative professional development alongside overall assessment is relatively new and we believe that if such approach is applied, nothing of importance would be neglected and the number of medical graduates who start their careers with considerable gaps in their armamentarium would be significantly reduced (28,29).

## PATIENTS

Cooperation with patients is instrumental for teaching of clinical skills. Young physicians-to-be have to touch,

feel, hear, and smell the textbook stories and cases in a real world. This presents a serious problem, because during the last half-century, patients' way of thinking and their attitudes toward physicians have radically changed (7,20,21,25,32). Today, the common patient is not a humble, grateful, and obedient one. Patients are more informed, more knowledgeable about their conditions, and less willing to be used as teaching subjects. Consequently, the student's chances to palpate a lump in a woman's breast are considerably reduced. Over the last years, there have been quite a few attempts to resolve this problem. Mannequins and different models of the human body are useful, even indispensable, in introductory lessons. In addition, there is an increasing number of good interactive software programs that create virtual reality, and their quality is improving constantly (33,34). A third track is the use of patient-actors (25,14).

## MOVING THE FRONTIERS IN CLINICAL SKILLS EDUCATION: ADDED VALUE OF BASIC CLINICAL SKILLS TRAINING INTEGRATED INTO AN ANATOMY COURSE

Numerous diagnostic as well as treatment procedures are invasive and involve manipulation of body parts; hence, they involve sound anatomical knowledge and understanding. For this reason, these procedures should be practiced for the first time on cadavers rather than on patients. At this stage, the student's focus should be on the comprehension of a routine procedure's anatomical basis, rather than on its clinical benefits and outcomes. This involves a specific knowledge of the following: anatomical features leading to the selection of an appropriate procedure site; anatomical structures that are visualized, palpated, or pierced during the procedure; and anatomical hazards that might be encountered during the procedure, ie, different structures potentially endangered by the procedure. A short and well-illustrated guide through the anatomical basis of clinical procedures that might be required of a general practitioner can be found in An@tomedia™ (35), a series of self-paced learning programs that explores anatomy from numerous perspectives, including the perspective of clinical procedures.

## RESEARCH AND EXPERIMENTAL ANIMALS AS TRAINING TOOLS

Another possibility rarely explored in the context of clinical skills training is basic research on experimental animals. Tedious work with small laboratory animals can provide significant experience to students. Once the student is able to puncture a rat's tail vein, the fragile veins of elderly people become less of a mystery. Once the student becomes acquainted with grave repercussions of blood loss or dehydration in rats, this lesson will stay embedded throughout their clinical career. We believe that, while working in the laboratory and generating original scientific data, students also acquire relevant manual proficiency and technical ability, in addition to gaining exposure to research (36).

## THE CHALLENGE OF INSTITUTIONAL CHANGE AT THE UNIVERSITY OF SPLIT SCHOOL OF MEDICINE

This article examines the processes by which the clinical skills training agenda has been translated into practice at the Split University School of Medicine, and we believe that similar approaches can be used at other medical schools. Such attempts at curriculum reform face a plethora of problems, many of which have remained constant over decades. The major obstacles in the teaching of clinical skills are listed in Box 1, and a list of possible solutions is provided in Box 2.

| BOX 2. Possible solutions for improving clinical skills training |
|---|
| Willingness of the management of teaching hospitals to reconsider the institution's value structure, with new Rules of Conduct |
| Formally linking teaching staff status and promotion to good teaching |
| Re-introduction of a firmly structured mentorship system |
| Cross-departmental ownership of the clinical curriculum |
| Publishing a clear-cut catalog, practicum and portfolio of clinical skills |
| Immersion of students into the patients' world |
| Independent external assessment of acquired skills and overall competency, on the state or national level |

Tackling those problems requires a multifaceted approach and integrated support of both the medical faculty and the clinical service provider, ie, the affiliated teaching hospital. They must cooperate in the clinical part of the curriculum, yet both systems currently seem reluctant to devote the required resources and they expect the other side to take responsibility for the clinical part of the curriculum. Such weak and even conflicting relationships result in poor quality of clinical teaching. As a starting point, both institutions, if willingness for reform exists, have to re-evaluate their system of values and introduce the adequate changes in their structure and ethos.

TABLE 2. NEPTUNE project implementation agenda in Split University School of Medicine and University Hospital Center*

| Action | Activity | Timeframe | Expected completion date |
|---|---|---|---|
| 1. Re-evaluation of institutions' values and ethos in Split University School of Medicine and Split University Hospital Center | | | |
| | Establishment of Joint Committee, Split University School of Medicine and Split University Hospital Center | May-June 2010 | Agenda and timetable, July 2010 |
| | Meetings | May-June 2010 | Memorandum (discussion paper), July 2010 |
| | Debate (policymakers) | July-October 2010 | Position paper October 2010 |
| | Agreement signed | 2010 | End of 2010 |
| | Teaching credits, debate | 2010-2011 | Elaborate, October 2011 |
| | Teaching credits, elaboration of documents | 2010-2011 | Final draft, June 2011 |
| | Credits operational in practice | 2010-2011 | October 2011 |
| 2. Curriculum restructuring | | | |
| | Clinical skills theoretical introduction | 2010 | Handouts, September 2010 |
| | Clinical skills theoretical introduction | 2010 | Lecture and small groups discussions in "Introduction to medicine" module October, 2010 |
| | CST (preparatory period) | September 2010-April 2011 | Handouts for module "CST One" April 2011 |
| | CST preparatory period | September 2010-April 2011 | Module "CST One" execution in May 2011 |
| | CST in anatomy module, preparatory period | September - December 2010 | Handouts, December 2010 |
| | CST in anatomy module, execution | September - December 2010 | January-March 2011 |
| | CST in pathology module, preparatory period | September - December 2010 | Handouts, December 2010 |
| | CST in pathology module, execution | September - December 2010 | January-March 2011 |
| 3. Mentorship | | | |
| | Establishment of Mentorship Committee | 2010 | Mentors' Rules of Conduct, October 2010 |
| | Establishment of Mentorship clinical skills instructors network | 2010 | Clinical skills instructors Rules of Conduct, October 2010 |
| | Retraining of clinical skills instructors in CST laboratory | 2010-2011 | October 2011 |
| | Certification of clinical skills instructors | 2010-2011 | Certificates awarded, October 2011 |
| | Formal appointment of mentors | 2010-2011 | October 2011 |
| 4. Resources | | | |
| | Clinical skills satellite laboratories (one in old Medical School and two in hospital) | 2010 | October 2010 |
| | Rearrangement of teaching tools and mannequins | 2010 | Laboratories equipped, October 2010 |
| | Installation of interactive software | 2010 | Software installed, October 2010 |
| | Central clinical skills laboratory in new Medical School building | 2010-2011 | Laboratory equipped, October 2011 |

TABLE 2. Continued. NEPTUNE project implementation agenda in Split University School of Medicine and University Hospital Center*

| Action | Activity | Timeframe | Expected completion date |
|---|---|---|---|
| | Furniture, tools and software purchase | 2010-2011 | October 2011 |
| 5. Assessment | | | |
| | Establishment of OSCE station | 2010 | Instruction manual, October 2010 |
| | MCQ test database | 2010 | Database, October 2010 |
| | SAT tests database | 2010 | Database, October 2010 |
| | Standardized patient training | 2010-2011 | Standardized patient trained and certified, December 2011 |
| 6. Publications | | | |
| | Catalogue of clinical skills | 2010 | First draft, October 2010 |
| | Practicum of clinical skills | 2010-2011 | First draft, October 2011 |
| | Students' portfolio (logbook) | 2010-2011 | First draft, October 2011 |
| | Clinical Examination courses | 2010-2011 | Last draft for publisher, October 2011 |

*Abbreviations: CST – Clinical Skills Training; MCQ – Multiple Choice Questions; OSCE – Objective Structured Clinical Examination; SAT – Short Answer Test.

At the Split University School of Medicine, discussion on clinical training intensified in summer 2009, and the Curriculum Reform Committee entered into permanent session (Table 2). Many elements important for successful implementation of a new paradigm are still missing, but there is already some progress. In March 2010, the new paradigm of teaching clinical skills was presented during a two-day international symposium in honor of Alexander Flexner. Subsequently, a partial curricular reform began, and training of clinical skills was programmed to start early, as three, one-week modules in the first two ("preclinical") years. Teaching of clinical examination will not undergo many changes, and clinical skills training will continue in the fourth and fifth (clinical) years, where it will take place in appropriate blocks of clinical courses. Radical changes are anticipated for the sixth year of study, which will become "the clinical practical year," when the students will have the opportunity to immerse themselves in the real world of clinical practice. The new curriculum is scheduled to become operational in the academic year 2010/2011.

The next planned step is to revitalize the laboratory of clinical skills, upgrade it, and increase its use and the use of interactive software for practicing clinical skills in virtual reality. In addition, working groups have been appointed to revise the existing "Catalog and Practicum of Clinical Skills" and to design the students' portfolio (logbook).

Finally, different methods to introduce and empower a well-defined mentorship structure are under discussion and hopefully all dilemmas will be resolved reasonably quickly. Difficulties have arisen around the position of the clinical instructor, as the status of this role within the higher education system has not yet been defined.

Our "new paradigm," addressing many longstanding and unsolved problems, should be observed as a call for discussion and not as a ready-made recipe. We hope that some of our suggestions can be implemented with success and that future generations will not be confronted with the same obstacles as ours have been.

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