

## **Nové možnosti v multidisciplinárním klinickém vzdělávání založené na bázi virtuálních klinických případů**

### **New possibilities in multidisciplinary clinical education based on virtual clinical cases**

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Practical classes are the fundamental segment of undergraduate medical education, focused on presentation of wide spectrum of most important symptoms, syndromes or diseases in any medical discipline. One of the important tasks which should be gained during this form of education is also adoption of basic diagnostic and therapeutic algorithms.

However, spectrum of patients available at the moment for clinical examination as well as by time of the courses is limited. This may lead to differences in the quality of each practical class and thus result in differences between individual students. The attempts to standardize spectrum of presented clinical cases can resolve this problem only partially.

One possible solution of this limitation is the simulation of various diseases by information technologies. The presented project is based on a newly developed dynamic database of virtual patients in an outpatient clinic.

After registration to the system, each user obtains login and password warranting an access to virtual doctor's office. The system simulates the real clinical practice as much as possible. It randomly generates a unique set of individual virtual patients (clinical cases) - thus, at the beginning, each participant sees a waiting room full of so far unseen patients seeking his advise and help. The spectrum of diagnoses, number of patients and criteria for completion of the course are defined in advance by the tutor. The system is designed as much flexible, as possible. It can be replenished by virtually unlimited number of patients without any limitation regarding type of disease, clinical specialization, type of diagnostic procedure, etc.

In each virtual patient are generated personal data, history, current complaints, clinical diagnostic findings and results of various tests (laboratory tests, imaging methods, biopsy results, etc.). Clinical history, physical examination results and findings from diagnostic procedure were acquired from charts of real patients. In each individual virtual patient are combined data from several real patients (to prevent possibility of student's bias based on experience from his colleagues, repetition of the same patient, etc). This combination, however, is not entirely random, but is based on highly sophisticated parameters, so that all data (patient's history, complaints, results of clinical examination, etc.) fit together and correspond with the final diagnosis.

Student must suggest the optimal diagnostic algorithm and determine the correct diagnosis for successful completion of the case. During the handling of each patient, student orders (based on patient's history and clinical examination) various diagnostic procedures (including the laboratory tests, wide spectrum of imaging methods, endoscopic examinations, etc.). Clinical findings and results of ancillary examinations are presented not only as text but also as photographs, instructive video sequences, X-ray pictures, virtual histological slides, etc..

Software evaluates how the selected tests contribute to solve the case and find final diagnosis. Each meaningful and rationally chosen method or test is awarded by positive points. In case of unnecessary (or even harmful) diagnostic method is the student awarded by negative points. The total economic cost of used diagnostic methods is calculated (based on costs of these procedures in real healthcare system) too. It is also evaluated, whether the sequence of diagnostic methods was correct or not.

Injury of patient due to the harmful examination, too long, inconvenient or complicated diagnostic approach or economical failure (depletion of the budget) leads to early termination of clinical case (the patient is withdrawn and student is penalized). The case is solved when the student is able to make correct diagnosis based on the WHO International Classification of Diseases.

The system allows detailed analysis of each student's work. The tutor can subsequently objectively assess student's diagnostic skills, diagnostic approach and strong and/or weak aspects leading to the success or failure.

The series of the gastroenterology cases is currently prepared and tested during courses of Internal medicine at the Charles University Medical Faculty in Hradec Králové.

The presented project of virtual case reports can be an optimal addition to face-to-face practical education of clinical subjects at medical faculties. The main advantages are comprehensiveness and diversity of presented cases, possibility to compare students' knowledge, possibility to present optimal, suboptimal and incorrect diagnostic algorithm, to demonstrate less frequent or even very rare symptoms, syndromes and diseases. In addition, each student can prepare assigned case individually at home and later on discuss it with the tutor and colleagues during the classes.

Virtual cases should certainly not replace the contact with patient, as this mode of teaching is essential for each medical student. However, it presents an additional option of broadening the spectrum of possible ways how to study clinical subjects at the medical faculty.