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PREFACE

We would like to present, with great pleasure, the second issue of the inaugural volume of a new scholarly journal, "MEFANET Journal (Mefanet J)". This journal follows the edition of the annual proceedings RITM report 01-02 and MEFANET report 01–05, published between 2005 and 2012. It is devoted to the gamut of medical education science issues, from theoretical aspects to application-dependent studies and the validation of emerging technologies. This new journal was envisioned and founded to represent the growing needs of computational science as an emerging and increasingly vital field, now widely recognized as an integral part of medical education scientific and technical investigations. Its mission is to become the premier vehicle for disseminating information about MEdical FAculties NETwork, which covers all Czech and Slovak medical faculties as well as schools or faculties of health care sciences.

This second issue includes two detailed editorial reports, one review and four original articles. The editorial material by Štourač P. et al. address the fifth annual AKUTNE.CZ congress, which was held in Brno during November 2013 and which attracted more than six hundred participants interested in advances in acute medicine. The other editorial material by Ban N. reports on the 45-year history and activities of the Japan Society for Medical Education. The review by Kiško A. et al. covers a very important problem in the current medicine: measurements of physical activity, which play a key role in internal medicine, pediatric medicine, orthopaedics, traumatology, physiotherapy etc. Authors of the original articles in this issue explore the potential of information and communication technologies in various domains of medical education. Sochorova et al. shares many years of experience of one particular medical faculty with the blended learning method and with the learning management system Moodle. Štourač P. et al. provides interesting insights into the interactive tools of the AKUTNE.CZ and SEPSIS-Q.CZ portals for problem-based learning (PBL) sessions. PBL sessions structured with the use of simulated cases represent an effective method for improving critical thinking and clinical reasoning skills of students who will once become physicians, dentists or nurses. The critical thinking and clinical competences are highlighted also in the article by Miertova et al. focused on professional training of nurses.

This second issue would not have been possible without the great support of the Editorial Board members and reviewers – I would like to express my sincere thanks to all of them. I would also like to express my gratitude to the honorary advisors of the journal: assoc. prof. Ladislav Dušek, prof. Vladimír Mihál, prof. Aleš Ryška and prof. Stanislav Štípek. I hope that the second issue of the MEFANET Journal will be another valuable resource for the MEFANET community and will stimulate further research into the vibrant area of medical education science.

December 2013

Daniel Schwarz
Editor-in-chief

AN OVERVIEW OF CURRENTLY AVAILABLE METHODS AND FUTURE TRENDS FOR PHYSICAL ACTIVITY

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ABSTRACT — ***Background:*** *Methodological limitations make comparison of various instruments difficult, although the number of publications on physical activity assessment has extensively increased. Therefore, systematization of techniques and definitions is essential for the improvement of knowledge in the area.*

Objective: *This paper systematically describes and compares up-to-date methods that assess habitual physical activity and discusses main issues regarding the use and interpretation of data collected with these techniques.*

Methods: *A general outline of the measures and techniques described above is presented in review form, along with their respective definition, usual applications, positive aspects and shortcomings.*

Results and Conclusions: *The various factors to be considered in the selection of physical activity assessment methods include goals, sample size, budget, cultural and social/environmental factors, physical burden for the subject, and statistical factors, such as accuracy and precision. It is concluded that no single current technique is able to quantify all aspects of physical activity under free-living conditions, requiring the use of complementary methods. In not too distant future, devices will take advantage of consumer technologies, such as mobile phones, GPS devices. It is important to perform other activities, such as detecting and responding to physical activity in a real time, creating new opportunities in measurement, remote compliance monitoring, data-driven discovery and intervention.*

INTRODUCTION

There are lots of research studies on physical activity and it is difficult to compare different methods and tools used. When selecting a physical activity assessment methods it is necessary to consider various factors, such as objectives, sample size, budget, cultural, social and environmental factors, physical load and statistical factors, such as accuracy and precision [1]. We assume that in the near future there will more technologies available for monitoring physical activity, such as mobile phones, GPS devices, and others.

METHODS

Up-to-date systematization of methods and definitions is essential for the improvement of knowledge in the area. A variety of techniques exist to quantify levels of habitual physical activity during daily life, including subjective self-reports of physical activity by diaries or logbooks (PA-log) methods and physical activity questionnaires, as well as objective measures, such as doubly labelled water (DLW) technique, direct observation, heart rate monitoring, pedometry, or accelerometry [2].

RESULTS AND DISCUSSION

The ability of accurate quantification of the total activity allows healthcare professionals to help in designing appropriate exercises. Modern systematization of methods and descriptions is essential to improve knowledge in this area.

Self-reports of physical activity by a diary or log method provide a detailed record of an individual's physical activity on a daily basis; these records are generally self-completed prospectively on paper or computer, in form of interview, daily logs or diaries. Strengths of self-reports include low cost of administration, ability to measure large samples, availability of many instruments with evidence of reliability and validity, and ability to tailor the measure to the population and study goals. Individual bouts of activity are recorded in diaries as they occur during the day typically in 15-minute segments that may

lead to the omission of some activities, but reducing the period has been shown to be too intensive and lead to non-completion. In contrast, logs capture the time individuals spend in broad categories of activity: inactive, sitting, light, moderate, vigorous and very vigorous and examples of activities in each intensity level are provided [3]. Diaries produce more detailed information, i.e., types of activity, intensity and patterns, but are more burdensome for individuals to complete and the data are more complex to reduce and enter. Correlations with accelerometry were moderate and ranged from 0.26–0.54 depending on the comparisons. Physical activity self-reports mainly assessed leisure or recreational activities, but adults can also be active in their jobs, through the type of transportation they use, and in performing household chores [4].

The International Physical Activity Questionnaire (IPAQ) was developed in 1998 to facilitate surveillance of physical activity based on a global standard [5]. The IPAQ assesses activities in all multiple domains among adults aged 18 to 65 years over the previous week and is adaptable to all cultures and languages in almost 70 countries and has been shown to be as reliable and valid as other self-reports. The IPAQs are the most practical subjective self-report instruments in physical activity research [6,7]. Recent reviews have documented 85 self-administered physical activity questionnaires in several forms of administration (face-to-face, telephone interviews, mailed forms) [8]. There is a clear lack of systematization and standardization of questionnaires, none of them was superior and therefore could not be strongly recommended over others. Several countries have adopted the IPAQ as their national or regional surveillance system and these data contribute to current WHO and European surveillance systems [9,10].

The IPAQ has gradually become the most widely used physical activity questionnaire, with two versions available: the long form (IPAQ-LF) and the short form (IPAQ-SF). Both of them involve 7-day recall of physical activity. The IPAQ-SF records the activity of four intensity levels: 1) vigorous-intensity activity such as aerobics, 2) moderate-intensity activity such as leisure cycling, 3) walking, and 4) sitting, in part because the burden on participants to report their activity is small. It was designed for use in surveillance studies to estimate the time spent performing physical activities (moderate to vigorous) and inactivity (time spent with sitting). The IPAQ-SF can be used for successful estimation of VO2 max as well as submaximal exercise tests. It was concluded that highly active participants could be correctly identified and distinguished from inactive participants using the IPAQ-SF, but other discrimination was poor. A limitation is that the IPAQ-SF does not provide summaries by domain; however, the slightly longer Global Physical Activity Questionnaire (GPAQ) does summarize activities by recreation, occupation, and transportation domains. The correlation between the IPAQ-SF and objective measures of activity or fitness in the large majority of studies was lower than the acceptable standard. Furthermore, the IPAQ-SF typically overestimated physical activity as measured by objective criterion by an average of 84 percent. Hence, the evidence to support the use of the IPAQ-SF as an indicator of relative or absolute physical activity is weak [11]. The IPAQ-LF was developed to obtain internationally comparable data on health-related physical activity. Its reliability and validity results showed correlations with motion detectors of 0.30–0.33. Later a revised IPAQ-LF version has been launched. As different from the first, the revised version does not aim to measure low-intensity physical activity. It asks in detail about walking, moderate-intensity and vigorous-intensity physical activity in each of the four domains. Data collected with the IPAQ-LF can be reported as a continuous measure and reported as median METs-minutes [12].

Direct observation is used most frequently for the assessment of physical activity of groups in specific settings. Advantages of the direct observation include high-quality data, ability to record numerous dimensions of physical activity, and flexible scoring of results. Disadvantages are the expense of human observers, need for training, difficulties of managing and scoring the data. Two widely used observation measures illustrate the method's use. The System for Observing Fitness Instruction Time (SOFIT) was developed to evaluate physical education classes and has been used to evaluate numerous physical education programs for research and non-research purposes. The System for Observing Play And Recreation in Communities (SOPARC) was designed to evaluate how recreation settings are being used [13].

Heart rate monitoring is a measure of the direct physiological response to physical activity to estimate the intensity of activity for people across the age range. The most common used heart rate monitors (HRMs) can detect in principle any type of activity and they can even be used for activities in the water. A single device that simultaneously collects synchronized heart rate and motion (HR+M) data is preferable in order to overcome the inherent limitations. The HR+M monitors compensate for the limitations of separate devices so that all types of activities can be assessed throughout the range of intensities, including sedentary behaviours. Incorporated software enables that individual calibrations based on an individual's heart rate response can be applied to the HR+M data. The devices are simple to carry, equipment needs are minimal and inexpensive, and they can be performed almost anywhere by non-experts [14].

Pedometers are small, belt-mounted devices primarily used for quantifying the daily number of steps

accumulated, which is the most common activity. Pedometers are easy to use for participants and evaluators and they accurately assess walking. They are less useful for running, cycling, and water activities and they work less properly for young children who do a variety of activities and for older adults who walk too slowly for accurate measurement. Pedometers provide an inexpensive overall measure of physical activity but are unable to assess intensity, frequency and duration of activity or to estimate energy expenditure. In few studies pedometers correlated highly in terms of both criterion (direct observation) and convergent validity (heart-rate monitor, accelerometer) and can be effectively utilized as a valid determinant of physical activity levels among children and adolescents, particularly in large-scale epidemiological studies [15]. Pedometers serve as motivational tools for promoting physical activity because immediate feedback on accumulated steps, whether incidental or intentional, provides goal attainment information and is a constant reminder to be active [16].

Accelerometry is the most common objective method used to measure physical activity; it has been used extensively in field settings to monitor activity patterns in subjects of various age [14,17]. Technological advances have resulted in devices that can measure activity accurately over an extended time period and that are small and discrete for people to wear. Accelerometers attached to the waist do not capture upper body movement or cycling and underestimate walking on an incline or carrying heavy loads. Accelerometers provide physical activity measurements, such as activity counts and vector magnitude, energy expenditure, steps taken, activity intensity levels, METs and more. Most of the devices collect data in raw format at a user specified sample rate up to 100 Hz. Filtering and epoch selection are performed after data are collected, allowing users processing datasets multiple times at different epoch selections, even after a study has ended. Some accelerometers can store over 40 days of raw data, having a rechargeable battery capable of providing power for 30 days between charges. Few models are waterproof and can be used for evaluating of water-based activities. The accelerometers appear to be a useful tool for measuring energy expenditure under free-living conditions for both short- and long-term periods [18]. The primary outcome measure of the accelerometry is body acceleration, often expressed as a count value. Secondary outcomes are estimates of bout frequency, duration and intensity of body movement. It has been suggested that establishing the relationship between activity counts and energy expenditure is sometime problematic. Additionally, an accelerometer placed on one body location does not capture activity of other body sites, although there is usually some cross-correlation. Cut-points for defining different intensity levels are somewhat arbitrary and the use of different cut points can have profound impact on the estimate of the physical activity. Laboratory-derived physical activity energy expenditure equations are not all equally suitable to assess physical activity in free-living populations. Laboratory-derived prediction equations have been found to overestimate free-living energy expenditure by 47% in a study using DLW technique [19]. Common phenomenon in accelerometry is that linear relationships derived for rest and ambulation displays much poorer validity in biomechanically diverse activities, e.g. cycling or lifting weights. Advanced statistical methods have been proposed to improve prediction equations. During the past decade the objective assessment of physical activity using accelerometer-based devices has demonstrated substantial potential, especially in documenting the pattern of light-, moderate-, and vigorous-intensity activity throughout the day. However, these devices do not provide information on activity type, location or context [3].

As physical activity monitoring moves into the future, it is incumbent on researchers to be open to new technologies, such as multisensory arrays as well as integrating familiar sensors into new devices. To improve health outcomes it is critical to accurately measure physical activity and sedentary time spent in- and outdoors. GPS devices linked with physical activity monitoring devices enable measurement of where and when individuals are active as well as their energy expenditure and are a promising tool that can improve understanding the spatial context of physical activity [20]. If the validity, reliability, and feasibility of wearable GPS devices are better understood, these devices can become important measurement tools in physical activity research. Several cell phone manufacturers are already building activity monitors into cell phones, with the cell phone service providing the data download. The iPod/iPhone's built-in accelerometer as a measurement of physical activity in order to create a better physical activity recognition program is currently tested [11].

CONCLUSION

We anticipate more modes of activity-sensing technology now and in the not too distant future. No single current technique is able to quantify all aspects of physical activity under free-living conditions, requiring the use of complementary methods. The various factors to be considered in the selection of physical activity assessment methods include goals, sample size, budget, cultural and social/environmental factors, physical burden for the subject, and statistical factors, such as accuracy and precision [21]. In the future, physical activity sensors, which are of low-cost, small-sized, and convenient for subjects, investigators, and clinicians, will take advantage of consumer technologies, such as mobile phones and

GPS devices, to detect location and respond to physical activity in a real time, creating new opportunities in measurement, remote compliance monitoring, data-driven discovery and intervention.

doc. MUDr. Alexander Kiško, CSc.

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LMS MOODLE IN TEACHING BIOPHYSICS AND MEDICAL INFORMATICS AT FACULTY OF MEDICINE, UNIVERSITY OF OSTRAVA

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ABSTRACT — *The paper deals with the assessment of the current state of use of LMS Moodle for teaching medical biophysics and informatics for students of the Faculty of Medicine, the University of Ostrava. The initial experience with the implementation of blended learning methods (combination of distance and full-time instruction) in teaching students in the part-time form of study were used for education and for full-time students. A few survey questions given to first-year students, which are presented in the paper, confirm that this is a move in the positive direction. A well-structured e-learning course and experienced teachers support student's attention, motivation and results in achieving educational goals.*

INTRODUCTION

E-learning is an educational method that integrates information and communication technologies, as a basic communication environment. E-learning is now used as the standard tool in education at most universities. It is basically the usage of electronic material and teaching facilities for effective achievement of the educational goals that are realized through computer networks [1]. While e-learning has been recently applied in distance education it is used nowadays in full-time education, too [2].

LMS are applications which integrate tools for management studies (discussion forum, calendar, deadlined tasks, testing), offering on-line communication (chat, messaging, and conferencing) and also made available learning materials and instructional content [1]. Systems known as CMS (Content Management System) are used mainly as a publication systems for publishing content on the website.

Is Moodle, the most common tool in particular because of its free-of-charge availability, a CMS or LMS? Despite offering resources for the management courses and control of the permeability of study, the system called Moodle meets the requirements of the LMS; it is sometimes classified as a CMS, however. On the moodle.org website the system is presented as "Moodle is a Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). It is a free web application that educators can use to create effective online learning sites" [3].

At the University of Ostrava LMS Moodle has been used for a long time, first courses were started in the academic year 2006/2007. At present the version 2.5.2+ is used. This version allows users to apply the above mentioned pass-conditions to manage students' way through the course [4,5].

Medical students of the University of Ostrava meet with the LMS Moodle during the university admission process, when they recognize one of the important activities – tests. Graduates of secondary schools nowadays enter the university equipped with the knowledge in the field of on-line communication. They are also technically skilled (see results of inquiry) and ready to work with electronic teaching materials. E-learning support studies is applied in this case as so-called blended learning, which complements some minor disadvantages of e-learning by combination with standard teaching methods in

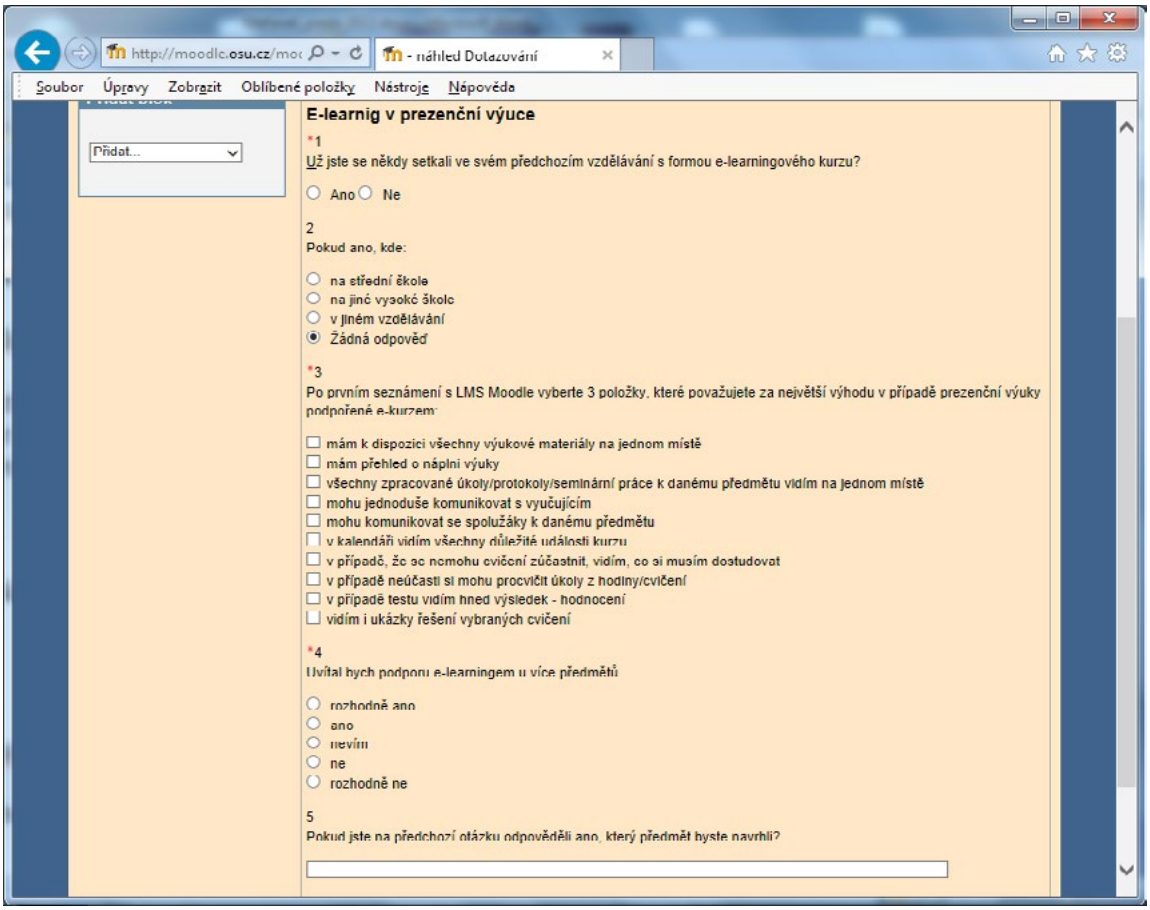

Figure 1: Survey questions

teaching full time students [6]. And it can be expected that the objects, which names contain the word base "information", will use these options in the maximum extent.

METHOD: QUESTIONNAIRE SURVEY AND EVALUATION OF EXISTING PRACTICE

At the beginning of the winter semester of the academic year 2013/14 after first few lessons in LMS Moodle General Medicine students were asked several questions relating to the integration of e-learning in full-time education.

At this time in LMS Moodle, there is only one available course in the field of Biophysics, Computer Science I – exercises. Survey questions are shown in Figure 1.

RESPONDENTS

Public inquiry investigation was attended by 97 students of the first year of the study program General Medicine, of which 31 were male and 66 female. The Querying activity in the Moodle course was used.

RESULTS OF SURVEY

The first question concerned whether the students have ever previously met with lesson supervised through e-learning. This was answered positively by 41% of students (Figure 2, Graph 1). Another question even specified the previous answer – 87% of the students have already met with e-learning in high school, 10% at another university and one student within another education (Figure 2, Graph 2).

In the next question students chose advantages of teaching course with the support of e-learning, which are most appreciated (Figure 3). Having all the learning materials in one place was chosen by the majority as the most important advantage, followed by the "all processed tasks/reports/essay on a given subject can be seen in one place." The students appreciated positively to see demonstrations of solving selected exercises, in case of absence; they can see what they have to learn, get an overview of the content of teaching and immediately can see the results.

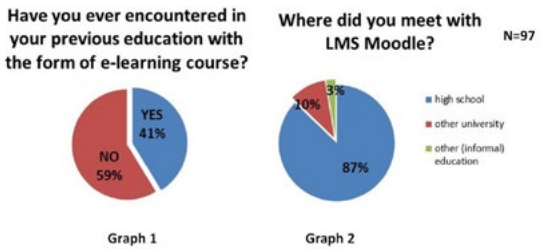

Figure 2: Answers to the first survey questions

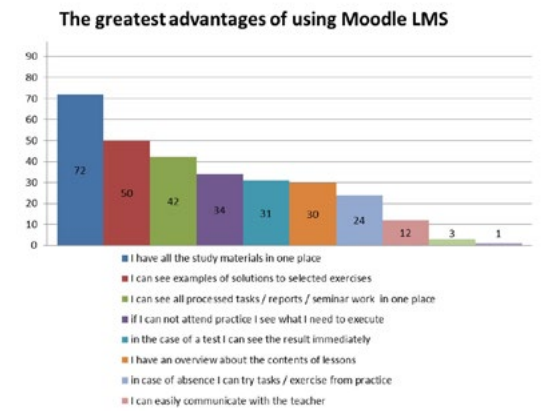

Figure 3: Answers to next survey question

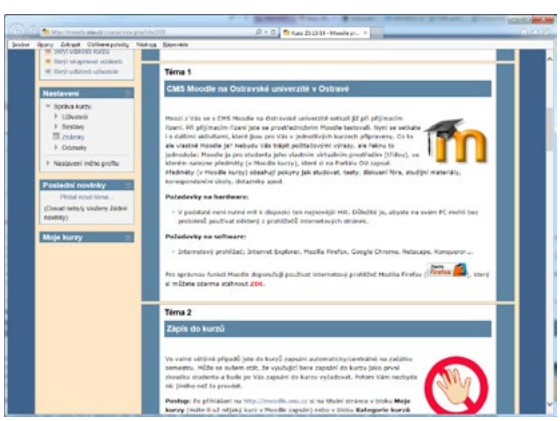

Figure 4: Moodle course for students of the University of Ostrava

On the contrary, students voted as the least beneficial the ability to communicate on-line and communication with the teacher and other students in groups. It is obvious that suitable communication tools are already available to them and Moodle does not bring anything new in this regard [7].

Next two questions relate to the possible use of LMS courses for other subjects – 40% of student could not decide whether this option would be beneficial also in other subjects, 46% of students would like to have LMS courses in other subjects. In the latest question students suggested other subjects where the LMS could be used – most often mentioned course was biology, where had been currently implemented tests in Moodle, chemistry (in the summer semester, students will have the LMS Medical Biochemistry course), anatomy and foreign languages.

LMS COURSES IN BIOPHYSICS AND INFORMATION TECHNOLOGY

After the onset of the study all medical students are offered a Moodle course for students of the University of Ostrava, which get them familiar with the principles of communication, registration of courses, correspondence tasks and other activities used in Moodle.

There have been currently implemented 5 courses for teaching biophysics and informatics in different versions depending on the particular form of study and field of study, which are guaranteed by the Department of Biomedical Sciences.

The table in Figure 5 shows an overview of these courses, their arrangement (Course format), the number of sections and used activities. The most frequently used activities in the particular course are marked with bold font.

COURSES FOR STUDY PROGRAM GENERAL MEDICINE

The first rate with which students encounter immediately after the onset of the study is Biophysics 1 BF1LF – exercises. It includes all learning materials necessary for the first semester of practical classes in the subjects Biophysics and Computer Technology I. Students in the course hand in ongoing correspondence tasks and finally they complete the practical assessment work. The first version of this course was established in the academic year 2010/2011, for some selected topics of practical lessons.

Since the academic year 2013/14 the course has been realized in an entirely new form that affects the whole syllabus of the first semester of teaching, including biostatistics. Approximately 300 students have passed through the course.

Biophysics 2 BF2LF is the course for the second semester of Biophysics (tutorial) and provides students with instructions for laboratory tasks, space for submitting reports, and links to other recommended sources. In addition to these two courses in Biophysics there is still used a special course created purposefully for testing which is a part of final assessment of students.

	General Medicine		Non-medical health-care profession				
Study program	General Medicine		Rescue Ranger, Physiotherap., Radiographer	Rescue Ranger, Radiographer	Medical Laboratory Technician, Assistant for Prot. of the Public Health	non-medical health care study programs	
Study form	Full-time		Full-time	Part-time	Full-time	Full-time	Part-time
Course format	weekly	topics	topics	topics	topics	weekly	topics
Number of sections	15	12	8	8	13	14	14
Course / Activities	Medical biophysics, computer techn. I.	Medical biophysics, computer techn. II.	Fundamentals of Biophysics		Selected Chapters from Physics and Biophysics	Information Systems in Healthcare	
Resources	✓	✓	✓	✓	✓	✓	✓
Assignments	✓	✓	✓	✓	✓	✓	✓
Quiz	x	✓	✓	✓	✓	✓	✓
HotPot	x	✓	✓	✓	✓	x	x
Forums	✓	✓	✓	✓	✓	✓	✓
Wiki	x	x	x	✓	x	x	✓
Choice	✓	✓	x	x	x	x	x

Figure 5: Overview of LMS courses in biophysics and information technology guaranteed by the Department of Biomedical Sciences and applied activities

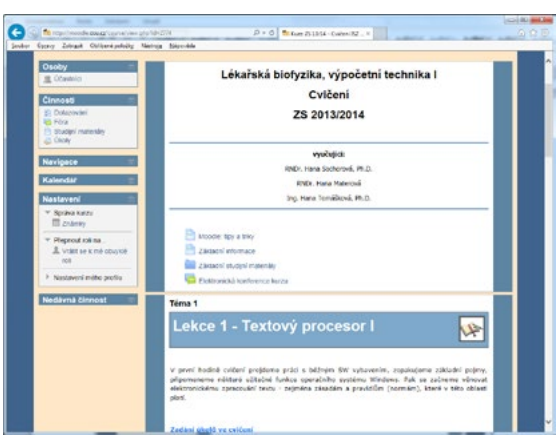

Figure 6: Course of Biophysics I – exercises, part Computing

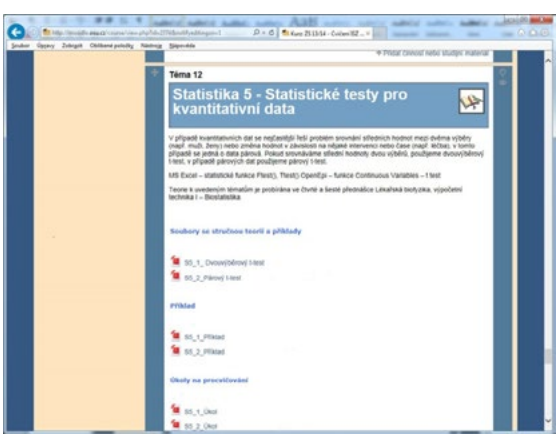

Figure 7: Biophysics Course I – exercises, part Biostatistics

COURSES FOR NON-MEDICAL HEALTH CARE FIELDS OF STUDY

Biophysics

The course Introduction to Medical Biophysics for Health Care Professions is being implemented from the academic year 2011/2012. The course is designed for students of full-time and part-time studies studying in the study program Physiotherapy, Radiographer and Rescue Ranger. The chapters of the course are incorporated into the next e-learning course in the subject of Selected Topics in Physics and Biophysics, which is designed for students studying in the study program Medical Laboratory Technician and Public Health Protection Assistant and it is extended to selected topics of elementary physics.

Information technologies

Information systems in healthcare are compulsory subject for all non-medical fields of study.

For the students in part-time form of study the lessons have been supported by e-learning course since

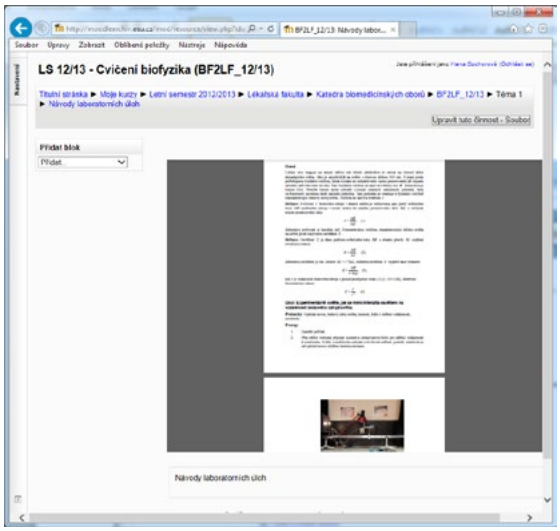

Figure 8: Biophysics Course II - exercises

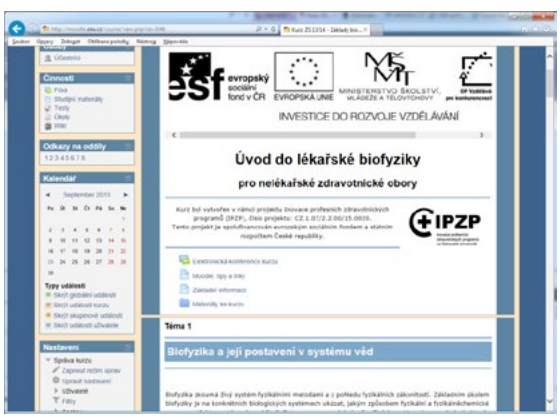

Figure 9: An Introduction to Medical Biophysics for health care profession courses

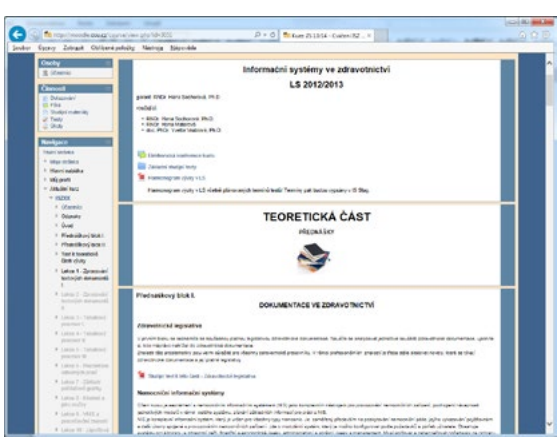

Figure 10: Course in IT in Health Care

2006, for the students in full-time study since 2009. In the year 2012 in the course IT Systems in Health care there were processed 2 texts underlying the course content – IT Systems in Health Care – Medical Records and IT Systems in Health Care – the Practical Application of Computer Technology. In addition, in 2006, it was prepared a course to the teaching Hospital Information System, which is still available to students. All courses after completing the course in the current semester are moved to the archive [8], where the teacher can, if necessary, let students remain accessible throughout during the study period.

DISCUSSION

The questionnaire survey showed that students like full-time teaching with the support of e-learning; they got familiar with this method of teaching at secondary schools and would welcome its introduction in other courses. Classes conducted in the form of blended learning provide students with new skills – ability to work with electronic resources in various formats, search for relevant information, the use of other software tools, etc.

This method of teaching provides tools for motivation increase and independent approach to the study. The motivating factor is the fact that students can see the results of their work, even self-evaluation tests. At this point, there is very important role of the teacher/tutor of whom are placed fairly high expectations. If the student does not receive a response relatively quickly, the effect of motivation is lost. This feature is especially important for students of the part-time form of study, for the students in full-time study it can maintain and support the motivation by frequent meetings.

For university studies an internal motivation to study and the ability of self-control in coping with a number of new knowledge are largely required. Well-structured and lectured course is really supporting in the study [9].

In general, we can conclude that some of the valued benefits for students, on the other hand, mean increased demands on teachers, especially in the area of timely communication with students. On the other hand, the lecturer has immediate feedback, a comprehensive overview of the performance and activities of the students, which can eventually simplify the evaluation the student's work.

Because the courses are offered for more fields of study, the proper setup of access rights to individual learning materials, setting deadlines of tasks, setting deadlines of attendance of tutorials for part-time studies, access to testing and its security are very important. In the courses there is used a group mode (visible groups) and grouping, which allows lecturers targeted access to materials and scheduling tasks [10].

In addition to publishing of learning materials also links to other materials freely available on the web and almost all of the offered activities – surveys, questionnaires, tests, wikis, discussion forums are used in our LMS courses.

CONCLUSION

Based on several years of experience using Moodle to enhance learning in part-time and full-time study, we can conclude that the method of blended learning has been very effective in practice, and we consider it as a step in the positive direction.

In practice that means that teachers must constantly keep teaching materials up to date, as well as add new information during the course, thoughtfully divide materials and display it in the way so as to motivate the students and force the students to be active not only during the lessons, but also during self-study at home. Appropriately selected learning methods lead to the achievement of educational goals.

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INNOVATIVE TEACHING METHODS IN THE PROFESSIONAL TRAINING OF NURSES – SIMULATION EDUCATION

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ABSTRACT — ***Introduction:*** *The article is aimed to highlight usage of innovative teaching methods within simulation education in the professional training of nurses abroad and to present our experience based on passing intensive study programme at School of Nursing, Midwifery and Social Work, University of Salford (United Kingdom, UK) within Intensive EU Lifelong Learning Programme (LPP) Erasmus EU RADAR 2013.*

Methods: *Implementation of simulation methods such as role-play, case studies, simulation scenarios, practical workshops and clinical skills workstation within structured ABCDE approach (AIM© Assessment and Management Tool) was aimed to promote the development of theoretical knowledge and skills to recognize and manage acutely deteriorated patients. Structured SBAR approach (Acute SBAR Communication Tool) was used for the training of communication and information sharing among the members of multidisciplinary health care team. OSCE approach (Objective Structured Clinical Examination) was used for student's individual formative assessment.*

Results: *Simulation education is proved to have lots of benefits in the professional training of nurses. It is held in safe, controlled and realistic conditions (in simulation laboratories) reflecting real hospital and community care environment with no risk of harming real patients accompanied by debriefing, discussion and analysis of all activities students have performed within simulated scenario. Such learning environment is supportive, challenging, constructive, motivated, engaging, skilled, flexible, inspiring and respectful. Thus the simulation education is effective, interactive, interesting, efficient and modern way of nursing education.*

Conclusion: *Critical thinking and clinical competences of nurses are crucial for early recognition and appropriate response to acute deterioration of patient's condition. These competences are important to ensure the provision of high quality nursing care. Methods of simulation education used within professional training of next generation of nurses can help them to get used to the recognition and management of this group of patients by the means of simulated cases to be able to implement the approaches trained within real clinical nursing practice.*

INTRODUCTION

In clinical practice there are frequently patients manifesting the signs of physiological deterioration. If timely and appropriate detection by medical and nursing staff of physiological deterioration is undertaken it is likely to benefit the patients [1]. Patients who are admitted to hospital are entering a place of safety, where they, their families and carers have a right to believe that they will receive the best possible care [2]. Recognizing the deterioration of patient (whether child or adult) and referring to critical care is a highly complex process, requiring skill, experience and confidence [3]. Nurses and other health care professionals are under increased scrutiny to provide safe and effective care [4]. According to clinical guidelines (e.g., NICE Clinical Guideline: Acutely Ill Patient in Hospital, Recognition of and Response to Acute Illness in Hospital, 2007; European Resuscitation Council Guidelines for Resuscitation, 2010) nurses must be competent to perform care of patient who is acutely ill (acutely deteriorated) [5].

Early recognition (assessment) and appropriate response (management) to patients who are in the condition of acute deterioration are the core themes of the project EU RADAR. It is 3-year Erasmus Intensive Programme (Erasmus IP) for nursing students focused on the competence to recognize and respond

Figure 1: International pan European / American dimension of EU RADAR project

properly to the acutely deteriorating patients of all ages (children, adults, seniors) with the respect to ethical, legal and socio-cultural aspects of health care provision within clinical practice of each participating country. In this project the Institute of Nursing at the Jessenius Faculty of Medicine in Martin belonging to Comenius University in Bratislava (Slovak Republic) is one of seven participating universities, along with School of Nursing, Midwifery and Social Work, University of Salford (United Kingdom), Tampere University of Applied Sciences (Finland), Fulda University of Applied Sciences (Germany), Cyprus University of Technology (Cyprus), University of Cordoba (Spain), Winona State University (USA). The University of Salford was the host university for the first year of IP for 26 lectures and 65 students in the period from 11 to 22 February 2013.

According to European Commission, ERASMUS Intensive Programme (IP) is a short programme of study which brings together students and teaching staff from higher education institutions of at least three participating countries. It can last from 10 continuous full days to 6 weeks of subject related work.

IP generally aims at encouraging efficient and multinational teaching of specialist topics which might otherwise not be taught at all, or only in a very restricted number of higher education institutions; enabling students and teachers to work together in multinational groups and thus benefit from special learning and teaching conditions not available in a single institution, and to gain new perspectives on the topic being studied; allowing members of the teaching staff to exchange views on teaching content and new curricula approaches and to test teaching methods in an international classroom environment. IP should provide something significantly new in terms of learning opportunities, skills development, access to information, etc., for the participating teachers and students and promote an element of curricular development.

EU RADAR undergraduate nursing intensive educational programme is innovative in teaching methods used – a combination of clinical simulations, blended learning and the use of digital and creative media [6]. From an educational perspective, the amount of knowledge required for safe patient care requires the adoption of a pedagogy that goes beyond traditional didactic teaching. Traditional education relies heavily on linguistic intelligence and rote memorization. In contrast, a well-designed simulation curriculum draws upon multiple intelligences and is learner-centred [7]. When compared with traditional teaching methods emphasizing linear thinking, the simulation education emphasizes critical thinking skills [8]. Today, simulations are being used in a variety of programmes (including nursing and medical education) designed to enhance the skills of health care providers.

METHODS

In the two weeks of first IP programme several innovative teaching and educational methods were used in combination, e.g., simulation educational methods with the use of human patient simulators, progressive digital and creative methods with the

Figure 2: Authors of the article together with the group of Slovak students

use of information technologies, digital and creative media. These methods, such as flash mob, time capsule, podcasts creations and photo stories were used to promote the idea of the programme to bring together students and teachers from various countries and cultures to facilitate multicultural communication with the aim to share experiences in the field. By systematic implementation of advanced simulation educational methods (simulations of patients' scenarios, case study group works, practical workshops, intensive clinical skills workstations with the emphasis on ABCDE approach application) and dramatic educational techniques (drama, role-play, communication games with the use of SBAR reporting approach) accompanied by discussions, debate, debriefing and reflections on actions, clinical decision making process in recognition and response to deteriorating patient was promoted in nursing student participants. ABCDE approach and SBAR reporting approach were trained within this programme as they are efficient particularly in the care of acutely deteriorating patients and are obviously used by health care professionals in hosting country. Simulation educational methods took place in simulation laboratories to train clinical skills and competences of nursing students related to the topic. Simulation laboratories in hosting university reflect real hospital and community care environment.

Systematic ABCDE approach to resuscitation is included in European Resuscitation Council Guidelines for Resuscitation 2010. It provides the essential treatment algorithms for the resuscitation of children and adults [5]. The approach is widely accepted by experts in clinical practice, e.g., emergency units, hospital wards, and improves outcomes by helping health care professionals to be focused on the most life-threatening clinical problems. The high-quality ABCDE skills among all healthcare team members can save valuable time and improve team performance and efforts and thereby improve patients' outcomes [9]. **ABCDE approach** *(AIM© Assessment and Management Tool)* used within EU RADAR programme is adopted by Greater Manchester Critical Care Skills Institute, National Health Service (NHS). It is a structured assessment and management tool to recognize acutely deteriorating patient's condition and respond appropriately prior resuscitation can be initiated. This tool is recommended to be used also in professional training of the next generation of nurses. ABCDE approach was used, e.g., to train assessment and management of acutely deteriorating patient (child, adult) within intensive clinical skills workstations where mixed groups of students from all participating countries had trained together [6].

SBAR reporting approach (*Acute SBAR Communication Tool,* Greater Manchester Critical Care Skills Institute, NHS) is a tool to improve communication and information sharing among the members of a multidisciplinary team. SBAR can be applied in both verbal and written communication [4]. Using the method of role-play this approach was trained in IP programme within the workshop Communication Games and Activities to highlight SBAR. Role play as a simulation method is effective to provide knowledge regarding the nursing contribution to effective communication

Figure 3: Sophisticated computer-controlled life-sized mannequins used within simulation educational methods

when assessing and responding to the acutely deteriorating patient [6].

Within EU RADAR IP programme, **human patient simulators** (sophisticated computer-controlled life-sized mannequins to simulate range of symptoms and signs in infants, school age children, adults) have been used to train clinical skills and competences in student nurses. Using human patient simulators is a relatively new teaching strategy that allows learners to develop, refine, and apply knowledge and skills in a realistic clinical situation as they participate in interactive learning experience designed to meet their educational needs. These interactive mannequins are capable of realistic physiologic responses, including respiration, pulse rate, heart sounds, breath sounds, urinary output, and pupil reaction. Additionally, the more advanced models can communicate with the student, responding to questions posed by the learner in real time during the simulation exercise [4]. Human patient simulators were used together with partial task trainers during simulations of patient scenarios, practical workstations and also within final assessment of competences and skills achieved in nursing students (OSCE) [6].

Various methods, such as role play and simulations of patient scenarios, intensive clinical skill workstations, practical workshops, case study group work and debate have been used to improve clinical competences of nursing student. These modern teaching and educational methods were used, e.g., to identify structural differences and physiological parameters across the lifespan in care of acutely ill patient; to train the procedures and equipment usage in the care of acutely deteriorating patient; to discuss legal, ethical and professional issues related to the care of dead patients, bereavement support. Debate Is restraint necessary? was used to facilitate students' reflection of professional, legal and ethical issues related to restraints used in the care of acutely deteriorating patient [6]. Debriefing was performed at the end of each simulation scenario. Through debriefing, the students were able to explore their own experiences and views whilst developing the understanding of the importance of clinical assessment [6]. Debriefing is considered to be the most important element of simulation and most valuable in producing gains in knowledge [10]. Debriefing, also referred to as guided reflection, is a planned session after the simulation and is led by the instructor, who provides students with the time to assess their decisions, actions, communication, and ability to deal with the unexpected [11]. Discussions and reflection were used in IP programme with the aim to improve student's understanding, self-confidence and to demonstrate learning to work in a multidisciplinary team context [6].

Contributors to the programme further enhanced a **multidisciplinary approach** as students were exposed to presentations from the North West Ambulance Service, the Royal Air Force/C Cast team, personnel of the Greater Manchester Critical Care Skills Institute, Creative Writing Team, Patients from the User and Carer Group and Performing Art Students. Students could get an overview of the work of health care teams from real practice about how they approach and manage the care of acutely ill patients. The students also had the opportunity to

Figure 4: Student's individual formative assessment with the use of OSCE approach

experience **digital and creative methods** using information technology and media such as flash mob, time capsule, podcasts creations, and photo stories. It was very interesting for them as they could develop awareness for digital and social media tools and strategies and their usefulness and security issues [6].

OSCE approach *(Objective Structured Clinical Examination)* was used for **student's individual formative assessment.** OSCE was used with the aim to assess safe practice in terms of performance of psychomotor skills as well as the declarative and schematic knowledge associated with their application [12]. It represents a performance-based exam in which students are observed demonstrating a multitude of clinical behaviours [13]. Within formative assessment the students had to apply ABCDE approach to assess and manage acutely deteriorating patient simulated on human patient simulator. At the end of formative assessment they were asked to apply SBAR reporting approach to report the situation of simulated patient to the teachers and facilitators.

RESULTS

Through collation of the student evaluations by the means of student survey it has been acknowledged that the objectives of the programme were achieved as for academic learning outcomes and expected personal outcomes as well. Evaluation forms prepared by hosting university used Likert type scale from 1 to 5 to measure what is overall evaluation of IP and how satisfied they were with selected aspects (1-poor/not at all; 5-excellent/very much). Student participants were satisfied with academic activities and the pedagogical aspects of IP. High level of satisfaction was in number of hours, expected learning outcomes, activities besides the general course. Students proved high level of satisfaction with IP (4,43 ± 0,53) and agreed their academic learning outcomes as well as personal outcomes were met (4,43 ± 0,59; 4,44 ± 0,59 respectively). The highest satisfaction was achieved in items concerning the equipment used while training (4,79 ± 0,44) and the overall quality of teaching (4,75 ± 0,43). Up-to-date we have no country specific results and all the results published are overall results of whole sample of nursing students (n = 65).

DISCUSSION AND CONCLUSION

Critical thinking and clinical competences of nurses are crucial for early recognition and appropriate response to acute deterioration of patient's condition. These competences are important to ensure the provision of high quality nursing care. Methods of simulation education used within professional training of next generation of nurses can help them to get used to the recognition and management of this group of patients by the means of simulated cases to be able to implement the approaches trained within real clinical nursing practice.

Simulation education used within IP allowed participating students to improve their knowledge, gain clinical competence and improve self-confidence to recognize and respond appropriately to acute deteriorating patient's condition prior to resuscitation, when a patient's vital signs indicate he/she is

becoming acutely unwell [6]. This type of education has lots of benefits in professional training of nurses. It is realized in safe, controlled and realistic environment of simulation laboratories reflecting real hospital and community care environment (specific clinical environment) with no risk of harming real patients. Simulation can be also used to train individuals in the context of team activities, creating a more realistic clinical environment. It contributes to creation of learning environment that is supportive, challenging, constructive, motivated, engaging, skilled, flexible, inspiring and respectful [14]. Thus simulation education is effective, interactive, interesting, efficient and modern way of nursing education. The use of simulation as a teaching strategy can contribute to patients' safety and optimize outcomes of care, providing learners with opportunities to experience scenarios and intervene in clinical situations within a safe, supervised setting without posing a risk to a patient [4]. This is excellent teaching strategy for many skills, particularly in critical care nursing. It can be used in professional training of nurses to teach the theory, assessment, technology, pharmacology, skills, knowledge and critical thinking [8].

The EU RADAR IP programme brought benefits for both the students and the teachers. It allowed the students to gain new knowledge and practical skills and competences in a pan European/American context (multicultural), and to make new friends. For teachers it was a great opportunity to acquire new contacts, mutual inspiration and motivation to introduce and implement progressive teaching methods in order to improve professional training of nurses. Further details of the project are presented on the EU RADAR project webpage (http://euradar.org/). 2nd year of the project will continue at the Fulda University of Applied Sciences in Germany, in February 2014.

Mgr. Michaela Miertová, Ph.D.

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AKUTNE.CZ ALGORITHMS AND SEPSIS-Q SCENARIOS AS INTERACTIVE TOOLS FOR PROBLEM BASED LEARNING SESSIONS IN MEDICAL EDUCATION

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ABSTRACT — *This paper describes the interactive tools of the AKUTNE.CZ (part of MEFANET) and SEPSIS-Q portals for Problem Based Learning (PBL) sessions in medical education. The portals aim to be a comprehensive source of information and educational materials, covering all aspects of acute medicine for undergraduate medical students and health professionals. Our focus is mainly on simulation-based tools for teaching and learning algorithms in acute patient care, the backbone of the AKUTNE.CZ and SEPSIS-Q portals. Over the last five years, more than 30 interactive algorithms in the Czech and English languages (http://www.akutne.eu) have been devel¨oped and published online, allowing users to test and improve their knowledge and skills in the field of acute medicine. Additionally, we have created six SEPSIS-Q interactive scenarios in the Czech version. The peer-reviewed algorithms were used for conducting PBL-like sessions in General Medicine (First Aid, Anaesthesiology and Pain Management, Emergency Medicine) and in Nursing (Obstetric Analgesia and Anaesthesia for Midwives, Intensive Care Medicine). The interactive scenarios serve to demonstrate interesting cases, with preference for Intensive Care Medicine sessions in General Medicine and Nursing.*

INTRODUCTION

Acute/intensive care/critical care/emergency medicine is a dynamic and time-pressure environment with high demands on crisp team communication and leadership, accurate clinical reasoning and often, immediate decision-making. Simulating such an environment offers good techniques for training multidisciplinary medical teams, facilitating drilled interaction and coordination, and enabling the team to function as an effective unit [1]. The Internet education resources for critical care medicine have been recently reviewed by Kleinpell et al. [2]. The authors deduce that the majority of these resources are only electronic forms of textbooks and articles rather than interactive algorithms and dynamic simulations. Davids et al. [3] described an interactive web-based simulation in which the user treats patients with electrolyte and acid-base disorders, selects therapies and dosage, and obtains immediate feedback on the treatment results. The GOLEM system devised at the Charles University in Prague (Kofránek et al.) simulates many different clinical situations (e.g., circulatory insufficiency, renal disorders, diarrhoea, etc.) enabling students to learn by experimenting with the basics of physiology [4]. A recent trend in the authoring of virtual patients is to embed them as 3D-characters in virtual worlds, as in the case of Second Life [5], where the user has the option of working on the cases jointly with fellow students via the Internet.

Apart from the cited studies, medical education in general is undergoing significant shift from traditional methods (textbooks, lectures, bedside teaching) to a more comprehensive approach, which includes modern ICT tools (e-learning, interactive algorithms, computer simulations, virtual patients). The new approach has been shown to improve the learning skills of medical students and residents

Table 1: Virtual patients academic implementations

Virtual Patient Implementation Web Address
WebSP from the Karolinska Institute in Sweden http://websp.lime.ki.se/
Virtual Patients from Harvard Medical School https://research.bidmc.harvard.edu/VPTutorials/
Virtual Patient Project from New York University http://www.tinkering.net/vp/
Virtual Patients from the Centre for Virtual Patients (University of Heidelberg, Germany) http://www.medizinische-fakultaet-hd.uni-heidelberg.de/index.php?id=109894&L=en
OpenLabyrinth from Canada http://openlabyrinth.ca/
Labyrinth from the University of Edinburgh, Scotland http://labyrinth.mvm.ed.ac.uk/
TUSK Case Simulator from Tufts University http://tusk.tufts.edu/view/url/H1185C/471802/490012/
Virtual Patient from Keele University School of Pharmacy, UK http://www.keele.ac.uk/pharmacy/
Virtual Patients Group Consortium at the University of Florida, University of Central Florida, Medical College of Georgia, and University of Georgia http://vpf.cise.ufl.edu/VirtualPeopleFactory/virtualpatientsgroup/
vpSIM from University of Pittsburgh http://vpsim.pitt.edu/shell/Login.aspx

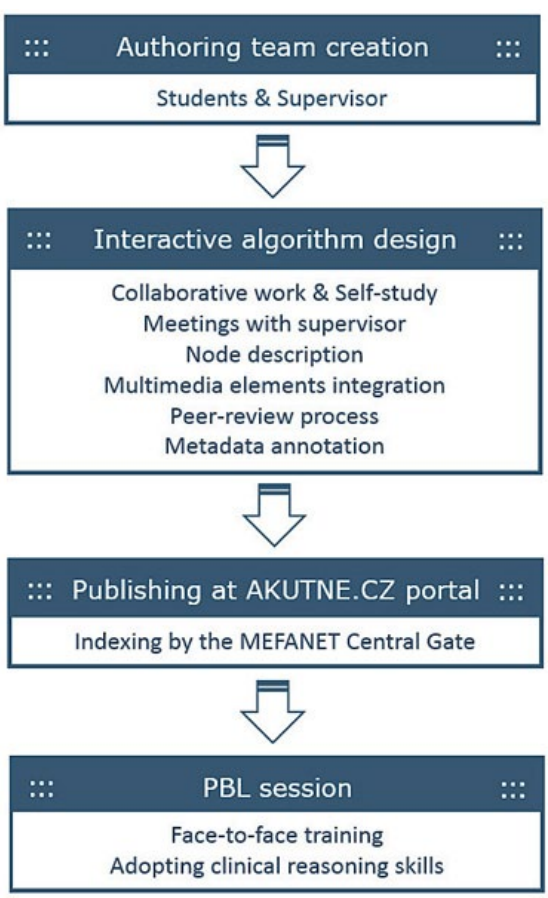

Figure 1: Authoring process of algorithms development

over traditional methods [5–8]. There are a number of factors in medicine and medical education that significantly support these trends; particularly, the rapid development of new technologies and generally shorter hospital stays leading to reduced opportunities for the medical student to develop adequate patient contact. The economic efficiencies of web-based education and traditional face-to-face education approaches were compared under randomized controlled trial conditions in Maloney et al. and the authors confirmed that the web-based education approach was clearly more efficient from the perspective of the education provider [9].

Most of the digital teaching works described in recent literature has been prepared as web-based, since web technologies allow easy incorporation of multimedia objects, interactive algorithms, animated simulations, etc. The teaching/learning objects may then be easily accessed from any computer and by any defined target audience (e.g., students of a particular medical school or course). The developed tools and simulations cover a wide range of medical fields, such as intensive care [2,10], cardiology [8], haematology [6], and surgery [11]. The MedBiquitous (http://www.medbiq.org) consortium established a working group in 2005 to create a free and open data standard for expressing and exchanging virtual patients between different authoring and delivery systems. This was, in part, to address the problem of exchanging and reusing virtual patients and, in part, to encourage and support easier and wider use of virtual patients in general. This standard has been very successful and is now widely adopted, e.g., in major

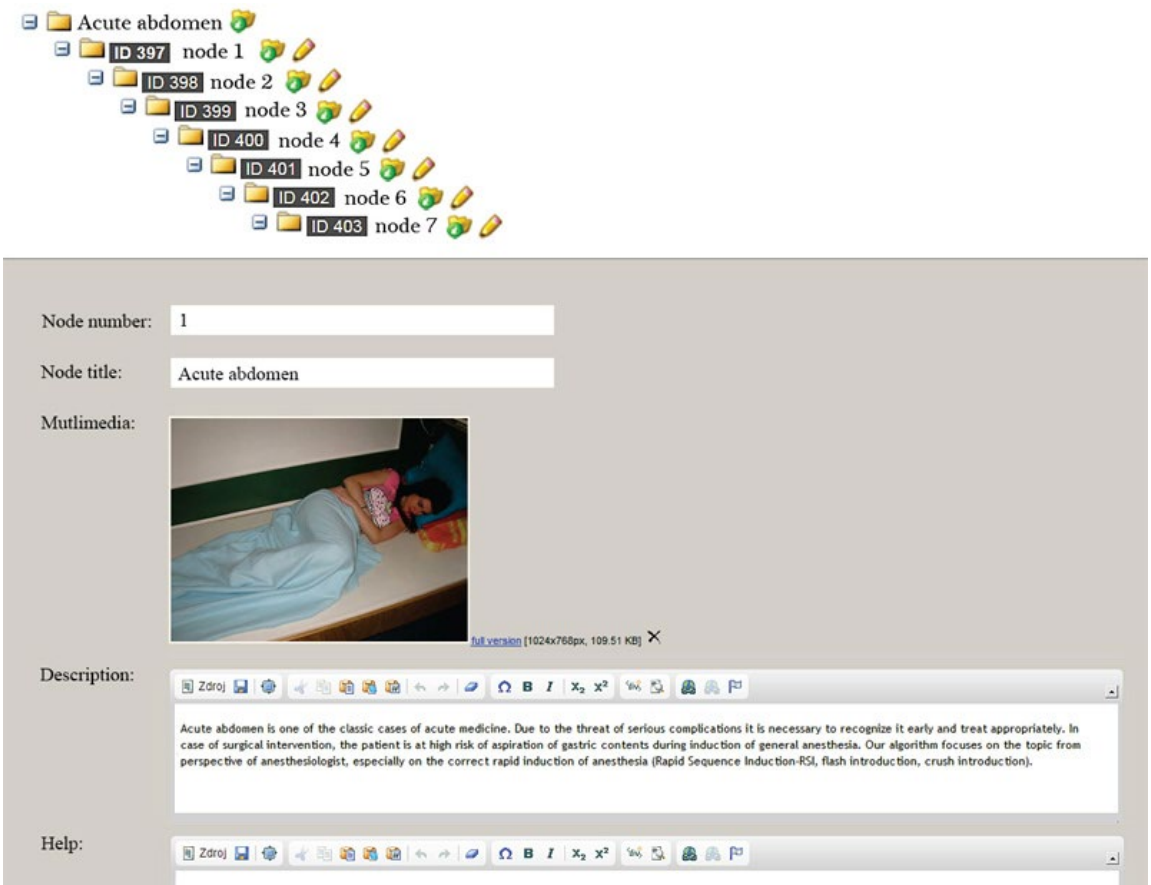

Figure 2: A screenshot from a node form in the backoffice application for the AKUTNE.CZ interactive algorithms

NODE PATH	1A	1B	1C	2A	2B	3A	3B	3C	3D	4A	4B	5A	5B	6A	6B	7	8	9
right option	•			•		•				•		•		•				
wrong option, to repair		•			•								•		•			
wrong option, fatal			•				•	•										
alternative option									•		•							
terminating node																•	•	•

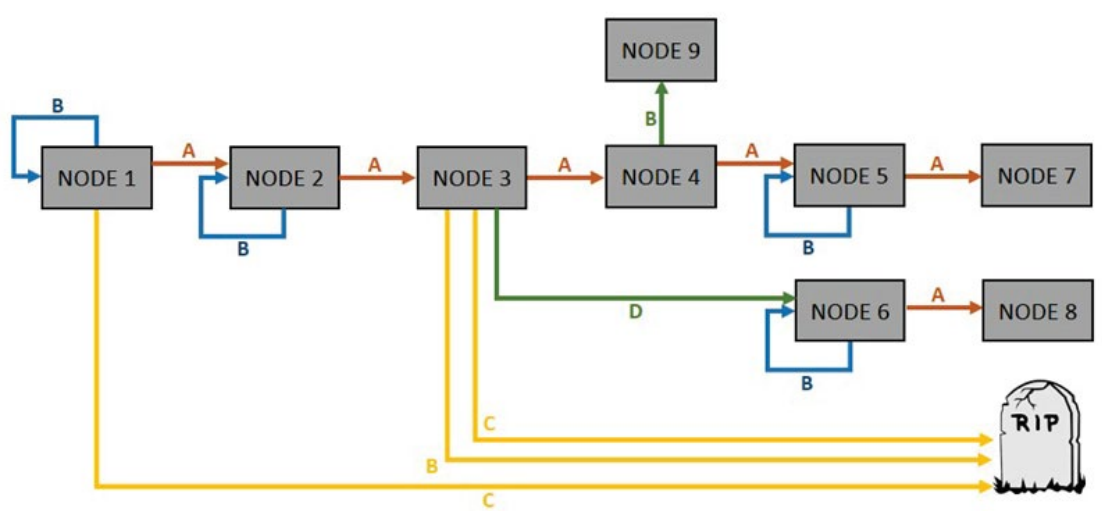

Figure 3: Various types of algorithm nodes

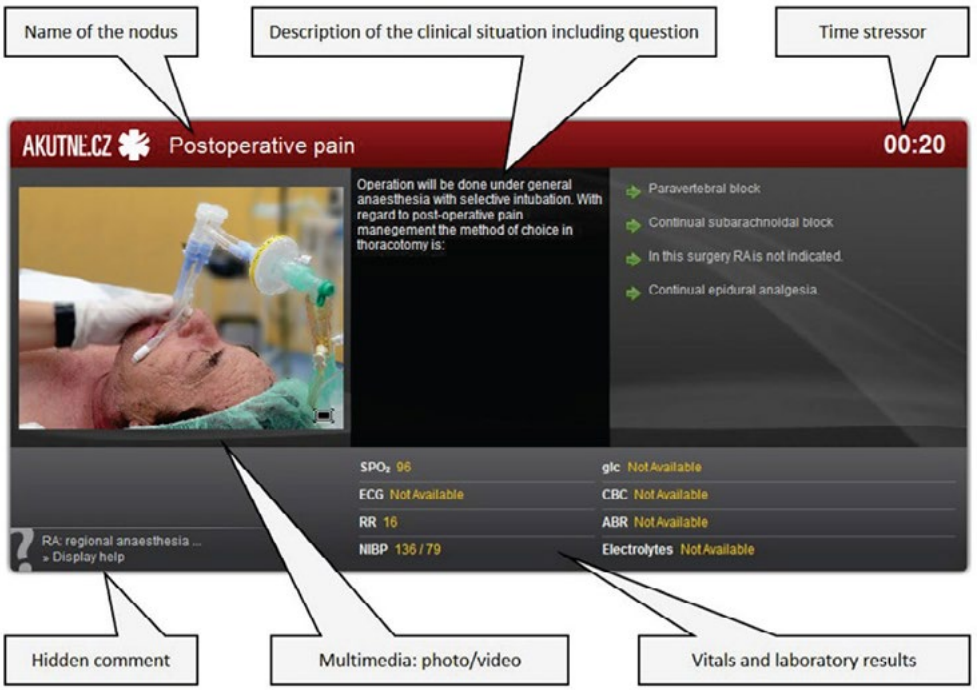

Figure 4: Interactive AKUTNE.CZ algorithm player with description for all elements of a node

projects like eViP. In 2010, this standard attained the status of an ANSI standard (American National Standards Institute). Some academic implementations of the Virtual Patient concept are shown in Table 1. The new options for virtual patient presentation cater for tablet computers and other mobile devices. A good example for new concepts and the possibilities in medical teaching and learning is the Burkhoff's electronic book (http://www.pvloops.com).

This paper describes the interactive tools of the AKUTNE.CZ (part of MEFANET) [12,13] and SEPSIS-Q portals [14] for Problem Based Learning (PBL) sessions in medicine. The portals aim to be a comprehensive source of information and educational material, covering all aspects of acute medicine for undergraduate medical students and health professionals. Our focus is mainly on simulation-based tools for teaching and learning algorithms in acute patient care, the backbone of the AKUTNE.CZ and SEPSIS-Q portals.

METHODS

AKUTNE.CZ interactive algorithms in the teaching/learning of acute medicine

Algorithmic thinking and correct clinical reasoning constitute the essential characteristics of any physician dealing with acute patients. Our interactive algorithms take the form of content-rich virtual cases, as they link together process flowcharts and multimedia. Creating such algorithms or electronic virtual patients is extremely laborious, time-consuming and often accompanied by ambiguities and hesitation. Following the principles of student-centred learning, our authoring teams comprise final-year medical students under the constant and expert supervision of an experienced clinician.

Algorithms development methodology

The estimated time spent on actual work to produce one interactive algorithm is roughly between 10 to 50 hours (approx. one semester). The team members exhaust their time on collaborative work, essential meetings and self-study. The first draft of an algorithm is prepared as a text file describing the situation at each node and then turns to designing the correct as well as incorrect answers, inclusive of comments to the correct and incorrect answers. After incorporating the supervisor's remarks, the values for vital signs and physical and laboratory examinations are added and the whole algorithm is entered node-by-node into an on-line backoffice application, together with supplementary multimedia files. Each algorithm must contain at least one video and one picture in all its nodes. The resulting algorithm to be played with is generated in the form of a flash object. Prior to publishing, its URL is first sent to an external reviewer – an experienced clinician or an academic staff member. After incorporating all reviewer's comments and remarks, the algorithm is supplemented with metadata in order to be published on the AKUTNE.CZ education portal and indexed by the MEFANET Central Gate. The completed and

published algorithms are used by students, either as outlines of Problem Based Learning (PBL) sessions or as supplementary learning objects for training and adopting correct clinical reasoning skills. The authoring process is summarized in Figure 1.

Technology and software

The interactive algorithms are authored using a web-based (PHP/MySQL) backoffice application, which provides the students-authors with the following functionalities through its on-line forms and drag'n'drop control: 1. node-based scenario design, 2. description of the situation in each node, including the intervals of parameter values of vital functions, intervals of laboratory values and multimedia, 3. description of the correct answers as well as distractors with the option to repeat or end in fatality, 4. data export of each finished algorithm to an XML document. A screenshot of the backoffice application is shown in Figure 2.

The resulting XML documents are then rendered into a Flash Player object resembling a serious game. A student-player moves between the nodes during the game; the nodes may be of different types (see Figure 3).

Each move causes a shift in the timeline as a side effect of the student-player's response, lending authenticity to the scenario and creating a stress effect, which is very much pronounced in real-life situations when dealing with acute patients. Continuous change in various numerical parameters reflecting the development of the patient's clinical status and vital signs over time (such as blood pressure, pulse, oxygen saturation, etc.) is also available. A screenshot of an algorithm node is shown in Figure 4.

SEPSIS-Q Interactive Scenarios

Data-based evaluation and prediction of outcome in severe sepsis (EPOSS) research database

The data acquisition system operates in the academic environment of the Institute of Biostatistics and Analyses at the Masaryk University in Brno. The system is continuously accessible over the Internet; the EPOSS portal URL is: http://eposs.registry.cz. Parametric data is stored from a set of on-line forms that include the input data (meeting the criteria of severe sepsis, birth date, gender, clinical workplace, etc.), clinical parameters in 10 time stages during the first seven days of hospitalization, as well as information on the anti-infection therapy regarding the course of the disease and finally, information on discharge. Furthermore, there are data inputs for follow-ups in the 90th, 180th and 360th days from the diagnosis, as well as a form to describe the causes and the date of the patient's death. Retrospective medical records are the only source of data for the EPOSS research database. No direct person identifiers are permitted. The EPOSS database allows export of septic patient data to the SEPSIS-Q education portal, constituting the cornerstone of SEPSIS-Q scenarios. The authoring process of SEPSIS-Q scenarios is shown in Figure 5.

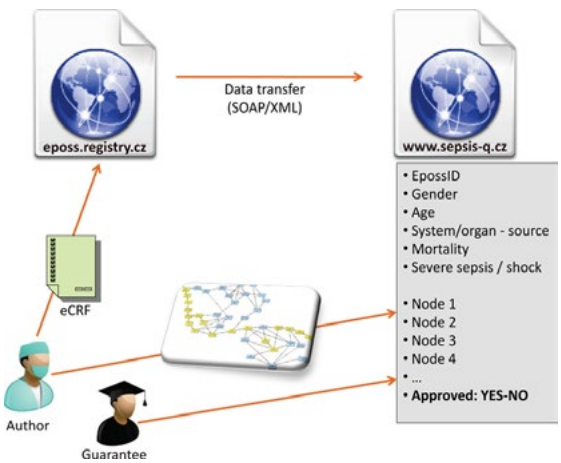

Figure 5: Illustrative diagram of the authoring process in publishing clinical scenarios on the SEPSIS-Q education portal

The SEPSIS-Q education portal

The SEPSIS-Q education portal (www.sepsis-q.cz) is equipped with a backoffice application (PHP/MySQL), which enables convenient and comprehensive web content management. An independent module has been developed for managing clinical cases, operated by the authors of the clinical scenarios as well as by the guarantees. A screenshot of the backoffice application is shown in Figure 6.

Player: how the clinical scenarios are presented

After a clinical scenario is completed and approved, it becomes immediately available on-line through the appropriate section of the SEPSIS-Q education portal. Here, the scenarios are sorted by mortality, gender, the severity of the sepsis and according to the organ/systems that are the primary source of sepsis. Each scenario is presented by its title, and an abstract and information on the respective author. Selecting one scenario from the entire collection activates a player, which takes the form of a Flash object executed in the Adobe flash player environment – see the screenshot in Figure 7.

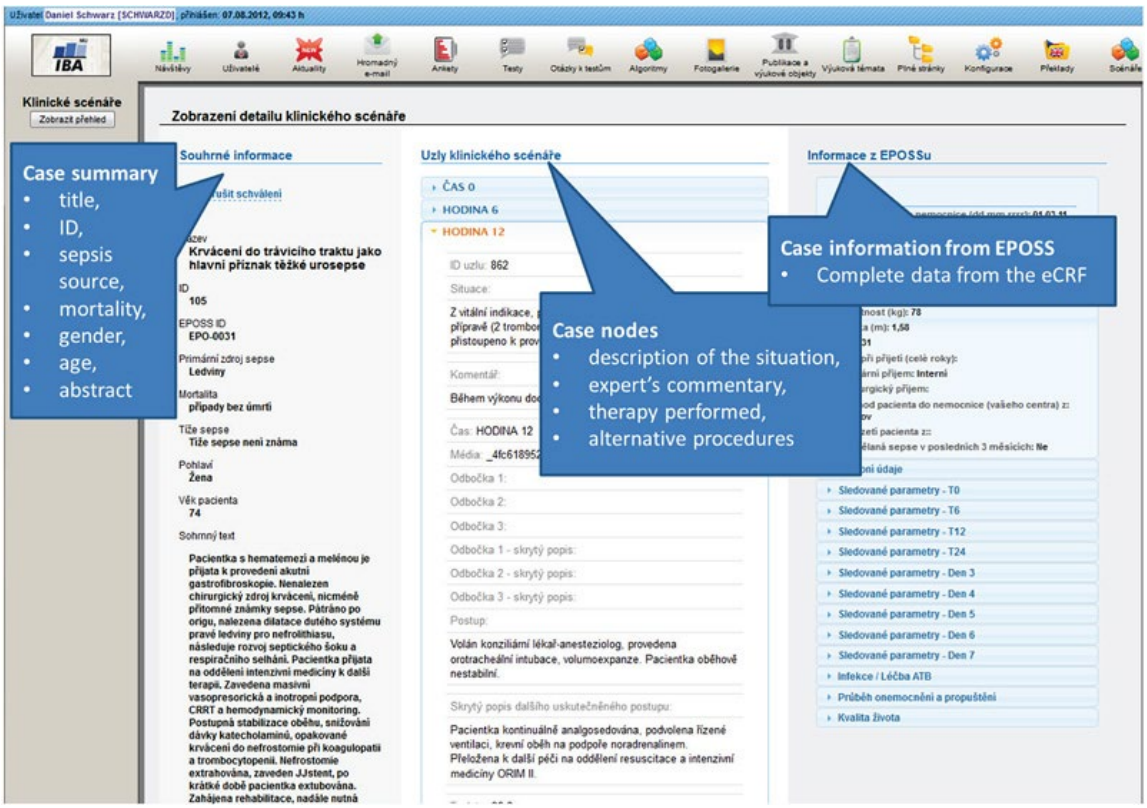

Figure 6: A screenshot of the backoffice application in the SEPSIS-Q education portal. Upper bar: list of available modules. Main frame: the module for clinical scenarios.

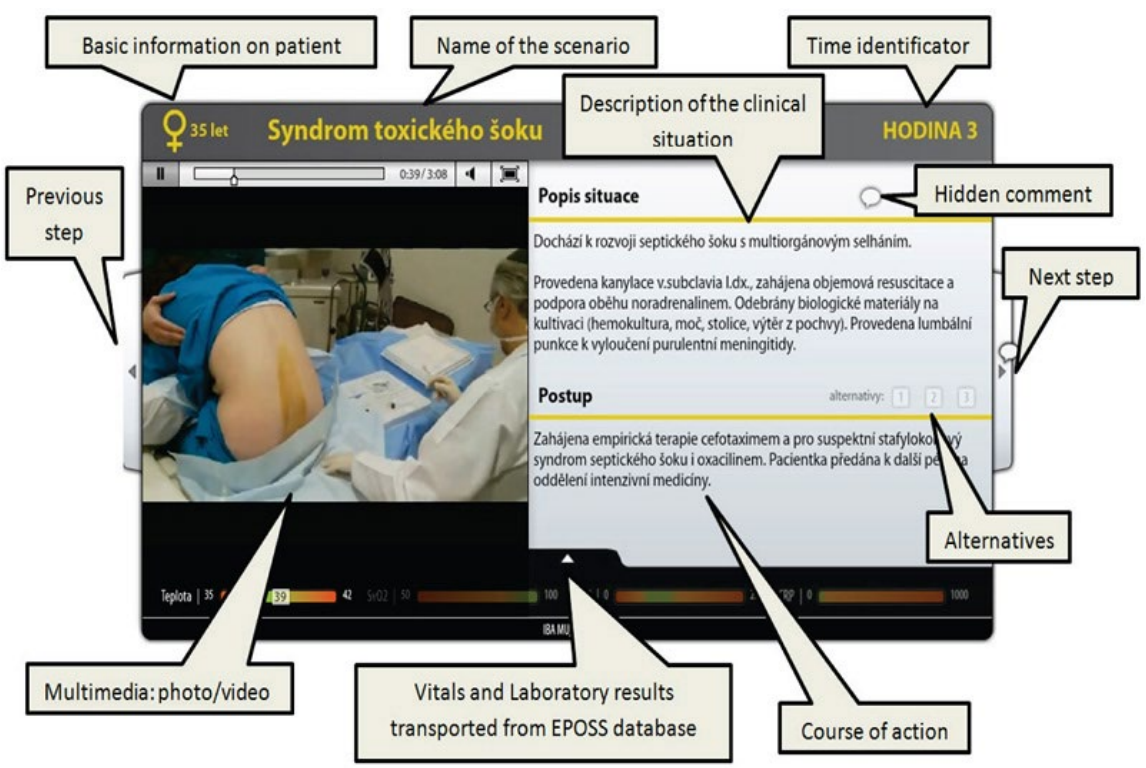

Figure 7: SEPSIS-Q scenario layout in Czech with description

Methodology of PBL sessions

A PBL session in the courses that use algorithms and/or scenarios takes 3 hours with some elements of Team Based Learning (TBL). The first half of the lesson comprises of presenting the theoretical context. In the second part, students use their computers and play with the selected interactive algorithms to complement the discussed topic. Students then go through the algorithm's nodes on a projection screen with a teacher. After introducing the situation at the presented node, students vote for further action. Bad and good choices are explained to them. Students can use any information available on the Internet to gather evidence and facts for their choice. The teacher then adds clinical experience as well as tips and tricks for the specific situation. Individual paths through algorithms are not recorded. Thus, it is impossible to use the algorithms for assessment. Evaluation and debriefing along with a short questionnaire is conducted at the end of each PBL session; see further details.

Quality self-evaluation of AKUTNE.CZ algorithms

We compared the quality of the algorithms in the group of authors and among the public. Over a period of 30 days (from 02-Jan-2013 to 31-Jan-2013), each author could vote for the three best algorithms in his/her opinion and assign 5, 3 or 1 point. The points were counted for each algorithm and a rank was created.

Medical students' evaluation

We asked the students of the Medical Faculty of the Masaryk University about their attitudes and interests in using the interactive algorithms as part of their medical and/or healthcare studies after completing the Anaesthesia lessons with the implemented PBL. The purpose was to ascertain how the students perceived our efforts authoring and implementing simulation-based learning tools that are so demanding to create. An anonymous questionnaire of 8 items was created. The first three questions addressed the attractiveness of PBL, memory footprint fixation during PBL and its complexity. Further three questions were on the quality of PBL (the professional level, presentation, preparation for dealing with real situations). The last two questions were focused on using PBL tools in preparing for the final exams and for evaluating the prospect of including PBL into the lessons. Data collection took 2 days in April 2013. Questions had answer options on a 5-point Likert scale aimed at seeking feedback on the use of our interactive algorithms in the studies of acute medicine topics.

Website accesses to AKUTNE.CZ interactive algorithms evaluation

User's attendance to the interactive algorithms was analysed using Google Analytics in the context of the whole AKUTNE.CZ website within a 3-month period (1st January to 31th March 2013). The number of targets to algorithms and the number of unique players were duly analysed for the period.

RESULTS

AKUTNE.CZ interactive algorithms in the teaching and learning of acute medicine

Over five years, more than 30 interactive algorithms in both the Czech and English languages (http://www.akutne.cz/index-en.php?pg=education--interactive-algorithms) have been developed and published on the website allowing users to test and improve their knowledge and skills in the field of acute medicine. The implementation of algorithms in the medical curriculum is shown in Figure 9.

Other algorithms are currently under construction and are scheduled to be accomplished during 2013. Overall, the algorithms cover a wide range of acute medical topics:

Basic Life Support (BLS) and Advanced Life Support (ALS)

The algorithms cover many BLS and ALS procedures described in the current European Resuscitation Council guidelines. We developed BLS for Adult algorithm, ALS for Bradycardia, Basic Life Support in Choking Children and Foreign-body Airway Obstruction in Adult algorithm.

Emergency Medicine

Emergency medicine encompasses a very specific type of care under exceptional conditions. We have attempted to replicate the ambience of a real car accident (RTA) in the interactive algorithm. Further topics of emergency medicine include two algorithms for Water Rescue, Severe Hypothermia in Winter Mountains, Out-Hospital Craniocerebral Injury and Syncope.

Critical Care Medicine

Critical Care Medicine (CCM) is the flagship of the medical field in general. It is no coincidence that the most demanding and most complex algorithms come from this domain. The Surviving Sepsis algorithm is based on Surviving Sepsis Bundles of the Society of Critical Care Medicine (SCCM). The Acute Coronary Syndrome algorithm provides a complete decision tree for the acute myocardial infarction patient. The

Field of Study	General Medicine							Nursing Bc.			Nursing MSc.			
Year of Study	1	2	3	4	4	5		1	2	3	1	1	2	2
Algorithms / Courses	First Aid	Emergency Medicine	Surgical Propedeutics	Anaesthesiology and Pain Management I	Intensive Care Medicine	Anaesthesiology and Pain Management II	Dentistry Courses			Anaesthesia, Analgesia and Intensive Care Medicine for Midwifes	Pain Management	Anaesthesiology	Emergency Medicine	Critical and Intensive Care
Surviving Sepsis			X		X					X				X
Advanced Life Support for Bradycardia	X	X		X	X	X	X			X	X	X	X	
Basic Life Support for adults	X	X					X			X	X	X	X	
Basic Life Support for children	X	X					X			X	X	X	X	
Basic Life Support: choking in adults	X	X					X			X	X	X	X	
Central Venous Catheter			X	X	X	X				X		X		X
Craniocerebral Injury		X			X							X	X	X
Postoperative Pain Management			X	X		X	X			X	X	X		X
Invasive Monitoring for severe Craniocerebral Injury	X	X	X	X		X								X
Car Accident	X	X								X			X	
Accidental Hypotermia	X	X								X			X	
Acute Coronary Syndrome		X			X								X	X
Water Rescue I	X	X								X			X	
Water Rescue II	X	X								X			X	
Analgesia in Dentistry							X							
Syncope in Dentistry							X							
Toxic reaction to local anaesthetics in dentistry							X							
Toxic reaction to local anaesthetics			X	X		X				X	X	X	X	
Anaphylaxis	X	X	X	X	X	X	X			X			X	X
Analgesia in GP practice			X	X		X	X			X	X			
Syncope	X	X			X		X			X			X	
Post-dural Puncture Headache			X	X		X				X	X	X		
Electrical Injury	X	X											X	
Diabetes Mellitus	X	X			X		X			X			X	X
Interactive Scenarios														
Bleeding in the Digestive Tract			X		X					X				X
Clostridial Colitis			X		X					X				X
Urosepsis with Bronchopneumonia			X		X					X				X
Subhepatal Abscess			X		X					X				X
Toxic Shock Syndrome					X					X				X
Lethal Pneumonia in Morbidly Obese Patient					X					X				X

Figure 8: Algorithms and scenarios implementation into the medical curriculum

algorithm for Diabetes Mellitus deals with sudden loss of consciousness in a diabetic patient.

Anaesthesiology

The algorithms cover interesting acute and propaedeutic situations during anaesthesia. We developed an algorithm describing the correct approach to the parturient with Postdural Puncture Headache after epidural labour analgesia. Another acute situation is described in the algorithm for Toxic Reaction to Anaesthetic Agents. Propaedeutic skills are represented by algorithms for inserting a Central Venous Catheter or various venous entry route options.

Pain Management

Providing good analgesia for both acute and chronic pain is a major problem worldwide. We cover these issues by the acute postoperative pain algorithm and by algorithms for correct approach to analgesia in GP and outpatient dental clinics.

Stomatology

The algorithms cover acute medical conditions in dental clinics. The most dreaded problems in stomatology care are syncope, toxic reaction to local anaesthetic agent and providing sufficient analgesia during and after the procedure (Analgesia in Dental Clinics).

General Practitioner (GP)

A general practitioner, physician, is the first contact with the patient and therefore, a number of situations must be resolved without imposing any delay risk. For this reason, we developed algorithms for Acute Coronary Syndrome and Analgesia for GPs. These begin right in the outpatient clinic.

Gynaecology and Obstetrics

The growing trend of incorporating algorithms into education makes it possible for creating algorithms for gynaecology and obstetrics. The published algorithm, Post Dural Puncture Headache, represents a complication of epidural analgesia that can be successfully treated when recognised. New algorithms are currently under review and will soon be adapted into lessons for midwifery, introducing the prospective midwives to the severe and rare aspects of their profession, such as Amniotic Fluid Embolism, Severe Peripartal Bleeding and Eclampsia.

SEPSIS-Q Interactive Scenarios

The EPOSS project involved rendering an overview of the incidence of sepsis and its treatment in the Czech Republic. Data on more than 930 patients was collected in the period 01/2010–07/2013. The data of a few preselected cases from this database was transferred to SEPSIS-Q, creating the basis for designing educational scenarios. This unique data from real patients with severe sepsis represents the core unit of each educational scenario and allows the author to create a story of his patient based on real life events. So far, six clinical scenarios have been created; all of them consisting of several nodes with pictures and/or video shots (http://www.akutne.cz/index.php?pg=aktuality&aid=389). The clinical scenario of Bleeding in the GI tract as a major symptom of severe urosepsis represents septic shock in a senior patient with all its deceptive points, such as easy misinterpretation of the presenting symptoms, difficult differential diagnosis, severe deterioration of the patient´s condition, collapse of the vital functions during examination, and the need for swift transfer to ICU together with rapid resuscitation. After emergent stabilization of the patient, it takes days to restore the patient to normal status. Under the clinical scenario of the toxic shock syndrome, we present a rare case of septic shock that can be easily overlooked. This clinical scenario highlights a different situation: a young healthy patient with sudden loss of consciousness and fever. Quick deductions leading to the correct diagnosis, together with massive fluid resuscitation and immediate institution of correct antibiotic therapy, culminates in immediate response and outright recovery within a week. The clinical scenario of Clostridial colitis is based on the most typical complication of trauma in the elderly, with fatal consequences. One of the most frequent fractures in older people, the hip fracture, poses serious risks to the patient in many ways, and one of the most serious of these is the development of post-operation clostridial colitis due to antibiotics. The first symptoms of sepsis in the elderly can be easily disguised as confusion, with no fever, and diarrhoea and mildly elevated inflammation markers. Despite all efforts and resuscitation care in the ICU, the treatment regimen failed and the patient died.

Urosepsis with overlying bronchopneumonia shows the fatal case of an 88-year old patient, her state rapidly worsening from the presenting fever, dyspnoea and oligoanuria. Despite immediate intensive care, artificial ventilation and high doses of catecholamins, multiorgan dysfunction (syndrome) caused death in two days. A scenario based on the case of a young man with subhepatal abscess, leading to peritonitis and sepsis, represents successful treatment of severe sepsis using LiDCO for monitoring the cardiac output. The abscess was formed one week after hemihepatectomy and resection of hepatal metastasis, one year after sigmoidectomy due to colorectal cancer.

A unique scenario built upon a case of a 58-year old obese man (BMI = 45), heavy smoker with COPD, shows acute worsening of ventilation during respiratory infection. Severe global respiratory insufficiency imitating ARDS lead to complete collapse of ventilation, despite targeted antibiotic therapy and aggressive artificial ventilation. The patient's obesity limited using the prone position and the required ventilation parameters were beyond the capacity of the ventilator; the patient expired on day 5.

Use of simulation-based objects in undergraduate teaching

There are more than 30 algorithms in the Czech/Slovak and English languages published on-line, covering a wide range of topics in acute medicine. The peer-reviewed algorithms were used for conducting PBL-like sessions in General Medicine (First Aid, Anaesthesiology and Pain Management, Emergency

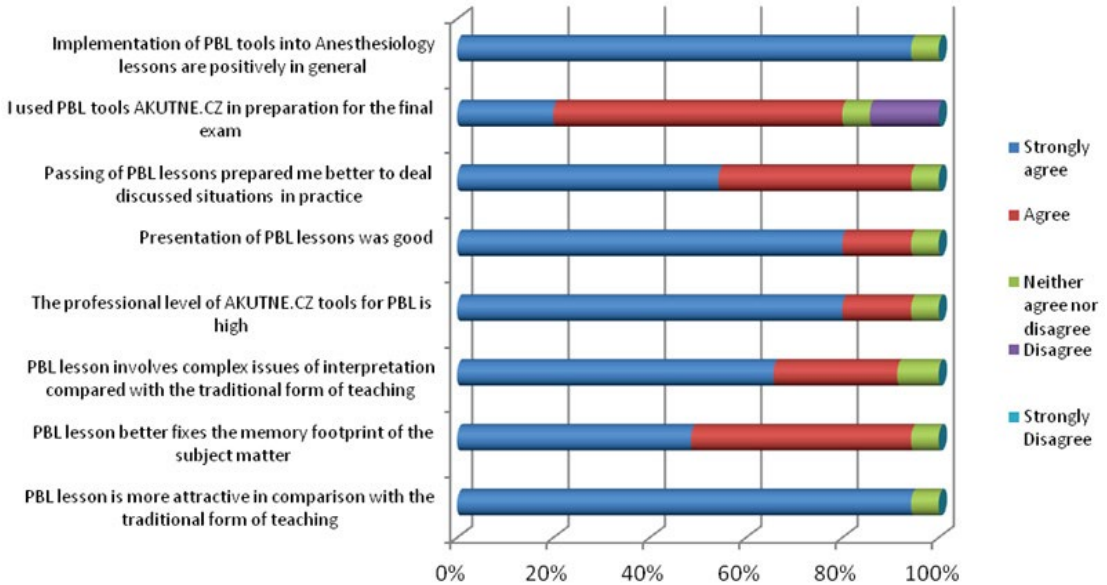

Figure 9: Students' evaluation

Medicine) as well as in Nursing (Obstetric Analgesia and Anaesthesia for Midwives, Emergency Medicine, Intensive Care Medicine).

The interactive scenarios have been designed to demonstrate interesting cases, preferably for the Intensive Care Medicine sessions both in General Medicine and Nursing. Implementation of simulation-based objects in the medical curriculum is shown in Figure 8.

Quality self-evaluation of AKUTNE.CZ algorithms

In the survey, we received 72 votes from 24 authors with values as 5, 3 or 1 point(s). The maximum points were received by the algorithm Acute Coronary Syndrome (37 points). In second place (25 points) was the algorithm Acute Postoperative Pain Management. The same total (24 points) and the third place was given to the algorithms Electrical Injury and Diabetes mellitus. The distribution of votes was heterogeneous; only 6 algorithms from the competing number of 24 received more than 20 points in total. Only 7 algorithms were voted by more than 6 persons. The most popular topics, excluding the four mentioned above, were the Surviving Sepsis algorithm, Car Accident (RTA) and Anaphylaxis.

User's attendance evaluation

User's attendance of the interactive algorithms was analysed using Google Analytics in the context of the entire AKUTNE.CZ website, within a 3-month period (1st January to 31th March 2013). In this period, 8,606 unique users visited the website (14,692 visits in total, 163 visits per day). All interactive algorithms together had 2308 unique page views. 386 users (16.7%) accessed the algorithms from Brno and were, therefore, identified as students of the Faculty of Medicine in Brno. Other large groups of visitors were from Prague (223 visits, 9.7%), Bratislava (70 visits, 3.0%) and Pilsen (64 visits, 2.8%), i.e., from the major cities with established medical education facilities. Although we are aware of the limited information value of such analysis (e.g., not all visits from Brno were from the Medical Faculty (some are hidden in proxy servers), or visitors from small villages could be students of the Brno's Faculty of Medicine), these results document that interactive algorithms were used within the whole MEFANET network and a significant proportion of students use them in places out of school – in their homes and during leisure time. The most frequently played algorithms were: Diabetes mellitus (275 unique page views), Electric Injury (183 unique page views), Hypothermia (180 unique page views), and Acute Coronary Syndrome (148 unique page views).

Medical students' evaluation

In the feedback survey, 35 participants out of the addressed 35 completed the questionnaire (two groups of medical students after finishing the Anaesthesia lessons with implemented PBL, response rate 100%). In general, there were very positive answers (258 answers out of 280 belonged to the Agree/Strongly Agree category). An overview of the student's evaluation is shown in Figure 9. Only one question: "PBL Tools I used in preparation for the final exam" was answered with Disagree, five times (14.3%).

DISCUSSION

A unique advantage of the interactive algorithms of AKUTNE.CZ is the possibility of creating complex and branching scenarios. Unfortunately, this feature has not been used widely. The reason could be the character of real acute medical situations, where there is no space for branching as the real acute situations are strictly linear. Real-life medical emergencies offer no extra options; only one correct option in most cases. The other typical feature of these emergencies is the "one-way traffic"; the professional usually has no chance to reprocess his/her actions in case of a wrong decision. The rapid deterioration of the patient's state leads him/her to a new clinical situation. We tried to introduce this uniqueness to medical students by the only-forward progress in interactive algorithms, with the need to reassess the application from the very beginning in case of a fatal outcome. We always proceed in due accord with the official guidelines of the respective medical societies. Any deviation from approved procedures may lead to worsening of the results/outcomes in real clinical situations. For this reason, we prefer to create simplex, linear algorithms. The algorithm that is closest to realistic simulation (non-linear or open format) could be more attractive for students; however, we believe that to be at the expense of didacticism. We also prefer topics that are endorsed and processed by the guidelines or recommendations of the European medical societies (European Resuscitation Council, the Society of Critical Care Medicine, the European Society of Regional Anaesthesia and Pain Therapy) and/or the national medical societies (the Czech Society of Anaesthesiology and Intensive Care Medicine, the Czech Society of Intensive Care Medicine, the Czech Society of Haematology, the Czech Society of Cardiology, the Czech Gynaecology and Obstetrics Society, the Czech Pain Society).

Given that the AKUTNE.CZ algorithms cover a wide range of acute medical topics, there is room for more themes. For example, in 2012 in the Czech Republic, there were widely publicized cases of fatal methanol poisoning. As a result, Methanol Intoxication is now included among the topics. Additionally, we are considering some other Advanced Life Support scenarios and the scenarios of out-hospital emergency medicine. Interactive algorithms are used during Obstetric Anaesthesia and Analgesia in midwife education. This is the reason for Severe Peripartal Bleeding, Amniotic Fluid Embolism and Out-Hospital Delivery algorithms. The main aim is to achieve a situation in which each teaching unit of acute medicine will have at least one interactive algorithm for PBL. Although the algorithms were tailored to the teaching and learning of acute medical issues, it is possible to utilize them for education in other medical and healthcare disciplines as well. The selection of parameters from physical examination results and laboratory tests can be easily changed and thus adopted as tools for use elsewhere.

Published SEPSIS-Q clinical scenarios represent various types of patients, from young and healthy to senior polymorbid individuals, various types of sepsis of different origins (urinary tract, genital tract or intestinal). This selection of septic cases creates a unique viewpoint on sepsis as a variable and fluctuating state and helps the student or doctor studying these cases to accustom themselves to recognizing and appropriately dealing with this condition. The experience gained by practicing on virtual patients creates particular resistance to common mistakes, such as underestimation of the crucial decision points in the diagnosis and/or treatment and misinterpretation of the warning signs. The real-life data, together with the time factor, supports the importance of rapid reaction and prompt initiation of a targeted therapy.

Virtual patients consist of a set of patient-related medical data that can be organised in various forms, thereby allowing its division into different classes of systems. In linear systems, the information is displayed in a fixed, predefined order. A user's decisions do not have an influence on how a case unfolds (CASUS®) [15]. Branched systems offer the students various paths to the solution of a case. The user is confronted with a clinical situation and may select one from a set of options. The user's decisions affect the treatment of the patient, which may in turn result in different outcomes. The underlying model of this virtual patient class is a directed graph with nodes, presenting the current status of the patient while the edges visualise the possible transitions between the states. A good example of a system from the class of branched models is Open Labyrinth.

Template-based systems (e.g., CAMPUS [16] or Web-SP [17]) offer students a wide choice of possible options. The user may select from hundreds of interview questions, laboratory examinations, physical examination and treatment methods. Most options contain standard values, but some have been changed manually by the case's author to reflect the characteristics of the condition. The interactive scenario of SEPSIS-Q is a typical linear system with no possibility of decision making. On the other hand, AKUTNE.CZ algorithms combine the branched system with the possibility of various solutions to each case (right, bad, fatal); template-based system (laboratory examinations, physical examination, possibility to change standard values). But in fact, AKUTNE.CZ algorithms are more linear than, for example, Open Labyrinth cases. Another difference is in the lack of possibility of evaluating the process of algorithm solving and that is the reason why it is not suitable for testing the students. Linearity can be an advantage for PBL

sessions because of the possibility to increase focus on optimal solution of the case.

There are differences in the layout of Flash Players as seen in Figures 4 and 7. The AKUTNE.CZ player is focused on branched scenarios and there are decision-making parts to each node. The SEPSIS-Q player focuses more often on linear scenarios with just one section explaining any bad decisions and allows for better demonstration of the cases and simple movement between the nodes, even retrograde. This may be considered as an advantage in teaching.

The main limitation of the interactive scenarios is also one of its main advantages, binding to the EPOSS database. The SEPSIS-Q scenarios are tailored to data mining from the EPOSS database. Of course, it is possible to change everything and develop a unique case report without being bound to the source data, but this was not the purpose of these scenarios. We believe, that interactive scenarios can offer a unique experience to the students, who usually visit ICU for a short time during their studies. Learning about the patient, the diagnosis and the progress of treatment with all possible consequences is time-consuming and difficult. Interactive scenarios offer the "virtual ward round" of real patients without overcrowding the ICU or entering an infectious environment.

A very pressing problem requiring prompt action is the missing support for Flash technology on mobile devices produced by Apple. The most likely way to solve this issue is to remake the players and switch them from Flash technology to HTML 5. This process has already started and we believe that by offering the AKUTNE.CZ algorithms and SEPSIS-Q scenarios in a cross-platform manner, our simulation-based teaching/learning objects will become even more popular, as the penetration of mobile devices such as tablets or smart cell phones among students has increased rapidly in recent years.

Although we assume that the algorithms used during teaching improved students' reactions to critical situations, we do not make any comparisons. Another fact is that students participating in developing algorithms more often combine their professional lives with acute medicine professions. As we supposed, the medical students' feedback was very positive. One interesting finding is that the most negative (5 disagree out of 35, 14.3%) answers were about using the tools during preparation for the final exam. An explanation could be the high professional level and complexity of the PBL tools. The opportunity to discuss during expert-moderated sessions could be a reason why students prefer this way of using the algorithms over self-study.

CONCLUSION

The methodological aspects of our interactive algorithms in the learning and teaching of acute medicine were presented. The interactive algorithms and scenarios form the core element of the educational content of the AKUTNE.CZ and SEPSIS-Q portals, and recently became also the basis for a new extension of the MEFANET – education network of all medical faculties in the Czech Republic and Slovakia.

The AKUTNE.CZ interactive algorithms, as a software platform, are open for academic use worldwide. The already created and peer-reviewed AKUTNE.CZ algorithms, as simulation-based learning objects, and the SEPSIS-Q interactive scenarios can be included easily into any education website, with the consent of the authors.

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

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EDUCATION OF DATA MINING AS A NOVEL APPROACH IN CLINICAL AND HEALTH CARE PRACTICE

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ABSTRACT — *Data mining (DM) is a widely adopted methodology for the analysis of large datasets which is on the other hand often overestimated or incorrectly considered as a universal solution. This statement is also valid for clinical research, in which large and heterogeneous datasets are often processed. DM in general uses standard methods available in common statistical software and combines them into a complex workflow methodology covering all the steps of data analysis from data acquisition through pre-processing and data analysis to interpretation of the results. The whole workflow is aimed at one final goal – to find any interesting, non-trivially hidden and potentially useful information. This innovative concept of data mining was adopted in our educational course of the Faculty of Medicine at the Masaryk University accessible from its e-learning portal http://portal.med.muni.cz/clanek-318-zavedeni-technologie-data-miningu-a-analyzy-dat-genovych-expresnich-map-do-vyuky.html.*

INTRODUCTION

The term "data mining" (DM) is currently widespread in all areas related to data analysis. Clinical research belongs to them as well and the application of complex computational methods has become very popular in this area because of increasing amount of available data. The DM concept is nevertheless often overestimated or incorrectly considered as a universal solution for all problems. Although data mining seems to be well defined, the opposite is true. Even its definition is problematic and there are many definitions books and web portals dealing with the data mining. There are two probably the most popular definitions: "The nontrivial extraction of implicit, previously unknown, and potentially useful information from data" [1] and "The science of extracting useful information from large data sets or databases" [2].

In the article we would like to introduce our educational materials presenting concepts and approaches of data mining for clinicians and other researches in clinical and health care fields.

DM is mostly considered in the relation to large datasets; its usage in the commercial applications is common as well. In fact, the DM is universal methodology applicable to any data analysis and it is not "owned" by any area of science. The DM has been adopted in wide area of applications, such as searching of risk clients, non-legal usage of credit cards, e-mail classification and spam messages detection, text and speech recognition or molecular data analysis. Therefore, the DM is the area of science where its development is multidisciplinary in its nature. Methods applicable in commercial applications can be applied in any other research areas and vice versa.

Data mining is often connected to an idea of genial machine mining previously unknown information from the data and the methodology is often presented as a "black box" with simplified description. The reality is of course more rational. Good knowledge of mathematical background of the DM methods and their limitations is crucial for the correct application of the DM; the most important is expert knowledge and long-term experience. Methods applied in the DM are principally multivariate and have to follow all rules of multivariate data analysis. The benefits of multivariate methods are as follows [3]:

- Visualization of data with multiple variables
- Searching of meaningful views on multivariate data, identification of importance and hierarchy of variables
- Identification of correlations among variables, simplification of their structure
- Analysis of similarities between analysed subjects, their stratification, classification and predictionn

The question is whether the data mining is in any way different from the commonly adopted statistical methods? The answer is both yes and no. DM uses methods available in common statistical packages and "mining" can be sometimes used as a marketing term only. On the other hand, even common statistical methods are used in novel, complex and logically joined context. The real DM is a standardized complex methodology covering all the steps of data analysis from data acquisition through pre-processing and data analysis to interpretation of the results; the example is CRISP-DM, JDM (Java Data Mining) or complex methods of model description such as PMML (Predictive Model Markup Language). The data mining thus brings new quality in data analysis which is more related to innovative combination of methods than to any single method. DM in the hands of experienced data analyst is an important tool of scientific data analysis to be applied on complex heterogeneous multivariate data.

The workflow of data mining can be separated into simple individual steps from data storage and preprocessing to their description and predictive modelling. The individual steps can be performed in various software, such as Statistica, SPSS, SPSS Modeler, S+, Matlab, WEKA or R.

METHODS

Workflow of data mining

As already mentioned, data mining can be considered as an innovative connection of various methods of multivariate data analysis. Methodology of the complex DM approach always incorporates process workflow of analytical steps. Example of such approach is the CRISP DM methodology describing life cycle of DM project and their interconnections [4]; this methodology as one of the most general approaches available was also adopted in our article and educational materials.

According to CRISP-DM methodology the DM project life cycle consists of six phases; their order and direction of crossing between them is not strictly given and the movement in the scheme is based on the results of the previous phase (the arrows in the scheme shows the most common paths). The outer circle symbolizes cyclical nature of data analysis which is repeated until the solution is found. The knowledge gained in one cycle can generate new questions and new cycles utilizing experiences from the previous cycles.

Figure 1: DM workflow according to CRISP-DM methodology (taken from CRISP-DM)

Understanding

This initial phase focuses on understanding the analysis objectives and requirements, and then converting this knowledge into a data mining problem definition and a preliminary plan designed to achieve the objectives. For example, in clinical data analysis this is the preliminary phase of literature review of given clinical problem (terminology, cut-offs, known correlations of variables etc.). Although it looks rather simple, this information is strategically important during the multivariate analysis. Limited knowledge on importance and meaning of variables can resulted into biased or uninterpretable results and during multivariate analysis these problems should not be necessarily revealed. Part of the preliminary phase should be also the power analysis and assessment of the necessary sample size.

Data Understanding

The data understanding phase starts with an initial data collection and proceeds with activities in order to get familiar with the data, to identify data quality problems, to discover first insights into the data, or to detect interesting subsets to form hypotheses for hidden information. Wide set of univariate and multivariate analyses can be adopted for this exploratory analysis (Figure 2).

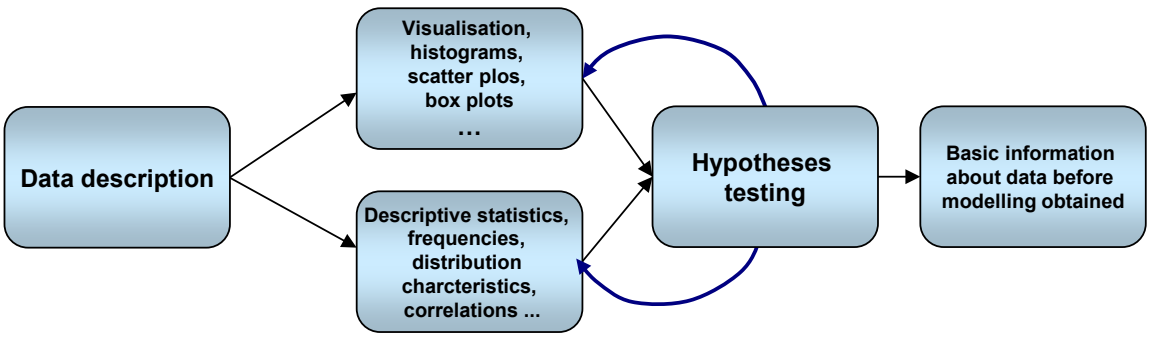

Figure 2: Example of methods applicable for data understanding

Data Preparation

The data preparation phase covers all activities to construct the final dataset from the initial raw data. Tasks include table, record, and attribute selection as well as transformation and cleaning of data. These data processing tasks do not have to be necessarily done in one step; it is more likely to have several data processing steps according to progress of exploratory analysis – for example in the first step we find non-normal distribution of data and data transformation follows; than we return to phase of normality assessment to prove it on transformed data.

Modelling

In this phase, various modeling techniques are selected and applied (typically, there are several techniques for the same data mining problem type). Some techniques have specific requirements on the form of data and, therefore, stepping back to the data preparation phase is often needed (Figure 3). Because the DM is commonly used on large datasets, methods of so called machine learning are often adopted [4]. The best known are neural networks, classification and regression trees, association rules, regression techniques (GLM, GAM, logistic regression as special approach of GLM), time series analysis of for clinical data very common survival analysis (Cox proportional hazards model for example).

The methods can be divided into supervised and unsupervised learning. During the supervised learning the presence of endpoint itself determines the learning process; we have a set of cases with known result [5]. The model is trained on these known cases which serve as a reference dataset for the evaluation of new case. The example can be a predictive model for probability of occurrence of given event in patients according to their initial characteristics. In this situation the model is developed on the base of reference dataset of patients with and without given event that differs in the values of potential predictors. During unsupervised learning we are looking for structure within the dataset based on similarities of cases. We are searching for typical patterns in the data (for example clusters of patients with similar characteristics).

Supervised learning methods are further divided into classification and regression according to the dependent type of variable. Regression is adopted for the continuous variables (blood pressure etc.); classification analysis is used for categorical variables.

Some of the above mentioned methods are sometimes called "black box" but it is not correct to understand this as an unknown principle of reaching the results; exact description of the model is necessary in these methods as well. In the last years the term "white box" is used for DM methods and it will hopefully modify the reputation of these methods; neural networks can serve as a typical example [6].

Evaluation

At this stage in the project, model(s) that appear to be correct and applicable from the data analysis point of view are built. Before proceeding to final decision about the model, it is important to be sure it properly achieves the project objectives. Model(s) should be validated and confronted with the reality to assess their general application for practice. It is also important to find whether there is no problem unaddressed by the analysis. This part of the DM process is based on analytical results, such as metrics of models quality (analysis of variance, BIC, AIC, sensitivity, specificity, etc.) or validation using independent dataset.

Deployment

Development of the predictive model and obtaining the data analysis results is not the final step of the DM project. Even in case of project aimed on description of the data the results have to be adequately presented. Requests on this phase cover wide range of tasks from descriptive report over scientific publication to implementation of the DM process. In most of the projects this phase is connected with results

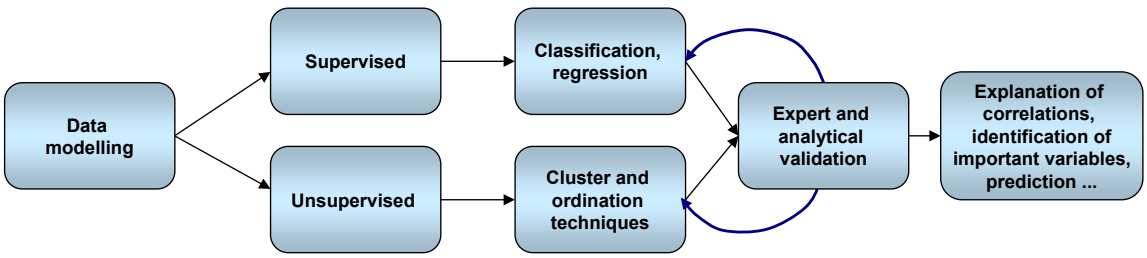

Figure 3: Methods applicable for data modelling

interpretation and requires expert knowledge of the analysed problem.

RESULTS: E-LEARNING COURSE ON DATA MINING

From the above description of data mining it is evident that the DM is a methodological concept based on innovative combination of univariate and especially multivariate statistical methods. Optimised analytical plan of the DM is the main guarantee that useful information will be "mined" from the complex multivariate data. This concept was also adopted in the preparation of educational course of the Faculty of Medicine at the Masaryk University "Introduction of data mining technology and gene expression maps analysis into courses of Faculty of Medicine" [7] accessible from its e-learning portal http://portal.med.muni.cz/clanek-318-zavedeni-technologie-data-miningu-a-analyzy-dat-genovych-expresnich-map-do-vyuky.html.

SUMMARY

Data mining techniques proved to be usefool tool for the analysis of clinical data [8,9]. Our educational materials are aimed on clinicians and other non-statistical users of these techniques to provide them with information about the process of data mining project based on CRISP-DM methodology and overview of the main analytical methods applicable during its steps; we hope these materials will help to spread out correct understanding of the utility of the data mining approach and its advantages and limitations.

RNDr. Jiří JARKOVSKÝ, Ph.D.

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JAPAN SOCIETY FOR MEDICAL EDUCATION (JSME): ITS HISTORY AND ACTIVITIES FOR THE LAST 45 YEARS

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ABSTRACT — *The Japan Society for Medical Education (JSME) [1] was established in 1969 and we are celebrating the 45th anniversary this year. In this article I describe the history of JSME as well as current activities of our society. In addition I briefly describe major changes in medical education during the last decade and current topics we are facing regarding medical education in Japan. It would be my great pleasure if this article can encourages development of the Czech and Slovak Society for Medical Education.*

HISTORY OF JSME

Foundation of JSME

Two key founders of JSME were Daizo Ushiba (Keio University) and Katsumi Kaketa (Juntendo University). In those days, the Association of Japanese Medical Colleges (AJMC), consisting of deans of medical schools and presidents of university hospitals, was the only organization that could make policy proposals concerning medical education. Unfortunately, AJMC was not able to adapt effectively or swiftly to the changing medical educational needs. Together with other physicians who were interested in medical education, they recognized that medical education required both experts in this field and appropriate educational innovation in the Japanese educational context and proposed the launch of JSME. Subsequently JSME was established in August 1969 at the inaugural academic meeting, organized by Dr. Ushiba.

Faculty development (FD) workshop

In June 1973 Dr. Ushiba together with Dr. Masatomo Tachi (Gifu University) and Dr. Shigeaki Hinohara (Saint Luke's International Medical Center) attended the WHO medical education workshop held at Regional Teachers' Training Centre (RTTC) in Sydney, Australia. Upon their return they recognized the need for an annual FD workshop in Japan and the first one was held near Mt. Fuji in 1974 (Figure 1). Since then, this Fujiken Workshop has been held once a year. Consultants from WHO were invited to the first several workshops, but the founding physicians then took over directing the workshop.

Launching the official journal

The official journal of the JSME, 'Medical Education (Japan)' was launched in 1970.

CURRENT ACTIVITIES OF JSME

Members

Other than all medical schools in Japan, JSME has 170 additional institutional members (mainly teaching hospitals) and about 2,300 individual members as of July 2013.

Various committees

At present, our society has 23 committees (Table 1), covering a broad range of responsibilities including organization of workshops and development of educational materials, such as curricula and monographs. Most of the proposals and outcomes released from the JSME come out of those committees.

Annual academic meeting

Since the first inaugural academic meeting in 1969, the meeting has been held once a year. The annual meetings feature several invited lectures, usually by speakers from abroad, as well as symposia and

Table 1: Standing committees

‣ Editorial committee ‣ Communications committee ‣ International relations committee	
Education committees for basic skills and ability ‣ Students admission ‣ Ethics & professional conduct ‣ Basic studies and proper behavior education ‣ Education for medical education specialists ‣ Basic medical sciences and life sciences	**Educational development committees** ‣ Outcomes evaluation ‣ Faculty development ‣ Educational materials development ‣ Medical education research ‣ Post-graduate medical education development
Education committees for clinical medicine ‣ Undergraduate education ‣ Core competence education ‣ National licensure examination & common achievement test ‣ Medical residency program ‣ Life-long education	**Special committees** ‣ Awards and prizes ‣ Research ethics and conflict of interests ‣ Elections of representatives ‣ Community medicine & interprofessional education ‣ Teaching disaster medicine

Table 2: Appeals JSME issued

2007	"Morioka appeal for community medical education"
2007	"Proposal for revision of the new clinical training system for doctors"
2008	"Appeal to the public for education of health care students and trainee doctors"
2009	"Proposal: toward revision of the clinical training system"
2010	"Proposal concerning the increase in the limit on the number of enrollees in medical schools"
2010	"Proposal: in response to the expansion of the local allocation system to reinforce community medical education"
2012	"Proposal for future renovation of national licensure examination"
2013	"Second proposal for revision of the new clinical training system for doctors"

workshops covering a variety of topics, and oral and poster presentations. Participation in the annual academic meeting has been increasing steadily such that the last several years have brought together roughly one thousand people, including health care professionals other than physicians as well as students.

FD workshop

Since the first 'Fujiken workshop' was held in 1974, we have been providing the FD workshop once a year in December at the same location, attracting 20 participants from the medical schools and 20 from the teaching hospitals. The duration of this workshop used to be 7 days, but it has been shortened to 5 days. The influence of this Fujiken Workshop has been widespread. There are now many educational workshops targeting both undergraduate and postgraduate educators are being held throughout Japan. These are organized by a variety of organizations in addition to medical schools.

Publication of the official journal

'Medical Education (Japan)' is issued every two months, including both Japanese and English articles. A peer-review system was introduced in 1991 and online subscription has been offered beginning in 2012.

Publication of white papers on medical education

An influential white paper covering recent topics in medical education, activities of the committees of JSME, and discussion of various medical education policies issued by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and Ministry of Health, Labour and Welfare has been issued every 4 years since 1972.

Appeal for medical education reform

Based on the outcomes of committee activities, JSME has been making appeals to the public, government, and political community regarding the most desirable directions for Japanese medical education and modalities of evaluation and strategies. Table 2 shows the variety of appeals we have made during last 7 years.

Internationalization of medical education activities

JSME considers peaceful contributions to worldwide medical education to be one of the important pillars of our activities. The following are examples of our recent international activities.

Figure 1: Founding members of 'Fujiken workshop'

In 2006, JSME reached an official exchange agreement with the Korean Society of Medical Education and began to exchange presenters at academic meetings in the two countries. We intend to pursue further development of practice and research in medical education through medical education exchange between the two countries.

Activities to contribute to the promotion of medical education in Pacific Rim countries will also be aims of our society. Since 2006 we have been heavily involved in the activities of the Association for Medical Education in the Western Pacific Region (AMEWPR) and Japan has since then been extending relevant activities. One of those activities is the Vietnam project (in cooperation with Japan International Cooperation Agency, JICA), which was initiated in 2008 to contribute to nurturing supervisory doctors for postgraduate clinical training in Vietnam. There are other JICA projects in which the University of Tokyo has been taking a central role in providing support for medical education in Afghanistan since 2003 and in Laos since 2008. Many JSME members have been contributing to those activities.

MAJOR CHANGES IN MEDICAL EDUCATION DURING PAST DECADE IN JAPAN

Table 3 shows the major movements in medical education in Japan during the past decade, movements to which members of JSME have made significant contributions. In 2001 MEXT proposed the model core curriculum, by which it was recommended that each medical school provides its own unique courses accounting for one third of all courses in the curriculum. In 2003, MEXT began to award grants for unique and appealing education curricula in medical schools.

In 2004, a new clinical training system for doctors was launched in Japan, and basic clinical competence education for 2 years after graduation became compulsory. Some people misunderstand this to mean an obligation for primary care training, but the real aim of this system is to raise the level of basic clinical competence required for all clinicians and forms the bridge between medical school and specialist/general medicine training just like the Foundation Programme in UK [2]. In 2005, the "Common

Table 3: Recent trend in medical education in Japan

2001	The model core curriculum was proposed.
2003	The Educational Grant Project of the MEXT was initiated.
2004	The new clinical training system for doctors was started.
2005	The shared examination (Common Achievement Tests) was officially launched.
2006	Rapid expansion of the local allocation system began.
2008	The projected raising of the limit on the number of enrollees in medical schools was initiated (the number is still increasing every year as of 2013).
2013	New specialty board system was proposed launching in 2017.
2013	Prime minister directed the consideration of new medical schools.

Achievement Tests" were launched. This examination, designed to evaluate the clinical competence of medical students prior to clinical training, is carried out in all medical schools nationwide. It consists of testing in the cognitive area by Computer-Based Test (CBT) and a skill test in the OSCE format.

As the shortage of doctors became obvious in Japan and collapse of community health care services be came a significant issue, the limit on the number of enrollees in medical schools has begun to be raised in 2007. The total limit on enrollees in medical schools increased from 7,625 in 2007 to 8,991 in 2012. Because the lack of doctors is particularly noticeable in areas already suffering a shortage of medical services, raising the limit on the number of enrollees allocated to local applicants has been strongly promoted in recent years. The total limit on the number of such enrollees was increased around 1100 last 10 years.

CURRENT TOPICS IN MEDICAL EDUCATION IN JAPAN

In Japan, there is a dominant view that it is desirable for teaching staff who are engaged in fundamental medical research in medical schools to have the title of Medical Doctor. However, a recent issue of concern is the decrease in the number of medical students who go into fundamental medical research.

The National Medical Licensure Examination in Japan consists of 500 multiple choice questions (MCQ) and is carried out over 3-day period. There is an increasing trend toward the view that performance-based evaluation should be adopted in the graduation examination in each medical school or in the National Medical Licensure Examination.

The third topic is the accreditation of the medical schools triggered by the announcement of the United States Educational Commission for Foreign Medical Graduates (ECFMG) stating that the ECFMG will require medical school accreditation for all international medical school graduates seeking certification beginning in 2023 [3]. Currently there is no accreditation system for medical schools in Japan, although accreditation system for the university level (not focused on faculties of medicine) is working. We are seeking the appropriate way to establish the organization to do the accreditation process of the medical schools.

The final topic is the propriety of establishing new medical schools. Graduate entry medical schools have been introduced in our neighboring country, Korea, and some people have advocated that Japan consider the introduction of such schools as well. Although this trend is not sufficiently steady, the Prime Minister Shinzo Abe made it clear that we should consider the necessity of new medical schools. Because this statement by the Prime Minister was issued just recently, in October 2013, it is unclear how this issue will unfold in the near future.

CONCLUSION

JSME plays significant roles in research on education in the medical sciences and medical care, propagation of educational knowledge and practice, and policy proposals concerning medical education, targeting not only doctors but also all other health care professionals.

JSME aims at international contributions through medical education. Our society intends to actively respond to requests from interested foreign countries as to international exchange and support. Contacts from interested parties are eagerly awaited.

Nobutaro Ban, MD, PhD

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5TH AKUTNE.CZ CONGRESS

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ABSTRACT — *This year's AKUTNE.CZ Congress was endorsed by the Faculty of Medicine of Masaryk University (MU), the University Hospital Brno, the Czech Society of Anaesthesiology and Intensive Care Medicine (CSARIM), the Czech Society of Intensive Care Medicine (CSIM), the Czech and Slovak Forum for Sepsis (CSFS), the MEdical FAculties NETwork (MEFANET), and the Expert Group for Obstetric Anaesthesia and Analgesia at CSARIM.*

The Congress was organized by the Department of Anaesthesiology and Intensive Care Medicine at the University Hospital Brno, the AKUTNE.CZ portal, the AKUTNE.CZ Foundation, the Czech Medical Chamber, and the Professional and Trade Union of Medical Workers of Bohemia, Moravia and Silesia.

INTRODUCTION

Traditionally, the initial speech of the opening ceremony was given by Prof. Roman Gal, head of the Department of Anaesthesiology and Intensive Care Medicine at the University Hospital Brno and chair of the scientific committee of the congress, and by Petr Stourac, MD, chair of the organizing committee. Prof. Gal also passed greetings from Prof. Jiri Mayer, Dean of the Faculty of Medicine at MU. Distinguished guests who accepted the invitation by the organizers spoke shortly afterwards. The audience could therefore listen to short speeches given by Prof. Karel Cvachovec (chairman of CSARIM), Roman Kraus, MD (director of the University Hospital Brno), Roman Kula, MD (chairman of the CSFS), Zdenek Mrozek, MD (vice president of the Czech Medical Chamber), and Jiri Mach, MD (chairman of the Czech Medical Chamber Brno).

MEDICAL SECTION

Experts in acute medicine gave lectures in the main medical section from the early morning hours. The very first lectures were a promising start of the entire programme; to mention just a few of them,

Figure 1: Opening ceremony: Dr. Kula, Dr. Kraus, Dr. Štourač, prof. Cvachovec, prof. Gál

Figure 2: Medical section

Figure 3: Nursing staff section

Prof. Cvachovec addressed the controversial topic of colloids, Dr. Kula presented the thorny issue of temporary malnutrition of ICU patients, and Prof. Gal gave a detailed lecture about the possibilities of using therapeutic hypothermia in the intensive care.

Interesting lecture by Dr. Kubricht entitled "The third Fate – current genetics and acute pain" with an equally exciting content described the position of molecular biology and genetics in relation to pain research. Individual genetic differences could thus explain the failure of standard procedures in pain treatment. The audience paid full attention to the lecture focused on using ultrasound (USG) during cardiac arrest, which outlined the possibilities of USG use to determine the causes of cardiac arrest in the field, prognostic significance and use for research. In the opinion of Dr. Skulec, USG examination during resuscitation is essential; nevertheless, it is not listed as a necessity according to the European Resuscitation Council. Dr. Mixa excellently summarized the issue of paediatric anaesthesia. In fact, he answered virtually all basic and most frequently asked questions about pre-anaesthetic examination, pre-operative fasting, prevention of delirium or use of regional anaesthesia in paediatric patients. At the end of a busy day of lectures, there was an inspiring presentation of Prof. Sevcik, entitled "How anaesthesiologist comes to happiness or what decides about the satisfaction of anaesthesiologists".

INTERESTING ANAESTHESIOLOGY CASE REPORTS IN THE DELIVERY ROOM

This section was endorsed by the ESPAA group. Listeners in a crowded auditorium attentively listened to case reports of a patient with secondary non-obstructive central sleep hypoventilation caused by eclampsia, a pregnant woman diagnosed with Myotonia Congenita Levior with neurological indication for Caesarean delivery, two pregnant women with a tumour of central nervous system diagnosed during pregnancy, or two women in the third trimester of pregnancy who suffered polytrauma in a car accident. At the end, five discussed cases from the experience of Dr. Blaha concluded the probably most unique section of the congress.

ELECTRONIC SUPPORT OF TEACHING IN MEDICAL AND HEALTH SCIENCES

Another success of this year's congress was the implementation of a parallel e-learning section which was endorsed by the educational network MEFANET. The first lecture on the interactive, case-based teaching with a focus on the education of health professionals was given by Dr. Pokorna. She underlined the importance of maintaining the didactic process and scientific background of the case, as well as leaving

Figure 4: Anaesthesiology case reports in the delivery room

space for discussion. The team of Prof. Mihal from Olomouc introduced the Virtual Paediatric Clinic. This project supports both the undergraduate and postgraduate training on case reports in paediatrics. The e-learning section was concluded by a lecture on the possibilities of using mathematical simulators of physiology, which was given by Assoc. Prof. Kofranek.

DIFFICULT AIRWAY MANAGEMENT

For the first time in a separate section of the AKUTNE.CZ congress, experts in airway management under the coordination of Dr. Otahal provided listeners with a detailed theoretical background on topics such as rapid sequence induction, fiberoptic intubation, scenario cannot ventilate / cannot intubate using the laryngeal mask, coniopunction/coniotomy and last but not least, percutaneous tracheostomy.

HANDS-ON WORKSHOPS

In light of the fact that the congress is intentionally focused on young physicians and medical students of higher grades, there were hands-on workshops called "It's about time..."; a workshop oriented on the management of difficult airways, the Bronchoscopic workshop, medical students-oriented Advanced simulator for acute conditions – METI®, Imaginative techniques or innovation of this year Coagulopathies and ROTEM.

CERTIFIED COURSE OF ULTRASOUND-GUIDED REGIONAL ANAESTHESIA

For the second time, the AKUTNE.CZ Congress also included a certified course of ultrasound-guided regional anaesthesia, led by experienced tutors such as Dr. Mach, Dr. Dolezal, Dr. Jelinek, and the course organizer alone, Dr. Krikava. Twelve course participants received a certificate of the CSARIM's Section of Regional Anaesthesia, which is part of the training programme for obtaining a certificate Ultrasound assistance in regional anaesthesia.

During the closing ceremony of the 5th annual AKUTNE.CZ congress, Dr. Stourac expressed his thanks to speakers, chairmen of the sections, audience, and the entire organizing team which consisted mainly of physicians of the Department of Anaesthesiology and Intensive Care Medicine at the University Hospital Brno and medical students of the MU's Faculty of Medicine.

And finally, we cordially invite you to the 6th AKUTNE.CZ congress which will be held on 22 November 2014 in Brno.

...Let's meet at AKUTNE.CZ...

MUDr. Petr Štourač, Ph.D.

MEFANET JOURNAL PROFILE

Aims and Scope

The journal is intended to present within a single forum all of the developments in the field of medical informatics, medical education, e-learning and thereby promote the synergism among these disciplines. The journal is the premier vehicle for disseminating information about MEdical FAculties NETwork, which covers all Czech and Slovak medical faculties.

The journal enables medical teachers and scientists to share and disseminate evidence demonstrating the actual practice in on-line education in medicine and healthcare sciences by focusing on:

- research in medical educational informatics and learning analytics
- applications of medical informatics into education
- design, usage and results of novel e-learning tools and innovative pedagogical methods in medical teaching and learning
- other interdisciplinary topics related to information and communication technology in medical education

In 2009–2012, MEFANET report was published as one volume per year and was printed in 1000 copies. Since 2013, MEFANET journal has been published biyearly.

Subjects of interest

- E-health and telemedicine
- E-learning
- Information science
- Innovative teaching methods
- Medical educational informatics and learning analytics
- Modeling and simulation
- Multimedia
- Social media pedagogy
- Evidence-based medicine in education

Indexing

MEFANET journal is going to be indexed in:

- Bibliographia Medica Czechoslovaca
- Bibliographia Medica Slovaca

On-line access

All volumes are available in electronic version at http://mj.mefanet.cz

PUBLISHER

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The Facta Medica Ltd. publishing house, based in Brno, was founded in 2008 by Dr. Boris Skalka, Dr. Eliška Skalková, and Assoc. Prof. Zdeněk Susa. The publishing house was founded with the aim of focusing on the publication of specialized literature from the field of medicine and health care – both periodical and non-periodical, but also medicine-related literature of fact and that of fiction. Since 2009 the publishing house has been represented by B. Skalka and E. Skalková.

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