Medical Informatics Education at Medical Faculty of Sarajevo University - 15 Years Experience

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Original paper

SUMMARY

In Bosnia and Herzegovina, Medical informatics has been a separate subject for the last 15 years with regard to Medical curriculum at the biomedical faculties in the country (1,2). Education in the field of Medical informatics is based on the concept which is used in developed countries, according to the recommendations of the working groups EDU – Education of Medical Informatics, of the European Federation for Medical Informatics (EFMI) and International Medical Informatics Association (IMIA). Theoretical and practical teaching and training performance as a whole is performed by use of the computer equipment, and the final knowledge check of the students is also performed using the Data Base Management System MS Access specifically designed to cover full teaching and training material by using question sets in the data base which encircled nearly 1500 question combinations. The distance learning is logical step that can further improve this method of education. In this paper, authors present 15 years of experience of Medical informatics education at biomedical faculties in Bosnia and Herzegovina. Medical Informatics, as an obligatory subject, was introduced to the biomedical faculties in Sarajevo (medical, dental and pharmaceutical as well as the High medical school) in 1992 and 1993. Students have practical computer exercises for a period of 7 weeks. Students had training in Excel, Word etc. During the semester, the students perform specific operation such as creation of data carrier for manipulation with medical information. The information was analyzed by statistical program such as Excel. From 2002 years Medical Informatics is divided in two parts in order to facilitate data processing and other procedure that are necessary to perform at time when student's knowledge of medicine is sufficient for practicing specific tasks that include management the data about patient, anamnesis and similar parameters cause we noticed that students without such knowledge cannot figure out the whole picture without difficulties. The Theoretical part of examination is done using the multiple choice answer form provided by special software with randomly selected questions for each student. Such way of practical and theoretical path of final exam make possible to perform such procedures such as electronic registration for exam and distance testing. Possibilities of introduction of distance learning in medical curriculum are the title of project which has been realizing at Cathedra for medical Informatics, Medical faculty since year 2002.

Our undergraduate and postgraduate students are satisfied with contents and organization of the teaching process.

Key words: Medical informatics, education, distance learning.

1. HISTORICAL BACKGROUND

The need for additional education of health professionals was realised after the first application of electronic data manipulation. For physicians in primary health care and in clinics, in order to perform their duties in a high quality manner, must have been

up to date with the latest accomplishments in medicine and health. Since the 60's the development of information technologies has had a quantitative and qualitative growth especially in diagnostics and therapy, and health workers had to follow that. The International Federation for Information Processing (IFIP) in the early 60's organized expert teams whose task was to develop strategy, concepts and content of under and postgraduate medical education. At a later date the IFIP separated and formed the IMIA – International Medical Informatics Association and EFMI – European Federation for Medical Informatics. Working groups in those scientific and expert associations, with their recommendations, defined education for medical informatics on three levels:

First, informatics education which should provide general knowledge to users and data analysis on the place of their generation, and on all places of collecting data in health system (physicians of all specializations, nurses and paramedical staff).

Second level, informatics education of this level is in regard to medical staff which was directly involved in collection, manipulation, analysis and interpretation of health data. This kind of education was expanded with skills, knowledge and practical applications which are necessary for personnel on this level.

The Third level is basically a very wide and highly specialized education for experts in the health sector who would like to be professionally involved in this kind of work. In B&H there has never been an accepted proposal for introducing sub-specialization from medical informatics in spite of the fact that authors

TABLE 1. *Curricula of Subject of Medical informatics at Medical faculties in Bosnia and Herzegovina*

Medical faculty (established)	Subject Medical Informatics	Curriculum	Cathedra website	Distance learning
Sarajevo (1946)	II and XI semester	30 + 45	Yes	Introduced in school year 2003
Tuzla (1976)	II, III and IV semester	60 + 75	n/a	n/a
Banja Luka (1986)	II semester	30 + 30	n/a	n/a
Foca (1994)	II semester	30 + 30	n/a	n/a
Mostar (1997)	II semester	30 + 30	n/a	n/a

of this paper put a lot of effort and energy into making it official. It is a fact that at some universities in European countries there are separate faculties or universities for graduates with the title of engineers of health informatics.

There are five medical faculties in Bosnia and Herzegovina (Sarajevo, established in 1946; Tuzla, established in 1976; Banja Luka, established in 1986; Foca, established in 1994; and Mostar, established in 1997). At all the faculties, since 1992 and later, cathedras for medical informatics were established and/or introduced as independent subjects: medical informatics or health informatics, bioinformatics, etc. In principle, 60-70% of the curriculum are the same, or very similar; the only difference is that the chiefs of some cathedras are medical doctors and of others are professors, engineers, mathematicians or economists with the title of MSc or PhD in this area. Most of those cathedras have web sites where students can check the number of hours and content to be taught.

Openly speaking in undergraduate education until 1992 when medical informatics was introduced as an independent subject at the Medical Faculty, University of Sarajevo just some lectures were taught; those were methodological units in that time very important for health practice (medical documentary with two teaching hours and health information systems also two teaching hours) under the subject of Social medicine and organization of health care and Professor Izet Masic. from 1979 on Postgraduate education at the Medical Faculty, Uni-

TABLE 2. Ratio of exam results of Medical informatics under and postgraduate students at Medical faculty University of Sarajevo during period 1991 -2008

Undergraduate students				Postgraduate students			
Year	Studied	Examined	%	Year	Studied	Passed	%
1991.	287	86	30,0	1991.	-	-	-
1992.	177	81	45,8	1992.	-	-	-
1993.	90	22	24,4	1993.	-	-	-
1994.	106	114	107,5	1994.	-	-	-
1995.	80	62	77,5	1995.	-	-	-
1996.	218	52	23,8	1996.	130	-	-
1997.	203	73	36,0	1997.	100	-	-
1998.	113	303	268,1	1998.	-	-	-
1999.	189	207	109,5	1999.	62	-	-
2000.	122	127	104,1	2000.	50	-	-
2001.	161	90	55,9	2001.	53	-	-
2002.	181	197	108,8	2002.	127	18	14,2
2003.	204	59	28,9	2003.	-	27	-
2004.	168	8	4,8	2004.	79	53	67,1
2005.	145	33	22,7	2005.	74	46	62,2
2006.	170	9	5,0	2006.	-	77	-
2007.	160	8	5,0	2007.	10	31	310,0

versity of Sarajevo there were subject Health informatics led by the pioneer of health informatics in ex-Yugoslavia Prof Gjuro Dezelic, PhD using concept, content and methodology at the Medical Faculty, University of Zagreb. In the school year 1970-1971 at the Medical Faculty, University of Zagreb was introduced "Basic Informatics" (named Use of electronic computers in health care) as obligatory subject for 6th semester students with a duration of 15 school hours. A similar programme was at postgraduate studies at the same faculty under the subject "Introduction in scientific work". In 1973 a separate cathedra for "Basics of Informatics" was established since it was obvious to make a distinction between those two areas. Both, under and postgraduate students had the chance to attend "Techniques of programming electronic computers" for a duration of 20 school hours. In 1973 the subject at postgraduate studies "Analysis of health data by methods of informatics and statistics" for a duration of 20 hours it was introduced (1,2,3,4,5).

Since 1985, Professor Izet Masic took over the leader position and with the help of Professor Gjuro Dezelic and Professor Arif Smajkic launched a separate course "Informatics

FIGURE 2: Lecture content of Curricula for Web based Medical informatics education

FIGURE 1. Screen window of exam questions

and Economics in Health” for a total duration of 30 hours. Numbers of postgraduate students became MSc and PhD in this subject, and some of them became professors and assistants in B&H universities and abroad. Since 1992 at the Medical Faculty, University of Sarajevo there have been Cathedra for Medical Informatics. The content of education is 30 hours of theoretical and 45 hours of practical education for students of the Medical Faculty, 15+15 hours for students of Faculty of Dental medicine and 30+30 hours for students of College of Nours-

ing. From 2002 the subject is split into two parts: Basics of medical informatics with funding of 15+15 hours in the second semester of studies and Applicative medical informatics with funding of 15+45 hours in the eleventh semester. The final exam is due after the 11th semester. Curriculum, teaching materials, application for the exam, the exam itself and checking of results are possible at the web site (www.imasic.org/mi). Also, since 2002 at Cathedra for Medical informatics the project “Distance learning in biomedicine” is in progress which allows students to use an electronic way of learning and to pass their exams in this subject.

This method of education is in a pilot phase and waiting for official approval from the appropriate institutions in charge for high education. In total, education from Medical informatics gained 2500 students. At postgraduate students of The Medical Faculty, University of Sarajevo there are subject Medical Informatics with funding of 15+15 hours and this type of education enabled over 800 medical doctors all medical specializations. In progress is the adaptation of curriculum of neighbouring countries in Medical informatics and content of methodological units with the Bologna process.

Fifteen years on from the establishment of the first Cathedra for Medical Informatics on Biomedical Faculties in Bosnia and Herzegovina. In October during the War year of 1992, by decision of the board of cathedra-chiefs in the Medical faculty, University of Sarajevo, and signed by dean Professor Borisa Starovic, the first Cathedra for Medical Informatics was estab-

TABLE 3. Curricula of Medical informatics education at Medical faculty of Sarajevo University from 1979 to 2008

Year 1979-1991	Year 1992-2001	Year 2002-2007	Year 2008
Teaching hours within Social Medicine and Organisation of Health Care System – 4 hours	Introduction to Medical Informatics – 2 hours	Introduction to Medical Informatics – 2 hours	Models, model making and simulation – 2 hours
Medical documentalistics/documents – 4 hours	Data, Information, Knowledge – 2 hours	Data, Information, Knowledge – 2 hours	Medical decision making – 2 hours
Health information systems (HIS)–“HIS of primary care, “HIS of pharmaceutical care, “HIS of scientific and reasearch work – 4 hours	System and Communication – 2 hours	System and Communication – 2 hours	Computer assistance in medical decision making – 2 hours
	Data Manipulation Methods – 2 hours	Data Manipulation Methods – 2 hours	System of biomedical scientific and research informations – 2 hours
	Medical Documentalistics – 2 hours	Medical Documentalistics – 2 hours	Computer assisted instructions/Computer assisted learning – 2 hours
	Nomenclature and Clasification Systems – 2 hours	Nomenclature and Clasification Systems – 2 hours	Information and communication technologies in biomedicine – 2 hours
	Structuring and Clasification Systems – 2 hours	Structuring and Organisation of the Data – 2 hours	Health information systems – 2 hours
	Hardwer and Softwer – 2 hours	Hardwer and Softwer – 2 hours	
	Models, model making and simulation – 2 hours		
	Medical decision making – 2 hours		
	Computer assistance in medical decision making – 2 hours		
	System of biomedical scientific and research informations – 2 hours		
	Computer assisted instructions/Computer assisted learning – 2 hours		
	Information and communication technologies in biomedicine – 2 hours		
	Health information systems – 2 hours		

lished. Cathedra staff at the time comprised of the following: Asst. Professor Izet Masic, Chief of Cathedra and teaching assistants - Zoran Ridjanovic, MD and engineer Safet Jakupovic, and associates Amra Redzepovic and Ljubomir Kravec). Later cathedras for Medical informatics at medical faculties in Tuzla, Banja Luka, Foca and Mostar were established. In past years the curriculum was modified and harmonized, but the basic one was the Program of Sarajevo Cathedra for Medical informatics.

Five years on from the introduction of the method of "Distance learning" in medical curriculum. In December 2002, at the Cathedra for Medical Informatics, Medical Faculty, University of Sarajevo a symposium was organised under the name "Tele-education in Biomedicine". Symposium was organized to celebrate the ten-year anniversary of the establishment of the above cathedra; participants at the symposium were health informatics experts from both Bosnia and Herzegovina and Croatia. During the symposium, for the first time in the history of the University, an intra-university network was tested, this was prepared by the University Tele-information Centre – UTIC (3,5,7,8,9). The leader of this activity was electro-engineer Safet Jakupovic, UTIC manager. On this occasion the tele-lecturing had a duration of 90 minutes. It was the start of the project "Learning from distance in biomedicine". Izet Masic was the leader of this project at the Medical faculty in Sarajevo, and the project was financed by funds of the cantonal Ministry of Science and Education and the Federal Ministry of Science and Education. Experiences from this project were presented at a number of world and european scientific events.

2. MEDICAL INFORMATICS CURRICULUM

The Curriculum of Medical informatics of the Faculty of Medicine of University of Sarajevo involved both practical and theoretical parts. Since 1992 at the Medical Faculty, University of Sarajevo there had been Cathedra for Medical Informatics. The content of education is 30 hours of theoretical and 45 hours of practical education for students of the Medical Faculty, 15+15 hours for students of Faculty of Dental medicine and 30+30 hours for students of College of Nursing. From 2002 the subject is split into two parts: Basics of medical informatics with funding of 15+15 hours in the second semester of studies and Applicative medical informatics with funding of 15+30 hours in the eleventh semester. The final exam is due after the 11th semester. In past years the curriculum was modified and harmonized, but the basic one was the Program of Sarajevo Cathedra for Medical informatics.

Students have practical computer training for a period of 15 weeks. We first provide a very short introduction to the architecture of computer systems, MS DOS, Windows 2000/ XP / Vista with all their characteristics and instructions, which are most frequently in use. So students are familiarized with the

FIGURE 3. Classroom of Cathedra of Medical informatics at Medical Faculty University of Sarajevo

style of delivery of contents on the computer, work with documents, installation of software and hardware, ways of making work on the computer faster, ways we can fix windows, as well as ways we can set up the computer desktop are all taught. Students have training in Excel, Word etc. During the final semester, the students perform specific operation such as creation of data carrier for manipulation with medical information. The student should manipulate with true data obtained using questionnaire or in hospital environment. In such way student will be prepared for real clinical studies. The students perform specific operation such as creation of data carrier for manipulation with medical information. After completion of this carrier, the students collect some data from patients that are entered into the database created by students. According to specific parameter students should choose adequate statistical method. After this we consider student eligible for final exam that consists of two parts. The students are taught how they can use computer in research or clinical trials and what is necessary for preparation of data for computer processing. In this way it is possible to avoid problem that came if data are not sorted and prepared well and shorten the time necessary for data collection and analysis. The information was analyzed by statistical program such as Excel. After this we consider student eligible for final exam that consists of two parts.

3. ELECTRONIC EXAMINATION

Both part of exam are performed using computers. Students must perform some of the task that includes preparation of information that should be analyzed, gathering of data, data manipulation, and finally analysis of data. Student must recognize the importance of every step and show that he is ready for medical data manipulation. First step is creation of data carrier that contains all data that must be analyzed. Second step is creation of database and final step is data analysis and descriptive analysis with statistical analysis. These steps are performed according to written instruction. The student use

data that are provided together with written instructions. The student must know how to prepare and manipulate with data to pass first part of exam.

The Theoretical part of examination is done using the multiple choice answer form provided by special software with randomly selected questions for each student. The final knowledge check of the students is also performed using the Data Base Management System MS Access specifically designed to cover full teaching and training material by using question sets in the data base which encircled nearly 1500 question combinations. In such way, using the combinations of questions it is possible to give different set of questions to each student. At the beginning of test, each student fills up the information about his name and index number. The time of solving all questions is limited to one hour. After exam it is possible to see result immediately. The students prefer this method because it is much easier to them to solve the test and they no need to wait for results as it is case when we perform the classic multiple choice test. The usual number of questions to be solved is twenty. There are six different scores that can be obtained. The mark "five" means that student did not pass the exam. Other marks are marks from 6 to 10 meaning that ten is the best mark. At least eleven questions must be answered correctly to pass exam and get mark six. For the best mark students need to answer 19 or 20 questions correctly. The student use mouse pointer to check correct answers in check boxes beside answers (Figure 1)

4. DISTANCE LEARNING, REGISTRATION AND TESTING

Such way of practical and theoretical path of final exam make possible to perform such procedures such as electronic registration for exam and distance testing (3,4,5,6,7,8,9). Possibilities of introduction of distance learning in medical curriculum are the title of project which has been realizing at Cathedra for medical Informatics, Medical faculty since year 2002. Project is approved by Federal and Cantonal ministries of science and education. The purpose of this project is to support improvement educational process at biomedical faculties using contemporary methods, methodologies and information technologies in accordance with strategy and objectives given by Bologna declaration. Pilot project is realized during five years, theoretical and practical part of subject Medical Informatics are adapted to modern concepts of education using world trends of distance learning. One group of students from Medical faculty was involved in this project, which was finalized by electronic registration of exam and electronic testing on 20 June 2005, in public in Physiological amphitheatre of Medical faculty in Sarajevo. The project and phases of its realization we described in other papers (3), and basic advantages and disadvantages we have noticed so far. In progress is the adaptation of curriculum of neighbouring countries in

Medical informatics and content of methodological units with the Bologna process (4,5).

Curriculum, teaching materials, application for the exam, the exam itself and checking of results are possible at the web site (www.imasic.org/mi).

Distance learning method of education is in a pilot phase and waiting for official approval from the appropriate institutions in charge for high education. In total, education from Medical informatics gained 2500 students. At postgraduate students of the Medical Faculty,

5. CONCLUSION

University of Sarajevo there are subject Medical Informatics with funding of 15+15 hours and this type of education enabled over 800 medical doctors all medical specializations (11,12,13,14,15).

Distance learning or learning from distance represents the educative technique which occupies significant place in the actual medical education of health care workers at the international plan, also in Bosnia and Herzegovina. This method of education is very useful in the domains of all kind of educational process: for undergraduate, postgraduate and continual medical education. It represents the educative technique of the significant effectiveness, which has to have at the disposal both the adequate technological infrastructure as well as previous education of the lecturer and user, adopted the teaching plans and the evaluation mechanisms of knowledge. By use of the rich choice of technological models, in relation to the traditional method

WEB BASED MEDICAL INFORMATICS EDUCATION
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Recent and development of distance learning technologies over the past decade has exposed the potential and the efficiency of new technologies. Benefit and use of contemporary information technologies for the same where needed information get the most on understanding and responses. Definition of distance learning as "use of technologies based on health care delivered on distance" covers areas such as electronic health, telemedicine, telemedicine, telemedicine, telemedicine, etc. as well as web-based education. For the need of e-health, telemedicine, telemedicine, web-based education and distance learning there are various technologies and communication systems from standard telephone lines to the system of communication digitalized signals with modem, optical fibre, satellite links, wireless technologies, and web sites, etc.

Web-based education represents health education on distance, using IT technologies and Internet, as well as continuous education of a health system beneficiaries and use of electronic database, data bases in electronic data with data bases of knowledge. Number of events due to this to promote distance learning and web-based education organized by teaching staff from Cathedra for Medical Informatics are very broad. First annual scientific events, workshops and congresses that is based on Medical Faculty, University of Sarajevo, introducing of Distance learning in curriculum at biomedical faculties, etc.

The paper presents these efforts in Bosnia and Herzegovina. Internet was not really meant to be a source of human communication at first but the clearly the Net became a multiplex of human communication.

- The need for all the universities in Bosnia and Herzegovina in the connection on the Internet nearly 100% and with adequate stability. This technical infrastructure was relatively high price on the leading factors of wider introduction of ICT and e-education into the educational institutions.
- Currently enrolled number of users of Internet is about 82% of population. The price of e-communication services are high and due to the high price through connecting and using Internet is research and educational process in Bosnia and Herzegovina.
- In development of distance learning there are some individual initiatives, mostly on faculty-level initiatives which mostly with assistance of small pilot projects.
- Serious initiative was generated by WUIS Austria (World University Service of Austria) in 2001. During 2002 and 2003 WUIS Austria, through its programmes, Distance learning 2002 and Distance learning 2003 year, supported the development of the educational processes at biomedical faculties.
- At the University in Tuzla by the beginning of 2003 was formed the University center for the development of distance education - UCED, since it was technical, organizational and didactic modern multimedia hall, equipped for the needs of videoconferencing and training in the field of ICT, the center possesses the own computer and communication equipment. To the students through web-based platform for Tele-education Learning Center, offers more multimedia interactive courses.
- At the University in Banja Luka of the Electro-technical Faculty since 1999 works the Center for open education and education from distance, whose primary role is to promote, develop and improve learning technologies based on the contemporary information technologies. The basic resources of the center are: computer classroom, the access for the WWW, educational platform of learning video software for the work with literature, and response and communication equipment.
- The University of Sarajevo in Medical Faculty of the Informatics technology provides the possibility of studying by the system for the distance learning since 2002-2003 school year. The student can approach to all practical works and lectures which get be founded the faculty web page. It is enabled to form also the on-line application, as well as the supplementary communication with the teacher by e-mail and of the forum.
- At the University in Zagreb in year 2003 is open the e-learning model for the support to the faculties the distance studies by use of the information technology.

At Medical Faculty of University of Sarajevo in Cathedra for Medical Informatics since 2002 is in progress the introduction of the project named "Possibilities of introducing of distance learning in medical education", supported by the Federal and the Cantonal ministries of science and education. The purpose of the project is to facilitate improvement of educational process at biomedical faculties, applying contemporary educational methods, methodologies and information technologies in accordance with strategy and objectives given by Bologna declaration. Pilot project was realized during three past school years, theoretical and practical education of subject Medical Informatics are adapted to the new concept of education using world trends of distance learning. One group of students was included in the project (taught by electronic exam registration and electronic exam on 20 June 2005, publicly, in the Physiological amphitheatre of the Medical Faculty at Sarajevo).

Project phases, which were involved in the project, were: project preparation, project realization, project evaluation and project implementation. The project was realized in three phases: project preparation, project realization, project evaluation and project implementation. The project was realized in three phases: project preparation, project realization, project evaluation and project implementation. The project was realized in three phases: project preparation, project realization, project evaluation and project implementation.

of learning, enables the simultaneous education to the great number of students of the various profiles, the approach to all the relevant forms of data bases and data knowledge as well as the mechanism of the evaluation by the eminent institutions and lectures.

This concept of learning based on practical test using computer and online test are ideal way of examination (16,17,18,19,20). Electronic registration and testing is important step in developing modern education that include distance learning. We hope than in future this is going to be widely used technique for education at biomedical faculties in Europe (21,22,23,24). Education in the last 15 years using experiences from other countries in which the field is developed and the recommendations in curriculum from medical informatics are given by the working groups of the European Federation of Medical Informatics (EFMI) and International Medical Informatics Association (IMIA). The up-to-now organization of instruction and the continuing innovation of the educational process from the Medical informatics chairs and their collaborators insured the high rating at the Medical faculty of the University of Sarajevo and also outside our country (25,26,27,28,29). The satisfaction of our undergraduate and postgraduate students with contents and organization of the teaching process up to now is indisputable and proven.

REFERENCES

- Masic I, Ridjanovic Z. Medicinska informatika [Medical Informatics]. Avicena. Sarajevo, 2000: 5-35.
- Masic I, Pandza H. Praktikum iz medicinske informatike [Practical training in Medical Informatics]. Avicena. Sarajevo, 1999: 61-74.
- Masic I. Medical informatics education in B&H. IMIA Yearbook of Medical Informatics 2004:204-8.
- Dezelic Gj. Teleedukacija – jucer, danas, sutra. AIM, 2002; 10(3-4): 127-8.
- Glinkowski W. et al. Advances in international telemedicine and e-Health. Vol. 1., around the world. MedPage Ltd., Warsaw, 2006: 28-36.
- Masic I, Ridjanovic Z. Medicinska informatika. Osnove medicinske informatike. Avicena, Sarajevo, 1999: 5-30.
- Masic I. A History of medical informatics in Bosnia and Herzegovina. Avicena, Sarajevo, 2007: 27-52.
- Masic I, Novo A, Kudumovic M, Masic Z. Medical informatics education at medical schools in Bosnia and Herzegovina. Acta Med Croatica, 2006 Dec; 60(5): 463-9.
- Masic I, Novo A, Deljkovic S, Omerhodzic I, Piralic A. How to assess and improve quality of medical education: lessons learned from Faculty of Medicine in Sarajevo. Bosn J Basic Med Sci, 2007 Feb; 7(1): 74-8.
- Masic I, Dedovic-Halilbegovic G, Novo A, Izetbegovic S. Quality assesment of education at Faculty of Medicine University of Sarajevo. Med Arh, 2006; 60(6): 396-400.
- Masic I, Novo A, Toromanovic S, Dzananovic A, Masic Z, Piralic A, Deljkovic S. Medical education and role of medical informatics. Stud Health Technol Inform, 2006; 124: 879-84.
- Masic I, Novo A, Kudumovic M, Rama A, Dzananovic A, Guso E, Basic M. Web based distance learning at Faculty of Medicine of Sarajevo University. Bosn J Basic Med Sci, 2006 May; 6(2): 71-5.
- Masic Z, Novo A, Masic I, Kudumovic M, Toromanovic S, Rama A, Dzananovic A, Bander I, Basic M, Guso E, Balta E. Distance learning at biomedical faculties in Bosnia & Herzegovina. Stud Health Technol Inform, 2005; 116: 267-72.
- Masic I, Kudumovic M, Novo A, Rama A, Masic Z, Bander I, Basic M, Guso E, Balta E. Possibilities of application of distance learning in medical curriculum. Med Arh, 2005; 59(4): 269-70.
- Kudumovic M, Masic I, Novo A, Omerhodzic I. Distance learning in medical education. Med Arh, 2004; 58(1 Suppl 2): 95-7.
- Masic I, Kudumovic M, Novo A. Education of medical informatics at Medical Faculty of Sarajevo. Med Arh, 2004; 58(1 Suppl 2): 88-91.
- Masic I. Medical informatics between technology, philosophy and science. Med Arh, 2004; 58(1 Suppl 2): 73-8.
- Masic I. Medical informatics in Bosnia and Herzegovina. Med Arh, 2004; 58(1 Suppl 2): 71-2.
- Masic I, Pasic E, Pandza H, Kudumovic M. Ten years of medical informatics education experience at the Faculty of Medicine in Sarajevo. Stud Health Technol Inform, 2003; 95: 750-5.
- Masic I, Pasic E, Kudumovic M. Ten years of medical informatics education at the Medical School in Sarajevo. Med Arh, 2002; 56(4): 233-9.
- Banjanovic B, Masic I. Telemedicine and telematics in medical education. Med Arh, 1999; 53(3 Suppl 3): 21-3.
- Masic I, Pandza H, Ridanovic Z. Education of medical informatics in the medical curriculum on biomedical faculties in Sarajevo. Med Arh, 1999; 53(3 Suppl 3): 15-8.
- Masic I, Pandza H. Internet in medical education. Med Arh, 1998; 52(4): 235-8.
- Masic I. Education of medical informatics in Bosnia and Herzegovina. Int J Med Inform, 1998 Jun; 50(1-3): 95-101.
- Zvarova J, Masic I. Medical informatics – an interdisciplinary approach. Med Arh, 1996; 50(3-4): 107-9.
- Masic I. The future of medical education in Bosnia and Herzegovina. Med Arh, 1996; 50(3-4): 71-2.
- Masic I. Telematics in medicine – developmental perspectives in Bosnia - Herzegovina. Med Arh, 1995; 49(3-4): 69-70.
- Masic I. Medical informatics – how long will it be a challenge? Med Arh, 1994; 48(1): 3-4.
- Masic I, Ridanovic Z. Collecting, publishing and searching scientific and research information. Med Arh, 1993; 47(1-2): 13-23.

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