

Proposed Module for Gynecological Integration – Preventive Measures in the Electronic Health in Republic of Macedonia

Edona Doko and Kire Jakimoski

*FON University, Faculty of Information and Communication Technology, Skopje,
Republic of Macedonia
edona.doko@fon.edu.mk, kire.jakimoski@fon.edu.mk*

Abstract

This paper presents improvements of the health information management system in Republic of Macedonia, specifically in Gynecology for early detection of cervical cancer and breast cancer, integrating a new model that does not have a single process out of the portal (nothing will be done manually, all processes will be initiated by the portal). All processes will be performed within the existing integrated portal, with all the standards that are used in health care and process modeling. My proposed module reduces morbidity and mortality among women. It provides optimal access and use of health information of patients in Gynecology portal for early detection of breast and cervical cancer. The family doctor gynecologist will have a comprehensive knowledge in real time which of his patients completed or not the preventive visits. With this, the gynecologist can influence, motivate and contribute to those patients who have not attended the visits to realize the same. The processes that will be presented will be thoroughly and effectively implemented for the best functioning of the Preventive measures in Gynecology, from calling the patients to diagnosing the cancer. The module Prevention will call all women for visit, access to preventive information, make preventive referrals, etc. The institution for preventive visit will make preventive report for each patient visited, it will also make preventive appointments, the register of cancer will be updated for each patient diagnosed with cancer, etc.

Keywords: *Integration, Prevention, Health Information System, Gynecology, Cancer*

1. Introduction

Information Systems in Health has a significant role in improving health outcomes and decision-making at the point of care, also on planning and funding. The new technologies dramatically will contribute to achieve the best results for healthcare in Republic of Macedonia. Integration requires a system that is consistent with day-to-day work or practical work. It has to accept the standards for sharing data and their interoperability. In the process of developing standards and frameworks are international agencies like the World Health Organization (WHO) and various national governments. [1] It is very important to develop and design appropriate schemes and processes that fit perfectly with the requirements of doctors, patients, administration and all included factors in healthcare, because this portal will serve them. Every employee in the health IT sector should gain advanced training for the area in which they operate. [4] Computerization is a necessary condition for strengthening management process of information. In the process of creating successfully the information system model of processes in healthcare, it is necessary to know how the system and subsystems are working in hospitals of Republic of Macedonia.

The aim of this paper is the integration of information systems in gynecology, designing a model of information system processes for early detection of cervical cancer and breast cancer. This means that it is necessary to have knowledge on functionalities of e-Health and Integrated Information System. With this research the functionality and security of activities in Gynecology will be improved, especially the prevention of cervical cancer and breast cancer. This is a nowadays phenomenon that affects lives of women. This integration will be made in the current Macedonian Integrated Health Information System - Portal. All patient data will be stored in a common server, because all this data has to be available to all public and private medical institutions, such as the medical center in the capital, regional hospitals and other medical centers.

There are attempts to release an integrated health information system in Republic of Macedonia, but still the practice shows that there is a need of improvements in this regard. It is necessary to make additional modules and improvements in this Integrated Information Healthcare System. Therefore, the aim of this article is to achieve this goal, to improve the functionality of healthcare institutions in Gynecology for preventing cancer. The benefits of the proposed processes have a great impact on the daily operations of hospitals, doctors, administration, the portal users in general, and of course the most important, the benefits for patients or lives of women.

2. Methodology

Health care organizations use Internet technologies to facilitate communications and transactions internally with suppliers and customers. Some health care organizations have developed health information web applications or have contracted third parties to maintain patient records electronically for them. Telemedicine and electronic data interchange (EDI) functions may be web based. This article is a result of direct reflection from direct involvement, experiences and attendance of real patients in real hospitals. For better results it is required an analytical approach for this topic. The most useful definitions of health care are: models of the database, operation of the database, databases on the Internet, warehouse data and data mining. [5] It is proved that system integration and e-Health is very important and every day it allows us make changes for improving their efficiency.

Thus, we consider it is very reasonable for us to add some important supplements into the current system in Gynecology for Prevention measures of cervical cancer and breast cancer. We analyzed the current Integrated Health System in Macedonian Gynecology and we decided to add a module for preventive measures of cervical cancer and breast cancer, which is a new approach in this area or in the specialized medical institution of Gynecology. We have modeled a functional scheme with processes for early detection of breast and cervical cancer, considering that it is very important to be included like a new module in the existing portal of Gynecology. Step by step the process diagram is designed by using VISIO tools and it is the main purpose of our research to show how this works and looks integrated into the existing portal. The research is based in existing modules and the integrated existing health system – portal. We have visited clinics and health institutions, interviewed the administration, nurses and doctors who are using this Integrated System in Gynecology and of course we have analyzed current situation of patients' needs and the importance for prevention of deadly diseases. We have come to the very useful and important conclusion that serves to patients as well as healthcare. According to those meetings we have taken all the information necessary for analyzing the functionality of the health sector for preventing breast and cervical cancer, and finally solve the problem regarding regular patient visits.

As a result we have achieved a new modified portal in Gynecology for early detection of cervical cancer and breast cancer. This additional module we have named

Prevention. It provides full health care for patients, better functionality of complex requirements providing effective and comfortable decisions, where quality and safety of medical services must remain at the highest level. Considering the need for improving the quality of the new generation of health care systems, we want to help in the process of improving the effectiveness, timeliness, safety and overall quality of medical services of this healthcare system. Aspects of quality are showed in Figure 1.



Figure 1. Aspects of Quality

Thus, patients will be regularly checked and the possibility of cancer will be reduced and discovered in time, in this way it can be treated and prevented. All this will be ensured or provided by modifying the existing integrated health system in Gynecology.

Currently there is an Integrated Health System in Republic of Macedonia that facilitates the work in health care. The purpose of this portal is that its existing customers can access better, easier and faster the data for their health insurance, to complete their obligations to compulsory health insurance and to realize services they are entitled under the health insurance.

E-health is considered as a possible solution in order to reduce the major problems of preventive medical errors. [6] Something that is necessary and very important for women and doctors is to have an Integrated System in Gynecology for early detection of breast and cervical cancer. This phenomenon is very influential and actual which involves women all around the world and currently the best we can do is to prevent or detect in the early stages, so lives can be saved. Our paper's aim is integration of a new module in the health portal of the Republic of Macedonia by looking into the real practical requests in health and using technological knowledge models.

3. Conceptual Framework

There are health portals in Republic of Macedonia that help toward better functionalization of the health care. One of them is the web portal of Health Insurance Fund of Macedonia for the insured, businesses, health care facilities and health care workers who have completed a cooperation agreement with the Fund (<https://portal.fzo.org.mk>). In this portal the doctor can see his/her registered patients, can register by him/herself a new patient or delete a patient, but this can be done with personal Electronic Health Card of the patient. Also in this section the doctor can see whether the patient has or not health insurance.

The other portal is “Moj Termin” (<https://mojtermin.mk>). This portal is trying to establish automated processes to work in practice at all levels of health care, health administration and pharmacies. In this level the portal has included those services: Issued Referrals (a doctor can see all issued referrals), New Referral (a doctor can make new referral), Prescription (a doctor can make prescriptions for his/her patients), My Patients (a doctor can see all his/her patients) and guidelines for doctors.

We want to add an important module in the portal that affects all women. It is important to add a module for preventing measures of cancer, because in this way we will prevent cancer for all women in our country without exception. The framework used to describe the new module for Preventive measures of information health care portal has social benefits and big impact on the daily work of hospitals, particularly in Gynecology. With the integration of Prevention module in the existing portal there will be:

- Reduced mortality of breast cancer in large percentages (at this point all women will be checked for a certain time interval).

- Discovered breast cancer in its early stages (when breast cancer is diagnosed at an early stage, there is an opportunity for five-year survival in 96% of cases and metastatic disease in 21%), thereby are reduced the costs of expensive treatment.

- Improved quality of life for patients with breast cancer and more.

Based on the top information and telecommunication technologies in the delivery of health environment are realized numerous benefits such as:

- Most effective and operative health information systems for Preventive measures in Gynecology through the portal. Further processes that we will present will enable patients to share the data to the final destinations where they should belong.

- Optimal access and use of health information for patients in Gynecology portal regarding early detection of breast and cervical cancer.

- Protect the privacy and confidentiality of patients in Gynecology in the process of detection of breast and cervical cancer.

- Ensuring the quality of health information for detection of breast and cervical cancer in Gynecology through our new model for the Report.

- Improve access to health information for all participants and end destinations where they should belong, in Preventive health care, in Gynecology.

- Automatic processing of information by significantly reducing errors in Gynecology for early detection of breast and cervical cancer.

- Provides advanced communication of patient and family doctor in Gynecology for early detection of breast and cervical cancer through integration of the Prevention part of the current portal.

- Medical information management and support for scientific research and statistical purposes in Gynecology for women who are or are not diagnosed with breast cancer and cervical cancer.

- Improvement of the existing model, integrating a new model that does not have a single process out of the system, of the portal (nothing will be done manually, all processes will be initiated by the system or the portal, except some necessary exceptions), but all processes will be performed within the current integrated portal, with all the standards that are used in health care and business process modeling.

- Patients will be regularly checked, by initiating and visiting accurate and contemporary processes of the portal, with what the possibility of cancer will be reduced, in time discovered, and as a result it can be treated and prevented.

- The system or the portal shall notify the doctor when the patients need to be called for a visit, at what time and how will the whole process of Preventive Health Portal be carried.
- The processes that will be presented will be thoroughly and effectively implemented for the best functioning of the Preventive measures in Gynecology, from calling the patients to diagnosing the cancer.
- In any case, the family doctor gynecologist, in the portal, in the section of Prevention, will have a comprehensive understanding in real time which of his/her patients realized or not the Preventive visits. With this, the gynecologist can influence, motivate and contribute to those patients who have not attended the visit to complete the same.

4. Case Studies

Considering the need for improving the quality of the new generation of health care systems and their solutions in the field of health, we want to help health institutions in Gynecology by improving the efficiency, timeliness, safety and overall quality of medical services. Thus, patients will be regularly visited and the possibility of cancer will be discovered in time to be treated and prevented. This will be provided with a modified Integrated System in Macedonian Web Portal.

In the current health care model the family gynecologist doctor has the opportunity to see the treatment goals of patients per quarter, which is very limited compared to the total number of doctors' patients. This model is called Goal in the current portal. Here can be seen just the number of goals achieved or number of realized visits in general. Visits are set only for 30 % of patients. The portal has no integrated report for visits, only plain paper that is placed into the personal program of the gynecologist, and then those results are applied to Health Insurance Fund of Macedonia as format type .xml or .xls with a usb stick, cd, or in some other form. Also, the results of the visits are not shown anywhere in the portal but there is only a glimpse of Statistics with numbers, which shows how many of those mandatory visits are realized.

We propose a new kind of approach to Preventive medical check or visit for breast and cervical cancer, which will include all patients during the year registered at a respective Gynecologist. This approach can be realized through:

- Adding a new type of Referral, Referral for Prevention.
- The Referral for Prevention will include referral mammography (breast cancer), referral Pap-Test (cervical cancer) for Preventive visits.
- Adding a new type of Report in the Prevention corresponds with Referrals in Prevention.
- We will add / create to the portal a separate category for Prevention, which will contain full information on current, future and past visits, and cycles for these Referrals, also their Reports for all patients registered in the family gynecologist.

So, in proportion to the working days of the year, a number of patients registered for the certain year group will be sent to a medical check, for example for Pap-Test. With priority are those women of a certain age who are potentially affected and the process will continue until the last registered patient for a particular year, and the same process will run through the following years.

We also propose a new kind of displaying results for Preventive visit, example for Pap-Test. The results are obtained from the Institution of preventive visits and then the family gynecologist will put them into the portal. From the portal the results will be displayed and accessed by certain institutions and patients who have access.

And with this we will have a number of scenarios and benefits which are mentioned below:

Scenario 1:

- When the Patient would successfully realize the Preventive visit, and the results of that visit are clearly visible that the patient has no symptoms of cervical cancer. In this case, the following steps should be taken:
 - o The family gynecologist will receive notification of the results and can see them after they appear in the system, together with the Report of the Pap-Test, in the Preventive part of the portal where it will be assigned that the patient is not diagnosed with cancer.
 - o Also, in the same time the patient will be notified by SMS or email that results are ready and are recorded in the EHR card.
 - o There will also be integration between the Health Insurance Fund of Macedonia, the portal and Register for Cancer in our category of Prevention.
 - o The patient will be transferred to a waiting list for next year and will not be called until the next term.

Scenario 2:

- When the Patient would successfully realize the Preventive visit, but the results of that visit are not clearly visible or somehow damaged and can't determine the type of symptom. In this case, the following steps should be taken:
 - o The family gynecologist will receive notification that the patient has completed the visit, but the results are not visible in the portal, because our system in the Report has diagnosed nothing about the patient and it is appointed as irregular.
 - o Also, in the same time the patient will be notified by SMS or email that she has to realize again the prevention visit as soon as possible, depending on the cycle, for technical reasons.
 - o There will also be integration between the Health Insurance Fund of Macedonia, the portal and Register for Cancer in our category of Prevention.
 - o The patient will be transferred to the following list of visits in the current cycle.

Scenario 3:

- When the Patient would successfully realize the Preventive visit, and the results of that visit are clearly visible that the patient has symptoms of cervical cancer. In this case, the following steps should be taken:
 - o The family gynecologist will receive notification of the results and can see them after they appear in the system, together with the Report of Pap-Test, in the Preventive part of the portal where it will be assigned that the patient is diagnosed with cancer.
 - o Also, in the same time the patient will be called personally by the family gynecologist for conversation and consultation, and the results will be recorded in the EHR card.
 - o Then the patient will be referred for further treatment and therapy in an institution for treatment of cancer.
 - o There will be integration between the Health Insurance Fund of Macedonia, the portal and Register for Cancer in our category of Prevention, where a patient will be added to the registry for cervical cancer as diagnosed with cancer.

- Automatically the patient will be deleted completely from the calling list of preventive visits.

Scenario 4:

- When a Patient has not successfully completed the Preventive visit for whatever reason, such as not attending the Preventive visit or the Preventive visit is not implemented for this patient because of other health problems associated with that visit, hence it does not receive any results and reports. In this case, the following steps should be taken:

- The family gynecologist will receive notification of the results that the patient did not attend the Prevention visit and in the portal will be appointed as unrealized visit.
- The family gynecologist will have to consult personally with the patient who did not attend the visit, to motivate or to change the personal data of the patient if they have changed or let the patient to decide when she will be able to realize the visit. Depending on the health inability to realize the prevention visit, they will find a common solution for these exceptions in any of the following cycles.
- There will also be integration between the Health Insurance Fund of Macedonia, the portal and Register for Cancer in our category of Prevention.
- Depending on the agreements of the cases the patient will be transferred to a waiting list for next cycles.

In any case, the family doctor gynecologist, in the portal, in the section of Prevention, will have a comprehensive understanding in real time, which of his patients realized or not the Preventive visit. With this, the gynecologist can influence, motivate and contribute to those patients who have not attended the visit to realize the same.

In the figure 2, we have shown the functional scheme of the existing portal in Republic of Macedonia in relation to the new proposed module for preventive measures of cancer. In the portal the module called Prevention is added. Registered patients of the family gynecologist are taken from HIF portal. In “Moj Termin” portal the new module Prevention is added, which is the main area regarding cancer prevention. In the module Prevention these steps are included:

- call patient for visit,
- access to preventive information,
- take preventive referrals,
- the institution for preventive visit will make preventive report for each patient visited,
- the institution for preventive visit will make preventive appointments,
- the register of cancer will be updated for each patient diagnosed with cancer.

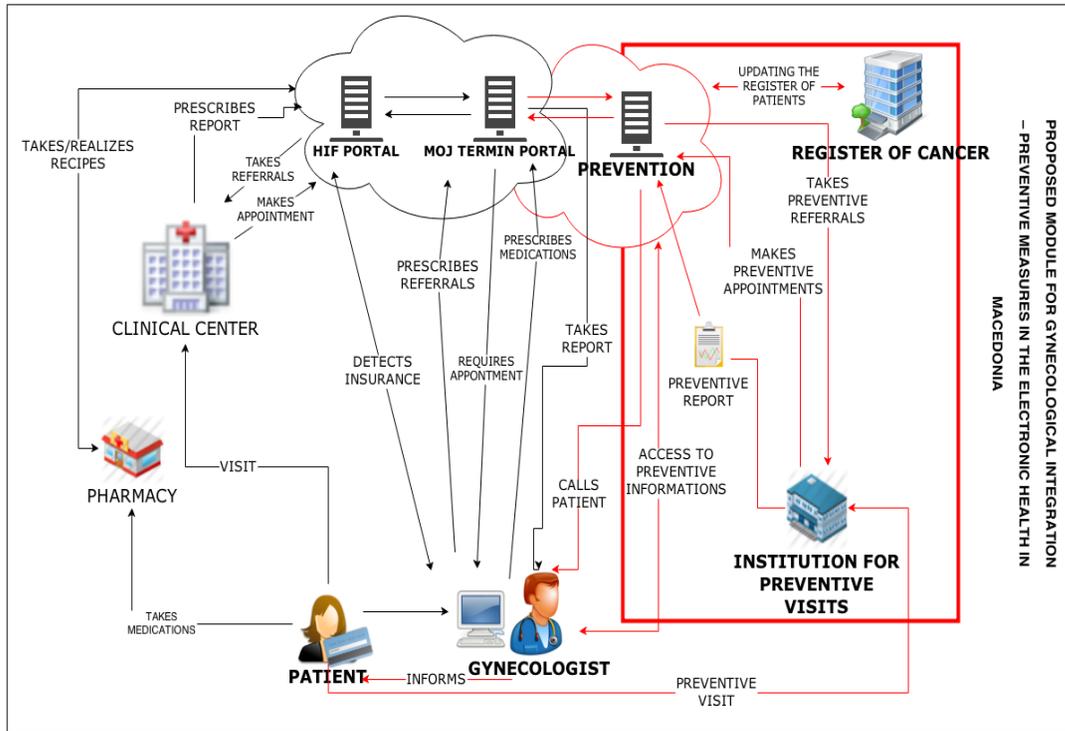


Figure 2. New Functional Integration Scheme for Gynecological Preventive Measures in the Current Healthcare

5. Discussion

Improvements in telecommunications and informatics have provided humanity with the opportunity to provide advanced services to people world-wide. One of the areas that have most benefited from information technology is the health sector. Health-related web applications have provided advanced services such as telemedicine to patients and doctors. However, these applications have brought along several responsibilities: to record, process and store medical information by following standard and lawful procedures, to protect medical data from unauthorized access, to ensure continuity and constant availability of healthcare services etc. Big changes in the demographic and social structure of many Western countries have brought new challenges, not only for the health system, but also for the development of new medical technologies. [9]

In this paper we have discussed about importance of new integrated module in health gynecological portal. By evaluating the importance of preventing cancer in early stages, the best and secure way is to add a new module in the existing portal in Republic of Macedonia. We have resolved four possible sections that can be included in the portal. The registered patients will be stored from HIF (Health Information Fund). The new module has to be web-based integrated into the existing portal for better results and functionality of the portal in general. It is important to note that with these steps the portal is getting improved, while meeting the needs of patients and doctors living and working better.

The solution that we are offering for a health program for early detection of breast cancer and cervical cancer is for a classic web application based on object-oriented technology, development code and relational database. Features of the system are integrated processes, data and organizational elements. This means that the system provides a single entry of data

in a database, which is then used in all the necessary organizational structures and workplaces, while providing for all users in the system consistency of the data. Technical implementation of solutions based on the layered architecture ensures the application of business rules for all transactions, scalability, performance and security of data and processes in the system.

The model can vary if in the current system some drastic changes are made. It is important to know that this model is new not just for e-Health integration in Republic of Macedonia, but also in general in functioning of health preventive measures of cancer. Maybe at the beginning it will be strange and unfamiliar for all the participants included in this process, but with time and practice it will be easier to face all difficulties that can occur.

We propose this model for the programmers to build and develop by taking into account information standards. Those standards can be: data standards, privacy standards, patient identification standards, ICT and Technical Standards.

In general, threats to health care information systems fall into one of these three categories:

- Human threats, which can result from intentional or unintentional human tampering
- Natural and environmental threats, such as floods, fires, and power outages
- Technology malfunctions, such as a drive that fails and has no backup

It is very important to take into consideration the threats that can occur during the operation of the portal and for these threats to have safety measures. Security in Health-Related Web Applications has many aspects such as: authentication, authorization, non-repudiation, and risk management. Over the last decade much attention is paid to the various aspects of health information security systems. [8]

6. Conclusion

“Better information, better decisions, better health” is the slogan that reflects importance of technology in health. Computing and networking techniques and technologies are gradually penetrating every feature of health care and medical practice [2].

The concept of e-Health is harmonizing inter-relations among all three main features of the modern health care, i.e. electronic, economic and environmental (Figure 3) [3] for all ICT tools and services in healthcare.

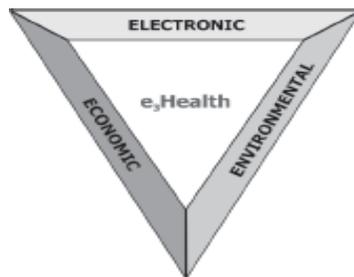


Figure 3. e₃Health Features

With implementation of our proposed module we will have most effective and operative health information systems for Preventive measures in Gynecology. Automatic processing of information significantly will reduce errors in Gynecology for early detection of breast and cervical cancer. Through integration of the Prevention part of the current portal we will have advanced communication between patient and family doctor in Gynecology for early

detection of breast and cervical cancer. This portal will serve for medical information management and support for scientific research and statistical purposes in Gynecology for women who are or are not diagnosed with breast cancer and cervical cancer.

Electronic Health is a new field for this country and needs improvements in different areas. Main components of the strategy for the new system are the development and implementation of technology, knowledge, organization and the community. They support the delivery and usage of high quality, timely information, when and where is necessary to use in order to get to effective clinical, operational and financial decisions. Executing this strategy in Republic of Macedonia, results with implementation of wide enterprise information systems. It includes computer-based system for patient records in hospital and ambulance settings, tactical and strategic decision support systems, well-developed intranet and internet access and workforce. All this has an impact in the adoption of interactive information directly to patients, caregivers, managers, directors and executives.

To a certain extent, efforts are made so far, to achieve effective functioning of health information management system in Republic of Macedonia by using computing technology. My proposed module is new not just for e-Health integration in Republic of Macedonia, but also in general in functioning of health preventive measures of cancer in general in Republic of Macedonia. It presents a functional scheme and processes for Preventive measures of breast and cervical cancer by considering the current health portal in Republic of Macedonia. All processes are created according to needs of the patients, doctors and specialists in Gynecology. We have created good and detailed plan how to communicate hospitals, laboratories, primary care physicians for improvement of quality services and more.

We hope that this paper will be the beginning of the initiative for improving the health portal in Republic of Macedonia. In the same time we are sure that this proposed module would make a significant impact in the prevention of cervical cancer and breast cancer.

References

- [1] J. Braa and S. Sahay, "Integrated Information Architecture Power to the Users", Matrix, New Delhi (2012).
- [2] I. Varlamis, I. Apostolakis and A. Chryssanthou, "Certification and Security in Health-Related Web Applications", IGI Global (2010).
- [3] A. Kastania and A. Moutzoglou, "E-Health Systems Quality and Reliability: Models and Standards", IGI Global (2010).
- [4] J. Manion, "From Management to Leadership: Strategies for Transforming Health", 3rd Edition, Jossey-Bass (2011).
- [5] J. P. Glaser, F. W. Lee and K. A. Wager, "Health Care Information Systems: A Practical Approach for Health Care Management", 3rd Edition, Jossey-Bass (2013).
- [6] A. Kastania and A. Moutzoglou, "E-Health Technologies and Improving Patient Safety: Exploring Organizational Factors", IGI Global (2012).
- [7] K. Khan, "Developing and Evaluating Security-Aware Software Systems", IGI Global (2012).
- [8] M. Ziefle and C. Röcker, "E-Health, Assistive Technologies and Applications for Assisted Living", IGI Global (2011).

Authors



Edona Doko, she is from Ohrid, Republic of Macedonia and was born in 1989. She received her B.Sc. degree in the field of Computer Science from the South East European University in Tetovo, Republic of Macedonia in 2011. She passed all exams with excellent success and is expected to get her master degree very soon, in the field of Business Informatics from FON University in Skopje, R. Macedonia. In 2012 she gained the title Oracle Database 11g Administrator Certified Associate. Since 2013 she is working as a teaching assistant at FON University in Skopje, R. Macedonia.



Kire Jakimoski, he was born in Gostivar, Republic of Macedonia, in 1979. He received his B.Sc. degree in the field of Telecommunications from the Military Academy “Mihailo Apostolski” in Skopje, R. Macedonia in 2002, M.Sc. degree in Electrical Engineering in 2007 and Ph.D. degree in Technical Sciences in 2013 in the field of Telecommunications, both from the Faculty of Electrical Engineering and Information Technologies, Ss. Cyril and Methodius University in Skopje, R. Macedonia. He is now Assistant Professor at the Faculty of Information and Communication Technology, FON University in Skopje. From 2002 to 2006 he works as an Officer for Telecommunications in the Ministry of Defense in the Republic of Macedonia. From January, 2006 to March, 2012 he works as an advisor for information security in the Directorate for Security of Classified Information in the Republic of Macedonia. From March, 2012 he is with the Faculty of Information and Communication Technology, FON University in Skopje. Also, he is an author/co-author of more than 25 published research papers and one book. His research interests include Wireless and Mobile Networks, Heterogeneous Wireless Networks, Computer Networks, Quality of Service, Information Security, Mobile Applications.

