

**Verification of current situation analysis in HClS  
and functional analysis**

**AND**

**Concept and General Network Architecture for  
IHIS of the Republic of Macedonia**

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## Acronyms

**IHIS** – Integrated Health Information System

**MOH** – Ministry of Health

**HIF** – Health Insurance Fund

**HCI** – HealthCare Institution(s) – Hospital, Health Centre

**WG** – Working Group

**NIHP** – National Institute for Health Protection

**IHP** – Institute for Health Protection (regional)

**WHO** – World Health Organisation

**HER** – Electronic Health Record

## 1 FOREWORD

The Republic of Macedonia has received a Specific Investment Loan from the International Bank for Reconstruction and Development in amount of US \$ 10 million toward the cost of a Health Sector Management Project. The project comprises of four components [1]:

Component 1: Policy Formulation and Implementation

Component 2: Strengthening HIF Governance and Management

Component 3: Improving Service Delivery

Component 4: Project Management, Monitoring and Evaluation

The Macedonian health care system faces multiple challenges of improving access, quality and efficiency. The Government of Macedonia's objectives are to obtain a healthcare system based on long term stability, sound governance and an appropriate institutional capacity in the key players in the health care system. It wants to see MOH, HIF and the health care providers operating in a reformed health care environment, all focused on the patient as the most important element in the health care system [1].

Within the Health Sector Management Project, there has been also developed Integrated Information System Strategy. Its primary aim is to recommend the necessary actions to rectify present deficiencies in health information systems and to put in place the frameworks to ensure the optimal development and utilisation of health information [2].

**The objective of this consultancy, which will perform one of first steps according to the above mentioned strategy, is to draft Technical Specifications (T/S) for the necessary hardware equipment, software, communication etc. for the establishment of Health Information System and for upgrading and improving Health Care Institutions software to implement the HIF prescription module, registration/enrollment and card identification modules, and share the information between health facilities and with central agencies (HIF, MOH, NIHP) [1].**

**The following activities will be carried out:**

- a. verify outlines of HCIs functional analysis (functional needs underlying business processes in prescription processing and subscriber registration, enrollment and identification);
- b. review the existing HCI hardware and software including related documentation, source code and actual practice in the field to determine necessary linkages; and outline the requirements for upgrading the existing software so it is inter-operable with the newly established one;
- c. perform the resulting gap analysis and subsequently draft Technical Specifications for the hardware and new modules of the HCI IT system, along the lines discussed above and agreed with the committee;
- d. monitoring the process used by the Evaluation Committee of the resulting tender and actual implementation by the selected Contractor.
- e. assist, if needed, the HCIs, HIF and MOH in defining the terms of reference for deployment and technical specifications for equipment.

**This report (ICT Report No.1) is prepared on the basis of the first visit of foreign ICT consultant in Macedonia and further consultations and coordination with ICT WG on second visit (report corresponds to contract activity a).** The purpose of the first report is to review the existing HCI hardware and software, to prepare general functional analysis of IHIS and to discuss IHIS concept with key stakeholders and institutions (e.g. MOH, HIF, WG, HCI, (N)IHP).

Report includes:

1. Verification of current situation analysis in HCI and functional analysis (corresponds to activity a)
2. General architecture or IHIS Concept (additional delivery agreed with WG and MOH)

All deliverables from described tasks above are verified and agreed with Working Group or MOH and local ICT consultant.

## 2 VERIFICATION OF CURRENT SITUATION ANALYSIS AND HCI FUNCTIONAL ANALYSIS

### 2.1 Background

MOH and local ICT consultant have recently prepared “Survey of the current conditions with ICT resources in healthcare institutions in the republic of Macedonia”, known also as Current situation analysis and HCIs functional analysis [3]. The task of foreign ICT consultant (us) was to verify this analysis and to supplement it with additional information to prepare quality basis for further discussions and decisions. Further report was prepared on the basis of the first visit in Macedonia and additional consultations and coordination with ICT WG and stakeholders during second visit.

### 2.2 Current Situation Key findings

As already mentioned the purpose of the first visit was to review the existing HCI hardware and software, to prepare general functional analysis of IHIS and to discuss IHIS concept and needs with key stakeholders and institutions (e.g. MOH, HIF, WG, HCI, NIHP). For that reason we participated in 17 meetings with MOH, HIF, WG, HCI and NIHP in 5 days, during first visit and another 5 meeting during second visit. Key findings about current information systems are:

1. There is no electronic communication through the internet between HCIs, HIF, NIHP and MOH and consequently no Integrated Health Information system (IHIS).
2. Reporting on provided services from HCIs to HIF is paper based or in some cases with magnetic media.
3. Weak local area network in HCIs, especially in health centers and some hospitals.
4. The data about HCI services is entered in different information systems up to 4 times – no single data entry point.
5. Rare internet access points in HCIs (dial-up or in some cases ADSL).
6. Relatively well established local area network in NIHP and local/regional IHPs and also well equipped with hardware and software.
7. There are few relatively well equipped hospitals and centers with hardware, software and local area network (e.g. , The Institute of Radiotherapy and Oncology – University Clinical Center of Skopje, Hospital of Orthopedics and Traumatology – Ohrid).
8. Lack of IT professional staff in HCIs for further information system development and implementation.
9. IT staff in HCIs are mostly working with older IT technologies and are not well educated for implementing new technologies, new IT processes and e.g. security threats on the internet.
10. No strategy, plan or clear vision in HCIs for their information system.
11. Some organizations are preparing plans or tenders for their own information system which should be part of the IHIS (e.g. NIHP, Health Center Skopje; we recommend to limit those

partial solutions as much as possible and to ensure solutions for all stakeholders through IHIS project).

12. Lack of knowledge about health record standards, coding and ICT standards.
13. Different standards or no standards used in local information systems in HCIs.
14. No central institution or body responsible for coordinating, planning, implementing and standardizing health information system in Macedonia.
15. Information systems in HCIs are mostly based on older and non-internet information technologies and environments (e.g. DOS environment) established from 1993 to 2001.
16. No electronic patient card or professional card for patient identification, authentication and checking patient insurance status (still using blue cards/tickets).
17. No central database or integrated system for electronic patient records or electronic health records.

## **2.3 Detailed information on Current Situation**

This chapter summarizes information on current situation of HCIs' information systems and other. Beside described institutions below we also had interviews during visit with MOH, WG and Minister of information society, where we discussed about current situation, priorities and possible solutions.

### **2.3.1 Health Center Skopje**

Summary report: Health Center Skopje uses basic administrative software on older DOS platform (e.g. accountancy and salaries); they do not use HIS with medical and patient data; they have no local area network; and they use only basic Dial-up internet access; communication with HIF is paper based. Health Center Skopje is planning to implement their own administrative software and also basic software for health services. Their plan is to implement new system in 3 phases: 1. Setting up Information System in central location, 2. Networking with other Healthcare units in Skopje, 3. Networking with MOH and HIF when needed. We recommend jointing their project to IHIS project or to implement it through IHIS project<sup>1</sup>.

Important: Private General Practitioner uses software (provided from HIF) to keep records on provided services. Reporting to HIF is implemented with magnetic disks in standard file format defined by HIF.

### **2.3.2 Hospital of Orthopedics and Traumatology – St. Erazmo - Ohrid**

Summary report: Hospital of Orthopedics and Traumatology in Ohrid is one of the most advanced institution regarding information system; they use administrative software and special hospital

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<sup>1</sup> Some organizations are preparing plans or tenders for their own information system which should be part of the IHIS (e.g. NIHP, Health Center Skopje; we recommend to limit those partial solutions as much as possible and to ensure solutions for all stakeholders through IHIS project).

software based on Access/SQL platform (implemented in 1995 and also upgraded); software is regularly maintained and upgraded; software consists of modules covering all core administrative and healthcare processes, software enables tracking expenses for each patient or service and also history; system uses local area network, central database and central server; internet access is satisfactory.

### **2.3.3 Hospital – Bitola**

Summary report: Hospital in Bitola is relatively well equipped<sup>2</sup> hospital regarding information system; they use administrative software and hospital software based on Oracle(Old)/WMS and Cobol platform; software platform and technology is older; hospital software was implemented years ago (in 1995) but is regularly maintained and upgraded; software enables tracking expenses for provided services, also history is available; system uses local area network and central database; internet access is relatively slow; communication with HIF is paper based.

### **2.3.4 Hospital – Prilep**

Summary report: Hospital in Prilep is relatively well equipped<sup>2</sup> hospital regarding information system; they use administrative software and hospital software based on Clipper platform; software platform and technology is older; hospital software was implemented years ago but is regularly maintained and upgraded; software enables tracking expenses for each patient, also history is available; system uses local area network, central database and central server; internet access is satisfactory and is used for internal communication and educational purposes; communication with HIF is paper based; communication with Pension and Disability Insurance Fund of Macedonia is performed through electronic channels. Prilep Hospital plans to upgrade their hospital system to more advanced platform from Clipper to C++ and also to upgrade its functionality.

### **2.3.5 Hospital – Tetovo**

Summary report: They use basic administrative software and basic software to keep records on provided services; software platform and technology is older (established 1993) based on FoxPro database; information system is maintained regularly; they don't use local area network and don't use central server or database; data is kept locally within departments (on single computers) and at the end of the month or other specific period data is manually (on paper) transferred to the accountancy department where invoice for HIF is prepared; some departments don't have computers; internet access is available on one computer; communication with HIF is paper based. They have general plans and ideas for modernizing information system, but do not have funds for this purpose.

### **2.3.6 Hospital – Kicevo**

Summary report: They use basic administrative software (salary, accountancy, finance) on single computers without network; they do not use hospital system or other software to track records on

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<sup>2</sup> Relatively well equipped regarding to other HCIs in Macedonia, but regarding to advanced EU countries they are still far behind.

patients, provided services or material; software platform and technology is older (established in 1991, upgraded in 1996); information system is maintained when needed; they do not use local area network and do not use central server or database; data is kept locally within departments (on single computers); software enables them to prepare invoices for HIF; internet access is available on two computers; communication with HIF is paper based. They have no plans for modernizing information system because they do not have funds for this purpose.

### **2.3.7 Institute for Health Protection – Ohrid**

Summary report: Institute for Health Protection in Ohrid is relatively advanced institution regarding information system; they use special software for collecting and processing data according to their field of work (Social medicine, Microbiology...); information system is based on Access platform; software is regularly maintained and upgraded; system uses local area network, central database and central server; internet access is satisfactory; they are collecting data from HCIs on electronic media (Excel format) or on paper, processing data in Access software and then regularly sending reports to NIHP on CD or DVD as data carrier; regional IHPs and their information systems are not connected to other IHPs within private or public network; regional IHPs and their information system are not connected to NIHP within private or public network;

Important: There is one project in progress regarding IHPs and NIHP communication – Medical Map Project. The objective of the project is to establish communication of NIHP with regional IHPs and to unify some software. This project should be considered while preparing specifications for IHIS.

### **2.3.8 The Institute of Radiotherapy and Oncology – University Clinical Center of Skopje**

Summary report: The Institute of Radiotherapy and Oncology in Skopje is one of the most advanced institution regarding information system, specially regarding hardware and software for providing services to patients; they use also administrative software (not examined on first visit, but according to statements all UCCS clinics use the same business/accountancy software) and special hospital software, hardware and equipment; Special hospital information system consists of hardware, equipment and software modules covering all core processes (diagnosis, planning radiotherapy, simulation, keeping record on therapy, Imaging, ...); software is regularly maintained; software enables tracking therapies for each patient or service and also history; system uses local area network, central database and central servers; internet is enabled through separated local area network on 10 to 15 computers (because of security reasons institute uses two separated networks, one for special hospital software and other for internet access and other purposes); reporting on provided services from special hospital software to accountancy (administrative software) is manual using preprinted forms; further reporting to HIF is paper based.

### **2.3.9 National Institute for Health Protection – Skopje**

Summary report: National Institute for Health Protection in Skopje is the central institution for collecting and processing health data and reporting (e.g. social statistics and other) on a national level; NIHP receives data from 10 regional institutes for Health Protection in electronic format (CD or DVD) and in paper forms (should be entered manually to central database); NIHP information

system is not connected to regional IHPs via private or public network; some data is produced also on central location of NIHP according to performed activities or services of NIHP; NIHP uses special software and database for collecting, processing and reporting; software is based on Access platform; system uses local area network, central database and central servers; internet access is satisfactory; system is regularly upgraded and maintained; system and database cannot be easily modified or prepared for e.g. ad-hoc reporting, new surveys, new summary reports etc. Reporting to MOH and HIF is paper based, reporting to WHO is performed electronically with special software and database. NIHP is preparing to accept new reporting rules and forms for health statistics.

Important:

- NIHP is preparing a tender for central information system for NIHP and 10 IHPs. Functionalities of new central information system will enable NIHP to collect data from IHPs for 10 important registers and catalogues. The system will be web based (online). The system would fulfill some goals of Medical Map Project. We recommend jointing this project to IHIS project or to implement it through IHIS project<sup>3</sup>.
- In the process of drafting IHIS specifications also analysis or report from "Paul Team" (IT Consultant) should be considered.

### **2.3.10 Bureau for Drugs – Ministry of Health**

Summary report based on short briefing about Pharmacies: In the Republic of Macedonia there is about 750 Pharmacies. Most Pharmacies are working with HIF (those which have a contract with HIF). Pharmacies are using their own software and hardware to support their business processes for selling drugs, issuing drugs and stock tracking. Software is running locally for each Pharmacy and there is no networking, central database or electronic reporting to HIF or MoH.

Bureau for Drugs: Bureau for Drugs is, among others competences, managing processes for registering new drugs, drug trading permissions and licences, and drug importing/exporting permissions. They are also tracking drug consumption in Rep. of Macedonia with several reports from pharmacies. For this purpose Bureau of drugs is using its own application and central database (platform: ASP, MS SQL database). This information system is running locally on MoH and is not electronically connected with other information system outside MoH.

### **2.3.11 Health insurance fond**

HIF is using its own information system which is running on 31 locations across Rep. of Macedonia (1 central location with database/application center and 30 regional units); information system basically consists of 36 modules supporting HIF functions (finance, accountancy, legal, registers, lists, analytics, control...), some of modules are used only on central location, others are/will be used on regional units considering regional unit rights; central HIF information system is developed in JDev and partial in Oracle Dev, central database is Oracle; each regional unit acts as

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<sup>3</sup> Some organizations are preparing plans or tenders for their own information system which should be part of the IHIS (e.g. NIHP, Health Center Skopje; we recommend to limit those partial solutions as much as possible and to ensure solutions for all stakeholders through IHIS project).

autonomous information system, 10 of them are already using newly developed system on same platforms and standards as central HIF information system, other units are still using older software (Clipper); 10 mentioned regional units are also connected asynchronously to the central HIF information system (e.g. over night data replications, electronic data exchange) using VPN, other regional units are at the moment of writing still waiting for modernization of software and hardware.

Communication with Pharmacies: Pharmacies, with contract to HIF, are sending monthly orders to HIF ordering drugs from positive list; orders are delivered to HIF using Excel file that is accessible on HIF webpage; according to its regulation HIF proceeds orders to wholesale dealers together with printed labels for each drug (labels are printed in HIF); wholesale dealers afterwards distribute drugs to Pharmacies; at the end of the month pharmacies report on issued drugs to the HIF together with monthly invoice. Communication between Pharmacies and HIF is based mostly on floppy disks and paper – there is no electronic reporting or communication between Pharmacies and HIF for described process. Important: HIF is currently generating its own codes for drugs which are aligned to codes generated by MoH. The same is for doctor identification codes – codes should be generated by Doctors Chambers, but they are generated by HIF.

Communication with HC Providers: Macedonian HC Providers, with contract to HIF, are reporting to HIF on provided services each month. Reporting is paper based. Together with report on provided services also monthly invoice is sent by each provider.

### **2.3.12 Pharmacy**

Pharmacies are using their own software and hardware to support their business processes for selling drugs, issuing drugs, stock tracking, reporting and others. Information system is running locally for each Pharmacy or in some cases central information system is established for a group of pharmacies belonging to one company (e.g. Zegin). There is no electronic communication between pharmacies and HIF or MoH - communication is based on paper and floppy disks according to predefined data structure for reporting.

Each Pharmacy, with contract to HIF, is using also Excel form from HIF web site for expressing their needs on drugs monthly – for positive list only. According to pharmacy needs and regulation HIF prints out labels for drugs and sends them to wholesale drugstore which delivers appropriate drugs to pharmacies. After selling/issuing drugs to the patients/customers each pharmacy prepares periodical invoice for HIF jointly with required documentation (e.g. paper prescriptions).

### **2.3.13 Private Hospital Remedica**

Private hospital Remedica is using its own Software and Hardware for medical processes and administration processes. Software supports most of medical and business processes in the hospital. Remedica is most advanced hospital concerning hardware and software equipment and also concerning organization, processes and people. Hospital has no contracts with HIF and therefore there is no need to communicate electronically with HIF. The role of Remedica inside the IHIS project should be discussed in the future.

## 2.4 Current business process analysis

Current business process analysis is crucial for understanding current problems regarding information system and future needs of IHIS. Listed processes are main processes for observed institutions (first and second visit in Macedonia). They are presented on the high level of abstraction and will be used for future drafting of detailed IHIS specifications.

High level processes and data flows related to HCIs are:

- Patient input (checking patient insurance, creating/opening patient record, doctor acceptance...)
- Providing services for a patient and keeping records (diagnosis, laboratory, treatment, placing the patient, nursing, rehabilitation, other services, ...)
- Patient discharge (preparing discharge documents, preparing invoice documents, reporting on costs, achieving patient records...)
- Preparing monthly cost reports (invoice) for HIF
- Cost reporting to HIF
- Prescription management
- Statistics reporting to IHP (NIHP)
- Administrative and accountancy processes
- Statistics and Business analytics – decision support

High level processes and data flows related to (N)IHPs are:

- Retrieving/recording data from HCIs
- Retrieving/recording data from own analyses, surveys, research
- Data processing and analyses
- Patient input, service providing, discharge (Microbiology)
- Reporting

High level processes and data flows related to HIF:

- Finance, accountancy processes
- Legal processes (e.g. tenders, contracts)
- Control
- Analytics
- Administration and other supporting processes
- Managing registers and coding lists (drugs, doctors, pharmacies, providers)

- Communicating with pharmacies and HC providers

High level processes and data flows related to Pharmacies:

- Ordering & purchasing drugs
- Retail & issuing drugs per prescription
- Managing drug register, codes and prices
- Stock tracking & Analytics
- Other administrative processes
- Reporting & invoicing to HIF, MoH, others

The next table shows the level of ICT support sophistication for above listed processes, institutions involved in the process.

Proces	ICT support Sophistication	Involved institutions	
<b>HCI processes - <u>Hospitals</u></b>			
Patient input	min1, max4	HCI, Patient, HIF	
Providing services for a patient and keeping records	min1, max4	HCI, Patient	
Patient discharge	min1, max4	HCI, Patient	
Preparing monthly cost reports (invoice) for HIF	min2, max4	HCI, HIF	
Prescription management	1	HCI, Patient, Pharmacy, HIF	
Preparing statistics reports for IHP (NIHP)	min1, max3	HCI, IHP	
Administrative and accountancy processes	min2, max4	HCI	
Statistics and Business analytics – decision support	min1, max4	HCI	
<b>HCI processes – <u>Health Center</u></b>			
Patient input	1	HCI, Patient, HIF	
Providing services for a patient and keeping records	1	HCI, Patient	
Patient discharge	1	HCI, Patient	
Preparing monthly cost reports (invoice) for HIF	2	HCI	
Prescription management	1	HCI, Patient, Pharmacy, HIF	
Preparing statistics reports for IHP (NIHP)	1	HCI, IHP	
Administrative and accountancy processes	2	HCI	
Statistics and Business analytics – decision support	1	HCI	

<b>HCI processes – UCCS</b>			
Patient input	min1 – max4	HCI, Patient, HIF	
Providing services for a patient and keeping records	min1 – max4	HCI, Patient	
Patient discharge	min1 – max4	HCI, Patient	
Preparing monthly cost reports (invoice) for HIF	min1 – max3	HCI, HIF	
Prescription management	1	HCI, Patient, Pharmacy, HIF	
Preparing statistics reports for IHP (NIHP)	min1-max3	HCI, IHP	
Administrative and accountancy processes	3	HCI	
Statistics and Business analytics – decision support	1	HCI	
<b>(N)IHP processes</b>			
Retrieving/recording data from HCIs	3	HCI, IHP, NIHP	
Retrieving/recording data from own analyses, surveys, research	3	IHP, NIHP, Patients, Others	
Data processing and analyses	3	IHP, NIHP	
Patient input, service providing, discharge (Microbiology)	3	IHP, NIHP, Patient, HCI	
Reporting	3	IHP, NIHP, SBRMK	
<b>Pharmacies</b>			
Finance, accountancy processes	4	HIF, HIF regional units	
Legal processes (e.g. tenders, contracts)	4	HIF, Providers, Pharmacies, Wholesale dealers, MoH	
Control	4	HIF, HIF regional units, providers, pharmacies	
Analytics	4	HIF, HIF regional units	
Administration and other supporting processes	4	HIF, HIF regional units	
Managing registers and coding lists (drugs, doctors, pharmacies, providers)	4	HIF, HIF regional units	
Communicating with pharmacies and HC providers	4	HIF, HIF regional unit, pharmacies, providers	
<b>Pharmacies</b>			

Ordering & purchasing drugs	min1 – max4	Ph, Wholesale dealers, HIF
Retail & issuing drugs per prescription	min3 – max4	Ph, Patients
Managing drug register, codes and prices	min3 – max4	Ph, HIF, MOH,
Stock tracking & Analytics	min1 – max4	Ph
Other administrative processes	min1 – max4	Ph
Reporting & invoicing to HIF, MoH, others	min1 – max4	Ph, HIF, MOH

Legend for ICT support sophistication:

- 1 – No ICT support or some low-level support in some institutions, whole process is paper based
- 2 – Basic Software and hardware support running on non-networked environment, interchange of data is paper based - inside or outside of the institution
- 3 – Software and hardware support running in local networked environment (LAN) with central database, interchange of data with other internal software is manual and paper based, interchange of data with other institutions is manual and paper based
- 4 – Relatively advanced software and hardware support running in local networked environment (LAN) with relational central database, interchange of data with other internal software is implemented electronically and automatic, interchange of data with other institutions is semi manual (including e-mails) and usually paper based
- 5 – Advanced Software and hardware support running in local networked environment (LAN) with modern relational or object central database, interchange of data with other internal software is implemented electronically and automatic, interchange of data with other institutions and customers is implemented electronically (B2C, B2B), including business intelligence.

**Key findings:** Most HCIs use some kind of basic administrative or accountancy software, in rare cases they use advanced software for this purpose. Administrative or accountancy system is usually not electronically connected with medical or hospital software (if exists) within the institution. Beside administrative software some institutions use medical or hospital software, usually this is older software with or without LAN and central database, but in some cases also advanced software is used (e.g. Hospital of Orthopedics and Traumatology – St. Erazmo – Ohrid; The Institute of Radiotherapy and Oncology – University Clinical Center of Skopje). Medical or hospital software is usually not connected to administrative software and therefore internal reporting and data transfer is made manually through reports.

The higher level of process ICT support sophistication (see legend 1-5) reached is level 4. Level 4 is reached only in a few institutions, most institutions can reach level 2 or 3, some institutions are still on level 1.

The crucial deficiency of HCIs and also others health related information systems in Macedonia is the fact that they are not connected electronically, they do not use unified coding standards, health

record standards, ICT standards and central registers, they also use different standard and formats for patient records. Therefore each institution represents a kind of isolated information island which is not capable to communicate with others electronically.

## 2.5 Verification

According to all information acquired during our first and second visit in Skopje, we can verify and agree on document prepared by MOH and local IT consultant [3] "Information from the conducted survey of the current conditions with ICT resources in healthcare institutions in the republic of Macedonia".

The following part of this document is more focused on future state of Integrated Health Information System - IHIS. Future objectives and functional requirements of IHIS, presented in next chapters, are prepared on the basis of current situation analysis, requirements from institutions in Macedonia, Strategy for the Development of Macedonian Integrated Health Information System, current health and ICT related trends in EU.

## 3 IHIS OBJECTIVES AND FUNCTIONAL REQUIREMENTS

General objectives and functional requirements are evident in the Strategy for the Development of Macedonian Integrated Health Information System where vision, principles and objectives are presented [2]:

The vision of the IHIS Strategy is of a trusted and valued health information environment within which all stakeholder groups, namely the general public, patients, carers, healthcare professionals and service staff, health service managers, public health, policy makers and Government, researchers and the media are enabled and empowered to make informed choices to promote, protect, restore and maintain the health of individuals and of the population. The achievement of this vision will touch the lives of all staff members in the health service and their clients/patients, and the process of making it a reality will pose a significant challenge to every part of the health sector.

- **Efficient and effective health information systems.** The development and continuation of information systems should be driven by their usefulness to stakeholders. Data that are routinely collected as an intrinsic part of service delivery (i.e. from operational sources) should be the primary source of information and be complemented by other sources as and when required. Data should be gathered once and once only; if data are not going to be transformed into useful information, they should not be collected;

- **Optimal health information access and use.** Stakeholders need ready access to available health information that is appropriate to their needs. Available information should be fully exploited and shared in the support of safe and high-quality client/patient care, the development and evaluation of health services and policies and for legitimate research purposes;

- **Safeguarding privacy and confidentiality.** Access, processing and use of personal health information should comply with legislative and information governance requirements. Special care should be taken to protect personal and sensitive information;

- **Quality assurance of health information.** Health information should be of the highest quality and be demonstrably compliant with health information standards.

**In achieving its vision, the Strategy is centred upon a number of fundamental objectives which are elaborated upon in later chapters. These are to:**

- Establish a legislative and information framework for safeguarding the confidentiality and privacy of health information while optimizing its use;
- Improve access to health information for all stakeholder groups;
- Establish health information standards that ensure the quality and comparability of health information and enable appropriate sharing of health information within the health sector;
- Exploit the enabling technologies in the collection, processing, analysis and dissemination of health information and its application in the delivery of health services.

Strategy vision and objectives are very ambitious and they require more detailed steps how to implement IHIS in the future. According to all gathered information from different sources we accomplished our proposal on next steps which could be the basis for further discussions with all key players.

1. Agree on general IHIS concept and decide on implementation phases or projects according to the strategy and real capabilities
2. Legal aspects and agreement on IHIS concept
3. Define standards for HCI hardware, software and communication infrastructure
4. Decide on ICT health related standards for patient records, services and data coding
5. Define and implement central modules, applications, registers and coding lists which will be used by IHIS
6. Set up an efficient infrastructure in HCIs capable of implementing modern software products and networking
7. Establish central body for coordinating ICT activities in health related institutions
8. Employ and train sufficient number of ICT staff to participate in the process of IHIS implementation
9. Provide training for HCIs employees on new software that will be implemented to support all basic health care procedures
10. Define standard and security scheme for all users of future IHIS – e.g. defining access rights to patient data
11. Define specifications for unified software for HCIs
12. Implement unified software in HCIs for medical/health care processes and for administrative processes – basic modules
13. Define reporting standard and forms for electronic reporting from HCIs to HIF.

14. Implement electronic data interchange between HCIs and HIF for verifying patient health insurance and communicating on services and costs (e.g. monthly invoice) – communication module with HIF
15. Define reporting standard and forms for electronic reporting from HCIs to IHP or NIHP.
16. Define and set-up central NIHP database and infrastructure for collecting data from all providers – HCIs and also IHPs if needed
17. Implement electronic data interchange between HCIs and (N)IHP to report electronically with no or not many additional effort – automatically or semi-automatically generated reports from HCIs central database – communication module with IHP or NIHP
18. Define standard identification procedure, documents and ICT infrastructure (including Electronic health card or other ID) for insured patients
19. Upgrade ICT infrastructure in HCIs, HIF and Pharmacies for using new identification procedures in all health related life events (using HCIs services, checking insurance...)
20. e-Prescription implementation
21. Decide on DRG system and prepare specifications for the implementation
22. Upgrade ICT infrastructure (software) in HCIs, HIF, MOH and (N)IHP and implement DRG system
23. Define and establish new central electronic health records database and infrastructure which will enable all HCIs and other institutions with sufficient rights to store and access patient and other relevant data in the central database – probably located in MOH – it's not needed to be the last step, but we propose to be implemented after implementation of electronic health card or similar mechanism for identification and authorization.

### 3.1 General software functional requirements

General software functional requirements are prepared for HCIs, HIF, NIHP(IHP), MOH and Pharmacy. Functional requirements are focused on HCIs to become fully operational and networked with other institutions. That means we are not describing e.g. how internal HIF system works and how it should work.

**Important: Specifications are presented on a general level; detailed specifications will be prepared during next activities as specified in TOR and agreed with WG and MOH.**

#### 3.1.1 HCIs

Functional requirements (processes): Patient input (checking patient insurance, creating/opening patient record, scheduling, waiting lists, placing the patients, doctor acceptance); Providing and recording services for patient (diagnosis, laboratory, treatment, nursing, rehabilitation, other services, ...), Patient discharge (preparing discharge documents, preparing invoice documents, prescription, reporting on costs, achieving patient records...); Electronic Cost reporting to HIF; Electronic reporting to (N)IHP; Accountancy (monthly preview reports, preparing invoice, history;

price lists); other administrative and accountancy processes; Statistics and business reports; automatic updating of registers or coding lists with HIF or MOH.

### **3.1.2 HIF**

Functional requirements: interface for checking patients insurance by HCIs; receiving monthly cost reports and invoices from HCIs; receiving reports and invoices from Pharmacies, receiving reports from NIPH; Secure web portal for MOH with relevant data on drugs, costs and other relevant data; Web accessible registers and coding tables relevant to HCIs; Other web available functionalities and data relevant to HCIs or public.

### **3.1.3 NIHP, IHP**

Functional requirements: interface for receiving reports from HCIs; confirmations to HCIs software; automatic tool for reminding HCIs with no reports sent (e.g. via e-mail); web portal with relevant functionalities; data and reports for HCIs, MOH and public.

### **3.1.4 MOH**

Functional requirements: central database with electronic health record, receiving EHR from HCIs, sending EHR to HCIs, digital signature or other security mechanism; implemented security scheme for accessing data; detailed log database on all accesses to central database; digital archive on EHR; Web accessible registers and coding tables relevant to HCIs; receiving data on drug stocks from Pharmacies through secure web access; receiving data from HIF on insurance status and drug status through secured web access

### **3.1.5 Pharmacy**

Functional requirements: automatic updating of registers or coding lists with HIF or MOH; reporting on drug stocks, costs and prescriptions to the HIF information system (positive list); reporting to MOH on drug stocks.

## 4 IHIS CONCEPT AND GENERAL NETWORK ARCHITECTURE

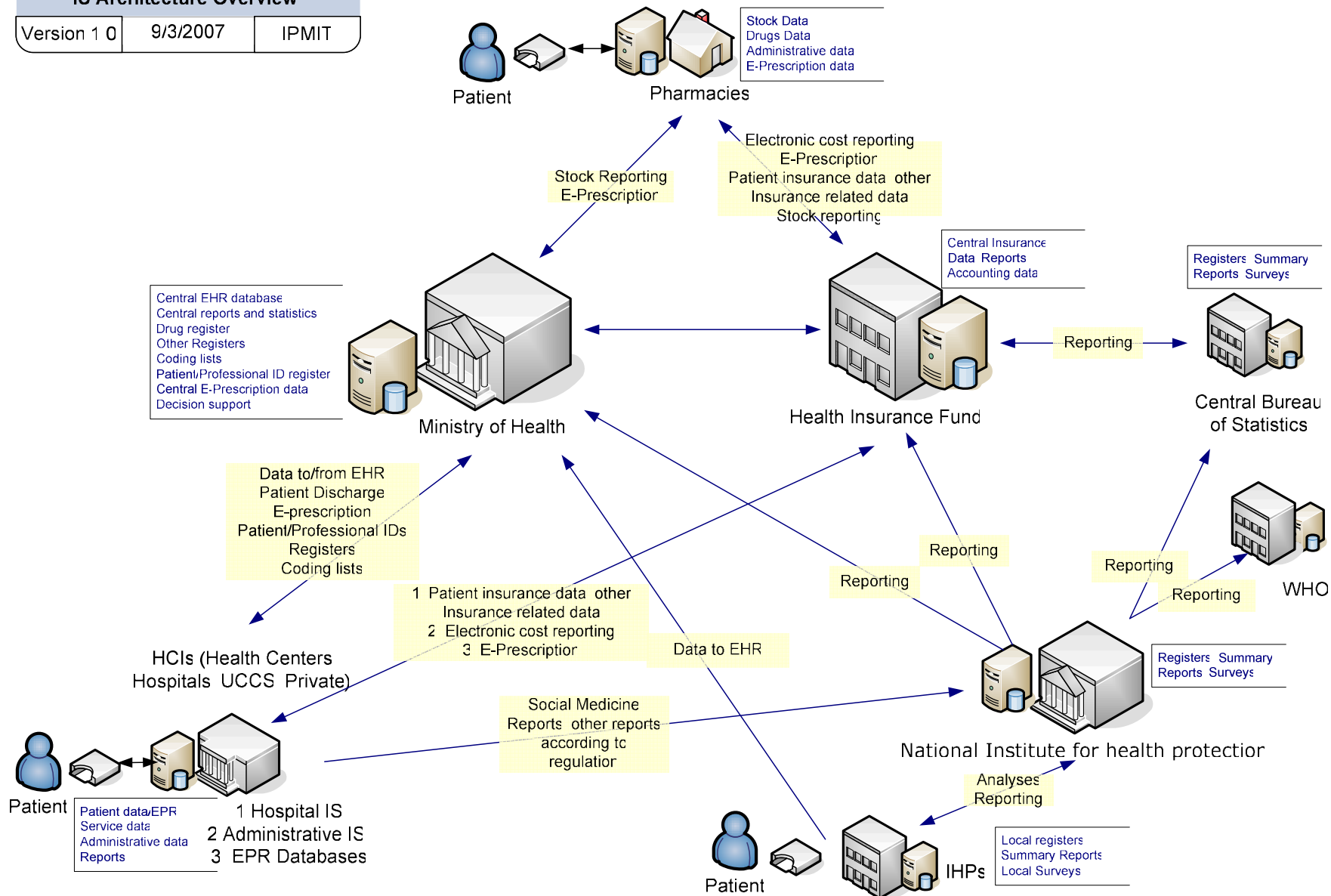
### 4.1 Introduction

In the process of drafting specifications of future IHIS it is important to have a clear picture, named also “the big picture”, who are key players – institutions in the system, who is communicating with whom, how they are communicating, where is the data stored, which data would be transferred through network and similar issues. On the basis of acquired information from first and second visit we prepared IHIS concept and general network architecture in the graphical scheme (next figure).

Logical scheme is presenting all described institutions in this document. For each institution it is evident which data is stored there or would be competent to store it (only data relevant to IHIS – on a general level). Scheme is also showing communication channels which will be implemented through internet (probably VPNs) and what data will be transferred or accessed by institutions.

**It is important to stress that this scheme is a logical view of the system and it is showing institution competences and obligations regarding health care data. Physical implementation (locations of servers, central databases...) will be described in detailed specifications of IHIS.**

IS Architecture Overview		
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## 4.2 IHIS Concept description

IHIS is basically central oriented information system with strong networking capacities connecting all relevant institutions and information systems in health sector in Macedonia. It consists of described components:

1. **Central IHIS database for patient health data and personal data:** It is planned to set up one central database for EHR and/or EPR data and prescription data. The database will be accessible to general practitioner and other doctors according to security schema, and also accessible to patients. Most reasonable physical location for central database is MoH data center. Decisions to be made:
  - a. What medical and personal data should/can be stored centrally (EHR) according to legislation?
2. **Central database for central registers and coding tables:** It is planned to set up all common health registers and coding lists in central database in data center in MoH. All other institutions will use unified registers and coding lists (e.g. drug register, IDC-10 coding list)
3. **Central system for identification:** Central system for patient identification and professional identification will be established. Each patient and professional staff will have their unique identification number. Decisions to be made:
  - a. What technology to use for identifications (smart card, bar codes...)
4. **Central software for data interchange/interfaces:** It is planned to establish central system for health related data interchange between health care related institutions. It is planned to develop interfaces according to world known standards on this field. Some interfaces: interface for checking patient insurance, interface to Pharmacies, Interface to HIF for reporting, interface to (N)IHP, others. Decisions to be made:
  - a. Who will pay for adjustments of third party software used by e.g. Pharmacies, Fund
5. **One-Stop-Shop Health Web Portal for:** One-Stop-Shop Health Web Portal will be established where patients or professional staff will have access to general or public information and also personal and health data according to security schema. It is planned to establish few sub-portals, e.g. for doctors, for patients, for public, for reports/statistics.
6. **Information system for HCIs:** It is planned to set up information system for HCIs for medical/hospital processes. Hospital or medical information system will provide modern information services for HCIs. It will support all relevant medical processes and data interchange with central information system. Information system could be implemented centrally and totally web based (physically running in MoH data center and accessible through web portal for HCIs), or it could be implemented locally for each HCI (physically running in HCIs) and then connected to MoH data center. Decisions to be made:

- a. Does hospital/medical information system support also administrative and accountancy processes within health care providers?
  - b. Hospital/medical information architecture: totally web based, client server based, mixed architecture, location of servers?
7. **Central information system for reporting:** It is planned to establish central database and software for collecting reports from HCIs and Pharmacies according to the regulation. Possible physical location for this system is MoH data center. Software will be capable to gather all reports centrally, to store reports, and to transfer data to other institutions using common interfaces.
8. **Central Hardware and telecommunication infrastructure – Data Center:** Heavy duty data center and telecommunication infrastructure should be set up in MoH where all described central systems and databases will be hosted. Detailed specification for this center will be prepared (servers, network, backup, switch, router, UPS...)
9. **Local Area Networks for HCIs:** Most HCIs still don't have any local area network or it is too weak to support future system. It's is planned to establish local area network for included HCIs and to set up personal computers for professional stuff (also training will be included).

Basic philosophy of IHIS is first to provide software, hardware and communications for those institutions they still don't have any software or is relatively old and useless for the future system (Health centers, Hospitals), and second to provide interfaces for institutions/systems they already use their software (HIF, Pharmacies, (N)IHP). It is not planned to develop new software for HIF and Pharmacies or to develop interfaces between pharmacies and HIF. It should be also decided if new software for (N)IHP should be developed during this project – it is planned to establish central database for reporting where (N)IHPs could acquire data, but it's is not planned to develop software for further analysis, indicators and research performed by (N)IHP.

### 4.3 IHIS Process description

The IHIS process starts with **patient** who visits **general practitioner** while having some health problems or needs. Patient identifies him self with **unique identification** (Smart Card, Plastic card with bar code, health book number, other number). General practitioner (GP) uses his professional identification and patient identification to start process within the Health information system. **Information system** first automatically checks **patient ID and insurance**. According to GP rights and policies, information system offers to the general practitioner new data stored in **EHR central database** – if any. GP can check new data in EHR or request more detailed data from third health care provider. After medical examination and checking data in the information system, GP can decide on diagnosis and further process. Data about diagnosis, further procedures for diagnosis (e.g. laboratory), doctor's note for hospital, treatments or prescribed drugs are all stored in the **Electronic patient data (EPR) or EHR central database**. After that patient leaves GP and visits other HCIs or accomplishes other examinations if necessary. During next examinations or during staying in the hospital, patient always uses his unique identification document to identify him self,

to check insurance electronically and to enable doctors to gain access to his EPR or EHR and after that supplement EPR or central EHR with new medical or other data according to the procedure (e.g. discharge letter, disease). The most important gain of the new integrated information system is unique identification, electronic insurance checking, and access to central EHR database for patient medical data wherever patient uses some medical services.

After finished treatments or examinations in several HCIs patient can return to his GP. GP can check all data about treatments or examinations in the central EHR or EPR database, check discharge letter or some other treatment/therapy conclusions. GP can also decide **to prescribe drugs** to the patient – in this case doctor uses information system to select drugs from the register and to confirm (prescribe) drugs to the patient. Data about prescription is stored in the central database and can be used either for Pharmacies when issuing drugs or for statistics on prescribing drugs.

When patient gets prescription for drug according to the treatment, he goes to the **pharmacy** having no paper document or paper prescriptions. Only thing he is carrying is his identification card. **Pharmacy information system** uses patient identification card to access central database and to gain data on prescribed drugs by the doctor. Pharmacist issues prescribed drugs to the patient and the action is stored in the central database.

The central information system, physically located in MoH, will enable HCIs **to automatically report** to other institutions according to the regulation. All data will be stored in central database and reports could be prepared automatically or semiautomatic and send periodically to other institutions using common interfaces.

## 5 DOCUMENT, SOURCES

- [1] Terms of Reference; Consultancy for Drafting the Technical Specifications For Health Information System
- [2] Strategy for the Development of Macedonian Integrated Health Information System; Final Draft
- [3] Information from the conducted survey of the current conditons with ICT resources in healtcare institutions in the republic of Macedonia
- [4] Tender specification for basic information system in Health Center Skopje
- [5] Tendeskata dokuemntacija za izgotvuvawe ili nadgraduvawe na softverski aplikacii za potrebite na Republi~kiot zavod za zdravstvena zaštita i 10 Zavodi za zdravstvena zaštita
- [6] Interviews with institutions (MoH, MoISoc, HCIs, UCCS, WG, PCU, IHP, NIHP)