Creation of Integrated Information System of "HYGEIA"

Project Duration: 2 years (Present phase: the project has been completed and end-user support services are being provided on site).

Number of Users: > 1100

Background Information

HYGEIA Hospital was founded in 1970 by a group of Greek doctors, headed by Dr. N. Christeas, with the aim of creating, our own standards, of a model private hospital. Its first year of operation was in 1974.

The operation of **HYGEIA** Hospital in time supplemented the necessities of the hospital care system. It developed not only into one of the top hospitals in the Hospital market in Greece , but also one of the top hospitals on an international level.

The main objective of the Hospital is the rendering of services with standards of quality, which will satisfy our patients - clients. The high biomedical technology and the specialized medical and nursing staff of the hospital support applied medicine, as much in the field of diagnosis, as in the one of therapy. The scientific achievements of HYGEIA Hospital were, and are the result of the constant extension and modernization of its scientific knowledge.

Web Page: **http://www.hygeia.gr/en/index.shtml**

PROJECT SCOPE

The aim of the project was the implementation of a novel Information System of Health *(Hospital Information System -HIS) for* the Diagnostic and Therapeutic Centre of Athens "HYGEIA". In this project, ATKOSoft S.A. and IBM Greece S.A. collaborated, each one with separate contracts with the "HYGEIA". It is pointed out that this project constitutes the **biggest installation of a complete HIS system in Greece**, with more than **1100 users**.

More specifically, "HYGEIA", assigned to ATKOSoft S.A. the implementation of an H.I.S. system based on *the* aMedLine© *Software Applications Series for the Management of Health Services and to* IBM Greece S.A. the implementation of an *Enterprise Resources Planning (ERP)* system that was based on the *SAP R/3* vertical solution. In this frame, the interoperability between the applications *aMedLine®* and SAP R/3 constitutes part of the project.

The project's objectives were:

- the upgrade of the health services provided and at the same time the offering of new, pioneering services,
- the rationalisation of expenses that are related to the provision of services, as a result of the reduction of operational expenses that the software brings and the increase of productivity of personnel as well as the effective management of services,
- the unified, "patient-centric" management of health services through a central technological infrastructure of hardware, software and networking. The "patient-centric" rationale of the software allowed the unification of all processes by putting in the centre of the operations the patient through a complete health record for the recipient of the services,
- the increased safety both from the side of ensuring the privacy of personal data and the medical confidentiality according to the international legislations, as well as from the side of integrity and reliability of data,
- the collaboration of different "actors" and organisational units of the hospital in a way that allows the effective collaboration between multiple specialities (Group work) for

each patient case (episode of care) aiming to the optimal synergy of scientific resources of the hospital with the patient being the central point,

- the ability of central control of all operations of the various departments via the structured and coded information. Through the use of the system, each sub-system and logical unit of the applications produces automatic Statistical Data which, supplied in a MIS / Business Intelligence system, contribute substantially in the decision-making of organisational and operational character from the administration,
- future expandability whenever this is required - more operations and services so that the software can "be developed" depending on the strategy and the priorities of the Hospital as well as on the degree of familiarization and assimilation of the information systems from the personnel,
- the support of Diagnostic and Therapeutic Protocols, that are fixed by the scientific council of the hospital according to international models and with the collaboration with the "HARVARD MEDICAL INTERNATIONAL", that decrease the margins of medical error, contribute in the training of medical personnel and increase the probabilities for effective care of patients.

PHASES OF THE PROJECT

- Phase 1: Finalization of Functional Specifications (Analysis/Specifications of Requirements). In this phase the study of existing system was conducted and the recording of requirements was completed.
- Phase 2: Logical System Specification and Physical Design
- Phase 3: Implementation of the new information system
- Phase 4: Interfaces with the systems below which were selected by the Hospital:
  - **ERP**: *SAP R/3*
  - **LIS**: *MediLAb, Computer Control Systems S.A*
  - **Home Care system**: Frontis, ATKOSoft S.A.
  - **System for CT & MRI**
- Phase 5: Migration and exploitation of existing data from the old to the new Information System.
- Phase 6: Test operation of the Applications (Unit Tests per application) and the interfaces (Integration Tests). The experimental operation of the system permitted the users to familiarize themselves with the new way of work and gave them the chance to identify possible problems or even improvements.
- Phase 6: Users' training: Doctors (clinical and laboratorial), Nursing personnel, Secretarial support personnel (of clinical departments), Administrative Personnel, Paramedical Personnel and Administrators of the new information system.
- Phase 7: Transition from the old system to the new one and parallel operation of the two systems so that the correctness and functionality of the applications of the new Information System are ensured and evaluated
- Phase 8: 24 hours, 7 days a week end-user support during parallel operation.

ANALYSIS/SPECIFICATIONS OF REQUIREMENTS

During the phase of analysis and collection of requirements more than 120 meetings were realised with everyone involved in the operation of the new Hospital Information System which aimed at the briefing in the operation and the processes that are executed in each department/organisational unit. The requirements that were described in the document of user requirements were based on these meetings with the following people:

- Heads of the Departments: Cardiology Laboratory - Holter Rhythm, Central Laboratories, Centre Of Radiation Oncology, Cytology Laboratory, Computed Tomography- Magnetic Tomography, Angiography, Interventional Radiology & Interventional Neuroradiology, Department of Obesity - Nutrition - Metabolism - Endocrinology, Department of Ultrasound, Dermatology Department, Ear - Nose - Throat Department, Haemodynamics Department, Helicobacterium of The Stomach, Hepatology Department, Histopathology

Laboratory, Hospital at Home, Laboratory of Cardiac Ultrasound, Laser Epilation Department, Lithotripsy Department, Molecular Biology Department, Nuclear Medicine Department, Ophthalmology Centre, Outpatient Clinic - First Aid, Pain Centre, Preventive Health Control Department (Check-Up), Prostate Center, Radiology Department, Thoracic Medicine Department, Vascular Department - Endovascular Department Andrology Laboratory

- *Heads of the Clinics:* Pathological, Cardiologic, Oncology, Thoracic, Haematology, General Chirurgical, Clinical Heart and Vessels, Plastic and Correctional Chirurgical, Cardiac Surgery, Neurosurgical, Urological, Orthopaedic, Chirurgical and Laser.
- *Heads of the* Units: Intensive Care Unit, Intermediate Care Unit, One Day Surgery, One Day Therapy, Artificial Kidney Unit, Bone Marrow Transplantation Unit.
- *Heads of* Nursing and Secretarial Personnel: Clinical Floors, Surgeries, Anaesthesiology
- *Heads of* Outpatients: Medical and Nursing personnel
- *Heads of Pharmacy* and Nutrition
- *Heads of the Admission and* Bed Management

At the phase of the Logical and Physical Planning of the new System, the description of functional requirements included:

- Structure of Hospital "HYGEIA": Units, Departments, Laboratories, Clinical, Pathological sector, Chirurgical sector, Floors and Nursing personnel,
- Processes / Use of electronic file: Flow chart of processes, Searching and finding patient, Card of patient - Appearance of patient's data, Modification of patient's demographic elements, patient's Follow-up,
- Processes / Appointment booking: Definition of availability of doctors /instruments /rooms, Reminder appointment,
- Processes / Outpatient: Flow chart of processes, Search of file, Creation of file, Management of orders of examinations, Creation of incident, Creation of order, Cancellation of order, Implementation of Examination, Payment, Transformation of incident from external to internal one.
- Processes / Internal patient: Flow chart of processes, Admission, Movement, Discharge from floor, Creation of discharge document, Cancellation of discharge, Discharge from office of movement, Management of sessions, Beginning of authorisation, Expiry of authorisation, Treatment plan, Nursing action, Pharmaceutical treatment, Audit Trail, Medical plan of orders and medicines, Recording of Medical orders, Treatment of medical orders, Creation of order, Cancellation of order, Debit of services, Recording of results, Ratification of results
- Management of medicines: Flow chart of processes, Projection of medicines for the patient, Debit of patient's medicines, Return of patient's medicines, Cancellation of patient's medicines,
- Management of materials: Flow chart of processes, Projection of materials of patient, Debit of materials of patient, Cancellation of materials of patient,
- Processes of Department: Order of Examinations, Flow chart of the process of order of examination, Search of examination, Registration of results, Ratification of results, Cancellation of examination, Debit of materials, Debit of medicines
- Definition and Coding of Parameters: Management of services, Management of action (types of results), Management of parcels, Management of check-ups, Management of protocols, Management of models of monitoring, Management of medicines, Definition of the list of usual medicines, Parcels of Examinations, Change of parcel
- Safety: Access, Responsible / Substitute doctors, Nursing personnel of floor, On duty, Departments, Definition of co-serving doctors/teams, Definition of substitute(s) of the responsible doctor/team, Change of responsible doctor
- Management of users: Management of teams of users, Link departments
- Issuance of Statistical Reports
- Interface with SAP: SAP's update from aMedLine©, aMedLine©'s update from SAP

APPLICATIONS INSTALLED

Patient Administration Information System

Patient Administrative Services Module involves integrated systems that manages and coordinates all aspects of patient care from the pre-registration of patients, appointments, assignment of beds to patient, patient billing and patient requisition of medical reports.

This module organizes data between the systems so that authorized staff in all hospital departments has access to timely and complete patient information. It ensures quality care, and helps caregivers expedite proper treatment and reporting.

The Patient Administrative Services Module ensures that patient information is formatted uniformly, communicating accurate data throughout the hospital, eliminating duplication of effort among multiple departments and providing an audit trail for department managers to maintain quality assurance.

The module incorporates the following basic functions:

- PMI (Patient Master Index) Registration
- Waiting List Management & Appointments Scheduling
- Bed Management for Impatients
- Admission, Transfer and Discharge of Patients

Nursing Station / Clinic Information System

A user-friendly and comprehensive module that is universal across all wards and nurse stations and:

- Automates nursing tasks and hospitalisation management
- Facilitates the workflow between ward nurses and other departments
- Allows the structured recording of Care Plans
- Automatically updates the Patient MHR with hospitalisation-relevant data.

The module integrates the following functions:

- Ward Monitoring
- Patient Information (at Ward)
- Care Plan Management
  - Care Plan Development
  - Nursing Tasks Scheduling
  - Care Plan Service - Results Reporting
  - Care Plan Services Revision
- Patient-related Ward Orders Management for Service, Medication and Medical Material Ordering

Medical Management / Clinical Support Units Information System

The application covers:

- Electronic medical orders from the medical personnel regarding the issuance of orders for Examinations, Nursing Acts, Pharmaceutical treatment, Calls of Doctors - Advisors, Dietetic Needs
- Patient monitoring through the results of execution of medical orders (results of examinations, electronic card for issuing pharmaceutical treatment, measurements of vital points, etc)
- Management of Medical Diagnoses: the doctor enters his initial (during admission) and his final diagnosis (during discharge), using ICD10 codification. The system permits the entering and follow-up (according to episode of care logic) of multiple diagnoses (one main diagnosis, and a lot of secondary).

Clinical Management via Touch Screen, Tablet PCs

For the successful **attendance of medical personnel** with regard to the issuance of medical orders and the patient monitoring, particular attention was paid to the functionality of the applications in combination with the better performance via a friendly interface.

A **special module for Touch-Screens and Tablet PCs** was developed, for the use of the applications by the medical personnel. This was done aiming at the facilitation of the quick familiarization and the increased efficiency of medical personnel. The application in both Desktops and Touch Screens offers important assistance for the avoidance of medical errors. Indicatively the following possibilities are reported:

- *Electronic prescription* with controls based on: the determination of the maximum allowed quantity (Alert Values), contradictions of active substances in the same prescription, patient allergy in active substances, etc.
- *Issuance of Medical Orders* with control based on diagnoses, sex, special characteristics (pacemaker, pestiferous illnesses, etc)
- *Predefined Electronic Protocols:* for the recording of medical, therapeutic and nursing services that are supplemented by the medical and nursing personnel based on DRGs (Diagnostic Related Groups) that either follow some external model (i.e. based on foreigner bibliography), or they are specific to the organization.

Management of Laboratorial/Diagnostic Departments Information System

This application covers a wide range of common needs:

- Management referrals,
- flow of work internally within the department for the preparation and implementation of examinations,
- Search of previous examinations for the patients,
- Registration of results,
- Ratification of results,
- Cancellation of examination,
- Debit of materials,
- Debit of medicines.

All the data that result from the provision of services and the operation of the system are incorporated automatically in the Electronic Medical Record for each patient. The Electronic Medical Record has been developed based on the latest technological developments and materialises Multimedia technology for the management of data in multiple forms – vital signs, picture, files of sound, files video, etc.

The software presents all the pending issues categorized and all the essential elements for the communication are presented in a simple and self-explanatory fashion. Possibility of data mining with criteria of search, cross-correlation with other results of the same patient, etc relieve the personnel from essential but time-consuming effort providing with safety and reliability all the essential information. The management of information is solid with minimisation of errors, with almost half the required time and consequently essential reduction of cost of production, regarding employees' time.

Tracking Order progress: Like any other order within the Order Management Module, having ordered a Lab service or test, the issuer can monitor and track the order progress

Interface with Radiology modalities: The system may interface directly with medical devices and equipment so as to acquire on line actual medical data and readings that are integrated, in a structured way, into the Multimedia Health Record of each patient. Such medical devices are:

- ECGs
- Digital Cameras
- Lab Analysers
- Axial Tomographers

- X-Ray Equipment
- Endoscopes
- Electronic Stethoscopes

Pharmacy Information System

The Pharmacy module incorporates functions dealing with:

Drug Inventory Management & Codification of Drugs

The codification mechanism for Medication involves the formation of a list of pharmaceutical products **sorted either by means of alphabetical order or area of application**.

Codification of Drugs & Substances is carried-out by means of the following data fields:

- Title/Name,
- Packing,
- Indications / Contradictions /Side effects,
- National Drug Organization codified value,
- Active Substance (tincture).

The mentioned fields of information and the overall codification mechanism allows for:

The search of the database for **related drugs** with respect to the **active substance** characteristics

The search for **countereffects** on the basis of the information available in the database concerning interaction between the active substances.

Composition of new drugs with respect to the formation of composite drugs (i.e. for the development of combined serums)

Medication Ordering

The module is functioning as a departmental service to all authorised personnel that are placing orders for Medication and Medical Materials.

Drug Monitoring (expiration, dispense policy)

The module includes special reports to provide information on drug expiration alerts and drive decisions based on the organizational drug dispense policies.

Patient Allergies, Counter-indications, Alternative Drugs

Based on codifications, the system allows the scientific personnel to check **counteractions** and **search for relative drugs based on active substances.**

Also, because the drugs are codified, it is possible for the scientific personnel to conduct correlations between prescriptions and diagnoses or other medical information for a patient or group of patients.

In any case, the system alerts the requester of any given prescription schema, correlating drugs' active substances given their counter-indications, and in relation to the patient's allergenic profile.

Provision is made for cases whereby the Pharmacy **does not have in stock** a specific medication that has been ordered.

In such cases the Pharmacy may send to the order requester another similar type medication based on the ordered drug active substance; the user is **immediately notified** for this change via the patient-related Medication Order Monitor since the altered medication is shown by a different colour. Via the same Monitor, the user who placed the order may see the medication initially ordered.

Drug Manufacturing

Based on the patient's Care Plan issued by the instructing doctor, the system incorporates a drug manufacturing module, extensively used in Medication prescribing process, especially for

Medication Cocktails. The module exhibits great adaptability and intelligence that assists the authorized user to manufacture medication cocktails

Emergency Room

The Emergency Room (ER), being treated the same way as any other department of a Hospital, incorporates two main differences:

- A patient can enter the ER anonymously, especially in cases where the collection of patient information is technically impossible and the time is running critical. In these cases, a Medical Case is being registered for the patient temporarily, and the formal registration takes place and time in the future.
- There are critical issues involved in prioritising the Waiting List for ER, depending on the availability of ER resources, introduced by criteria such as Hierarchy of incidents in the waiting list based on correlations of factors such as, i.e.:
  - Degree of priority of each incident,
  - Survival probability per disease,
  - Age patient,
  - Demanded date of admission.

It is pointed out that the system is dynamic and not static so as to effectively reflect the changing needs of the organization over time.

Blood donation

The module covers completely all the work of the department and extensively follows the routine of the department.

The system is capable of maintaining an inventory of stored usable human blood products and automatically recording any haematology tests performed. Subsequently, a blood donor file management subsystem is capable of maintaining a list of blood donors, updating the list and processing the list to retrieve donor names, locations, and contact date by blood type, area of the donor, or any user-specified criteria.

The System includes: Patient's card with complete data, easy access in all the previous hospitalisations of the patient, unlimited diagnoses per movement, Recording of Particular characteristics - Medical history, Childhood illnesses, Medicines, Surgeries, Allergies, other substances (alcohol, smoking, toxic), General situation of health, Family's history, Daily recording of Nursing File data, Course of Illness, Pharmaceutical Treatment - Issuance of Individual Prescription, Issuing of medicines, Follow-up of vital points, Opinions of advisors, Symptoms, Discoveries, Diagnosis, Complications, Natural examination.

Therapeutic Radiation Oncology Information System

The system allows the management of special services such as Radiation Oncology whereby:

- Complex and very expensive equipment, powerful computers and modern technological know-how are required.
- Services are provided at regular time intervals (at specific "visits" and "sessions") taking, though, under consideration factors such as the minimum time period required between two "sessions" (i.e. dependent on the dose of radiation transmitted for each session).
- The scheduling of "visits / sessions" is done automatically based on a predefined session plan as well as the availability of doctors and equipment.

By the use of this module, the user is able to:

- Define equipment availability
- Define Visit/Session Plans

- Schedule Visits and Services
- Record Session and Services Results
- Automatically charge pertaining services and visits to patient

Dietary Control Information System

The Dietary Control module supports the administration of meals to hospitalised patients.

Meals can be defined:

- Either daily (whereby a diet is defined for the whole day including all meals)
- Or per meal timing (whereby separate meals are defined for breakfast / lunch / dinner for each day)

The software supports the parametric definition of codes of meals per diet used by the hospital, in terms of meal substances, such as, for example:

- Fat Percentage in Diet
- Diet without salt
- Un-hydrated diet
- Pre & Post-operation diet
- Low-cholesterol diet
- Low-sodium diet
- X gr Protein Diet (whereby diets with different amounts of proteins can be defined)
- Fasting diet

When assigning diets for hospitalised patients, the user simply selects either the patient or the room / bed at the diets management window. When either one of patient or room / bed is selected the other attribute is automatically completed (i.e. in case the patient is selected, the software automatically completes the room / bed where this patient is hospitalised).

In order to compose each patient diet, the user simply makes the appropriate selection from the list of predefined codes for each day.

The list of patients per ward, with their designated diets, is shown at the appropriate department, responsible for fixing and distributing the meals. Specifically, the system allows the automatic issue of reports that facilitate personnel to:

- Schedule the filling of food carts
- Schedule and distribute the meals to wards.

Surgery Management & ODS Information System

The system has a comprehensive Surgery Management module that allows:

- The scheduling of Operating Theatres
- The management of surgery orders by doctors for specific patients
- The management of pre-surgery services
- The transfer of patients from ward to Operating Theatre
- The management of the Surgery Department including the recording of Operation details as well as the management of Operation-related materials and drugs.
- The management of One-Day Surgery Services (ODS)

The workflow and rules pertaining to surgery management depend upon the organizational model as this is implemented via the software

Main functions

Operating Theatres Scheduling: In a concept similar to the management of appointments, the system allows the scheduling of operating theatres and in specific:

- The parametric definition of availability per Operating Theatre Room both for default availability and availability per day.
- The booking of rooms for specific patients / Operations.
- The cancellation or modification of bookings

Surgery Order Management: Depending on the organizational policy, the system supports the placement of "Surgery Orders" that:

- Are placed by doctors or on behalf of doctors for specific patients.
- Are automatically routed to the Ward Monitor of the Ward and can be accessed by nurses via the Services Monitor for each patient
- Depending on the organizational policy, may serve as prerequisite for the transfer of the patient to surgery.

Pre-Surgery Services Management: The function provides the possible for the organization to define specific groups of services that should be provided to the patient prior to surgery. These services may be:

- Medical (i.e. routine lab tests)
- Non-medical (i.e. washing, shaving, removing jewellery, etc.)

The group of pre-surgery services is management as any other order via the system and serves as a "checklist" for nurses while preparing the patient for transfer to surgery.

Transfer to Surgery: Via the Inpatient "Movements" function, the system allows the transferring of the patient to the Surgery Department. When a patient is transferred to Surgery by the ward staff:

- Surgery Department staff gets automatic access to the patient's MHR with full history, epidemiological details, etc
- Nursing Ward staff continues to see the patient in question on the Ward Monitor as well as have access to the patient MHR.

Surgery Department Management: For each pending surgery order, Department staff documents the exact type of operation to be implemented for each patient by selecting one or more predefined codes for specific operation(s).

One-Day Surgery: The One-Day Surgery module (O.D.S.) has been specially developed to cover the particularities of such departments.

In specific, the module allows the management of multiple surgery episodes per surgery bed / per day along with the other surgery management features such as management of surgery orders, recording of surgery data, etc.

Medical Decision Support Tools (DSTs)

The module integrates a collection of medical software, aiming at supporting health care professionals in the decision making process while collecting and examining medical results accumulated by various sources of information and equipment.

All modules are

- Able to run as stand-alone applications or attached to pre-existing Clinical Information Systems
- Having a scientific content supervised by the European Medical Associations network related to each particular Medical field
- Are multiplatform, available for PDAs , Web environment and PCs

The environment can provide DSTs in a format easy to use for the working clinician. The emphasis thereby is to allow clinicians working in the hospital to have access to medical expert knowledge.

The DSTs has been validated by a network of clinical experts that have assisted in selection and validation of the decision support tools. The DSTs are covering several areas of clinical medicine and special attention has given in Gastroenterology, Endocrinology, Intensive Care, Emergency, Paediatrics and Laboratory Medicine.

The computer assisted DSTs provided can:

- increase the rate of conformity between diagnostic prediction of the initial examiner (i.e. history, clinical examination, basic laboratory) and the diagnosis at discharge with use of DSTs
- increase in the rate of conformity between diagnostic prediction of the final examiner after performance of all examinations (i.e. laboratory, ultrasound, X-ray) and the diagnosis at discharge with use of DSTs.
- increase in the rate of conformity between diagnostic prediction based on the DST and the diagnosis at discharge with and without use of DSTs.
- decrease in the number of patient's who did wrongly not undergo operation or operation was delayed to the total number of patients with DSTs.
- decrease number of diagnostic examinations (i.e. ultrasound, X-ray, etc.)
- decrease period of time between admission and diagnosis
- decrease in the Number of complications (i.e. wound infection) in patients

Telemedicine Information System

The Telemedicine module is differentiated from other telemedicine systems that exist today that are restricted to the teleconference concept, that is, the sporadic exchange of fragmented patient information in request of expert opinion.

The Telemedicine System allows the logged, effective and structured communication between two or more medical experts on the Network, regardless of their physical location.

The structured nature of the system Telemedicine capability and the automatic integration of the process to the MHR are almost necessary prerequisites for a successful Telemedicine Network. The Telemedicine system:

- allows the dissemination of medical expertise and know-how all over the Network members, developing thus the medical skills of the overall organization.
- maximizes the possibility for successful diagnosis since the attendant doctor can acquire expert assistance and fully utilize the medical expertise in the Network, in a fast and reliable way.
- ensures that the communication between the requesting and responding doctor is logged in a structured manner so that all telemedicine activity is recorded and documented. The Audit Trail feature of the system that applies for the telemedicine capability as well, makes it possible to retrieve all past telemedicine requests and answers within the Network along with all relevant data (names of involved doctors, patient name, time and date, diagnoses, e.t.c.).
- the answering doctor has in his or her disposal all medical history of the patient as this is included in the Multimedia Health Record that he or she retrieves from the Network. In this way, expert opinion and telediagnosis are based on actual medical data of the patient.

Home Care Information System

The module implements an Integrated system for the provision and the management of a wide range of integrated homecare services, which are offered in a structured manner by teams of multiple disciplined professionals

The system creates a network of Health professionals, GPs, Social Workers, e.t.c., that work together on the provision of Home Care Services, combining their knowledge and expertise for the benefit of the end recipients of the Services.

All Home Care Services are coordinated via a Virtual Coordination Centre that brings together all actors involved in Service Provision, organises resources and work and manages medical and administrative information of Home Care Service recipients. In this way, Home Care Services, are offered in an integrated and computerised manner so that:

- All medical and administrative information on the patient, including actual medical data in the form of ECGs, biosignals, pictures, videos, values, e.t.c. is organised and continuously updated in a single point of reference - the Multimedia Care Record.
- All medical and administrative personnel providing the Home Care Services works on this single point of reference. Medical Experts from different disciplines also work on this single record.

System Components

The application consists of the following components:

- **Home Care Plan** that is developed and monitoring by healthcare professionals of multiple disciplines.
- **Scheduling of Home Visits** implemented by visiting personnel of multiple disciplines
- Module of **On Line Real Data Acquisition** from Portable Devices for the collection of actual medical readings at home visits and their automatic integration in the patient MHR.

Administration System

The Administration System is a collection of software modules, aiming at customising the whole set of applications, as far as the following aspects are concerned:

- Software Environment Customisation
- Codifications of Master Data
- Parameterisation of Organizational Rules
- User Profiling
- Monitoring Profiling
- Reports Parameterisation
- Security & Access Rights management
- Multilingual Support

Parameterisations / Codifications of Master Data: The system allows the parametrical definition, codification and complete profile maintenance of “organizational entities” to fit each the requirements of each organization. Such organizational entities are:

- Organizational units (Departments, Wards (Rooms, Beds), Pharmacy, Operating Theatres)
- Users (Doctors, Nurses, Administrative staff)
- Organizations (Insurance Organizations, Hospitals and Clinics)
- Medical Equipment (Axial Tomographers, X-Ray Equipment)
- Services (Check-up examination, Blood Test, Vital Signs)
- Medical Materials
- Medicines

Parameterisations / Codifications of Organizational Rules: The system allows the parametrical, dynamic definition of “organizational policies and rules” to fit the organization workflow and security policy. The parametrical definition of rules and procedures applies basically to all aspects of hospital functioning like, for example:

- User Profiles
- Data Entry & Modification Rules
- Waiting List Rules
- Service Ordering procedures
- Department procedures (i.e. right to “cancel” a pending service order upon authentication)
- Inpatient Episode Rules i.e.:

- A patient cannot be transferred to surgery, to ICU or to another Room / Ward without doctor authentication.
- A patient cannot be discharged unless he or she has settled his or her outstanding hospitalisation bill.

For any specific software implementation, based on the above organization-specific parameters, the application is "built" to reflect the organization-specific model with the organization-specific workflow.

Software Environment Customisation: Easy customisation of any software parameters following parameters to fit organizational requirements:

- Menus
- Windows
- Data sheets
- Messages
- Buttons

User Profiling: Fully parametrical development of user profiles without hard code programming. Depending on the entity to which each user is "assigned" (user group), he or she has a specific user profile that consists of specific access and/or modification rights to:

- Function and Drop Down Menus
- Tabs and Forms
- Windows
- Function Buttons
- Fields

It is also possible to set specific access and/or modification rights to specific user within a user group (i.e. a doctor is also part of the management team and needs to have access to data such as managerial reporting); in this case, user rights supersede group rights.

User profile management ensures:

- Security – each user has access only to data that he or she is authorized.
- User Friendliness – users do not get mixed up with parameters and functions that are not needed for their everyday tasks.

Monitoring Profiling: The scientific committee or individual medical can create their own "Monitoring Profiles" through the correlation of an integrated set Care Service results. The Monitoring Profile is actually a listing or correlation of medical results and events, regarded as crucial for the specific patient during the medical monitoring process.

These Monitoring Profiles are integrated into the Multimedia Health Record of each patient and allow seamless monitoring of each patient's health. The software allows the parametrical definition of:

- System Profiles (defined and maintained by the system administrators and viewed by all users)
- User Profiles (defined and maintained by each user and viewed only by him or her)

The capability to customize such profiles for specific cases allows attendant or department medical doctors to monitor the progress of his or her patients in the way that he or she sees fit for each specific case.

After the required parameters have been identified and the way of correlating the data has been defined, the system automatically correlates acquired data and presents the doctor in one of the following formats (user-defined:

- Chronological List
- Matrix
- Graphical Presentation (for numerical data like i.e. vital signs)

- Fluid Balance (measuring the intake / output of fluids)

The resulting flexibility and usability of the Monitoring Profile feature facilitates the overall provision of medical services by the user/medical expert, in a structured, documented, traceable and secure framework.

Security & Access Management: The system offers a robust, multi-level security mechanism that:

- Enforces the organizational security policy across all users and organizational units.
- Ensures patient confidentiality
- Provides complete audit trail of entries and modifications
- Supports the organizational working practice

System administration of the organization can use the security mechanisms of the software to build rules and policies that can be maintained based on organizational model. Security Mechanisms implemented are:

- User Authentication (User name & Password)
- User Access and Modification Rights (per database and application roles)
- Access to Patient Multimedia Health Records
- Audit Trail (of each user application action or database action)
- Software "Locking" (while unattended or idle)

Optional Security Mechanisms

- Data Encryption
- Smart Card Use

Multi-lingual Support: The system has a "translation" facility that allows the easy customisation of any parameters to fit organizational requirements. Via this mechanism and the corresponding tables, the system administrator may centrally:

- "Rename" any of the above parameters to fit particular organizational requirements, without hard code programming.
- Define names for any of the above at multiple languages to offer multilingual support**,** without hard code programming (as long as the character set is available).

INTEROPERABILITY WITH OTHER APPLICATIONS

Interfaces with the following systems which were selected by the Hospital:

- ERP: SAP R/ 3: Communication of the two systems was achieved via Business Application Programming Interface (BAPI).
- LIS: MediLAb. Via the communication protocol HL7
- System of Management of Hospital at Home: Frontis (ATKOSoft): The communication was materialised via interface that was developed in Oracle RDBMS.
- System of Axial and Magnetic Tomography: the communication was materialised via an interface that was developed in Oracle RDBMS, because the other system did not support HL7.
- Interface with application of External Pharmacy: the communication was materialised via interface that was developed in Oracle RDBMS, because the other system did not support HL7.

DATA MIGRATION

Attention was paid in the migration of historical data from the older system. Indicatively, we mention the following numbers regarding the migrated data:

Patients' Demographics	> 350000
External Patients' Incidents	> 270000
Transports of internal patients	> 550000
External patients' incidents	> 570000
Materials charged	> 1700000
Medicines charged	> 3000000
Total services/examinations	>9000000
(from which laboratory examinations)	(>7500000)
Total referrals	> 2300000

USERS TRAINING

The users' training included more than 400 class-hours to the following users' categories:

USER'S CATEGORY	**TRAINEES**
Clinical Doctors	400
Nursing and Administrative personnel of Clinics	300
Departments' Doctors	50
Nursing, Paramedical and Administrative personnel of departments	160
Doctors Secretariats	40
Doctors on Duty	50
Pharmacy	5
Nutrition Unit	3
Administrative personnel	10
IT personnel	5

SUPPORT

Until the end of September 1200 man-days of on-site support services (7 days a week) had been provided.

RESULTS

The "HYGEIA", through the installation of the system aMedLine© from ATKOSoft, gained the ability of managing the medical information in all areas of the hospital:

- Automated workflow between doctors, nurses, labs, etc.
- Management and automation of medical services
- Automation, management and planning of examinations
- Management of medical materials and medicines provision
- Management of floors, outpatients, Surgeries
- Electronic Health Record for each patient

By the installation of this pioneering, for Greece, HIS and MIS system, the hospital optimises both the medical services provision to its patients and the management of the medical information.

Today, the system:

- Supports over 1100 users
- Supports 53 departments including special departments like One day Surgeries, centre of radiation oncology, etc.
- Handles more than 4000 medical actions

The application is expected to satisfy the following annual needs:

- 45000 new patients
- 27000 internal patient incidents
- 60000 outpatient incidents
- 62000 patients' movements
- 230000 materials
- 507000 medicines
- 1100000 services
- 270000 referrals