

Better Information, etter Decisions, better Care— Introducing a Web-based Inventory System for Medical Devices in Moldova

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Abstract – As in most health care systems, health technologies made a significant contribution to improvements in quality of care in the Republic of Moldova in the last decades. However, there are currently no instruments in place to efficiently plan, manage and coordinate investments in health technology. The present work describes the assessment, evaluation and introduction of a web-based application with the objective to strengthen the Health Technology Management (HTM) in the country. The open source tool “openMEDIS” was configured, adapted and successfully introduced in six pilot hospitals. The new management instrument has received good attention by the decision-makers at national and at regional level. As a next step, openMEDIS will be scaled-up to all maternities in the country to facilitate evidence-based planning in Perinatology.

Index Terms – Health Technology Management, Health Information Systems, Open Source Software

I. INTRODUCTION

Clinical equipment is one of the major contributors to the rapid progress of healthcare [1]. The global market today counts more than 10'000 distinct device groups and 500'000 products from over 13'000 registered manufacturers worldwide [2], [3]. Innovation is the growth motor of the industry: There are studies suggesting 50% of all diagnostic and treatment methods we use today did not exist 10 years ago [4]. This constant increase in the variety and complexity of available health technologies require good management instruments to allocate the available resources efficiently.

The review of the World Bank's global \$1.5 billion investment in medical devices showed that there are cases where 30 % of the more sophisticated equipment stock was unused and the rest had 25 to 35 % downtime because of weak capacity to maintain equipment. A root cause turned out to be ineffective management including planning, acquisition and subsequent operations [5].

The foundation for good management practice and good policies is good data. Decision-makers in the Moldovan health care system have yet not been able to draw from a respective information base in order to plan and streamline investments in medical equipment efficiently. Given the large number of international actors and programs with different procurement- and supply channels the need for coordination becomes even more apparent.

The WHO collaborative agreement with Moldova [6] prioritizes capacities to monitor and evaluate the performance of the health system strengthened and systems to facilitate coordination. Considering the large share of investments in medical monitoring its performance deserves a special attention.

In the last years, the Swiss Government has been supporting Moldovan's health care system in the area of Perinatology (Moldova-Swiss Perinatology Project) and in

the Regionalization of Pediatric Emergency (REPEMOL Project). Besides the development of clinical standards, capacity building, quality management, etc., both projects have also taken care of the procurement of respective medical equipment. In this light, the introduction of an electronic information system in order to sustainably improve planning and management of the new technologies was a recognized as a priority by the Swiss Government.

II. METHODS

The process started in 2009 with a qualitative needs assessment looking into the Health Technology Management (HTM) landscape of Moldova – the managerial and technical environment in which an information system for medical equipment will function in the future. The advances in HTM driven by the two projects were coordinated by the HTM-Working Group which involved 20-30 stakeholders mainly from hospital directorates, the Technical University of Moldova (TUM) and Ministry of Health (MoH).

Based on the needs, a software application including a nomenclature system was to be identified and – if necessary – adaptations and translations to be implemented. Along with the SW tool, targeted training modules on both the use of the software application and on the importance in a broader HTM context needed to be developed.

Before the system was ready to be scaled-up it had to be tested in two to three facilities (ideally in places where technical workshops were established in order to assure a sustainable benefit for the hospitals). The data collection was mainly done through biomedical engineering students during their internship or their first assignment in hospitals. In this process, but also in the adaptation and further development of the tool, the Technical University of Moldova (TUM) has played an important role.

III. RESULTS

At the time of the evaluation, HTM in Moldova was not very developed: planning and procurement were largely influenced by donors and vertical intervention programs. The corrective and preventative maintenance of equipment was done by private companies. Technical workshops to service and maintain equipment were normally not present in public health facilities. Often, a head nurse or a director of a department without formal technical background was in charge of equipment management. Given such circumstances, key requirements to a software tool to manage the equipment inventory were identified to be the following:

- Be easy to use (simple graphical user interface).
- Offer possibility for remote data review, analysis, backup and technical support.
- Include nomenclature according to ISO [7].
- Facilitate translation of user interface and equipment tables into local language.
- Allow step-wise approach: Begin with a simple system which can be extended as other areas of HTM start to develop (e.g. maintenance)
- Do not impose high license cost to the public health care budget once the system is scaled-up.

An evaluation of existing tools has shown that most products on the market are either made for high-expenditure health care systems or they are country specific tailor-made solutions. The above mentioned criteria and the literature suggested that web-based open source software would be most suitable. The application which could meet the requirements best was “openMEDIS” [8] - a software originally developed by the Swiss TPH that had also been validated through implementation in similar settings.

“openMEDIS” was programmed using a PHP interface and a MySQL database. The software provides functions needed for systematic collection and exchange of health technology data. Information such as a manufacturer database, an integrated, reduced UMDNS nomenclature (with 325 generic terms), or equipment images shall facilitate data collection. The tool’s main focus is on the management and planning of the equipments and therefore also captures data on suppliers, service agents, warranty contracts and financial matters.

The department of Biomedical Engineering at the Technical University of Moldova has provided significant support in e.g. the translation of the user interface and nomenclature lists or writing of a user’s manual in local language.

Along with the software, six thematic training modules on Health Technology Management and information systems, nomenclature use, data management and -analysis, etc. were created.

The training of the users in three pilot centers was done in a two-day workshop whereby the first day was focusing on theoretical background and the second day involved a practical exercise in a real-life environment.

The data collection itself was rather challenging. Even the minimal datasets that the system required were difficult to obtain. For example, at the hospital level, information about purchase date, expiration of warranty or supplier data was often not present. As a result of absence of systematic

planning in the past years, the paper-based lists found at some departments were often outdated, incomplete or faulty.

Another challenge was the experience of the data collectors who had difficulties in finding the correct nomenclature term for a specific devices or who have not recognized them in the wards. Later on, a consultant was employed to supervise the data collection process and to assure good data quality. After repeatedly addressing and discussing the problems and fine-tuning of the application in the formal HTM working group meetings, the three inventories were initially collected over a period of six months to one year.

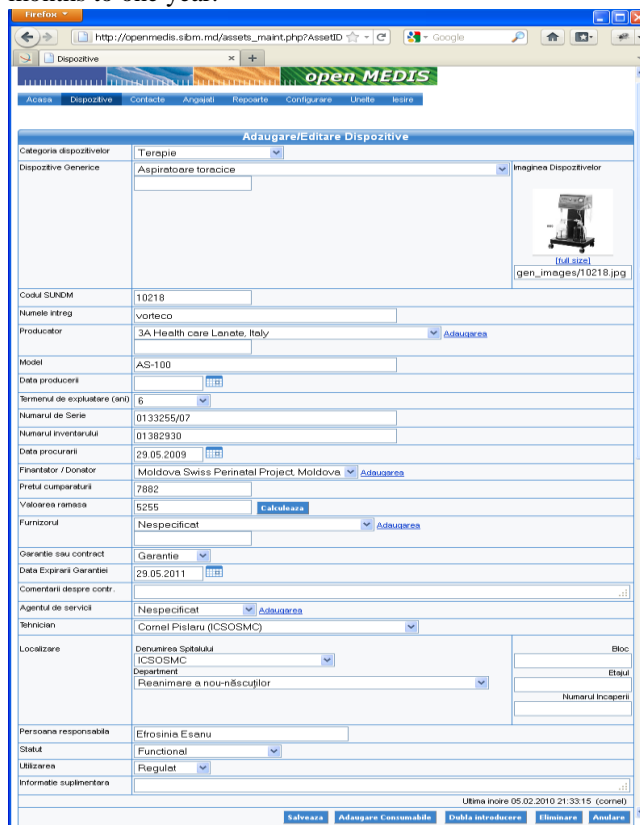


Fig. 1. openMEDIS data entry page in a firefox® Web-Browser

The stock of the three tertiary and secondary level pilot facilities counted 2120 devices all together with a total net book value of more than 33 Mio. MDL at the time of writing. The results also show that the three facilities together managed to assign a nomenclature term to 1775 out of 2120 terms (83.7 %). In other words, more than 80% of the equipment found in the hospital could be denominated using the 325 translated UMDNS terms.

As the piloting was successful, the installation of the software was expanded to three further institutions which were involved in the HTM initiative. The local inventory consultant has trained the new users independently using the training material and the user’s guide.

As for the hosting of openMEDIS, the project has managed to transfer and install the application to the web-space of the Society of Biomedical Engineers of Moldova (SIBM) who is actively involved in the development and promotion of the management instrument.

First analysis of the equipment stock in the three pilot facilities resulted in the summary indicators listed Table 1.

The analysis shows that all three facilities own roughly

the same number of equipment from more than 100 different manufacturers. It can also be seen that Facility #1 (a tertiary level referral hospital) has by far the most valuable stock (21'239'946 MDL) as more sophisticated is in operation there.

TABLE I. KEY INDICATORS FOR PILOT HOSPITALS

Indicator	Facility 1	Facility 2	Facility 3
Number of assets	680	585	855
Total purchase price (lei)	32'102'060	18'522'648	13'716'653
Total remaining value (lei)	21'239'946	9'966'155	1'881'258
Number of manufacturers	102	119	100
Number of suppliers	21	37	27
Departments with equipment	18	35	29
Unique nomenclatures	576	430	769
Non-specific nomenclatures	104	155	86

Other summary graphs are also obtainable from the system at real time; One of these being a “histogram” showing the age distribution of the inventory. As Figure II illustrates, there is still a significant amount of equipment in place which was purchased before independence in year 1991. On the other hand, there was little investment made in the following years until year 2000.

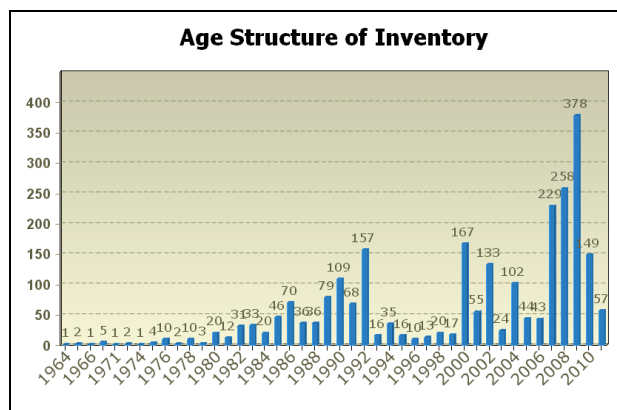


Fig. II. OpenMEDIS output - graph showing the distribution of the equipment stock (partial data for 6 facilities)

Another graph shows the “health” of the equipment. In this case (aggregated data from 6 hospitals) 20 % of the devices are currently not functioning properly or need repair (Figure III).

Now that data is available in a standardized and structured format, the possibilities for analysis and aggregation are nearly unlimited. An intelligent filter in openMEDIS allows a combination of search criteria.

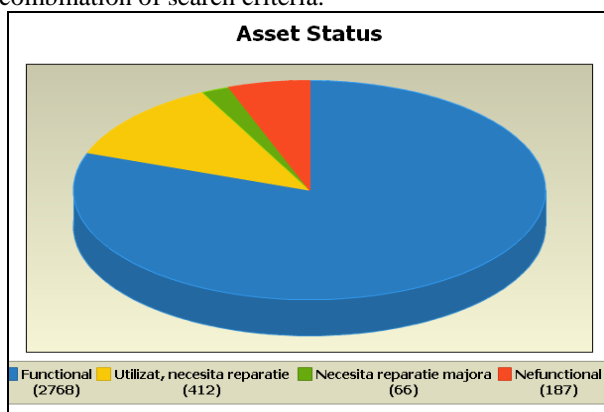


Fig. III. OpenMEDIS output - graph showing the overall status of the assets

Thus, decision-makers at facility, regional or national level have the opportunity to run queries and to extract the information they are interested in. Another feature of openMEDIS is the option to define “essential equipment” and customize it for each facility type- and size. Depending on the clinical discipline, MoH or WHO guidelines and provide such lists which later serve as a standard to which the actual inventory is compared with. Concretely, the Moldova-Swiss Perinatology Project is incorporating the Ministry Health’s standard equipment list for Obstetrics and Neonatology [9], expanding inventory practices to all facilities in the country with perinatal services and using openMEDIS as evidence-based planning tool.

The open source license of the application allowed creating modules and features freely. Properties and characteristics can be removed or new ones can be added. A good example is a corrective- and preventative maintenance module linked to the inventory which is being developed by the Technical University of Chisinau.

IV. CONCLUSION

The situation analysis for medical devices should urgently be implemented in Moldova. The open source application “openMEDIS” has met the needs for an easy to use, flexible and inexpensive system best.

During the implementation it was shown that “openMEDIS” as a tool to collect data on the medical equipment stock was a good choice. After training and a few cycles of quality awareness workshops, the equipment of six hospitals was entered into the web-based application without major problems. The pilot activities were also key in revealing shortcomings in the current documentation system of medical devices.

One of the biggest challenges was the availability of human resources. Until recently, the profession of biomedical- or clinical engineers was not existent in Moldova and respective working places at the hospitals are only at the stage of development. People responsible for the health technologies at the 1st level and 2nd level facilities were head-nurses or deputy chiefs with limited interest and skills for electronic information systems. On the other hand, the new workforce of Bioengineers was yet lacking practical experience.

Nevertheless, the initiative was widely supported because the power of the openMEDIS tool lies in its ease of use and the fact that it addresses the issues at management level at first. This creates acceptance by the decision-makers. Initiatives towards a (possibly commercial) more sophisticated and hospital-based Computerized Maintenance Management System (CMMS), where the focus is rather in the organization of the maintenance should be deferred.

As the project’s efforts to establish further maintenance workshops move along, either a CMMS can be evaluated or further modules (for maintenance, calibration, billing) can also be programmed in openMEDIS.

In particular the web-based- and open source architecture has proven to be suitable to the Moldovan setting. Firstly, because it can be up-scaled with no extra license fees and secondly because it can be hosted, managed and supported remotely.

The tool is also appreciated by hospital managers and by the Ministry of Health. The Ministry is in the process of

building-up an Agency for HTM and formulating respective policies and guidelines. It is also in-line with the World Bank funded “e-Governance” initiative and the Government of Moldova’s proclamation to put an ICT toolkit in place to achieve better governance in public health [10].

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