Hungary

Markhot Ferenc Teaching Hospital: Measuring what's measurable to improve patient care and safety

Challenge

Most healthcare providers have significant amounts of information about their patients, yet they don't know the costs associated with caring for these patients. Today, hospital management needs to know exactly how much a treatment or a disease costs the hospital in order to effectively manage its budget.

Approach

There is a need for a new paradigm shift in healthcare where healthcare providers measure revenues and expenditures similar to profit-oriented businesses. With new technologies and standardised solutions, they can optimise their processes and make them cost-effective. With data recorded precisely at locations where patient treatments take place, hospitals can improve patient safety, reducing time spent on the administration of IT systems.

Case-level data management since 2019

5%
cost savings on medicines and medical device materials in the first year

Inventory of assets registered at locations throughout the entire hospital

Separating data collection from data entry saves time for caregivers to improve patient care

Throughout the 21st century, developments in the medical profession are advancing with the emergence of technologies like artificial intelligence (AI) and machine learning. Yet, in the fields of healthcare process control and management, there appears to be no unified paradigm shift among healthcare providers.

The collection and analysis of data related to the costs of patient-care processes are prerequisites for high-quality and cost-effective healthcare services. For this professional challenge, GS1 can provide an appropriate framework of standards—a mandatory foundation for the smart hospital.

Centuries of providing care

Founded in 1769 as the Eger Hospital of the Hospitaller Order, the Markhot Ferenc Teaching Hospital was named after Markhot Ferenc—a medical physicist who graduated from the University of Bologna and established the first Hungarian medical school in Eger on 25 November 1769.

Today, Markhot Ferenc Teaching Hospital is a leading healthcare provider in the region with a staff of 1,750. The hospital has 990 beds and offers the entire spectrum of medical services, except for cardiac and neurological surgery. In 2019, 10,600 patients were treated and cared for in the hospital.

Dr. József Vácity, Dr. Krisztina Orosz, Dr. Róbert Gyetvai

A clear view of costs

Most healthcare providers have significant amounts of information about their patients (e.g., medical history, diagnosis, investigations, medications), yet they don't know the costs associated with caring for these patients.

Today's hospitals need to take a new approach in providing care. They must measure revenues and expenditures in a similar way that profit-oriented businesses do in order to optimise their processes and increase their cost effectiveness.

In Hungary, in-patient care is financed according to homogeneous disease groups (HDG) based on the Diagnosis Related Groups (DRG) system developed in the United States. A diagnosis-related group is a patient classification system that standardises prospective payment to hospitals and encourages cost containment initiatives.

Using this approach, the hospital categorises patients based on their DRG-based homogeneous disease group, and the government pays for their care based on a set rate. However, in reality, every patient is unique and may need different resources for their treatment, even if the diagnosis (and DRG) is the same.

A major issue for Markhot Ferenc Teaching Hospital was that it couldn't be sure whether one disease was being over-financed while others were under-financed. To get a clear picture, the hospital decided to implement a case-level control system in 2019.

The hospital needed to implement the following tasks to achieve a complete accounting of costs:

- Change the organisational structure.
- Implement GS1 standards, identification keys and barcodes.
- Label the entire warehouse and departmental stock with GS1 barcodes.
- Build the data capture environment.
- Implement special paper based on GS1-barcoded lists of specific professional materials and unit-dose products to which barcodes cannot be added.
- Implement specialised software for data capture and data processing.
- Create an administrative "data entry" team.
- Integrate different healthcare systems and software (e.g., pharmaceutical and financial software).
- Train administrative staff.
- Train medical personnel.

Collecting revenues and costs by case

With the use of GS1 global standards, the hospital realised it had to make care processes more transparent and traceable. The goal was to determine the explicit revenues and costs based on valid data.

To achieve this goal, a case-level control system would be created. The management of the hospital recognised that it was appropriate to take a step-by-step approach to reach this goal.

Using a quote by Galileo Galilei, the key strategy for the solution was to: **"Measure what can be measured, and make measurable what cannot be measured."**

Detailed professional material and medicine administration

Since the costs of medicines and professional materials comprise the largest percentage of variable costs, the hospital started with the standardised identification and marking of pharmaceuticals and medical devices, to measure the use of these materials and record the use for each patient.

Using GS1 standards—the Global Trade Item Number® (GTIN®) and Global Service Relation Number (GSRN)—the hospital uniquely identified all pharmaceutical and medical devices used for each patient, not only in the departments but in the operating theatres, as well.

GS1 standards provided many new opportunities and possibilities for the hospital, its management, staff and even its patients.

One of the most important success factors of the project was the medical staff's engagement. Staff members are often afraid that introducing new technology means more administrative work. It's important not to burden the healthcare staff with further administrative tasks, since their primary job is to treat and care for patients.

"Our philosophy is that data are generated near the bedside where they should be collected, but data entry and processing must be separate from the actual patient care."

"That's why the hospital employs five colleagues called the 'barcode team,' who are responsible for entering data into the system. Based on their experience so far, one data entry colleague is needed for every 200 beds."

Dr. József Vácity MD
General Director
Markhot Ferenc Teaching Hospital

Regarding the administration of professional materials, the only task that the nursing staff members need to do is to put the packaging materials of every used professional material in a container. The container is marked with the name of the patient and is identified by a GSRN encoded in a GS1 DataMatrix barcode. Data entry is done by the barcode team by scanning the barcodes on containers and packaging materials once they have been collected.

Since implementing GS1 standards, the hospital has used standardised identification and scanned barcodes—not only for pharmaceuticals, medical devices and services, but also for transfusions, ordering antibiotics, diagnostics for the identification of patients and healthcare staff, and triage administration.

Markhot Ferenc Teaching Hospital's use of GS1 standards also supports EU regulations such as the Falsified Medicines Directive (FMD), Medical Device Regulation (MDR) and In Vitro Diagnostic Regulation (IVDR). The hospital is taking advantage of the possibilities offered by GS1 standards and the benefits derived from them.

Location registered inventory

Before using GS1 standards, low-value and high-value assets were registered only at the organisational level; inventory picking was complicated, time-consuming and labour intensive for HR and, on several occasions, outcomes were inaccurate. It was imperative for the hospital to revise these practices.

To address this issue, every room of every department was labelled with a GS1 Global Location Number (GLN), which uniquely identifies the physical location and generated in accordance with GS1 guidelines.

In addition, every asset in inventory was uniquely identified with a GS1 Global Individual Asset Identifier (GIAI). Now, each of these assets can be followed throughout its life cycle.

The hospital purchased a laser-engraving machine so that all surgical instruments used in the operating theatre can now have its GIAI encoded in a DataMatrix barcode, engraved on the instruments by the summer of 2020. With the IT system, the medical devices will be properly assigned to operations, resulting in better patient safety. Each instrument in the operating theatre can be tracked throughout its life cycle and any failure can also be monitored.

In the future, the cost of repairing tangible assets – including medical devices – can now be linked to the physical instrument.

Case-level control system

Since 2019, the case-level control system has been operating in the hospital. The main tasks include the division of human costs (e.g., salaries, fees of suppliers) and the introduction of the utilisation of medicines and professional materials (e.g., data collection of expenditures) for the entire hospital.

Successful case-level control has six factors:

- Commitment of senior management
- Allocation of HR expenses (e.g., Fixed income of a surgeon is allocated: 70% surgery inpatient care, 20% outpatient care and 10% vascular surgery inpatient care. Flexible income (duty) is allocated: 50% general surgery and 50% vascular surgery.)
- Itemised data collection of expenditures of medicines and professional materials
- Effective IT system
- Professional advisors like GS1 and controllers
- Committed colleagues

Measurable results

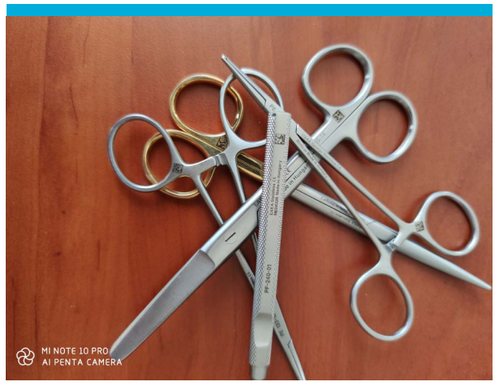
In 2017, Markhot Ferenc Teaching Hospital began the implementation of GS1 standards. The required information technology system was provided of bcMecial.

Tasks performed (in chronological order) included:

- In-patient case-level data entry of medicines and professional materials – September 2017
- Case-level data entry of transfusion data – January 2018
- Case-level data entry of surgical medicines and materials – March 2018
- Triage date entry – May 2019
- Individual identification of rooms with GLNs – July 2019
- Individual identification of tangible assets, room-level inventory with GIAIs – August 2019
- Individual identification with GIAIs via laser engraving of medical devices – October 2019 –August 2020
- Patient identification with GSRNs and wristband printing, and UHF-based RFID (radio frequency identification) patient identification – December 2019 – July 2020
    - The RFID antenna gates – December 2019
    - Wristband printing –March 2020
    - Patient tracking software –July 2020
- Notification process of antibiotics therapy – February 2020

Today, the hospital is experiencing numerous benefits, including:

- In the first year of using GS1 standards, the hospital achieved 5% cost savings on medicines and medical devices, due to improved inventory management.
- During the past two years, the hospital has been using controlling data at an organisational level.
- Since Q1 2019, the hospital has been using controlling data at the case level with certification by the case-level control system.
- By separating data collection from data entry, the hospital has reduced the administrative burden of medical staff to improve patient care and safety.
- For the 1,000 bed hospital, the five data entry colleagues need only 2.5 minutes per patient per staff to enter the daily use of pharmaceuticals and medical devices.
- Daily data of the pharmaceuticals and medical devices used for every patient are now available, enabling the administration of patient-specific device usage.
- As an additional advantage, medication administration is now better controlled, based on the accurate and reliable identification of medications and patients.
- With a unique GS1 identifier, each inventory item can be tracked throughout its life cycle.
- Location registration information is available for both low-value and high-value assets, for faster and accurate location activities.
- The hospital can readily address EU regulations (e.g., MDR) since it implemented a global GS1 standards-based system.
- Due to GS1 standards, the hospital has improved performance, order, discipline and patient safety. In addition, patient satisfaction has significantly increased, and medical staff are fully engaged with the new system.



Components of costs	HUF	EUR (330 Ft/EUR)
Medicine	5 970 Ft	18,09 €
Blood, blood products	1 567 Ft	4,75 €
Single use medical materials	2 586 Ft	7,84 €
Other special materials	90 Ft	0,27 €
Disinfectants	293 Ft	0,89 €
Total costs of medical items	**10 506 Ft**	**31,84 €**
Single use textiles	267 Ft	0,81 €
Costs of other items	**267 Ft**	**0,81 €**
Medicine, anaesthesia	1 027 Ft	3,11 €
Medicine, operating room (OR)	193 Ft	0,58 €
Implanted materials, OR	22 935 Ft	69,50 €
Single use materials, anaesthesia	10 343 Ft	31,34 €
Other special materials, OR	70 Ft	0,21 €
Costs of materials used in OR	**34 568 Ft**	**104,75 €**
VAT (value added tax)	**3 127 Ft**	**9,48 €**
Direct cost	**48 468 Ft**	**146,87 €**

Components of costs	amount	unit	cost/unit	HUF	EUR (330 Ft/EUR)
Doctors' salary, Traumatology	15,40 Ft	working hour	6 948,40 Ft	107 005 Ft	324,26 €
Nurses' salary, Traumatology	6,90 Ft	nursing day	9 868,30 Ft	68 091 Ft	206,34 €
Additional costs of patient care	6,90 Ft	nursing day	3 123,70 Ft	21 554 Ft	65,31 €
Mediacal ward's direct costs				**196 650 Ft**	**595,91 €**
Anaesthesiology	120,20 Ft	minute	410,60 Ft	49 354 Ft	149,56 €
Central OR	120,20 Ft	minute	580,30 Ft	69 752 Ft	211,37 €
Other materials, OR	1,00 Ft	case	330,00 Ft	330 Ft	1,00 €
Operation related costs				**119 436 Ft**	**361,93 €**
Diagnostics, laboratory	764,30 Ft	point	1,20 Ft	917 Ft	2,78 €
Diagnostics, radiology (US, CX, CT)	1 479,00 Ft	point	2,90 Ft	4 289 Ft	13,00 €
Diagnostics, pathology	54,10 Ft	point	1,40 Ft	76 Ft	0,23 €
Physiotherapy	5 388,00 Ft	point	0,40 Ft	2 155 Ft	6,53 €
Total costs of diagnostics				**7 437 Ft**	**22,54 €**
Consultation, traumatology	24,70 Ft	point	5,00 Ft	124 Ft	0,37 €
Consultation, ophtalmology	26,60 Ft	point	1,30 Ft	35 Ft	0,10 €
Consultation, anaesthesiology	998,80 Ft	point	1,10 Ft	1 099 Ft	3,33 €
Consultation, infectology	15,00 Ft	point	2,90 Ft	44 Ft	0,13 €
Consultation, musculosceletal rehabilitation	12,10 Ft	point	1,80 Ft	22 Ft	0,07 €
Consultation, neurosurgery	4,00 Ft	point	10,40 Ft	42 Ft	0,13 €
Consultation, dermatology	6,40 Ft	point	3,00 Ft	19 Ft	0,06 €
Total costs of consultations				**1 383 Ft**	**4,19 €**
Costs of the food and nutrition	6,30 Ft	nutrition day	1 426,80 Ft	**8 989 Ft**	**27,24 €**
Indirect costs				**333 895 Ft**	**1 011,80 €**

Figure 1: Shows cost data associated with Disease Related Groups (DRG) leg operations, collected by the Traumatology department between January and June 2019. Over the six months, there were 88 patients/cases spending 474 days in the hospital. The operations generated a total revenue of HUF 37.597 million (€113.930) Implementing GS1 standards, which made case-level control possible, helped the hospital precisely identify the costs associated with each of the 88 cases.

Data were further analysed and the average of all cases was calculated. The results showed that the average cost per case is HUF 44.145 or approximately €132. The hospital then checked how the expenses of the individual cases differed from the average.

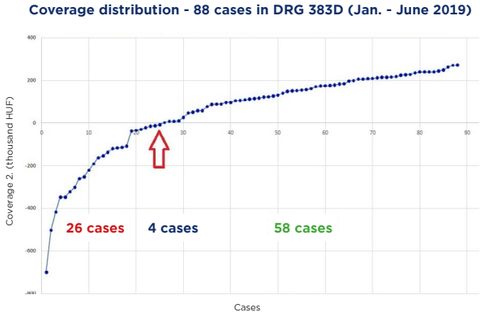


Figure 2: In 34% (26) of the cases, the costs of the operations were lower than average, while in 66% (58) of the cases the revenue of the operations covered the costs. All of this information offers very important input for improving the management of the hospital and making better decisions—all for more effective hospital processes.

Average cost per case is HUF 44.145 or approximately €132

Next steps: patient and staff identification

Markhot Ferenc Teaching Hospital's new project is UHF RFID-based patient and staff location identification. By analysing the measured results of patient journeys and the movement of staff within the hospital, processes and space can be optimised for time savings. This will ultimately help the hospital improve patient safety and efficiency in the workplace.

- Every in-patient wears a UHF RFID-based identification wristband. Based on the detection of data provided by 56 antennas in the hospital, it can always identify the location of each patient. Each staff member also wears a UHF RFID-based badge so that the hospital can identify the exact location of each person. In both cases, the GS1 identification keys will be applied—the GSRN for patient and staff identification and the Global Location Number (GLN) for location identification.
- Another short-term project is the creation of a room maintenance and repair worksheet system. This will include the identification via GS1 standards of notifiers, rooms, faulty instruments and repairmen as well as recording the duration of repair—all done by scanning GS1 DataMatrix barcodes. With precise data provided, the maintenance process can be analysed and verified, and as a result, the quality of work is expected to improve.
- Verification of hand disinfecting is also planned. With a networked RFID reader by each hand disinfectant dispenser identified with the GS1 GIAI, staff members can identify themselves—via GSRNs encoded in barcodes on their name badges—prior to washing their hands. This solution will also help to track the hand disinfection of staff members.

Taking a measured approach

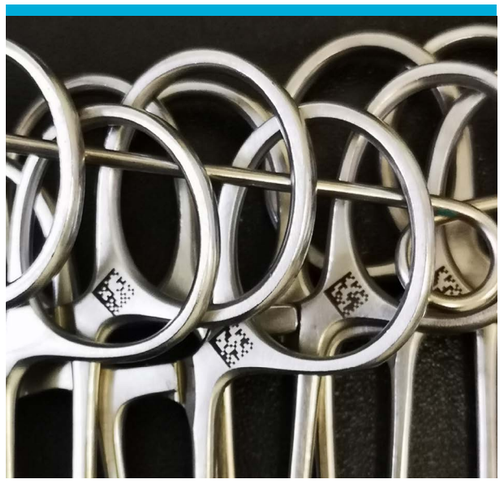
The hospital has implemented GS1 standards, step-by-step. It started with a small project that paid for itself within one year.

Key factors for success include:

- Change the organisational structure.
- Set clear goals. Gain commitment from hospital leadership.
- To motivate teams, involve those impacted by the changes.
- Include pilots as part of the implementation to test the concept and technical feasibility.
- Integrate IT systems into the total solution.
- Get support from GS1—the experts when it comes to standards.

"GS1 Hungary supported us during the whole implementation and development phase. We remain closely connected to them and keep in touch. We really appreciate their help."

Dr. Krisztina Orosz
Strategic Director, Hospital Pharmacy
Markhot Ferenc Teaching Hospital



About the authors

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Dr. József Vácity graduated in 1984 as a General Practitioner, obtained Pediatrics Specialist Certification in 1988, ENT Specialist Certification in 2001 and his Healthcare Manager degree in 2014. He started his medical career in the Hospital of Baja. From 1993 to 2006, he practiced as a full-time private doctor. Dr. Vácity worked as Controlling and Financial Manager at the Hospital of Baja from 2009 to 2011. He was the General Director of the Hospital of Nagyatád from 2011 to 2016, and since then, he has been the General Director of the Markhot Ferenc Teaching Hospital of Eger. Special courses include Hal Krause, Bulletproof Manager, Manager with Catholic Values degree at the University of Kaposvár; Franklin Covey, The 7 habits of Highly Effective People and the 7 Habits Leader Implementation; Franklin Covey coach.

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Dr. Krisztina Orosz graduated as a pharmacist at the University of Szeged in 1996. She obtained a Healthcare Economist and Manager degree in 1999, and completed Medicine Technology Specialist Certification in 2001 and Clinical Pharmacy Specialist Certification in 2019. Dr. Orosz worked as an intern at the University of Szeged from 1996 to 1998. She was a Product Line Manager then Sales Manager at Alcon Pharma Division from 1999 to 2012. She has been with the Markhot Ferenc Teaching Hospital of Eger since 2012, and as Hospital Pharmacy Director since 2015. She was Deputy Medical Director between 2018 and 2019. Since 2019 she has been Strategic Director. She has participated in several clinical research programs and trials. Special training programs and courses: GMP, GCP in 2018; Hal Krause, Bulletproof Manager in 2019; Franklin Covey, The 7 habits of highly Effective People and the 7 Habits Leader Implementation; Franklin Covey coach in 2020; GS1 expert.

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Dr. Robert Gyetvai MD, DEAA is a consultant anaesthetist and currently the Head of the Department of Anaesthesiology and Intensive Therapy in Eger, Hungary. He is a Diplomate of the European naesthesiology Academy. Dr. Gyetvai has gained extensive experience while working in one of UK's National Health System's hospitals in 2008, during which he used in his practice upon returning to Hungary. With an interested in his own speciality, Dr. Gyetvai is focused on how to achieve high standards in the processes of patient care.

About the organisation

Markhot Ferenc Teaching Hospital was founded in 1769 as the Eger Hospital of the Hospitaller Order. The hospital was named after Markhot Ferenc—a medical physicist who graduated from the University of Bologna and established the first Hungarian medical school in Eger. Today, the 990 bedded hospital is the leading healthcare provider in the region with a staff of 1.750 providing comprehensive medical services, except cardiac and neurological surgery. In 2019, 10,600 in-patients were treated and cared for in the hospital.

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