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World Hospitals and Health Services

The Official Journal of the International Hospital Federation

Global identifiers for enhancing efficiency and patient safety

- | Healthcare regulations: driving opportunities for hospitals
- | Our Patient, Our Responsibility: Correct Patient Identification for Patient Safety
- | The Canberra Hospital uses positive patient identification to significantly reduce errors when collecting pathology samples
- | Transparency on a foundation of standards
- | Brazil's Hospital Israelita Albert Einstein makes significant progress toward the full traceability of pharmaceuticals
- | From the simple scan of a barcode to a complete patient safety strategy
- | Decreasing medication errors through bedside barcode scanning (BCMA): our patients deserve the additional safety barrier
- | University of Fukui Hospital Surgical Center creates an integrated sterilization management system for traceability and patient safety
- | Mercy shows how collaboration and the introduction of global identification standards can lead to increased patient safety in the operating room
- | NHS trusts demonstrate benefits of implementing standards

Pollution, the health scourge of the 21st century

- | Pollution and global health – A time for action

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Global identifiers for enhancing efficiency and patient safety





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Global identifiers for enhancing efficiency and patient safety



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This volume of the World Hospitals and Health Services (WHHS) Journal focuses on how global identifiers (barcoding) can support the monitoring of safe healthcare and improve efficiency while reducing waste.

Healthcare automation and digitization offers the opportunity of improving patient safety and efficiency, even if at the same time there are still some challenges that need to be solved. Making sure patients are diagnosed correctly and that they will receive the right treatment at the right time is always an essential concern for healthcare workers. Care is intended to do good to the patients and not to bring them harm. However, there are countless examples of identification errors that have caused harmful effects in patients. A recent, dramatic example involves a doctor that performed brain surgery on the wrong patient.

The use of the automatic identification and data carriers (AIDC) technology, like barcode scanning, proves to be a great enabler of patient safety. Although many countries and hospitals now use barcodes, there is a need for a global system that goes beyond the borders of a department, hospital or country. This technology also offers the opportunity for improvements in efficiency and combating fraud, such as in the stocking of drugs in pharmacies and identification of drugs or devices that are not counterfeit.

Automation and the implementation of barcoding standards in a healthcare environment requires vision and training. This issue of the Journal highlights diverse examples from several countries in which barcode scanning using a global AIDC-system is implemented for patient safety purposes as well as for efficiency and a better healthcare supply chain.

IHF has developed a survey to better understand the use of global identifiers in healthcare organizations around the world; the results reported in this issue underscore that there is a lot of room for further use of global identifiers to enhance the safety and efficiency of health services to patients.

GS1 is a non-profit organization that develops and maintains global standards for business communication. Several of the articles in this issue highlight how GS1 standards and identifiers have capabilities for full interoperability across hospitals,

healthcare supply chains and even country borders.

In several countries, AIDC use regulations act as drivers to combat falsified medicines, improve recalls and reduce reimbursement fraud. Manufacturers and suppliers comply with these regulations. Products that are identified by the manufacturer and can be monitored along the supply chain improve patient safety and increase health system efficiency.

As explained by several authors, one of the most critical steps toward patient safety is correct patient identification. Apollo Hospitals Group, from India, describes the results of a long-term implementation, including barcode-scanning and an appropriate mix of culture change in the form of 'Our Patient, Our Responsibility.' New IT developments in Canberra Hospital, Australia, support safer processes to ensure positive patient identification by using identifiers as building blocks. This has led to more than 40 percent reduction in wrong-blood-in-tube incidents based on clinicians scanning barcodes when collecting pathology samples. In Danish hospitals, the focus has been on full traceability of staff and assets, also using global location identifiers. In Brazilian, Colombian and Dutch hospitals, the primary focus has been on closed loop medication administration safety with barcode assisted bedside scanning. In Japan, the Fukui Hospital Surgical Center created an integrated sterilization management system for traceability and patient safety using the global AIDC system, also leading to efficiency gains in the deployment of nurses. The case study from the US describes how collaboration and the introduction of global identification standards brought increased patient safety in operating rooms. In the UK, the National Health Service (NHS) applying standards to people, products and places, helped quantifying the costs and benefits across the organizations. Learnings from each trust have provided a wealth of knowledge to help future NHS implementations.

All these cases show that staff hours can be gained, errors reduced, and the work environment made more sustainable.

The International Hospital Federation is committed to helping its members improve patient safety and efficiency in health care delivery. AIDC global standards make a significant contribution to this effort.

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Results from the survey conducted among IHF members

The survey on the use of identifiers received 28 responses, providing information on the awareness of hospital workers and professionals from healthcare organizations with regard to the benefits of identifier technology and also an idea of its implementation level by hospitals.

The distribution of responses according to hospital categories is as follows: 44% are general hospitals, 36% are specialized healthcare providers and 20% are university hospitals, given that one response could combine several hospital types. 58% of the respondents work in the private sector, 21% in the public sector and the rest are from a combination of public and private sector.

70% of the respondents indicated having implemented identifiers in their facilities. Medical devices is the type of item for which proprietary identifiers are used the most; 29% of the respondents use them for this purpose. Compared to the other items, the highest score for international identifiers belongs to pharmaceuticals with 15%.

Pharmaceuticals, patients and staff are the three items for which identifiers are used the most (respectively, 58%, 56% and 53% of respondents indicated full coverage), while linen and physical location come first when considering items for which there is no plan to use identifiers, with respectively 39% and 29% of responses.

A question listed the factors preventing the adoption of identifiers. 74% of the respondents said that cost was a major factor, while the absence of interoperability of information systems hinders half of the respondents.

As for guiding the adoption of identifiers, 63% of the respondents consider costs and 55% the dissemination level to be major factors. Regulatory requirements come third with 37% of responses.

Looking at the benefits deriving from using identifiers, the most important are overall patient safety (for 90% of respondents), physical tracking (80%) and the optimization of the supply chain, tied at third place with the provision of an integrated information system (75%). Increasing staff responsibility is not considered as much of a benefit as the other factors ("major factor" represents 55% of responses), nor is reducing their costs (60%).

To complete the survey, Dr. Oscar A. Miguel, Dr. Enrique Tonelli, CA Enrique Cimino and Dr. Juan Carlos Linares wrote an article on the use of identifiers in Argentina. They reported

that this country is in the process of implementing identifier technology for pharmaceuticals, healthcare workforce, patients and medical supplies at the primary level. The adoption of identifiers for pharmaceuticals is supported by the current legislation and also by the benefits brought across the supply chain in terms of traceability and communication with other stakeholders. They also noticed, in accordance with the IHF survey, that this technology is better implemented in university hospitals and specialized healthcare facilities.

The survey was a preliminary work with the purpose to form an idea about the level of adoption of identifiers in healthcare facilities around the world. This work was developed further by looking for cases that would show the benefits of using identifiers. The above led to the preparation of this journal issue, whose topic is traceability and barcoding.

Healthcare regulations: driving opportunities for hospitals



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ABSTRACT: In today's global healthcare landscape, more and more healthcare regulations are being developed and/or implemented. For example, in Argentina, Europe, Turkey, India, South Korea and the U.S.A., regulations aim to put practices in place to better protect patients as consumers of healthcare services, pharmaceuticals and/or medical devices. Some of the main regulatory objectives include combating falsified medicines, improving recalls, reducing medication errors, improving supply chain efficiency and reducing reimbursement fraud. While specific objectives and timelines may differ from country to country, manufacturers are complying with regulations, delivering medical devices and pharmaceuticals with barcodes that hospitals can use for the benefit of their operations and patients.

Taking a closer look.

What has sparked this heightened activity of healthcare-related regulations? One doesn't need to look too far to find troubling patient safety incidents in the news.

Released in the late 1950's, Thalidomide was prescribed to treat morning sickness in pregnant women. What followed was a man-made medical disaster; over 10,000 children were born with a range of severe and debilitating malformations. One of the world's largest selling drugs, Thalidomide was distributed in 46 countries and advertised as completely safe right up until the time it was banned, in November 1961. We will never know precisely how many women were given the drug, because 'the world was still on paper' at that time, with limited traceability possibilities.

In 2010, breast implants manufactured by the French company PIP were found to contain industrial-grade silicone. This had worldwide implications, affecting about 300,000 women in 65 countries who had received implants made by this company. Since accurate records were not kept, the total number of women affected can only be an estimate; no one really knows exactly how many women received a PIP implant.

In 2017, pharmaceutical counterfeiting involved falsified batches of the cancer drug Velcade, which were found in the European supply chain. Interestingly, the active ingredient in the vials from these batches matched the levels and specifications indicated on the label, suggesting that the counterfeiters had taken lengths to source the drug and cover up their activities.

How are regulations addressing issues like these? When examining regulations related to medical devices as compared to pharmaceuticals, different pictures emerge. Falsi-

fied medicines entering the supply chain appear to be the driving force for pharmaceutical regulations, requiring that products be serialized to authenticate their sources and effectively enable product traceability and visibility throughout the supply chain, and ultimately to the patient.

On the other hand, medical device regulations are focused on making the link between a device (including implants) and a patient to enable precise and highly efficient recalls and post-market corrective measures. Their purpose is global identification—to uniquely identify medical devices around the world and, ultimately, to be able to trace each device's identification data back to its patient via the healthcare provider's electronic health record system. Furthermore, more and more countries are developing medical device and implant registries where globally unique identifiers are stored. Such registries can facilitate recalls and enable healthcare providers to contact possibly affected patients.

Good news and challenges

While hospitals are typically not targeted with these regulations, they can certainly benefit from them.

Consider that manufacturers from around the globe are labelling or marking their medical devices and pharmaceuticals with globally unique and harmonized identifiers encoded in barcodes; additional data is also available, like batch/lot number, serial number and expiry date. Currently, manufacturers are using GS1 standards on healthcare products for regulatory implementation in about 65 countries.

As manufacturers' products arrive at their warehouses, hospitals are starting to leverage the value of information provided by regulatory requirements. More and more, hos-

pitals are automating processes that are mostly manual and paper-based, resulting in cost and time savings, productivity gains, lower risks and, ultimately, safer environments for patients.

The unique identification of medical devices and related products like surgical instruments is helping hospitals to optimize operating room processes for improved inventory management and better patient outcomes via post-procedure surveillance and monitoring; it is also facilitating recalls down to the patient level.

Still, hospitals may find regulation-driven changes to be burdensome. Not all manufacturers comply in the same way; for example, barcodes may differ in quality and “read-ability” and multiple barcodes may appear on packages, causing confusion and errors. In addition, they have to deal with changes in administrative procedures and the need for investments in software, systems, scanners and training.

Furthermore, regulatory-driven actions result in manufacturers labelling pharmaceuticals with barcodes at the secondary package level. Yet, hospitals need medicines to be identified and labelled as single dosages for administration to patients, thus preventing medication errors. As hospitals take on this responsibility to add labels at the single-unit dose level, they are investing in what they believe is improved patient safety.

Even though more and more hospitals are starting to take advantage of what regulatory compliance has delivered to them, there is still a lot of work to be done...and it takes time.

Simply start scanning

What can hospitals do? Hospitals can begin to realize the benefits of global standards-based barcodes already applied on products by manufacturers...by simply starting to use them.

Consider that many hospitals of all sizes and all around the world are already using barcodes. In the UK, the

Scan4Safety programme is showcasing the scanning practices and tangible benefits of six different NHS hospital trusts as demonstrator sites. In Australia, Brazil, Colombia, Japan, several European countries and the U.S.A., to name just a few, hospitals are scanning barcodes in operating rooms, pharmacies, supply rooms and at patient bedsides. They are starting to experience the value of barcodes and the information they carry—data that can be collected, managed and ultimately used for the benefit of their operations and patients.

Healthcare environments are quickly evolving with regulations as major drivers of change. It's time to get started and help build a better and safer healthcare future for everyone.

Biography

Géraldine Lissalde-Bonnet is the Director of Public Policy for Healthcare at GS1 Global Office. She leads the GS1 Healthcare Global Public Policy Work Team, whose mission is to interact with decision makers globally and provide strategic leadership on the use of GS1 standards in the healthcare sector, with the goal of enhancing patient safety and supply chain efficiencies worldwide. Based in Brussels, Belgium, Géraldine works with her local GS1 colleagues in 112 countries across the world.

References

- Vargesson, Neil. June 4, 2015. “Thalidomide-induced teratogenesis: History and mechanisms.” *Wiley Birth Defects Research*. 105 (2): 140–156.
- Jones, Bryony. January 27, 2012. “Breast implant scandal: What went wrong?” CNN website.
- Taylor, Phil. September 8, 2017. “More falsified Velcade discovered in Europe.” *Securing Industry* website.
- Berry, MG and Jan Stanek. June 2012. “The PIP mammary prosthesis: A product recall study.” *Journal of Plastic, Reconstructive and Aesthetic Surgery*. 65 (6): 697-704.
- Kessel, Lily. 19 April 2012. “Nog meer kapotte PIP-borstimplantaten.” *Journal of Plastic, Reconstructive and Aesthetic Surgery*. doi: 10.1016/j.bjps.2012.02.019
- GS1, January 2018. “GS1 General Specifications: The foundational GS1 standard that defines how identification keys, data attributes and barcodes must be used in business applications.” Release 18.

Our Patient, Our Responsibility: Correct Patient Identification for Patient Safety



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ABSTRACT: Correct patient identification is one of the most critical steps in patient safety. The World Health Organization recognizes that patient misidentification can contribute to medication, surgery, diagnostic and documentation errors. The Joint Commission has defined 'Identifying Patients Correctly' as the first International Patient Safety Goal. At the Apollo Hospitals, a long-term process of improvements has led to reducing cases of incorrect patient identification and eventually upholding the ultimate goal of patient safety. This entailed improving and learning from incident reporting as well as implementing a culture change through a correct mix including the 'Our Patient, Our Responsibility' initiative, rigorous trainings and technologies like bar coding & SSC with Voice-Over.

Introduction

Mr. Chris Lawrence was admitted to the inpatient ward of a hospital for an elective surgery; his vitals and blood sugar levels were within the normal ranges. Mr. Chris Wilson, in the room next to Mr. Lawrence's, was admitted for treatment of severe Diabetes Mellitus. When administering medications, the nurse always checked the patients' first name to verify their identity. After one day, Mr. Chris Lawrence, who was supposed to undergo the elective surgery, collapsed due to diabetic shock. On the other end, doctors were worried that Mr. Chris Wilson was showing no signs of improvement even after prescribing high doses of insulin.

This is a typical story of patient misidentification in a healthcare setting. One small error in what seems to be a trivial task - identifying the patients correctly - can lead to fatal consequences, as shown in the story above.

The very first step in any healthcare setting is patient identification. The importance of accurate patient identification cannot be overstated, and hence, rightly so, Joint Commission International has defined "Identifying patients correctly" as the first in its list of International Patient Safety Goals (1). Therefore, it can safely be said that the first step in the journey towards patient safety starts with patient identification.

Unfortunately, patient misidentification is one of the major root causes for various incidents impacting patient safety. Throughout the health care industry, failure to correctly identify patients continues to result in medication errors, transfusion errors, testing errors, wrong person procedures and the discharge of infants to the wrong families (2).

Background

Patient identification and the matching of a patient to an intended care process is an activity performed routinely in all care settings. The usual checkpoints where a patient needs to be identified are as

follows (3);

- On admission or at registration
- When care, treatment or medicine is provided to a patient
- When a patient is undergoing a procedure
- When there is a change of clinician (for example, at shift change); for high-risk patients, this could include when a clinician goes on a break or has to leave the patient unattended (for example, in an intensive care unit)
- When a person is moved between different levels of care in the same location (for example, surgery to ward)
- When part of person's care is transferred for diagnostic purposes, like whenever a blood sample is taken
- When there is a follow-up of patient referrals and communication of test results (for example, from pathology or radiology)
- When a person is transferred to a different service (for example, hospital to aged care home or other non-government organization)
- When a person is admitted to a hospital, or leaves a hospital and returns to their care giver or primary clinician (for example, general practitioner)
- Whenever discharge documentation is generated
- In specific service settings, if they are different from those generally used across the organization

The commonly used Patient identifiers in the above-mentioned situations are the following:

- Patient name
 - Date of birth
 - Healthcare record number
- Other identifiers may include
- Gender
 - Address (including zip code)

■ Social security number

Identifiers such as room or bed number should never be used, because they change frequently and are not unique to patients. Since patient identification is a common task that is done regularly, it might be perceived as unimportant, but the development of safety routines for such tasks provides a powerful defense against simple mistakes that may cause harm.

Technologies that are currently being used for patient identification include the following:

- Bar coding
- Radio Frequency Identification
- Quick Response (QR) Codes
- Biometrics, like fingerprinting
- Iris scanning
- Facial recognition
- GPS enabled tracking through smartphones, etc.

Methods

Initially, the most critical problem faced by Apollo Hospital was the underreporting of incidents. The reasons for underreporting were numerous, ranging from lack of awareness to staff negligence and fear of punitive action. As determined later on, the root cause of many of these incidents was patient misidentification. Hence, at first it was necessary to strengthen the incident reporting system in the hospital, which would then help identify the areas that required improvement.

Creating a Culture of Safety

Regular and prompt reporting of incidents meant there was a need for an organization-wide culture of safety. However, the biggest challenge in creating a new culture within the organization was the resistance to change coming from the workforce. Hence, it became important to change the employees' mindset or perspective towards patient safety from the grass root level.

To bring about this change in the culture of the organization, multiple approaches were implemented, starting with the rigorous training of employees on the importance of incident reporting and providing an online portal to report incidents so as to make it convenient for them to do so at any time, while ensuring no punitive action would result but rather recognition and appreciation. Safety Culture Surveys were also subsequently conducted to evaluate and take further actions for continuous improvement.

Our Patient, Our Responsibility Initiative (OPOR)

Once the incidents started being regularly reported, the root cause for many of them was identified as wrong patient identification. To tackle this issue, it was important to set up a comprehensive, organization-wide system for the reliable and correct identification of patients when care, medicine, therapy and other services were provided or transferred, and it was also important to educate and remind the workforce about the use of routines, including who would have to do what, when and how. This is where the OPOR initiative was put into action.

From the beginning of an employee's journey in a hospital, i.e. from the time of recruitment, the inductions and trainings were designed such that the new resident doctor, nurse or technician would develop a sense of ownership towards the patients they cared for. Additionally, a guide (consultant for resident doctors, nurse in charge of the

department for staff nurses and departmental heads for technicians) would be assigned for every new employee, to hold their hand and mentor them on the organization's policies and protocols. This developed a culture of safety from the beginning. The guides were also responsible for ensuring a smooth clinical handover process, because correct identification is particularly important at transitions of care time, where there is an increased risk of information being miscommunicated or lost. Transitions of care occur frequently in health care and include situations when a patient's care is transferred between members of the clinical workforce, to another health service organization or to their primary care clinician. At these times, information about a person's identity is critical to ensuring safe patient care (3). Smooth clinical handovers, especially patient identification, were ensured through direct supervision on a daily basis.

The OPOR's supervision by guides encourages the staff to take ownership with a sense of responsibility rather than fear.

As per Apollo Hospital policy, a patient's full name & unique hospital number are used as the minimum two patient identifiers. In the special case of neonates, "baby of ... (mother's full name)" is used. The mother/father or significant other identified by the family has a matching- numbered band applied on their wrist for identification at this time as well, which is compared each time the infant is handed over.

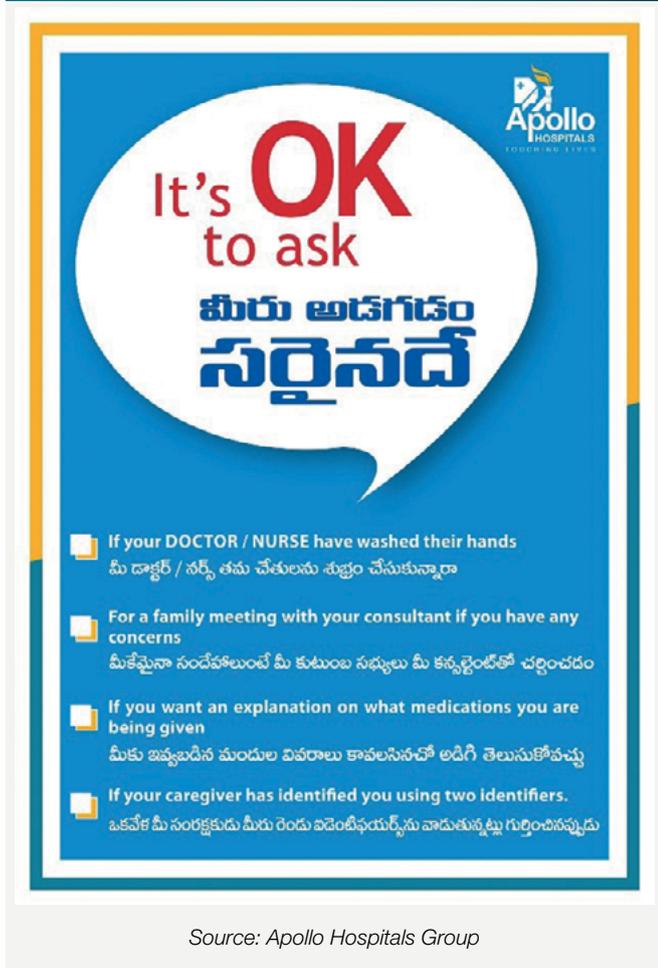
Unidentified Comatose patients are identified with two identifiers as unidentified patient 1/2/3 along with a unique hospital number; the actual name is used once it is confirmed.

It has also been noticed that patient misidentifications are drastically reduced when the patient/patient's family is involved in the process. This can be achieved by regular patient and family education and informational posters in the common areas (Figs. 1 and 2). Patients and their families are encouraged to take part in the identification process so as to avoid any errors, which includes asking them to confirm their identity or to confirm details about their care.

Patient Identification Technology:

- i. Bar Coding: Bar coding is used for every patient treated at Apollo Hospitals. Bar codes are placed on the patient's wristband for inpatients and every page of the medical record for all the patients, apart from investigation reports, patient samples, etc. Accurate patient identification is just a scan away.
- ii. Surgical Safety Checklist (SSC) with Voice-Over: The surgical safety checklist developed by WHO is a great tool to avoid wrong site, wrong patient and wrong surgery. Compliance with SSC and related documentation was a concern, especially when it came to senior doctors. SSC with voice-over helped overcome this issue. A pre-recorded SSC voice-over is played in the operation theater to conduct the 'Time-out' procedure. Time-Out includes verification of correct patient identity and procedure, correct surgical/invasive procedure site and side, agreement on procedure, correct patient position, availability of correct implants/equipment and blood products, verification of site markings and availability of all relevant images, documents, studies etc. (1). The process of calling out loudly, with the added voice of the surgeon and anesthetist ensures that Time-out is carried out appropriately, while the doctors have to be part of the

FIGURE 1: PATIENT EDUCATION POSTER



process and also document it (Figs. 3 & 4).

One Apollo:

The Apollo group of hospitals comprises 66 secondary & tertiary care hospitals, more than 150 primary care clinics and almost 200 diagnostic units, including collection centers, spread across India. This is apart from the network of Apollo Pharmacy & Wellness Spas. With such a large network, it is easy for patient identification errors and duplications to occur. To tackle this, one unique hospital number is generated for every patient treated in any of the Apollo units, which can then be easily used for the retrieval of patient identification details by any other Apollo Center. The Apollo Group provides a large range of healthcare services, from primary healthcare and diagnostic services to secondary and tertiary care services, including retail pharmacy services. Hence, once registered, patients need just for the bar code to be scanned on their wristband (in-patients), sample tubes, investigation reports, prescriptions, medical records, etc. and all their details will be retrieved instantly and in an accurate manner. (Fig. 5)

Results:

At first, incident reporting improved remarkably with the

implementation of the interventions described above. The number of incidents reported peaked in between; subsequently, a gradual decline took place, as the preventive actions were implemented to handle the root causes. (Fig. 6)

A Safety Culture Survey based on the Agency for Healthcare Research & Quality (AHRQ) survey¹ is being conducted annually which also depicts the culture of safety developed at the hospitals. (Tab. 1)

With the growth of a culture of safety and the eventual improvement of incident reporting, patient identification errors were identified as 0.5% in 2003 (because of gross underreporting) and reached 8.3% in 2007. With the implementation of the interventions described above, a gradual improvement took place from then on year after year. (Fig. 7)

SSC with Voice-Over also showed a great impact with respect to compliance as far as surgical safety. Improvements were seen in compliance with SSC, doctor participation and completion of medical records. (Fig. 8)

The universal unique hospital number had a positive impact on patient satisfaction levels as well, due to hassle free registrations and drastically reduced waiting times (Fig. 9).

Conclusion:

A right mix of culture change and technology implementation is required to bring about a positive impact on the improvement of the patient identification process. One without the other makes the change unsustainable, if it ever happens at all. Apollo's OPOR initiative had that right mix, which was evident from the improved metrics in the results. It had a comprehensive effect, from bringing about a culture of safety across the organization and patient involvement in the process to technological implementations like bar coding, SSC with voice-over and integration of services across the spectrum. These have brought down the patient identification errors in a sustainable manner. Hence, this step towards Right Patient Identification is truly a giant leap towards Patient Safety.

Biographies

Mr. Gaurav Loria

A Senior Healthcare Executive with over 15 years of experience in hospitals, ambulatory care clinics, healthcare IT, consultancy projects and multi-site management, Mr. Loria has led the successful completion of 60 Joint Commission International and 40 National Accreditation Board for Hospitals & Healthcare Providers real-time surveys at various hospitals.

Dr. Sagar S. Ganga

Dr. Ganga is the Coordinator and Manager of the Quality for Excellence Program in more than 20 Specialty Care Hospitals and over 30 Primary Care Clinics of Apollo Health & Lifestyle Ltd. across India, which includes the design, implementation, monitoring and sustenance of Quality standards & initiatives. He has led the successful completion of 7 surveys of the National Accreditation Board for Hospitals & Healthcare Providers at different hospitals.

¹ Hospital Survey on Patient Safety Culture. Content last reviewed August 2018. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.ahrq.gov/sops/quality-patient-safety/patientsafetyculture/hospital/index.html>

FIGURE 2: PATIENT EDUCATION POSTER



Source: Apollo Hospitals Group

FIGURE 3: SSC WITH VOICE-OVER PROCESS IN PROGRESS



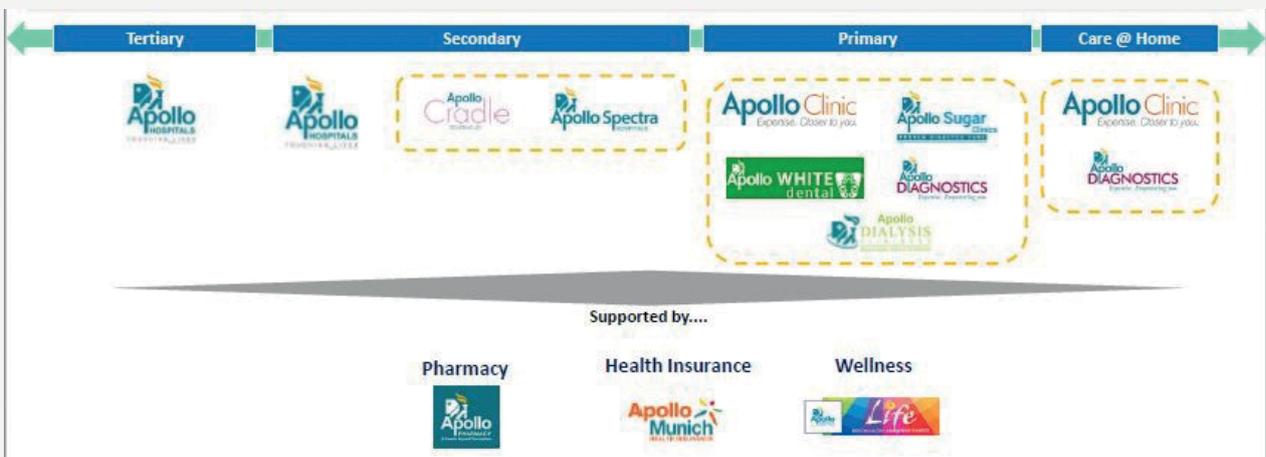
Source: Apollo Hospitals Group

FIGURE 4: SSC WITH VOICE-OVER PROCESS IN PROGRESS



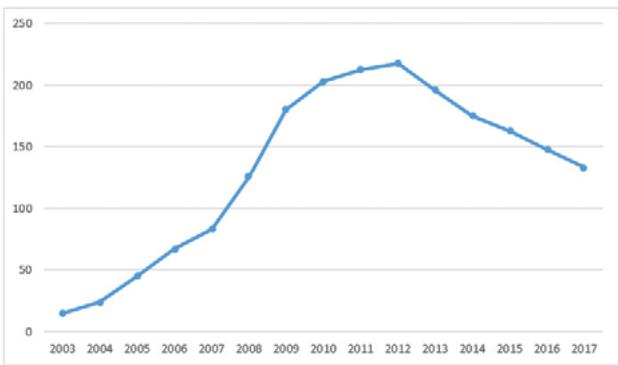
Source: Apollo Hospitals Group

FIGURE 5: APOLLO GROUP'S CONTINUUM OF CARE AS ONE APOLLO



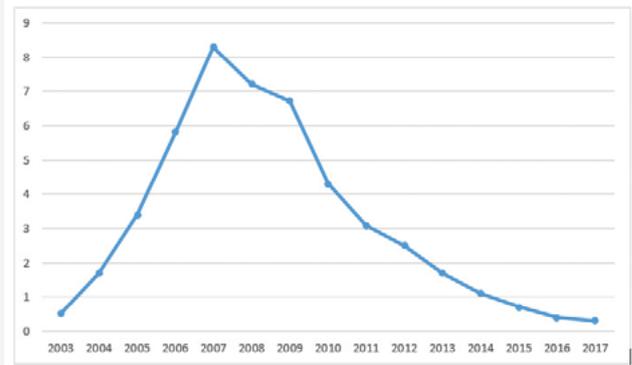
Source: Apollo Hospitals Group

FIGURE 6: AVERAGE TOTAL NUMBER OF INCIDENTS REPORTED AT APOLLO HOSPITALS, 2003-2017



Source: Apollo Hospitals Group

FIGURE 7: AVERAGE PERCENTAGE OF WRONG PATIENT IDENTIFICATION INCIDENTS REPORTED IN APOLLO HOSPITALS, 2003-2017



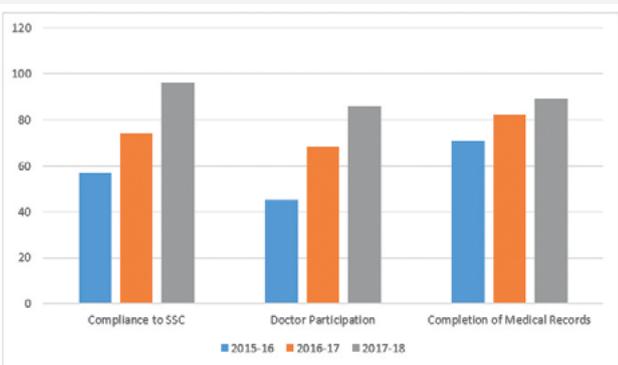
Source: Apollo Hospitals Group

TABLE 1: A SNAPSHOT OF THE ANNUAL SAFETY CULTURE SURVEY DATA

Safety culture survey parameter	2013	2014	2015	2016	2017
Overall Rating (out of 5)	3.35	3.8	4.3	4.7	4.6
% of incident reporting system awareness	88	92	91	94	94
% of respondents who feel that positive changes have happened based on incidents being reported	85	89	88	89	92
% of respondents who feel empowered to speak up if they see something that may negatively affect patient care	78	86	83	85	89
% of respondents who thought their work climate promotes patient safety	82	88	94	94	96

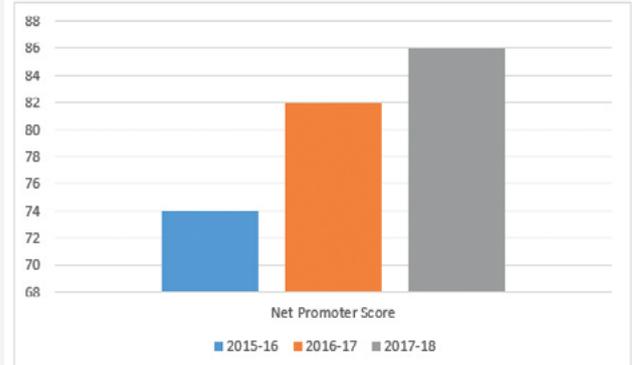
Source: Apollo Hospitals Group

FIGURE 8: PERCENTAGE OF COMPLIANCE WITH SSC, DOCTOR PARTICIPATION & COMPLETION OF MEDICAL RECORDS



Source: Apollo Hospitals Group

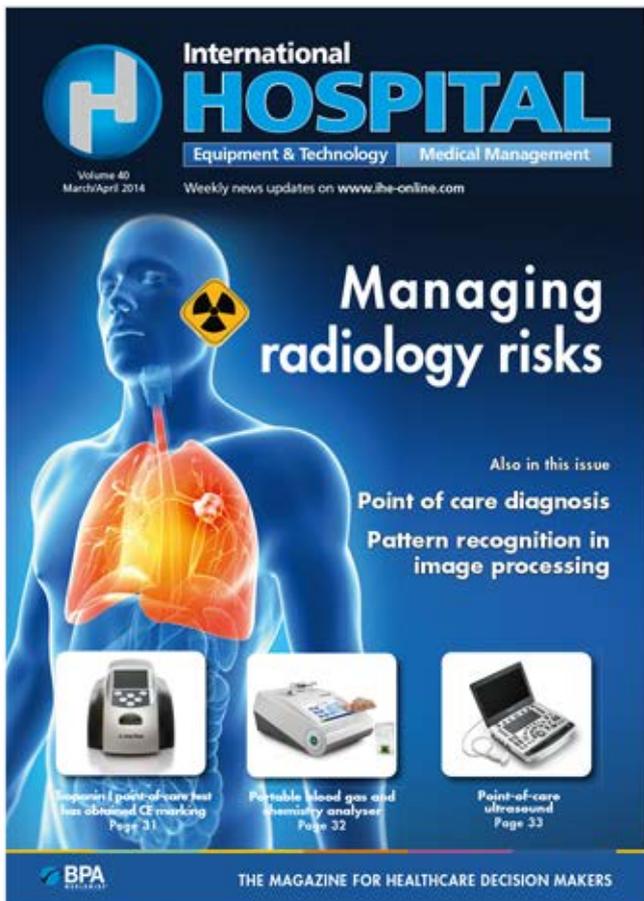
FIGURE 9: COMPARISON OF NET PROMOTER SCORES DEPICTING PATIENT SATISFACTION LEVELS



Source: Apollo Hospitals Group

References

1. Joint Commission International, *Accreditation Standards for Hospitals*, 6th edition
2. World Health Organization. 2007. *Patient Safety Solutions: Patient Identification*, Volume 1, Solution 2. WHO Press, Geneva.
3. Australian Commission on Safety & Quality in Healthcare. 2017. *National Quality & Health Service Standards: Guide for Hospitals*. ACSQHC, Sydney.
4. The Victorian Surgical Consultative Council (Royal Australasian College of Surgeons). 2003. *Correct Side and Correct Site Surgery Guidelines*.
5. Australian College of Operating Room Nurses LTD. 2004. *ACORN Standards*. ACORN, O'Halloran Hill.
6. García-Betances, R. I., & Huerta, M. K. 2012. A Review of Automatic Patient Identification Options for Public Health Care Centers with Restricted Budgets. *Online Journal of Public Health Informatics*, 4(1), ojphi.v4i1.4011. <http://doi.org/10.5210/ojphi.v4i1.4011>
7. ECRI Institute. June 2016. *Health Technology Assessment Information Services Special Report: Patient Identification Errors*. https://www.ecri.org/Resources/HIT/Patient%20ID/Patient_Identification_Evidence_Based_Literature_final.pdf
8. Campbell K, Muniak A, Rothwell S, Dempster L, Per J, Barr K. 2015. Improving Quality and Safety through Positive Patient Identification. *Healthcare Quarterly* 18(3) October 2015: 56-60.doi:10.12927/hcq.2015.24431.
9. Tasel T. H, Lourençãoll D, Bianchinill S. M, Tronchin D. 2013. Patient identification in healthcare organizations: an emerging debate. *Rev. Gaúcha Enferm.* vol.34 no.3 Porto Alegre Sept. 2013. <http://dx.doi.org/10.1590/S1983-14472013000300025>



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The Canberra Hospital uses positive patient identification to significantly reduce errors when collecting pathology samples



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ABSTRACT: To provide greater patient safety and deliver better outcomes, today's healthcare providers need to "capture" the identification of their patients and clinicians at the points of care. Positive patient identification is especially important in busy clinical areas and where mis-identification could lead to adverse events. Using GS1 standards as the needed foundation, ACT Health and The Canberra Hospital are identifying their patients, lab and pathology samples in addition to care providers to ensure accuracy in patient-care processes throughout each patient's journey within their hospital. As a result, there has been more than a 40% reduction in wrong-blood-in-tube incidents based on clinicians scanning GS1 barcodes when collecting pathology samples.

Digitization of healthcare

ACT Health provides healthcare services to an estimated 550,000 people in south-eastern Australia. Like in many parts of the world, the region's demographics is shifting towards an older profile of patients, with increased age-related, chronic conditions and heavier demand for health services. With the goal to achieve better outcomes for patients and improve their safety, ACT Health is making significant investments in creating a digital healthcare infrastructure.

The healthcare system needed to develop a framework to support its digitization of clinical processes across ACT Health and The Canberra Hospital campus. Part of the framework was implementing GS1 identifiers that would enable the hospital to scan barcodes in order to accurately identify patients, caregivers, locations and instances of patient care. This also needed to be scalable for implementation at the new University of Canberra Hospital and Calvary Public Hospital Bruce.

The challenge: room for errors

Since its inception, ACT Health has worked to continuously improve its treatment of patients, identifying issues, establishing prevention policies and driving compliance of these policies. Yet, manual processes could only help so far. The health system

found that, as more and more patients needed services, and when using manual processes, there was always room for error.

The hospital was experiencing a continuation of possible preventable incidents despite its efforts to implement policies to prevent them, like signaling (near-) incidents and discussions about process improvements. For example, its wrong-blood-in-tube occurrences were above the national average. Based on an error-prone process when collecting pathology samples, there was an elevated risk of people getting the wrong treatments. Simply put, the situation was unacceptable.

Paper-based policies were not making a big enough difference, as compliance by staff proved to be low. To increase compliance, a better understanding of the source of resistance to change was needed. The need was identified to use technology to create standardized, automated processes to support error-free patient care. To address this, the ACT Health team established the Location Based Services Steering Committee in 2013 and set off on its multi-year journey to transform patient care processes across many areas—starting specifically with the collection of pathology samples.

The hospital needed to implement a more robust method to ensure the identification of patients and caregivers in the process of collecting pathology samples and enable "positive

patient identification” (PPID), in line with Australia’s National Safety and Quality Health Service (NSQHS) standards for patient identification and procedure matching. In addition, this method needed to be able to support other patient care interactions within the hospital where PPID was required.

GS1 Australia introduced the team to the ISO Technical Standard 18530:2014, which provided detailed workflows to assist them with pathology samples. The ISO technical specification outlines how GS1 identifiers, specifically the Global Service Reference Number (GSRN) and Service Relation Instance Number (SRIN), can be used for patient and care provider identification across many processes. The document also illustrates how these can be applied along with several other international standards to support good practices within a series of 30 use cases.

The solution: building a foundation

The first step taken by the team was to implement GS1 identifiers in the hospital’s IT-system as the building blocks for the PPID solution. ACT Health initially implemented GS1 identifiers with minimal integration and then derived value through integrating the standards with its systems.

In an integrated world, the hospital knew well how hard it would be to make a change without it having a widespread impact on everything else. The team soon realized that they needed to contain the impact and make the right changes with the greatest risk reduction and benefit. This meant focusing on patient identification. It also meant facilitating the safest processes, leading to staff “automatically” following these.

The team needed to ensure positive patient identification could only occur at the bedside by scanning the patient’s wristband. To achieve this, the patient wristband’s two identifiers (one identified the patient and the other the “instance” of patient care, such

as taking a blood sample) were electronically distinct from any other forms of patient identification, such as the identifiers on the clinical notes labels.

The GS1 publication of ISO Technical Standard 18530:2014 solved this problem with the use of the GSRN and SRIN. The subsequent expansion of the specification to support staff/caregiver identification with the SRIN was also very useful.

Planning was underway for a multi-year, major project to upgrade to a Patient Administration System (PAS). Rather than wait on the new PAS, the hospital developed a middleware solution to generate the GS1 patient wristbands. By doing this, the roll-out of the wristbands would not be reliant on the upgrade and could avoid the delays that the process would have introduced.

Today, each patient wristband includes the GSRN and SRIN identifiers encoded in a GS1 DataMatrix barcode to uniquely identify the patient and the instance of patient care. Labels associated with a patient’s clinical notes and specimens also include the same identifiers with subtle yet technically significant differences.

The team also worked with its existing vendors to modify the hospital’s security system and print staff identification cards that used the GS1 identifier in a GS1 barcode. (Figure 3)

With any change come challenges, yet the vast majority of caregivers and staff at The Canberra Hospital appreciated the ability to work in a safer and more productive way, enabled by the PPID solution.

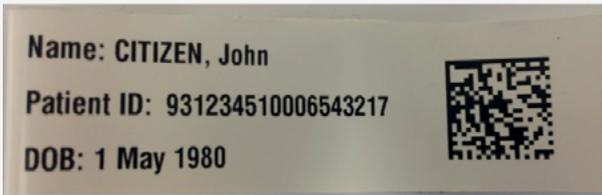
Perhaps the biggest push back occurred when implementing GS1 standards on patient wristbands. It pertained to the cost of upgrading the hospital’s barcode scanners to support 2-dimensional DataMatrix barcodes. However, this soon became a non-issue when put into the context of patient safety. It was a small price to pay to ensure the hospital was always working with the right patient.

FIGURE 1: GS1 STANDARDS PROVIDE THE IDENTIFICATION FRAMEWORK FOR PPID

- **Patient ID:** Global Service Relation Number (GSRN) + Service Relation Instance Number (SRIN)
 - Wristband
 - Clinical Notes Labels
 - Specimen labels
- **Staff ID cards:** GSRN
- **Location ID:** Global Location Number (GLN)
- **Product ID:** Serialised Global Trade Item Number (SGTIN)
- **Asset ID:** Global Returnable Asset Identifier (GRAI) or Global Individual Asset Identifier (GIAI)
- **Document Type ID:** Global Document Type Identifier (GDTI)

Source: ACT Health

FIGURE 2: SAMPLE PATIENT ID WITH GS1 IDENTIFICATION IN GS1 DATAMATRIX BARCODE



Source: ACT Health

FIGURE 3: SAMPLE STAFF ID WITH GS1 IDENTIFICATION IN A GS1 BARCODE



Source: ACT Health

How the solution works: PPID solution in action

With the PPID solution in place, a collector (nurse or phlebotomist) can now scan barcodes each step of the way when identifying a patient and the specific pathology lab test to be administered.

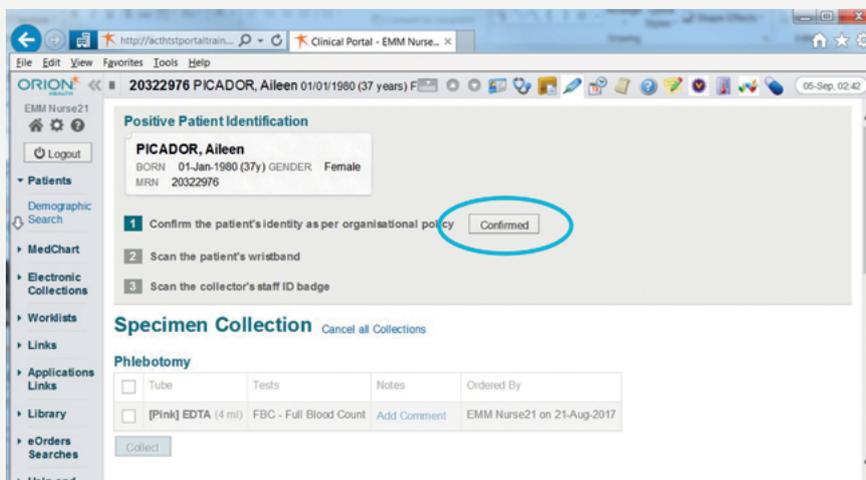
Here’s how the new process works:

- The collector (doctor, nurse, or phlebotomist) selects a patient from a pending collections list. Using the ACT Health Clinical Portal displaying the specimen collection screen, the collector first verbally confirms the patient’s identity with the patient, using their name, date of birth and address. (Figure 4)

Preventing possible errors/incidents

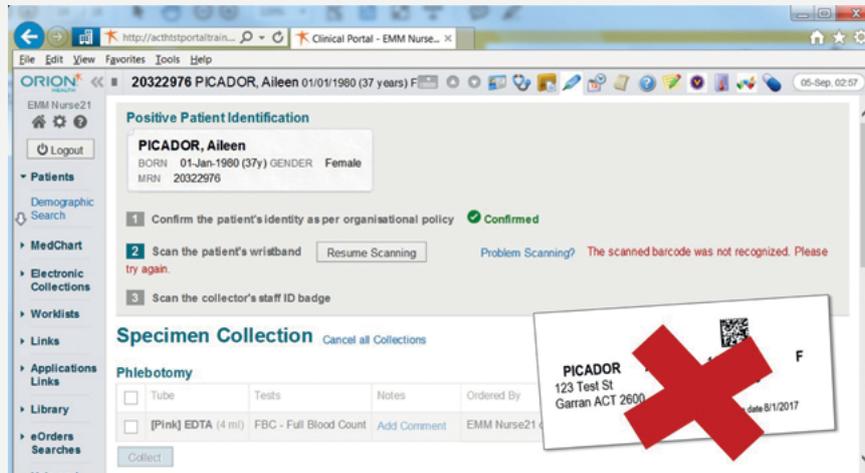
- Upon scanning the barcode on the patient’s wristband, the system recognizes if/when he or she is not the right patient for the ordered pathology test. This represents a near miss, since either the collector has not sufficiently verbally confirmed the patient’s identity or the wrong wristband has been placed on the patient. With this, patient safety has been preserved, and the near-miss detail is automatically captured within the system, available for analysis.
- With the right patient identified and verbally confirmed, the collector needs to scan the patient wristband. If instead the collector scans the patient’s GSRN identifier on the clinical notes label (which may be away from the patient bedside), the PPID system will not accept the patient identifier, because it is not the same as the one on the patient wristband; as a result, the collector cannot proceed until the wristband is correctly scanned. (Figure 5)
- Once again, patient safety has been preserved, and the details of the incorrect identifier scanned have been recorded.

FIGURE 4: POSITIVE PATIENT IDENTIFICATION DISPLAYED IN THE ACT HEALTH CLINICAL PORTAL



Source: ACT Health

FIGURE 5: SYSTEM ALERTING COLLECTOR: SCANNED BARCODES DO NOT MATCH



Source: ACT Health

This is perhaps the most significant point of differentiation for the PPID solution driving patient safety. The wrong-blood-in-tube incidents were typically a result of blood collections being taken from the correct patient, only to then become inadvertently switched with another patient's specimen before being submitted to the lab. This could happen when order handling and labeling is performed away from the patient for a batch of collections. With the new identification system, order handling and labeling are all done at the point of care.

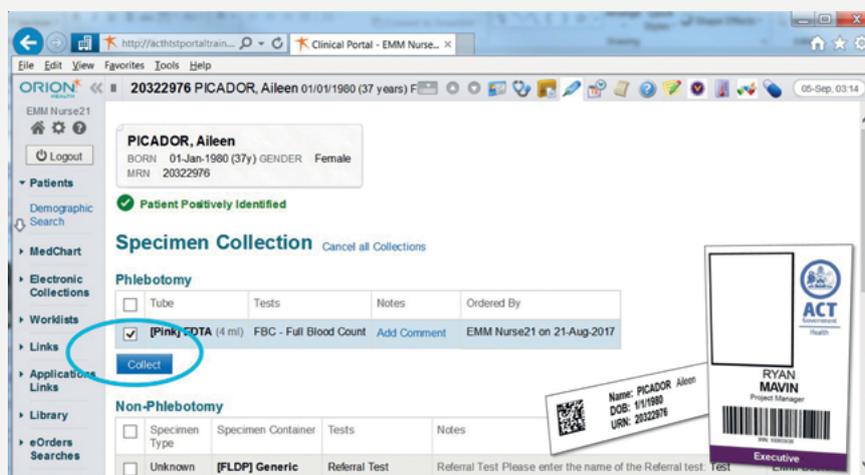
A safe process

- Only when the correct patient's GSRN identifier located on the wristband is scanned can the collector proceed

to the next step.

- Now that the patient wristband identifier has been successfully scanned and matched with the clinical notes label, the order is confirmed for this patient. The collector can proceed by scanning the staff identification card. Only a valid staff card with a barcode is accepted. The PPID system checks the unique identifier against the ACT Government Active Directory before allowing the collector to continue. This allows for only correctly qualified and trained staff to proceed.
- Once the sample is collected, the collector checks off all of the successful collections in the eOrders system and prints the required specimen labels.

FIGURE 6: ACT HEALTH CLINICAL PORTAL SHOWS PPID EACH STEP OF COLLECTION PROCESS



Source: ACT Health

The results: error prevention is a priority

The implementation of the PPID solution has focused on the need to improve patient safety and outcomes by preventing errors while supporting clinical teams in their work.

Patients benefit from needing to take only a single sample. Without errors, there are no delays in results and treatments. In addition, the PPID solution eliminates risks associated with the wrong results and incorrect diagnoses.

Clinicians benefit from an automated process with electronic ordering and collection that has eliminated paper order readability and transcription incidents, reducing lab data entry efforts. This solution allows them to work more efficiently and collect samples safely, reducing the risk of errors. With the PPID solution, the use of technology helps them mitigate the impact of interruptions that occur in a normal care setting.

GS1 standards and barcode scanning applied at the point of printing the specimen labels ensures that the physician or medical staff collecting the sample will perform precisely the steps set by the organizational policy.

ACT Health reports obtaining 100% compliance with the adjusted process and that its policy will preserve patient safety. To date, more than a 40% reduction in wrong-blood-in-tube incidents has been achieved, with remaining incidents only occurring during system maintenance periods, or with orders that have remained on paper due to patient transfers.

management change and policy compliance.

Scalable solution

The overall GS1 standards framework is providing the foundation for many more process improvements where positive patient identification is key. To date, the PPID scaled solution has been implemented across all adult wards.

The key principles defined in the initial implementation are being used in the deployment of additional projects, such as tracking blood products to patients, matching breast milk to babies, managing and administering electronic medications at bedside and more.

There is an overall transformation of systems and processes happening at ACT Health and The Canberra Hospital with patient safety and outcomes as a priority.

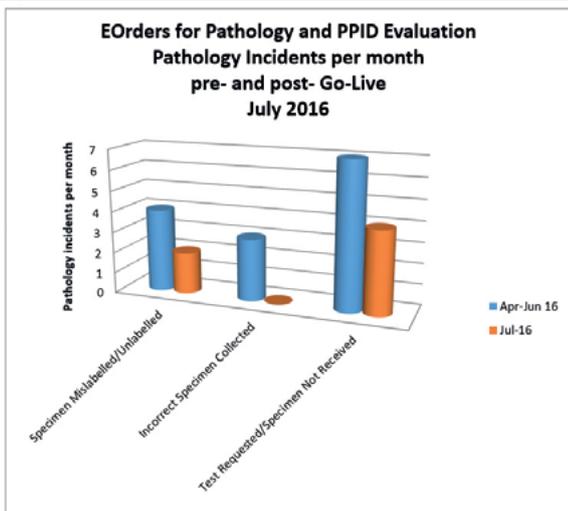
Biographies

Ryan Mavin is Manager of the Enterprise Architecture Office at ACT Health and has been working in the IT Industry for more than 20 years. For the past six years, Ryan’s focus has been on Healthcare, implementing electronic systems to streamline clinical interactions and information capture for ACT Health. Ryan is passionate about IT interoperability, delivering better patient outcomes and enabling the industry to adapt to the challenges posed by an aging population.

Sandra Cook is the Director of Future Capability and Governance at ACT Health, a role that incorporates development of and adherence to the Digital Health Strategy as well as oversight over the delivery of ICT Work Projects and Programs. Sandra has been working for ACT Health for the last 14 years, with over 10 years experience in implementing health information technology projects in the public health environment. She was trained as an Exercise Physiologist.

Peter O’Halloran was appointed Chief Information Officer (CIO) of ACT Health in September 2016 and has been a CIO in the healthcare sector for over a decade. Peter is a transformational CIO with a proven track record of delivering ICT solutions quickly, using agile methodologies that are on-time, on-budget, meet or exceed user expectations/requirements and make a real-world difference both in improving the quality of life and saving tax-payers’ funds.

FIGURE 7: REDUCTION IN WBIT INCIDENTS



Source: ACT Health

In pathology, clear patient identification reduces labeling errors and the amount of testing needed due to incorrect labeling, thereby saving time and resources.

The Canberra Hospital has been able to significantly reduce the number of pathology collection related errors, repeated processes and pathology costs, while also securing better patient care. The hospital also notes that its staff members are finding out that the easiest way to do their jobs is now the correct way, scanning GS1 barcodes each step of the way; thus supporting the needed

References

Australian Commission on Safety and Quality in Health Care. 2012. *National Safety and Quality Health Service Standards*. Sydney. ACSQHC.

International Organization for Standardization. ISO/TS 18530:2014: *Health Informatics-Automatic identification and data capture marking and labelling – Subject of care and individual provider identification*. <https://www.iso.org/standard/62805.html>

Transparency on a foundation of standards



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With standards in place, Aarhus University can now easily locate the people and assets it needs to provide patients with timely and safe care.

ABSTRACT: Enhancing information levels and expertise combined with reducing costs are some of the basic drivers designing the new University Hospital in Aarhus. The focus is on the supply chain, service and raising information levels without adding labor costs. Transparency throughout hospital processes allows for better decision making and planning. Introducing an automated tracking system based on global standards allows the hospital to strengthen internal processes, enhance transparency, raise system interoperability levels and extend the overall information model for object identification to suppliers and partners. A key benefit is the ability to ensure a safe and repeatable patient experience, built on reliable methods with a high level of information and quality assurance based on automatically produced data.

Background

As part of a nationwide reorganization of the Healthcare System in Denmark, Aarhus University Hospital was created by merging five medium sized hospitals in the Central Denmark Region. The vision was to create fewer, more efficient hospitals, each with a greater level of expertise.

To achieve the full effect of the merger, it was decided to expand Skejby Hospital to accommodate all activities from the original hospitals. Aarhus University Hospital will be the largest hospital complex in Denmark, covering nearly 500,000 square meters, with 10,000 employees treating about one million patients each year.

Building a hospital this large takes a considerable amount of time. The technology available at the inception of the building project was generally expected to be outdated by the time the hospital would be ready to take in patients. Guessing which technologies would be available in the future was not a viable solution. Creating a technological foundation to support an efficient hospital with a high level of technological automation and patient empowerment needed a change in focus away from current day technology.

Accountability: a key factor in Aarhus University Hospital's design

A key design concept of Aarhus University Hospital is a high level of accountability and traceability to ensure high quality, efficiency and patient safety. These concepts are not unique to healthcare, even though some of the markers are a bit different

from other sectors. Many of a hospital's operations are similar to businesses in other industries. Building and running a large hospital requires a focus on supply chain efficiency and a just-in-time delivery model. An analysis of the just-in-time delivery concept showed a general mistrust among staff that goods would truly be available on time—an issue that is addressed by the science of logistics management. Creating transparency in the supply chain, allowing access to information on goods in transit and showing the whereabouts of goods reassure staff that supplies will be ready on time. This mitigates the mistrust.

Research into potential focus areas produced different results. Some of the significant challenges to overcome included the following:

- Every employee in patient wards, surgery and outpatient clinics spent, on average, at least 12 minutes a day searching for items or personnel. Newer data suggest an even higher amount of time spent searching (1).
- The time needed to order new hospital beds and clean beds in patient wards put a heavy load on both nurses and service personnel.
- Several transports were made without goods due to a tight split between service personnel responsibilities and organization.
- Much of the medical technical equipment appeared to have a very low utilization rate.

To turn this strategy into future systems, obvious gaps had to be bridged. For example:

- A shared digital model describing the locations inside

the hospital was needed; at minimum, the identities of locations would have to be shared.

- Events in the supply chain had to be shared between systems that were not necessarily compatible.
- A common data set identifying items and actors needed to be introduced.

The basic concept of “What - Where - When”

Early in the physical design of the hospital, just-in-time delivery was evaluated as an enabler, resulting in the following strategic design decisions:

- Reducing the number of storage rooms reduces the amount of floor space built.
- Better utilization of hospital equipment reduces procurement.
- Knowledge of staff whereabouts could ensure that the nearest employee will handle a task, reducing waiting time.

Combining “Just-in-time” with “Accountability” and “Transparency” leads to an overall system that automatically registers the **location** and **identity** of a mobile object at a known **time**. This again leads to the basic concept of “What-Where-When”.

Methods and foundation

Initially (in 2010-2012), this concept was adopted into a reference architecture in the Central Denmark Region, unfolding the perceived effect of 40+ use cases (2). The reference architecture was upgraded and co-released amongst all Danish Healthcare Regions¹ (3). Since 2016, the reference architecture has been governed in its third generation by the Danish Ministry of Health (5)(6), as a joint methodology to share tracking information between all Actors in the Danish Health Systems. The National reference architecture (4) unfolds the principles and requirements that create the foundation for Aarhus University Hospital's use of standards and implementation of tracking and tracing in both generalized and specialized systems.

Information backbone

Automated tracking poses many challenges:

- The relationship between objects and their locations could be handled within dedicated business applications. However, this approach is not economically acceptable.
- Building a new system to register the location of an object based on each specific business need would be costly.
- The hospital struggles with different location models in different applications.
- It is not technically possible to introduce numerous wireless tracking technologies side-by-side without creating electronic interference that could jeopardize the functionality of medical technical devices and, therefore, patient safety.

Introducing a generalized information model and

underpinning the model with a generalized tracking infrastructure was chosen as the best solution to support hospital requirements.

GS1 standards were found to be the best fit for many of the model's requirements: GS1 identification keys like the Global Location Number (GLN), which identify locations, and the Global Trade Item Number® (GTIN®²), Global Individual Asset Identifier (GIAI) and Global Returnable Asset Identifier (GRAI), which identify objects, were used along with the Electronic Product Code Information Service (EPCIS) to share data about the physical movement and status of objects and products as they transit throughout the hospital and supply chain.

In combination with the Core Business Vocabulary (CBV), EPCIS enables the creation of an event-based infrastructure. An EPCIS integration system has been implemented, making event data available to multiple actors at the same time. Business applications subscribe to events through EPCIS query interfaces and handle the supplied information to cover the needs of the individual processes supported by the applications³.

Multiple tracking technologies are also used. These technologies supply tracking information through an EPCIS-capture interface within the integration system. Wi-Fi is used for devices like smartphones and computers, while EPC-enabled RFID is applied for more accurate, low-cost tracking applications. Additionally Infrared-, Ultrasound- and Bluetooth Beacon systems are being tested and implemented in this Hybrid tracking model. Replacing and upgrading hardware can be done without affecting business applications.

Scalability and interoperability on a global level

Today, a GLN identifies each location inside the hospital. A minimum level of usage is the exchange of GLN information between systems, yet, a high level of metadata and location context information is available for systems. The general availability to systems of the 25,000+ registered locations creates a uniform data set. Previously, these were split into more than 11 known location models, not counting system specific location models. Now, users have the ability to communicate about locations, thus minimizing the risk of misunderstandings.

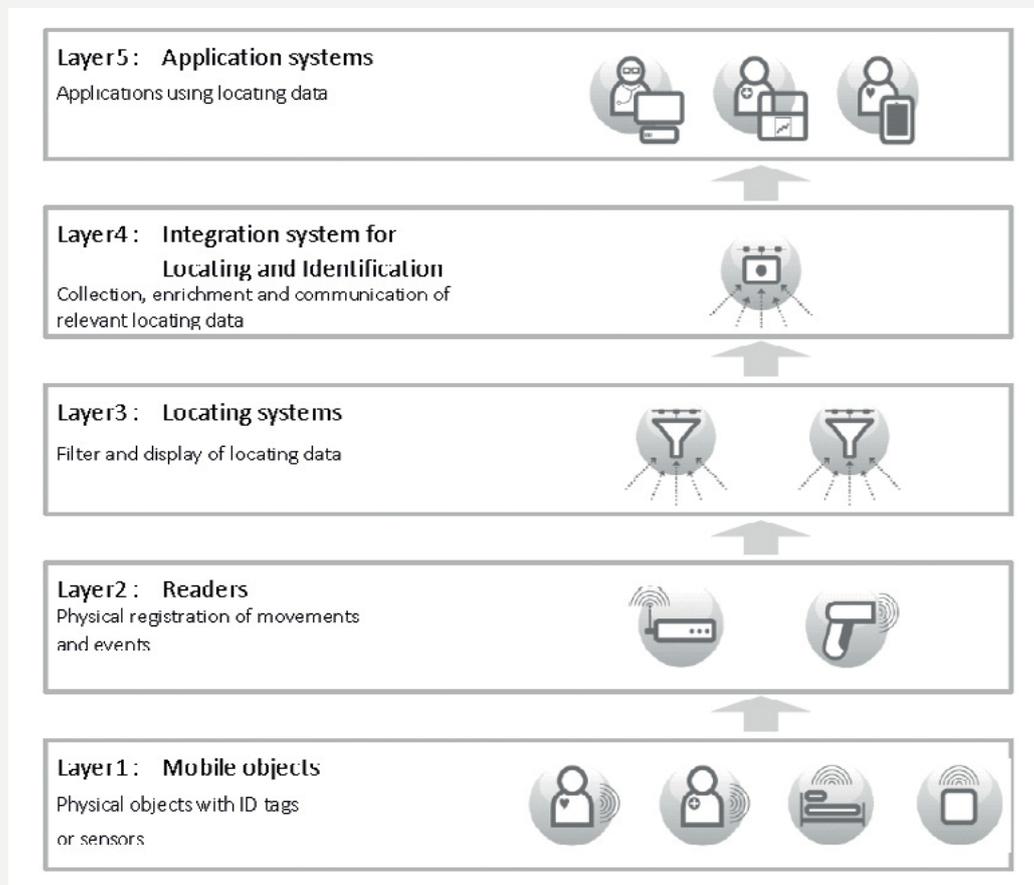
An example is planning a patient encounter. It is now done in a way which ensures that the planner and the patient have access to a strictly managed data set. For all systems used in the process, now the data need to be entered only once. Since the identification of a location is based on GLN, multiple levels of information such as GPS coordinates and addresses can be provided tailored to the user's needs. This gives the hospital the possibility to give an Ambulance Driver, who uses a high-level system to consume and provide information, the same data that are converted into written text in a letter to a patient. Inside the hospital, a patient can use the automated tracking systems for guidance through wayfinding apps on their smartphone, again by transferring data to a new platform that can enhance the patient experience.

² The GTIN ® is a trademark registered of GS1 AISBL

³ <https://www.gs1.org/standards/epcis>

¹ The document was deprecated in 2014 and is not available in English.

FIGURE 1: THE REFERENCE ARCHITECTURE IS A LAYERED ARCHITECTURE IN WHICH THE PRIMARY DATAFLOW IS BOTTOM-UP



By layering the architecture, the model supports multiple tracking technologies that can be replaced at any time without affecting the business applications subscribing to the tracking data.

Source: Resource 4

EPC/RFID was chosen to introduce a general traceability method. A hospital-wide EPC/RFID infrastructure with more than 2,400 gates has been placed in doorways of both old and new buildings. This investment has reduced the cost of adding traceability to an object, since EPC/RFID tags can be very cost-effective and durable. More than 20 different tag types are in use with plans to tag more than 250,000 objects over the next two years. The first 10,000 tags are already in use. Combined with barcodes, EPC/RFID allows the hospital to share and consume data from any supplier that can deliver GS1 compliant data, allowing end-to-end traceability from manufacturer to consumer and automating tracking at key steps of the process.

Right now, the focus is on getting a real-time overview of

carts and goods transported inside the hospital. The aim is to support decision-making and allow for a rapid change of transportation flows to reduce the internal costs of logistics. The produced data highlights poor utilization of capacity and identifies bottlenecks. All of this is achieved without staff performing manual registrations.

Tracking and searchability of personnel

A pilot project within a Ward was conducted to identify the effect of making co-worker locations available in real-time. Location data are available at two levels, both through overview screens and a search engine available on multiple platforms. Adding a location to a co-worker is translated into context information. For example, staff in a patient room is probably

attending to the patient in the room. This context allows the employee to make an informed decision on whether to contact that co-worker, risking a counterproductive disturbance, or seek help or guidance from someone else. The general ability to search for equipment also shows a reduction in the time used to find it.

Conclusion

Ensuring the general availability of master data like location and object data can create a robust foundation for business development. Several systems, which were not part of the original project, consume tracking and location data just by using the general services available from the EPCIS service and the location database.

Overall traceability sustains the staff's and patients' ability to make informed decisions. However, the higher level of information made available to users is only a benefit if maintained with a high level of integrity. As opposed to deterministic task distribution or routine behavior, information based decisions reduce the time spent on tasks and allow the user to avoid seeking help from coworkers who have more important tasks to tend to.

Aarhus University Hospital is looking into the possibility of extending the use of automated traceability based on GS1 standards to more clinical processes in conjunction with the

current focus on supply chain, logistics and services.

Sharing the standardized data with other Healthcare Suppliers and Business Partners has a high priority. A use of the GDSN network (<https://www.gs1.org/healthcare/share-data-gdsn>) to share data on a global level is seen as a key means of delivering transparency to actors outside the company.

Biography

Henrik Stilling, an engineer by trade specialized in IT design focused on process management and technology adaption, is an Information Technology Architect at Central Denmark Region. He is the Lead Architect for item identification and tracking and is part of the Danish national initiative on identification and traceability in healthcare.

References

- 1) GS1 UK. 2009. *Leeds Teaching Hospitals NHS Trust*. Case study. https://www.gs1uk.org/~media/documents/case-studies/92950_casestudy_leedsteachinghospitalstechnical_2014.pdf?la=en
- 2) Central Denmark Region. 2012: "Reference architecture for Item identification and Traceability". http://www.dnu.rm.dk/siteassets/dnudnu/it/sporbarhed/referencearkitektur-for-sporbarhed-og-emneidentifikation-2-2_en.pdf
- 3) Danish Ministry of Health. 2016. *Structure of Danish Healthcare - Overview*. Ministry of Health, Denmark. https://www.sum.dk/English/~media/Filer%20-%20Publikationer_i_pdf/2016/Healthcare-in-dk-16-dec/Healthcare-english-V16-dec.ashx
- 4) Danish Ministry of Health. 2017. *The Danish Health Data Authority: Reference Architecture for object locating and identification*. Danish Health Data Authority, Denmark. https://sundhedsdatastyrelsen.dk/-/media/sds/filer/rammer-og-retningslinjer/referencearkitektur-og-it-standarder/referencearkitektur/object-locating-and-identification-1,-d,0,-d,4,-d,3_en-public.pdf?la=da
- 5) The Danish Health Data Authority can approve standards according to an executive order. Read more here: <https://sundhedsdatastyrelsen.dk/-/media/sds/filer/rammer-og-retningslinjer/referencearkitektur-og-it-standarder/standardkatalog/engelsk-version-af-bekendtgørelse-af-standarder.pdf?la=da>
- 6) Ministry of Health. 2013. *Executive Order no. 160 of 12 February 2013 on Standards for IT application in the Health Sector*. Translation of Danish executive order. <https://sundhedsdatastyrelsen.dk/-/media/sds/filer/rammer-og-retningslinjer/referencearkitektur-og-it-standarder/standardkatalog/engelsk-version-af-bekendtgørelse-af-standarder.pdf>
- 7) Henrik Stilling and GS1 Healthcare Provider Advisory Council 2017. 2018. "GS1 Healthcare Reference Book 2017-2018, State-of-the-art hospital relies on GS1 standards for highly efficient and safe ways to work and care for patients". GS1 AISBL, Belgium. https://www.gs1.org/sites/default/files/docs/healthcare/gs1_hreferencebook_17-18.pdf

Brazil's Hospital Israelita Albert Einstein makes significant progress toward the full traceability of pharmaceuticals



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ABSTRACT: Hospital Israelita Albert Einstein (HIAE) is using GS1 standards to enable the traceability of all medicines with the goal of improved patient care and safety. HIAE has partnered with suppliers and worked internally to ensure all single-dosage medicines are assigned a unique identifier in a GS1 barcode including batch/lot number and expiration date. With GS1 standards, the hospital can scan the medicines' barcodes as they travel from receipt to patient bedside and HIAE's surgical center, completing an end-to-end traceability system. More than 240,000 units are labeled at suppliers' sites each month, saving HIAE over 600 hours and R\$13,620 in labor costs monthly.

The need: Improved patient care

Hospital Israelita Albert Einstein is an integrated healthcare system located in São Paulo, Brazil, with more than 13,000 employees, including over 1,200 physicians. In 1999, HIAE became the world's first hospital to receive Joint Commission International (JCI) accreditation. In 2018, HIAE became the first JCI-accredited hospital to receive the seventh consecutive re-accreditation certificate. The hospital provides healthcare services that span the spectrum: promotion, prevention, diagnosis, treatment and rehabilitation.

With a commitment to patient care, HIAE set out to develop an internal system that would allow the tracking of medicines as they were delivered from suppliers to the hospital and their administration at patient bedside. The hospital's vision was to create an intra-hospital traceability system that would enable the visibility of individual doses of medicines throughout the hospital's receipt, distribution, dispensation and administration processes.

At that time, traceability was not possible because the pharmaceutical drugs supplied by HIAE's manufacturers did not include the minimum identification requirements. Even if suppliers did include barcodes on their drugs, they typically only identified the type of drug and barcodes were applied only to the secondary packaging.

To achieve traceability, it was imperative that the barcode would include complete identification: product type, batch/lot number and expiration date. Furthermore, for administration purposes, each dosage needed to be identified and labeled.

The solution: Re-labeling in the pharmacy

To address this need, incoming medicines that were not properly barcoded or carried only a product identifier were re-identified and re-labeled in-house by the hospital's pharmacy staff. An internal barcode was developed for this purpose, carrying not only the product type but also the batch/lot number. This barcoded information was also provided on the label in a human-readable format. The barcoded information matched the same unique combination as the hospital ERP system that provided the expiration date.

Ampoules and vials proved to be a cumbersome task due to their small sizes. However, the situation became even more critical when dealing with drugs in solid dosage forms (e.g., tablets, capsules). In order to have the needed detailed information on each dosage, the pharmacy had to cut the original blister packs and overwrap each single unit individually. To facilitate this process, HIAE invested in a table-top machine for unit dose repackaging.

In 2005, at the beginning of the project, HIAE repackaged approximately 80,000 oral solids and re-labeled about

FIGURE 1: RE-LABELLED AMPOULES



Source: Hospital Israelita Albert Einstein

250,000 ampoules or vials *per month*, supporting its 460 beds, emergency care and two outpatient units. Today, in 2018, more than 200,000 oral solids and 200,000 ampoules or vials are still re-labeled *per month*, supporting 630 beds, emergency care and seven outpatient units.

Significant improvements have been made recently in the identification and control of oral solids, thanks to a complete automated solution called Swisslog PillPick®. This machine double-checks processes throughout each production step, including a camera-based validation system, cutting blisters, overwrapping them and identifying every single dose with a GS1 DataMatrix barcode, which carries the product identifier, batch/lot number, expiration date and serial number. Currently, more than 100,000 units per month are being identified this way.

FIGURE 2: IDENTIFICATION OF ORAL SOLIDS



Source: Hospital Israelita Albert Einstein

However, since drugs could be incorrectly identified, re-labeling has introduced risk into the process. To prevent errors, a post-labeling quality control step needed to be developed and added. All this added up to high costs, mainly related to labor. Finally, HIAE needed to pay special attention to the quality of barcodes, considering that a faded or “smudged” barcode could not be read when scanned, thus compromising

the ability to capture data and ensure traceability.

Phase 2 of the solution: Suppliers join in

With help from GS1 Brazil, HIAE identified a supplier (Hypofarma) that accepted the challenge to print a GS1 DataBar barcode on the label of each electrolyte ampoule unit in its production line. This barcode could hold the additional batch/lot number and expiration date information as needed. The partnership demonstrated to HIAE the value of having a supplier assign and apply the barcodes at the source—in their production facilities.

In 2008, the GS1 DataMatrix barcode was introduced. The GS1 DataMatrix barcode is highly desirable for healthcare products, because it can hold large amounts of data in a very small footprint, which is ideal for small bottles, individual dosage blisters and vials.

At that time, other suppliers (Baxter, Isofarma and Eurofarma) partnered with HIAE by uniquely identifying their medicines at the single-dose level using GS1 DataMatrix barcodes. Soon, other suppliers followed.

Today, HIAE requires that all of its suppliers codify their products at the dosage level with the GS1 DataMatrix barcode. Currently, about 70 products are received from suppliers bearing GS1 DataMatrix barcodes, amounting to about 240,000 single-dosage units each month.

Other products that don’t receive barcodes at suppliers’ locations are still re-labeled. However, HIAE continues to negotiate relentlessly with new suppliers. Suppliers that find barcoding more difficult to comply with are those that produce in different facilities around the world.

With medicines labeled at suppliers’ manufacturing sources, HIAE is saving more than 600 hours and R\$13,620 in associated labor costs every month, as its pharmacy no longer needs to re-label medicines. Furthermore, this minimizes the risk of inaccuracies in the identification process.

FIGURE 3: AMPOULES LABELED WITH GS1 DATAMATRIX BARCODES



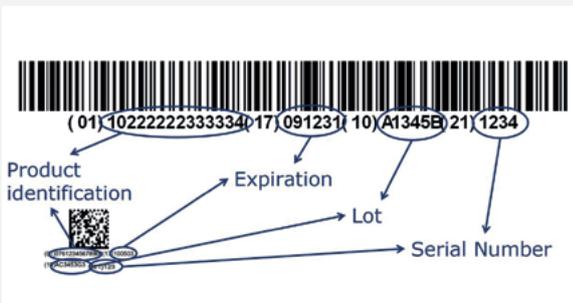
Source: Hospital Israelita Albert Einstein

Challenges along the way

The transition to scanning GS1 DataMatrix barcodes has presented its own set of challenges for the hospital. Some suppliers printed different information in the human readable format while others printed barcodes that scanners could not read, such as on black backgrounds.

The hospital was also faced with the challenge of how to “best engage” with its suppliers, initially encouraging and then eventually requiring the application of barcodes. HIAE also had to upgrade the barcode decoding logic in the hospital ERP system in order to capture the correct information from each identifier’s AI (application identifier). Its barcode readers had to be reconfigured because of the AI structure in GS1 barcodes. GS1 Brazil provided very helpful guidance throughout the implementation.

FIGURE 4: MEDICINE INFORMATION ENCODED IN GS1 BARCODES



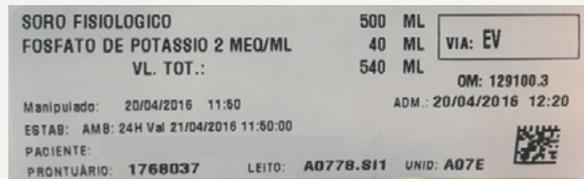
Source: Hospital Israelita Albert Einstein

How the solution works: End-to-end traceability for patient safety

Safer logistics processes were implemented under the direction of the pharmacy—including an electronic ordering system—with barcode scanning each step of the way. The hospital now scans medicine barcodes at the following times:

- Receipt** – As medicines are received, GS1 DataMatrix barcodes are scanned to register the medicine’s type, batch/lot number, expiration date and active ingredients in the hospital’s inventory system.
- Distribution** – The GS1 DataMatrix barcodes are scanned to capture the movement of medicines from the warehouse to the pharmacy.
- Dispensation** – Whenever a dosage of medicine is scheduled for administration to a patient, the GS1 DataMatrix barcode is scanned as it is dispensed by the pharmacy or at the time of its compounding inside the cleanroom. Compounded medicines are labeled with a unique code generated by the EMR identifying the patient, drug, form, dosage and administration route, as well as with a serial number for traceability purposes. The EMR code is printed in the DataMatrix barcode format for the administration step.

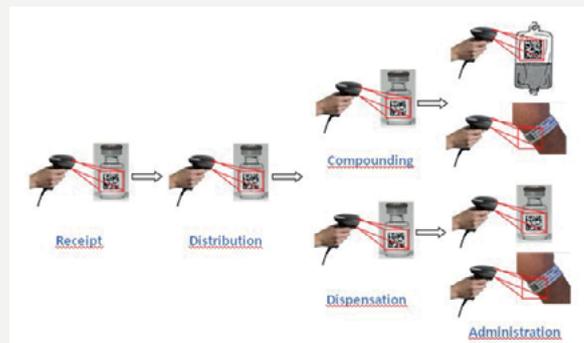
FIGURE 5: EMR UNIQUE CODE ON COMPOUNDED DRUG LABEL



Source: Hospital Israelita Albert Einstein

- Administration** – After the caregiver logs into the EMR system, as the dosage of medicine is administered to the patient, its GS1 DataMatrix barcode is scanned along with the patient wristband barcode, registering the type of medicine—drug, dosage and form. The capture of the medication’s batch/lot number and expiration date is under development. Drugs that do not carry a GS1 DataMatrix barcode applied by suppliers will carry a customized SAP ERP code, internal product code and batch/lot number in the DataMatrix barcode. This identification is applied in the previously discussed re-labeling processes and the EMR is appropriately configured to identify drug, form and dosage. Pharmacy compounded medicines are also identified by a unique EMR code.

FIGURE 6: TRACEABILITY SYSTEM OF MEDICINES AT HOSPITAL ISRAELITA ALBERT EINSTEIN



Source: Hospital Israelita Albert Einstein

Further steps: Taking traceability into the OR

The next phase of the traceability project introduced the identification of surgical supplies by means of GS1 DataMatrix barcodes. As products are scanned for use in the OR, the information is captured in the hospital’s inventory system as well as the newly implemented electronic medical record system.

Identification information of surgical supplies and products used in the OR for a specific procedure can now be captured for tracking back to the patient’s electronic health record.

This new capability has helped HIAE extend traceability to the patient level. The hospital can now analyze and control the materials used for each patient based on their lot information and expiration date.

The results: Focusing on patients

The most important benefit of implementing GS1 standards is patient safety, enabled by medicine traceability up to the final step, when it is administered. One way that HIAE measures the impact of GS1 barcode scanning is by examining the number of errors related to the administration of pharmaceuticals.

HIAE uses a software-based system through which its staff reports the occurrence of errors to the hospital voluntarily and anonymously. HIAE's Risk Management office analyzes the errors reported and, based on its investigations and findings, classifies them according to the National Coordinating Council (NCC) for Medication Error Reporting and Prevention (MERP) Index (Fig. 7).

Figure 8 shows the decline in medication errors based on categories; these errors could have been prevented with adherence to and use of the barcode scanning process.

In 2016, 31 medication administration errors were reported

FIGURE 8: SUMMARY BREAKDOWN OF ADMINISTRATION ERRORS BY CATEGORY

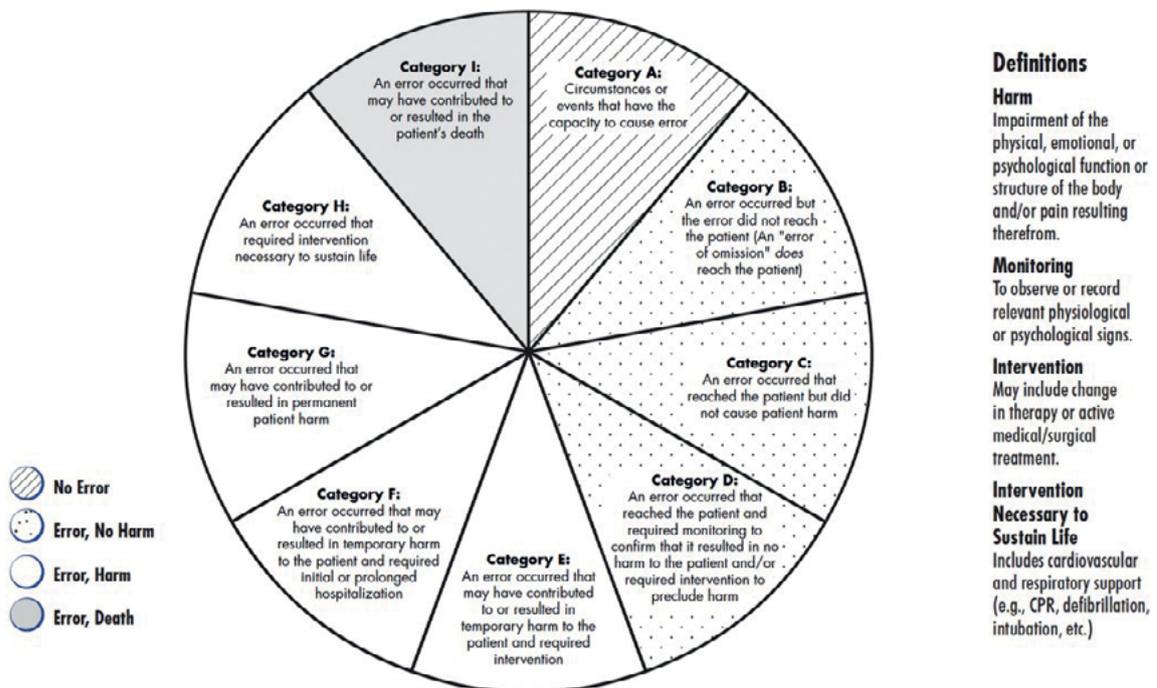
NCC MERP CLASS	2014	2015	2016	2017
B	-	2	1	1
C	45	54	25	2
D	7	4	2	-
E	5	-	2	-
F	-	-	2	-
TOTAL	57	60	31	3

Source: Hospital Israelita Albert Einstein

related to wrong patient, drug or dose. In 2017, only 3 errors were reported, 2 of which classified as C, i.e., clear process violations. If the barcode scanning process had been followed, the violations would have been classified as "B": an error that occurred without reaching the patient.

The following are positive impacts of traceability with GS1

FIGURE 7: NCC MERP INDEX FOR CATEGORIZING MEDICATION ERRORS



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PS0306

Source: NCC MERP (<http://www.nccmerp.org/sites/default/files/indexBW2001-06-12.pdf> at <http://www.nccmerp.org/types-medication-errors>)

barcode scanning:

- End-to-end traceability of medicines—inside and outside the hospital—from suppliers' production sites to the hospital's patient bedsides and into the surgical center
- Agility in the dispensation process, with up-to-date online inventory status
- Verification of the medicine dispensed, as ordered
- Confirmation of dispensing drugs that have not expired nor have been recalled
- Ability to quickly locate recalled products and links to the patients they were administered to or used on in a procedure
- Automated bedside check of medication being administered, ensuring control over 7 of 9 administration rights—right patient, drug, dose, time, route, form and documentation
- Essential capability for obtaining quality certifications

In the near future, HIAE plans to capture more detailed information about medicines, recording the product's serial number when available. Tracking high-cost products in the OR is also planned, by using GS1 EPC (Electronic Product Code)-enabled RFID (Radio Frequency Identification) technology.

Biography

Nilson Gonçalves Malta is the Hospital Automation Manager at Hospital Israelita Albert Einstein. For 18 years, he has led multiple automation projects in hospital pharmacy logistics and clinical processes. Nilson graduated as a Pharmacist-Biochemist with a post-graduate degree in Hospital and Healthcare Systems Administration. He is a member of the ANVISA (Brazilian Regulatory Agency for Drugs) Committee for the National System of Drug Control.

References

“Staking Out a Quality Position,” video, 1999. Joint Commission International website, www.jointcommissioninternational.org/accreditation/the-jci-difference/

Malcolm Elliott, Yisi Liu; “The nine rights of medication administration: an overview.” *British Journal of Nursing*, 2010, Vol 19, No 5.

NCC MERP (<http://www.nccmerp.org/sites/default/files/indexBW2001-06-12.pdf> at <http://www.nccmerp.org/types-medication-errors>)

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From the simple scan of a barcode to a complete patient safety strategy



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ABSTRACT: Centro Médico Imbanaco de Cali (Imbanaco) uses GS1 standards to simplify and automate its clinical processes for increased efficiencies and enhanced patient safety. The hospital has launched several initiatives focused on ensuring the traceability of medicines, medical devices and other supplies to enhance patient safety and reduce errors. Based on automated ordering processes, Imbanaco has experienced a 98 percent improvement in inventory shrinkage and waste, in addition to a 25 percent reduction in inventory levels at its satellite pharmacies. Furthermore, the time needed to create a patient invoice has been reduced from nearly an hour to only 18 minutes.

About Colombia's leading hospital

Imbanaco is a private hospital located in Cali, Colombia. Its more than 2,500 physicians, nurses and other administrative and healthcare staff service approximately 1.5 million patients each year. In July 2017, Imbanaco received the Gold Seal of Approval® accreditation from the Joint Commission International as the fifth Colombian hospital to achieve all the quality standards required by the JCI committee.

One of Imbanaco's primary goals is to continuously evaluate and adopt innovative technologies and practices so as to ensure a high level of care and safety for its patients.

For more than a decade

As early as 2007, Imbanaco started implementing GS1 standards to efficiently identify and capture information about all products, such as pharmaceuticals and medical supplies. The same standards were also used as part of invoicing and inventory control activities in the main distribution center and pharmacies. Prior to this, the hospital used paper-based activities and information was processed manually.

In that same year, Imbanaco led the way to the adoption of the GS1 DataMatrix barcode—a two-dimensional (2D) barcode capable of holding large amounts of data in a very small footprint. This new barcode enabled Imbanaco to automate

the identification of the medical devices, pharmaceuticals and medical supplies used in patient care. The size of the GS1 DataMatrix has enabled the hospital to include the management and control of drug blisters, bottles, vials and syringes, as well as other small devices.

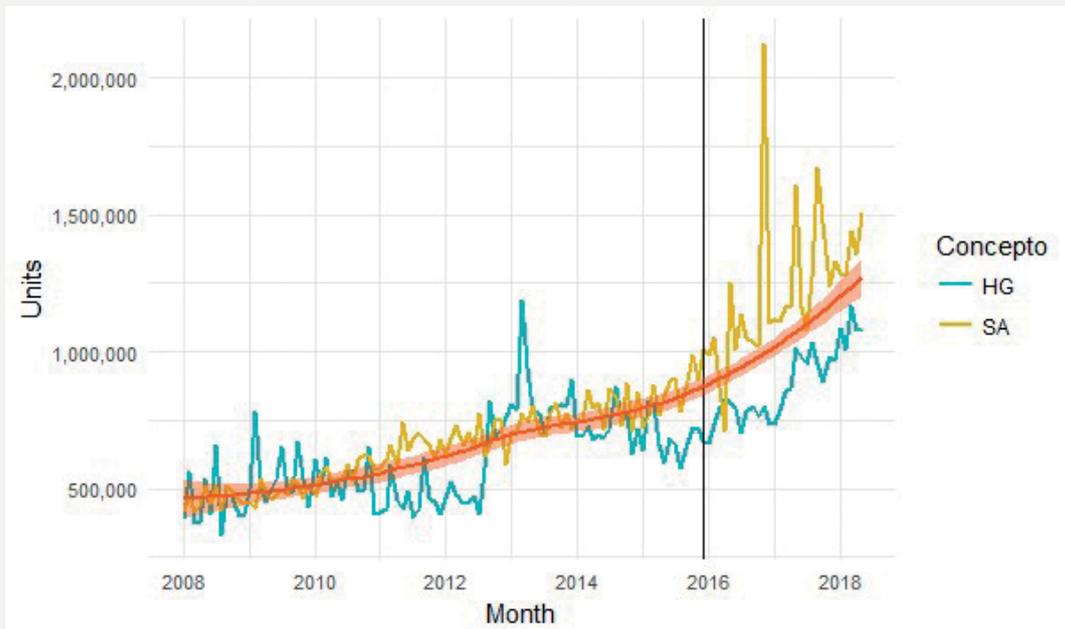
In 2010, Imbanaco's Board of Directors recognized the clear benefits of using GS1 standards, resulting in granting their financial support to extend the use of standards to internal processes like medication administration, pharmacovigilance and inventory management for patient safety and improved efficiencies.

In 2010, Imbanaco started the construction of a new, much larger facility. Its challenge was to expand the care and treatment areas by 300 percent with only a 15 percent increase in operational costs for nurses and staff and other administrative costs. As part of the expansion, there were new technologies like automated dispensing cabinets (ADCs), supply carousels, traceability solutions for surgical instruments (tray and surgical devices), RFID proximity access control systems and connectivity solutions for medical device data integration—all of them designed to help the hospital gain efficiencies.

Migration to traceability

In 2014, Imbanaco commenced its multi-phase project to migrate its processes, products, systems and people to a

FIGURE 1: 10-YEAR TREND OF PRODUCT CONSUMPTION AND SCANNING



Source: Centro Médico Imbanaco

HG: Charged to patient; SA: Charged to the floor; Black vertical line: Milestone date of new facility opening (Dec. 2015)

traceability system using GS1 standards. To do this, the project required the following actions:

- Generating GS1 identifiers to update the master data catalogue
- Using GS1 standards to uniquely identify single-dose medicines, medical devices, trays, surgical instruments and supplies, including ADCs
- Training more than 350 nurses and physicians on the new GS1 barcodes
- Preparing all IT systems to handle the new GS1 standards-based system

Laying the GS1 identification foundation

Only about 4 percent of medicines and medical supplies received into Imbanaco’s central warehouse are uniquely identified with a GS1 Global Trade Item Number® (GTIN®¹), along with a serial number, batch/lot number and expiration date. This data is encoded in a GS1 DataMatrix barcode that is then applied to a single dose of medicine, medical device or medical supply.

As for products without a GS1 identification, Imbanaco re-labels each of them with the same data provided by the suppliers (GTIN, serial number, batch/lot number and expiration date) encoded in GS1 DataMatrix barcodes to fulfill its commitment to patient safety.

Today, more than 7,500 barcode labels are printed and applied daily to medicines and medical supplies in Imbanaco’s warehouse before being delivered to each department. This represents more than 96 percent of the products used by the

¹ The GTIN ® is a trademark registered of GS1 AISBL

hospital. At the same time, all trays and surgical instruments without unique identifiers are marked by Imbanaco’s provider using direct marking technology, which assigns an internal device identification number in a 0.25 mm DataMatrix barcode.

For Imbanaco to achieve full traceability, this level of identification (and investment) is critical. Only with this identification system in place can Imbanaco track products as they are used throughout the hospital and with patients, as well as trace their origins back to each supplier.

Automated inventory management

Once pharmaceuticals, medical devices and supplies have been individually identified with DataMatrix barcodes, they are stored in one of two automated carousels or a fixed storage

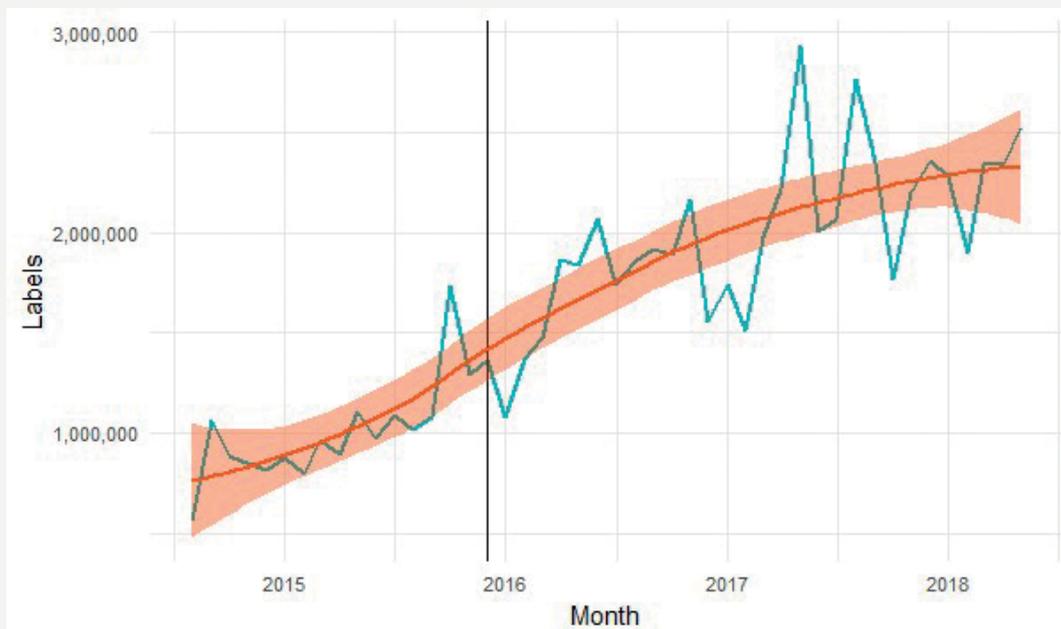
BOX 1: UPDATING THE MASTER DATA CATALOGUE WITH GTINS

Prior to the traceability project, the vast majority—about 96 percent of nearly 22,000 products—did not have unique identifiers (GTINs) assigned to them and were not part of the hospital’s master data catalog.

While Imbanaco could have requested that its suppliers provide and update this information, it decided instead to move forward, generating the GTINs internally so that GS1 barcodes could be created and applied to all single-dose medicines, medical devices, supplies and other items.

Source: Centro Médico Imbanaco

FIGURE 2: QUANTITY OF DATAMATRIX BARCODES APPLIED BY IMBANACO ON SINGLE MEDICINE DOSES



Source: Centro Médico Imbanaco

HG: Charged to patient; SA: Charged to the floor.

The vertical black line represents the milestone of the new facility's opening date (Dec. 2015).

structure, each of them also individually identified with GS1 standards and barcodes.

The central warehouse scheduler dispatches products to Imbanaco's Pharmaceutical Central Service, pharmaceutical services satellites and other venues throughout the hospital. As medicines and medical devices are requested by different services within the hospital, the central warehouse and pharmaceutical service sites can easily locate and deliver these products to multiple dispensing sites for immediate access.

As medicines and medical devices are distributed and administered to or used by patients, their barcodes are scanned at each point of service to track their location and progress throughout the care process. This information is automatically integrated into the hospital's information system so that Imbanaco always has near real-time information and visibility into inventory levels and can charge the appropriate costs to patients' accounts.

The inventories are automatically replenished when they reach pre-determined levels. Imbanaco has automated the monitoring and management of its inventory so that patient care is not compromised. The hospital's goal is to make inventory always available to minimize patient care delays or even eliminate them. Requests for additional products are generated automatically and, if necessary, purchase orders for suppliers are generated as well.

Based on its automated inventory and ordering system, Imbanaco estimates a 25 percent reduction in inventory levels at its satellite pharmacies, along with a 98 percent improvement in inventory shrinkage/waste.

Elimination of expired medicines and their disposal

In 2009, Imbanaco started checking the medication expiration date during the bedside scanning of the product's barcode. During 2009 and 2010, a new feature was implemented to closely monitor the expiration of pharmaceuticals and their disposal.

During 2010 and 2011, an inspection process was performed using barcode scanning to remove all expired medicines from all available stock (e.g., crash cars, bags, emergency boxes and shelters). In 2015, the warehouse management system was implemented; no medicines expired during that year nor in 2017, therefore, no disposals were recorded.

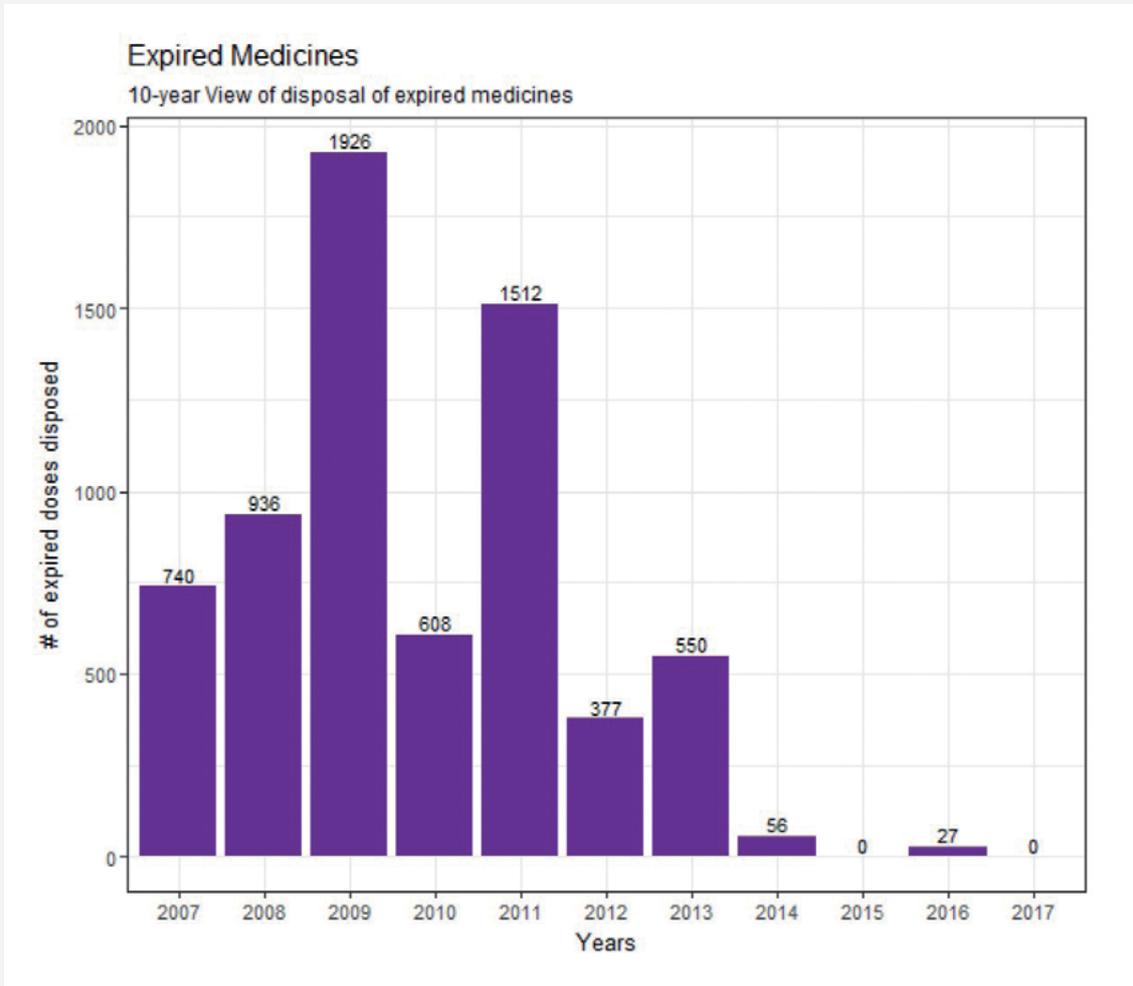
Reducing medication errors

At the same time that product information is recorded in the inventory system, it is also recorded in patients' electronic health records and in Imbanaco's billing system for invoicing.

When admitted to Imbanaco, each patient is presented with an identification wristband that has his or her own unique identification number encoded in a GS1 barcode. As for neonatal patients, a printed stamp with the same information is applied on the back.

As medications are administered to patients, the GS1 barcode on the single dosage is scanned together with the barcodes on the patient's wristband. In the near future, the hospital plans the capability to scan the caregiver's badge that contains his or her identification to complement record-enhancing traceability. As a result of bedside scanning, medication errors have been reduced significantly.

FIGURE 3: SUMMARY OF DISPOSED EXPIRED MEDICINES



Source: Centro Médico Imbanaco

In preparation for the next step in safe medication administration, all prescriptions will include a GS1 barcode integrated with ADCs to control dispensing quantities at administration time.

Automating the issuance of invoices

As a healthcare provider in Colombia, Imbanaco is required to issue an invoice to each patient *before* leaving the hospital. Therefore, when it comes to patient discharge, speed, accuracy and consistency of billing services are all necessities.

To do this, the hospital efficiently captures all relevant care costs for improved billing and accounts receivable. During hospitalization, the patient’s GS1 barcode identification allows Imbanaco to instantly access the record of the prescription drugs administered to the patient and the procedures performed and then compile all charges for billing purposes upon discharge.

The accuracy of charges to a patient account during their treatment or hospital stay has increased by 90 percent. Data accuracy has also reduced the time needed to create an invoice.

By automating administrative processes like billing, Imbanaco is able to achieve the following:

- Reduce the time needed to calculate stock and replenishment levels
- Reduce documentation time
- Increase data entry accuracy
- Increase the time spent with patients
- Reduce patients’ waiting time for procedures, results from procedures and the final invoice when discharged from the hospital

GS1 identification in operating theaters

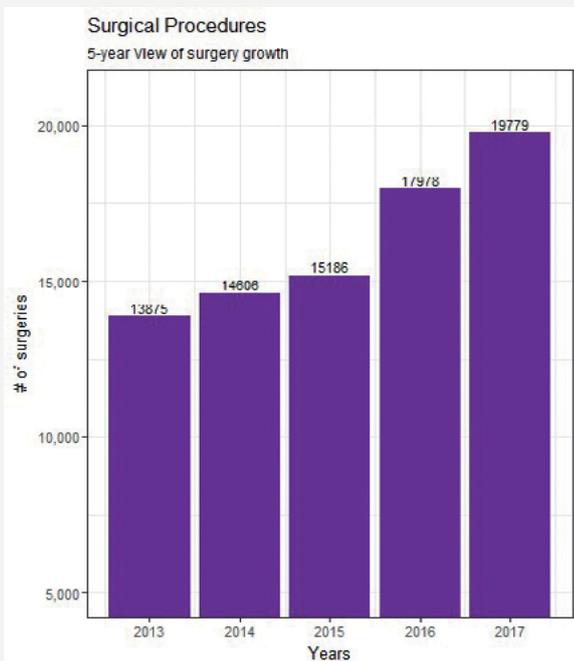
In order to maintain the highest infection control standards, Imbanaco has optimized the flow of sterile processing of surgical instruments and non-implantable materials at its sterilization center.

To achieve this in the complex framework of a sterilization center, traceability is essential. Previously, Imbanaco had tried to track each instrument manually, which was labor intensive

and not very effective. Now, the hospital has announced the implementation of an automated traceability system based on the efficient use of a Unique Device Identifier (UDI) for each instrument by 2H 2018.

This will enable Imbanaco to locate each instrument in its traceability system efficiently and accurately, including on which day and by whom it was used, what class of procedure was performed and on which patient. Since each instrument is uniquely identified, Imbanaco can also trace and evaluate the quality of materials and number of times used compared to the standards set by the manufacturer, as well as use big data to set better controls and enable more effective decisions about its instruments.

FIGURE 4: SUMMARY OF SURGERY PROCEDURES



Source: Centro Médico Imbanaco

Imbanaco is implementing two strategies to ensure instrument traceability using standards. For future acquisitions, the hospital has requested that suppliers provide instruments with direct UDI markings. One of the hospital's suppliers already marks its surgical instruments with GS1 unique identifiers. For now, the hospital has decided to move forward, generating an internal identification code to mark trays and surgical instruments. More than 35,000 individual trays and instruments have been marked this way.

Training nurses and physicians

In a busy working environment, mistakes are inevitable. By using GS1 identification and scanning strategies for medications, patients and locations, Imbanaco has achieved the reduction of inevitable errors.

Every three years, Imbanaco measures nurses' activities based on four major categories. Starting in 2017, there has been an increase in the time spent by nurses with patients, reaching 30 percent spent on clinical activities.

FIGURE 5: SUMMARY BREAKDOWN OF TIME SPENT BY NURSES

Activities	2007	2010	2014	2017
Documentation	50%	65%	75%	50%
Clinical	20%	20%	15%	30%
Communication	20%	10%	5%	15%
Other	10%	5%	5%	5%

Source: Centro Médico Imbanaco

Conclusion

Imbanaco is currently collaborating with pharmaceutical and medical device manufacturers and other suppliers to use GS1 standards for the identification of their products *prior* to shipment and arrival at Imbanaco's warehouse. As more and more of its suppliers use GS1 standards, Imbanaco will be able to save on time and costs and gain further efficiencies in its operations.

Another current effort involves entering standardized patient identification in support of patient transfer processes to help with the electronic exchange of clinical history records and the reception of patients outside of Colombia.

Additional initiatives include implementing traceability of sterile implants and using UDI (GS1 standards) in procurement and sourcing processes. Imbanaco is also collaborating with other local hospitals to create a medications data pool for information sharing purposes.

Biographies

José Luis Sabogal is the Chief Information Officer at Centro Médico Imbanaco de Cali. He has actively promoted technological innovation that started with the development of the homegrown version of the SIAM ERP, making Centro Médico Imbanaco de Cali a key leader for the implementation of cutting-edge medical technologies in the region. His vision of the future has positioned him as a leader of committees such as the GS1 Advisory Board.

Andrés Rodríguez is the Chief Operations Officer at Centro Médico Imbanaco de Cali. He is a supply chain professional with 24 years of experience leading and managing advanced logistics and operations for several worldwide renowned companies in the Colombian market. Andrés is a business administrator with post-graduate studies in Supply Chain, Integrated Logistics, Marketing and Finance.

Juan Camilo Rincon is a former Project Manager Coordinator for Centro Médico Imbanaco de Cali. He has participated in the implementation of key technological innovations for logistics and patient safety, acting as the link between suppliers and vendors and Imbanaco's IT, Biomedical Engineering, Procurement and Clinical and Medical Coordination Departments.

Decreasing medication errors through bedside barcode scanning (BCMA): our patients deserve the additional safety barrier



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ABSTRACT: Administration is one of the most error-prone steps of inpatient medication use. Barcoded medication administration is used at most US hospitals, but limited in European hospitals. This is unfortunate, as this technology can decrease medication administration errors by 50%. To achieve the full benefit of this technology, BCMA requires the continuous monitoring of appropriate use and analysis of alert data. Our approach is based on two pillars: making sure end users can seamlessly use the technology and that they will use it appropriately.

Introduction

St Jansdal Hospital, Harderwijk, is a 340-bed community hospital in the centre of The Netherlands with 17,350 clinical admissions, 85,000 first outpatient visits and 300,000 subsequent outpatient visits annually. The hospital's vision is to provide safe, effective and efficient care by fully harnessing the power of information technology. In November 2017, St Jansdal Hospital, Harderwijk was only the 4th hospital in Europe to be granted the HIMSS Electronic Medical Record Adoption Model (EMRAM) Stage 7 award. Stage 7 is the highest level of the EMRAM model and is a certificate of excellence for the effective adoption and widespread use of the Electronic Medical Record (EMR).¹

A closed loop medication system is an essential part of the EMR. **Figure 1** illustrates the typical inpatient use of medication and summarizes how we optimize this cycle by applying the EMR. In this article, we focus on barcoded medication administration (BCMA).

The challenge

Administration is one of the most error-prone steps of inpatient medication use. In 8 out of every 100 cases, medication is not administered to the right patient in the right form, dose or route.² Barcoded medication administration (BCMA) is a mature technology and standard of care in hospitals in the United States. Already by 2013, almost 75% of all US hospitals had adopted this technology and an additional 17% were planning to implement it within the next 3 years.³ Multiple studies have shown that, when implemented correctly, medication administration errors decrease by 50%.⁴ A recent study by the Dutch Ministry of Health concluded that 47 deaths could be prevented annually in the Netherlands

alone if this technology was universally adopted.⁵ However, another recent study showed that the full effect of BCMA on medication error reduction is often not achieved due to the emergence of many workarounds.⁶ The authors conclude that BCMA needs more post-implementation evaluation.

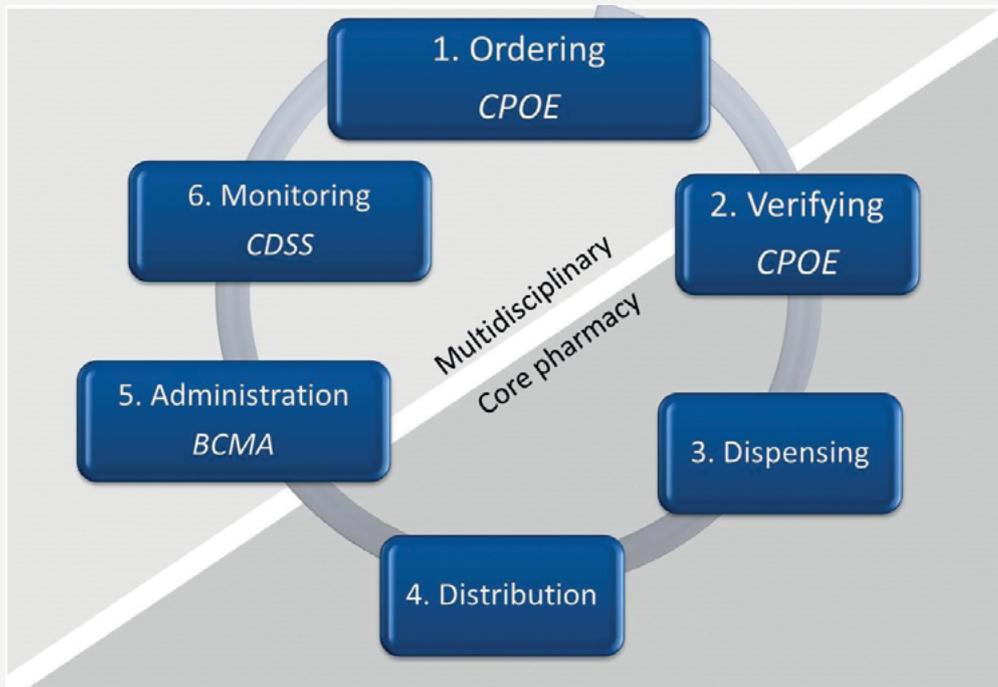
We describe pre- and post-implementation strategies resulting in high barcode scanning compliance rates. In addition, we implemented a continuous quality improvement cycle to detect and fix workarounds so we can fully harness the medication error reduction potential of this technology (Fig. 2).

Our approach

We focused on two key aspects:

1. *Making it easy to do it right.* Keep the objective in mind, only implement the technology when it is relevant and feasible:
 - a. Don't scan everything! We created an institution-wide BCMA policy describing where and what to scan. We only scan those administrations that present relevant patient safety risks due to the systemic effects of the medication. Therefore, we do not require barcode scanning of topical, ear, eye, nose and local administrations.
 - b. Make full use of the electronic Medication Administration Record (eMAR). Highlight medication orders that do not require scanning on the eMAR, so nurses know which orders require scanning and which orders may be scanned.
 - c. If barcode scanning is required, make sure the items in question are barcoded from the start of the project.

FIGURE 1: INPATIENT MEDICATION MANAGEMENT PROCESS AND INFORMATION TECHNOLOGY



Source: HIMSS Guidance document: "Costs, Benefits and Potential Unintended Consequences of Automating the Pharmacy Medication Cycle in Acute-Care Settings" 2010.

Available from: <https://www.himss.org/system/files/Downloads/PharmacyGuidanceDocumentAcuteCareSetting.pdf>

CPOE: Computerized Provider Order Entry
 BCMA: Barcoded Medication Administration
 CDSS: Clinical Decision Support System

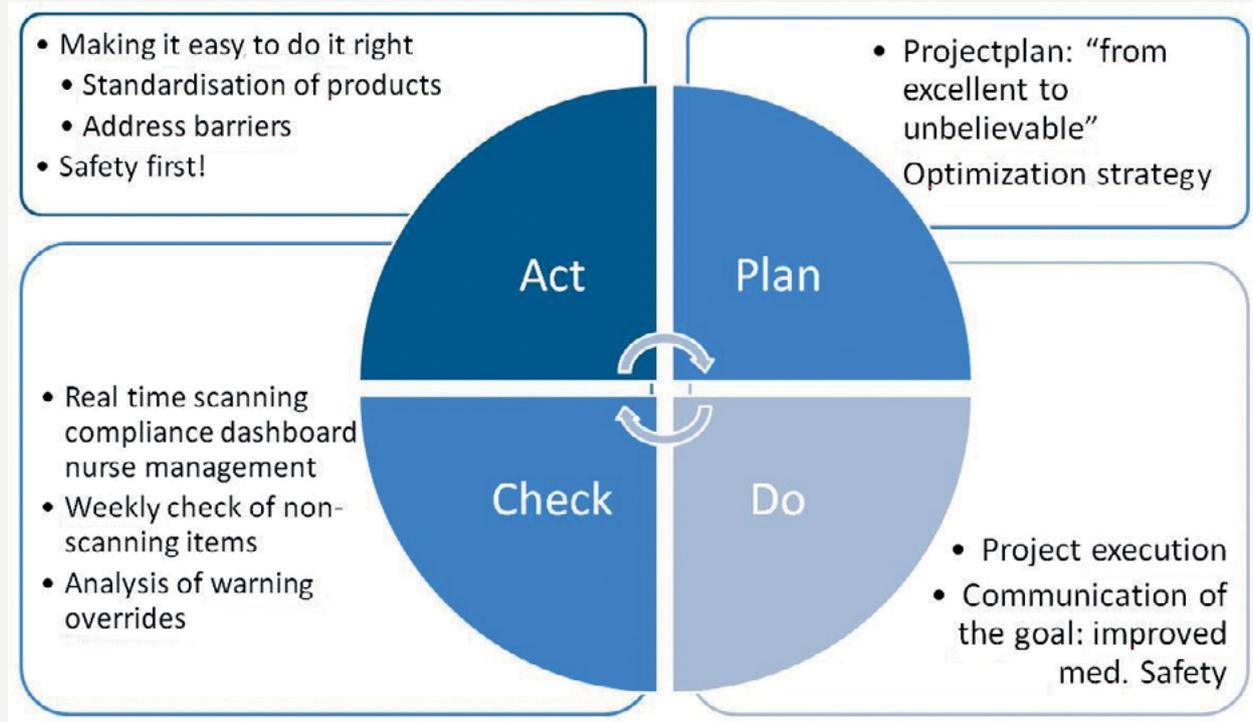
We used a mobile printer/scanner combination which allowed us to barcode medication stock on the floors and in our Automated Dispensing Cabinets prior to go-live.

4. Create custom barcodes for the primary package (individual tablet/capsule) based on the secondary package. These barcodes are already loaded onto our EMR through our national G-Standard medication loading system, which eliminates the need for the custom "mapping" of barcodes.
2. *Safety first, so adhere to our policies and procedures!* Our institutional BCMA policy is the basis of our BCMA implementation. We created a nurse manager BCMA compliance dashboard which shows daily BCMA compliance for each ward. The dashboard also has a preformatted pivot table which ranks nurses by lowest to highest BCMA compliance and is used by managers to provide direct feedback to their nurses. Last, we use the dashboard to provide feedback to the user when relevant alerts have been ignored.

Our results

1. We achieved 95% patient identification and 90% scanning compliance at go-live (12% higher than other BCMA adopters using the same EMR in the Netherlands).
2. Continuous post-implementation feedback increased medication scanning compliance by an additional 6% to 96%.
3. BCMA prevented 654 medication administration errors in 50,254 administrations during the first month after going live.
4. Continuous focus on nursing workflow resulted in a reduction of the number of alerts/10.000 administrations by 16%, from 403/10.000 administrations at go-live to 340/10.000 administrations in September 2017.
5. Continuous data monitoring showed 42 overrides of relevant alerts in one month and highlighted several workarounds and system errors (Tab. 1).
6. Nursing staff appreciate the continuous feedback and the focus on the goal of BCMA (e.g. zero BCMA preventable medication errors).

FIGURE 2: BCMA SCANNING COMPLIANCE OPTIMIZATION



Source: St Jansdal Hospital. Scanning Optimization Quality Improvement Process

TABLE 1. MOST FREQUENTLY OCCURRING SCANNING ISSUES AND WORKAROUNDS

Type	Issue	Cause	Fix
Workaround	A duplicate print of patient wristband is scanned instead of the actual band worn by the patient.	Easier Didn't want to wake the patient	Periodic audits and direct feedback to nurse and nurse manager: a patient sleeping is not a valid reason for deviating from a safety measure
System issue	Medication scanning compliance is low at night and high during daylight	Scanner laser light is bright and always on	Setting on scanner: fixed.
System issue	Multiple "barcode does not scan" alerts for products that normally scan perfectly	Caps Lock key on keyboard is on: barcode is case sensitive	Setting on scanner to ignore Caps Lock on keyboard: fixed.
System issue	Patient has order for combination product, ingredients are given separately	Formulary constraints	Addition of most frequently occurring items to the formulary and EMR pop-up to change order to individual ingredients at admission

Source: St Jansdal Hospital Electronic Medical Record Source Data.

Lessons learnt

1. You have only one chance to make a first impression: use a mobile scanner-printer solution to quickly barcode ALL your floor stock so almost everything scans upon go-live.
2. BCMA implementation does not stop at go-live, it requires continuous focus on medication administration safety.
3. Create a preformatted dashboard which can be easily accessed by nurse managers and team leaders.
4. Use the dashboard to make it even easier to do it right: the EMR is a great source for finding and addressing workarounds and non-adherence cases.
5. Praise your nurses, they deserve it! They do the hard work, so keep focusing on supporting nursing workflow.
6. Scan relevant medications ONLY!

Conclusions

Barcode scanning at the bedside is a mature technology and has the potential of decreasing the number of medication administration errors by 50%. This article outlines our efforts to correctly implement this technology and continuously monitor its use.

However, the biggest drawback for institutions against adopting this technology is the lack of a barcode on the primary unit of dispense (e.g. the individually packaged tablet) in about 20% of the products found in the hospital pharmacy. Based on the secondary barcode (the one on the outer box), our hospital pharmacy manually affixes barcode labels to each individual tablet, ampoule etc. that does not contain a barcode, which is labour intensive. In addition, the barcodes of 80% of barcoded medications are not standardized, they are sometimes poorly readable and need to

be manually linked to the right product in the EMR ("mapping"). Indeed, barcode scanning technology can be implemented more rapidly and effectively if two conditions are met:

1. A standardized barcode is part of the labelling of every primary package; the GS1 standard is a great example of how standardization leads to further efficiency gains. This barcode standard also includes a lot number and expiration date, making inventory control and expiration date checking possible with a single scan.
2. The barcode data of the primary package is part of the EMR's drug information database update that is already performed monthly.

Even with the aforementioned drawback, we have demonstrated that barcode scanning can already be implemented effectively and efficiently. Let's not wait any longer and prevent patient harm by introducing an additional electronic barrier between medication errors and our patients. They deserve it!

Biography

Pieter Helmons, Ph.D, MAS

From 2007-2011 Pieter Helmons was the Pharmacoeconomics Specialist at UCSD Medical Center in San Diego, California. Since 2011, Pieter Helmons works as a hospital pharmacist at St Jansdal Hospital Harderwijk, The Netherlands. He obtained his PhD in Pharmacy Informatics in 2014 and is recently appointed as the Chief Pharmacy Informatics Officer (CPIO).

References

1. EMRAM: A strategic roadmap for effective EMR adoption and usage. <https://www.himss.eu/healthcare-providers/emram>. Date accessed: June 18th, 2018
2. Hassink J, Jansen M and Helmons, P. 2012. Effects of bar-code assisted medication administration (BCMA) on frequency, type and severity of medication administration errors: a review of the literature. *European Journal of Hospital Pharmacy. Science and Practice* 19:489-494
3. Fox B, Pedersen C, and Gumpfer K. 2015. Am J Health-Syst Pharm. ASHP national survey on informatics: Assessment of the adoption and use of pharmacy informatics in U.S. hospitals—2013. *American Journal of Health System Pharmacy*, 72:636-55
4. Helmons P, Wargel L, Daniels C. 2009. Impact of bar-coded medication administration (BCMA) on medication administration errors and accuracy in multiple patient care areas: a before-and-after study. *American Journal of Health System Pharmacy* 66(13): 1202-1210
5. Barcodes on the primary package of medication in the hospital: a return-on-investment analysis (2016, Dutch). Dutch Ministry of Health. Available from: <https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2016/11/07/barcodering-op-de-primaire-verpakking-van-geneesmiddelen-in-ziekenhuizen/barcodering-op-de-primaire-verpakking-van-geneesmiddelen-in-ziekenhuizen.pdf>
6. Van der Veen W, Van den Bemt P, Wouters H, Bates D, Twisk J, De Gier J, Taxis K for the BCMA Study Group 2018. Association between workarounds and medication administration errors in bar-code-assisted medication administration in hospitals, *Journal of the American Medical Informatics Association* 25 (4):385-392

University of Fukui Hospital Surgical Center creates an integrated sterilization management system for traceability and patient safety



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ABSTRACT: Since 2014, the University of Fukui Hospital (Fukui Hospital) has been focused on the cost-effective management of its surgical operations. The hospital has successfully achieved the traceability of surgical instruments in its surgical center's sterilization process by identifying each of 30,000 instruments with GS1 standards. The error rate in counting was reduced from 3,054 to 175 ppms, and the time required to assemble and check instruments for surgical operation was reduced by 4,000 hours per year. Using GS1 Global Location Numbers as part of its surgical container setting system has helped reduce Fukui Hospital's overall operation time by 4,971 hours per year.

The need: improved safety and efficiencies

Fukui Hospital is located in the Fukui region of Japan, with a population of around 400,000. It is the central hospital of the region with 600 beds and approximately 5,000 surgical operations performed annually.

Fukui Hospital needed to ensure the safe use and traceability of instruments used in surgical procedures. The hospital was experiencing an error rate of 3,054 ppms when counting instruments, which introduced risks associated with leaving surgical instruments in a patient's body. Furthermore, Fukui Hospital wanted to improve efficiencies in its operating rooms and inventory processes.

The hospital's Surgical Center and Central Sterilization department decided to research the concept of "marking" instruments directly with unique identifiers (UDIs) encoded in barcodes.

In 2006, the Japan Association of Medical Devices Industries (Jamdi) released the *Guideline for Two Dimensional Symbol Marking on Steel Instruments*. This guideline defines the need for direct marking and using GS1 standards for symbol engraving, recommending the use of GS1 Global Trade Item Numbers GTIN®¹ plus serial numbers, together with direct marking by means of GS1 DataMatrix barcodes.

¹ The GTIN® is a trademark registered of GS1 AISBL

Outside Japan, in 2013, the International Medical Device Regulators Forum (IMDRF) and the U.S. Food and Drug Administration (FDA) issued, respectively, *UDI Guidance: Unique Device Identification of Medical Devices and UDI Final Rules*. Both require the identification of a medical device using Unique Device Identification (UDI). For surgical instruments, direct UDI marking is expected to improve patient safety and optimize patient care.

The solution: Integrated Sterilization Management System

From 2010 to 2014, the Surgical Center and Central Sterilization Department introduced the Integrated Sterilization Management System (ISMS), which ensures the traceability of steel instruments by means of unique identification.

The system enables the linkage of patient identification, surgical schedule and surgical instruments information within a hospital information system. For the identification of surgical instruments and sterilization-related equipment, the hospital decided to adopt GS1 standards.

Some guidelines were already in place, such as the one by Jamdi, previously mentioned, and the *Practical Guideline for Operative Medicine*, released by the Japanese Association for Operative Medicine, which recommended using UDI for

the identification of surgical instruments. However, there were few manufacturers who had actually implemented direct barcode markings on their products.

Uniquely identifying surgical instruments and locations

Surgical operations require around 20,000 pieces of surgical instruments whose marking must be performed without affecting scheduling. Due to these factors, it was imperative to conduct direct marking in the hospital, for a smooth transition to the management of surgical instruments using unique identification.

To do this, Fukui Hospital used the GS1 DataMatrix barcode as a data carrier for the unique identifier on steel instruments.

The initial number of steel instruments marked with GS1 identifiers encoded in DataMatrix barcodes totaled approximately 18,000. The hospital spent nearly one year on the direct marking and registration of all the instruments in its database.

The Integrated Sterilization Management System has been in operation since September 2015. As of June 2018, the hospital has in total about 31,000 pieces of steel instruments marked with GS1 identifiers and barcodes.

The hospital has also adopted another GS1 standard, called Global Location Numbers (GLNs), to identify locations. A GLN is assigned to each operating room, every location in the surgical container storage cabinet that accommodates sterilized containers and items, fixed shelves and storage racks in the hospital wards and more. In total, more than 1,000 of the hospital's locations have GLNs.

Applying barcodes on surgical instruments

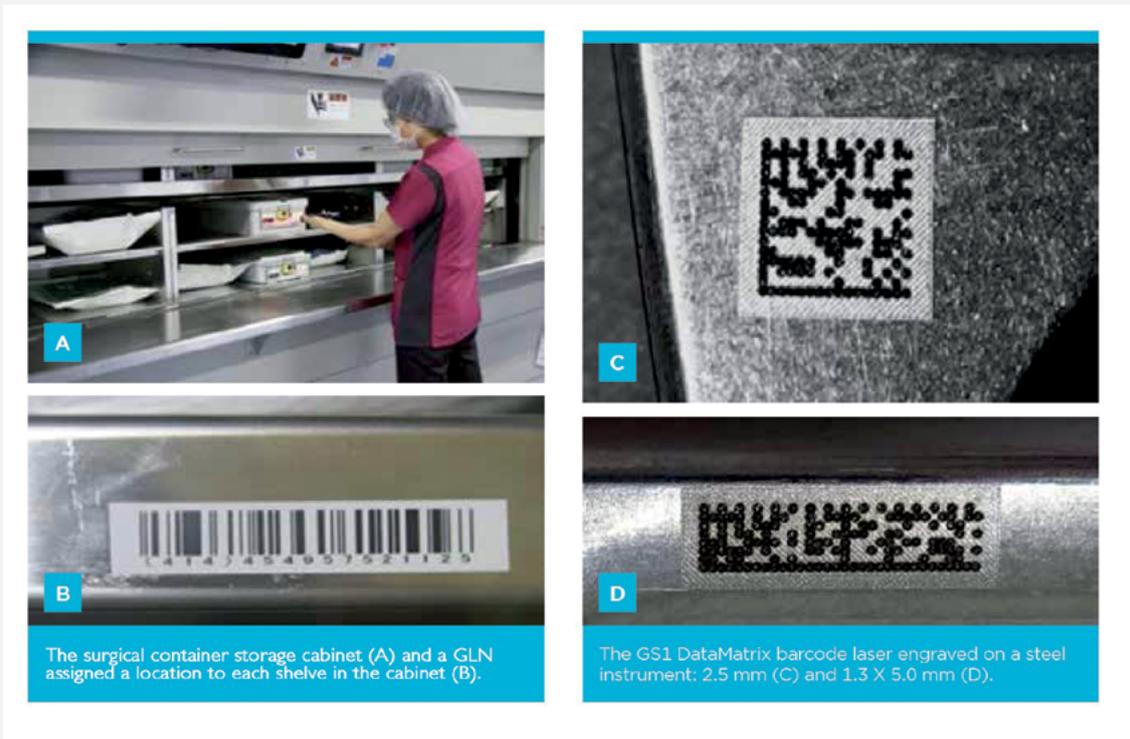
The hospital has a laser-marking machine that marks steel instruments with the GS1 unique identifier encoded in a DataMatrix barcode.

For those instruments that have been identified and marked by the manufacturers, Fukui Hospital uses the manufacturer-provided GS1 unique identifiers and serial numbers encoded in DataMatrix barcodes, instead of marking them internally.

The hospital marks instruments in two places for several reasons:

- By repeated washing and sterilization, the surfaces of these instruments are gradually worn away.
- If marked in only one place, there would be a possibility that the code might become “un-scannable”, making it quite difficult to identify the original identification

FIGURE 1: MARKING INSTRUMENTS, CABINETS AND LOCATIONS FOR TRACEABILITY



The hospital's surgical container storage cabinet (A) and a GLN assigned a location to each shelf in the cabinet (B). The GS1 DataMatrix barcode laser engraved on a steel instrument: 2.5 mm X 2.5 mm (C) and 1.3 X 5.0 mm (D).

Source: University of Fukui Hospital Surgical Center

code.

- It is easier to scan a DataMatrix barcode when two sides are marked; this is also very useful when time is limited during a surgery.
- Based on extensive experience, two-place marking has been strongly recommended by the Jamdi guide for surgical instruments in Japan.

How the ISMS works

By using portable digital devices, the system allows Fukui Hospital to manage information during each step of a surgical operation: collecting, cleaning, sterilizing and storing surgical instruments, along with preparing for operations (Fig. 2).

The GS1 DataMatrix barcode that is directly marked on each steel instrument is read twice—during the collection step after a surgical operation and during assembly.

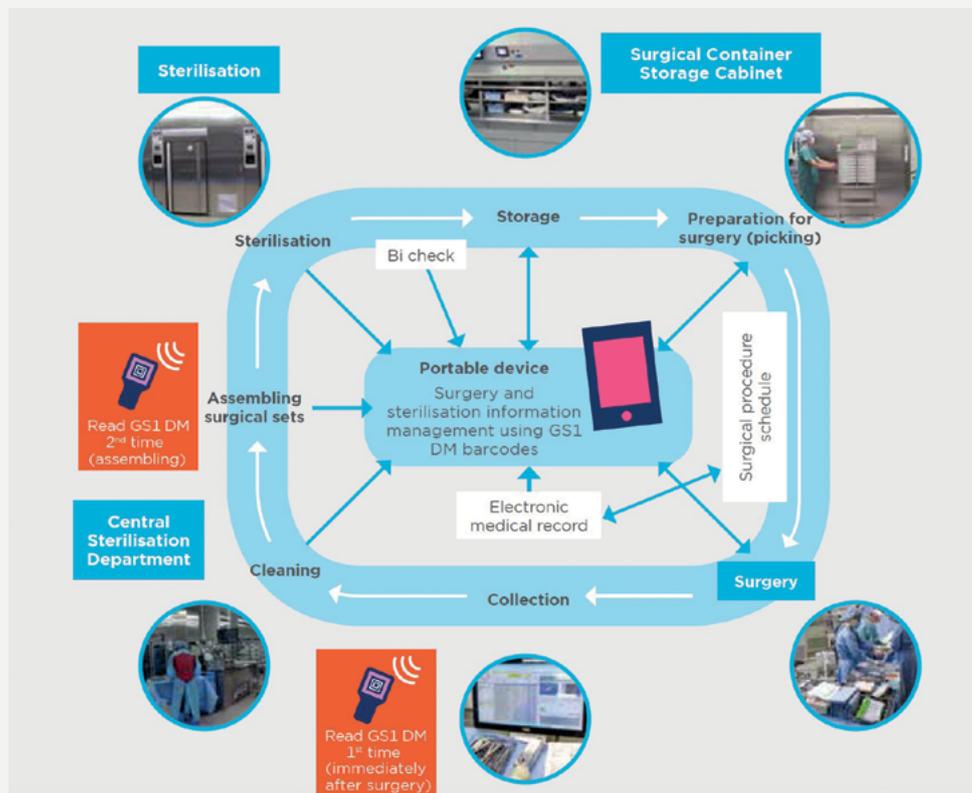
Detailed steps for reading the GS1 DataMatrix barcode and preparing for surgical operations are as follows:

- Immediately after the completion of a surgical operation, GS1 DataMatrix barcodes are scanned on the steel instruments used during the operation, counting all of them before the patient leaves the operating room. This ensures that all prepared

instruments have been collected.

- After the instruments are cleaned, skilled staff members conduct a visual check, scan the GS1 DataMatrix barcodes again and assemble a surgery set. They thus ensure that all necessary instruments are in place.
- GS1 barcodes are used for checking at each step of the containers’ registration process: before and during sterilization and upon storing, placing and selecting the sterilized containers.
- The hospital’s surgical container storage cabinet has been developed specifically for storing containers and sets of sterilized items and is equipped with a touch-panel monitor to display stock status. The monitor displays real-time surgical operation-related information based on electronic medical records.
- A staff member reads the surgical operation schedule from electronic medical records using a smartphone-like portable device. By scanning a surgery ID and a barcode on a surgery cart, the shelf inside the cabinet automatically rotates and stops on the position where the necessary container is stored, allowing staff members to select it with ease.

FIGURE 2: WORKFLOW OF THE INTEGRATED STERILIZATION MANAGEMENT SYSTEM



Source: University of Fukui Hospital Surgical Center

- There are approximately 600 storage locations inside the cabinet. Each of them is assigned a GLN for identification, thereby automatically controlling its “stop” position.

The tangible results

Specific benefits of the new system using GS1 standards include improved medical safety measures by ensuring traceability on individual steel instruments (Fig. 3). This includes preventing surgical instruments from being left inside a patient’s body, preventing errors in counting, surgical sets being assembled more precisely, preventing loss and unauthorized takeout.

FIGURE 3: PREVENTING ERRORS IN COUNTING			
	# of errors	# of surgeries per year	Error rate (ppm)
2013: Before ISMS	15	4,911	3,054
2015: After initial implementation	2	5,025	398
2017: After full implementation of ISMS	1	5,715	175

Source: University of Fukui Hospital Surgical Center

The system enables the hospital to analyze more easily the instruments’ frequency of use, turnover and stock status at specified piece and set levels. This leads to a highly efficient stock management system and a 1.5% reduction of surplus stock, resulting in \$20,000 USD cost savings.

Furthermore, frequency of use by surgical method type analysis can help the hospital optimize the number and content of surgical sets. In the past, an experienced nurse with specialized knowledge was needed to assemble the steel instruments into containers. Now, with the new system, this process can be performed by staff members without these specialized skills and knowledge.

Under this system, the assembly operation is quick and accurate. One of the major benefits of the system is that labor costs are lower than before in spite of the increased number of surgical cases during the past four years.

The hospital estimates that in 2017 the system has also contributed to a reduction of approximately 4,000 hours in overall operation time, including the confirmation of steel instruments after surgery.

Container storage and selection tasks, part of the preparation process for surgical operations, have become automated, paperless processes based on the real-time stock status of sterilization containers. Fukui Hospital estimates the time for such work has been reduced by approximately 1,000 hours annually.

The management of steel surgical instruments directly marked with GIAs and the management of locations using GLNs have saved a total of nearly 5,000 hours and more than \$200,000 USD annually (Fig. 4). This allows nurses to concentrate on other duties; furthermore, it can contribute to a reduction of their overtime work.

For medical washer disinfectors and sterilizers, Fukui Hospital has a system in place that provides the real-time operation status of each piece of equipment through a monitor. This means that the cleaning and sterilization history of each instrument can be easily checked, as well as its location and utilization history, thereby enabling the hospital to swiftly respond to a lack of instruments during surgery and recalls. It is expected that the analysis of instrument turnover in addition to their usage rate would further improve the efficiency of the operations.

Next steps

Fukui Hospital plans to introduce a similar system for all of its medical devices and establish a real-time traceability system. The hospital will expand the scope of its traceability management to single-use medical devices and materials using GS1 identifiers marked by manufacturers on packaging.

The hospital will adopt this kind of traceability scheme to loan instruments, as well. A new system is under development to collect real-time location information on carts being prepared for a surgical operation in. Using this system,

FIGURE 4: REDUCTION IN OPERATION TIME AND ASSOCIATED LABOR COSTS (ANNUAL)

Timeframe	Number of surgical cases	Number of operation hours	Labor costs (USD\$)	Estimated reduction in labor costs (USD)*	Estimated reduction in total department work hours*
2013: Before ISMS	4,911	24,400	\$700,058	n.a.	n.a.
2015: After initial implementation	5,025	22,842	\$589,385	\$126,923	2,124
2017: After full implementation of ISMS	5,715	23,424	\$613,105	\$201,562	4,971

Source: University of Fukui Hospital Surgical Center

*Correction for number of surgical cases, adjusted based on increased number of surgical cases

FIGURE 5: ESTIMATED TIME AND COST SAVINGS OF ISMS

5,000 hours time and \$200,000 USD cost savings annually for the overall operation, including post-surgery confirmation of steel instruments for increased patient safety

- 1,000 hours time and \$40,000 USD cost savings annually, based on automated, real-time stock status of sterilization containers
- 4,000 hours time and USD \$160,000 cost savings annually, based on the improved management of steel surgical instruments

1.5% reduction of steel instruments surplus stock and \$20,000 USD cost savings

Source: University of Fukui Hospital Surgical Center, "Improving patient safety and effective traceability of surgical instruments during the sterilization process using GS1 standards," Prepared for the 6th World Congress of Clinical Safety Conference, September 2017.

Fukui Hospital will further improve the existing workflow so that it can confirm that carts are transported to and from an operating room and respond to an urgent change of surgery procedure and/or operating room.

The hospital believes that the GS1 identification system can be widely used for a variety of reasons in the future.

Biographies

Shingo Kasamatsu is the Technical Officer of Faculty of Medical Science at the University of Fukui. He introduced GS1 standards into the University of Fukui Hospital. He is one of the key people who spread the adoption of GS1 standards in the medical field. His interest in GS1 standards is now expanding to other GS1 identification standards beyond the Global Trade Item Number®, Global Individual Asset Identifier and Global Location Number.

Yoko Ishimoto is the Deputy Head Nurse of the Sterilization Management Department at University of Fukui Hospital. As a nurse for the surgical center and also a certified sterilization specialist, she has played a key role in the design of the current central sterilization chamber and has led the implementation of the Integrated Sterilization Management System.

Dr. Kazufumi Sato, M.D., Ph.D., is the Associate Professor of the Surgical Center at the University of Fukui. He graduated from the Kanazawa University Medical Department in 1980. Since 2003, Dr. Sato has served as Deputy Director for the Surgical Center at University of Fukui Hospital. He is leading the implementation of GS1 standards in the Surgical Center for secure traceability of the sterilization process and cost-effective management.

References

- Japan Association of Medical Devices Industries and Japanese Society of Medical Instrumentation. 2017. *Technical Guideline on Direct Marking for Two-Dimensional Symbol on Steel Instruments, Version 1.3*. [http://www.jamdi.org/business/data/Technical_Guideline_on_Direct_Marking_for_Two-Dimensional_Symbol_on_Steel_Instruments\(Ver.1.3\).pdf](http://www.jamdi.org/business/data/Technical_Guideline_on_Direct_Marking_for_Two-Dimensional_Symbol_on_Steel_Instruments(Ver.1.3).pdf)
- Japan Association of Medical Devices Industries. 2017. *Standard Guideline for Two dimensional (2D) Symbol Marking on Steel Instruments, Version 3*. [http://www.jamdi.org/business/data/Standard_Guideline_for_Two_dimensional\(2D\)Symbol_MarkingV3.0.pdf](http://www.jamdi.org/business/data/Standard_Guideline_for_Two_dimensional(2D)Symbol_MarkingV3.0.pdf)
- International Medical Device Regulators Forum and United States Food and Drug Administration. 2013. *UDI Guidance: Unique Device Identification of Medical Devices* and the UDI Final Rules. <https://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM452262.pdf>
- Japanese Association for Operative Medicine. 2013. "Practical Guideline for *Journal of Japanese Association for Operating Room Technology*," *Journal of Japanese Association for Operating Room Technology*. 34. (in Japanese)

Mercy shows how collaboration and the introduction of global identification standards can lead to increased patient safety in the operating room



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ABSTRACT: Mercy is using GS1 standards to identify medical devices and pharmaceuticals for the automation of its hospital operations. As Mercy's cross-functional team has demonstrated, collaborative relationships within its own institution are enabling the digital transformation of its health system. In fiscal year 2018 (FY18), Mercy reported a 99% reduction in expired products and recalls reaching its operating rooms (ORs) for cases. During FY17 – FY18, charge capture in surgery also improved by 28%, contributing to \$909 additional revenue per case. At the same time, there were reductions in the cost of supplies of \$123 per case and labor of \$29 per case. More accurate charging of supplies has given the clinical team full visibility over the items used in surgery, which has led to a reduction in variation of supplies.

Change requires collaboration

US healthcare providers and suppliers are partnering with GS1 US as well as one another to champion industry initiatives and help government agencies to formulate regulations. The connection between voluntary initiatives and government regulations is increasingly evident as compliance moves from healthcare manufacturers to providers. (Box 1)

In hospitals that are now on the frontlines of compliance, internal partnerships are being formed to collaborate on targeted projects.

When Mercy's perioperative team wanted to increase efficiencies and optimize preference cards in its operating rooms, they turned to the hospital's center of excellence team for assistance to improve the management of product inventory listed on the cards.

Mercy's center of excellence team focuses on driving improvements throughout the hospital's operations, finding new and better ways of helping the work of staff and clinicians and improving processes that deliver better patient outcomes.

At the same time, there was a need to adopt processes surrounding the adoption of unique device identifiers (UDIs) encoded in barcodes that were moving from healthcare manufacturers' production lines into Mercy's operations, specifically in its operating rooms.

System preferences

Mercy's 259 operating rooms within its 45 healthcare facilities

BOX 1: HEALTHCARE PROVIDERS: AT THE CENTER OF COMPLIANCE

The 2013 Drug Supply Chain Security Act (DSCSA) mandated adopting lot-level standards among all supply chain partners, manufacturers and distributors. The DSCSA is now moving toward item-level serialization, which can be accessed by healthcare providers for patient safety in the next two years.

In 2013, the U.S. Food and Drug Administration (FDA) established the Unique Device Identification regulation to "adequately identify medical devices through their distribution and use." When fully implemented by the 2020 deadline, the label on most devices will include a unique device identifier (UDI) in human- and machine-readable forms, ultimately readable by the caregiving community.

Healthcare providers have been at the forefront of the transition to Electronic Health Records (EHRs) as part of a mandate within the American Recovery and Reinvestment Act enacted in 2009. An important part of the EHR regulation provides criteria for doctors and other caregivers to be certified for "meaningful use." The Meaningful Use Stage 3 requirements include capturing UDI data on implantable devices beginning in 2018.

Source: Betty Jo Rocchio and Matthew Mentel, Mercy Health System

are governed by preference cards for thousands of cases. Each preference card provides an individual surgeon with a unique set of product requirements for each of the procedures performed.

Operating rooms hold the dual distinction of being among the highest cost centers as well as the highest revenue-generating centers in Mercy. The goal of the project was twofold: to better manage the products used in the ORs and to accurately capture and document the charges per case. This could reduce costs, increase revenues and document precisely how the hospital cared for each patient.

Surgical precision for patient safety

Perioperative services represent from 40% to 50% of any hospital's revenue stream; it is essentially a business within a business. To be successful, perioperative services must deliver quality care, yet, also consider the cost of that care. Currently and in the future, successful health systems will deliver the same or higher quality care—for less cost.

Therefore, being able to accurately identify the exact products that an OR is using in every single case helps establish the cost and reduce patient risk. Furthermore, accurately identifying the cost of delivering care enables Mercy to tie this cost to a quality outcome for comparative effectiveness.

GS1 identification standards and barcodes uniquely identify a product, its origin and attributes, including lot number and expiration date. Before introducing a new product in the OR, the new product's identifier is loaded into the Mercy's ERP system for consumption. At the same time, the staff is fully trained on the new product.

The inventory management system interfaces with the ERP and the electronic health record system. When a product is consumed, a single scan of the barcode "pulls" all product information, including pricing, from the ERP/financial system into the inventory management system and it "pushes" appropriate information into the patient's electronic health record for documentation and billing.

If a product has expired or is recalled, the system will automatically flag it during the front-end process so it will not make its way into the OR for use or implantation in the patient. Via its identifier, the hospital can also link the product to patient outcomes post-surgery.

Exactly what is needed in the OR

However, the true measure of Mercy's success is the widespread *collaboration* it has achieved.

When Mercy first started implementing barcode scanning in its OR, hospital representatives would tell the story of the surgeon who asked to use a product before it was scanned. The circulating nurse stopped the surgery and said, "Doctor, please recognize we're scanning a product to make sure it's been properly identified, to see if it's been recalled or expired before you put it in that patient's body. Do you want to go around that process?" He said, "No, I do not. Scan the product. I can wait."

There are still obstacles to seamless operations, some of which are occurring upstream. Manufacturers may not be applying the proper barcodes to products, or applying multiple barcodes, which can be a source of confusion in the OR. Some manufacturers are using a single identifier for several similar,

but not identical, products. These issues associated with the implementation of GS1 identifiers and barcodes are being corrected throughout the healthcare supply chain and will eventually impact healthcare providers like Mercy.

Yet, even with these challenges, Mercy has high praises for the changes enabled by the use of GS1 identifiers and barcodes. Specifically, there are significant improvements of the preference cards themselves—the roadmap to any surgical procedure.

The charges are taken from the preference card. The OR has a process for keeping preference cards optimized as well as a system for scanning preference card products for each case. The back half of the system checks the OR nurse to make sure that the products brought into the OR are consumed and charged, or products not consumed are returned to inventory. (Fig. 3)

This has been a significantly positive change for the nurses and doctors, since they have exactly what they need in the OR. Mercy verifies in the pre-procedure area that implants and products are available for the patient and then scans barcodes on the products immediately prior to their use in surgery.

The Triple Aim

At Mercy, the Triple Aim of quality, service and cost guides the hospital's strategy, operations and culture. It is about reaching a balance between these three goals to obtain the following:

- Achieve patient safety, reduce risks and ensure comparative effectiveness
- Improve clinical workflow and satisfaction, minimize distractions and increase productivity via standardization
- Control the cost per case and realize charge capture

Based on the Triple Aim of quality, Mercy's SAFE system tracks unusual events related to pre- and post-surgery. Prior to implementing GS1 identifiers and barcodes (FY17), Mercy reported 459 events that were related to recalled or expired implants or products making their way into the operating room. Post implementation of GS1 standards (FY18), only 5 events were reported, yielding a 99% reduction. (Fig. 2)

In the area of service, Mercy is experiencing a 12% reduction in OR turnover times.

When it comes to the financial picture in perioperative services, Mercy has noticed a 28% to 30% improvement in the identification of supply charges being captured per [surgical] case. The charge capture improvements equal \$909 in additional revenue per surgical case. Finally, the cost of supplies has decreased by \$123 per case with a reduction in labor of \$29 per case.

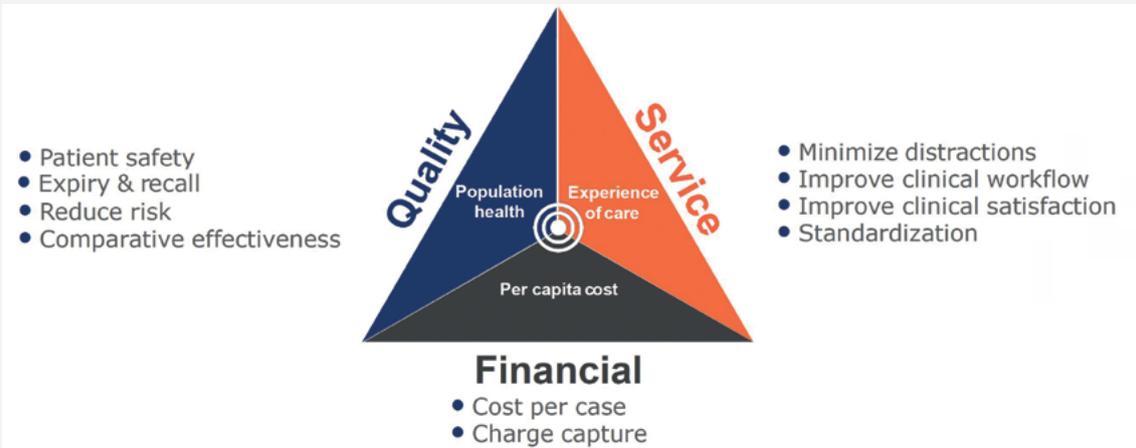
By implementing GS1 standards, Mercy has been able to reduce variations among its surgeons' preferences for the same procedure, which has translated into reduced costs and greater patient safety and throughput. When nurses are trained with the same equipment in the same way, it helps them perform better in surgery and focus more on the patient.

Mercy believes this ultimately leads to improved clinical user satisfaction. With accurate and complete charge capture, the hospital is able to provide the true cost of care for every single procedure.

Inventory management and labor

Mercy stresses how GS1 standards are helping in the

FIGURE 1: THE TRIPLE AIM



Source: Betty Jo Rocchio and Matthew Mentel, Mercy Health System

FIGURE 2: PERIOPERATIVE SERVICES TRIPLE AIM RESULTS, FY17 – FY18

QUALITY	SERVICE	FINANCIAL		
Reduction in expired products and recalls reaching the Operating Room for a case	Reduction in OR turnover times	Increase in revenue	Reduction in supplies costs	Reduction in labor
99% reduction from FY17 to FY18 459 in FY17 5 in FY18	12% decrease from FY17 to FY18	Increase of \$909 per case from FY17 to FY18	Decrease of \$123 per case from FY17 to FY18	Decrease of \$29 per case from FY17 to FY18

Source: Betty Jo Rocchio and Matthew Mentel, Mercy Health System

important area of inventory management—not expending labor pulling unneeded product that must then be returned to inventory. The hospital realizes that the amount of time spent on a redundant activity increases the risk of inaccuracy, which could impact patient safety.

The hospital has improved its preference card optimization by 284%, reducing the number of products on preference cards and resulting in a one-time savings of US\$500,000 in product cost savings.

Collaboration is critical

The partnership between business and clinical operations is clearly one of the keys to Mercy’s ongoing success in leveraging GS1 standards in the OR, not just as a means of compliance, but also using them to make vast process improvements.

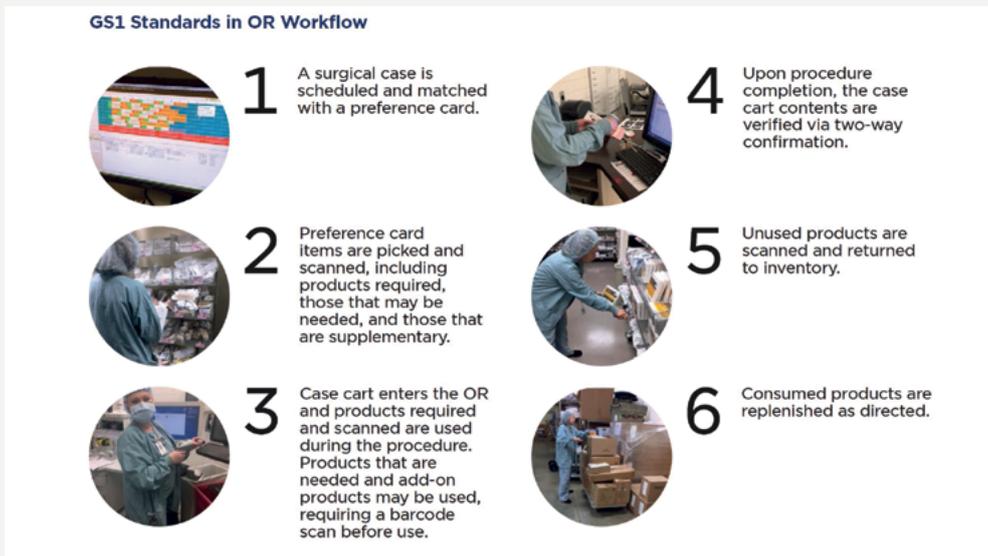
Mercy advises that its unique product identification and barcodes facilitate data capture and reduce the burden on operations. Healthcare systems cannot afford to ignore GS1 standards, since they provide the foundation for automating healthcare processes.

Biographies

Betty Jo Rocchio, MS, BSN, CRNA, CENP, Chief Nursing Optimization Officer, has more than 26 years of healthcare experience, including 20 years holding various leadership positions in Perioperative Services and Procedural Areas. Within Mercy, she has oversight and leadership accountability for over 45 clinical and procedural areas across four states, including a \$2.8 billion revenue stream and \$550 million cost structure.

Matthew Mentel, MHA/MBA, CMRP, Executive Director for Business Transformation and Integration, is responsible for identifying and implementing creative solutions as well as leveraging current technology to drive efficiency increase and expense reduction throughout Mercy. He oversees initiatives that seek to optimize the use of tools, technology, processes and metrics across the care continuum, driving more predictive and outcome-based decisions to help enrich the Mercy experience for caregivers and patients.

FIGURE 3: GS1 BARCODE SCANNING IN OPERATIONS ROOM WORKFLOW



Source: Betty Jo Rocchio and Matthew Mentel, Mercy Health System

FIGURE 4: TANGIBLE BENEFITS OF USING GS1 STANDARDS IN MERCY OPERATING ROOMS



Source: Betty Jo Rocchio and Matthew Mentel, Mercy Health System

References

Rocchio, Betty Jo, and Matthew Mentel. Mercy Health System. 2017. "Mercy Cites Collaboration as Best Medicine," Case study presented at GS1 Connect conference. www.gs1us.org/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=1197&language=en-US&PortalId=0&TabId=134

NHS trusts demonstrate benefits of implementing standards



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ABSTRACT: GS1 standards are increasingly being adopted across acute trusts in England, with a number of government reports recommending their use to increase patient safety, reduce clinical variation and drive operational efficiencies. The trusts currently using standards are diverse: some are large, metropolitan centers and others include hospitals serving mostly rural populations. Learnings from each trust have provided a wealth of knowledge to help future National Health Service (NHS) implementations. By applying standards to people, products and places, they are quantifying costs and benefits across their organizations. This article highlights the achievements of two trusts.

Leeds Teaching Hospitals NHS Trust

Leeds Teaching Hospitals (LTHT) is one of the largest trusts in England with more than 2,000 beds across eight hospitals. The two main hospitals, the Leeds General Infirmary and St James' University Hospital, have over 17,000 staff, 1.1 million out-patient appointments annually and deliver regional specialist care for up to 5.4 million people.

Based on the need for greater efficiencies, improved patient safety and lower costs, LTHT decided to focus on standardizing the way it captured data. They implemented GS1 standards and barcodes to identify and track patients, products and locations.

LTHT implemented an inventory management solution that today captures product data, and also *patient* identification data. This data is used to link each product administered back to the patient.

LTHT then decided to extend its use of GS1 barcodes, rolling out mobile barcode scanners into their operating theaters. Clinical staff can now scan a patient's barcode on the wristband to identify the patient, the theater's barcode that identifies its location and barcodes on products administered at the point of care.

With the GS1 identification and barcode system in place, the trust has achieved end-to-end traceability of products as they travel from manufacturing sites to the hospitals and throughout their operations to the administration to patients.

Since 2017, LTHT has been able to track all Class III implantable medical devices by batch-level information, simply by scanning GS1 barcodes. This enables the trust to better manage inventory levels, expiration dates and, if needed, recalls of products. As a result, the trust has been able to reduce inventory on hand by more than £1.5 million.

The hospitals have also automated their order and receipt processes and helped reduce online requisitions to 11% of total orders.

In turn, this has released valuable staff time and reduced the cost of ordering, while also saving approximately £75,000 per year

based on increased productivity through the use of automated quoting systems.

Real-time patient tracking

To achieve full traceability throughout its hospitals, LTHT needed to deploy GS1 Global Location Numbers (GLNs) encoded in barcode labels to 22,303 locations. The initial rollout prioritized clinical areas (the most logistically complex) and, at the same time, encouraged clinical staff to engage with the program and consider different ways of working.

The trust combined the GLN-provided data with the development of a mobile application that links directly to the patient's electronic health record. In this way, the trust has been able to explore real-time patient tracking.

In fact, LTHT has delivered a successful prototype that allows nursing staff to scan a patient's barcode on the wristband and either open the record or scan the location, down to the bed level. The electronic whiteboard on each ward is then updated with this information, showing the exact location of the patient.

One look at the electronic board enables hospital staff to see if the patient has gone to another department (for pre-operating theater procedures), and at what time, as well as what time they actually went to the theater, or how long they have been out of the theater and in the recovery area.

Thanks to these changes, LTHT have already seen a decrease in the number of telephone calls between the ward and departments such as Nuclear Medicine and Breast Imaging. They can now check where the patient is and know that the information is accurate. This means they're able to give better information to relatives if they call, rather than putting them on hold or calling them back. It saves their staff time and offers peace of mind for the patient's family.

Much faster recalls

For the next area of focus, LTHT centered on improvements in

FIGURE 1: PATIENT WRISTBAND BARCODE INVENTORY MANAGEMENT



Source: Leeds Teaching Hospitals NHS Trust

product recalls. Previously, any information about used implants was captured manually—hand-written in a book.

Now, with standards, the trust can electronically store this information with a simple barcode scan. A product recall that once could take days, now only takes minutes, with an estimated savings of over £80,000 annually based on saving nurses' time.

Patients are safer, too. With implantable products recorded electronically, if a recall is needed, patients who are affected can be more quickly identified and brought back into the LTHT with urgency.

LTHT ran a product recall test in Ophthalmology, to see where the real savings were being made. With its former manual system, the recall process would have cost a minimum of £173, based on 8.33 hours of time for a theater team leader. Now, with barcode scanning, the process takes only 35 minutes and a maximum of £9, since a less senior staff member is able to perform these duties.

Improved data management

To support these use cases, product management has been key. LTHT has worked directly with suppliers and other trusts to lead the largest work of its kind in the NHS, producing a singular, transparent source of product information for all products purchased by the trust. The catalog now holds over 130,000 product identifiers and has integrated this data throughout all points in the demand systems.

Now, LTHT can scan products efficiently at points of care and automate the process of re-ordering products, all because of GS1 barcodes on suppliers' packages.

Significant benefits for LTHT and its patients include the following:

- Reduced inventory to 21 days across the trust.
- Reduced inventory by more than £1.5 million across operating theaters, wards and pharmacies.
- Saved more than £80,000 annually based on saving nurses' time through more efficient product recalls.
- Saved approximately £75,000 annually on implementing automated quoting systems.
- Several rooms were cleared of stock for re-utilization.
- Improved reliability and increased visibility of the trust's supply chain.

FIGURE 2: ROOM BARCODE FOR PATIENT TRACKING



Source: Leeds Teaching Hospitals NHS Trust

- Minimized stock wastage.
- Improved accuracy in patient-level costing.
- Freed up clinical staff's time to spend caring for patients.

Derby Teaching Hospitals NHS Foundation Trust

Derby Teaching Hospitals NHS Foundation Trust (DTH) provides both acute hospital and community-based health services, serving a population of over 600,000 people in and around Southern Derbyshire. The trust runs two hospitals: the Royal Derby Hospital is a busy acute teaching hospital and London Road is the trust's community hospital.

Optimizing without compromise

Royal Derby was built more than 10 years ago, with 35 theaters that operate at maximum capacity. Rather than build more, the hospital needed a solution that would optimize its existing theaters' efficiency and use without compromising patient safety.

They wanted a solution that would not only work in theaters, but could eventually work in their wards and clinics. Derby Teaching Hospitals were also challenged with the need to efficiently and effectively manage product safety recalls. The hospitals used a manual, paper-based process that was time-consuming for clinicians and inadequate for patient safety.

Scanning barcodes at each step

In response, Derby Teaching Hospitals implemented and are now using GS1 identifiers encoded in barcodes to track and trace every person, product, piece of equipment and location that is part of an operating procedure. They have implemented scanning barcodes across all of their theaters as well as in endoscopy and cardiac catheter labs.

Basically, everything and everyone involved in a procedure is now identified with a GS1 identifier encoded in a barcode that is scanned and can be traced back to the related patient.

Clinicians scan barcodes that identify the patient and the times during which the procedure starts and progresses—from administering the anesthetic through to recovery—and then at

the time when the patient is out of recovery. Location barcodes are scanned as well as barcodes that identify who is present and what job they are performing, the type of anesthesia used and any procedure that is performed on the patient, especially when a medical device is implanted.

By scanning barcodes each step of the way, Derby hospitals are confident that these new processes are safer for their patients.

In addition, their inventory management, product catalog and financial systems have all been integrated so that data captured from scanning barcodes can be used across all hospitals—such as automating the creation of orders to suppliers triggered by the actual usage of products and supplies.

As a result, Derby Teaching Hospitals are saving valuable clinical time that was once spent ordering stock and, at the same time, they have reduced inventory waste and costs.

The hospitals have also achieved complete and accurate procedure cost calculations since equipment and implants are recorded based on each patient and procedure, and linked to the associated costs, staff and time information.

Analyzing patient outcomes

By scanning GS1 barcodes, Derby Teaching Hospitals now have access to large amounts of data. Since information about all of their theater procedures is recorded, this major database can be used to identify and analyze patient outcomes and differences in clinical treatments.

The hospitals also use barcodes to record comorbidities. In particular, there has been a major improvement in endoscopy practices based on the ability to track patient outcomes.

Increased access to data has had huge implications for performance management in Derby hospitals. Having accurate costs and times linked with each procedure highlights any variations between a group of clinicians performing the same procedure. Furthermore, because scanning barcodes improves the accuracy of data captured, the data is undisputed, enabling clinician-to-clinician discussions about where procedural efficiencies can be made.

Realizing benefits at multiple levels

- Derby hospitals now have full traceability in their theaters. When a recall is needed, they can identify all patients that may have been impacted and if any of the recalled products are still in inventory. Before GS1 standards, the recall process took on average 50 hours per patient to trace the affected products and/or medical devices used. Now, it takes 30 minutes at most—a dramatic saving in time and improvement in patient safety.
- The hospitals have increased the recording accuracy of their OPCS codes—used to classify procedures that are encoded in GS1 barcodes—and are now capturing all data and costs at points of care. This improvement has enabled Derby hospitals to earn more than £1 million in additional revenue per year from commissioners.
- Complete and accurate procedure costs are now captured for each patient due to the recording of scanned data from barcodes on all implants, equipment and products.
- Derby hospitals have recorded more than 150,000 theater episodes, giving them an expansive database to identify

patient outcomes and variances in clinical treatments and outcomes.

- Efficiencies in the hospitals' processes are expected to reach £2.8 million in savings during the hospitals' 2017 - 2018 fiscal year—and that's just from the implementation of standards in theaters, endoscopy and cardiac catheterization labs.

Conclusion

GS1 standards have only just begun to demonstrate some of the potential improvements barcode technology can make within the NHS. As NHS healthcare systems face increasing pressure to improve safety and efficiency and to be a world leader in delivering care, technology will be key. In the UK, an increasing number of national programs, mandates and initiatives—whether from NHS England, NHS Improvement or the Department of Health and Social Care's Scan4Safety program—are pushing trusts to stay ahead of the game in their use of data and technology. GS1 standards will be key to help achieve both.

Biography

Glen Hodgson is Head of Healthcare at GS1 UK. He is charged with supporting the NHS and the healthcare industry to deliver greater efficiency and a more robust approach to patient safety.

With over 15 years of national and international experience, Mr. Hodgson has served at board level in a variety of operational and commercial roles within complex organizational structures inside the pharmaceutical/ healthcare arena.

References

- GS1 UK. 2018. "Leeds Teaching Hospitals NHS Trust uses GS1 standards to track patients." April 30, 2018. www.gs1uk.org/our-industries/news/2018/04/30/leeds-teaching-hospitals-nhs-trust-uses-gs1-standards-to-track-patients
- Downs, Kevin. "Product safety recall – the view from the theatre." September 2015. www.gs1uk.org/our-industries/healthcare/demonstrating-success-in-healthcare/product-safety-recall
- GS1 UK. "The eProcurement strategy: GS1 and PEPPOL standards in healthcare." www.gs1uk.org/our-industries/healthcare/gs1-standards-for-nhs-acute-trusts/the-eprocurement-strategy-for-trusts
- NHS. Scan4Safety website. <https://www.scan4safety.nhs.uk/>
- GS1 UK. "Demonstrating success in healthcare: See how GS1 standards are delivering benefits in the UK and globally." www.gs1uk.org/our-industries/healthcare/demonstrating-success-in-healthcare
- GS1 UK. "Industry news: Read industry news and watch the latest videos," www.gs1uk.org/our-industries/news

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Pollution, the health scourge of the 21st century



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Pollution, the health scourge of the 21st century



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As described in the article by Richard Fuller, Philip J. Landrigan and Alexander S. Preker, environmental pollution is now the largest cause of deaths in low and middle-income countries (LMICs), having thus become the scourge of the 21st Century. No one is spared. The rich and poor in both developed and developing countries are all vulnerable.

Despite this, pollution as a major public health threat continues to receive less attention by the international public health community and development/financial agencies than other conditions that have dominated during the past three decades.

Household air and water pollution, the forms of pollution associated with deep poverty and traditional lifestyles in low- and middle-income countries, are slowly declining, but ambient air pollution, chemical pollution and soil pollution—the forms of pollution produced by industrial emissions, automotive exhausts and toxic chemical releases—are all on the rise and the largest increases are seen in rapidly developing low- and middle-income countries. Non-communicable diseases—heart disease, stroke, chronic obstructive lung disease, diabetes and cancer in adults, and asthma, cancer, neurodevelopmental disorders and birth defects in children—are the major health consequences, while the rates of these diseases are rising globally. The forces responsible for increases in industrial, automotive, and chemical pollution include poorly controlled urbanization, increasing demand for energy, growth of polluting industries, proliferation of toxic chemicals and pesticides and the growing global use of cars, trucks, and buses. In the absence of aggressive intervention, the contribution of ambient air pollution to premature death is projected to increase significantly by 2050.

Pollution also has complex economic repercussions through both direct or indirect costs, including the loss in labor market productivity associated with illness and increase in pollution-related health expenditure. Depending on the methodology used, the authors of the paper estimate that annual expenditures

range from US\$660 billion (upper bound) to US\$240 billion (lower bound), or approximately three to nine percent of global health care spending in 2013 (the reference year for the analysis). In low and middle-income countries, the relative share of spending for pollution-related illnesses is substantial.

The International Hospital Federation (IHF) and its members remain committed to a strong action plan to combat pollution-related health problems—both the pollution caused by the health sector itself, like medical waste, and the broader societal causes of pollution. This special issue of the Journal provides an opportunity for the IHF to raise the awareness of policy makers, health care providers and others of the analysis and recommendations for a strong action plan by the recent Lancet Commission on Pollution and Health¹.

¹ <https://www.thelancet.com/commissions/pollution-and-health>. Register for free to access the full text in English. Full text translation available in French; executive summaries available in Spanish and Chinese.

Pollution and global health – A time for action



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ABSTRACT: Pollution is a major threat to health and the global economy that was responsible in 2015 for an estimated 9 million deaths and enormous economic losses and high associated health care costs. Despite these great impacts, pollution has been overlooked in the international development and global health agendas. To end this neglect and advance potential solutions, we formed the Commission on Pollution and Health under sponsorship of *The Lancet*.

This Commission examined pollution's health and economic effects; studied the interconnections between pollution, poverty and social injustice; identified strategies that have cost-effectively curbed pollution; and outlined an agenda for intervention. The Commission noted that over 70% of the diseases caused by pollution are non-communicable diseases (NCDs). To identify gaps in knowledge and highlight opportunities for research and prevention, the Commission developed the concept of the pollutome, a taxonomy that classifies pollutants according to knowledge about their effects on health.

The Commission concluded that control of pollution is a winnable battle. The worst forms of pollution and pollution-related disease could be curbed in all countries by applying technical and legal strategies that have proven successful and cost effective in controlled pollution in high-income and, more recently, in some middle-income countries.

Progress against pollution and pollution-related disease will require that leaders at the highest levels of international organizations to unequivocally and forcefully integrate the pollution and NCD control agendas. Because the vast majority of pollution-related disease occurs in low- and middle-income countries, new pollution control efforts must be developed and undertaken at the country level with financial support from wealthier countries and international development partners, and technical guidance from countries that have implemented successful interventions.

To track progress toward control of pollution and prevention of pollution-related disease, the Commission recommended creation of a Global Pollution Observatory that will aggregate, analyze and archive data on pollution and pollution-related disease and make this information available to researchers, policy makers, the media and the global public.

Pollution is one of the great existential challenges of the 21st century. It threatens the stability of the earth's ecosystems, undermines the economic and social development of nations, and endangers the health of billions (Rockström et al. 2013). Pollution - especially pollution of air, water and soil caused by industrial emissions, motor vehicle exhausts, and toxic chemicals - has risen sharply in the past century, and in the absence of aggressive intervention is projected to increase further. The greatest increases will be seen in the cities of rapidly industrializing low- and middle income countries. (Lelieveld et al. 2015).

Despite the great magnitude of its effects on human health and the environment, pollution from industrial, automotive and chemical sources has been gravely neglected in the international development and global health agendas as well as in the planning strategies of many countries. The foreign aid budgets of the European Commission, the US Agency for International Development, and bilateral development agencies all direct only meager resources to control of these modern forms of pollution and to prevention of the

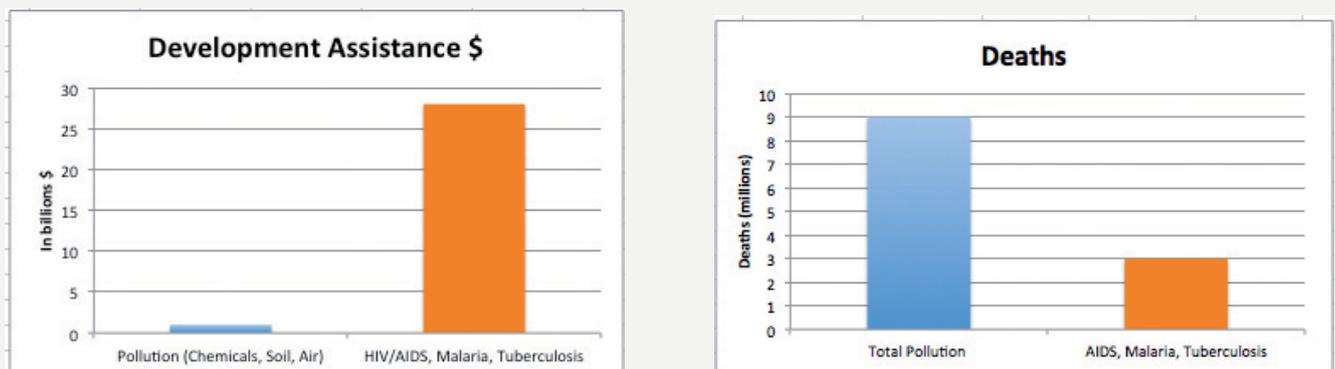
diseases that they cause (Greenberg et al. 2016; Nugent 2016). No major foundation has made pollution control its priority. The two panels below illustrate the striking imbalance between pollution's great impacts on human health and the scant international resources directed towards its control. (Figure 1.)

The Lancet Commission on Pollution and Health

To address the neglected global problem of pollution, we formed the Commission on Pollution and Health under the sponsorship of *The Lancet* (Landrigan et al. 2017). The Commission was launched in 2015 and conducted its work over a two-year period. The Commission's goals were to raise awareness of the great magnitude of the problem of pollution, end neglect of pollution-related disease, and mobilize the resources, the political leadership and the civil will needed to control pollution and prevent disease in cities and countries across the world.

Based on a definition proposed by the European Environment Agency (European Union, 2010), the Commission defined pollution

FIGURE 1. DEATHS DUE TO POLLUTION V. RESOURCES DIRECTED TO POLLUTION CONTROL



Source: Fuller R. Personal communication

as “Any material introduced into the environment by human activity that endangers human health or harms living resources and ecosystems”.

Findings

The Commission’s main finding on health was that all forms of pollution combined were responsible in 2015 for an estimated 9 million premature deaths—16% of all deaths worldwide— as well as for 268 million disability-adjusted life-years (DALYs). (Forouzanfar, 2016a) The number of deaths due to pollution was three times greater than the number due to AIDS, tuberculosis, and malaria combined and 15 times more than the number resulting from all wars and other forms of violence. (Forouzanfar, 2016b) In the most severely affected countries, pollution-related disease is responsible for more than one death in four.

Air pollution was responsible for 6.4 million deaths - 2.8 million from household air pollution and 4.2 million from ambient air pollution. (Yadama, 2013) Water pollution caused 1.75 million deaths. Occupational pollutants, including carcinogens caused 0.85 million deaths. Soil pollution, heavy metals and toxic chemicals caused 0.5 million deaths.

The burden of disease and death due to pollution is growing in many parts of the world. Increases are seen in particular in the numbers of deaths due to ambient air pollution, chemical pollution, and soil pollution. The main drivers are uncontrolled urbanization, globalization of heavy industry, the unregulated proliferation of toxic chemicals and pesticides, and the growing global use of cars, trucks, and buses. Rapidly growing cities in industrializing countries are very hard hit by pollution.

Chemical pollution is a great and growing global challenge. Its effects on human health are not well defined and its impact on the global burden of disease is undercounted. An estimated 140,000 new chemicals and pesticides have been invented since 1950, and many have become widely disseminated in the environment (Landrigan and Goldman 2011). Human exposure to manufactured chemicals is virtually universal. Far too few of manufactured chemicals in wide use have been tested for safety or toxicity and thus their possible contribution to the global burden

of disease cannot at present be assessed.

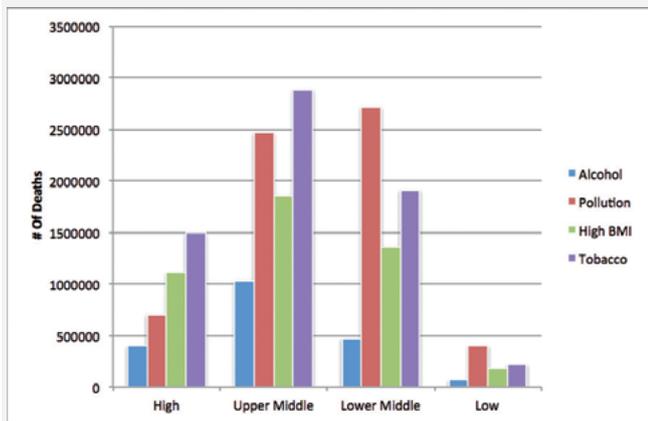
Non-communicable diseases account for 71% of deaths caused by pollution. Pollution is responsible for 21% of all cardiovascular deaths worldwide, 26% of deaths from ischemic heart disease, 23% of stroke deaths, 51% of deaths from chronic obstructive pulmonary disease, and 43% of deaths due to lung cancer (Forouzanfar, 2016a; Forouzanfar, 2016b). Pollution appears also to be linked to adverse reproductive outcomes, obesity, diabetes (Meo et al. 2015), and neurodegenerative diseases (Cacciottolo et al. 2017; Heusinkveld et al. 2016) , but the global burden of disease due to these health effects has not yet been quantified.

The impact of pollution on NCD mortality varies greatly among countries by national income (Figure 2). (Fuller et al., 2018) In high-income countries, where many of the unhealthiest forms of pollution have been controlled, behavioral and metabolic risk factors are the major causes of NCD mortality and overshadow the impacts of pollution. But in upper middle-income countries, pollution and behavioral risk factors are of approximately equal importance in NCD causation. And in lower-middle- and low-income countries, pollution is the predominant risk factor for NCD mortality.

The Commission found that pollution control will advance attainment of many of the sustainable development goals (SDGs), the 17 goals established by the United Nations to guide global development in the 21st century. In addition to improving health in countries around the world (SDG 3), pollution control will help to alleviate poverty (SDG 1), improve access to clean water and improve sanitation (SDG 6), promote social justice (SDG 10), build sustainable cities and communities (SDG 11), and protect land and water (SDGs 14 and 15).

The Commission found that pollution is closely linked to global climate change (McMichael 2017; Perera 2017). Energy production and use are major sources of both pollution and climate change. Fuel combustion accounts for 85% of airborne particulate emissions, for almost all emissions of sulfur oxides and nitrogen oxides, and is a major source of the greenhouse gases and short-lived climate pollutants responsible for climate change (Scovronick et al. 2015).

FIGURE 2: GLOBAL NCD DEATHS BY RISK FACTOR AND INCOME GROUP



Source: Fuller R, Rahona E, Fisher S, Caravanos J, Webb D, Kass D, Matte T, Landrigan PJ. *Pollution and non-communicable disease: time to end the neglect. The Lancet Planetary Health 2018; 2: e96-e98.*

The pollutome

To frame current knowledge about pollution and guide future research, the Commission developed the concept of the pollutome, defined as the totality of all forms of pollution that have potential to harm human health.. Because scientific knowledge of pollution’s effects on health varies by type of pollution, the Commission divided the pollutome into 3 zones (Figure 3).

Zone 1 includes well-established pollution-disease pairs for which there are robust estimates of contributions to the global burden of disease. The associations between ambient air pollution and non-communicable disease are the prime example.

Zone 2 includes the emerging, but still unquantified health effects of known pollutants. Examples include the reported associations between fine particulate air pollution and diabetes (Meo et al. 2015) preterm birth (Cacciottolo et al. 2017; Malley et al. 2017) and diseases of the central nervous system including autism (Casanova et al. 2016; Heusinkveld et al. 2016; Perera 2017; Perera et al. 2014),and dementia (Cacciottolo et al. 2017; Kioumourtzoglou et al. 2015). Soil pollution by heavy metals and toxic chemicals at contaminated industrial and mining sites is another example(Prüss-Ustün et al. 2011).

Zone 3 includes new and emerging pollutants (Grandjean and Landrigan 2014; Landrigan and Goldman 2011), materials that have become extensively disseminated in the global environment but whose effects on human health are only beginning to be recognized and are not yet quantified. These include emerging chemical pollutants such as developmental neurotoxicants, endocrine disruptors, chemical herbicides, newer classes of insecticides such as the neonicotinoids, and pharmaceutical wastes.

It is likely that the list of diseases attributed to pollution will expand as the health effects of newer chemical pollutants are better defined and new associations between pollution and disease are discovered. The result could be that the total number of deaths attributed to pollution will increase and that some pollution-disease pairs currently placed in Zones 2 and 3 of the pollutome will move to Zone 1 and be counted in future estimates of the global burden of disease.

Health Care Cost of Pollution

Annual expenditures on health care related to pollution ranges from US\$660 billion (upper bound) to US\$240 billion (lower bound) depending on the methodology used to estimate costs or approximately three to nine percent of global spending on health care in 2013 (the reference year for the health care cost analysis). Although only 14 percent of global total for pollution related health care spending is in lower- and middle-income countries (LMICs) in our primary (lower bound) model, the relative share of spending for pollution related illness is substantial, especially in very low-income countries. Cancer, chronic respiratory and cardio/cerebrovascular illnesses account for the largest health care spending items linked to pollution even in LMICs (Preker et al 2016).

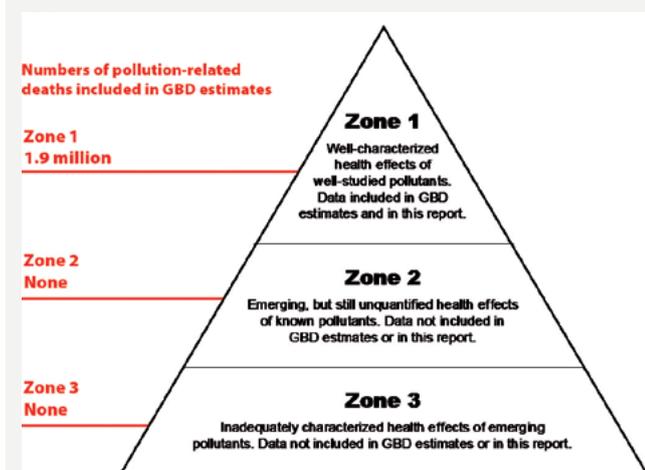
Other studies suggest that intangible costs associated with environmental pollution include lower productivity and reduced income which also have an indirect impact on health and health care costs. The financial and health impacts therefore substantial even when intangible costs are excluded. In addition, in many LMICs poor households simply forgo medical treatment and lose household income as a result of man-made environmental degradation. When evaluating the value of public health or environmental programs which prevent or limit pollution-related illness, policy makers should consider the health benefits, the tangible cost offsets (estimated in our models) and the opportunity costs.

Prospects for prevention

A key message of the *Lancet* Commission is that with leadership, resources and clearly articulated, data-driven strategies, pollution can be controlled and pollution-related disease prevented. The experience of the many cities and countries that have developed, field-tested and successfully implemented pollution control policies provides strong support for this proposition. Successful pollution control strategies are based on law, policy and technology; are held to targets and timetables; are subject to continuous evaluation; are backed by strong enforcement; eliminate tax breaks and subsidies for polluting industries; and are grounded in the ‘polluter-pays’ principle. They mandate clean air and clean water, require that chemicals be tested for safety and toxicity before they come to market, and strictly control the disposal of hazardous wastes. Their goal is to eliminate the externalization of unwanted materials into the environment at no cost to the polluter, the current modus operandi of modern-day polluters.

A second key message is that implementation of pollution control strategies can provide multiple benefits, both short-term and long-term for human health, the economy and the environment for societies at every level of income. The air and water in countries that have controlled pollution are now cleaner,

FIGURE 3: THE POLLUTOME



Source: *Lancet Commission on Pollution and Health (Landrigan et al. 2017)*.

the blood lead concentrations of their children have decreased by more than 90% (Grosse et al. 2002), their rivers no longer catch fire, their worst hazardous waste sites have been remediated, their cities are less polluted and more livable. Health has improved and people are living longer. Moreover these gains can be achieved while at the same time growing regional and national economies. In the United States, for example, levels of the six principal air pollutants have been reduced by nearly 70% in the 45 years since passage of the Clean Air Act of 1970 while in the same time GDP has grown by nearly 250% (Samet et al. 2017).

The Commission concluded that many of the pollution control strategies that have proven successful and cost-effective in high-income and middle-income countries are now ready to be exported and adapted to cities and countries at every level of income. Their application in carefully planned and well-resourced campaigns that are modified to suit local circumstance can boost economies, increase GDP, and enable countries to avoid and leapfrog over the worst of the human and ecological disasters that have plagued industrial development in the past.

Policy implications

Strategies for success within countries require a cross-sectoral approach. Such have been developed, field-tested, and proven cost-effective in high-income countries and are now moving into middle-income countries. They are based on law and regulation, rely heavily upon technology, are subjected to continuous evaluation, are backed by strong enforcement, and incorporate the polluter-pays principle. These programs are held accountable to targets and timetables. These successful, effective strategies for pollution control can be used as models and adapted to local circumstances in cities and countries at every level of income. Their application can enable developing cities and countries to leapfrog over the worst of the human and ecological disasters that have plagued economic development in the past.

A key message is that control and prevention of pollution provide several benefits, both short-term and long-term, for societies at every level of income. The direct benefits of pollution mitigation include improvements in air and water quality and improvements in health. The health benefits include reductions in disease incidence and prevalence, improvements in children's health, reductions in the numbers of premature deaths, increasing longevity, and substantial enhancements in quality of life. Indirect benefits include enhancing gender equity, alleviating poverty, increasing tourism, improving education, and enhancing political stability. Pollution control makes cities more livable and attractive, benefits ecosystems, improves the economy and, when coupled with efforts to transition to clean fuels and to control emissions of greenhouse gases, pollution control can help to slow the pace of global climate change and accelerate the transition to a cleaner, more sustainable, circular economy.

These many benefits of pollution control underscore the reality that pollution is much more than merely an environmental challenge; pollution is a profound and pervasive threat that affects many aspects of human health and wellbeing.

Effective plans to control pollution require support from many sectors of society and, therefore, must involve collaborations among many agencies and organizations within and outside governments, and nationally and internationally. These stakeholders must be fully integrated into a city's or a country's development agenda. If they are to be successful, these efforts must include not only ministries of health and environment, but also ministries of finance, energy, industry, agriculture, and transport. Pollution control policy cannot exist in isolation.

A key mechanism currently being tested in a number of countries is the Health and Pollution Action Plan (HPAPs). This series of workshops brings together Ministries of Health, Environment, Finance, Transport, Interior, Mining and Industry and others to review the key pollution issues facing a country or city. Working together, a review of current programs is undertaken, and an assessment is made to determine if they are sufficient to be able to reduce mortality and morbidity. If not, the group examines additional interventions to implement. The outcome of this work is a number of new programs designed to mitigate pollution adequately. These HPAPs are, if you like, a kickstart for a country who has paid scant attention to pollution, and with the participation of funding agencies such as the World Bank, can lead to substantive programs that can save lives.

Prioritize interventions

A good part of the processes needed involves adequate prioritization of interventions. Resources must be spent where they can do the most good. The key metric ought to be health impact (both death and DALY), but other imperatives, such as economic planning, tourism impact, public pressures are also likely to be a part of prioritization. Prioritization efforts require a reasonable (if not definite) assessment of health impact, environmental damages, and cost-effectiveness of control of various pollution sources. A robust system for assigning priority will avoid the pitfall of prioritizing interventions on the basis of political expediency or because they happen to be an item in the evening news.

Quick, highly visible successes are extremely important in

gaining public support for a pollution control program. It is therefore essential that intervention plans identify pollution sources whose early control will result in quick wins. Rapid, measurable improvements in public health, especially in the health of children, are powerful levers for building public and political support.

Key steps in ranking pollution sources in terms of their health effects, a key process of an effective health and pollution action plan, are as follows:

- I Examine the frequency and severity of disease attributed to various types of pollution using data from national sources and data from the GBD study, and use this information to prioritize interventions against pollution;
- I for each type of pollution apportion the relative contributions of different exposure sources;
- I evaluate the efficacy of new programs that have potential to reduce health effects from each pollution source, review existing programs for efficacy and reach, and identify performance gaps and legal, regulatory, and enforcement gaps;
- I identify potential interventions (new and expanded) for those exposures for which there are dramatic effects on health outcomes and measurable indirect benefits, and evaluate these interventions for cost-effectiveness;
- I focus not only on high-visibility sources of pollution, but also on pollution sources that historically have received less attention, such as household air pollution, contaminated sites, lead (including lead in pottery glazes, lead in paint, and lead from other source that might be specific to a specific culture), and occupational risks, including asbestos;
- I review the benefits of interventions against pollution and health improvement, considering the roles of gender equity, alleviation of poverty, slowing of the pace of climate change, increased tourism, economic growth, improved education, and political factors
- I bring all relevant agencies into the prioritization process, including senior representatives of ministries of health, environment, industry, development, finance, transportation, energy, planning, and legislative branches, and civil society, if possible; and
- I begin implementation with those program areas where past experience will be a strong return on investment, as measured by benefit to public health and the possibility for early victories: examples include removing lead from paint or pottery, cleaning up highly visible toxic hotspots, banning asbestos, or publishing a ranked list of the most important pollution sources in a city or country, involving the media in advertising early successes.

Successful interventions rely on a mix of primary prevention approaches that eliminate pollution at source, coupled with downstream pollution control technologies, such as filters and stack scrubbers, that remove pollutants from the waste stream after they have already been formed. Examples of highly transformative strategies for pollution control that are based on primary prevention include shifting the mix of energy sources in a city or country away from polluting fuels toward non-polluting, renewable fuels; use of safer feedstocks in industrial production,

such as feedstocks produced by the burgeoning technologies of green chemistry, which eliminate use of hazardous feedstocks and production of materials that can cause injury to human health and the environment; incentivizing the adoption of clean production technologies; and enhancing access to efficient, affordable public transportation. Primary prevention can also be achieved by banning highly hazardous and carcinogenic materials such as asbestos, benzene, PCBs, and DDT, as has been successfully achieved in many countries. Primary prevention of pollution based on the elimination of pollution at source is inherently more effective than downstream control technologies, such as stack scrubbers or water filters that reduce the amount and toxicity of pollutant emissions after they have already been formed. Primary prevention of pollution at source is also essential for accelerating transition to a more sustainable, circular economy.

High quality metrics that monitor pollution and track progress towards national and local pollution prevention and disease control goals are essential to the success of any health and pollution action plan. Early establishment of public health and environment monitoring systems should therefore be a priority. Targets and timetables are essential for programs to control pollution; these provide benchmarks and metrics for assessing progress towards pollution control. Establishing specific targets at the country, state or city level, along with deadlines for pollution control are critical to success. Of course, pollution control targets must be appropriate for each country's level of income and development and guided by the WHO pollution control targets. These targets will be most effective when they are focused on pollution sources that are established to be priorities and must be integrated into commitments to meet the SDGs and to reduce greenhouse gas emissions.

Engagement with the private sector, international agencies, and funders

Multiple stakeholders should be involved in controlling pollution and preventing pollution-related disease, including top government leaders, but also key civil servants, business, academia, and civil society. Carefully listening to the views of the most important and influential stakeholders (both formal and informal) can help to ensure that all the parties who can advance (or derail) programs are taken into account.

Enlightened business leaders can be powerful advocates for pollution control and disease prevention. The creation of incentives by governments for non-polluting industries can be powerful catalysts for innovative action, as seen by the rapid development of solar power systems and the organic food industry.

International development organizations, including UN agencies, multilateral development banks, bilateral funding agencies, private foundations, and non-governmental organizations, have important responsibilities in pollution control and prevention of pollution-related disease that complement and extend the role of governments. These agencies should elevate pollution prevention within the agendas of international development and global health and substantially increase the resources they devote to pollution, establishing it as a priority in funding mechanisms.

These agencies should build on existing global data platforms to develop a central platform to monitor and coordinate information

on all forms of pollution globally and should consider convening a bi-annual conference on pollution.

International agencies should also provide resources to reduce pollution-related disease in low-income and middle-income countries by:

- encouraging the development of action plans regarding health and pollution, both nationally and regionally, and of specific pollution control projects that set time targets;
- building data tracking systems to collect information on pollution and disease;
- supporting direct interventions against pollution where such actions are urgently needed to save lives;
- supporting interventions against pollution when international action can leverage local action and resources;
- building professional and technical capacity within governments;
- strengthening the capacity of universities in low-income and middle-income countries to research environmental health science and to train future health and environmental professionals; and
- supporting research program in environmental health science in partnership with international academic institutions, including clinical and epidemiological studies to learn more about the undiscovered links between pollution and non-communicable disease.

Responsibilities of health professionals

Physicians, nurses, and other health professionals have important responsibilities in helping societies to confront the challenges of pollution and pollution-related disease as they have educated societies around the world about the dangers of nuclear war and global climate change.

Health professionals can begin by controlling pollution and reducing carbon emissions from hospitals and health-care facilities and by reducing pollution and carbon-intensive energy sources in their own lives. Health professionals can support local, regional, and national planning efforts and emphasize the links between pollution and health, develop new transdisciplinary educational curricula that build knowledge of environmental health science and about the health effects of pollution, and support research in exposure science, environmental science, health policy research and health economics.

Partnerships between government, civil society, and the health professions have proven powerfully effective in past struggles to control pollution. For example, in the ultimately successful effort to remove lead from gasoline, which was fiercely resisted for many years by the lead industry, partnerships were built between government agencies, health professionals, and civil society organizations.

Recommendations

To advance pollution prevention and disease control, the *Lancet* Commission on Pollution and Health offered six major recommendations:

1. Make pollution prevention a high priority nationally and internationally and integrate it into country and

city planning processes. Leaders of government at all levels - Mayors, Governors, and Heads of State - need to elevate pollution control to a high level within their agendas, integrate pollution prevention into development planning and link pollution prevention with commitments to advance the UN Sustainable Development Goals, slow the pace of climate change, and control non-communicable diseases.

2. Increase the funding dedicated to pollution control within cities and countries as well as internationally.
3. Establish robust systems to monitor pollution and its effects on health.
4. Build multi-sectoral partnerships for pollution control that include Ministries of Finance, Development, Transport and Energy as well as Health and Environment as well as industry, environmental groups and civil society.
5. Integrate pollution mitigation into planning processes for non-communicable diseases and make pollution prevention a core component of the Global Action Plan for the Prevention and Control of Non-Communicable Diseases.
6. Support an interdisciplinary research portfolio on pollution and pollution control.

Future directions

To operationalize these six recommendations, the following actions will be needed:

Elevate the priority of pollution prevention

Effective plans to control pollution require support from many sectors of society and, therefore, must involve collaborations among many agencies and organizations within and outside government. Leadership by the head of government—the President, Prime Minister, Governor or Mayor—is of the utmost importance. Heads of government are uniquely well positioned to educate the public and the media about the importance of preventing pollution-related disease and can create a vision for a country or a city without pollution.

Increase funding for pollution control

Increased funding for pollution control and prevention of pollution-related disease is an overarching need. Increased funding is needed both within countries and internationally.

To increase the international funding devoted to pollution control, the Commission calls on international foundations and private donors to come together with governments around the world to establish dedicated international development funding specifically dedicated to the control of industrial, vehicular, mining, and chemical pollution. Such funding will be most effective when its award is contingent upon host countries' implementation of the polluter-pays principle and ending financial subsidies and tax breaks for polluting industries. In addition to providing funding, international agencies and foundations can also provide much-needed technical assistance that will enable cities and national governments in low- and middle-income countries to reduce pollution and prevent pollution-related diseases.

Global Pollution Observatory

To track pollution and pollution-related disease in cities and countries around the world, monitor progress toward prevention and generate hypotheses for further research, the *Lancet* Commission recommended creation of a Global Pollution Observatory. The Global Pollution Observatory will be a new transnational, multidisciplinary collaboration that continues the work of *The Lancet* Commission on Pollution and Health. (Landrigan et al., 2017) The core mission of the Observatory will be to aggregate, analyze, archive and disseminate data on pollution and pollution-related disease in cities and countries around the world. The Observatory will be modelled on the disease surveillance programs of the Centers for Disease Control and Prevention. (Langmuir, 1963)

Research

Research is needed to expand the knowledge base on pollution, both globally and in affected countries. The health and economic impacts of pollution have not been adequately studied. Large gaps in knowledge impede effective implementation of policy and interventions. The science correlating pollution exposures to health impact is substantially incomplete – and is available for only a limited number of toxicants and diseases. Research is needed to expand knowledge of the pollutome, enhance the burden of disease analysis, and to support country-level programs to ascertain exposures and economic viability of programs.

Conclusion

Increases in ambient air, soil, and chemical pollution – the modern forms of pollution - over the past century as well as global climate change can both be directly attributed to the currently prevalent, linear, wasteful, take-make-use-dispose economic paradigm—termed by Pope Francis “the throwaway culture” (Francis, 2015). In the throwaway culture, natural resources and human capital are viewed as abundant and expendable, and the consequences of their reckless exploitation are given little heed (Raworth 2017; Whitmee et al. 2015). This economic paradigm focuses single-mindedly on GDP and is ultimately unsustainable. It fails to link the economic development of human societies to social justice or to maintenance of the earth’s resources (McMichael 2017; Steffen et al. 2015; Whitmee et al. 2015).

Sustainable long-term control of pollution and mitigation of climate change will require that societies at every level of income move away from pollution control to prevention of pollution at source by fundamentally changing societal patterns of production, consumption and transportation. This transition will require movement away from the linear economic paradigm towards a new paradigm rooted in the concept of the circular economy, (World Economic Forum, 2014) an economic model that decouples development from the consumption of non-renewable resources and minimizes the generation of pollution and other forms of waste through the creation of durable, long-lasting products; large-scale recycling, reuse, and repair; the removal of distorting subsidies; the substitution of hazardous materials with safer alternatives, and strict enforcement of pollution taxes (HEAL, 2015). A circular economy conserves and increases resources, rather than taking and depleting them. In a fully circular economy,

the only new inputs are renewable materials, and all non-renewable materials are recycled. The underlying assumption is that waste is an inherent inefficiency, a loss of materials from the system and thus a cost (World Economic Forum, 2014).

The steps needed for transition towards a circular economy include large-scale transition to non-polluting sources of energy - wind, solar, and tidal; the production of durable products that require lower quantities of materials and less energy to manufacture than those being produced at present; incentivization of recycling, re-use, and repair; replacement of hazardous materials with safer alternatives such as those that have been developed using the technologies of Green Chemistry (Ahmed, 2012); and the development of new transportation strategies that include safe, accessible and affordable public transport coupled with an emphasis on active transportation – walking and cycling.

Finally, the juxtaposition of two recent events suggests that global neglect of pollution may be coming to an end. The release on October 19, 2017 of the *Lancet* Commission on Pollution and Health followed by the convening of the Third UN Environment Assembly on 4-6 December in Nairobi, in which pollution prevention was the overarching theme, suggests that pollution is beginning to receive the high-level attention that has long needed. With the impetus of these events and growing recognition of pollution’s enormous human and economic costs, the time has come to end the neglect, to acknowledge that pollution is a major NCD risk factor, especially in poor countries, and to make pollution prevention a core component of the global NCD strategy.

The *Lancet* Commission concluded that control of pollution and prevention of pollution-related disease are winnable battles.

Biographies

Richard Fuller is an Australian born environmentalist, founder and President of Pure Earth, a non-profit dedicated to solving pollution problems in lower income countries. Mr. Fuller initiated and leads the Secretariat of the Global Alliance on Health and Pollution, and in October 2017 cochaired the seminal *Lancet* Commission on Pollution and Health.

Philip J. Landrigan, MD, MSc is Professor of Biology and Director of the Global Public Health Initiative at Boston College and Professor Emeritus of Preventive Medicine and Pediatrics in the Icahn School of Medicine at Mount Sinai. From 2015 to 2017, he co-chaired the *Lancet* Commission on Pollution & Health. For four decades, Prof. Landrigan has been a thought leader in environmental medicine.

Alexander S. Preker is President and CEO of the Health Investment & Financing Corporation and a member of the board of several of the companies in which the group has invested. Mr. Preker is one of the Commissioners for the Global Commission on Pollution, Health and Development, and is an Executive Scholar and Adjunct Professor at Columbia University, New York University and Icahn School of Medicine at Mt. Sinai.

References

- Ahmed K. 2012. *Getting to green: a sourcebook of pollution management policy tools for growth and competitiveness*. World Bank. Available: http://siteresources.worldbank.org/ENVIRONMENT/Resources/Getting_to_Green_web.pdf [accessed 17 April 2017].
- Cacciottolo M, Wang X, Driscoll I, Woodward N, Saffari A, Reyes J, et al. 2017. "Particulate air pollutants, APOE alleles and their contributions to cognitive impairment in older women and to amyloidogenesis in experimental models". *Transl. Psychiatry* 7:e1022; doi:10.1038/tp.2016.280.
- Casanova R, Wang X, Reyes J, Akita Y, Serre ML, Vizuete W, et al. 2016. "A Voxel-Based Morphometry Study Reveals Local Brain Structural Alterations Associated with Ambient Fine Particles in Older Women". *Front. Hum. Neurosci.* 10; doi:10.3389/fnhum.2016.00495.
- European Union. 2015. *Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)*. Available: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:ev0027> [accessed 30 March 2017].
- Forouzanfar M, GBD 2015 Mortality and Causes of Death Collaborators. 2016. "Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015". *Lancet* 388:1459–1544; doi:10.1016/S0140-6736(16)31012-1.
- Forouzanfar M, GBD 2015 Risk Factors Collaborators. 2016. "Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease". *Lancet* 388:1659–1724; doi:10.1016/S0140-6736(16)31679-8.
- Francis. *Laudato Si'*. 2015. *Encyclical letter on care for our common home*. Vatican City Holy See.
- Fuller R, Rahona E, Fisher S, Caravanos J, Webb D, Kass D, Matte T, Landrigan PJ. 2018. Pollution and Non-Communicable Disease – Time to End the Neglect. *Lancet Planetary Health*, Mar;2(3):e96-e98.
- Grandjean P, Landrigan PJ. 2014. Neurobehavioural effects of developmental toxicity. *Lancet Neurol.* 13:330–338; doi:10.1016/S1474-4422(13)70278-3.
- Greenberg H, Leeder SR, Raymond SU. 2016. "And Why So Great a "No?"" *Glob. Heart* 11:381–385; doi:10.1016/j.heart.2016.10.018.
- Health and Environment Alliance (HEAL). *Walking the Circle – the 4 guiding pillars for a Circular Economy*. Available: http://env-health.org/IMG/pdf/walking_the_circle.pdf [accessed 30 March 2017].
- Heusinkveld HJ, Wahle T, Campbell A, Westerink RHS, Tran L, Johnston H, et al. 2016. "Neurodegenerative and neurological disorders by small inhaled particles". *Neurotoxicology* 56:94–106; doi:10.1016/j.neuro.2016.07.007.
- Kioumourtzoglou M-A, Schwartz JD, Weisskopf MG, Melly SJ, Wang Y, Dominici F, et al. 2015. "Long-term PM2.5 Exposure and Neurological Hospital Admissions in the Northeastern United States". *Environ. Health Perspect.* 124; doi:10.1289/ehp.1408973.
- Landrigan PJ, Fuller R, Acosta NJR, Adeyi O, Arnold R, Basu N (Nil), et al. 2017. "The Lancet Commission on pollution and health". *Lancet*; doi:10.1016/S0140-6736(17)32345-0.
- Landrigan PJ, Goldman LR. 2011. "Children's Vulnerability To Toxic Chemicals: A Challenge And Opportunity To Strengthen Health And Environmental Policy". *Health Aff.* 30:842–850; doi:10.1377/hlthaff.2011.0151.
- Langmuir AD. 1963. "The surveillance of communicable diseases of national importance". *N Engl J Med* 268:182–92.
- Lelieveld J, Evans JS, Fnais M, Giannadaki D, Pozzer A. 2015. "The contribution of outdoor air pollution sources to premature mortality on a global scale". *Nature* 525:367–371; doi:10.1038/nature15371.
- Malley CS, Kuylenstierna JCI, Vallack HW, Henze DK, Blencowe H, Ashmore MR. 2017. "Preterm birth associated with maternal fine particulate matter exposure: A global, regional and national assessment". *Environ. Int.*; doi:10.1016/j.envint.2017.01.023.
- McMichael AJ. 2017. *Climate Change and the Health of Nations: Famines, Fevers, and the Fate of Populations*. Oxford University Press:London.
- Meo SA, Memon AN, Sheikh SA, Rouq FA, Usmani AM, Hassan A, et al. 2015. "Effect of environmental air pollution on type 2 diabetes mellitus". *Eur. Rev. Med. Pharmacol. Sci.* 19: 123–8.
- Nugent R. 2016. "A Chronology of Global Assistance Funding for NCD". *Glob. Heart* 11:371–374; doi:10.1016/j.heart.2016.10.027.
- Perera FP. 2017. "Multiple Threats to Child Health from Fossil Fuel Combustion: Impacts of Air Pollution and Climate Change". *Environ. Health Perspect.* 125:141–148; doi:10.1289/EHP299.
- Perera FP, Chang H, Tang D, Roen EL, Herbstman J, Margolis A, et al. 2014. "Early-Life Exposure to Polycyclic Aromatic Hydrocarbons and ADHD Behavior Problems". *R.L. Tanguay, ed PLoS One* 9:e111670; doi:10.1371/journal.pone.0111670.
- Preker AS, Adeyi OO, Lapetra MG, Simon DC, Keuffel E. 2016. "Health Care Expenditures Associated With Pollution: Exploratory Methods and Findings". *Ann Glob Health.* 2016 Sep - Oct;82(5):711–721.
- Prüss-Ustün A, Vickers C, Haefliger P, Bertollini R. 2011. "Knowns and unknowns on burden of disease due to chemicals: a systematic review". *Environ. Heal.* 10:9; doi:10.1186/1476-069X-10-9.
- Raworth K. 2017. *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist*. Chelsea Green Publishing:White River Junction, Vermont.
- Rockström J, Steffen W, Noone K, Persson Å, Chapin III FS, Lambin EF, et al. 2013. "A safe operating space for humanity". *Nature*, v.461, 472–475 (2009) 46.
- Samet JM, Burke TA, Goldstein BD. 2017. "The Trump Administration and the Environment — Heed the Science". D. Malina, ed *N. Engl. J. Med.* 376:1182–1188; doi:10.1056/NEJMms1615242.
- Scovronick N, Dora C, Fletcher E, Haines A, Shindell D. 2015. "Reduce short-lived climate pollutants for multiple benefits". *Lancet* 386:e28–e31; doi:10.1016/S0140-6736(15)61043-1.
- Steffen W, Richardson K, Rockstrom J, Cornell SE, Fetzer I, Bennett EM, et al. 2015. "Planetary boundaries: Guiding human development on a changing planet". *Science* (80-.). 347:1259855–1259855; doi:10.1126/science.1259855.
- Whitmee S, Haines A, Beyrer C, Boltz F, Capon AG, de Souza Dias BF, et al. 2015. "Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation–Lancet Commission on planetary health". *Lancet* 386:1973–2028; doi:10.1016/S0140-6736(15)60901-1.
- World Economic Forum. 2014. *Towards the Circular Economy: Accelerating the scale-up across global supply chains*. Geneva, Switzerland
- Yadama GN. 2013. *Fires, Fuel, and the Fate of 3 Billion: The State of the Energy Impoverished*. Oxford University Press.

Résumés en Français

Réglementation relative aux soins de santé : des opportunités pour les hôpitaux

Au niveau mondial, on observe aujourd'hui que de plus en plus de réglementations sont développées ou mises en places dans le domaine des soins de santé. Par exemple, en Argentine, en Europe, en Turquie, en Inde, en Corée du sud et aux États-Unis, la réglementation a pour objectif de définir des bonnes pratiques pour protéger au mieux les patients en tant que consommateurs de services de santé, de produits médicaux ou pharmaceutiques. Certains des principaux objectifs réglementaires comprennent la lutte contre les médicaments falsifiés, l'amélioration des rappels, la réduction des erreurs médicamenteuses, l'amélioration de l'efficacité de la chaîne logistique et la réduction des fraudes de remboursement. Alors que les objectifs spécifiques et les délais peuvent varier d'un pays à l'autre, les fabricants respectent les réglementations, fournissent des produits médicaux et pharmaceutiques avec des codes-barres que les hôpitaux peuvent utiliser dans l'intérêt de leurs opérations et de leurs patients.

Notre patient, notre responsabilité : Une identification correcte du patient pour sa sécurité

La bonne identification d'un patient est l'une des étapes les plus fondamentales pour sa sécurité. L'Organisation mondiale de la santé reconnaît que la mauvaise identification d'un patient peut contribuer à des erreurs de traitement médicamenteux, de chirurgie, de diagnostic et de documentation. La commission commune a défini que la « bonne identification des patients » est le premier objectif international pour la sécurité des patients. Dans les hôpitaux d'Apollo Hospitals, un processus d'amélioration à long terme a permis de réduire les situations de mauvaise identification des patients et, ainsi, de parvenir au respect de la sécurité des patients. Ce processus impliquait l'amélioration et les leçons à tirer de la signalisation des incidents, ainsi que la mise en place d'une culture organisationnelle par un ensemble comprenant l'initiative « Notre patient, notre responsabilité », des formations rigoureuses et des technologies telles que les systèmes à code-barres & le numéro séquentiel de colis (SSC) avec système vocal.

L'hôpital de Canberra utilise l'identification positive pour réduire de manière considérable les erreurs lors du prélèvement d'échantillons pathologiques

Pour améliorer la sécurité des patients et fournir de meilleurs résultats, les prestataires de soins doivent « saisir » l'identification de leurs patients et des médecins dans les services. L'identification positive des patients est particulièrement importante dans les secteurs hospitaliers surchargés, de même que dans les situations où une erreur d'identification peut entraîner un événement indésirable. En utilisant les normes GS1 comme fondamentaux, l'ACT Health et l'hôpital de Canberra identifient leurs patients, leurs laboratoires et leurs prélèvements pathologiques, de même

que leurs prestataires de soins, afin d'assurer l'exactitude des procédures de soins auprès des patients tout au long de leur séjour dans l'hôpital. Les résultats ont montré une réduction de plus de 40 % des erreurs transfusionnelles lorsque les médecins scannent des codes-barres GS1 lors des prélèvements pathologiques.

La transparence sur la base de normes

L'amélioration des niveaux d'information et d'expertise, associée à une réduction des coûts, représente l'un des piliers de conception de l'hôpital universitaire d'Aarhus. L'accent est placé sur la chaîne logistique, les services et l'augmentation des niveaux d'information, sans augmenter les coûts salariaux. La transparence des procédures de l'hôpital permet d'améliorer la prise de décision et la planification. L'introduction d'un système de suivi automatisé basé sur des normes internationales permet à l'hôpital de renforcer ses procédures internes, d'améliorer la transparence, d'augmenter les niveaux d'interopérabilité du système et d'étendre le modèle global d'information pour l'identification d'un objet pour les fournisseurs et les partenaires. L'un des principaux avantages de ce système est la capacité à assurer une expérience sécurisée et constante pour les patients, conçue sur des méthodes fiables avec un haut niveau d'information et d'assurance qualité, basées sur des données automatiquement générées.

L'hôpital Israelita Albert Einstein, au Brésil, progresse considérablement vers la traçabilité complète des produits pharmaceutiques

L'hôpital Israelita Albert Einstein (HIAE) utilise la norme GS1 pour permettre la traçabilité des tous les médicaments, avec pour objectif d'améliorer les soins et la sécurité des patients. L'HIAE a travaillé en partenariat avec des fournisseurs externes et internes pour garantir que tous les médicaments à dose unique soient associés à un code-barres GS1 d'identification unique, comprenant un numéro de lot et une date d'expiration. Avec les normes GS1, l'hôpital peut scanner les codes-barres des médicaments lorsqu'ils sont déplacés, de la réception au lit du patient, jusqu'au centre chirurgical de l'HIAE, concluant ainsi un système complet de traçabilité. Plus de 240 000 unités sont étiquetées chaque mois sur les sites des fournisseurs, permettant à l'HIAE d'économiser plus de 600 heures et 13 620 R\$ en coûts salariaux tous les mois.

De la lecture d'un code-barre à une stratégie globale de sécurité des patients

Le Centro Médico Imbanaco de Cali (Imbanaco) utilise les normes GS1 pour simplifier et automatiser ses procédures cliniques afin d'améliorer l'efficacité et renforcer la sécurité des patients. L'hôpital a lancé plusieurs initiatives axées sur la garantie de la traçabilité des médicaments, des produits médicaux et d'autres produits pour renforcer la sécurité des patients et réduire les erreurs. À partir de processus de livraison automatisés, Imbanaco a observé une amélioration de 98 % de la freinte des stocks et des

déchets, ainsi qu'une réduction de 25 % des niveaux d'inventaire dans ses pharmacies satellites. De plus, le temps nécessaire à la création d'une facture pour le patient a été réduit, passant de presque une heure à seulement 18 minutes.

La réduction des erreurs médicamenteuses par lecture de codes-barres au lit du patient : nos patients méritent une sécurité supplémentaire

L'administration est l'une des principales étapes à risque d'erreur lors de la prise de médicament chez un patient. L'administration de médicaments par lecture d'un code-barre est utilisée dans la plupart des hôpitaux des États-Unis, mais est rare dans les hôpitaux européens. Cela est regrettable, car cette technologie peut réduire de 50 % les erreurs d'administration médicamenteuses. Pour tirer pleinement parti de cette technologie, l'administration de médicaments par lecture d'un code-barre nécessite une surveillance continue de sa bonne utilisation et une analyse des données d'alerte.

Notre approche est basée sur deux piliers : s'assurer que les utilisateurs finaux peuvent utiliser cette technologie en toute transparence et qu'ils l'utiliseront de manière appropriée.

L'université du centre hospitalier de chirurgie de Fukui met en place un système de gestion intégré de la stérilisation pour la sécurité du patient et la traçabilité

Depuis 2014, l'université de l'hôpital de Fukui (Fukui Hospital) s'est concentrée sur la gestion de la rentabilité de ses opérations chirurgicales. L'hôpital a mis en place avec succès la traçabilité de ses instruments chirurgicaux grâce au processus de stérilisation de son centre chirurgical, en identifiant chacun des 30 000 instruments avec la norme GS1. Le taux d'erreur de comptage a été réduit, passant de 3 054 à 175 ppm, et les temps d'assemblage et de vérification des instruments ont diminué de 4 000 heures par an pour les opérations chirurgicales. L'utilisation des codes lieu-fonction de la norme GS1 comme système de paramétrage des conteneurs chirurgicaux a favorisé une réduction des délais globaux de fonctionnement de 4 971 heures par an à l'hôpital de Fukui.

L'hôpital Mercy démontre que la collaboration et l'introduction de normes globales d'identification peuvent permettre d'augmenter la sécurité des patients en salle opératoire

L'hôpital Mercy, aux États-Unis, utilise les normes GS1 afin d'identifier les produits médicaux et les médicaments pour l'automatisation des opérations de l'hôpital. Comme l'équipe interfonctionnelle de Mercy l'a démontré, les relations de collaboration au sein de sa propre institution permettent la transformation numérique de son système de santé. Au cours de l'année fiscale 2018, Mercy a rapporté une réduction de 99 % des produits expirés et des rappels après entrée dans les salles opératoires pour chaque chirurgie. Au cours des années fiscales 2017-2018, la saisie des frais chirurgicaux a également été améliorée de 28 %, permettant un revenu supplémentaire de 909 \$ par chirurgie. Des réductions ont été observées en parallèle, 123 \$ par chirurgie pour les coûts de logistique et 29 \$ par chirurgie pour les coûts salariaux. Une gestion plus précise des approvisionnements a fourni à l'équipe clinique une visibilité complète des produits utilisés en chirurgie, ce qui a conduit à une réduction de la variation des approvisionnements.

Le service national de santé britannique démontre les bénéfices de la mise en place de normes

Les normes GS1 sont de plus en plus adoptées dans les fon-

dations de soins intensifs en Angleterre et un certain nombre de rapports gouvernementaux recommande de les utiliser pour augmenter la sécurité du patient, réduire la variation clinique et améliorer l'efficacité opérationnelle. Les fondations utilisant les normes sont variées : on retrouve des centres importants et métropolitains, tandis que d'autres regroupent des hôpitaux desservant principalement des populations rurales. Les enseignements tirés par chaque fondation ont fourni de riches connaissances pour les mises en œuvre futures du NHS (service de santé national britannique). L'application de normes pour les personnes, les produits et les structures leur permet de quantifier les coûts et les bénéfices dans leurs organisations. Cet article souligne les résultats de deux fondations.

Pollution et santé mondiale : il est temps d'agir

La pollution est une menace majeure pour la santé et l'économie mondiale, responsable en 2015, selon les estimations, de 9 millions de décès, de pertes économiques colossales et de coûts associés élevés dans le secteur de la santé. Malgré ces impacts majeurs, la pollution a été négligée dans le développement international et dans les agendas de santé mondiale. Pour mettre fin à cette négligence et proposer d'éventuelles solutions, nous avons fondé « Commission on Pollution and Health », avec le soutien de la revue *The Lancet*.

La commission a examiné les effets économiques et sanitaires de la pollution, elle a étudié les interconnexions entre la pollution, la pauvreté et les injustices sociales. Elle a également identifié des stratégies ayant endigué la pollution de manière rentable et a présenté un agenda d'intervention. La commission a noté que plus de 70 % des maladies causées par la pollution sont des maladies non transmissibles (MNT). Afin d'identifier les lacunes à combler en matière de connaissances et de souligner les opportunités pour la recherche et la prévention, la commission a développé le concept de pollutome, une taxonomie qui classe les polluants selon les connaissances sur leurs effets sur la santé.

La commission a conclu que le contrôle de la pollution est un combat qui peut être gagné. Les pires formes de pollution et les maladies causées par la pollution peuvent être endiguées dans tous les pays en appliquant des stratégies juridiques et techniques qui ont déjà démontré leur succès et leur rentabilité pour le contrôle de la pollution dans les pays à revenu élevé et, plus récemment, dans certains pays à revenu moyen.

Pour progresser contre la pollution et contre les maladies causées par la pollution, il sera nécessaire que les dirigeants aux plus hauts niveaux des organisations internationales intègrent avec force et sans équivoque la pollution dans les agendas de lutte contre les MNT. Puisque la grande majorité des maladies causées par la pollution surviennent dans les pays à revenus faible ou moyen, de nouveaux efforts doivent être élaborés contre la pollution et doivent être mis en place au niveau national avec le soutien financier des pays plus riches et les conseils techniques des pays ayant déjà mené des interventions efficaces.

Pour suivre les progrès réalisés dans le cadre de la lutte contre la pollution et de la prévention des maladies causées par la pollution, la commission a recommandé la création d'un « Observatoire mondial des villes » chargé de rassembler, analyser, conserver des données sur la pollution et les maladies causées par la pollution, ainsi que de rendre ces informations disponibles pour les chercheurs, les décideurs politiques, les médias et le grand public.

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Resumen en Español

Normas sanitarias: ofreciendo oportunidades para los hospitales

En el panorama sanitario global actual, se han ido desarrollando e implementando cada vez más normas sanitarias. Por ejemplo, en Argentina, Europa, Turquía, India, Corea del Sur y EE.UU., las normas ayudan a establecer procedimiento para mejorar la protección de los pacientes como consumidores de servicios sanitarios, farmacéuticos y/o de dispositivos médicos. Algunos de los objetivos de las principales normas incluyen combatir los medicamentos falsificados, mejorar las llamadas, reducir los errores de medicación, mejorar la eficiencia de la cadena de suministros y reducir los fraudes de reintegro. Mientras los objetivos específicos y la puntualidad pueden variar de un país a otro, los fabricantes están cumpliendo con las normas enviando los dispositivos médicos y farmacéuticos con códigos de barras que los hospitales pueden utilizar para mejorar su funcionamiento y beneficiar a los pacientes.

Nuestro Paciente, Nuestra Responsabilidad La Identificación Correcta del Paciente para Seguridad del Paciente

La correcta identificación del paciente es uno de los pasos críticos para la seguridad del paciente. La Organización Mundial de la Salud, reconoce que la identificación errónea puede acarrear errores de documentación, diagnóstico, cirugía y medicación. La Comisión Mixta definió «Identificación Correcta del Paciente» como el primer Objetivo Internacional de Seguridad del Paciente. En los Hospitales Apollo, un proceso prolongado de mejoramiento ha llevado a reducir los casos de identificación incorrecta del paciente y a salvaguardar finalmente el objetivo último de proteger al paciente. Esto implicó el mejoramiento y aprendizaje de los incidentes notificados así como la implementación de un cambio de cultura mediante una combinación correcta que incluye: la iniciativa 'Nuestro Paciente, Nuestra Responsabilidad', la rigurosa formación y las tecnologías como el código de barras y SSC con Voz en Off.

El Hospital de Canberra utiliza la identificación del paciente positivo para reducir los errores significativos cuando se toman muestras patológicas.

Para ofrecer resultados mejores y seguros, los actuales proveedores sanitarios necesitan 'capturar' la identificación de sus pacientes y médicos en los lugares de atención. La identificación de pacientes positivos es especialmente importante en áreas clínicas concurridas y donde la errónea identificación puede provocar eventos negativos. Empleando las normas GS1 como fundamento vital, el Hospital de Canberra y el ACT Health identifican sus pacientes, las muestras patológicas y el laboratorio además de preocuparse que los proveedores sanitarios garanticen la precisión en los procesos de asistencia al paciente durante cada etapa de éste dentro de su hospital. Como resultado, ha habido más del un 40% de reducción de la incidencia

de tubos con sangre equivocados debido al escaneo clínico de códigos de barra GS1 cuando se toman las muestras patológicas.

Transparencia basada en los estándares

Niveles de información optimizada y especializada con costos reducidos son algunos de los objetivos básicos diseñados por el nuevo Hospital Universitario de Aarhus. La atención se centra en la cadena de suministro, el servicio y los mayores niveles de información sin aumentar el costo de personal. La transparencia a lo largo de los procesos hospitalarios permite una mejor toma de decisiones y de planificación. La introducción de un sistema automatizado de trazabilidad basado en estándares universales permite al hospital reforzar sus procesos internos, mejorar la transparencia, aumentar los niveles de interoperabilidad y extender el modelo de información generalizada de identificación del objeto a proveedores y colaboradores. La ventaja principal es la capacidad de asegurar al paciente una experiencia segura y repetible, basada en métodos confiables, con un elevado nivel de información y una calidad asegurada basada en datos producidos automáticamente.

El Hospital Israelita Albert Einstein de Brasil realiza significativos progresos para lograr la completa trazabilidad de los medicamentos

El Hospital Israelita Albert Einstein (HIAE) utiliza los estándares GS1 para favorecer la trazabilidad de todos los medicamentos con el objetivo de mejorar la atención y la seguridad del paciente. HIAE se ha asociado con proveedores y trabaja internamente para asegurar que todas las medicinas de dosificación individual sean asignadas a un identificador único con un código de barras GS1 que incluya partida/número de lote y fecha de caducidad. Con los estándares GS1, el hospital puede escanear los códigos de barras de los medicamentos mientras circulan de la recepción a la cabecera del paciente y el centro de cirugía HIAE, completando el sistema de trazabilidad integral. Más de 240.000 unidades son etiquetadas cada mes en las instalaciones de los proveedores, ahorrando al HIAE más de 600 horas y \$13,620 de costo mensual de personal.

De un simple escaneo de un código de barras a una estrategia completa de seguridad para el paciente.

El Centro Médico Imbanaco de Cali (Imbanaco) utiliza los estándares GS1 para simplificar sus procesos clínicos con la finalidad de aumentar la eficiencia y mejorar la seguridad del paciente. El hospital ha lanzado numerosas iniciativas destinadas a garantizar la trazabilidad de los medicamentos, los dispositivos médicos y otros suministros a fin de mejorar la seguridad del paciente y reducir los errores. Basándose en procedimientos de pedido automatizados, Imbanaco ha experimentado un 98 % de mejora por pérdidas de inventario y despilfarro, además de

una reducción del 25 % en los niveles de inventario de sus farmacias satélites. Asimismo, el tiempo requerido para preparar el recibo del paciente se ha visto reducido de casi una hora a sólo 18 minutos.

Disminución de los errores de medicación mediante el escaneo del código de barras en la cabecera (BCMA): nuestros pacientes merecen una barrera de seguridad adicional

La administración es una de las fases más propensas a errores en el uso de medicación hospitalaria. La administración de medicamentos con códigos de barras se utiliza en la mayoría de los hospitales de EE.UU., pero está limitada en los hospitales europeos. Esto es lamentable, dado que esta tecnología puede disminuir los errores de administración de medicamentos en un 50%. Para alcanzar el máximo beneficio de esta tecnología, BCMA requiere un seguimiento constante del uso apropiado y el análisis de datos de alerta.

Nuestra estrategia se basa en dos pilares fundamentales: asegurar al usuario final que puede utilizar la tecnología sin problemas y que la usarán de manera apropiada.

La Universidad del Centro Quirúrgico del Hospital Fukui ha creado un sistema de gestión de esterilización integrada para la trazabilidad y la seguridad del paciente.

Desde 2014, la Universidad del Hospital Fukui (Fukui Hospital) se centró en la gestión eficiente de los costos de sus operaciones quirúrgicas. El hospital tuvo éxito consiguiendo la trazabilidad de los instrumentos quirúrgicos en los procesos de esterilización de su centro de quirúrgico mediante la identificación de cada uno de los 30.000 instrumentos con las normas GS1. El porcentaje de error en el conteo se redujo de 3,054 a 175 empp así como el tiempo requerido para ensamblar y controlar los instrumentos para operaciones quirúrgicas se redujo 4000 horas por año. El empleo de Números de Localización Global GS1, como parte de su sistema de asiento de contenedores, ayudó a reducir el tiempo de funcionamiento general del Hospital Fukui en 4.971 horas por año.

Mercy muestra cómo la colaboración y la introducción de estándares de identificación global permiten aumentar la seguridad del paciente en la sala de operaciones.

Mercy está empleando estándares GS1 para identificar los dispositivos médicos y farmacéuticos para lograr la automatización de sus operaciones hospitalarias. Como lo ha demostrado el equipo multidisciplinario de Mercy, las relaciones de colaboración dentro de la propia institución están facilitando la transformación digital de su sistema asistencial. Durante el ejercicio fiscal 2018 (FY18), Mercy comunicó una reducción del 99% en productos caducados y llamadas extendiéndose a sus salas de operaciones (ORs). Durante los ejercicios FY17 – FY18, el coste captado en cirugía también mejoró un 28%, contribuyendo con \$909 en ingresos adicionales por caso. Al mismo tiempo, se han producido reducciones en el costo de los suministros de 123\$ por caso y de personal de 29\$ por caso. La mayor precisión en los costos en suministros ha dado completa visibilidad al equipo médico sobre los elementos usados en cirugía, lo que ha permitido una reducción de los diferentes los suministros.

Consortios NHS demuestran los beneficios de implementar los estándares

Los estándares GS1 están siendo adoptados cada vez más por los Consortios de Medicina en toda Inglaterra, con una se-

rie de informes gubernamentales recomendando su uso para aumentar la seguridad del paciente, reducir la variación clínica y lograr eficiencias operativas. Los consorcios que usan normalmente estándares son diferentes: algunos son grandes centros metropolitanos y otros incluyen hospitales que asisten mayormente a la población rural. Aprender de cada consorcio ha proporcionado un bagaje de conocimiento que ayuda a realizar las futuras aplicaciones del Servicio Sanitario Nacional (NHS). Mediante la aplicación de los estándares a personas, productos y lugares, están cuantificando costos y beneficios en todas sus organizaciones. Este artículo destaca los logros alcanzados por dos consorcios.

Contaminación y Sanidad Mundial - Es el momento de actuar

La contaminación es una de las mayores amenazas para la salud y la economía mundial. En 2015 fue la responsable de 9 millones de decesos estimados y de enormes pérdidas económicas altamente asociadas a los costos de asistencia sanitaria. A pesar de estos grandes impactos, la contaminación ha sido pasada por alto en el desarrollo internacional y en las agendas de sanidad mundial. Para acabar con esta indiferencia y avanzar hacia potenciales soluciones, hemos formado la Comisión sobre Contaminación y Salud bajo el patrocinio de The Lancet.

Esta Comisión examinó los efectos sanitarios y económicos de la contaminación; estudió las interrelaciones entre contaminación, pobreza e injusticia social, identificó estrategias que contrarresten la contaminación de manera más eficaz y estableció un programa de intervención. La comisión destacó que más del 70% de las enfermedades causadas por la contaminación son enfermedades no contagiosas (NCDs). Para identificar los vacíos en el conocimiento y destacar las oportunidades de investigación y prevención, la Comisión desarrolló el concepto 'pollutome', una taxonomía que clasifica los contaminantes según la información sobre sus efectos en la salud.

La comisión concluyó que el control de la contaminación es una batalla que se puede ganar. Las peores formas de contaminación y enfermedades relacionadas con la contaminación pueden contrarrestarse en todos los países aplicando estrategias técnicas y jurídicas que hayan demostrado ser exitosas y asequibles en el control de la contaminación en países de renta elevada y, recientemente, en países de renta media.

Los progresos contra la contaminación y las enfermedades relacionadas con la contaminación requerirán que los líderes de los más altos niveles de las organizaciones internacionales incluyan en sus agendas, de forma inequívoca y contundente, el control de la contaminación y las NCD. Dado que la mayoría de las enfermedades relacionadas con la contaminación se presentan en países de renta media a baja, los nuevos esfuerzos en el control de la contaminación deben desarrollarse y adoptarse a nivel de país con la ayuda financiera de países ricos y de asociados internacionales del desarrollo y bajo la guía técnica de países que hayan implementado con éxito las intervenciones.

Para progresar en el control de la contaminación y prevención de las enfermedades relacionadas con la contaminación la Comisión recomienda la creación de un Observatorio Mundial de la Contaminación, que incluya el análisis y el archivo de datos sobre la contaminación y las enfermedades relacionadas con la contaminación y deje esta información a disposición de investigadores, formuladores de políticas, medios de información y público en general.

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中文摘要

医疗保健法规：推动为医院提供机遇

在当今的全球医疗保健格局下，相关机构制定和/或实施的医疗保健法规越来越多。例如，在阿根廷、欧洲、土耳其、印度、韩国和美国，众多法规都旨在落实各项实践，以便更好地保护患者作为医疗保健服务、药物和/或医疗设备消费者的身份。在主要监管目标中，有一部分包括与伪药作斗争、提高召回率、减少药品错误、提升供应链效率和减少报销欺诈现象。虽然具体目标和时间线可能因国家/地区而异，但制造商都会遵循相应法规，交付携带条形码的医疗设备和药品，而医院则可以使用这些条形码以使其手术和患者受益。

我们的患者，我们的责任：正确识别患者身份，确保患者安全

正确识别患者身份是确保患者安全最重要的措施之一。世界卫生组织认识到，误判患者身份可能会导致药物、手术、诊断和归档等方面的错误。联合委员会亦将“正确识别患者身份”定为首个国际患者安全目标。阿波罗医院推行的一项长期改进流程已经成功减少了错误识别患者身份的现象，最终亦维护了患者安全这一终极目标。为取得这一成果，医院从意外事件报告中吸取经验并进行改进，同时借助包括“我们的患者，我们的责任”倡议、严格培训和各项技术（例如条形码编码和带有语音功能的手术安全检查清单）在内的适当整合，推进文化变革。

堪培拉医院采用患者身份积极识别技术，在采集病理样本时大幅减少差错

为了进一步提高患者的安全性和提供更好的结果，如今的医疗保健提供商需要在医疗点“采集”其患者和临床医师的身份。在忙碌的临床区和误判可能会导致不良反应的情况下，患者身份积极识别技术尤为重要。澳大利亚首都领地（ACT）卫生部与堪培拉医院以 GS1 标准作为所需基础，对其患者、实验室和病理样本以及医疗服务提供商进行身份识别，在每一位患者身处医院期间全程确保患者保健流程的准确性。最后，由于临床医师在采集病理样本时扫描 GS1 条形码导致的试管内血液有误事件减少了 40% 以上。

标准基础清晰透明

能够提升信息水平和巩固专业知识并降低成本，是在奥胡斯设计新的大学医院的若干基本推动因素。重点在于供应链、服务和在不增加人工成本的情况下提升信息水平。医院各流程清晰透明，能够实现更出色的决策和规划。根据全球标准引入自动化跟踪系统，让医院能够巩固内部流程，提高透明度，提升系统互操作性水平，并将用于对象识别的整体信息模型扩展至供应商与合作伙伴。一项关键优势在于能够以具备高水准信息和质量保证（基于自动生成的数据）的可靠方法为基础，确保安全且可重现的患者体验。

巴西医院 Israelita Albert Einstein 在药物全面可追溯性方面取得重大进展

Israelita Albert Einstein 医院（HIAE）秉承提高患者护理水平和安全性这一目标，采用 GS1 标准实现了所有药物的可追溯

性。HIAE 与各供应商携手，并在内部开展各项工作，确保所有单次剂量药物在 GS1 条形码中均分配有包括批次编码/批号和到期日在内的唯一标识符。借助 GS1 标准，该医院得以在药物从收货点到达患者床畔与 HIAE 外科中心期间扫描药物条形码，为端到端可追溯性系统画上圆满的句号。每个月都有超过 240000 个装置在供应商站点标上记号，每月为 HIAE 节约了 600 多个小时和 13620 雷亚尔的实验室成本。

从简单的扫码到完整的患者安全策略

Centro Médico Imbanaco de Cali (Imbanaco) 采用 GS1 标准来简化和自动执行其临床流程，成功地提高了效率和增强了患者的安全性。该医院已启动多项专注于确保药物、医疗设备和其他物资可追溯性的倡议，增强了患者的安全性，减少了差错。借助自动化的订单流程，Imbanaco 医院的库存缩减和浪费现象改善了 98%，其卫星药房的库存率也降低了 25%。此外，开具患者付款通知单的时间也从将近一小时缩短到仅 18 分钟。

通过床畔扫码 (BCMA) 技术减少用药差错：我们的患者值得拥有更多安全防护

给药是住院病人用药期间最易于出错的步骤之一。大多数美国医院已经采用了条形码给药技术，但欧洲医院这方面的应用却是有限。这非常令人遗憾，因为这一技术可以使给药差错减少 50%。为了发挥这一技术的全部优势，BCMA 需要对正确用法进行不间断的监测并对警报数据进行分析。

我们的方法以两项支柱为基础：确保最终用户能够无缝使用这一技术，同时确保他们会适当地使用这一技术。

福井大学医院外科中心针对可追溯性与患者安全打造综合杀菌管理系统

自 2014 年起，福井大学医院（福井医院）就一直专注于对其外科手术进行经济高效的管理。医院通过利用 GS1 标准识别全部 30000 台器械，成功实现了对其外科中心杀菌流程所用外科器械的可追溯性。计数误差率从 3054 降至 175 ppm，装配和检查外科手术器械所需时间每年也缩短了 4000 小时。将 GS1 全球位置代码作为外科器械容器定位系统的一部分这一做法，帮助福井医院使其每年总体手术时间缩短 4971 小时。

Mercy 医院展现了协作与引入全球身份识别标准如何在手术室中增强患者安全

Mercy 医院利用 GS1 标准识别医疗设备和药物，实现医院手术的自动化。正如 Mercy 跨职能团队所呈现的，其自有机构内的协作关系使其医疗体系的数字化转型成为现实。2018 财年（FY18），Mercy 医院报告称，其到达患者手术室（OR）的过期产品和召回产品数量减少 99%。2017 至 2018 财年间，外科收费信息的获取也得到了 28% 的改善，推动增加了 909 美元的患者人均额外收入。与此同时，患者人均物资成本减少 123 美元，患者人均人工成本亦减少 29 美元。更准确的物资收费让临床团队能够全面了解手术期间使用的物品，并推动减少了物资的变化。

NHS 信托证实了实施标准的益处

GS1 标准日益得到英格兰急症信托机构的应用，同时众多政府报告也推荐使用这一标准来增强患者的安全性、减少临床变异和推动提高手术效率。目前采用标准的信托机构形形色色：有的是大型都会中心，有的则是主要服务于乡村人群的医院。各信托机构积累的经验提供了丰富知识，有助于英国国家医疗服务体系 (NHS) 未来实施各项措施。通过将标准应用于人群、产品和场所，信托机构在整个机构范围内量化了成本和益处。本文重点介绍了这两家信托机构取得的成果。

全球健康与污染 - 行动起来

污染是威胁人体健康和全球经济的主要因素之一，2015 年，污染导致 900 万人死亡，更造成巨大的经济损失和高额的关联医疗保健成本。尽管污染已经产生这样巨大的影响，却一直遭到国际发展和全球健康议程的忽略。为了终结污染不受重视的现象和推进潜在解决方案，我们在医学期刊《柳叶刀》的资助下成立了污染与健康委员会。

该委员会审视污染对健康和经济的影响，研究污染、贫困和社会不公现象之间的关联，找出业已经济高效地抑制污染的策略，并勾画出干预议程。委员会指出，在由污染导致的疾病中，超过 70% 为非传染性疾病 (NCD)。为了确定认识上的差距和强调研究预防机会，委员会提出了“pollutome”这一概念，按照人们对污染物给健康造成的影响对污染物进行分类。

委员会断定，污染控制是一场有胜算的战役。通过运用在高收入和近来的部分中等收入国家/地区证实能够成功且经济高效地控制污染的技术策略和法律策略，任何国家/地区最为恶劣的污染和污染相关疾病都能够得到抑制。

要想在污染和污染相关疾病方面取得进展，最高级别的国际组织领导人必须坚定而明确地融入污染和非传染性疾病控制议程。由于绝大多数污染相关疾病都发病于中低收入国家/地区，必须在较发达国家/地区和国际发展合作伙伴的经济支持下以及已成功实施干预的国家/地区的技术指导下，在国家/地区层面制定和开展新的污染控制工作。

为了追踪污染控制和污染相关疾病预防进度，委员会建议成立全球污染观测站，对与污染和污染相关疾病有关的数据进行收集、分析和归档，并向研究人员、政策制定者、媒体和全球公众提供这些信息。

Meet the IHF Award Sponsors

IHF/Dr Kwang Tae Kim Grand Award



Dr. Kwang Tae Kim is a surgeon with immense contributions to the healthcare sector both nationally and internationally. He was President of the International Hospital Federation from 2013 to 2015, President of the Asian Hospital Federation in 2008-2009 and President of the Korean Hospital Association in 2003-2004. He has been the Chairman of Daerim Saint Mary's Hospital in Seoul, his own hospital, since 1969.

As a strong advocate of excellence in clinical governance, leadership, quality and safety, Dr Kim initiated and generously donated to set up the IHF Awards Program during his presidency to promote IHF's visibility and its role as a knowledge hub. Because of this, the Grand Award, the most prestigious among all the IHF Awards, was aptly named after him.

The IHF/Dr Kwang Tae Kim Grand Award will be bestowed to health system, healthcare organisation or facility which achieves excellence in multiple areas including, among others, quality and patient safety, corporate social responsibility, innovations in service delivery at affordable costs, healthcare leadership and management practices. This Award is only open to healthcare service provider organisations which are either IHF Full or Associate Members.

IHF Excellence Awards Sponsors



Austco is the sponsor of the Excellence Award for Quality & Safety and Patient-centered Care

Austco Communication Systems is a global manufacturer of Nurse Call and Clinical Workflow solutions for hospitals and aged-care facilities.

Austco's flagship solution, Tacera, is an integrated IP-based Critical Communication System that delivers safety solutions for patients. By linking nurses and patients in real-time, Tacera enhances the quality of information available to caregivers, enabling them to provide immediate assistance and measurable improvements to patient's quality of care.

Pulse Mobile is the newest component of Austco's innovative Tacera Pulse software suite of next generation clinical business intelligence solutions. Pulse Mobile enhances staff efficiency and caregiver response times, which help improve patient/resident outcomes.

More information about Austco: www.austco.com



Bionexo is the sponsor of the Excellence Award for Corporate Social Responsibility

Bionexo is a technology company that offers digital solutions for purchasing, sales and process management in healthcare. In the healthcare supply chain, there has never been a greater need to reduce costs and operate more efficiently. Through high performance digital solutions, Bionexo offers process automation, increasing the visibility and transparency of information for faster and more intelligent decision making.

More information about Bionexo: bionexo.com/en/



EOH is the sponsor of the Excellence Award for Leadership and Management in Healthcare

EOH provides the technology, knowledge, skills and organisational ability critical to Africa's development and growth. Following the Consulting, Technology and Outsourcing model, EOH provides high value, end-to-end solutions to its clients in all industry verticals. Listed in 1998, EOH attributes its 36% compounded annual growth to a culture of remaining prudent, and not just meeting, but exceeding, customer expectations. More information about EOH: www.eoh.co.za

IHF events calendar

2019

IHF

43rd World Hospital Congress
November 7-9, Muscat, Oman
For more information, contact
patricia.mencias@ihf-fih.org

2020

IHF

44th World Hospital Congress
November 3-5, Barcelona, Spain
For more information, contact
patricia.mencias@ihf-fih.org

2019

MEMBERS

AUSTRALIA

#NextCare Health Conference

Australian Healthcare and Hospitals Association - AHHA
May 30-31, 2019, Brisbane Convention and Exhibition Centre, Brisbane
<https://nextcarehealthconference.com.au/>

BELGIUM

39th International Symposium Intensive Care & Emergency Medicine

Belgian Association of Hospitals
March, 19-22 2019, Square - Brussels Meeting Center, Brussels
<https://www.intensive.org/1/main.asp>

CANADA

National Health Leadership Conference

Healthcare innovation: Advancing better outcomes and economic growth
HealthcareCAN
June 10-11, 2019, Toronto, ON
<http://www.nhlc-cnls.ca/>

FRANCE

Paris Healthcare Week 2019

French Hospital Federation
May 21-23, 2019, Paris Expo, Porte de Versailles, Paris
<https://www.parishealthcareweek.com/en/visit/2019-exhibitors/>
**This event is in French*

HONG KONG

Hospital Authority Convention 2019

The Hospital Authority, Hong Kong SAR
May 14-15, 2019, Hong Kong Convention and Exhibition Centre
www.ha.org.hk/haconvention/hac2018 (Convention held in 2018)

JAPAN

69th Congress of Japan Hospital Association

Japan Hospital Association
August 1-2, 2019, Sapporo, Hokkaido
<http://www.hospital.or.jp/gakkai.html>
Event in Japanese only

NORWAY

Leader Conference 2019

Norwegian Hospital & Health Service Association (NSH)
February 8-9, 2019, Oslo Congress Center, Oslo
<http://www.nsh.no/lederkonferansen-2019.6115702-375023.html>
** This event is in Norwegian*

SOUTH KOREA

10th Korea Healthcare Congress

Korean Hospital Association
April 4-5, 2019, Seoul
Simultaneously translated in Korean-English

SWITZERLAND

Swiss eHealth Forum 2019

Relayed by H+ Les Hôpitaux de Suisse
March 7-8, 2019, Bernexpo, Bern
<https://www.e-healthforum.ch/>
**This event is mostly in German, and French*

UNITED ARAB EMIRATES

Arab Health 2019

Dubai Health Authority (DHA)
January 28-31, 2019, Dubai International Convention and Exhibition Centre, Dubai
<https://www.arabhealthonline.com/en/Home.html>

UNITED KINGDOM

Confed19

NHS Confederation
June 19-20, 2019, Manchester
<http://www.nhsconfed.org/events/2019/06/confed19>

UNITED STATES

AHA Rural Health Care Leadership Conference

American Hospital Association (AHA)
February 3-6, 2019, Arizona Grand Resort & Spa, Phoenix, AZ
<https://www.aha.org/education-events/aha-rural-health-care-leadership-conference-0>

For further details contact the: IHF Partnerships and Project, International Hospital Federation, 151 Route de Loëx, 1233 Bernex, Switzerland;
E-Mail: info@ihf-fih.org or visit the IHF website: <https://www.ihf-fih.org>

2019 IHF MUSCAT

43rd World Hospital Congress

7-9 November 2019
Oman Convention and
Exhibition Centre



CALL FOR PAPER PRESENTATIONS AND POSTERS NOW OPEN!

“People at the heart of health services in peace and crisis”

The call for abstracts for Paper Presentations and Posters for the 43rd IHF World Hospital Congress is now open.

Don't miss the opportunity to showcase your work to the international healthcare community composed of health leaders, experts and key decision makers - submit your abstract now in any of the following sub-themes:

- 1. Resilient health services**
- 2. Innovation for health impact**
- 3. Health investment for prosperity**

For more information on the criteria, submission process and sub-themes visit www.worldhospitalcongress.org.

Deadline of abstracts: 15 February 2019