Healthcare Technology Management Systems

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Toward a New Organizational Model for Health Services

Luis Vilcahuamán and Rossana Rivas

Reviewed by
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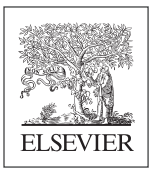

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Rossana Rivas is a PhD candidate at the Ecole des Mines de Paris, France. She received MSc in Health and Social Organizations Management with a major in Management, Organization and Strategy at the Univ. Jean Moulin – Lyon, France. She is a key leader and specialist in Health Technology Management, Clinical Engineering, Biomedical Engineering, Health Technology Assessment and Innovation particularly for Health Technology policy, leadership, planning, contracting, and establishing new programs,

such as with MoH and EsSalud in Peru, since 2006 in the Clinical Engineering−Health Technology Management online training in partnership with the University of Vermont—UVM that also supported Clinical Engineers in Mexico, Colombia, and Argentina. She was a consultant with UVM in 2015—PAHO Healthcare Technology Planning & Management online course aimed to 18 countries. She is a co-founder of Technopole CENGETS—an international known organization interacting with external entities nationally and internationally to improve the viability of the Health Sector through investigations, evaluations, studies, projects, and training. She is internationally recognized as indicated by her Award from the American College of Clinical Engineering—ACCE, her role at the 2015 World Congress of Medical Physics and Biomedical Engineering, and her appointment as a Collaborator to the Clinical Engineering Division of the International Federation for Medical and Biological Engineering—IFMBE. At the Peruvian NIH she has focused on Health Technology Transfer, Maternal Health and Child development, and Heavy Metal Environmental Health; three of the NIH's top-priority areas in Peru today. She has been a consultant in healthcare technology management for the Pan American Health Organization (PAHO), the Canadian International Development Agency (CIDA), Resources International Group Ltd., USAID, and UNDP. She is a member of the American College of Clinical Engineering (ACCE), International Discussion Forum for Global Exchange: Infrastructure and Technology of Health Services (INFRATECH), the World Technology Association (WTA), Health Technology Assessment International (HTAi), Latin and Ibero American Association Technology Management (ALTEC), International Federation for Medical and Biological Engineering (IFMBE), Health Technology Task Group—International Union for Physical and Bio-Engineering Sciences in Medicine (IUPESM), Health Technology Assessment Discussions-Panamerican Health Organization (PAHO-HTA), Medical Device Announcements from the World Health Organization. From 2011 to 2015 she worked as a member of the Commission for the creation of the Biomedical Engineering Joint Career at UPCH and PUCP Universities. Rossana Rivas has received several awards, including the 2015 International Federation of Medical Physics & Biomedical Engineering award, Science, Technology and Innovation International Internships, National Development Fund for Science, Technology & Technological Innovation—FONDECYT, awarded by the National Council for Science, Technology & Technological Innovation—CONCYTEC, Lima, Peru, 2015, and the American College of Clinical Engineering, ACCE and ORBIS International Award for having demonstrated significant improvements in Health Technology Management—HTM as part of a group of more than 23 countries around the world in 2010.

Introduction

Problems are part of solutions, it is said. What is going on in hospitals?

The book is aimed toward technology decision makers, stakeholders and users in hospitals, institutions of research, health regulatory agencies, and other related organizations. In this regard medical staff, engineers, nurses, care technicians, managers, researchers, policy-makers, head of clinical services, and students are considered as the audience. We think also that the book will provide students and professionals a practical approach to improve the technology status in hospitals and other healthcare organizations.

We observe that the status and the utilization of technology in hospitals change according to the surrounding environment. Certainly effective regulations, appropriate budgets, and an adequate organizational culture result in a better response from the health organization but in general all of them have distinctive problems. In developing countries problems are related to low-level medical devices operability, undetected high risks resulting from the use of technology, high costs and the disarticulated work that characterizes the labor of health staff, administrative staff, the technical team, and the engineers.

Biomedical Engineering—BME brings a distinctive impact to medicine and health, in particular Clinical Engineering—CE which focuses on the improvement of technology status in hospitals, BME and CE are relevant change-drivers, but in general they find barriers for the implementation expected. Next to the observation of the current status of technology it is obvious that something is not working or something is missing. A trusted health service, with clinical effectiveness and reasonable costs, requires a strategy. The authors worked on this book to provide insights for new ways to define the strategy. For this purpose, we include a holistic concept of what technology is, the integration, the inter- and multi-disciplinary approach, the network of communication between the stakeholders and, last but not least, the approach that the patient is the priority person and job recipient of health staff, administrative, technicians, and engineers.

Raising the target: In hospital functioning with appropriate technology, are we talking only about medical equipment? Are purchase, installation, and maintenance activities all we need? A skillful engineer is all which is required to accomplish the target? Is it needed to hire an engineer? or it is enough a technician. What is the suitable coordination between the engineer or technician and the medical and administrative staff? These and other questions are unresolved in the hospital, so we think the best is to start at the beginning.

Technology and Technic are both relevant concepts but have a different meaning; for hospitals, the best is to talk about Technological level capacity and Technical level capacity. See the difference as follows:

Technology [Webster Dictionary]: (1) The practical application of science to commerce or Industry (syn. Engineering). (2) The discipline dealing with the art or science of applying scientific knowledge to practical problems.

Technique [Webster Dictionary]: (1) Practical method or art applied to some particular task. (2) Skillfulness in the command of fundamentals deriving from practice and familiarity (syn. Proficiency, facility).

In order to have a hospital with *technological capacity*, it is necessary to have the scientific knowledge applied to the practical problems. On the other hand, to have the *technical capacity* is required to have the skill achieved through fundamental and daily practice. Both are basic and essential, also, the proper balance between them is critical. The technological complexity of the hospital is increasing and requires professionals with a capacity for analysis and synthesis, that is, they have scientific knowledge to solve the problems, be they engineers, physicists, or even administrators or architects. In this sense, we consider the scientific knowledge a basic capacity in the hospital regardless of the size of the hospital. Since it is impossible for the professional to be an expert in all technologies, the natural tendency is to move toward specialization, as is the case with specialization in the various clinical services. The current complexity of hospital technology demands that experts in the hospital field be consulted and at this point it is practically inappropriate to consider an engineer with a traditional education away from hospitals, it is true that every engineer will be able to learn and adapt in some way, but it is also true that particular training is required to master the technologies currently in use in hospitals such as biomedical engineers and clinical engineers.

HEALTH TECHNOLOGY

According to the World Health Organization [1], when referring to Health Technology the definition must include clinical technologies (medical

procedures, medical devices, drugs, and medical materials); support technologies (infrastructure and hospital systems, energy systems, information systems and communication, and the organization itself); also technologies for community health should be included: prevention technologies, protection, and promotion; and even technologies for environmental health. Technology has reached high levels of complexity, sophistication and today it is essential to be able to provide health services with the expected level of quality [2]. Complexity and risk related to the investment determine having an approach of new organizational structures and management, both key to deciding issues effectively taking into account the high costs of acquisition and operation, risk control, clinical effectiveness and efficiency in the use of technological resources; all of which makes a sustainable health system whether in a developed or developing country. Consider, as we did in the 1960s that health technology is only a matter of repairing medical equipment is obsolete and inadequate. Technological resources are more than ever, capital assets of high economic value, essential in clinical service and require specialized decisions focusing on the benefits of investment. Nowadays, it is not enough to have a medical devices operative, what really serves to medical staff and especially what serves patients are functional clinical environments, absolutely everything technological must work to the point of being effective for the clinical procedures. This is one of the milestones of this book; to achieve a functional clinical environment as a result of integrated and specialized work.

THE TECHNOLOGY USER AND DESIGNER

The lack of hospital technology specialists determines that in many places the users, called healthcare staff, require to complement the designer approaches and strategies. This is very common, even useful if developed carefully, but it is also harmful often. The following analogy will help us to understand this: the captain of the airplane is in charge of the passengers during the flight, in a similar way it is the doctor who is in charge of his patients. On the plane, the captain is an expert staff in all maneuvers and forecasts in order to carry passengers safe and on time to their destination, he knows in depth the operation and limitations of the airplane, he may even review the functionality of the airplane and propose improvements. However it is not the captain who designed the plane. They were specialists who designed the plane probably not known to the captain nor the passengers. So why assume that the healthcare staff should provide all the information required to design a clinical service? The information and opinion provided by the healthcare staff is important, but as in the case of the airplane, designing a hospital requires having expert designers with different

range and level of competence. The user of technology has a different field of action with regard to technology designers and both must interact. On the other hand, health system must have technology designers. They may be biomedical engineers, clinical engineers, hospital engineers, health managers, architects of hospitals, medical physicists, and other specialists of the health sector, which in the 21st century is a sector by nature interdisciplinary [2]. It is clear that today in many places this expertise does not exist or there are insufficient skilled health professionals in technology.

ENGINEERS IN THE HOSPITAL

To what extent can the engineers intervene in a hospital? Traditionally hospitals in developing countries, health organizations call for engineers with conventional education: electrical, electronic, mechanical, industrial engineers, etc. By observing the curriculum, there is few or no courses related to hospitals, hopefully there are some additional courses in biomedical. We think that the traditional education of engineering is not enough to work in hospitals. How can the engineers work adequately with the previously described types of technology without specialized education? The conventional engineers, untrained in hospitals, tend to address only the maintenance and neglects the other substantive interventions such as the design of clinical services, support for the development or implementation of clinical procedures, analysis of events related to safety, assessing cost-effectiveness of the technologies used, technology planning, design of technology strategies, among many other possible and necessary interventions that this book describes. An essential cross-cutting issue should then be observed: health sector demands professionals with strong background in biomedical and hospital technology, based on physiology, mathematics, physics, chemistry, and biology of the human body, in addition to engineers being able to apply engineering sciences to the clinical aspects of the hospital.

In developing countries, hospitals often have a distant organizational structure related to the integrated technology management. Consequently, the engineer is not motivated to develop a career in hospitals. The resulting inefficiency and lack of clinical effectiveness, both direct consequences of the situation described above, will generate possibly much higher unnecessary costs to the investment that would be realized if the hospital had hired the right people. The negative scenario then is against one of the relevant objectives of the hospital: raising the functionality of the technology in a cost-effective way. The paradox here described is still poorly understood and explains why hospitals lack economic resources due to technological decisions (see Chapter 4: Health Technology Planning and Acquisition) [3], and

it also lets us understand the reason for resistance in hospitals to incorporate expert engineers.

We think a key aspect required to achieve the expected objectives is that the modern engineer for hospitals should take in count, either a biomedical engineer or clinical engineer or other similar professional interacting not only with the healthcare staff, but keep also an open mind to other disciplines such as architecture, economics, law, and administration. To do this, it is required to think of a new structure of hospital organization and its processes, a hospital structure in which all the aspects of technology work in a coordinated and functional way to the benefit of the patient and the health professionals. This is another milestone of this book.

ETHICS IN HEALTH ENGINEERING

Related to this book, we cannot fail to mention our commitment to ethical principles concerning Health Engineering [4,5]: beneficence (benefiting patients), nonmaleficence (doing not harm), patient autonomy (the right to choose or refuse treatment), justice (the equitable allocation of scarce health resources), dignity (dignified treatment of patients), confidentiality (of medical information), informed consent (consent to treatment based on a proper understanding of the facts), and human enhancement (design to enhance healthy human traits beyond a normal level).

The purpose of the book then is to provide a model and its components to implement an effective Healthcare Technology Management (HTM) system in hospitals, and reflect on the need to rethink the hospital organization for decision-making processes related to technology. Current models of management and organization of technology in hospitals have evolved over the last 40 or 60 years ago, according to totally different circumstances than now, therefore, they all have a "factory default." Our proposal is that in the context of new technologies it is not enough to update the obsolete model, but requires a re-engineering of management and organization to achieve adequate levels of clinical effectiveness, efficiency, safety, and quality that users expect of the technology used in hospitals. Many of the current premises on good practices in HTM provided by specialized institutions on health are impracticable due to the lack of human resources, responsibility, and adequate procedures for the implementation of the proposed processes.

The book is aimed at decision makers, stakeholders and users of technology in hospitals, research institutions, health regulatory agencies, and other organizations related. In this regard, three aspects are relevant in the book: (1) the focus from a "field perspective" in health technology and the "holistic approach," including the academia background and research; the perspective

then is not general but integral; (2) the inclusion of the perspectives, knowledge, and best practices of expert global organizations; and (3) the two authors' experience on exchanging with health sector stakeholders from developed and developing countries over a significant number of years to the present.

Finally, we think that the current problem regarding the status of medical devices can be improved in a viable way. The contribution of many experts and researchers in many different parts of the world over recent years has established advances and open doors. The following steps may be oriented to consolidate a better organization and processes for proper management, not only with respect to medical devices, but referred to the technological environment in hospitals. The solution designed in this context will largely exceed the original problem, giving better opportunities for patients and for everyone in general.

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