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SPECIAL ARTICLE

Innovation and technology transfer in the health sciences: A cross-sectional perspective☆

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Abstract This article is based on the strategic reflection and discussion that took place on the occasion of the first conference on innovation and technology transfer in the health sciences organized by the REGIC-ENS-FENIN-SEMICYUC and held in Madrid in the Instituto de Salud Carlos III on May 7th, 2013, with the aim of promoting the transfer of technological innovation in medicine and health care beyond the European program ''Horizon 2020''. The presentations dealt with key issues such as evaluation of the use of new technologies, the need to impregnate the decisions related to adoption and innovation with the concepts of value and sustainability, and the implication of knowledge networks in the need to strengthen their influence upon the creation of a ''culture of innovation'' among health professionals. But above all, emphasis was placed on the latent innovation potential of hospitals, and the fact that these, being the large companies that they are, should seriously consider that much of their future sustainability may depend on proper management of their ability to generate innovation, which is not only the generation of ideas but also their transformation into products or processes that create value and economic returns.

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PALABRAS CLAVE
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Compra pública innovadora

Innovación y transferencia tecnológica en ciencias de la salud: Una visión transversal

Resumen Este artículo se basa en la reflexión estratégica y el debate que tuvieron lugar en las primeras jornadas de innovación y transferencia tecnológica en ciencias de la salud, organizadas por REGIC-ENS-FENIN-SEMICYUC y que se celebraron en el Instituto de Salud Carlos III en Madrid, el 7 de mayo de 2013, con el objetivo de impulsar la transferencia de la innovación tecnológica en medicina y asistencia sanitaria, más allá del programa europeo «Horizonte 2020». Las ponencias trataron de temas clave como la evaluación de la utilización de las nuevas tecnologías, la necesidad de impregnar las decisiones relacionadas con la adopción y desarrollo de innovaciones de los conceptos de valor y sostenibilidad y de la implicación de las redes de conocimiento en la necesidad de intensificar su influencia en la creación de una «cultura de la innovación» entre los profesionales de la sanidad. Pero, sobre todo, se insistió en la capacidad de innovación latente en los hospitales y en que estos, como grandes empresas que son, deben plantearse seriamente que buena parte de su sostenibilidad futura puede depender de la buena gestión de su capacidad de generar innovación, lo cual no es únicamente generar ideas, sino llegar a transformarlas en procesos o productos que generen valor y retorno económico.

Introduction

For over a decade, the issue of innovation has been present on practically all the agendas of business development, including the healthcare sector. There have been many initiatives to support the development of innovations in Spain, beginning with the financial aids that are now increasingly scarce because of the difficult economic situation.

However, without forgetting the necessary financial flow, the strategic reflection and discussion session that took place on occasion of the first conference on innovation and technology transfer in the health sciences organized by the REGIC-ENS-FENIN-SEMICYUC and held in Madrid (Spain) at the Instituto de Salud Carlos III on 7 May 2013 fundamentally addressed other factors crucial for success of the culture of innovation in the hospital setting.

Hospitals comprise a range of situations, experiences, knowledge and wisdom, and are a source of wealth in the form of both tangible and intangible returns ranging from health outcomes to professional satisfaction and growth, and benefits for the industry and economy of the reference geographical context. However, the hospital setting lacks a driving element that is necessary in order to allow the mechanisms for the generation of innovation to function, making it self-sustaining and promoting development of the hospital itself.

The hospital as a company

Hospitals cover key social and economic needs by preserving and restoring the health of the population, though they are also companies that generate products and services, with benefits for society. In Spain there are some 760 hospitals with over half a million fixed employees that generate a business volume of over 44,000 million euros.[1] Hospitals generate unique, specialized and diverse services and products, ranging from the care of patients and their environment to the application and development of highly complex technologies, the training of professionals, and research and development (R&D) initiatives in collaboration with public or private universities or institutes, and private companies. All these and also many more services are what conform the products portfolio of the ''hospital-company''.

The hospital industry comprises many professionals and technologies, and each of these in turn is enormously diverse. In effect, however the hospital employees cover a broad range of professional profiles with highly diverse qualifications, all of which are essential for proper functioning of the hospital (physicians, nurses, clinical assistants, scientists, psychologists, dieticians, software engineers, etc.). The relevant technologies are no less diverse and range from disinfection to the application of complex experimental techniques, kitchen services, transport, patient care, communication and attention, pharmacy management, purchases, and the financing of technological resources. All these areas of activity have their function and impact upon the generation of services, and condition the quality of the outcomes obtained.

In addition to this extraordinary complexity as a company, mention must be made of the legal nature and economic and organizational dependency of the hospital upon structures at a higher (and often territorial) level that determine policies and legislative frameworks that can either limit or promote hospital initiatives. In addition, the healthcare sector is subject to many and complex local and international regulations that must be known and applied, as well as to ambiguous circumstances that can generate uncertainty when it comes to supporting initiatives that are not supported by clear legal specifications.

Technological innovation and evaluation

Technological innovation is defined as innovation resulting from the application of scientific and technological knowledge to the solution of problems that arise in different production sectors and which results in changes in the

company products or services, or in the company itself, with the introduction of new products, processes or services based on new technology.[2] In the case of the healthcare setting, when the technology is of novel application in the institution, it is regarded as an innovation–whether available in the market or otherwise–if it affords improvements in the diagnosis, treatment or prognosis of patients; contributes to shorten treatment time; improves the monitoring and follow-up of disease; avoids ulterior costs or treatments; or improves patient quality of life, etc.

In this sense, it is increasingly common for new healthcare technologies financed by the Spanish National Health System (*Sistema Nacional de Salud*) to have to produce adequate evidence of their therapeutic and social values in relation to their cost.[3] The evaluation of healthcare technologies is a multidisciplinary process pooling information on the medical, social, economic and ethical aspects of its use in a systematic, transparent, solid and unbiased manner. The aim is to properly inform in order to facilitate the decision as to whether or not to incorporate the technology in line with the applicable health policies.[4,5]

However, it must be remembered that evaluations have intrinsic limitations derived from their own methodological rigor. An example of this is the need to base the evidence on the results of randomized clinical trials designed for regulatory and registry effects, and which are not necessarily indicative of the results that will be obtained in the routine clinical practice setting. Another common issue is associated with the rapid obsolescence of the introduced technologies.[6–11] Beyond the strictly methodological considerations, evaluation implies the assignment of resources and economic costs.

Business innovation and growth

A study recently presented by Price Water House & Coopers predicts that 20% of the most innovating companies in the world will grow by 62% in the coming 5 years, while 20% of the least innovating companies will do so by only 20.7%. The same study reports that in Spain only 45% of all companies dedicate 1–5% of their income to innovation–this proportion being far lower than the figures corresponding to Germany and France (61% and 54%, respectively).[12]

The study makes no mention of the hospital industry, though under the current circumstances, in which the health systems of the European countries are facing a sustainability crisis and the provision of medical care must cope with financial restrictions, can hospitals–as the large companies they are–afford not to incorporate innovation with a view to continue progressing in a more sustainable manner?

Reverting the economic situation with the objective and possibility of making financing possible through the returns afforded by innovation may and should be a vector for obtaining resources and for aligning objectives and policies at all levels, both within and outside the hospital setting.[13]

Innovation in the hospital

When addressing innovation and hospitals it is difficult to know exactly what we are talking about. To begin with, it is essential to make a distinction between the generation of innovation and the adoption of innovating products.

Hospitals generate innovation in the organizational setting, since they typically manage very large diverse collectivities of employees. Hospitals provide around the clock (24-h) on site and out-hospital services; hence there is a capacity to innovate in the optimization of processes and in the provision of services. They can also generate products as a result of hospital innovation, with access to the market–a condition that should not be confused with the R&D activities carried out in collaboration with or for other institutions.

Hospitals have all the ingredients for generating multiple types of innovations capable of offering success in their environment. This may seem evident, though hospitals must assume this reality and transmit it to the professionals in the center and to their collaborators or the companies with which they interact.

Adopting innovation

When speaking of ''adopting innovation'', we normally refer to the obstacles hospitals face in implementing a new technology, and which can be summarized as: (a) a lack of funds with which to acquire the technology; and (b) reluctance on the part of the users to make use of the technology, since they feel that it has been imposed upon them and that they have not had the opportunity to properly assess the actual needs. There are many known cases of the introduction of innovating information and imaging systems (TIC) which have failed because of this, despite adequate financing and their great quality. Innovation should arise from a need perceived by the agents implicated in the ''hospital-company'', i.e., those which can assign value to a given solution and therefore adopt it.

On the other hand, funding is currently a serious problem, and sustainability is therefore a crucial issue in evaluating and defining the product introduction scenarios. A recent development has been the adoption of innovating purchasing policies that include ''shared risk'' protocols between the hospital and the supplying company, with the dual purpose of affording access to complex therapeutic technology and of lessening the financial risk–conditioning reimbursement of the product to achievement of the expected results, as defined by contract (health outcomes, savings, etc.).[14] However, the adoption of such policies can be complex and costly, since management of the data needed in order to establish such agreements requires new developments for the processing and exploitation of such information.[15]

Another example of support of the adoption of technology is the ''innovating public purchasing'' mechanism which the Spanish Ministry of Economy (MINECO), through the Center for Industrial Technological Development (CDTI),[16] has made possible thanks to a legislative amendment,[17] allowing the technological innovation purchasing contracts of the armed forces to be extended to the rest of the public administrations and companies. These innovating public purchasing contracts make it possible for companies in the public sector (including hospitals) to become clients and partners in innovating developments with private

companies.[18] As an example, mention can be made of the Hospital 2050/Innosaude pilot initiative, which will allow the development of healthcare infrastructures and facilities in Galicia. The project encompasses 9 subprojects, with the assignment of 90 million euros to the contracting of innovating technology.

Implicating professionals in the innovation process

It may seem contradictory, but it is necessary to adopt measures for hospital professionals to become involved in innovating activities, in the same way as happened in its day in defining the healthcare activities quality criteria. The creative capacity of the healthcare personnel, which can offer practical and brilliant solutions, is one matter, while becoming involved in the process of converting such solutions into efficient innovations that can be reproduced in other settings is another matter entirely.

Clinicians do not know the methodology and are not familiarized with processes of this kind. Rushing to develop an idea therefore may easily cause them to run into a series of obstacles that can suppress enthusiasm and confirm their distrust of the capacity of the system to adopt and develop their contributions. The first obstacle tends to be the impossibility of obtaining the financial support needed to start the process, though there are also other barriers. Transfer is usually not planned during the development of an innovation. As a result, after finally reaching the end of the process and obtaining a fully designed and even evaluated product, the latter may not be prepared for transfer. Success thus turns into failure, with the consequent frustration and discouragement.

The challenge for hospitals is to capture these ideas and transfer them to a professionalized innovating product development process. This will serve to make the product scaleable (useful for many patients or users), transferable (applicable in other hospitals or healthcare settings) and, especially, capable of generating value (for the patient, cost savings for the hospital, production of income). Due recognition and appreciation of authorship are also necessary–thereby further contributing to the quality and innovation process.[19]

Innovation generation processes

Innovation processes cause an ''idea'' to transform into ''value''. They essentially involve identification and assessment of the relevance of the idea or solution; the development of scalability and transferability; evaluation or prediction of the value of the resulting innovation; and, particularly, the integral management of the entire process in a transparent, comprehensible and acceptable manner.

Identification and relevance of the need and the ''idea''

Technological needs are identified particularly during clinical practice, and fundamentally not only by the healthcare professionals, but also by the rest of the hospital employees and even by the patients and their caregivers or relatives. The idea is to capture the practical vision of the user who contributes effective solutions to perceived necessities, whether the patient or the attending professionals.

Innovations can arise in any area of the hospital.[20] A documented example is the development of ice cream with a composition specifically designed to improve the recovery of patients with iatrogenic throat dryness and pain. In another example, maintenance technicians devised a system that improved the safety and mobility of geriatric patients receiving infusions. This solution not only improved patient safety and quality of life but also facilitated the normal functioning of the hospital personnel.

Scalability and transferability

If the proposed idea or solution is not scalable (i.e., if it cannot be applied or used systematically many times and in many patients) or is not transferable (i.e., if it cannot be used in another context), it will be unable to offer more than improved quality healthcare. In contrast, if it is indeed scalable and transferable, then the process for converting the idea or solution into an innovation capable of generating returns should be started. This in turn will require a prevision of its economic impact and, possibly, the implication of external partners (whether public or private). Setting this process in motion has a cost that must be evaluated according to the expected returns, which may consist of income for the hospital, savings, or improvements. In all cases a risk has to be assumed, however.

Generation of value

Investing in this process, with the implication of other centers or industrial partners to start development and obtain an accessible end product, makes sense if there is a fair and acceptable setting for all those that intervene in the process. Innovation should result in returns for both the acquiring and the innovating party (including the generator of the idea and the organizations that develop, finance and manage it), with a view to supplying continued feedback for the generation of new developments, and promoting the culture of innovation in the hospital.[21]

Management of the innovation process

In order for the idea-innovation generating mechanism to function properly, each idea must receive the assessment and returns it deserves according to its capacity to generate value. This process requires specific and specialized dedication, offering professional support for the ''developers'' in matters related to evaluation methodology and legal, business and financial aspects–thereby contributing to win the confidence of the ''generators'' of the idea. In this regard, it would be advisable to institutionalize or formalize this function in the hospital, in the same way as was done with the quality departments in the 1980s.

Creation of a culture and environment oriented towards the generation of value

The culture of innovation must transcend beyond the hospital, and in this respect the scientific societies and networks play a very important role.[22] It is within this concept where presentation has been made of the Medintech project, a virtual platform for the promotion and facilitation of innovation in the field of healthcare technology, with a view to using a single forum to join all the agents implicated in the healthcare technology innovation and marketing process in Spain. Medintech has references in other exchange platforms such as the National Innovation Center of the national health system in the United Kingdom, recently transformed into the Knowledge and Information Zone,[23] and which in an open and transparent manner makes it possible to define a need, design a solution including the proposals submitted by the different agents, demonstrate its efficacy, and finally support distribution and purchase by the national health system. Other platforms, such as the *Red de Entidades Gestoras de Innovación Clínica* (REGIC) or the *Red de Innovación en Tecnologías Médicas y Sanitarias* (ITEMAS),[24] within the *Redes Temáticas de Investigación Cooperativa en Salud* (RETICS),[25] facilitate mechanisms for the transfer of proposals from multidisciplinary teams that in a cross-sectional manner take advantage of common elements from different projects.

Thanks to the networks, innovating efforts can achieve greater visibility, recognition and access to a source of alternative reflections that help improve ideas and projects. Moreover, networking and critical exposure to external opinion based on other views and experiences, contribute to the modeling, standardization and future transferability of the product. Innovation networks are platforms that act as tools to promote innovations capable of offering value–detecting them, making them visible, generating networking, and facilitating support and counseling with the aim of ensuring that the ideas generate the desired returns.

Scientific societies also play a role in introducing the concept of innovation and the generation of value in the schemes and reasoning of clinicians–beginning with the contents of the articles published in their journals. The article screening criteria influence and define the type of work to which clinicians will dedicate their effort. Professionals must understand that beyond publication for academic or professional promotion purposes, they should publish articles that offer value for the patient, the professionals or the system. We must publish what has value, and conversely, what has value should be published. Innovating ideas should not be simply forgotten or set aside.

Implementation

The implementation of these processes in complex settings takes time: it is generally accepted that 10–20 years are needed in order for results to be obtained and for consolidation in culture to become effective. Initiatives have been started in Spain, much has been spoken about innovation, and we now must go beyond mere words, clarify concepts, redefine objectives and persist in launching mechanisms which not only improve the quality of hospital services but also contribute to their sustainability.

This has been the spirit of the session, and the present article attempts to synthesize a debate that strives to define the key elements for ensuring that implementation of the innovation process in hospitals is seen as both desirable and necessary.

Conflict of interest

The authors declare that they have no conflicts of interest.

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Appendix A.

The authors appear in alphabetical order. The authors and participants have contributed equally to the contents of the present work.

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