Health Industries in the Twentieth Century

Introduction

Pierre-Yves Donzé & Paloma Fernandez

Healthcare has experienced a deep transformation characterized by significant growth in expenditures during the twentieth century. Today, it represents one of the fastest growing sectors of the economy.[1] While estimates of health expenditures came out to about 1% of a country's total GDP in 1900, OECD statistics put that proportion at 4–6% in 1970 (5.2% in France; 5.7% in Germany; 4.4% in Japan; 4% in the UK; and 6.2% in the US) and on a steady increase through the present day. In 2015, health expenditures accounted for 11% of the GDP in France, 11.1% in Germany, 11.2% in Japan, 9.8% in the UK, and 16.9% in the US.[2] Moreover, this phenomenon is not limited to developed countries. Emerging countries follow the same trend, too, with health expenditures that went from 4% to 6% of GDP in China and 4% to 5% in India between 1995 and 2014, for example.[3] Throughout the world, endless growth of health expenditures has led to financial concerns for governments of all kinds. Scholars have also engaged in public debate, trying to provide evidence to explain this development. The mechanisms of the growth of health expenditures led to the emergence of a new academic field in the 1960s—health economics, whose main objectives are to evaluate the most economically efficient system to take care of people's health and to measure the impact of new technologies on health expenditures.[4]

Health industries stand as one of the cornerstones of the welfare system, and the regulation of market access to the corresponding products and services represents a major battlefield in political debates in OECD countries. In referring to "health industries," we consider the various activities in manufacturing (drugs, biotechnology, medical devices, etc.), infrastructure (hospital design and construction) and services (nursing care, insurances, hospital management, etc.) in relation to healthcare. We use the plural term "industries" rather than "industry" to emphasize the broad variety of sectors engaged in healthcare. Although health has become a fast-growing sector of global economies, the foundations of the welfare system, and one the major reasons for progress in the Human Development Index around the world during the twentieth century, very little is known about the conditions shaping the transformation of health industries from small, local, personal services into big, globalized, high-tech businesses.

The heterogeneous nature of the health industries may account in part for the relative scarcity of related studies from a historical perspective. The World Health Organization, as well as the OECD official statistics about healthcare, tackle medical activities and measure human capital that includes

physicians, nurses, and pharmacists. *Forbes* and *Fortune* analyze medical and drug corporations, among them large manufacturers and distributors. National governments consider the wholesale and retail distribution of drugs and medical services via public and private institutions as entities that provide products and services related to healthcare. Health economics scholars concentrate the bulk of their research on studies financed and used by health insurance companies to analyze risk and health spending. In fact, the specialized literature reveals a clear divide. On the one hand are approaches from health economics, which tend to tackle current problems (such as growing costs, the organization of the health market, the role of insurance providers, and the financial impact of new technology) with little, if any, historical perspective. On the other hand, the approaches from the history of medicine and public health field focus more on social, cultural, and gender issues (such as the personal experiences of patients, the professionalization of nurses, social control through health policies, and the international expansion of Western medicine within the context of imperialism).

The bibliometric analysis of the vast number of publications related to the history of health, history of hospitals, and history of medicine using the Web of Science, Scopus, and Mendeley, over the last 15 years, below, reveals that the field has expanded enormously and is therefore difficult to summarize or analyze (see table 1). Pressure for academic productivity and the effects of the internet era in expanding the possibilities of cooperative research and publications may help explain the fact that there are more than one million references to the history of health, hospitals, and medicine alone.

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Works by health economists have helped shed light on the workings and challenges of current health systems. Nevertheless, they do not explain why or how medicine and health have transformed from local services into fast-growing and largely globalized businesses during the last century. What were the driving forces of transformation and growth in this sector? Which companies and entrepreneurs engaged in building new kinds of businesses to improve the population's health and answer the needs of medical doctors and patients? What were their incentives, and what possible alternative choices and pathways were available to them during the modernization of the healthcare business of the twentieth century? How did a financial system take shape, operating on a foundation of insurance providers and state interventionism, to support the growth of the system? Answering such questions is essential to achieving a proper understanding of the historical development of health. Despite the sector's tremendous record of development during the twentieth century, however, very few scholars have analyzed health from a systemic perspective adopting an approach of business and economic history.[5] Numerous scholars have addressed the history of medicine and health, but they often opted for inquiries into specific, fragmented parts of the health market.

Hence, the objective of this special issue is to employ a longitudinal, business history-centric approach in analyzing and understanding the complex context in which the construction of health industries and services took place—via a variety of pathways—throughout the world since the 1900s. This volume first illustrates the role of path dependence and the diversity of the models that different countries followed in transforming locally embedded health services into fast-growing globalized businesses. Second, the articles in the special issue emphasize the impact of the diverse institutional frameworks that helped define national health systems. Third, the issue aims to shed new light on the emergence of new therapeutic agents and new frames of care and culture, as well as the influence of new actors and changing organizations. Fourth, the influence of entrepreneurship, together with different types of ownership and management styles, is a subject of analysis for both fostering a deeper understanding of the complexities in each country and exploring the branches of the health industry for establishing incentives, obstacles, and opportunities in the creation of technological and scientific innovations and the transfer thereof from firms to society.

1. Literature review

This volume builds on a rich and diversified literature in the history of medicine, pharmacy, and general science and technology pertaining to health. Numerous works have examined particular aspects of this transformation, but, unlike the articles in this issue, very few offer an inclusive perspective that establishes a dialogue with the diverse factors that have had and continue to have a key role in the construction of our national health systems: institutions, medical technology, and private and public healthcare companies.

The most relevant literature can be classified in three major fields. First is the history of health system organization and funding.[6] These works emphasize the evolution of public health systems and the funding structures of hospitals, addressing elements like the involvement of the state and insurance providers, the roles of local communities, the relative decline of philanthropy and charity in the Western world. These works, however, lack a focus on new medical technology and the action of private companies, which are vitally important in the diverse experiences of Japan, the United States, and some European areas like Catalonia and Madrid in Spain. Second, there are publications in the history of medical technology that have shed light on the process of innovation in health and medicine and demonstrated the role of social networks in the diffusion of new technology.[7] However, these seldom embrace the analytical perspectives of business and economics and rarely account for the role of enterprises and market structures. Third, the pharmaceutical industry has generated several studies employing a business history approach.[8] They follow a perspective that analyzes the competitiveness of firms relative to organizational capabilities, industrial organization, and markets. The existing research does not usually consider the organization of health systems and the interactions with other

actors within them (governments, insurance companies, and medical doctors) as determinants of change, though, and our special issue aims to contribute to the discussion on that point.

Hence, there has been relatively little analysis of the construction and management of public and private hospitals and clinics, first of all, and the factors that created opportunities or obstacles for those entities in transferring modern, life-saving technologies and knowledge to real patients—to society. We also know relatively little about the construction of health insurance companies or the process through which, in some countries, periods of coexistence or private and public health insurance came about in order to finance the population's access to scientific and technological modern healthcare innovations. Entrepreneurship and innovation among late comers in regions of the world that were far from the leading pioneers in Germany, France, the United Kingdom, the United States, Switzerland, and Japan, too, remain relative unknowns. How, when, and why did life-saving drugs or knowledge make their way to "the rest of the world?" In which subfields of the healthcare industries has "the rest of the world" innovated and transferred technological, scientific, and organizational developments into their public and private healthcare institutions? How can innovative entrepreneurs and small enterprises in the healthcare businesses grow and become medium or large corporations in markets increasingly dominated by oligopolies headquartered in a few pioneering countries? Through which possible mechanisms, in which context, and under which obstacles and incentives can these changes take place? We know extremely little about the history and typologies of historical regulatory systems affecting the volume and prices of drugs and medical services in our countries. Today, when so much is at stake, when we are witnessing the transitions and crises of national health systems created in the latter half of the twentieth century, we believe that business historians have a responsibility to integrate dispersed, isolated methodologies and approaches into a historical overview of the historical construction of our national health systems.

Given the scope of that goal, this special issue cannot fully cover all the aspects of the institutional and business dimensions of health systems. This introduction concentrates on a few relevant topics: medical professions, innovation and new medical technologies, and the creation, management, and growth mechanisms of healthcare firms and corporations. It then provides a general model for historical analysis of the construction and development of health systems around the world.

2. **Medical professions**

Since ancient times, Greek, Roman, Chinese, Arab, South American, and African practitioners created and preserved knowledge about remedies and techniques to prevent illnesses, safeguard against epidemics, and heal and treat the sick with varying degrees of centralized control and funding. The commercial revolution of the fifteenth century onward brought unprecedented changes in political systems across the world, along with wars and upheavals both social and demographic, all of which

had consequences on the world's diverse healthcare institutions. Asia and the Middle East maintained ancient systems of religious provision of care for the poor and sick in large, centralized buildings and temples where religion and local healing traditions prevailed. Meanwhile, the Western world witnessed a more dramatic change from the Middle Ages and well into the sixteenth and seventeenth centuries—a long period of darkness during which authorities disregarded and abandoned advanced Greek, Roman, and Arab medical knowledge and institutions and yielded control of public healthcare to religious authorities and charitable institutions. According to those in control, illness was a consequence of sin, as was the study of the human body. The sixteenth-century Protestant revolution and seventeenth-century scientific revolution were transformations that elevated the medical profession to a higher social status in some Western European countries, as the anatomic analysis of the body was no longer a condemned pursuit and the regulation of scientific studies started to take shape. The biological study of plants and the exploration of medical drugs of organic origin, which had started in a scattered, informal way as curious individuals from a variety of professional origins in other parts of the world delved into inquiry, received a more institutionalized form of acknowledgment in the eighteenth century in most of the Western world; royal institutes, royal associations, and specialized books and journals lent that brand of research more legitimacy.[9] "Imperial science" during the nineteenth century contributed to marginalizing ancient medical knowledge from non-Western civilizations and also spreading to and imposing on distant parts of the world Western academic knowledge and medical institutions and practices relating to biology, chemistry, and medicine thanks to new rotary printing machinery, continuous paper production, new mass media, and, of course, the revolutions in communication and transportation stemming from the first wave of globalization.[10] Since the mid-nineteenth century, until the end of the two World Wars, most countries in the Western world had established new, centralized national sanitary legislation and governmental agencies that slowly took control of the business of health away from religious, philanthropic, or local institutions. Closely linked to the new role of governments in taking control of health problems, particularly epidemics (many related to the processes of mass migration and industrialization of the world), countries set up new national educational institutions and plans to train members of the medical profession—now in urgent demand—through new faculties and schools of medicine, pharmacy, biology, and chemistry. The number of graduates of medicine, pharmacy, and chemistry programs increased in the last decades of the nineteenth century, as records of existing student registers at European universities and the preserved records of local and provincial doctors' associations reveal.[11]

International statistics that take account of the expansion of the medical profession and the construction of Western-style hospitals started to emerge after World War I in a fragmented, experimental way. The figures that came from numerous European, American, Asian, and African countries have only recently came under scholarly scrutiny, with researchers examining the pioneering efforts at transferring knowledge of the modern organization of large hospitals.[12] Statistical collection

only became a systematic, significant process after the creation of international associations focusing on healthcare after World War II. The World Health Organization and OECD provide relatively reliable and representative information for a large sample of countries since the 1960s and particularly after the 1990s. As the OECD statistics in Tables 2, 3, and 4 illustrate below, only a handful of countries with high concentrations of professionals— Germany, the United States, Japan, Spain, Italy, and the United Kingdom—have substantial amounts of data before the crisis in the 1970s. These professionals were physicians, nurses, and pharmacists. Considering the numbers of professionals per 1,000 inhabitants, nurses have clearly been the segment most available to the sick.

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3. Innovation and the history of new medical technologies

The various works on the history of the organization and funding of hospitals emphasize that the introduction of modern management practices from the private sector and the diversification of financial resources were key conditions for enabling the growth of the sector during the twentieth century. Yet, organizational scholars very rarely analyze the reasons and the necessity to develop and grow. In brief, the literature on the subject does not tackle the issue of change in external conditions, the new social and political demand for health services in liberal societies and traditional developing countries with accelerated urbanization and immigration, or the pressure to develop medical innovations to meet the new challenges.

Studies of the history and sociology of medical technology can thus help us better understand the conditions of innovation in medicine and their relations with the healthcare system. In this field, the influence of social constructivism was very important. In the wake of groundbreaking books by Bruno Latour and Steve Woolgar,[13] as well as Thomas Hugues, Wiebe Bijker, and Trevor Pinch,[14] many authors tackled cases of medical innovation from a social history perspective. Stuart Blume studied the example of medical imagery,[15] while Thomas Schlich focused on surgery,[16] and Julie Anderson, Francis Neary, and John V. Pickstone analyzed hip replacement technology.[17] All these works made the argument that medical innovation was not a “natural” phenomenon. They highlighted the major roles of social networks in bringing an innovation into the public eye—on a global scale—and professional use. In this sense, medical innovation can be approached as a social construction: what innovation literature has labeled as innovation through “communities of knowledge” or what entrepreneurial

scholars have described as “collective entrepreneurship.”[18]The articles in this special issue are especially important in contributing new empirical evidence about the complex social, political, and educational professional contexts in which medical innovative knowledge and management can and must develop.

However, the sociology and social history of medical technology has usually overlooked the establishment of connections with business and the relevant economic context, a trend that this special issue aims to change. Analyses of innovation in medicine must address the pertinent relationships with hospital finances, the effects of market regulation, and the roles of health insurance. As in other economic sectors, innovation in medical technology occurs within organizations (universities, R&D centers, and enterprises) within a given market; therefore, business conditions have a major impact on the way medical innovation comes about. The pharmaceutical and drug industry appears here as a specific case, as pharmaceuticals represent one of the very few medical technologies to have been the subject of special analysis by business historians. Most of the works focus, however, on the first phase of drug innovation, running from the development of aspirin in the early twentieth century to that of beta-blockers in the 1960s. Innovation in the drug businesses followed different waves, of course, aligning closely with the product life-cycle theory. The development of cell biochemistry in the 1970s and insights into molecular structure since 2000 have led to the emergence of new players, mostly start-ups, which followed various paths of development (transformation into global companies, absorption by established multinational enterprise, and decline, for instance). The dynamics of the drug industry since the 1970s are still under-addressed by scholars, while they have a growing impact on healthcare consumption.

4. The creation, management, and financing of Healthcare corporations and organizations

Hospitals, manufacturers of medical technologies and drugs, and wholesale and retail distributors of technologies and drugs are the main players in the business of healthcare industries and services. Large hospitals were well-known since antiquity in the Middle East; there have also been large charitable hospitals in the Western world since the fifteenth century, mostly in the largest urban centers of Europe and the Americas. Large hospitals, in their modern form, began emerging slowly in the late nineteenth century and then in an accelerated way in the mid-twentieth century. In ancient and early medieval times, hospitals were often financed by charitable religious organizations, local institutions, and pious sponsors, with non-professional voluntary entities with little or no professional medical or administrative knowledge responsible for hospital management in nearly all cases. The primary objective of these hospitals centered on taking care of and controlling the poor and marginal sectors of society. Their original goal was, in many cases, to take away sick poor people and their illnesses (or deaths) from the eyes of society at large. It was industrialization and the rapid urbanization of the Western world first—and the rest of the world shortly thereafter—that increased

the speed in the growth of the poor and sick populations, transforming what was once a charitable action into an urgent social problem of public healthcare; that transformation gradually prompted local and national authorities to realize the need to organize and control the situation, which after the nineteenth century became a problem of civil order, in a more centralized, civil way relative to the former administrations of religious institutions and specific individuals. It was impossible for the church or for pious individuals to finance and manage enough buildings to accommodate the millions of people migrating from the countryside into the industrialized cities of Europe or the East-Coast cities of the United States after the mid-nineteenth century. It was also a problem for large commercial cities in the East, like Hong Kong, to deal with the massive waves of migration they witnessed in the nineteenth century, which brought with them epidemics and illnesses. During the late nineteenth century, the effects of expanding Latin American metropolises, the construction of the Panama Canal, and the Spanish-American Wars of the late nineteenth century revealed how inefficient traditional hospitals for the poor were in treating and healing ~~a~~an ballooning number of wounded and sick people as the imperial powers and foreign multinationals—together with the urban pull from the countryside—drove millions to large cities in the region.[19] From the mid-nineteenth century onward, the world's large cities, industrialized countries, and urban centers where the economic powers dealt in trade and logistics reformed or created brand-new, larger centralized hospitals. Mechanisms combining public money and private funding also established themselves as the key most efficient approaches on a global scale. The medical and managerial organization of new large hospitals and the underlying philosophical and political basis of the societies and institutions in which the hospitals operated varied greatly in Asia, Western and Eastern Europe, North and South America, and Africa and Australia. Despite that variety, facilities expanded across the board, and a transnational process for disseminating organizational and medical ideas took place well before World War II, with the exchange and movement of technologies, human capital, funds, and ideas picking up speed right after the 1940s.[20]

Hospitals had to be built, organized, and managed by administrative staff accountable for the funds supplied by the authorities provided with hospital equipment, supplied with drugs, and connected to the regular-salaried services of the new class of professionals in medicine and the pharmacy that was graduating by the thousands at the end of the nineteenth century from European and North American universities.

Most of the works on the historical evolution of management and finances of hospitals have tackled American and British cases, although there is ongoing research on digitalized account books and commemorative books with historical accounts and data on hospital organizations at the hospitals of France, Germany, Spain, Italy, Hong Kong, China, Egypt, Colombia, Argentina, Mexico, Peru, Brazil, Chile, Russia, Canada, Scandinavian countries, Central and Eastern Europe, India, and Australia, among others.[21]

In the United States, there were strong pressures seeking the modification and modernization of the country's fragmented, poor hospital system in the second half of the nineteenth century. With the deaths of legions of soldiers in the American Civil War, the casualties of the Spanish-American Wars in Cuba and the Philippines in the late nineteenth century, and the rapid immigration and urbanization on the East and West Coasts since those years, the unprecedented problem of managing the wounded and addressing epidemics affected the country both at home and abroad in its international operations. The pressure led to an organizational and managerial revolution in US hospitals that science and business historians have only superficially tackled thus far. New research reveals that there were two driving actors in the modernization of American hospitals in this context of change from the demand side during the late nineteenth century and the first half of the twentieth century: the Army and the Navy, on the one hand, and the influence of industrial ideas from Taylorism and Fordism in hospital management.[22] The wars made the medical services of the US Army and Navy realize the poor conditions in which thousands of their wounded soldiers received medical attention at home and abroad, first of all. In addition, the wars exposed the urgency of not only improving the endowment of medical products and professionals for the soldiers but also organizing new, large, centralized buildings, managed with new logistics to move provisions more efficiently and standardized medical resources from one place to another, to save more lives and improve the psychological and physical conditions of the sick and wounded at hospitals. In parallel to the new hospitals organized by the US Army and Navy, new hospitals in East- and West-Coast metropolises were built, or old ones were moved to new locations with expanded facilities. Scale and scope in the new hospitals were chief concerns, and the owners of the new hospitals embraced the new industrial organizational ideas of the new large corporations from the start in hopes of organizing or reorganizing hospital resources and designs and also managing the facilities.[23] One must stress the influence of Alfred D. Chandler, to whom several historians of medicine explicitly have referred, on the literature about the subject. For example, Neil Larry Shumsky argued as early as 1978 that "the world of contemporary medicine is one of structure, bureaucracy, and organization"[24] and explained the development of the municipal clinic of San Francisco based on Chandler's work on large enterprises. Barbara Bridgman Perkins, meanwhile, asserted that American hospitals reorganized during the years 1900–1930 through the introduction of management methods from the industrial sector (essentially division of work and hierarchy), which gave way to the establishment of medical specialties.[25] However, the most influential work in this field is undoubtedly Joel Howell's seminal book on New York Hospital and Pennsylvania Hospital.[26] Based on a study of patient files from the two hospitals between 1900 and 1925, he showed how medical technology, such as X-ray equipment and laboratories, became central to hospital administration. Howell's primary contribution lay in demonstrating that the development of hospitals relied as much on organizational and managerial issues than on medical innovation itself. According to sociologists Marc Berg and Stefan Timmermans, the standardization of hospital infrastructure during the beginning of the twentieth century in the United States was the first step of a general trend that reached the entirety of medical practice during

the 1980s and 1990s, characterized by the generalization of a so-called “evidence-based medicine” that relies on international standardized norms.[27]

Some other scholars focused on the issue of financing hospitals, and more broadly health systems, from a historical perspective. Here, too, the most important works came from Anglo-Saxon countries. Steven Cherry published extensively on the evolution of hospital funding in the United Kingdom, stressing the shift from philanthropy to other sources (public funding, patients, and insurance providers).[28] In the US, one can cite the research of Stephen Kunitz on the emergence of health insurance in the early twentieth century,[29] and, more recently, of Christy Chapin on the development of insurance to the present day.[30] As financing health and medicine had become a major political issue throughout Western countries in the 1990s, many scholars undertook historical studies on the historical development of funding for health in countries, such as Germany,[31] Spain,[32] France,[33] and Switzerland.[34]

Hospitals had to have sufficient supplies of medico-technical equipment and drugs, the latter of which also served outpatients. During the end of the nineteenth century and the first six decades of the twentieth century, new firms and corporations appeared, first in developed pioneering countries, and eventually in other latecomer countries, to fill the expanding needs for new products: drugs, medical machinery, medical technology, and precision devices. In the pharmaceutical and chemical industries, the pioneering firms first established new scientific and technological knowledge and learning bases between the 1870s and the 1930s; after World War II and through the 1990s, the pioneers then established solid entry barriers to fend off competitors at home—and particularly abroad—in the markets they were creating with disruptive new products and services. Only from the end of the 1990s onward did global competition from challengers begin to erode the competitive basis of some of the industry’s first comers.[35] This chronology explains well the establishment of leaders like Bayer, Ciba Geigy, and Sandoz in the United States, Germany, France, the United Kingdom, Switzerland, and Japan. In latecomer countries, many of these innovative products and services arrived soon due to early nineteenth-century contact between scientists and the leading pioneering centers and corporations, as well as via the efficient networks that faculties of medicine and pharmacy in Europe, America, and Asia had established among them to communicate knowledge of innovations quickly and efficiently.

Regarding the manufacture and distribution of hospital equipment, in Europe, North America, Latin America, and Asia, small and medium companies with scientist-entrepreneurs soon started to register their mercantile activity in order to take advantage of the expanding market opportunities as millions of sick patients congregated in the industrialized cities that began to grow in tandem with industrialization and globalization after the mid-nineteenth century. Studies on trademarks and corporate monographs have revealed the coexistence of multiple pathways of this multiplication of small entrepreneurship in the production of chemical drugs and medicines that appeared in the mid- and late nineteenth century. Some grew serving the military needs of their armies (Nobel in Russia,

Behring in Germany, Abbott and Baxter in the United States); some transformed into large multinationals in the food industry in the twentieth century (like Nestlé, Danone, and Coca Cola); some developed via government support to cover large population needs (CSL in Australia); some changed headquarters due to war pressures and enjoyed successes in becoming large multinationals on other continents (Danone moved from Spain to France, for example, while Andrómaco shifted from Spain to the United States and then to Central and Latin America). Of the litany of small laboratories that existed before the 1920s, however, very few remained intact after the 1950s; many did not survive the two World Wars and the collapse of global trade in the interwar period.[36]

After World War II, there was a decline in the number of small and medium family-owned companies in Western Europe, particularly in the United Kingdom, and a concentration of the chemical and pharmaceutical and medical drugs business into larger corporations.[37] North American corporations were particularly well placed to assume leadership in the new world order, including in the healthcare industries covering the manufacturing and distribution of hospital equipment and drugs. As the need for complex technologies and medical drugs expanded with population growth in the postwar period, and as hospitals grew in number to serve the increasing number of potential sick people, hospitals faced the need to purchase diagnostic instruments, pharmaceuticals, and laboratory equipment like sterilizers, masks, gloves, microscopes. During the late nineteenth century in the US, as was the case in Europe, there were many small manufacturers of such items; the Gendron Wheel Chair Company (founded in 1872), Davol Rubger Company (1874), American Sterilizer Company (1894), Beckton, Dickinson and Company (1897), and Bard-Parker Company Inc. (1915) are several examples. In the pharmaceutical industry, Merck and Company, Abbott Laboratories, Cutter Laboratories, and Mead Johnson and Company were all founded between 1883 and 1900. However, most manufacturers had to sell their products directly to thousands of hospitals across the country, and the transaction costs involved were high. The American Surgical Trade Association, founded in 1902, had attempted in vain to organize the industry. Then, a talented medical supplies salesman named Foster McGaw emerged and, in 1921, founded the American Hospital Supply Corporation—which would go on to be one of the world's largest wholesale distributors of hospital supplies through 1985.[38] The reasons behind their success were the new competencies developed in connecting distant manufacturers, establishing price convergence across distant hospitals within the given country and abroad, and organizing of a professional salesforce trained specifically for the products that they had to sell. This "Chandlerian" corporation would be difficult to imitate in other countries until the late 1980s. In Western Europe, particularly in Germany and German-speaking countries, the same type of concentration took place in a different context. Around twenty local manufacturers and distributors were taken over during World War I by the X-ray equipment producer Reiniger, Gebbert & Schall, a company that was based in Erlangen and founded in 1887. In 1921, a holding company called Industrie-unternehmungen AG (INAG) took control of the group to provide all the technical equipment that hospitals and independent doctors needed. A few years later, in 1924, Siemens & Halske purchased INAG and

established itself as a leader in hospital equipment business.[39] This leadership grew even stronger and extended to emerging countries after WWII, when Siemens engaged in hospital building.[40]

OECD statistics again prove useful in understanding the dynamics of hospital systems and healthcare business in various countries over the last thirty years (see Tables 5 and 6 below). The availability of beds per hospital is a simple variable that indicates the concentration of professionals, drugs, and services that have implemented healthcare among populations across countries; the figures demonstrate the United States' dominance in total number of hospital beds, followed by Japan and Germany. When one considers the number of hospital beds per 1,000 population in each country, the power of the United States becomes less pronounced, and Japan appears as the best-served country in that different statistical context. Moreover, the numbers express the existence of a broad variety of systems (the high density of small hospitals in Japan vs. the presence of a small group of large hospitals in Western Europe) with a major impact on the diffusion of medical technology and the consumption of healthcare.

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5. For a business history of health

The literature on the management of hospitals and the social history of medical technology offers an important basis for building and developing a new approach to considering the transformation of health into a fast-growing business during the twentieth century. A business history of health requires a systemic perspective that includes the producers (companies), practitioners (medical doctors), and users (patients and hospitals) of medical technology, as well as the providers of capital and the bodies responsible for regulating the health system (government). Figure 2 illustrates the organization of a healthcare system.

Business historians can employ this model as an analytical tool for discussing the development of health in various countries through different examples and sources. Of course, it is not always possible to consider all five actors with the same importance in any case study. Some scholars may give more attention to relations between two of the actors (insurance providers and government, practitioners and patients, or technology producers and investors, for example). They should, however, be aware of the existence of and roles played by other actors in the health system to provide a comprehensive view of the business history of health.

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The articles in this special issue focus particularly on one or two of these actors but explain the interactions with other actors to offer a fuller understanding of how given health systems developed, either nationally or globally. The perspective of the producers of medical technology is the framework for the three first articles, which analyze various cases of development and growth of small and medium enterprises in a sector dominated by large, multinational enterprises. Paloma Fernández Pérez, Nuria Puig, Esteban García-Canal, and Mauro F. Guillén demonstrate that the successful internationalization of small and medium enterprises in a developing economy (the plasma laboratory Grifols and the pharmaceutical company Ferrer, both from Spain) relied not only on the internalization and transfer of knowledge from US and German first movers but also on the local institutional environment, a system of innovation that encouraged the collaboration of scientists, politicians, and entrepreneurs in modernizing and transforming local healthcare businesses. The Barcelona district of biomedical scientists gave the entrepreneurs the opportunity to build the learning bases necessary for launching cooperative efforts with large foreign companies. For example, the roots of Grifols go back to a small clinical laboratory that doctors from the University of Barcelona's Faculty of Medicine opened in 1910. During the following decades, members of the Grifols family studied medicine and pharmacy and acquired scientific knowledge from both Germany and the US after World War II. The subsequent expansion of these family firms in Europe, the US, and Japan resulted from cross-border mergers and acquisitions that allowed them to acquire knowledge and develop their R&D facilities.

The article by Ken Sakai on Mani, a Japanese surgical needle manufacturer, during the second part of the twentieth century is another example of how a small company in a country with a seemingly weak, uncompetitive pharmaceutical industry managed to grow. Mani's technological development was achieved through cooperation with large private companies, like Toshiba, and semi-governmental organizations such as the Atomic Energy Research Institute. Moreover, the company's growth tied into a fast-expanding hospital market, then the company started to expand abroad since the 1990s, when the number of hospitals in Japan started to stagnate then to decline. This example thus reflects the impact of regulation in the healthcare market on medical technology firms: the lack of interventionism on the part of the Japanese government, which led to the opening of numerous hospital beds (about 700,000 in 1960 and more than 1.6 million in 1990), represented an opportunity for many small companies like Mani because it offered a large market for medical devices.

The third paper on medical technology firms, by Maki Umemura, compares firms in regenerative medicine since the 1970s in the US, UK, and Japan. She argues that this specific sector was shaped by more than just technological issues related to cell-based therapies, regardless of how undoubtedly complex the issues may be. She details the relations between scientist-entrepreneurs and investors, the latter of which were impatient to transform firms into highly profitable businesses and sometimes withdrew their investments. The connection between capital and medical technology shines through

in Umemura's incisive analysis. Another dimension that comes to light through the paper's international comparison is the importance of regulation. R&D and the consumption of biotechnology products are subject to legal frameworks that differ between countries—and that regulatory environment has a deep impact on innovation.

Next, three articles analyze the perspectives of the organization and regulation of healthcare markets. Sabine Schleiermarcher focuses on the attempts of the Allied forces in Germany to restore medical care and public health service immediately after World War II. She also looks at how, in the context of the European Recovery Program, the Rockefeller Foundation organized grants, visitation programs, and a school of public health. The article shows how the North American initiative underestimated the strength and endurance of pre-World War II traditions of public health organization and also miscalculated the medical profession's resistance to adapting outside models of medical care and service.

The article by Jean-Paul Domin tackles state interventionism in France between 1890 and 1938, an effort to implement a public insurance system that would support the access of the population to healthcare—what the author calls the "socialization of healthcare demand." The interventionism relied both on assistance (free medical assistance for the poor, introduced in 1893) and insurance (workers' health costs due to work accidents, covered by employers in 1898, and social insurance for all citizens, enacted in 1928–1930). Regulated competition following state interventionism led medical professions to organize themselves and adopt common fees for government-supported patients, as free competition would result in decreasing revenues. The important outcomes of this policy were increasing insurance coverage (from less than 5% of the population in the late nineteenth century to 46% after 1930) and rapid development of the hospital market—due to growing guarantees of revenues by patients. The state organized the competition, but the business management of medical doctors and hospitals was autonomous.

Roser Álvarez studies the important changes that took place in the Chinese public healthcare system during the Maoist period (1949–1976), confirming the general increase in health resources in those years. The study also reveals a decrease in infectious diseases, a reduction in mortality rates, and an increase in life expectancy. However, she also uses provincial data for the Henan Province to uncover a strong provincial inequality in the allocation of health resources, an imbalance that may have accounted for the gaps in the provincial and regional health indicators she presents. Her study illustrates the transformation and endurance of traditional healthcare services like the rural medical agents that took shape in years and regions where large hospitals could not be built.

The users of medical technology are the main subject of the article by Pierre-Yves Donzé, who tackles a case study of the transnational experiences of knowledge transfer from the West to the East: the introduction of Western hospital designs to Japan between 1918 and 1970. The paper demonstrates

the influence and relevance of studying hospital design and architecture. Neither factor is a simple, short-term decision with minimal significance; after all, hospitals are enduring service infrastructures that, on average around the world, serve millions of people over periods lasting more than a century. Making the right decision on an efficient design that accounts for the needs of the population, the costs involved in maintenance and repairs, and the human capital that must coexist and manage the hospital efficiently is of paramount importance—yet historians of medicine and business have tended to overlook the topic. Donzé describes the transformation in Japan from prewar models of small hospitals in urban areas to the large public hospitals of the post-war era, explaining how the main drivers of the new hospitals were architects with knowledge of large Western hospitals who had the support of local authorities to introduce foreign designs in dealing with new local needs. The article details some of the pioneering new Japanese hospitals, the architects behind them, and the context that helps elucidate the introduction and hybridization of Western concepts of hospital design in Japan.

Finally, this special issue includes an article by Jerònia Pons and Margarita Vilar on private providers of capital for healthcare in Spain during the last century: private health insurance companies. The authors assert that the private insurer community is not a new outcome of the current welfare crisis in Europe but rather an old actor that has been part of the healthcare system for a century, flexibly adapting to changing external institutional and economic conditions. Private insurance companies have transformed not only their internal organizations and strategies but also their external relationships with foreign competitors and the state.

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