

The evolution of the Finnish health-care system early 19th Century and onwards

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Abstract.

The purpose of the paper is twofold. First, it seeks to appreciate key events in the development of the Finnish health system and in particular those of the hospital system over the last two centuries. In doing so, the paper analyses the mutual influence among emergent organisational and clinical routines for the evolving body of medical scientific knowledge and the system for the training of doctors. The second objective of the paper is to focus on one specific actor in this evolutionary process, namely university hospitals, a specific form of organisation emerged in the post-war period.

Keywords: evolution of Finnish health care system, emergence of organisational and clinical routines, training of medical doctors, university hospitals

Introduction

The transition to modern medicine started in the first half of the nineteenth century. The dominant approach before 1850, at least in Finland, was less interventionist in the face of grave illness and the dominant philosophy was basically very much 'God gives and God takes'. Startling discoveries in chemistry and laboratory techniques and equipment during the nineteenth and twentieth centuries – e.g. Pasteur's theory of micro-organisms, Koch's breakthroughs in bacteriology, Röntgen's invention of the X-ray and the electrocardiograph, to name but a few – contributed to the replacement of old notions and approaches. Behind such advances was also a narrowing between medicine as a body of science and as area of professional practice. The emergence of bacteriology and virology accelerated an impending transformation of medical knowledge base, not only because of the remarkable scientific novelties but also in terms of how health-care is understood, organised and managed over time and across realms of medical practice.

The purpose of the paper is twofold. First, it seeks to appreciate key events in the development of the Finnish health system and in particular the hospital system over the last two centuries. In doing so, the paper analyses the mutual influence among emergent organisational and clinical routines for the evolving body of medical scientific knowledge and the system for the training of doctors. A staple of our argument is that these independent, yet highly complementary, dimensions are strongly interwoven in the long-term trajectory of medical know-how. Against this background we analyse the functional role of hospitals, their origins and the reasons behind their transformations in the service of a changing Finnish health care system (HCS). The second objective of the paper is to focus on one specific actor in this evolutionary process, namely university hospitals, a specific form of organisation emerged in the post-war period. In particular we aim at elucidating the origins of their emergence vis-à-vis the changing background of health science and health care delivery in the context of the Finnish HCS. The main contribution of this paper is therefore a historical overview of the changing role of hospitals within the evolving context of the Finnish health-care system. This draws on and adds to the Health Innovation System framework by Consoli and Mina (2009) with a view to provide an appreciative illustration.

The paper begins with an historical background of health care needs and setting in Finland during the nineteenth and twentieth centuries.

The next two sections concentrate on the origins of the national hospital infrastructure and the final section looks at the current health challenges with which the Finnish system is confronted, and brings us to our conclusion.

Background: clinics and hospitals as a response to changing attitudes in medical treatment and training in Finland

When the Royal Academy of Turku was founded in 1640 by Queen Christina of Sweden its main function was the training of priests and civil servants. Indeed, a faculty of medicine was included from the start and expectations ran high at its inauguration. It was intended that ‘the medical faculty would become equal to Padua, Freiburg, Strasbourg and Paris’. (Tommila and Korppi-Tommola 2006.) In practice, however, only one chair was established, offering theoretical lectures on medical treatises from the classics. It took more than a century before the first Doctor of Medicine graduated from the Turku Academy. Until 1750 the only academically trained physician in Finland was the professor of medicine at the university.

Very late from a European perspective, medicine became one of the crucial interests of the university. Decisive were the low social status of physicians and the lack of prestige of medicine in general (von Bonsdorff 1975). The change of power in 1809, when Finland became a (autonomous) part of the Russian empire, did not directly result in a different policy in this respect. From the introduction of the civil service examinations in 1817, the Academy of Turku became an institution almost exclusively in the service of the national (Finnish) state, with the training of civil servants as its main duty. Certainly, with the move of the university from Turku to the capital of Helsinki in 1828, building up the nation became even more explicitly the task of the university. The location of the new Imperial Alexander University on Senate Square was significant, with the government residing on the opposite side of the square, whilst next to it stood the imposing cathedral. Supported by the Russian government, the university had to explore the indigenous Finnish culture in its broadest sense, to the disadvantage of the study of medicine. (Dhondt 2008.)

Revealing in this respect is the development of the number of professorial chairs. Until the end of the 1860s, a clear dominance of human sciences prevailed (see Figure 1). Gradually the balance between the number of lecturers at the different faculties and departments improved, but the humanities continued to outnumber the other disciplines after independence in 1917. At that time, only eight permanent professors were attached to the faculty of medicine in Helsinki. Two years later, Finland established its second university, but it took until 1943 before a medical faculty completed this institution. Priorities were on quite a different level. It became a major task of the university in Helsinki, and of history and jurisprudence faculties in particular, to answer the question of how Finland had matured to the unexpected situation of independence. In medicine, extensive resources were devoted to the study of the origins of Finns. (Tommila and Korppi-Tommola 2006.)

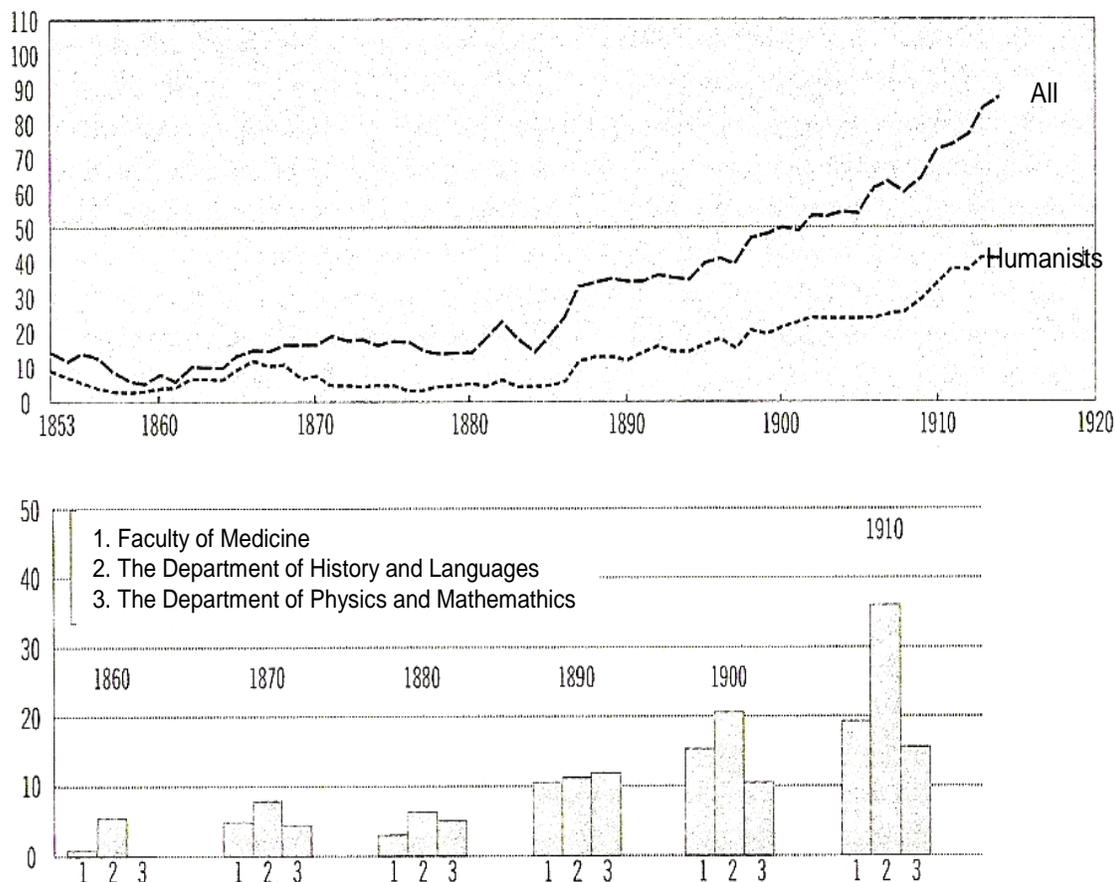


Fig 1. The development of the number of lecturers and professors at the University of Helsinki between 1853 and 1914 and the ten-yearly development of their numbers in the largest faculties (Tommila 2002).

The lack of physicians was significant. At the end of the eighteenth century Josef Pipping, professor of gynaecology, argued that it was difficult to find a civilised country that lacked physicians as much as Finland (Pesonen 1980). In 1776 there was only one doctor per 51.000 people. The ratio improved slowly to one academically trained physician per 41.000 people in 1800 but by the end of the nineteenth century only five to ten students graduated every year in medicine (Pesonen 1980). From the beginning of the twentieth century the ratio of physicians to general population improved steadily.

A crucial factor in this process was the growing awareness of the exceptionally high death rates in Finland compared to neighbouring countries¹. At root of this were low hygiene standards (Harjula 2007). Folk wisdom such as 'God gives and God takes' sums up perfectly the widespread fatalism that dominated the attitude towards health. Infections were believed to spread only through the air and not through touching (Harjula 2007). As a consequence surgeons' clothing were neither cleaned nor washed between operations. The legendary cutting dress of Jakob Estlander, professor of surgery, could even 'stand by itself' because of old, dried blood and tissue fluids which had made the dress like a harness (Ignatius 2000). Therefore it is not surprising that infectious diseases were among the most common cause of death in Finland in the first half of the nineteenth century, especially cholera and typhoid fever around 1800, and tuberculosis and dysentery around 1850 (see Table 1). To be sure high mortality among babies and children worried the authorities and drew attention to the training of midwives (in a special school which was founded in Turku in 1816) and let do the early introduction of gynecology and obstetrics at the university (in 1784) (Pesonen 1980).

¹ Figures are available for 1880 when the mortality in Sweden and Norway was about 16.6 and 17.8 per mille, against 22 per mille in Finland.

Table 1. The most common causes of death in Finland in the 1850s² (Ignatius 2000).

Cause of death	Mortality
Infectious diseases	20 000
- tuberculosis	4 300
- dysentery	4 300
- typhoid	2 600
- whooping-cough	2 400
- measles	1 300
- scarlet fever	1 200
- smallpox	1 100
- diphtheria	700
debility	4 100
accidents	1 200
drowning	600
sudden infant death	570
other diseases	14 000
others, not diagnosed	6 700
Total	47 000

Other medical fields, viz. surgery and pharmacy, were taught at university level in Finland much earlier than elsewhere in Europe. By the end of the eighteenth century the training of physicians and surgeons was clearly separate in Finland, as in the rest of Europe. Surgeons were considered as craftsmen, they were trained at the (vocational) *Collegium Medicum* and formed their own guild whereas physicians received a much more theoretical education focusing on internal diseases (Bonner 1995).³ Largely because of the growing awareness that internal and external medicine could no longer be divided completely the so-called minor medical schools for surgeons gradually disappeared during the first decades of the nineteenth century. Only in France and in countries within France's range of influence, such as the Low Countries, did the distinction between these classes of medical practitioners survive a little longer, until around 1850.

The University of Helsinki had taken the same initiative almost ten years earlier, in 1840, but in fact the integrated doctoral degree in medicine and surgery was already in existence by the middle of the 1820s. At that time the Finnish *Collegium Medicum* had abolished the examination to obtain the degree of 'master in surgery', which they organised themselves. In consequence, all medical practitioners were educated at the university, receiving a medical training with considerable emphasis on surgery (Klinge, Knapas and Leikola and Strömberg 1989). This re-orientation of training draws attention to the fact that professional practice is not static but rather evolutionary in the sense of being forced to adapt to the emergence of new needs (Langlois and Savage 2001). In this specific instance we begin to notice the first steps in the trajectory that led to the coordinated management of training and practice that is at the heart of university hospitals.

The reasons for the early introduction of the integrated doctoral degree in medicine lay in the vastness of a sparsely populated country, which made it impossible in many cases to consult a specialist. As a consequence general practitioners were expected to master all medical fields: medicine as such, surgery, obstetrics and pharmacy. As a result in Finland and other Nordic countries, the last three disciplines became part of the standard university curriculum earlier compared to most other European countries. The drawback of this extensive medical training, however, was the extremely long period of study, on average eleven years: three years for the preparatory studies, the so-called preliminary medical examination (*medikofili*), two and a half years for the candidature in medicine and five and a half years to obtain the licentiate. Many students were put off by this long study period, resulting in the aforementioned lack of physicians (Dhondt 2009.) One way in which the Russian authorities attempted to improve health care and the training of physicians was by forcing practitioners to register officially, in order to get rid of the (still large number of) quack doctors.

² These statistics should be interpreted with caution, because the cause of death was determined by priests until 1936. Still, they do show a certain trend.

³ The Association for Doctors of Medicine was founded in Sweden in 1663 and functioned simultaneously as an educational institution, a professional association and a government body to monitor health care.

The underlying idea was to improve the attractiveness of the medical profession by recognising well-trained physicians and thus countering the scarcity of physicians, at least to some extent. In 1811, a *Collegium Medicum* was established for this purpose in place of the former Swedish Association for Doctors of Medicine. The members of the new *Collegium*, the three professors from the medical faculty and the professors of biology and chemistry from the arts faculty, were appointed to supervise and monitor the field of health care and medical practice, e.g. by registering all those who wanted to practice medicine, be it as physician, surgeon or pharmacist. If only on a small scale, gradually health care was withdrawn from the purely private sphere and became a public concern. One other government action in this respect was that all seven hospitals operating in the country at that moment became government trusts. Simultaneously, the number of county doctors increased from eleven to twenty. (Vauhkonen 1992; Pesonen 1980; Joutsivuo and Laakso 2008.)⁴

Because of these and similar measures, after a while the lack of physicians was not such a concern in Helsinki (and other cities), but it appeared to be particularly difficult to convince young doctors (who were already undervalued and underpaid) to set up a practice in the remote interior. Once they had studied at the (Swedish-speaking) university, former farmer's sons, who had now climbed the social ladder, were not immediately inclined to return to their home city, far away from the political and cultural life of the capital. To tackle this problem, which Finland shared with the other Nordic countries, the political and university authorities encouraged local priests to obtain basic medical training or even to study for a full degree at the university (Klinge, Knapas, Leikola and Strömberg 1989). This policy had some success, but opening the doors to female students from the 1870s proved to be much more effective. The general restrictive Russian policy in this regard also had repercussions in Finland, so that it was only in 1902 that women were freely admitted to study at the university. In the field of medicine, however, female students were enrolled on a fairly regular basis from the 1870s to increase the number of physicians, inter alia.

The increasing attention to health care in general, the policy of conferring official recognition on well-educated medical practitioners and the (early) introduction of the integrated doctoral degree also had an effect on the content of the medical training which was characterised increasingly by a clinical approach. The Finnish university resembled its German counterparts in this respect. The University of Helsinki differed, however, in two important respects from universities such as Göttingen and Berlin, which were often referred to within the scope of the reform of the Finnish university statutes in 1811. First, the requirements with regard to surgical knowledge were clearly much stricter in Finland than in Germany (precisely because of the impossibility of guaranteeing the availability of a specialist surgeon when needed). Second, pharmacy at university level was introduced in Finland earlier and also integrated in the general curriculum of the doctoral degree. The almost exclusively theoretical training at the end of the eighteenth century was thus gradually replaced by a combination of theoretical lectures with practical training at the bedside. One of the reasons for the building of the province hospital in Turku in 1759 was so that young, recently graduated doctors from the Academy could practice their clinical skills there. The basic conditions at the hospital did not, however, provide good opportunities for this. The new clinical institute which was built immediately after the move of the university to Helsinki in 1828 met expectations much better in this respect.⁵

This predecessor of a university hospital was enthusiastically welcomed as a supplement to the few existing hospitals in terms of both medical training and medical treatment. By the end of the eighteenth century, only 20 hospitals existed in Sweden and six in Finland. Most of them were no more than shelters for sick and wounded people, run by the church or other private initiatives, and dependent on donations, voluntary fees and fines (Pesonen 1980). Owing to the belief that disease was spread through the air, at least from the beginning of the nineteenth century many of these hospitals were built outside the city, on a hill or at the seaside where the pure air could aid the recovery process. Only in the 1870s did things start to change in this regard. In the 1840s, the Hungarian professor Ignac Semmelweis was one of the first to document the risk of spreading diseases by touching and the need for clean hands in medical praxis, more particularly in the prevention of puerperal fever. His ideas did not reach Finland, however, until 30 years later.

⁴ The first country doctor operated in Vaasa in 1749. By the end of the nineteenth century 53 were active in Finland. Soon afterwards the county doctor system was replaced by the provincial doctor system.

⁵ From the start, the clinical institute had a separate delivery section, which proves again the early introduction of obstetrics at the university level.

Josef A.J. Pippingsköld was struck by the huge difference in mortality rate between deliveries in the countryside, in the (clean environment of the) sauna with a lot of boiled water, and those on the maternity ward. After the introduction of some simple measures, such as forcing his personnel to wear clean dresses, paying great attention to blankets and cushions, heating instruments before use, etc., the results were immediately visible. When the new lying-in hospital was opened in 1878, Pippingsköld got the opportunity to realise his intentions to the full. (Monos, Faragó and Hänninen 2002.) The breakthrough of bacteriology in the same period was probably the main explanation for the abandonment of the theory of ‘miasma’, viz. the idea that diseases and infections were caused by bad air. The discovery by the German Robert Koch that anthrax and tuberculosis were caused by a bacterium turned the prevailing ideas upside down. Slowly but steadily the new approach, characterised by all kinds of hygienic measures, found general support (Harjula 2007; Ignatius 2000). German researchers and universities took the lead in this field and succeeded in promoting the new, scientific approach abroad. Also, Finnish professors of medicine increasingly had the opportunity to make study trips to German and other foreign universities between 1880 and 1910, the ‘golden age’ of Finnish medicine, and to adopt these characteristics of the foreign institutions which were suitable for the Finnish system (Ignatius, 2000; Dhondt 2009).⁶

For instance, the introduction of many specialist fields followed foreign models, be it Germany, Sweden, Russia or elsewhere: cell pathology, ophthalmology, syphilidology and dermatology, hygienics, forensic medicine, odontology, psychiatry, bacteriology, etc. In combination with increasingly professionalised clinical training this led to the establishment of many new clinics and hospitals from the 1880s, almost all of them run by the government (see Table 1). Only from the end of the nineteenth century did the municipalities also start to build their own hospitals because they were not satisfied with the current situation and with the government policy in this regard. The first of these hospitals was built in Ruovesi in 1881 and their number increased enormously. By the 1920s there were already 236 hospitals, of which 142 were run by local municipalities and 60 privately (Kaarninen and Kiuasmaa 1988). Also, the number of beds grew spectacularly: from 373 places in 1820 (for a population of 1.2 million) to 26225 in 1939 (for a population of 3.7 million) (Vauhkonen 1992).

Table 2. The number of hospitals between 1820 and 1920 (Vauhkonen 1992).

Year	general hospitals	mental hospitals	tuberculosis hospitals	sum
1820	9	2		11
1850	16	2		18
1880	28	2		30
1900	90	8		98
1920	205	15	16	236

Although the hospital network started to expand from the early twentieth century, being treated in a hospital was still quite rare. The largest hospitals in the 1920s were the state-owned provincial hospitals located in the big cities.⁷ The municipal hospitals in the countryside often had fewer than 20 beds and many municipalities lacked hospitals altogether because of lack of resources. They were dependent on government-owned general hospitals in bigger localities, even though the distance to the hospital was sometimes very long. In the late 1920s, the Federation of Rural Municipalities together with the Common Association of Finnish Doctors of Medicine made a declaration to increase, first, government funding for municipally-run hospitals and, second, the total number of hospitals. (Pesonen 1980; Vauhkonen 1992; Kaarninen and Kiuasmaa 1988; Sorvettula 1998.)

Building up a network of central and university hospitals: the need for a more organised healthcare system

In 1929 the government set up a committee to canvass how to develop the fragmented system of hospitals in the country. The committee compared the Finnish situation with other Nordic countries, and noticed that the hospital services in Finland were unbalanced across the country. The rural areas were in a totally different situation from the urban ones.

⁶ The orientation towards Germany was also apparent in the language of the dissertations, which were written mostly in German. After the Second World War, however, English became the main language of communication in medicine, which had the unexpected effect that some innovations dating from before the War, yet published in German, had to be ‘re-invented’ because of the language gap (Ignatius and Nuorteva 1999).

⁷ Turku, Kuopio, Vaasa, Mikkeli, Oulu, Viipuri and Helsinki (the hospital in Helsinki was transferred later on to Hämeenlinna) (Väänänen 2005).

According to the committee's comparison, there was only one patient place for every 838 inhabitants in Finland, whereas the ratios in Sweden and Norway were 1 to 356 and 1 to 260. (Kaarninen and Kiuasmaa 1988.)

The committee suggested that federations of municipalities should join forces and establish hospital districts to allow them to run larger hospitals in the regions. Besides, 30 to 60% of the costs of building and running these new hospitals should be covered by the state. In addition, the committee put forward the idea of dividing the country into several hospital districts, in which the municipalities could benefit from each other. In their opinion, the proposed actions should be fully implemented within the next fifteen years. Even though the committee's report was widely supported, it was rejected by the doctors' association from the state-run general hospitals. According to Kaarninen and Kiuasmaa (1988), this also explained why the report had only marginal effect on immediate legal actions. Consequently, it is not really surprising that the medical staff of the state-run hospitals resisted the building of new hospitals, because they feared the loss of their highly valued status. As elsewhere, this phenomenon occurred in Finland several times, for example, when the university network was created in the 1960s. (Saarivirta 2003.) Professions tend to defend themselves and keep the number of specific professionals small in order to gain more status, money, etc.

The seed for developing the hospital system had, however, been planted, and another committee was set up in 1933 to see how central hospitals and faculties of medicine operated in different countries and how the governance of the hospitals was divided between the state and the municipalities. The examples were taken from Sweden, Germany and Latvia. Before the report of the 1933 committee was published, the National Board of Medicine had already suggested that the state-owned general hospitals should be enlarged to become central hospitals, where all special medical fields should be covered. (Pesonen 1980; Kaarninen and Kiuasmaa 1988; Joutsivuo and Laakso 2008.)

Altogether, the year 1933 was epoch-making with regard to the future hospital network. Especially remarkable in that period was the growing role of the municipalities. As mentioned before, in the early 1900s government initiatives were often supplemented by the municipalities, certainly with respect to the building of new hospitals for the treatment of people suffering from tuberculosis and mental problems. In the 1930s, however, the municipalities increasingly made the first move, as Pesonen has shown, for instance, on the basis of the discussions about the future of the state-owned province hospital in Turku. (Pesonen 1980.) The hospital was suffering from old facilities and desperately in need of refurbishment, but since the government was not willing to invest in it, the municipalities belonging to the province of Turku made an offer to share the refurbishment costs as well as the operation costs of the hospital afterwards. The Finnish parliament accepted the offer and this action can be seen as the starting-point for the characteristic role of the municipalities in health care in Finland, in comparison to the other Nordic countries.

The ideas presented by the early 1930s committees started to be introduced step by step and the National Board of Medicine too gradually adopted the view that the current state-owned provincial hospitals should be altered to more focus central hospitals where specialised treatment could be concentrated. The Second World War, however, delayed the plans for the individual central hospital projects for a while. On the other hand, according to Kaarninen and Kiuasmaa (1988), the war, terrible as it was, actually boosted the overall development of the central hospital system: during the war against the Soviet Union the need for special health care (i.e. taking care of serious war injuries) increased hugely, and speeded up the planning process of the central hospitals. In 1941, the National Board of Medicine submitted a proposal to the government to establish central hospitals. The law was passed by parliament in 1943 and it obliged the municipalities to share the costs caused by the establishment of central hospitals to the tune of 50%, even though the hospitals were still owned by the government. The 1943 law had to be renewed in 1948, however, because of the changed policy with regard to the treatment of epidemics. (Joutsivuo and Laakso 2008.) Whereas previously the treatment of patients suffering from epidemic diseases was taken care of by the municipalities (and usually quite badly organised), after the war it became one of many responsibilities of the new central hospitals and special wards for the treatment of epidemics had to be built (Pesonen 1980).

After the introduction of the law on central hospitals, the country was divided into 20 hospital districts with a central hospital in the middle of each. This allocation exists even today. The building of the hospitals took place mainly in the 1950s and 1960s, starting with the regions where the hospital situation was most deficient. In practice, this meant the regions in the eastern part of Finland.

The first central hospital was completed in 1953 in North Karelia (Joensuu) and the second one in 1954 in Jyväskylä. In line with the aforementioned increasing role of the municipalities the whole system of central hospitals was transferred in 1957 to the rule and ownership of the municipalities, and in 1965 all the other state hospitals were subjected to the same measure. (Joutsivuo and Laakso 2008; Pesonen 1980; Kaarninen and Kiuasmaa 1988.)

In the hospital districts where there was a university, the central hospitals were called university hospitals. Indeed, Turku received a university of its own again in 1920, but it was not until 1943 that a faculty of medicine completed the new institution. Therefore, immediately after the war, only Helsinki and Turku had a medical faculty and a hospital connected to it. Both hospitals, the state-owned general hospital in Helsinki and the state-owned province hospital in Turku, were thus changed into central/university hospitals at the beginning of the 1950s. In the same period the country's university network started to expand, from the previous domination of Southern Finland to different parts of the country: universities were established in Oulu (the northern part of the country), Kuopio, Joensuu, Lappeenranta (all in the eastern part), Vaasa (the western part) and Tampere (the middle part of the country). (Saarivirta 2003.) The last university to be established in Finland was the University of Lapland (in 1979, in the northern part of the country). Two years after the establishment of the University of Oulu, it received its medical faculty and later two of the other new universities were gradually completed with a faculty of medicine. One of the intentions behind these new foundations was clearly to meet the still prevailing lack of physicians.

For similar reasons the government started to subsidise studying abroad for the degree of medical doctor at a foreign institution. According to Seppälä (2003), however, all these interventions failed to fulfil the demand for medical doctors. A government committee in the 1960s (led by the head of the National Board of Medicine, Niilo Pesonen) calculated that the country would need approximately 11.000 medical doctors by 1990. A few members of the committee (including Pesonen himself), however, suggested that the need for MDs would be as high as 14.000. The actual number of medical doctors in 1990 was 14.325, proving that the committee's official calculation was clearly an underestimate (Lääkäriliitto 2008). On the other hand, it could be the case that the numbers presented in the 1960s have actually guided the educational plans with regard to the number of students admitted to study medicine at the universities during the following years. Indeed, the number of medical students was controlled by the government, which was in this respect often in conflict with the powerful association of medical doctors. This professional body has always resisted the expansion of the number of MDs.

Complaints about the lack of physicians were continuous and even persisted after the 1950s when the number of physicians increased spectacularly in answer to the increased demand owing to the creation of the central hospital system. The provision of healthcare services and the training of medical professionals evolved hand-in-hand in response to changing demands. The 1960s special committee suggested that the universities of Helsinki and Turku should produce more graduates in medicine in order to eliminate the new imbalance between demand and supply. Both universities acted upon the committee's advice, which resulted in a duplication of the number of medical students in just a few years (Seppälä 2003). Nowadays, the ratio of doctors of medicine to the population is 1 to 300.

Table 3. The number of doctors of medicine compared with the population between 1900 and 2008 (Pesonen 1980, p. 668; Lääkäriliitto 2008).

Year	MDs	population per MDs	10 000 inhabitants for every MD
1900	373	7120	1.4
1910	523	5628	1.8
1920	657	4791	2.1
1930	1000	3463	2.9
1940	1379	2680	3.7
1950	1997	2018	4.9
1960	2827	1573	6.4
1970	4798	958	10.4
1980	9016	531	18.8
2008	17609	301	33.2

Thanks to the suggestions and calculations made by Pesonen's 1960s committee, it became evident that the government was willing to establish a new faculty of medicine.

The two main competitors were the universities of Kuopio and Tampere. In the end, both of them received a faculty of medicine in the 1970s. Seppälä (2003) has argued that the University of Kuopio was the stronger candidate in fact, and that the university authorities in Tampere owed their medical faculty only to their excellent lobbying. Owing to the financial crisis of the early 1990s, Tampere's faculty threatened to shut down to save on the overall costs of education. Again, good lobbying prevented this happening.

Nowadays, medical doctors are trained at five faculties of medicine (in Helsinki, Turku, Oulu, Tampere and Kuopio) and, the costs of the training are covered by the state. The central hospitals in these districts are therefore called university hospitals. Today's policy holds that medical doctors are needed even more because many regions are still suffering from a certain lack. Medical doctors are still concentrated in the south of Finland and the profession has started to be strongly 'womanised': more than 50% of the MDs are women (Lääkäriliitto 2008). It has been suggested that, owing to the domination of women, the work ethos among MDs has differentiated recently, and that an increase in the number of MDs would not automatically lead to the disappearance of the demand (Lehto 2008). Female medical doctors tend to have maternity leave and in addition many MDs have started to appreciate free time more often. For instance, the orientation of medical doctors has shifted towards greener pastures which require fewer emergency duties. By and large the health-care system in Finland is expected to expand further in the foreseeable future due to aging population which will entail prospectively higher demand for health services. To be sure financial boundaries may be a significant hurdle likely to be decided by the political realm.

Another important remark concerns the growing role of university hospitals as foci of novelty for both clinical research and best practice. As the illustrative example of breast cancer research will show university hospitals have become central hubs in the emerging mode of medical knowledge production. This phenomenon has already been observed in disease areas as different as interventional ophthalmology (Metcalf et al, 2005), interventional cardiology (Mina et al 2007) as well as in clinical ophthalmology (Consoli and Ramlogan, 2011). Experts interviewees (Lehto 2008; Visakorpi 2008; Kontula 2008) further confirm that best practises originated in university hospitals diffuse rapidly to other component parts of Health Innovation Systems by bringing up to date the skill base of both medical students and senior medical practitioners.

Health Innovation Systems and the emergent patterns of knowledge: breast cancer in Finland

Consoli and Mina (2009) propose the Health Innovation Systems (HIS) framework to articulate the intertwining of technical, institutional and organizational gradients in the evolution of medical practice. Such systems are dynamic constructs comprising of gateways, that is, constellations of component organizations engaging health-related activities, and pathways, that is, mechanisms aimed at the coordination of the ecologies of competences across five dimensions⁸: (i) the body of knowledge that makes up scientific understanding of disease; (ii) the set of clinical practices that shape the provision of diagnostic and therapeutic services; (iii) the constellation of design and production activities underpinning the supply of medical instruments; (iv) the regulation of health activities to ensure quality criteria; (v) the instituted channels for assessing the effectiveness of patient care, and for receiving and processing the feedback stemming from the front-end.

Throughout their continuing evolution Health Innovation Systems encapsulate different configurations in the division of labour across universities, research laboratories, hospitals and other organizational types. The following paragraph sets out to show the patterns of the volumes of the publications in the realm of breast cancer. The diagram in Figure 2 shows the percentage contribution of various types of organisation to medical research on breast cancer between 1987 and 2008 (Source: ISI Web of Science).⁹ To provide the context, this period coincides with an important regime transition in cancer management from being a surgically dominated practice to include a whole variety of alternatives, namely combined use of chemotherapy and radiotherapy. Tellingly in this period the term 'cancer' is no longer used to refer to a single disease, as it was frequently the case until the late 1970s, and instead becomes an umbrella term under which more than a hundred different types of disease fall.

⁸This conceptual outline can be expanded to include more components as well as finer specifications of the existing ones; however we think that the above is inclusive enough for our purpose.

⁹ Our current work in progress articulates further the pathways of medical problem-solving, namely: the systems for skill formation for cancer specialists; the loci of scientific collaboration wherein new clinical practice and new medical understanding are nurtured; and, the technological complex that emerges both as a response or as a stimulus to shifting perceptions of disease. None of these taken in isolation would suffice to account for the long-term evolution of the discipline.

Accordingly, the period is one in which differentiated methods of understanding and treating cancer emerge (Weinberg 1999).

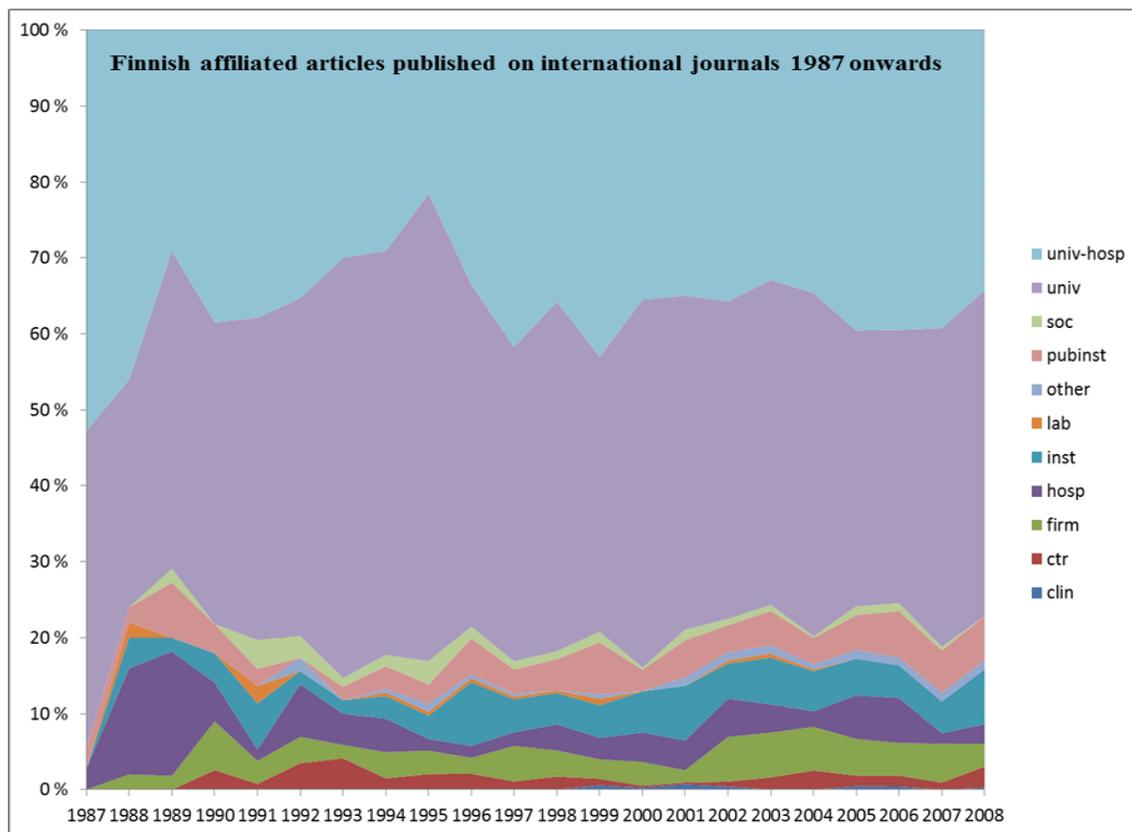


Fig 2. Percentage of research articles on breast cancer by type of affiliation¹⁰, 1987-2008. Source: ISI web of knowledge.

Fig. 2 shows that throughout the period a large majority of research, as captured by international scientific publications, originate within either universities or university hospitals. In the late 1980s and early 1990s however we observe the consolidation of a percentage of ‘other’ organisational types contributing up to 30% of the overall research. Besides a decline in the early 1990s most likely related to the economic recession that hit Finland’s economy as well as the research capacity we observe the progressively steady role played by public organisations, firms and specialised research laboratories. Overall this offers a hint at the increasing diversification in the patterns of division of scientific labour in this area of medical specialty, and a clear indication of how the patterns and sources of knowledge production have changed. An important remark is that the dynamics observed in Breast Cancer offer a heuristic representation of a broader class of disease areas where bridges have been built to unite formerly separated domains of clinical practice and scientific research.

The current structure of the Finnish healthcare system and the main milestones

The Finnish healthcare system can be described as modern and well-performing compared to other countries. The system is based on the responsibility of the municipalities, which provide primary and specialist health care, supported by the government, employers and taxpayers. They are also responsible for other social services such as nursing homes, child day care, social assistance, basic education and services for the elderly (Häkkinen 2005). Altogether, Finland spends 8.2% of its GDP on health care, 76% on the public sector and 24% on the private sector (OECD Health Data 2008). The country is divided into 20 hospital districts and every municipality has to be a member of such a district. Each district is responsible for providing hospital services and coordinating the specialised public hospital care within its area.

¹⁰ Type of the affiliation: univ = universities, univ-hosp = university hospitals, pubinst = public non specialist organisations (e.g. National Institute of Health), ctr = Specialised Health Centres (mostly research, mostly private), clin = clinics, inst = research institutes (mostly research, mostly public), firm = firms, soc = non profit organisations, lab = specialised laboratories

The most challenging specialist health care is being provided in five university hospitals. The next level consists of non-university central hospitals which are smaller than university hospitals and which do not offer university education, even though medical doctors can opt to obtain their practical training for the specialist medical doctor degree at the central hospitals. The third level of hospitals is formed by district hospitals which are again somewhat smaller than non-university central hospitals. Even in the district hospitals, however, challenging treatments are often taken care of. The fourth level of hospitals is the health centers which provide primary health care. Originally, the health centers were built on the basis of the 1960s NHI (National Health Insurance) scheme and the Primary Health Care Act of 1972 which were supposed to balance the unequal distribution of health care in the country.¹¹ In the 1960s, the rural areas especially were in need of health care. The network of health centers was built in the 1970s to meet the demand. (Lehto 2008; Häkkinen 2005; Harjula 2007; Kunnat 2008; Järvelin 2002.) The structure of the health care system in Finland is presented in Figure 3.

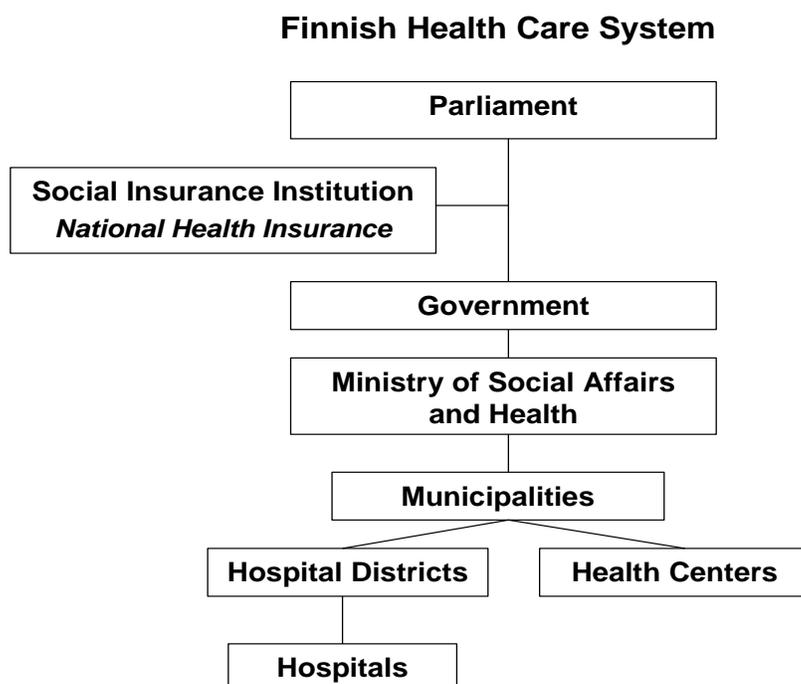


Fig. 3. Finnish health care system (Järvelin 2002; Häkkinen 2005).

According to Häkkinen (2005), by the late 1970s the basic elements of the Finnish healthcare system had been developed. The next decades were a period of rationalisation and management of the system. The 1990 Hospital Act brought all municipal hospitals under the ownership and management of the hospital districts. As mentioned earlier, the government had already given a lot of freedom to the municipalities in terms of organising health care in their region. In addition to this, when the economic recession hit Finland heavily in the early 1990s, even more freedom was given to the municipalities. Häkkinen (2005) argues that one of the most important reforms the Finnish healthcare system has faced in the last decade was the change in the state subsidy system. In the old system, state subsidies to municipalities had been earmarked and related to real costs. Under the new system, however, state subsidies are no longer earmarked but lump sums that are founded on a need-based capitation formula are calculated prospectively.

¹¹ The Primary Health Care Act was originally a national planning system that obliged municipalities to provide primary health care including public health services as well as family planning in health centers. Before the 1972 act, the system was fragmented (Järvelin 2002); NHI (National Health Insurance) covers all its members (residents of Finland) for sickness allowances, maternity allowances, special care allowances, student health services, rehabilitation services, and medical expenses (drugs prescribed by a doctor, private sector examinations and treatments, etc). Usually NHI pays 50 to 70% of the expenses of medical treatment up to a fixed sum depending on the treatment (drugs, private medical doctors, dentists). NHI is funded by taxes.

The aim of this reform was to reduce central government control, and to increase local freedom in providing services. Despite the past history, the current trend seems to be moving again slightly towards more government guided control. An example of this is the guarantee that any citizen will receive medical treatment within a reasonable time (Sosiaali- ja terveystietomus 2006). This *hoitotakuu*, which is imposed by the government on the municipalities, implies that, for instance, the municipalities cannot keep patients waiting forever to have a heart or knee operation. Every municipal is a part of a hospital district formed together with the municipals close to each other. Within the hospital district, the costs of the central and university hospitals are shared with the financial support from the state. The first step for a patient seeking health assistance is referring to the local health-center. If no appropriate treatment can be offered the patient will be referred to either to the central hospital or to the university hospital for specialised treatment. The same route will be followed in the private sector. However, one can enter to the university hospital or central hospital as a patient immediately through the university or central hospital own emergency clinic. (Lehto 2008.)

With no doubt, the municipal organisation of health care and the state level guidance (*hoitotakuu*) puts tension between these two. Municipals struggle with economical constrains within their hospitals, that are run by the taxpayers money, namely the money from the citizens living in the municipal. Therefore municipals have autonomy in organising their health care, but the municipals are obligated to follow the law by the state to provide health care for the citizens. However, due to the economical battles, especially the small municipals are suffering from, health care is often organised together with the other municipals. This is because of the small municipals tend to loose citizens to the bigger cities, and therefore municipals money from the taxpayers reduces, and this is why organising municipal's own health care (not the one included in the hospital district) independently is nowadays a huge challenge. (Saarivirta & Consoli 2007.)

The main milestones in the development of the Finnish healthcare system in the second half of the twentieth century can be summarised as follows (Järvelin 2002):

- 1940s: the establishment of maternal child care measures to treat and prevent tuberculosis (tuberculosis districts);
- 1950s: the development of the hospital system;
- 1960s: the introduction of the National Health Insurance scheme;
- 1970s: a large increase in the number of medical doctors (which had started in the 1960s), the promulgation of the Primary Health Care Act, the establishment of health centres. In this decade the national health planning system was introduced and also occupational health care was developed;
- 1980s: health care and social services were incorporated into the same national planning and financing system. Through a number of campaigns the population was urged to pay more attention to their personal health and in the same period the 'personal doctor' system was created. Towards the end of the decade the deregulation and decentralisation of the system was about to start;
- 1990s the deregulation process was continued and the emphasis was put increasingly on municipal autonomy, reforms were introduced with regard to the subsidy system.

It is worth reflecting briefly on these developments in relation to the above-mentioned remarks on the growth of knowledge and the professionalization of medicine. More precisely, we ask ourselves: what is the function of university hospitals (UH) in a health system? As many have pointed out before us, this type of organisation emerged first in the United States as a response to the need to facilitate interdisciplinary research (E.g. Rosenberg 2009; Gelijns and Zivin and Nelson 2001; Consoli and Mina 2009). The environment of a university hospital offers great opportunities for joint research between medical professionals in different fields (e.g. radiologists and oncologists), as well as clinicians and other scientists whose knowledge is relevant to medicine (e.g. molecular genetics, biochemistry, etc.). Another function of university hospitals is that of facilitating the integration of patient care and medical training. This connection is crucial in relation to the broader issue of how the design of health care adapts to the pressure exerted by new scientific and clinical discoveries. Learning within practice insures the diffusion and transmission of professional routines that are tailored to the tasks and the needs at hand. As Rosenberg (2009) remarks, however, appropriate conditions need to be in place for this to happen effectively: the creation of university hospitals requires lower barriers across scientific disciplines as well as the creation of what Nelson and Sampat (2001) call 'social technologies', meaning professional bodies supplying the managerial skills that become necessary as the practice of health care is applied to new demands.

There is a final dimension that is worth spelling out, and concerns the paradox of innovation in healthcare. Innovations are usually understood as either enabling new or enhancing existing solutions. Their efficacy is judged on the basis of the ability to provide solutions that were not formerly available. This implies that shortly after their appearance medical innovations stimulate higher demand for health services which likely leads to increased expenditure. A related matter is that increased life expectancy brings about other problems, especially the spectrum of expectations and solutions associated with aging populations. Therefore, from a purely static perspective, medical innovations are incompatible with the ethos of 'cost containment', at least in the short term. The historical perspective proposed in this paper, however, illustrates that the advance of medical know-how cannot be reduced to individual scientific breakthroughs but rather has to be framed within a wider appreciation of the myriad of incremental improvements in the organisation of healthcare supply. The story of university hospitals is therefore a testimony to the importance of viewing medical innovation as a dynamic process, one that informs policies aimed at fostering open systems of innovation, that is, systems that are capable of sustaining and coordinating a rich and necessarily unpredictable set of experiments. (Consoli, McMeekin, Metcalfe, Mina and Ramlogan 2009.)

Conclusion

One of the most decisive steps in the transition from pre-modern to modern medicine was the finding of the bacterium as a cause of infection around the middle of the nineteenth century. Gradually, large medico-philosophical systems according to which vital functions were explained by fixed physico-chemical processes in the solid and fluid parts of the body were replaced by treatment methods based on extensive medical examination. Until the 1850s it was very common for diseases to be treated without their cause being known. Increasingly, however, the idea of 'miasma' was left behind and plain and simple hygiene, for example, resulted in a remarkable slowdown in the death rates of babies. Another major innovation in modern medicine was the development of antibiotics in the 1930s. With antibiotics/penicillin, diseases caused by a bacterium could be treated.

The evolution of the Finnish healthcare system kept pace with the aforementioned transition to modern medicine. Its beginning can be traced back to the early nineteenth century when it was realised that the death rates in Finland, certainly these of small babies, were much higher than in neighbouring countries. The solution consisted, among other measures, in an increase of midwives and the obligation for all medical practitioners to be registered at the *Collegium Medicum* to facilitate supervision. These were the first systematically coordinated measures that launched a new era of Finnish health care.

Starting from the 1820s, this kind of measure was supplemented by an integration of practical training in hospital for future physicians and, partly as a result of this, a gradual increase in the number of hospitals took place. In 1820, there were only eleven hospitals in the country, but a century later the number had increased to 236. In 2006, Finland had 110 hospitals, of which 50 can be considered as private (Kunnat 2009). A specific characteristic of the Finnish system is that the public hospitals are run by the municipalities. Also, these hospitals, which were previously owned by the government, belong these days to the municipalities, which collaborate in hospital districts. One of the reasons behind this is that the municipalities have been active in hospital issues since the early twentieth century. There has always been a need for people to be treated locally.

Owing to the fact that the central government and the municipalities were sometimes acting apart from each other, a fragmented hospital system was built up, and it took until the 1930s for a consensus to be reached about building up a network of central hospitals which focused on specialist treatment and were spread equally across the country. The Second World War delayed the plans for a while, but, as mentioned earlier, it also boosted the plans to organise specialised medical treatment because of the increased need owing to wartime casualties. Eventually, the establishment of central hospitals took place mainly in the 1950s and 1960s. The models were drawn from the other Nordic countries and from Germany. (Kaarninen and Kiuasmaa 1988; Lehto 2008; Visakorpi 2008.)

The most important reason for building up the hospitals was the increased awareness of the state of affairs in Finland's neighbouring countries. It was realised that more hospitals were needed to reach healthcare standards comparable to those of other countries. This also meant that more medical doctors were wanted. Until the 1950s, they were trained only at the universities of Helsinki and Turku but, in line with the expansion of the university network between 1950 and 1980, the training of medical doctors was now spread across the country.

New medical faculties with their own university hospitals were established in Oulu, Tampere and Kuopio. Nowadays, university hospitals are highly valued and the most challenging treatment is concentrated on them. University hospitals are divided between five territorial districts and they carry out the most advanced treatments in their territories.

The modes of the development of medical knowledge and the practise in health care go hand in hand over time. New medical knowledge change practices, but the observations made in practise change, are also driving forces for new medical knowledge. One of the examples mentioned in this paper was the establishment of the link between hygiene and infections which changed completely the existing spectrum of medical practices. Medicine needs both scientific knowledge and clinical routines. When a new treatment or a drug is introduced its effectiveness has to be assessed against a set of widely accepted criteria. The accepted gospel is that these should be built against clinical evidence. The balance between health care demand and capacity growth is never in equilibrium but in constant flow. One could say that the demand for health is constantly one step ahead of the system's capacity to satisfy it, the reason being that availability of more effective diagnostic and therapeutic avenues affords improved lifestyles and longer living. Organisational changes are an important part in the response that health managers and policy makers give to this demand-supply reinforcement path. Systemic innovations of the kind mentioned above provide an important contribution: in many systems everything needed is within the system, but organising the pieces in the existing system in a new way may lead to a better system.

To conclude, the evolution of professions and organisations seems driven primarily by the need to co-ordinate specialised activities by means of standardised routines (Langlois and Savage 2001). In the area of medicine these are developed through lengthy processes of training and apprenticeship. At the same time, such routines are shared among individual practitioners and other staff with similar or complementary tasks and skills, such as clinical staff or health managers. It follows that the application of medical knowledge implies the creation of practical skills to manage and co-ordinate those standardised routines in an open-ended fashion. The broader point is that the growth of knowledge triggers trajectories that involve on the one hand the diversification of competences that are relevant and on the other hand the creation of institutional mechanisms for their governance (Gelijns and Zivin and Nelson 2001; Consoli and Mina 2009). Physical and social technologies co-evolve, since they both are triggers for new modes of organising and using medical knowledge. On one hand physical technologies can provide new ways for treating people in a way that was not possible before, when the crucial technology was missing. On the other hand the need for treating people, like in the face of a persistent disease, is in itself a catalyst for exploring and developing new technology.

Acknowledgements – the authors wish to thank the Academy of Finland, Otto A. Malmi Foundation and the European Commission (FP7-PEOPLE-IEF-2008-235278) for financial support. The authors also wish to thank Juhani Lehto and Jussi Mikkelsen for valuable discussions.

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