The Cybernetic Hospitals Revolution in the Age of Artificial Intelligence

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Abstract

AI can lead to better care outcomes and improve the productivity and efficiency of care delivery. It can also improve the day-to-day life of healthcare practitioners, letting them spend more time looking after patients and in so doing, raise staff morale and improve retention. It can even get life-saving treatments to market faster. At the same time, questions have been raised about the impact AI could have on patients, practitioners, and health systems, and about its potential risks; there are ethical debates around how AI and the data that underpins it should be used. This short article aims to contribute to the debate surrounding AI in Hospitals, specifically looking at how practitioners and organizations will be affected.

INTRODUCTION

Today the cybernetical revolution influence strongly the field of medicine. The issue is not new, the first publications appeared in 1951 by Neurologists Dr. Flettcher *(Flettcher K.H. Matter with a mind; a neurological research robot. Research. 1951 Jul;4(7):305-7.)* followed by Anastesiologist Dr. Harward in 1952 *(Harward L.R. The robot anesthetist; an introduction to the automatic control of anesthesia using an electro-encephalographic intermediary. Med World. 1952 Aug 8;76 (23):624-6.)*. A Pubmed literature review with the search terms „Artificial Intelligence" (AI) shows 100987 results. In comparison a google search review shows 629000000 results, hence the medical scientific world does not present itself as ultra-modern. The time of change came, accelerated with the pandemic crisis, which pushed all of us into the Virtual World. All areas of medicine will evolve very quickly. In our development, we are somewhere between Medical Art and sophisticated mathematical big data multivariable probabilities calculus. Healthcare financials have many complex financial aspects influenced by political systems, religion, and social development. Local development status influences the number of financial resources invested and influencing the effectiveness of their application. By a fast-growing population, it would be very difficult to include everyone in the global healthcare system. The central healthcare financing, using only the economic processing, leads to the grey zone of ethics. For example the DRG systems shows exploding counts of special well paid procedures with narrow specialization with leading examples of last year's growing counts of spine surgeries or oncological therapies. At the same time, we have growing number of patients who are searching for
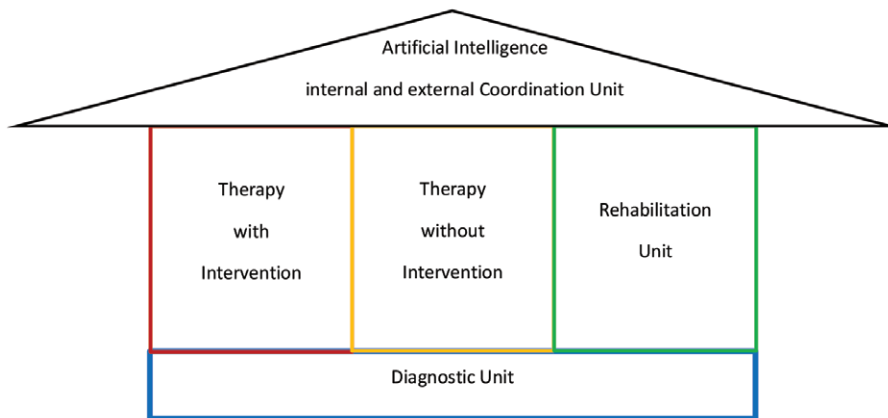
help but the system is not stimulation the institutions and the medical staff to put some more attention on this group of patients with low paid DRG diagnosis. On the other hand, using the pure hospital completion as a model for healthcare we are moving into the revenue-oriented system. This leads to a lot of deviations, which are already observed by therapies which do not improving the health, but could be calculated by the DRG system. Healthcare today is very complex and its importance will grow for the population in the future. Long-term improvement will be achieved using some new AI technologies. Before that, we should start with the medical education where ethical behaviour and emotional intelligence should be a big part of the recruitment process of medical students. Collective intelligence should be used to develop trends and make complex decisions. The big data analysis will be in the future to build the background of each political decision, healthcare included. Artificial intelligence will be indispensable, especially in areas of clashing group interests and potential conflict situations. The developments in AI will increase productivity and efficiency of care, allow the practitioners and nurses to spend more time in direct care by patients. In consequence, it will introduce faster delivery of help and accelerating diagnostic time and optimize to allocating resources. Let's analyze several interesting points like hospital structure, management, logistics, and employees.

Expected changes in hospital structure

Our considerations of the future hospitals and their permanent structures are evolving with time. Two trends will influence its cultural. First work-life balance and secondly the general trend to eradicate the feudal relations. This process will accelerate especially now after the pandemic situation which was pushing us strongly into virtual reality. The future brings hospitals with more flexibly (Fig.1.) and focuses on efficiency according to resources (personal, equipment, and infrastructure). The huge influence will come through the machine learning (ML) and Big Data analysis – which already exists. The physical division into specialist departments will not be necessary. The beds will be flexible. Every single place will be able to change its belonging or function according to the temporary needs of patients. The gold era of coordinators will come. How it should be functioning? Some colleagues think that the coordination will in the future not come from personal human interactions. Why? Everybody who worked in the hospital knows that we have to deal with the "human nature" which supposes to be flexible, gentle, and solution-oriented. This is the ideal imagination but mostly it is confronted with conflict of interests and daily competition for resources. The situation produces stress by both sides the coordinator himself and of course the therapeutic teams who have to deal with the suffering patient.

The Surgisphere Corporation in Chicago, USA records and analyses all patient's admission in several hospitals thought out the USA. The data are clustered with the machine-learning program. First results showing prediction of involved resources including the specialty, councils, need of diagnostics, OR, ICU, and length of stay. Alone this simple information allows simplifying hospital coordination and optimizing the use resources. The transparency presented by Time Table Tools (already existing in progressive emergency rooms) allows us to decrease the stress within the small units responsible for the patient tasks. The communication and workflow is integrated into Smartphones or Tablets. In the future, the patient will receive individual personal sensors which follow continuously the vital parameters and localization of the patient (technically several
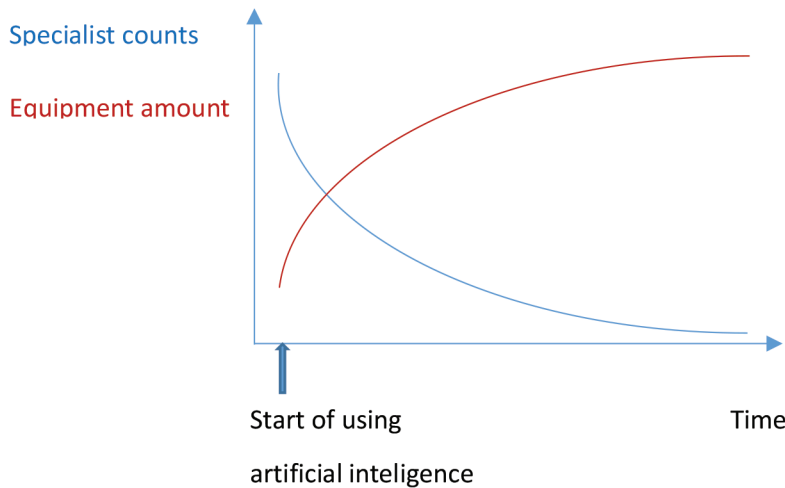
Figure 2. Development of the amount of equipment and specialist in healthcare

systems already existing). The whole process will be controlled similar to the industrial processing of Air Trafic Control by the software and human coordinators/ controllers. Each Hospital Unit will receive one or more coordinators/ controllers. With this industrialised workflow the hospital of the future will be more efficient, faster and saver.

MANAGEMENT AND LOGISTICS

In the age of ground income considerations, the idea to stop thinking about the Hospital system like the average business is important. Why? First, from the economical point of view, we are dealing with country healthcare budgets collected directly or separated from taxpayer money, hence the Healthcare systems are always funded form public money. Competition and industrialization in the healthcare sector will have one result - continuous growth of costs and growing counts of patients and overtreatment. Paying for performance or a flat rate per case showed not to be the best option to finance the healthcare system. By using machine learning and AI three major developments will arise: Standardization of bed counts per 100000 residents, Hospital profiles optimization and change of employment structures. All these changes will be a direct consequence of the analysis of already existing data by artificial intelligence followed by rationalization and use of robots, engines, or software. All parts of the hospital's systems will change from staff, through supply to infrastructure. Two aspects will completely surprise us: first management change which will be reduced and replaced by artificial intelligence, and its sustainable human part completely politicized, second logistics and contracting will be based on AI analysis of appearing medical innovations on the market and hospital waste.

EVOLUTION BY HOSPITAL STAFF

The hospital employment change is already here. Currently, there is a growth in the IT area, as well as in the technical supporting staff. This shows a present evidence of the technological progress in medicine. Analysing the cybernetic progress these changes will influence all hospital employees. We already mentioned management programs. Furthermore the development of Natural Language Processing (NLP) will have a big impact by recognizing the emotional state of a person who is undergoing its analysis. The first known software of this kind was the "Cogito". Nowadays, its variations are used regularly in companies to identify customers interested in buying products. The application of this system to health care will lead to standardization of communication and reduction of employment in call centres and emergency wards of hospitals. Another example is Amelia a cognitive virtual agent platform from IPSoft, demonstrates learning abilities and elements of emotional intelligence. It can perform autonomic task management using conversational AI and manage some operational and administrative hospital processes. Amelia can play the role of a care protocol "whisper agent" (e.g., reminding practitioners of steps that need to be followed), as well as a care operations agent, helping document a patient visit, admitting patients, retrieving medical history prior to a conversation, checking availability of hospital beds, retrieving lab results and scheduling specialist appointments. The Amelia Health agents, enabled by AI technology, learn continuously with every completed task and can communicate through voice, mobile, web, and chat. The program needs some adaptations but will shortly allow almost everyone to have cyber office management. We observe the development of cleaning or transport robots, these

developments will lead to employee reduction in hospitals. Furthermore, there are Robots that distributes medication or food to patients on a normal ward. This will lead, to the reduction of nursing staff. There will be no exceptions with doctors. There will be five steps of the employment amendments by medical specializations (Fig. 2.). First, there will be a reduction in all specializations that are dealing with static images. There are programs like DeepMind (a UK-based AI company owned by Google) which can describe the radiologic diagnosis and is even better than a human specialist. The same will happen in pathology and dermatology. The next step will appear by all specializations which are dealing with medical algorithms based on reproducible standardized examinations like cardiology, diabetology, oncology, neurology, endocrinology, etc. The alteration will not come from the medical societies but more likely from the internet itself. Insurance companies will prefer AI-based diagnostic for its efficiency and lower costs. With autonomic mobility in the rise, autonomic invasive diagnostic and treatement will become the standard tool. The modifications will allow us to perform robotic punctions, endoscopic robotic intraluminal treatments, robotic tooth treatment and further more. The fourth steep will be a combination of technological tracking accuracy and operational safety. We do not know if operations will be obsolete in 30 years. Maybe biologic, nano- and picotechnology will solve the problem. The last step will be psychiatry. Here the molecular biology will allow us to transfer the mind in an artificial environment.

CONCLUSION

Healthcare is one of the major success stories of our times. Medical science has improved rapidly, raising life expectancy around the world, but as longevity increases, healthcare systems face growing demand for their services, rising costs and a workforce that is struggling to meet the needs of its patients. Demand is driven by a combination of unstoppable forces: population aging, changing patient expectations, a shift in lifestyle choices, and the never-ending cycle of innovation being but a few. Of these, the implications from an aging population stand out. By 2050, one in four people in Europe and North America will be over the age of 65—this means the health systems will have to deal with more patients with complex needs. Managing such patients is expensive and requires systems to shift from an episodic care-based philosophy to one that is much more proactive and focused on long-term care management. Building on automation, artificial intelligence has the potential to revolutionize healthcare and help address some of the challenges set out above.