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Digital and Artificial Intelligence in Hospital Activities

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Abstract: ***Beyond reflections works and books produced on the subject of intelligence systems Artificial (AI), there is little practical data on their contributions in the context of hospital activities, in this case in Morocco. The objective of this article is to provide empirical elements concerning the benefits, the risks and the transformations that can be caused by AI in professional situations from the point of view of hospital actors. This exploratory study is based on a qualitative survey combining 10 semi - structured interviews and open observations carried out during conference - debates and workshops on AI. If the first results show that the majority point of view of the participants is to consider AI as a support tool for health professionals, they also highlight a gap between the AI functionalities offered on the market or imagined by designers and their real needs. They also voice a number of fears that echo the well - studied issues in ergonomics regarding automation. These results invite us to reflect on the way in which the ergonomic approach can address these questions concerning the place of AI in the field of health.***

Keywords: digital, artificial intelligence, hospital activities, medical actors, scoping study

1. Introduction

Hospital technological advances in recent years, such as the rise of predictive health models, and the availability of massive medical data (Big Data), combined with deep learning, have enabled artificial intelligence (AI) to make progress considerable in certain areas such as prevention, diagnosis, treatment and patient follow - up. Research has led to the emergence of "new" AI systems based on different machine learning techniques. The announced distribution of these systems in hospital structures raises many questions and issues concerning their consequences (positive or negative) on hospital activities. A whole series of reflections and works that attempt to anticipate and define these consequences have therefore been produced. Although it contributes to reflections, this literature has the disadvantage of being essentially speculative in the sense that it relies little on empirical data, from the point of view of the actors concerned (medical staff, hospital decision - makers, etc.). The objective of the exploratory study1 presented here is precisely to fill this gap by providing empirical elements concerning the contributions and potential risks of AI in the health sector, according to the judgment of the respondents.

2. Literature Review

AI can be defined as "a set of algorithms, machines and more broadly technologies in different forms (software, robotics, etc.) which are inspired by or which aim to imitate human cognitive faculties such as perception, natural language production and understanding, knowledge representation, or even reasoning" (Gamkrelidze, Zouinar & Barcellini, in press). As far as the hospital sector is concerned, the rise of artificial intelligence (AI) is currently leading to a reduction in the cost of clinical research as a whole. The new big data technologies exploit a large quantity of analysable health data from various sources (results of medical examinations, connected objects worn on the person, forums on the Internet.

Moreover, the current development of AI has generated a substantial body of thought and debate on how it could affect clinical research. In summary, these reflections revolve around four themes.

A first theme, echoing artificial intelligence and its application in hospitals. It is in this context that expert systems for decision support, or even diagnosis, which integrate AI find their place. In the context of chronic or complex pathologies such as cancers, we thus have new means enabling us to adapt and personalize treatments according to extremely precise factors specific to each patient.

AI originates in machine learning, a series of operations to perform statistical learning automatically. The tools using it all go through a learning phase which then allows them to recognize and detect hidden links between images, sounds, words, etc., which are submitted to them.

Computer AI has existed since the 1940s and 1950s, but its developments were initially quite limited, mainly due to the lack of computing power of processors. It is the rise of new graphics processors that has made it possible to divert the calculations usually carried out by the central processor and ultimately to multiply the possibilities of machine learning processing. Also, the quantities of data generated by the various digital tools available are increasingly important, which generates the current enthusiasm for AI, the applications of which are numerous. F If we are interested in the human body, a large amount of data can indeed be collected. These are those linked to the genotype, phenotype or even the environment, which can now be identified, grouped and used, in prediction models for example. In medicine, when the decision is made to administer one treatment rather than another, the mind is limited to manage several factors at the same time (age, history, constants, etc.) and quickly adapt an optimal treatment in charge. There are, in some cases, simply too much heterogeneous data to take into account to be effective while algorithms can take over. It is in this context that expert systems for decision support, or even diagnosis, which integrate AI find their place. In the

context of chronic or complex pathologies such as cancers,

A second theme therefore relates to health chatbots. They testify to the desire to improve patient support, to strengthen the unique patient - physician consultation and to engage him in clinical research, especially since the recorded responses constitute data that can be used for prospective studies.

The chatbot – an English contraction of “chat” and “robot” – is software that uses tistic learning and aims to simulate a conversation by text or voice message. The design is based on three key functions. It involves understanding the question asked (Natural Language Processing [NLP] step), extracting the interesting variables stated in the sentence (contextualization step), and then providing the most relevant answer to the user. F Chatbots are not new, the first, Eliza, appeared in 1966. It was a small software of 200 lines of code, used in the context of psychotherapy. Its aim was to make the patients talk by asking open - ended questions or by rephrasing those they were asking. Some of them could then chat with him without realizing that he was a robot. Another fairly well - knownchatbot is called Clippy, the famous paper clip integrated into the Microsoft Office software suite which has just celebrated its 20th anniversary. It was located at the bottom right of the window and appeared (too frequently for some) in order to assist the user in carrying out a task in progress.

Now, chatbotsare mainly used in the context of customer support on the web (telephone operators, online stores, etc.). The advantage is then twofold: to quickly deal with basic questions and, consequently, to relieve the operators of part of their work. They can thus devote themselves to more complex questions or requests. Today, there are still some technical limitations to the development of chatbots, related to their fields of action. It's basically restricting their possibilities because they can't carry on a full conversation. To overcome this difficulty, the developers use contextual menus to “script” or “guide” the discussion towards topics known to the chatbot; it's about weak AI.

For a few years, virtual assistants have been part of our environment without us paying attention to them, but their use is exploding thanks to smartphones in particular, with the big digital players like Microsoft with Cortana, Google with Allo or Apple with Siri which are AIs. strong. Since 2015, there are more monthly active users on instant messengers than on social networks. Services like Facebook's Messenger or Whatsapp exceed one billion users when Weechat has 500 million. There is therefore a real interest in using these channels to interest the most people and allow them to access new services.

In the field of health, what would be the contribution or role of a “doctor” chatbot? Could he become a new player in the care pathway? Patients tend to respond differently to their doctors, pharmacists or nurses. Could they express themselves more, even more freely, in front of a neutral interlocutor who would not be a human?

In the context of clinical studies, chatbots show their usefulness in collecting information through questionnaires directly submitted to patients during conversations or through keyword analysis. There is therefore no longer any delay between the moment when the patient notices a side effect, for example, and the moment when he mentions it during a consultation. He is more involved in the trial or the study and the staff (technician, nurse or clinical research associate) can concentrate on other more complex activities. In these cases, chatbots can replace logbooks. This is one of the main advantages they can provide: improving follow - up, a patient's adherence to treatments and securing data collection in real time.

In 2012, 37% of people over 15, or 19 million people, suffered from a chronic disease in France, including 13 million with a limitation in everyday life. There is therefore a need for patient support, particularly at home, to help them manage their disease. A chatbot, accessible at home, can answer their questions (how to take my treatment, how to counter the side effects, how much am I reimbursed, etc.) and, if necessary, redirect them to a doctor who has a interface allowing to supervise the cases which need to be. F In the United Kingdom, Babylone Health is developing a chatbot specializing in the triage of patients arriving in the emergency room in partnership with the National Health Service (NHS). The aim is to gradually replace the local admission system.

In the United States, recommendations written by doctors are used by the startup Health Tap. The principle is simple: when a patient asks a question to the chatbot, it answers it according to a source created by a partner doctor. It is then possible to dialogue with the professional as part of a pre - consultation, carried out remotely.

A third theme concerns the future of clinical research. New technologies make it possible to obtain information that can be analyzed in real time thanks to big data: text mining of the web and forums, meta - analysis of gray literature, etc. Real - life data is a prerequisite for the use of AI in clinical trials or research: it is massive and will become increasingly important. Difficult to manage by a human when the analysis is very fine, they will have to be exploited by the AI.

These data make it possible to specifically identify situations and practices in which the benefit of the drug, for example, is optimal.

Traditionally, to prove the efficacy or safety of a health product, clinical studies rely on randomized controlled trials combined with meta - analyses and systematic reviews. However, these trials are carried out on selected cohorts, which may then not fully represent what is observed in current practice. However, laboratories are increasingly demanding tools to assess the overall effect of their drugs in order to support marketing authorization requests (MA) on a medico - economic side.

The data collected in real life is complementary, collected outside of a randomized trial (the gold standard for decision - makers). They make it possible to evaluate performance rather than efficiency and, therefore, better integrate the environment, the various influences that interfere with health

products and other interventions. These analyzes can then help guide health priorities.

Onco - hematology is, for example, a field in which innovation is quantitatively major (new mechanisms of action, targeted therapies, associations, emergence of data centers to produce personalized treatment algorithms, etc.), d 'where treatment costs escalate. Real - life follow - up meets multiple uses: monitoring of the methods of use of products and prescriptions outside the standards, confirmation of effectiveness and decisions on financing/reimbursement according to the indication or the results.

Another example of collection, the American Society of Clinical Oncology (ASCO) launched in 2010 a big data initiative, CancerLinQ8, with a digital platform linking and analyzing the computerized medical records of voluntary hospitals. The ambition is to create a “rapid and reactive learning system” (rapid learning system) which analyzes in real time the observational data of a very large number of patients and provides in return, to each practitioner, for the patients he treatment, clinical decision support. This database is fed by structured and unstructured information extracted from patients' medical records after anonymization and analysis. The personal data relating to the patients are then returned to the medical teams along with decision - making aids.

Beyond supervised trials, patients themselves become actors and start sharing their health data on the internet, thanks to connected self - measurement objects, but also to forums or social networks, by discussing their problems with other patients. In the field of pharmacovigilance, NLP systems are used to analyze the various messages posted to find weak signals corresponding in particular to side effects not found during conventional tests. These operations are carried out through data mining of all conversations. Social networks are indeed a very interesting source because patients discuss among themselves freely the way they live their pathology and what they would have to discuss with their doctor.

With the cost of developing a new drug estimated at 2.6 billion dollars and clinical trial phases lasting between six and eleven years on average, the pharmaceutical industry is increasingly turning to approaches that appeal to AI to propose new therapeutic strategies while reducing costs. Example of this desire: the OncoSnipe® research project set up in partnership with the Unicancer group, the federation of centers for the fight against cancer, whose objective is to identify new molecules through a detailed analysis of the problems of resistance to cancer treatments.

3. Methodology

In order to understand the visions of the hospital actors, we mobilized a qualitative methodology with semi - structured interviews (recorded), interviews in the form of informal exchanges (with note taking) and open observations.10 people were interviewed, 5 of whom are designers2 (of medical imaging) and 10 are professionals (radiologist doctors, medical radiology technicians, radiology secretary coordinator, health executive, digital law lawyer, Innovation project manager). For our open observations, we attended about ten events around the theme of AI in the form of conference - debates or even workshops. The objective was to understand and describe the visions around AI, its benefits, its usefulness and potential consequences in the field of health. This collection was supplemented by discussions with dozens of people involved in AI projects and interested in this subject, such as representatives of public services. The data collected was subject to thematic analysis.

4. First Results

AI: one “tool” among others

If a fictional imaginary of AI is present, the interviewees (designers and professionals) nevertheless clearly differentiate between this imaginary and the current capacities of AI. Thus, some see it as a set of algorithms or sophisticated and powerful tools: “artificial intelligence is a tool, a tool like any other but a very powerful tool” (Doctor radiologist 1). AI is also considered to be all “learning” machines, capable of analyzing a large amount of information and extracting salient elements from it. However, despite the evolution and learning capacities of these machines, some interviewees emphasize that humans will always be necessary for certain functions such as the interpretation of the results they produce: "the I symbolize it by an algorithm therefore learning algorithms which will not code themselves but which will self - code from the data that we will give them so in that sense there is not necessarily need humans to orient them but need a lot of humans to interpret them” (AI designer – industrial domain). Contrary to what science fiction conveys and speculative discourse concerning the possible appearance of a super - intelligence, the interviewees manifest a “realistic” conception of AI. They don't humans to interpret them” (AI designer – industrial domain). Contrary to what science fiction conveys and speculative discourse concerning the possible appearance of a super - intelligence, the interviewees manifest a “realistic” conception of AI. They don't humans to interpret them” (AI designer – industrial domain). Contrary to what science fiction conveys and speculative discourse concerning the possible appearance of a super - intelligence, the interviewees manifest a “realistic” conception of AI.

In this communication, the term "designer" refers to a set of people directly involved in AI design projects: the computer scientists who develop as well as the representatives and managers of companies who develop and market these AI systems.

In this communication, the term "professional" includes interviewees who may potentially be required to use AI systems in their work and/or those involved in AI reflection projects.

The potential benefits of AI

Alongside the generic functionalities, we have also identified specific functionalities considered potentially useful by the participants in the context of their work. For example, for the professionals (particularly healthcare)

interviewed, AI tools could prove useful for several tasks: medical planning (staff and examinations, especially in conditions where hospitals encounter difficulties such as lack of staff, lack of time and emergency management); sorting and prioritizing examination requests; analysis of medical records in order to extract important information for health professionals to know and issue alerts; detection of hidden elements, anomalies ignored by the professional.

According to our participants, the contributions of AI could be expressed in terms of saving time, improving the quality of work or even developing new skills or professions (for example, the creation of new workstations in companies such as a linguist position on an AI design project). However, our results highlight a gap between the AI functionalities offered on the market or by designers and the expressed needs of professionals. Take the example of medical imaging.

AI systems are mainly tools to help interpret radiological images, mainly intended for radiologists responsible and authorized to interpret them in order to produce a medical opinion. However, for some radiologists, this aspect of the job is the least problematic today: "Before someone explains to me that there are things that will interpret the images better than me and that will save me time, save me some time on this [the task of sorting/filtering examination requests]" (Doctor radiologist 2).
How to work with AI: between trust and perceived risks.

The people interviewed put forward the idea that the information provided by AI must be relevant, coherent and really useful. Otherwise, humans would tend to question the usefulness but also the reliability and performance of AI. He would thus find himself in a position of distrust rather than trust in the system: "From the first error, we will discredit the machine much more than we would have discredited a human (. . .) we will say to ourselves, I will put the machine on only if it is perfect" (Lawyer – area of digital law). The lack of reliability of an AI system justifies for some the need for a human presence in the control of the results it produces:

Confidence in AI also seems to depend on its explainability abilities. However, there are two different views on this point. For some, it is essential that the system be able to explain its results (even if it is 100% reliable), but for others, as long as we are sure that the system gives reliable and relevant elements, the explanations that he can produce are not essential but are rather additional information that may be of interest: "what is commonly accepted and what is important there must at least be some explicability4 (…) if it doesn't match what I think, there is the real question of what did he see? (Doctor radiologist 3); "I don't see any point in knowing how he does it, if he does it reliably and tells me there's a problem, look, me as a controller, that would be enough for me" (Radio controller 1). This verification of the results produced could in particular be used by professionals to assure themselves of the reliability of the system.

Before to follow the system's predictions and recommendations and to ensure its reliability, professionals stress the importance of having "proof" but also of "criticizing", validating or invalidating the result produced by the AI (particularly in the field of medical imaging): "today, in the current state of knowledge for aiding diagnosis (. . .) you need someone who is able to criticize it (. . .) everything that the system tells us proposes either we validate it or we don't validate it, but we have to be able to not validate it, because once again there are plenty of inter - individual variations" (Doctor radiologist 1). However, even if these conditions of verifiability and control are met, using AI,

The challenges of business transformations by the uses of AI

According to the professionals interviewed, the deployment of AI could cause various transformations in their profession or even their professional status. In the example of medical imaging, the potential use of AI as an advanced diagnostic aid is envisaged by radio manipulators as a means of enhancing and enriching this profession: "that [the AI as a diagnostic aid] would open the door to the liberal" (Radio manipulator 1). The idea of using AI as a diagnostic aid by paramedical staff is indeed emerging: "the nurse, using AI, could make a diagnosis instead of a doctor" (Extract observation notes – AI and Health conference - debate).

This scenario is evoked in connection with the problems of medical deserts and the lack of doctors (in particular radiologists) in hospitals: "our future is rather x - rays which are not read when there is a lack of radiologists or when there is there are activities such as emergencies where there is no radiologist, that is where artificial intelligence [would be useful]" (AI designer – medical imaging field). However, for professionals, these potential uses of AI systems raise various issues concerning the reconfiguration of roles and the transformation of professions. For example, the technicians are the first to look at the images and carry out a pre - analysis, even detecting anomalies in certain cases. In this direction,.

This potential reconfiguration of roles and professions also introduces regulatory issues in terms of the use of AI: "we can imagine that doctors will use the algorithm because they will be authorized to use algorithms" (Doctor radiologist 4). As this doctor mentions, the transformation of the profession also means the acquisition of new practices, and, no doubt, training in the use of AI.

5. Discussion & Perspectives

The first results from this exploratory study make it possible to make an initial inventory of the potential contributions of AI as well as its impacts (positive and negative) at the individual, collective and organizational level in the hospital environment, and this, according to the point of view. view of the actors involved.

Although the fear of a replacement of humans by AI in their field of activity exists for some participants, our study shows that the majority point of view is to consider AI as one tool among others in a perspective of help for the human. As a tool, different types of AI - based functionalities could prove useful in the work of the professionals interviewed such as

for tasks of planning, sorting, prioritization, analysis and synthesis of information as well as detection of problematic elements. One of the benefits of these features that some consider important is a performance improvement, such as "saving time" on supposedly "simple" and "repetitive" tasks.

However, this potential time saving is not without risks according to them and can have the effect of increasing the pace and the workload. Our results also show that participants envisage two types of distribution of tasks between the human and the AI: either by delegating repetitive tasks to the AI, or by imagining that the AI performs tasks that the human cannot. not to do. The human on his side could perform tasks that the AI cannot do. Finally, according to the conditions of integration and use of AI, our results highlight concerns about the nature and content of the transformations of professions and professional organizations.

Part of this vision and these concerns, particularly about the place and role of AI, the distribution of tasks, the opacity of systems or the consequences of AI on work, have already been well documented by previous work on automation and expert systems (De Terssac et al., 1988; Parasuraman & Wickens, 2008). These issues therefore arise again with the "new" AI systems. If on the whole, these concerns go in the direction of the problems treated for a long time in ergonomics and which must therefore be taken into account in our reflections on the design and the (potential) consequences of current AI systems, other points we seem equally important.

A first point is that the possibilities of permanent and rapid evolution of AI through its "learning" capacities, questions the conditions of appropriation of this tool, which could result in a requirement for permanent reappropriation on the part of the human. Another point is that the design and integration of AI must take into account the consequences of its introduction at the individual level but also at the collective and organizational level. We have seen that the deployment of AI systems can challenge the organization and work groups. Therefore, it is not only a question of designing and studying a Human - AI system but a system including a collective (with its norms and rules), the AI and other tools used - the whole enrolled in an organization.

Based on these elements, designing an AI system therefore means designing a support tool – rather than an element of substitution or automation of human activities – taking place as one resource among others in an activity, by collective definition and registered in an organization. Several approaches to design this type of system are proposed; they consider more or less the collective and organizational dimensions of work. In this sense, the Human - Centered AI approach (Xu, 2019) is interesting. For the design of "human - centered" AI systems, the author proposes to take into account ethical issues, technological capabilities and the criteria of explainability, usability and utility. This type of proposal nevertheless presents limits in taking into account the organizational and collective dimensions of the work, but also on the questions of design and project management. We therefore propose to include our work and the proposals for AI design approaches centered on human work, in the ergonomic design approach anchored in the analysis of the activity with the involvement of the people concerned (Barcellini, Van Belleghem, &Daniellou, 2013). Indeed, from the analysis of the real activity of people, it would be possible to identify the possibilities of assistance and uses of AI that make sense for the actors, while taking into account the possible consequences and transformations of activities and organization. Confronted with the actors concerned.

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