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Editorial

Healthcare's Data: Information Technology for Oncology

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Editorial

Nowadays, computer technology pervades the daily life of a large number of people: in a few years the development of the Internet has led to connect over 23 million devices worldwide [1] and over 4 million people: beyond 50% of the inhabitants of the earth [2-4].

The World Wide Web was born only 35 years ago, after 15 years – in the 2000 - it was possible to download a high definition picture in about 20 seconds (if millennium bug and more or less reliable lines permitted it), after at least another 15 years it was globally broadcast online TV that allows you to download and watch a movie in real time thanks to the high speed of data transfer achieved on the Internet. It is easy to find, on the net, effective representations of the amount of data transferred on the Internet every 60 seconds [5], these show the pervasiveness of technology in everyday life in a striking way.

The same computer science has changed in the contents and, above all, in the approach and vision, forced to face issues related to the cohesion and the deep interaction between data, devices, environment and humans, developing new methodologies, new algorithms but also rediscovering research and tools putted aside - like neural networks - being able to exploit the technological capabilities available nowadays. Today computers can talk, see, hear, translate, drive, coordinate, create (music, drawings, phrases, ...) and infer; in fact raising their abilities to an approximation of human ones (for this reason important personalities, in 2015, have signed an Open Letter on Artificial Intelligence [6], in which they recommend to dedicate resources to the study of the problem of the "control" of Artificial super-intelligences on the part of man). These dynamics are amplified by the growth of the potentials of the ever smaller and more portable devices, which increasingly reduce the distances between the real world and the digital world (wearable devices capable of gathering tens of thousands of information on the human body, environment, over time, process them and share them or share their elaborations, *via* the internet, with other distributed devices).

The world of health is not exempt from these dynamics and the use of health data is an open topic particularly important both for the heterogeneity of the types of information, and for the different levels of quality in the collection and use of information, both for issues related to privacy and data protection.

In a few years we are moving from software applications developed by small local software houses capable of addressing specific, "vertical" problems, to clinical ERP systems able to coordinate the different production processes from the management of resources, to the management of diagnostic images and results of laboratory and genetics examinations, the production of pharmacological preparations, the planning of therapeutic procedures, the collection of outcomes and the entire clinical history of patients.

Gregory Nelson presented in a conference paper, in a simple, pragmatic and quite complete way, the potential and the dynamics connected to the use of data in healthcare [7].

However, the data, which grew so rapidly during the modern era, so quickly collected and disseminated in different social, cultural and geographic areas, are rather heterogeneous and require strong common movements for standardization in order to guarantee their integrability and comparability. Many experiences have been born or grown in this field: International Statistical Classification of Diseases and Related Health Problems (ICD) [8], Logical Observation Identifiers Names and Codes (LOINC) [9], Health Level Seven International (HL7) [10], there are just three examples of homogeneous coding attempts at international level. In recent years there have been many international initiatives linked to network implementations for the collection and homogenization of health information for research purposes. However, a small part of clinicians involved in everyday activity is aware of these initiatives and, above all, their potential.

The different health care scenarios are placed in increasingly complex and unstable economic realities: the resources dedicated to healthcare are very different in different countries and according to some estimates vary from just over $1,000 in Mexico to almost $10,000 per capita USA [11]. As is also known, the health systems are significantly different in different countries for funding and insurance coverage for citizens, ranging from Universalist models structured

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and linked to limited resources, to public/private mix financing models such as the United States, to unstable models in areas of poverty or emerging governments [12].

However, the various estimates show growing scenarios in health expenditure linked to the introduction of innovations, the increase in incidence and the increase in survival with consequent growth in the number of patients prevalent in charge of the health system.

These dynamics are very important in the area of chronic diseases and in particular of oncological diseases. In a recent paper under submission, the outcome research group of the "Istituto Scientifico Romagnolo per lo Studio e la Cura dei Tumori (IRST) IRCCS" (Cancer Institute of Romagna) estimates a per capita expenditure (per resident citizen) in Romagna's area (central Italy) just over €200, by different information data sources available integration. In the same work it was analyzed the per capita cost and per patient cost for the pathology group, identifying the different settings with high use of resources (surgery, chemotherapy, radiotherapy, home care and hospice) for each group. Beyond the numbers resulting from the analysis, the proposed work has above all the aim to provide a method and an address to implement information tools for health decision-makers, policies must know the situation with a fundamental "information compromise": the best information possible in the best time possible. It's not useful for managers to know the exact number of drugs administered or positive diagnostic tests for a particular condition 10 years later (for example) any possible intervention.

Integration of data from different sources is an open and open problem: starting from isolated database or dataset, through data warehouse management and Extraction-Transformation-Loading (ETL) procedures, business intelligence, by reaching big data, open data and machine learning skills, nowadays many powerful tools are available to support clinical decisions, to provide information for research, to help managers make operational choices for the involvement of the healthcare system. A vision for data integration is represented in (Figure 1).

The Values in healthcare principles proposed by Michael Porter's [13] and the Triple Value defined by Sir J.A. Muir Gray's [14] are relevant points of view for improving the management of resources, the quality of care (measuring outcomes) and the taking charge of Health problems.

To achieve this vision, a new multidisciplinary and multifactorial alliance is needed that allows a flow of information and the dissemination of the analytical capacity (or the results of a centralized analysis capacity). In these dynamics it is clear that it is necessary to bring the data and the ability to use them in the decisional area and make them flow up to the decision delegation areas: to the clinicians working in the field and to the patients that choice their treatments (Figure 2).

In conclusion, information technology must be considered a fundamental ally for medical science and health management: in the coming years, data science, algorithms, artificial intelligence will be fueled by programming paradigms under development (as distributed, parallel and concurrent systems) and increasingly pervasive devices will continue the process of dissemination and sharing of information, in social contexts and for private life, will face the challenges of data protection and health management will have to necessarily exploit this potential to offer quality services.

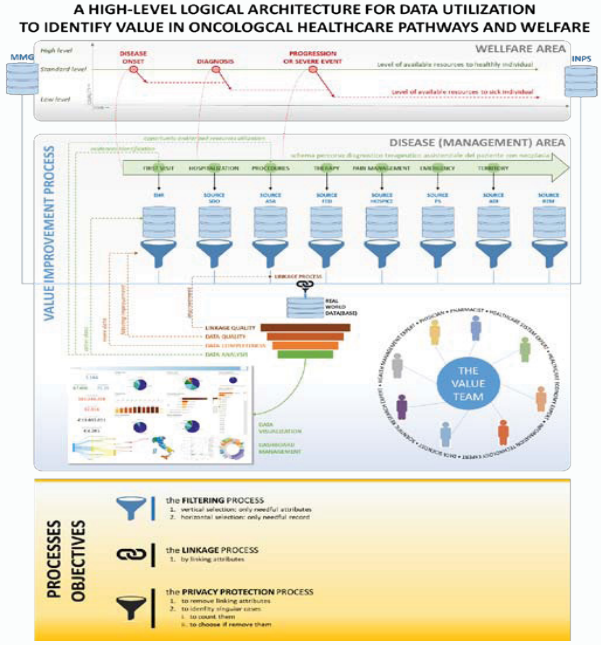

Figure 1: Data Integration Vision.

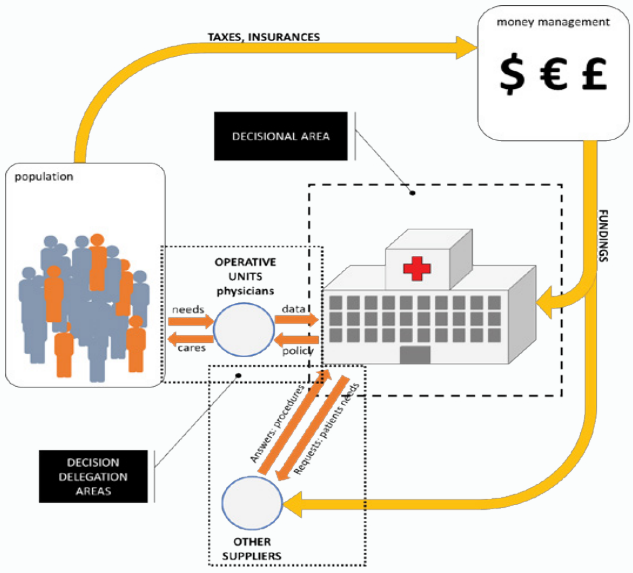

Figure 2: Healthcare management decisional areas and decision delegation area.

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