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Expectations and boundaries for Big Data approaches in social medicine

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ABSTRACT

It seems no longer possible to produce knowledge, even biological knowledge regardless of social, cultural and economic environments in which they were observed. Therefore never the term “social medicine” or more generally “social biology” has appeared more appropriate. This way of linking the social and the biological exceeds the sole social medicine by involving also other medical disciplines. As such, forensics, whose an important activity is represented by clinical forensics in charge of types of violence (physical, psychological, sexual, abuse) and persons held in custody could see its practice heavily modified through the use of various data describing both the clinical situation of patients but also their context of life. A better understanding of mechanisms of violence development and potentially a better prevention of these situations allow forensics not to be restricted (or seen as limited to) a “descriptive medicine”, but to be seen also as a preventive and curative medicine.

In this evolution, the potential contribution of Big Data appears significant insofar as information on a wide range of characteristics of the environment or context of life (social, economic, cultural) can be collected and be connected with health data, for example to develop models on social determinants of health. In the common thinking, the use of a larger amount of data and consequently a multiplicity of information via a multiplicity of databases would allow to access to a greater objectivity of a reality that we are approaching by fragmented viewpoints otherwise. In this light, the “bigger” and “more varied” would serve the “better” or at least the “more true”.

But to be able to consider together or to link different databases it will be necessary to know how to handle this diversity regarding hypotheses made to build databases and regarding their purposes (by whom, for what bases have been made). It will be equally important to question the representativeness of situations that led to the creation of a database and to question the validity of information and data according to the secondary or tertiary uses anticipated from their original purpose. This step of data validity control for the anticipated use is a sine qua non condition, particularly in the field of public health, to guarantee a sufficient level of quality and exploit in the best way the benefits of Big Data approaches.

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1. Context: social medicine, forensic and big data

Social medicine aims to take the social context into account as a determinant of population health. This approach tends to be in contrast with a more classical approach in modern medicine based on the biomedical model with a focus on mono factorial relationships between a cause and a biological process.^{11,8} In this framework health is not described as the only result of individual

characteristics, in particular biological determinants, but is also determined by the context, the environment, the structure of society in which individuals and populations live. This broader way to consider health refers more to the ecosocial model which considers health as determined at several levels, from the individual to the society, integrating economical, temporal, spatial and historical dimensions. Interestingly evidence from disciplines as diverse as sociology, psychology, epidemiology, biology, is accumulating to show how the social and the biological are interconnected. The concept of embodiment, developed in social epidemiology by Nancy Krieger,⁹ postulates that the social becomes biological, that

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we literally incorporate, biologically, the environment we live in, especially the social environment. Recent biological studies, in particular in epigenetics, show that several aspects of the environment (nutritional exposures, psychosocial stress) are likely to modulate from the early life the expression of the genome, including through DNA methylation processes, and more broadly the biological functioning in animals^{15,12} and potentially in human.^{4,14} This vision refers to the etymology of the word “biology” proposed by Lamarck in 1802 (“Recherches sur l’organisation des corps vivants”), as a science of the living functioning in relationship with its environment. Recently Margaret Lock has proposed the concept of “localized biology”¹⁰ to characterize the fact that the biological functioning is the result of interactions with the environment, including the social and cultural ones.

It seems no longer possible to produce knowledge, even biological knowledge regardless of physical, social, cultural and economic environments in which they were observed. Therefore the term “social medicine” or more generally “social biology” has never appeared more appropriate. This way of linking the social and the biological exceeds the sole social medicine by involving also other medical disciplines. As such, forensics, whose an important activity is represented by clinical forensics in charge of situations of violence (physical, psychological, sexual abuse) and persons held in custody could see the conceptual and factual bases of its practice heavily modified through the use of various data describing both the clinical situation of patients but also their context of life using a social medicine approach. A better understanding of mechanisms of occurrences of violence and potentially a better prevention of these situations could allow forensics not to be restricted (or seen as limited to) a “descriptive medicine”, but to be seen also as a preventive and curative medicine.

In this evolution, the potential contribution of Big Data appears significant insofar as information on a wide range of characteristics of the environment or context of life (social, economic, cultural) can be collected and be connected with health data, for example to develop models on social determinants of health as conceptualized in the Dahlgren-Whitehead model of health⁶ including individual lifestyle factors, social and community networks, and general socio-economic, cultural, environmental conditions. The underlying assumption is that in the field of health, data from several bases, with their diversity, are likely to generate information and knowledge on health and the environment which builds it. The objective of this article is to discuss some of the expectations and issues that raise the use of Big Data for medical discipline like forensics and more largely for the development of a social medicine approach.

2. Big Data and big questions

In the common thinking, the use of a larger amount of data and consequently a multiplicity of information via a multiplicity of databases would allow to access to a greater objectivity of a reality that we are approaching by fragmented viewpoints otherwise. In this light, the “bigger” and “more varied” would serve the “better” or at least the “more true”.^{1,2}

Beyond the technical questions about the practical possibility of using Big Data approaches, some of the implicit assumptions beyond big data need to be asked: **does Big Data necessarily lead to greater “truth” about the phenomena involved?**⁵ Is it possible and relevant to merge different databases without an examination of the assumptions regarding their constitution, their purposes? And in the end what do “data” mean? Another major issue linked to the advent of Big Data is the notion of causality that needs to be questioned particularly when we are interested in health. The question “why” may be not essential for commercial or marketing uses, as opposed to the question “what”, but the question “why” is

essential in the specific field of health and for developing interventions in this area. Acting on factors and determinants for improving health without the prior attempt to approach the causes cannot be a relevant and efficient approach for investigating health. At this time, the volume of both structured and unstructured data becomes difficult to use conventional solutions because of a lack of tools to jointly analyze and produce an information upon. It becomes crucial to be able to use data from various sources and of various types to produce a “new” information that should be more complete and reliable. The search for causality and data veracity may thus be more than ever major challenges in the Big Data era, and even more in the specific field of health.

3. Issues about databases

Thinking about data validity implies to ask the notion of database. According to the definition proposed by Georges Gardarin,⁷ a database is a collection of data modeling objects of a part of the real world and serving as a support for computer application. It structures and stores data for their use and analysis by programs and models. A database contains therefore information collected for a specific purpose and a particular use. Underpinned by assumptions that led to its construction, a database is thus like a photograph of a given population at a given time and under given conditions. A database is the observer's point of view because there is a significant amount of subjectivity through the objective, the choice of the population or the hypotheses of the data collection. A multitude of databases is therefore so many points of view that depend on the scale at which the hypotheses, data collection conditions, and so forth operate.

A database can therefore be seen as a social construction, i.e. built by human to respond a specific aim, both in its constitution and its analysis. Assume a reality exists that we suppose true, not depending on the observer. It can be approached only through different visions and measures which are thus relative and subjective. In a relativistic physics sense, the relativity of observations for a measurement tool reflects the different position of observers in the description space of a universal and structuring law. Health outcomes can be defined as latent variables that would be independent of any observers but that could be understood and approached through various concepts and components that are themselves dependent of observers. Each viewpoint is then conditioned by the investigator and the context attached to the database implementation (methods and assumptions for data collection, history, geography, economic, statistical plans). To be pragmatic we will take the following example of the study of cancer incidence: it is supposed a true incidence at a biological and physiological sense, independent of contexts, measurement methods that we try to approach by using methods that are themselves variable in time and space according to disciplines. However the definition of a disease such as cancer, or even more such as health, evolves over time including in its semiology and its clinical and biological characteristics. Each measure corresponds therefore to a given time or a specific period of time and reflects a point of view supposed real of the incidence.

4. Issues about data merging

With big data, we will gather different databases created in potentially different and specialized fields. The issue is interconnection of such different databases via a decompartmentalisation (or de-partitioning) of disciplines.

Integrating different databases, from the same area (e.g. health) or from different domains (administrative, financial), means considering different perspectives, different social constructions of

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