Digital Medicine and Biomedical Informatics: What’s in a Name?

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This issue of *Methods of Information in Medicine* features a special section that begins with a provocative article by Martin-Sanchez and Lopez-Campos examining the relationship between biomedical informatics and digital medicine [1] and closes with a series of invited commentaries [2] that includes reactions to the points made in the analytical paper. The paper, and subsequent responses, identify and clarify a number of issues that have recently led to both excitement and angst in the biomedical informatics (BMI) community. Accordingly the two papers taken together constitute a valuable snapshot of where the field currently stands and of the issues that are affecting its trajectory and its appreciation in the larger world of biomedicine.

Drs. Martin-Sanchez and Lopez-Campos begin by examining the increasingly popular term *digital medicine*, assessing its definition, its relationship to BMI, and the implications for health and health care that result from society’s current fascination with the notion. Fundamental to their discussion are the fields of *participatory medicine* and *precision medicine*, which the authors argue combine with BMI to define the scope and motivation for digital medicine. They make a strong distinction between the older term *personalized medicine* and the newer *precision medicine*, arguing that personalized medicine focuses primarily on an individual’s genomic information and its use whereas precision medicine works with a broader tableau of information and influences that extend into the community and environment (see their Table 1). Although one could dispute the general acceptance of the distinctions that they make (my own impression is that *personalized medicine*, *individualized medicine*, and *precision medicine* have been used almost interchangeably, with local arguments about which is preferred but no agreement on detailed definitions), they make a strong and compelling point about the importance of information from a wide variety of sources when making health and health care decisions. Furthermore, they clearly argue for the central role of BMI in gathering, validating, managing, and interpreting such diverse data sources.

The important notion of *participatory medicine* is also highly relevant to a discussion of the character and implications of digital medicine. The emergence of increasing patient empowerment is widely acknowledged, with online access by patients to their own health data, and to health-related information more generally, accelerating at a rate that challenges both cultural and legal norms [3]. Thus individuals are becoming not only better informed, but more involved in decision making about their health and in taking steps to understand and tactically manage their risks and personal opportunities in areas as varied as exercise monitoring [4], diet [5], and management of one’s own microbiome [6, 7]. Digital tools to assist with such efforts are popular and are raising new issues regarding the role of patients in contributing directly to their personal (or provider-based) electronic health record.

Martin-Sanchez and Lopez-Campos then examine the role of biomedical informatics as a key disciplinary element in...
the evolution of digital medicine. They examine the role of social media, for example, as a means for individuals to join communities of individuals with chronic diseases and, in some cases, to use social media as key interventions in the management (or self-management) of such participants. The notion of self-quantification is also examined, emphasizing the role of sensors, personal devices, and targeted applications in self-monitoring and measuring aspects of an individual's health. BMI clearly has a wide range of roles in creating such data, managing them, integrating them with input from other data sources, and providing a framework for decision support as well as for frank interventions in care.

Although medicine and public health have long recognized the importance of external factors in determining a patient's risk of disease and response to therapy (consider, for example, the longstanding awareness of the role of cigarette smoking in health or the recent attention paid to epidemic ebola or to the role of mosquitoes in the risk of Zika virus transmission), the notion has been formalized recently in the concept of *exposotype* (the contribution of an individual's external environment to their phenotypic characterization), or of *exposome* (one's lifelong exposure to environmental factors that may play a role in their current health or disease). Martin-Sanchez and Lopez-Campos argue that one's exposome needs to be considered with similar emphasis and analytical power as does their genome or phenome – leading to the notion of *exposome informatics* [8].

In Section 4 the authors turn to discuss the evolving role of BMI as a discipline, especially in light of the emergence of key new areas of scientific emphasis, such as those outlined above and discussed in more detail in their article. They argue the need for a broadened perspective and close in Section 5 with an assessment of how the field is now seen in a world where "big data", data science, and other variations on the notion of information and knowledge management and analysis are extant. They note Google Trends' data revealing the greater use over time of the phrases "digital health" or "digital medicine" than "biomedical informatics" (their Figure 5), and they bemoan the persistent lack of a popular understanding of the term "informatics" and its central role in health and biomedicine. A major concern expressed is the sense of competition between BMI and other emerging fields and disciplines, many of which are addressing challenges that are central to BMI itself and should logically be embraced and addressed by those who work in the informatics field. They close with a call to arms: "If biomedical informatics does not start to significantly embrace and complement the emergence of these new disciplines, we could be in grave danger of becoming irrelevant."

It is my impression that, at its heart, the discussion in this article is as much about terminology and characterization of disciplines as it is about significant changes in the way that health and health care are being perceived and understood in a digital world. I can appreciate the desire to develop a logical basis for the names we use to describe our field and its activities, having personally made attempts to offer a clear rationale for how we organize, characterize, and refer to various elements in the discipline. This is a major thrust in the first chapter of our textbook of biomedical informatics [9] and in the AMIA Board White Paper on the definition and core competencies of BMI as a field of graduate study, to which I contributed [10]. Agreement on names of a field and its subdisciplines is important – at least to the extent that it offers coherence to those in the field and clarity to those who observe it from outside.

Because of rapid changes in both biomedicine and digital technology, BMI has perhaps had more challenges related to naming than other scientific disciplines. Many of us remember the early days of "computers in medicine" or "medical computer science", which briefly gave way to "medical information sciences" and then "medical informatics". This last term was embraced for a few decades internationally, but then came the human genome project and the discovery that informatics notions were crucial to modern molecular biology research. When the phrase bioinformatics was introduced by the computational biologists (and by informaticians who chose to work on genomic problems), the medical informatics community recognized that many of the methodological issues being addressed in basic life science research were identical or closely related to those that had been addressed for years in their more clinically oriented informatics world. The field's transition from "medical informatics" to "biomedical informatics" had begun by the end of the 1990s – largely in an effort to keep bioinformatics and clinical informatics joined together as two application domains within a single core science: biomedical informatics. With the subsequent explosion of interest in public health informatics, the applied clinical and population health worlds came together under the "health informatics" name. The result has been a set of competing terms that continue to defy unanimous acceptance or definitions, complicating efforts to address the issues raised in the Martin-Sanchez and Lopez-Campos article within a coherent naming framework.

Yet despite the naming confusion, the field has thrived. It is ironic that, at least in the USA, the biomedical informatics moniker rose to acceptance and broad use largely because of an NIH grants program rather than through the efforts of the BMI community. When a large program in Clinical and Translational Science Awards was introduced [11, 12], including mandatory BMI core components (and using the biomedical informatics term), the academic medical community rapidly became aware of the field, struggled to understand what it was about, and, over time, began to create new academic units of BMI in medical schools and health science universities.

I have accordingly concluded that names are part of a political and cultural process that often dominates, despite the efforts of individuals who are entrenched in the named discipline. Perhaps we are seeing this again today in the broad use of terms such as "big data", "data science", and "digital medicine". Alternatively (and this is my expectation), there will be acceptance that BMI as the name for the core science while acknowledging that there are specialized subfields (e.g., data science), research challenges (e.g., big data in medicine), and popular terms that appeal to the public and refer to the broad world of applications...
more than to the scientific discipline itself (e.g., digital medicine). It is hardly surprising that an easily understood applied term such as “digital medicine” would be searched more frequently in Google than the name of a scientific discipline such as “biomedical informatics”.

Competition among existing and emerging disciplines is an inevitable part of this sociopolitical and cultural process. We have long known that academics will adapt the description of what they have always done so as to embrace newer notions or applications if that heightens their ability to get funding or a position of greater respect within their institution. Those of us who view ourselves as informaticians may therefore feel threatened by an exploding interest in data science, but that has not prevented people in BMI from making opportunistic use of the term “data science” in their papers, grant applications, or description of their academic units.

I suspect this kind of evolutionary process has been common in the advancement of science, occurring as fields and academic units come and go over time. But surely the field of biomedical informatics is here to stay, regardless of what it is called in a decade or so, and the fruits of our labors will enhance the world of health and health care as long as we keep the emphasis on patients and the public – which after all is the motivation for the entire effort, whatever we call ourselves.

References