The Intellectual Structure of Health and Medical Informatics

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ABSTRACT

This paper presents the results of an author co-citation analysis of the health and medical informatics discipline. It updates a smaller study that focused on health information systems. Drawing on such sub-fields as bioinformatics, clinical decision support systems, computational genomics, e-health, health informatics, and others, this body of knowledge defines the core internal structure of the discipline and delineates its sub-fields. An author co-citation analysis was performed for a nine-year period using the members of editorial boards of several medical informatics-related journals as an initial author sample (N = 272). Several multivariate analyses, including cluster analysis, factor analysis and multidimensional scaling, were performed. The authors results confirm that several established sub-fields still stand but a number of new sub-fields are emerging. Future research can build on this work and examine other journals and additional authors to gain insights into the collaborative and interdisciplinary nature of the health and medical informatics discipline.

Keywords: Author Co-Citation Analysis (ACA), Bibliometrics, Discipline, Health & Medical Informatics, Intellectual Structure

INTRODUCTION

In this article we present a contemporary view of the intellectual structure of the health & medical informatics discipline by analyzing co-authored papers for the nine-year period, 1998 to 2006. The study described here builds on a prior smaller study that looked at health information systems and was published in Methods of Information in Medicine (Raghupathi & Nerur, 2008). Editorial board members of various health & medical informatics-related journals shown in Table 1 served as proxies for leading researchers/authors. We gathered co-citation data from the Web of Science’s Science Citation and Social Science Citation Indexes. The results of our research confirm the historically dominant fields, emerging topics, leading researchers, as well as the relationships among researchers and topics over a nine-year period. The study, therefore, is an attempt to map the overall structure of the health & medical informatics discipline. Our primary objective is to develop a benchmark that may be used to develop taxonomies and frameworks of future research topics, investigate changes in the discipline as a whole, and document the emergence of new research areas and the decline of established areas of research. This study also updates the findings of prior studies that used

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different methodologies including co-citation analysis to elucidate the intellectual structure of health & medical informatics (Andrews, 2002; Morris & McCain, 1998).

The rest of the paper is organized as follows. First, we discuss the research objectives and methodology of this study, focusing on the bibliometric technique of author co-citation analysis (ACA). Subsequently, we analyze and discuss the results of various statistical methods employed and weigh in on the scope and limitations of this study. Finally, we offer conclusions and directions for future research.

While there is no clear definition of health & medical informatics, several definitions and descriptions of the medical informatics discipline exist (Morris & McCain, 1998; Shortliffe, 1987) and these are consolidated in (Morris & McCain, 1998). A more recent study also looked at the domain of medical informatics (Schuemie et al., 2009). As Morris and McCain suggest, “medical informatics draws on, and contributes to, multiple disciplines in the health sciences and information sciences” (Morris & McCain, 1998). They also report on other definitions, for example, that of Lincoln and Korpman who defined it as “the hybrid child of medicine and those logical sciences that are suggested by computer technology” (Lincoln & Korpman, 1980). They point out that Shortliffe affirmed the ‘information’ dimension of medical informatics, observing an NLM note that “medical informatics is the study of biomedical information, data and knowledge – their storage, retrieval, and optimal use for problem solving and decision making” (Shortliffe, 1988). Morris and McCain also indicate that Greenes and Siegel visualized medical informatics as “the field concerned with the cognitive, information processing, and information management tasks of medical and health care, and biomedical research, and with the application of information sciences and technology to those tasks” (Greenes & Siegel, 1987). Building on prior work, as reported in Morris and McCain, Lincoln included additional fields that linked to medical informatics observing that it drew on “various branches of logic, mathematics, computer science and behavioral science as well as focused disciplines such as decision theory, artificial intelligence, systems analysis, and industrial psychology” (Lincoln, 1990). Another discussion is by Blois who described the field observing that “medical information science (medical informatics) may be viewed as a discipline with several sub-fields, some of which (e.g., biostatistics) are already in the standard medical curriculum, while others (e.g., inference methods, decision theory) are not” (Blois, 1986) (as reported in Morris & McCain, 1998). Morris and McCain conclude that one can anticipate that the discipline borrows from numerous other disciplines (Morris & McCain, 1998).

As indicated by the multiple definitions and the variety of journals that exist, health & medical informatics is interdisciplinary and poses special problems for study (Morris & McCain, 1998). New sub-fields, domains and topics emerge from old ones “when the paradigms followed by existing disciplines no longer meet the needs of their researchers” (Kuhn, 1970). In contrast, Morris and McCain (1998) point out that inter-disciplines form when themes from existing disciplines are consolidated.

Table 1. List of journals

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<tr>
<th>Journal Name</th>
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<tr>
<td>IEEE Transactions on Information Technology in Biomedicine (ITITBM)</td>
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<tr>
<td>International Journal of Electronic Healthcare (IJEIH)</td>
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<tr>
<td>International Journal of Healthcare Information Systems and Informatics (IJHISI)</td>
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<tr>
<td>International Journal of Medical Informatics (IJMI)</td>
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<td>Journal of the American Medical Informatics Association (JAMIA)</td>
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<td>Journal of Biomedical Informatics (JBI)</td>
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<tr>
<td>Journal of Medical Internet Research (JMIR)</td>
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<tr>
<td>Medical Informatics &amp; The Internet in Medicine (MIIM)</td>
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