

What is health informatics?

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Health informatics is a relatively recent jargon term for a subject that may be of great interest to health services researchers and policy makers. Most countries with highly developed health systems are investing heavily in computer hardware and software in the expectation of higher quality for lower costs. Recent systematic reviews have indeed demonstrated the health benefits of a range of electronic tools, particularly in the areas of prevention and therapeutic monitoring. However, there remains a relative lack of published evaluations of informatics tools and methods. Uncritical adoption of new systems based on the pressures of technological push continue to discredit policy makers who have had to commit significant resources despite inadequate information on what can be realistically expected from a proposed system. There are great opportunities for researchers interested in evaluation to fill the vacuum left by informaticists who are too busy writing their next line of code.

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Health informatics has moved from hope to hype, to here and very now.¹ Everyone engaged in health services research needs to know what it is and what it can do for their area of interest. Some readers will want to be involved in the research opportunities within the field itself.

Basic details

The term informatics itself is a rare example of reverse Franglais where the English language appropriated the term l'informatique from our francophone colleagues, although the first use probably occurred in the former Soviet Union.² In practice, the term health informatics is commonly used to describe the study and application of computers to assist the gathering, storage, processing and use of information to improve the procedures or outcomes of health care services.³

Some see health informatics as a subset of bioinformatics, while others see little overlap between these two fields and reserve the term bioinformatics for studies involving the biosciences, including genomics. To add to the confusion, terms such as clinical informatics have been introduced as a further subdivision of health informatics. Is health informatics more than just another piece of evanescent jargon? Clinicians and health services researchers are unlikely to take the field seriously unless they are convinced that acquiring the skills that are necessary to deliver informatics solutions will result in significant improvements in clinical outcome. Ten core skills that are essential for health informatics have been identified (Box). Several of these

skills are directly applicable to non-clinicians who wish to engage with the subject.⁴ To some, the definition is too broad and all embracing to be useful, but in an emergent interdisciplinary field the benefits of allowing a range of mutually beneficial areas is being realised with rapid advances being made in methodology and application.⁵ An intercitation network analysis suggests

Box Ten skills that are essential to health informatics

1. Understand the dynamic and uncertain nature of medical knowledge and be able to keep personal knowledge and skills up-to-date
2. Know how to search for and assess knowledge according to the statistical basis of scientific evidence
3. Understand some of the logical and statistical models of the diagnostic process
4. Interpret uncertain clinical data and deal with artefact and error
5. Structure and analyse clinical decisions in terms of risks and benefits
6. Apply and adapt clinical knowledge to the individual circumstances of patients
7. Access, assess, select and apply a treatment guideline, adapt it to local circumstances, and communicate and record variations in treatment plan and outcome
8. Structure and record clinical data in a form appropriate for the immediate clinical task, for communication with colleagues, or for epidemiological purposes
9. Select and operate the most appropriate communication method for a given task (e.g. face-to-face conversation, telephone, e-mail, video, voice-mail, letter)
10. Structure and communicate messages in a manner most suited to the recipient, task and chosen communication medium

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that the disparate fields of biomedical engineering, biomedical computing, decision support and education have a shared core journal set of 29 journals.⁶ Many publications are in a wider group of journals, however, with a systematic review in primary care informatics identifying 5475 papers in 646 journals in 17 different languages.⁷ Readers who are averse to more informatics jargon or who are having difficulty following the terminology in this account can turn to the online (of course) glossary that is part of one of the subject's standard textbooks.⁸ An evidence-based medicine group has also produced a readers' guide to reading reports of such innovations.⁹

What has health informatics done for health services?

Some of the key achievements in health informatics might be considered as prerequisites for efficient patient-centred care, which is the goal of most health services.¹⁰ Clinicians and researchers can now find the data they need more easily by electronic information retrieval techniques.¹¹ These data can then be linked using a variety of deterministic and probabilistic tools to increase their usefulness.¹² Raw or enhanced data can then be processed in a variety of ways to render their meaning clearer. Finally, the usefulness of information may be increased when presented in optimal formats and rates.

To date, the literature on health informatics has been overburdened with descriptive work at the expense of evaluation of informatics solutions. Nonetheless, evidence of the effectiveness of computerised decision support is growing. For example, one systematic review of 28 trials found evidence of improvement in physician performance in three of four studies of computer-assisted prescribing, one of five studies of computer-aided diagnosis, four of six studies of preventive care reminder systems and seven of nine studies of computer-aided quality assurance for active medical care. Three of ten studies that assessed patient outcomes reported significant improvements. The authors concluded that there is strong evidence that computerised decision support can improve physician performance but that additional well-designed studies are needed to assess their effects and cost-effectiveness, especially on patient outcomes.¹³

A Cochrane Review identified 15 trials of computerised decision support for determining the dose of nine drugs.¹⁴ Interventions have usually targeted doctors, although some studies have attempted to influence prescribing by pharmacists and nurses. All the included studies took place on acute medical conditions in hospitals. Although they used reliable outcome measures, sample size was often small and only two studies reported a sample size calculation. Computer support for drug dosage gave significant benefits, reducing: the time to achieve therapeutic control; toxic drug levels; adverse reactions; and length of

hospital stay. There was a tendency for computer support to result in higher doses of drugs, although this did not reach statistical significance. The reviewers concluded that this provided evidence to support the use of computer assistance in determining drug dosage. Further clinical trials are necessary to determine whether the benefits seen in specialist applications can be realised in general use.

Other examples include the appropriate use of laboratory investigations and antibiotics.^{13,15} At the health system level, informatics tools have opened the way to re-engineer services, including managed clinical networks, and providing information to planners and patients upon which to base decisions.^{16,17}

Informatics tools useful to health services research

Almost everyone engaged in health services research will already be using a large range of informatics tools, as the information revolution has already transformed the way we work. Every potential research question will demand an electronic search of the existing literature and current research databases. It would be folly not to use some form of reference management system and any project with data is likely to use a database to aid the querying process, whether the data are quantitative or qualitative. Specific new tools include data mining techniques, record linkage and web technologies to interact with study subjects. For example, a researcher interested in the use of health services by people with asthma could use linkage of routine data to identify people of the same age and sex, living in a similar area of a city and on the same treatments but making very different uses of accident and emergency departments. In addition to defining study populations, informatics could be used to automate and extend the period of follow-up in a pragmatic randomised controlled trial of an intervention to influence the patterns of use of services.

Health services research methods useful in health informatics

Health services researchers might engage with informatics research at a number of levels from basic science to applied.¹⁸ Fundamental research might include developing more sophisticated understanding of the human/machine interface in computer laboratory and in field conditions. Ethnographers, health economists and cognitive psychologists involved in health services research all bring valuable skills to this under-researched area. Applied research might investigate whether and why informatics tools used in particular contexts had a significant impact on the effectiveness of interventions or patients' experiences. Clinical research might focus on near-patient testing, examining how diagnostic and therapeutic strategies are altered by the introduction of new technologies.¹⁹ New service developments require piloting and then evaluation. In the

early stages, the varying perspectives of clinicians, service users, administrators and funding bodies need to be taken into account.²⁰

Evaluation studies might examine the costs and benefits of new approaches that integrate informatics tools into an organisation, both for individual service users as well as for society.²¹ There is an 'evaluation paradox' in health informatics which states that new information systems cannot be believed until they are evaluated but they cannot be evaluated until they are in routine use. The range of evaluation tools can be categorised as objective or subjective.²²

Objective approaches, as their name implies, attempt to provide objective assessment of clearly defined variables, usually assessed quantitatively. For example, study participants (or practices) may be (cluster) randomised either to a system's new information functions or to an alternative (maybe an existing version of software aiming to meet the same objective). This approach is driven by an hypothesis rather than by an open research question. The aim is to determine whether the intervention meets its designer's objectives.

Subjective approaches, by contrast, focus on the judgements of expert evaluators, system users, potential users or other stakeholders. Examples include software reviews in technical magazines, case reports by an expert team and ethnographic studies of users' perceptions and experiences. This type of research may be particularly useful to investigate the acceptability and usability of a technology, to identify unexpected technical problems, to elucidate the processes of change necessary for system integration into working patterns, the impact of a new system on organisational structure and to identify barriers to implementation.

Dissemination of emergent informatics tools that have been shown to be useful is a particularly problematic area that would benefit from additional health services research input. Many of those engaged in the development and initial application of new tools have little interest or aptitude for this type of research.²³

Research challenges for health informatics

Quality improvement requires that information that assists the assessment of service quality be more freely available.²⁴ However, issues of confidentiality and data security arise whenever such informatics tools are used for these purposes. Data protection legislation in many countries has led to major difficulties for researchers using patient-identifiable data.^{25,26} The precise impact in Europe of recent human rights legislation remains unclear, with many believing that methods of working within the legislation can only be definitively clarified by the courts.^{27,28} Debate as to what research activities may be legally undertaken has occurred in research ethics committees, research funding bodies and professional associations, but a unified opinion has not emerged. Unsurprisingly, controllers of subject-identifiable patient data have been reluctant to release permission for access to data for fear of acting unlawfully.²⁹ Failure to achieve

a satisfactory resolution will deprive researchers of access to some of the strongest methodologies and patients of the benefits to patient care from observational research and integrated health care networks.^{30,31}

Other research issues arise from the fundamental ability of new information tools to challenge existing systems: bypass of current services in favour of web-based sources; integrating the additional information brought to consultations by electronically empowered patients;³²⁻³⁴ 24-hour access to personal records and issues around ensuring equity of access to technological fixes which some patients can neither afford nor understand.³⁵ The potential contributions of health services researchers to health informatics over the next decade are immense.

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