

Issues in the Implementation of Computer-based Medical Algorithms

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Introduction: A medical algorithm encodes one or more chunks of knowledge used to solve a clinical problem. Starting from simple rules-of-thumb increasingly sophisticated computational methods have been devised by biomedical researchers and published in the medical literature. Computer-based versions of these algorithms have a great potential to enhance medical care by supporting enhanced systematization and automation of diagnosis and treatment. These can help decrease medical errors, improve efficiency, and speed communication.

Discussion: A number of issues need to be addressed before there can be widespread use of medical algorithms. These include: content development, interface design, automation with enhanced functionality, and operations.

The number of medical algorithms available in published literature is large - probably in the order of 100,000 - and growing daily. Identification and encoding information of this magnitude requires ongoing cooperation between a large number of domain specialists. Delivery requires a content management system with tools for search, retrieval, navigation and archival storage. Links back to the original literature are needed to validate the information. The ability to annotate the material and to include user comments can enhance the sharing of knowledge.

PDA's and wireless devices have made access of information at the point of patient care possible. The presentation of content must be able to adapt to the limitations imposed by small screens and constrained input devices. Integration of systems with the electronic health record (EHR) can significantly reduce input requirements and reduce data entry errors. However, there are a number of issues that make integration with electronic health records a challenging task. The system must be able to adapt to the needs of diverse users with different goals and knowledge sets. In addition, the system should be accessible by users with a variety of disabilities.

Software tools need to be developed to enhance functionality and automate tasks. These can provide feedback on algorithm selection and the evidence supporting its use. An algorithm can be automatically selected based its performance characteristics for a given patient or clinical situation. Tools can also be developed to simplify transportability of an algorithm to a practice environment different from the one in which it was developed.

A number of operational issues need to be addressed. The system needs to be validated for compliance with good manufacturing practices as specified by the US FDA or other regulatory agencies. User access needs to be tracked and confidentiality of patient records maintained. Systems must be in place to identify and respond to problems and to quickly notify users of failures. Finally, to serve as a global resource the system must be available in different languages and modified to the needs of different cultures.

Conclusion: The most efficient way to develop these algorithms and to develop the necessary software tools to utilize them is through a centralized bureau supporting the open-source model. This can utilize mass production techniques and economies of scale to develop a global resource. Local implementation would be performed by local health informatics professionals based on the needs and standards of care in the community.

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