Visualization to improve patient learning and communication

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Appropriate use of images, information graphics, and diagrams could help patients better digest medical information and provide an effective way of promoting empowerment and enhancing care.

Understanding and managing personal health information can pose a significant challenge to patients. They may be overloaded with a large volume of complex medical data, at times when emotional stress is high, which adds to the difficulty of making informed decisions. Patients must also consider choices about lifestyle, diagnostic testing, and therapeutics. They may receive verbal guidance from their health care providers, but patients need more help in understanding and managing complex information, as do providers in conveying it.

Visualization—the creation and use of visual attributes such as images, information graphics, and diagrams—provides a compelling solution to support both learning and communication. Patient-orientated visualization of medical information can improve their understanding and enhance the communication process, engaging the patient in an active information exchange and in the decision-making process. This is essential as effective communication between providers and their patients has been shown to result in significantly improved medical outcomes.1–3

To a limited extent, visualization is already used in clinical care. For example, a visual rating scale for pain using face-based scoring has had a positive impact in assessing and managing pain in pediatric patients and those who have difficulty with numerical scoring. Graphical growth charts can illustrate progress in nutritional and exercise regimens, and dynamic peak airflow curves indicate pulmonary function in acute exacerbations of lung disease. Finally, time trends of laboratory values are used to track fluctuations in diabetic blood sugar control in relation to insulin doses, diet, or physical activity, and the response of serum cholesterol to statin medications.

However, the development, design, and implementation of effective patient-oriented visualizations is not simple. Moreover, several important research questions need to be addressed to ensure the utility of visualization in improving clinical care.

Figure 1. Causes of ineffective communication between patients and providers.

Figure 2. A multidisciplinary research agenda for medical information visualization.

These include the following: accessibility, to determine what forms of medical information visualizations are available to...
enhance communication and empower health decisions; context, to discover the health care contexts in which information visualization techniques can be employed, including different health and disease use cases, complexities of diseases and procedures, and levels of patient literacy; gaps, to assess the medical contexts in which visualization techniques may have an impact but are not being used; cognition, to determine the patient behaviors to which visualization can be applied to make the biggest impact; and best practice, to outline the visualization techniques and combinations of techniques, tools, and contexts that would contribute the most to patient empowerment and care.

We have examined one area of this research by characterizing the complex barriers faced by patients and physicians in communication and shared decision processes (see Figure 1). An understanding of these barriers, including physical limitations, and language, literacy, and numeracy constraints, is vital to facilitate the translation of messages into understandable visual forms.4

The dimensions of research needed in the field of medical information visualization are numerous. Therefore, we have proposed a comprehensive, multidisciplinary research agenda to address them (see Figure 2). Research findings from this agenda will then be used to construct and validate a grounded conceptual model.5 This is essential to ensure development efforts are focused on high-priority health areas containing gaps in visual capabilities, and the development of effective solutions.

As an exploratory effort, we intend to solicit clinicians’ opinion on visualization tools and techniques in different communication and decision contexts. We will then study the spectrum of health information visualizations to create a taxonomy of tools and techniques applicable to different medical contexts and for patients’ different needs and education levels.

Our study will provide insight into the role of existing medical information visualizations in patient-provider communication, leading to a greater understanding of the cognitive and technical aspects of these methods and their categorization into best practices. Increased awareness, research, and publication within a multidisciplinary community will allow the development, expansion, and thorough classification of relevant ideas, principles, and engineering practices. Ultimately, we hope to construct a valid theory for the field.

The potential benefits of such developments for building and using medical information visualization in patient-provider communication are immense. They include more timely and accurate exchange, significantly reducing information overload,6 and increasing patients’ understanding and empowerment. This greater autonomy, in turn, will promote shared medical decision making and mitigate safety risks for patients as they become partners in their own health management.

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