The Personal Web and Clinical Medicine: A Physician's View

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Abstract

This paper will discuss the Personal Web as it pertains to supporting the practice of clinical medicine. An overview of the practice of clinical medicine is provided. Current challenges stem from heterogeneous data collection and storage formats; insufficient links between existing electronic resources, and lack of smart services and interactions to support the use of this information both at the point of care and across clinical practices. Potential research directions envision the Personal Web supporting clinical medicine with the ultimate goal of improved patient care through patient-centered data aggregation and integration as well as smart interactions and smart services that support the use of evidence based decision tools and assist with practice management.

1. Introduction

The Personal Web has been described as the user view of the smart internet. The smart internet has been defined as being composed of smart interactions and smart services. Smart interactions pertain to the discovery, aggregation, and delivery of data. Smart services are comprised of data infrastructure and task management [1]. Currently, electronic based health care data and resources are increasing but not ubiquitous. Links are forming but networks are incomplete. Smart interactions and smart services are scarce. Data aggregation, transmission, and analysis are still largely manual. An environment that supports context specific user driven integrations across the web is desirable. The Personal Web holds great promise in supporting the practice of clinical medicine, with the ultimate goal of improved patient care. This paper will provide an overview of the practice of clinical medicine, discuss challenges, and potential research directions.

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2.0 The Practice of Clinical Medicine

The practice of clinical medicine can be divided into the following categories: clinical decision making, requests for further services, documentation, practice management, and ongoing education. This classification does not encompass procedures.

2.1 Clinical Decision Making

The process of clinical decision making requires the collection of relevant patient specific data in a timely fashion. The time scale is in the order of minutes. The absence of information often cannot delay decision making. Information is gathered from the patient, involved caregivers, other clinical team members, other involved physicians, documented past medical history, laboratory results, imaging results, and decision support tools such as guidelines, reference material, risk calculators, etc. Formats include: direct or indirect verbal communication, paper based records and communications, electronic records. Sorting relevant from irrelevant information ('signal from the noise') is one of

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the main challenges in clinical decision making. More information is not always better.

As information is gathered, the physician concurrently formulates the problem and generates possible solutions. These critical calculations are constrained by cognitive capacity. Currently, no analytic tools exist to generate final optimal recommendations given a patient's unique parameters.

2.2 Requests for further services

Having gathered available relevant information, management of a patient's issues may require requests for further services**.** This may include requests to obtain further patient specific information such as 'labs' (analysis of bodily fluids) or imaging (such as CT scans, ultrasounds, etc). Sometimes, the opinion of another physician is required ('referral') or requests are made for specific procedures. Each of the foregoing requires the requesting physician to specify the service and forward selected and/or required patient information to assist the next provider in the interpretation of clinical picture, urgency, and results. Transmission of this information varies according to the recipient's permissible formats.

2.3 Documentation

Physicians are not only readers of the patient record, they are also the authors. Documentation is required for a number of reasons: to contribute to the local patient record for the purposes of personal recollection and thought organization; to provide communication to other health care providers who will view the patient record in order to gather information necessary for their decision making around patient issues; to serve as an historical record of the events that transpired (particularly in the event of undesirable outcomes); to support financial remuneration.

2.4 Practice management

Most physicians practicing clinical medicine manage a number of patients at one time. This may vary from a few patients in an ICU setting, to several dozen during a shift in an emergency department, to a few hundred for specialists, or upwards of 2500 patients for a family physician. Beyond seeing one patient at a time, physicians must manage incoming information for all of their patients. Information arrives irregularly and by various means: mail, fax, phone messages, direct verbal communication from other health team members, electronic health record, email, etc. New information must be managed in terms of urgency. All information must be reviewed and acknowledged in some manor. Management of this information is usually up to the individual physician, subject to the influence of their environment (e.g. group vs. solo vs. hospital practice).

To date, support of overall practice management has been limited. The Ministry of Health in Ontario has started to provide subgroups of physicians with some practice specific clinical audit information, such as the percentage of their patients who have received an indicated screening test. Some electronic health records may support scheduling, information management and reconciliation, clinical audits, etc. Incorporating patient information from multiple sources (in heterogeneous formats) into a specific EHR to allow for this analysis remains a challenge.

2.5 Ongoing Education

Physicians require up to date information in two general circumstances: in a given clinical context or as a general knowledge base update. The latter is often referred to as Continuing Medical Education or 'CME'. Information for a given clinical context is usually required instantaneously and may be obtained via database search, website specific searches, general search engines (e.g. Google), paper based references, or colleague query. Electronic information is usually accessed through mobile or desktop devices. Finding the answer to a specific question is often not straightforward.

The process of formal CME is varied and an ongoing area of research [2]. The overall goal of CME is to improve the quality of healthcare. Whether or not this is actually realized is unclear. CME includes but is not limited to: journal reading (paper or electronic), medical

meetings or educational rounds, academic detailing, informal discussions amongst colleagues, self study, individual practice audits, public media stories, etc. These events may be scheduled, prompted (arrival by mail, email, RSS feed, etc), or occur spontaneously.

The amount of new and existing research based clinical data is immense. The National Institutes of Health's Medline® indexes 5485 journals [3]. In an effort to assist in the management of this massive amount of information, clinical guidelines and systematic reviews have been developed however, often more than one set of guidelines will exist on a particular topic. Repositories for these resources are in turn immense: The National Guideline Clearinghouse currently houses more than 7000 guidelines [4] and The Cochrane Library more than 4000 systematic reviews [5].

Access to information varies. Some journals, such as the British Medical Journal, update their publications daily and provide open access to all articles [6]. Others, such as the New England Journal of Medicine, publish weekly and limits access to full articles only to subscribers [7]. Direct links between electronic health records and these evidenced based resources are lacking.

3.0 Current challenges

The practice of clinical medicine today faces a number of challenges. These may be summarized as heterogeneous data collection and storage formats, lack of links between existing electronic resources, and lack of smart services and interactions to support the use of this information. Functionally, the problems may be divided as follows:

3.1 Access to existing information

One of the greatest challenges facing physicians in Ontario today is the timely access to existing documented patient information. Access is limited by heterogeneous, agency-centric data storage methods and privacy concerns. For the purposes of this paper, 'agency' will include: hospitals, laboratories, community pharmacies, and physician offices. Within an agency, each patient may have a paper as well as an electronic chart, and one software system may not be linked to another requiring the user to 'exit' one system and 'enter' another to access information on the same patient. External linkages between health care agencies are forming but remain scarce. Searching for relevant data within an existing electronic record is often a challenge as user interfaces are inflexible, search features are lacking or absent, and software architecture varies from vendor to vendor.

Individual agencies are strictly charged with the privacy and protection of patient information. If information housed in another agency is required by a physician, current policies and procedures around these important privacy concerns often necessitate permission to be obtained on a case by case basis before the information can be released, something that is often not feasible in a timely manor especially in urgent situations or outside of routine business hours. Some links between participating agencies are starting to form, facilitating view only access to existing patient data.

Accessing up to date, relevant data to support evidence based point of care decision making is another challenge. As discussed, the body of literature is immense. Though many clinical guidelines exist, studies have found adherence rates to be as low as 27% [8]. Factors influencing uptake include ease of use and time constrained work environments. Cumbersome access and inefficient search methodologies may be contributing to these issues.

3.2 Dissemination of information

Not dissimilar to the problems associated with accessing information, information dissemination is plagued by heterogeneous formats and requirements. Documentation may occur in a paper and/or electronic chart; orders may be written or electronically entered; requisition forms are paper based or electronic; most referrals are handwritten and faxed to the next office for review; prescriptions may be hand written or electronically generated, and are then transmitted by hand or fax. Requirements are

agency specific and electronic links are forming but still lacking.

3.3 Poor uptake of electronic health records

In a 2008 survey of Canadian hospitals, 54% were identified as having some sort of EHR. Fewer than 3% had no paper record [9]. Electronic health records have not performed as anticipated. There has not been a clear reduction in errors and cost, nor an increase in provider productivity [10]. Documentation time has increased [11]. Undesired effects, such as increased mortality, have been observed [12]. Reasons for poor performance may include: cost, implementation and integration issues, and poor usability. Software is inflexible and often not well suited individual user's needs, forcing users to alter workflow to accommodate software requirements. Service aggregation [13], where by users decide select and integrate services is lacking.

Without electronic records, we have no potential to connect and integrate them.

3.4 Information and Practice Management

As discussed in 2.4, physicians must manage information across the spectrum of their patients. On a daily basis, this means accumulating incoming information, reviewing each piece, and triaging accordingly. Information may be categorized as 'no further action required', or 'action required'. If no further action is required, that information may be 'filed' in the patient chart. If further action is required, decisions must be taken regarding level of urgency, etc. Incoming information arrives sporactically around the clock via phone, fax, mail, email, within an EHR, or via handwritten notes. Currently, it is up to the individual physician to develop a plan to accumulate and manage all of this information and the resulting actions, and to develop some sort of reconciliation strategy. Electronic services supporting integration and management of information across an entire practice are lacking. Similarly, there is little or no automated data collection, analysis, and feedback related to general practice management issues such as scheduling optimization, etc.

4.0 Research directions

The Personal Web holds great potential to support the practice of clinical medicine with the ultimate goal of improved patient care. This may be measured in terms of clinical outcomes, error reduction, patient satisfaction, etc. The 'user' may be viewed from the patient or physician perspective. Following are proposed research questions:

4.1 Patient-centric data

Can smart interactions and services support the collection and aggregation of patient information from multiple agencies, for multiple users? The Personal Web would allow the creation of patient based sites that would automatically aggregate laboratory results, imaging results, medication records, documentation from involved physicians, hospitalizations, etc. Patients would access and contribute to their own records while the integrity of other information is maintained. Interfaces would be user specific and flexible; defined by need and context; ensure privacy; support quick search and aggregation of relevant web based information and services.

4.2 Practice management

Can smart interactions and services support the aggregation and management of data as it is generated across a clinical practice? The Personal Web would allow the physician-user to easily automate practice-wide aggregation of incoming information; customize alerts; bin and batch according to review preference; automate reconciliation; provide analysis and feedback to optimize efficiency; support smart interactions pertaining to tasks that require further action.

4.3 Decision Support and Continuing Medical Education

Can smart interactions and services facilitate the delivery and discovery of context specific information to support point of care clinical decision making and ongoing education? The Personal Web would allow the physician user to easily and directly access context specific information on demand; provide automated prompts; allow for customized information delivery.

5.0 Summary

The practice of clinical medicine is complex. Current challenges in accessing and disseminating information stem from heterogeneous data collection and storage methods; insufficient links between existing electronic patient records; lack of automated data aggregation, integration, and utilization; inefficient access to an immense body of existing evidence based research. Built on smart interactions and smart services, the Personal Web holds great potential to facilitate the practice of clinical medicine, with the ultimate goal of improving patient care.

About the author

Tammy Sieminowski is a lecturer in the Faculty of Medicine at the University of Toronto and attending physician in Neurorehabilitation at Bridgepoint Hospital. She has worked in community based family practice offices, emergency departments, and inpatient settings in Canada, Australia, and the United States. She received her medical degree from the University of Toronto, where she also did her post graduate training in Family and Community Medicine. She recently completed a Master of Engineering degree in the Department of Mechanical and Industrial Engineering at the University of Toronto. Her research interests include forecasting length of stay, healthcare based process improvement and optimization, and physician workflow.

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