

A Preliminary Investigation of an Integration Tool to Improve Access to Information Resources in Clinical Software

Jean-Pierre Calabretto, Bryn Lewis, James Reeve

National Prescribing Service, Sydney, Australia

Abstract

Decision support (DS) tools offer opportunities to improve the delivery and quality of health care by preventing errors, improving communication and increasing knowledge accessibility. Effective implementation strategies across different settings need to be determined. With the rapid uptake of computers in Australian general practice over the past decade, there is potential for general practitioners (GPs) to access independent, evidence-based information at the point of care through their clinical software. However, there is a lack of standard approaches or specifications for this purpose. This remains a poorly investigated area where there are potentially valuable gains to be made.

A software application was developed to deliver key clinical information resources to GPs at the point-of-care. The tool was designed so that it would automatically trigger a search at specific points during the GP's workflow, providing context-sensitive links to clinical information resources. A prototyping approach for software development was taken and a qualitative approach to user-needs assessment consisting of user meetings, one-on-one interviews with GPs and prototype testing with four GPs, and a clinical pharmacologist.

The ability to access multiple independent information resources using a single search was highly valued by participants. The automated search facility linked to specific triggers in the clinical software was considered less valuable. Simplicity of use and speed were critical factors determining overall use of the tool. Our experience provides some insight into realising a practical and useful way of supporting GPs' access to independent evidence-based information resources to support decision-making during patient encounters.

Keywords: *Information Retrieval, Decision Support, General Practice*

1. Introduction

Against a background of increasing health system demands in part caused by aging populations, the increase of chronic diseases, increasing costs and shrinking resources, one emerging priority for governments includes relying on an evidence base for health care to achieve best practice in health services [1]. It is accepted that governments increasingly see information technology (IT) as a valuable tool in health care to cope with increasing demand on services, reshape delivery to make it more citizen-centred [2] and address issues of quality and safety [3];

Decision support tools in particular offer opportunities to reduce the numbers of adverse events, unnecessary hospitalisations, duplication of diagnostic tests and enhance decision-making for providers and consumers [1]. Bates and Gawande (2003) suggest that the types of tools able to prevent errors and adverse events are those which can improve communication, make knowledge more readily accessible and assist with calculations and monitoring. Although evidence suggests that DSS have the potential to produce improvement in outcomes, the variability in approaches to implementation and resulting effectiveness suggests that work remains to determine effective implementation strategies across different settings and popula-

tions [4]. In particular, the predominance of DSS have been developed within academic settings which limits generalisability to other, particularly community-based practice settings [4]. Within these activities, there is recognition of the importance of better use of health information, including access to up-to-date health information for both consumers and health providers [1].

The amount and complexity of health-related information has increased to such a degree that information processing in itself has become a major activity for health organisations [2]. This overwhelming amount of information makes it very difficult for individual health clinicians to provide high-quality, error-free care on a consistent basis, and clinicians are supported by poor systems that allow errors to occur [5].

Clinical software on General Practitioners' desktops has become an essential tool with the ability to influence prescribing practices. In Australia, computers have rapidly been integrated into general practice over the past decade [6]. Through clinical software, there is the potential for timely delivery of important messages about medicines; and in particular, a mechanism for providing clinicians with independent, evidence-based information at the point of care to support decision-making and potentially influencing prescribing decisions. However, McInnes, Saltman and Kidd (2006) found that less than 20% of GPs who used a clinical package accessed computerised information during the consultation. The authors suggested that the low frequency of accessing electronic information during consultations may reflect low "usefulness" where GPs may perceive that taking even 1 or 2 minutes to seek information will reduce their productivity [7].

Information integration in health is a challenging aim requiring the coordination of independent clinical software systems in an environment where there are few useful standard approaches or specifications for this purpose. There have been some efforts in Australia to address this issue, such as Lewis (2003) [8] and Coiera *et al* (2005) [9]. As this is an area of limited success where there are potentially valuable gains to information decision-making, the NPS undertook a proof of concept project to investigate the feasibility of a software tool that integrated evidence-based information for the GP at the point of care.

2. Methods

The project employed a prototyping approach for software development and a qualitative approach to user-needs assessment consisting of user meetings and one-on-one interviews during prototype testing.

2.1. Prototype Concept

The concept of the prototype was that it would reside on the GP's computer and would function independently of the prescribing software, aiming for an information integration mechanism. Neither prescribing system vendors

nor information providers needed to be directly engaged in the development process. The tool would be triggered by clinical terms at appropriate points in the GP's consultation workflow enabling a context-based search of information from evidence-based resources to inform decision-making. In addition, the search tool allowed users to enter their own search terms. The project was not intended to result in production level software but provide direction as to how such software might be designed and implemented. This approach was informed by previous experience of the NPS in the area of information use and retrieval by GPs and other similar activities investigating information provision to clinicians.

We distinguish our approach from many others, including *QuickClinical* [9], as there is no need to log on to a separate online application prior to formulating a search. The information resources here are immediately available to the search tool. Functionally, the tool comprised three components: a search component, information resources and an integration interface component between the search tool and clinical software. The integration interface monitors the user activity in the prescribing system. The interface obtains data elements from certain trigger points within the clinical software, performs a context specific search using those data elements as search parameters and presents potentially useful information within its user interface. A simple approach was taken based on a straightforward full text search with refinement of query structures using other clinical parameters (e.g. age) to be considered after a full text search was demonstrated successfully. The monitoring of the clinical system was intended to be unobtrusive with mechanisms transparent to the user. The tool was designed to reside on screen alongside the prescribing system and was able to be re-sized by the user.

2.2. Prescribing systems and information resources investigated

It was not intended that any particular prescribing system would be targeted initially and this would be determined during the project, although it was intended that more than one system would be considered. Similarly, a broad range of information resources could be investigated; although a small range of evidence-based information resources were selected. These were NPS resources (e.g. Australian Prescriber, NPS News and Radar) Therapeutic Guidelines (TG) and the Australian Medicines Handbook (AMH). The only technical requirement for information resources was that their content or indexes to contents were searchable using Web-based technology.

2.3. Conduct of the project

This observational study sought feedback about the operational prototype from representative users who formed a five member Project Reference Group consisting: a clinical pharmacologist, two experienced GPs, a GP

registrar and a GP academic. Although this was a small group, we considered that the breadth would allow us to gain early feedback about the tool's potential as well as allowing prototype development to proceed sufficiently to a candidate tool for field testing.

An initial demonstration of the prototype to the Reference Group provided feedback on visual aspects, tool functionality and suitability of information resources. The prototype was then individually tested by members of the Reference Group while being observed by a Project Team member. Five scenarios were developed to test the prototype. These were brief 'cases' attempting to mimic a general practice patient consultation whereby the trigger points for the tool could be tested and/or resulted in the need to search for information. The scenarios consisted of diabetes management, osteoporosis, post-natal depression (in breast feeding), chronic otitis media (paediatric) and scabies in pregnancy. One scenario is shown for example (

Figure 1.) For the clinical pharmacologist - who did not use GP prescribing software - testing consisted of searching for information based on real clinical questions that had arisen for the clinical pharmacologist in his clinical practice on that day. A subsequent meeting of the Reference Group validated findings and impressions gained during prototype testing. Project ran over a period of approximately 18 weeks from the end of July 2008 to end of November 2008.

Example scenario used in prototype testing

Recall for HbA1c result and ongoing diabetes

Jocelyn, 65 year old retiree presenting for review.

History

History includes hypertension and Type 2 Diabetes.

She has no known allergies

Non-smoker, consuming 2 glasses of wine per week and walks daily. Is careful with her diet.

Over the last 6 months, self-monitored daily blood sugars have increased to between 11.0 and 13.0 mmol/L in the last three weeks.

Her HbA1c six months ago was 8.5% but a recent reading two weeks ago was 9%.

Her medications for the past 6 months have been:

aspirin 100 mg daily, perindopril 4 mg daily, metoprolol 25 mg twice daily, simvastatin 20 mg daily, metformin 850 mg three times a day; and gliclazide 120 mg twice daily with food

Current presentation

Examination reveals:

blood pressure is 135/80 mmHg, heart rate regular 65 beats per minute, weight 68 kg, height 170 cm (BMI 23.5 kg/m2), waist circumference 76 cm.

Figure 1: Example Scenario.

2.4. Technology

The tool was implemented in Delphi (7) - incorporating XML, XSL, HTML, JavaScript and CSS - and consisted of four major modules. These are the: User Interface (presents results to the user and allows the user to control the application); Sources (manages searching and presentation of search results); Links (manages links) and Controller (coordinates search activity).

3. Results

Despite our intention to implement in a number of GP systems, our time frame and users' experience led to testing only one system, Medical Director 2® based on this system being that most commonly used by GPs [7]. We report our findings under three headings: information resources, the search tool component and use of data triggers. A screen shot of the prototype is shown in **Figure 2**.

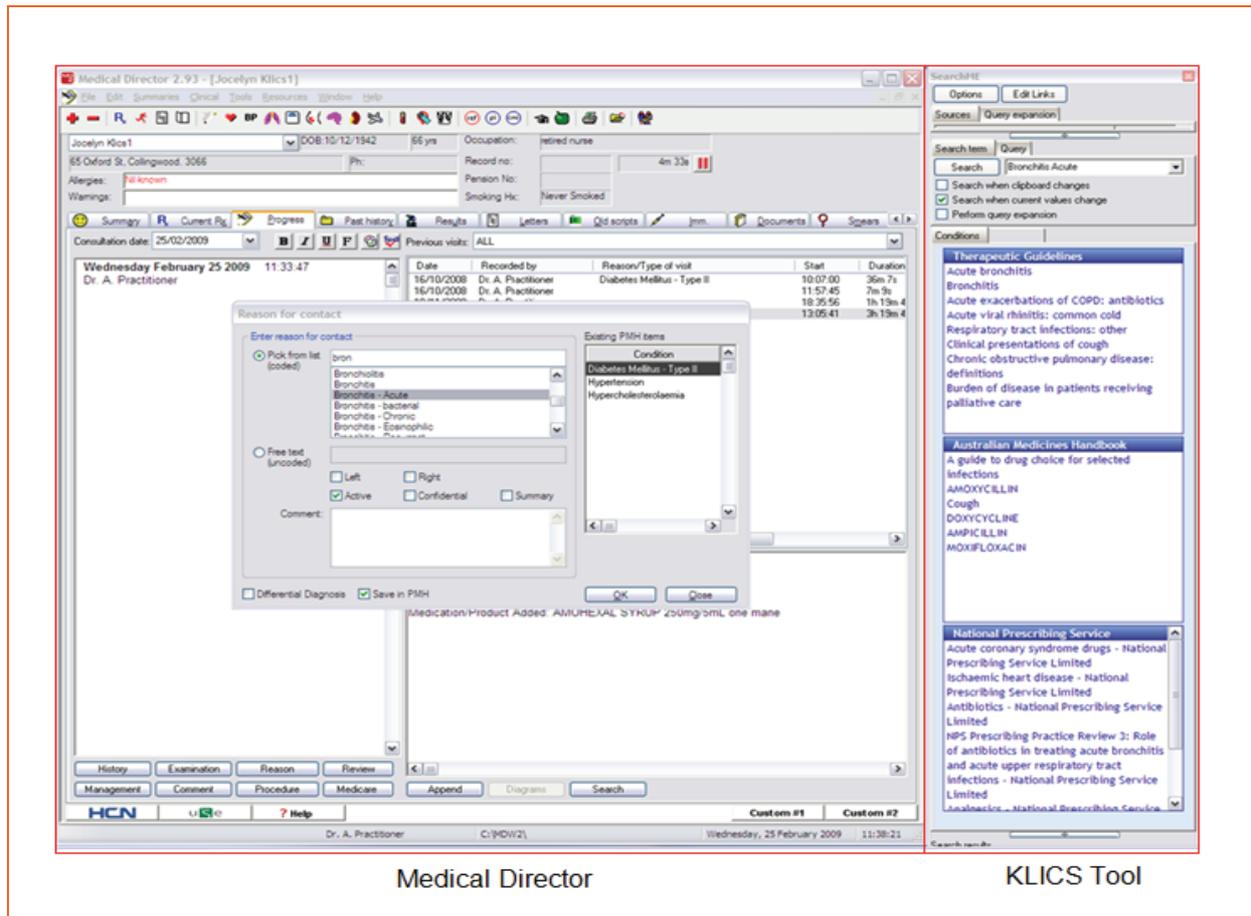


Figure 2: Screen shot of prototype.

3.1. Information resources

Users revealed the information resources generally used in day-to-day practice were those most easily accessed in the clinical software system. However, independent resources were highly regarded and providing increased access to these resources would result in greater usage. Summary information was considered the most useful to the prescribing process and the perceived ‘usability’ of the information in the decision-making context of a patient encounter was very important. The TG, AMH and NPS information were positively viewed as sources that would provide an alternative viewpoint to information already existing in the clinical software.

The nature of information that best suited inclusion in such a tool was that supporting clinical areas of least experience and/or that likely to be updated regularly (e.g. in clinical guidelines). The group identified a ‘wish list’ of information types during the project. A priority area identified was an information resource on complementary medicines.

3.2. The search tool

The search tool was valued in its own right independently of the trigger process, based on the ability to allow a federated search over useful information resources - when the GP decided this was useful. Speed and flexibility were deemed critical factors affecting use. We observed that the frequency of use of the tool use would very much depend on the level of clinical experience and the nature of the patients presenting. For example, a patient with diabetes presenting to an experienced GP would be less likely to result in an information need in contrast to a lesser experienced GP registrar less familiar with this population. It was suggested that although this tool may not have daily use, it would be of value when information needs arose. The impact of the search tool on screen space was not of concern to users.

3.3. Data triggers

The triggers operational in the prototype were ‘new history item’, ‘reason for prescribing’, ‘reason for visit’, ‘diagnosis’, ‘medication’, and ‘immunisation item’. These are terms used by Medical Director® but have equivalent terms in other software systems. In the case of medication,

implementation was different in that there was no list structure (as with other trigger terms) from which the interface could select a data value. However, the search could be triggered by using form header data in a Product Information form, that is, clicking on the 'search' button in the KLICS tool would use the drug name in the title of the Product Information form as the basis for the search.

The main finding of testing these triggers was the significant impact of clinicians' consultation workflow. The ability of these triggers to 'intervene' and provide context relevant information relies on the clinician using the clinical software during the course of the patient consultation. However, much of the patient consultation consists of dialogue with the patient while the clinician assimilates information and moves to a diagnosis. The first encounter with the clinical software is often to order treatment, that is, prescribe medication, bypassing possible triggers. Despite this, users still considered that these may have particular value. For example, a lesser experienced clinician might be more likely to use the software in this way during the consultation

4. Discussion

Despite the availability of evidence-based peer reviewed information resources and value placed on these resources by clinicians; it is clear that accessibility is a key determinant of use. The quality of information resources per se may not in itself guarantee use. Users acknowledged that whatever information resources were the most accessible within the clinical software were most often used - . However, offering evidence-based information resources alongside the clinical software enables easy access to valuable information that complements or augments existing information. Our findings suggest that simply increasing (information) access by one or two steps is met with enthusiasm.

The success of the search tool reported by users was that it maximised the value of a single search term through federated searching. Further, the user must remain in control of interactions (passive presentation is preferable to 'pop-ups' - many GPs may turn these off) - speed, simplicity and unobtrusiveness were emphasised by the group as important. Despite suggestions for prototype enhancements, users themselves decided that it was important to maintain simplicity, rather than add features that would slow the speed of the search.

Delivery of context-sensitive information to users of clinical systems has also been attempted using 'Infobuttons' [10]. These act primarily by providing links to Web-based information resources, usually from common questions which have been identified. Although there are some similarities to our approach, our use of a full text search over generally useful information resources is simpler and less demanding with respect to changing information resources and information needs as there is no need to identify new questions nor (manually) update links.

The investigation of the opportunistic use of data triggers was revealing in how the clinician's consultation workflow influenced the use of this tool - workflow as an important determinant of health technology use has been reported elsewhere [3]. In addition, trigger points may often be turned off by individual GPs. As there may be limited interaction with the clinical software during a patient consultation prior to making a diagnosis, the use of this tool is unlikely to support diagnosis but more likely to help with decisions about treatment. Moreover, treatment could be based on symptoms in light of an uncertain diagnosis. However, where there was a need for diagnostic-related information; individuals were more likely to elect to use the search function.

Interestingly, users felt that improvements in the recording of trigger data elements (e.g. reason for visit) might improve the completeness of the patient record. We also feel that there might be a possibility of influencing workflow over time, as data being available for triggers would mean an increased likelihood of triggers being fired to deliver contextual information rather than requiring a manual search. However, this is a question for future investigation given our experience with the usefulness of triggers.

On reflection, it is interesting to note that many of our findings fit with the '10 commandments' suggested by Bates *et al* (2003) as being important to the design of DSS. Some relevant 'commandments' are:

- 1) Speed is everything
 - 2) Anticipate needs and deliver in real time
 - 3) Fit into the user's workflow
 - 4) Little things can make a big difference
 - 5) Recognize that physicians will strongly resist stopping
- The fact that users would resist performing additional tasks (such as searching for information) during their normal routines was the premise for 'delivering' information to them using triggers.
- 6) Simple interventions work the best
 - 7) Monitor impact, get feedback, and respond
We believe that our prototyping approach to development achieved this aim well.
 - 8) Manage and maintain your knowledge-based systems

The information sources we used were developed and maintained independently of the tool. We believe this separation is important not only to allow independent development of the tool but also to minimize complexity and cost over time as information resources are updated.

5. Conclusion

Although limited by the time frame and the small number of participants, this proof of concept project was successful in achieving its initial intentions and was viewed positively. We conclude that:

- Independent information is valued by GPs and complements information existing in clinical software
- Federated searching over several evidence-based information resources is considered very useful
- Access, simplicity and speed are critical factors that determine overall use
- Workflow will be a major determinant of how a tool is used
- Triggers seem to offer few opportunities for information interventions

The outcomes from this project are first steps towards providing clinicians with independent evidence-based information resources to support decision-making during patient encounters.

6. Future research

The next stage will be a pilot project in GP practices to obtain broader feedback and allow further testing of the tool for usability and robustness.

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Correspondence

Dr. Jean-Pierre Calabretto
Australian Medicines Handbook
PO Box 240 Rundle Mall PO
Adelaide SA 5000 AUSTRALIA
Phone: +61 8 8303 4788
Fax: +61 8 8303 6980
Email: jean-pierre@amh.net.au
<http://www.amh.net.au>