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Is population-oriented IT supported preventive care in general practice feasible? A database study

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Abstract

Background: Introducing a clinical decision support system (CDSS) in general practice that provides broad support based on all available guidelines for preventive care might dramatically increase the workload of a general practitioner. Aim: We evaluated the potential effect on workload of a CDSS that aims to support the whole breadth of preventive guidelines currently used in The Netherlands. Methods: We analysed the guidelines of the Dutch college of General Practitioners (DCGP) for preventive activities, developed a CDSS based on the guidelines and studied the behaviour of the system on real patient data. Results: 20 of the 87 DCGP guidelines contained data on preventive activities which was incorporated in the system. Out of 485 793 patients, the system indicated that for 138 885 (28.6%) a preventive action was needed. Conclusion: A CDSS that aims to support the whole breadth of preventive activities in general practice will have a substantial effect on workload. Further tailoring of the support will be needed.

Keywords:

Clinical decision support, Electronic patient records, Prevention.

Introduction

Prevention is often positioned as a disease-oriented activity (prevention of cardiovascular diseases, prevention of diabetes, etc.). Guidelines are disease or risk specific, resulting in overlapping or sometimes even conflicting recommendations. Disease-oriented organizations typically target a limited set of diseases reflecting their own focus. Continuous medical education is often also characterized by disease orientation when preventive care is discussed. In day-to-day care, health-care workers and even the target populations themselves have to integrate (or select between) the separate preventive activities for the different risks or diseases, and, in the context of what is locally feasible, and merge these preventive activities with other activities (such as curative care). Faced with limited resources, a general practitioner, for example, may have to decide whether preventive activities in the context of diabetes should take priority over prevention of cardiovascular diseases.

Research in the past years has shown that Information and Communication Technology (IT) is able to support practitioners and changes physicians' behaviour [1, 2] Already in 1989, the first review paper that also included IT-based interventions suggested that of all known interventions, computer-supported interventions were most effective and costs efficient [3]. In subsequent years, randomized trials studied the impact of IT-based interventions. As a result, most researchers will now accept that IT can play an important role in the implementation of guidelines[4]. IT has also been successfully used to support prevention [1, 4].

The use of IT in the context of prevention has been characterized by a disease-oriented approach. The resulting software modules are aimed at supporting a practitioner in an individual disease domain - resulting in separate, individual software applications. In the Netherlands [5], for example, the general practitioner is confronted with a range of separate modules: a software module for cardiovascular screening, another module for diabetes, yet another for influenza vaccinations, still another for cervical smears, etc.. The general practitioner often decides to focus on just a few diseases (for example, cardiovascular disease), and uses the software available for that disease. That choice for a given domain, however, may have as consequence that another disease or risk will receive less attention. Ideally, the practitioner should tailor, within the constraints of available time and possibilities, preventive activities to the local population. This process of tailoring to the local population needs to be informed by both the total set of possible preventive activities and the specific characteristics of the local population [5]. In a resource-limited setting, allocation of resources should be a careful and explicit decision based on local circumstances. At present, IT tools typically do not aid the practitioner in selecting, from all the possible preventive activities, the most suitable to his or her population. The need to develop an intervention strategy that enables an individual practitioner to tailor preventive activities to his or her local population and local circumstances is often ignored.

Our objective is to assist the practitioner with the whole range of possible preventive activities and subsequently aid him or her in tailoring these activities to his or her own local circumstances. The first step in this approach is to confront the practitioner with the consequences of all the available guidelines. That is, not until the physicians has realised what it would mean to actually conduct all these activities will he or she be confronted with the limitations posed by their own environment (e.g. financial constraints, limited time available, or patient compliance). Guidelines are often developed as individual guidelines, but the consequences of a collection of guidelines with the resulting possibly exponential growth of activities are typically not studied. In order to gauge the consequences of implementing a collection of guidelines, we need to gain insight in the actions that will need to be performed once the IT intervention is implemented.

Various authors have described critical success factors when introducing any computerized decision support system (CDSS) into daily practice[1, 6]. These include integration of the software with the electronic patient record, performance and enabling general practitioner workflow. It is, however, interesting to observe that the consequences of a CDSS on workload are often not addressed. The fact that the introduction of decision support carefully tailored to workflow might have as a consequence a prohibitive increase in workload is of ten not considered.

In this paper we evaluate the potential effect on workload of a CDSS that aims to support the whole breadth of preventive guidelines currently used in The Netherlands.

To understand the consequences of a CDSS supporting all the available preventive actions in guidelines, we first need to analyse the guidelines, secondly need to develop a system based on the guidelines, and, finally, based on actual medical records, study the behaviour of that system based on real patient data.

The objective of this study is to understand the practical consequences the CDSS would entail if physicians would introduce the system in daily care.

Materials and Methods

Design overview

Our study analyzed the guidelines of the Dutch College of General Practitioners (DCGP) on preventative activities, formalized the recommendations into a CDSS framework, and studied the recommendations of the CDSS based on the electronic patient records of general practitioners.

CDSS knowledge base

In the Netherlands the DCGP publish and maintain evidence based guidelines for use in the Dutch setting [7]. The guidelines have a high acceptance and penetration amongst Dutch general practitioners. The guidelines advise on actions that a GP should undertake in the presence of a trigger factor. A trigger factor can be previous diagnosis, physical exam results, measurement values, or more difficult, a combination of any of the above.

If a trigger factor is present, the guideline suggests any of a number of actions to perform; Table 1 lists the possible actions.

Table 1- Definition of activities needed in prevention

Type of action	Definition of action
Diagnosis	Capture a specific diagnosis in the presence of absolute values
Medical History	Capture a value needed to complete a risk profile or set a diagnosis
Physical exam	Capture a value related to the physical examination a of a patient
Laboratory investigation	Request a laboratory investigation
Medicine	Prescribe or change medication
Referral	Refer the patient to a specialist
Patient action	Advise patient on actions that can be objectively measured

A limiting factor of electronic patient records is that not all patient data will be available in a coded, structured format. Data, for example, may be available only in free text. That is, a guideline might refer to a medical condition that can only be recorded in text. In order to integrate the CDSS with the commercially available electronic patient records and existing workflows, we focus on data that is available in a coded (e.g., diagnosis, laboratory values or prescriptions) or structured (e.g., system-specific defined coding schemes) fashion. That is, we did not include free text analysis to mine for data not available in a coded or structured fashion. As a result, sections of guidelines that refer to data not available in a coded fashion were ignored.

Patient data, setting

To study the consequences of the CDSS, we conducted a retrospective cohort study in the Integrated Primary Care Information (IPCI) database. IPCI is a longitudinal GP research database, which contains information from computer-based patient records of GPs in The Netherlands. Within The Netherlands, patients are registered at single GP and the record for each individual patient contains all medical information on that patient [8, 9]. The database contains information on approximately 500,000 patients.

The computer records contain information on patient demographics, symptoms (including free text), diagnoses (using the International Classification for Primary Care (ICPC)), episodes, referrals, laboratory values, measurements (e.g. BP, cholesterol levels), drug prescriptions with their ICPC-coded indications, and hospitalizations [10, 11]. Summaries of the hospital discharge letters or information from specialists are available in a free text format. To maximize completeness of the data, GPs who participate in the IPCI project are not allowed to use paper-based records. The system complies with

European Union guidelines on the use of medical data for medical research and has been proven valid for research [12].

Participants

The sample date in IPCI was July 1st 2008. The source population comprised all living patients, with at least one year of valid history (that is, the patient had to be alive on July 1st 2008, and registered in that practice prior to July 1st 2007). All subjects were evaluated from the earliest of the following dates: one year of valid history, or birth.

Outcome measure: Recommended Preventative actions

Data from IPCI were submitted to the CDSS. We established whether any patient in our cohort had any of the identified trigger values available that should lead to a preventative action by a GP. When a trigger value was present we evaluated if the action had been performed. We thus counted the total number of actions needed as an indicator of the clinical workload needed to perform preventative activities recommended by the guidelines.

RESULTS

Knowledge Base

We analyzed all of the guidelines of the DCGP up to 31 March 2007 [7]. Of the 87 guidelines, 20 contained trigger factors and related recommendations relevant to preventative activities that could be determined based on coded or structured data. The recommendations in the guidelines could not be translated to coded or structured data were ignored. For example, the guideline on asthma for adults contains a reference to the patient feeling a shortness of breath over the last month. This information, however, cannot be captured in a coded or structured fashion in the available Dutch systems. As a result, such instances in guideline were not included.

Preventative Activities

The electronic patient records of 103 GP practices with a total valid population of 485 793 patients (females 247 557, males 238 087) were submitted to the CDSS.

Of these 485 793 patients, the CDSS generated for 138 885 patients (28.6%) recommendations to perform one or more preventive action(s). Of the 247 557 females, the CDSS generated for 71 944 patients (29.1%) one or more recommendations. Of the 238 087 males, the CDSS generated for 66 941 one or more recommendation (28.1%).

For an individual patient, the CDSS could recommend a range of preventive action to be taken (see Table 1). Table 2 shows the number of patients requiring actions recommended by the CDSS.

As shown in Table 2, a total of 1092 patients had sufficient information in the electronic patient record to assign a diagnosis whereas 138 885 required the inclusion of the results of a physical examination. It is interesting to observe that in total 40 113 patient needed some form of modification of the drug prescription, whereas 64 006 needed laboratory tests.

Discussion

We built a CDSS that support preventive care in general practice, and we studied the potential impact on the workload by submitting electronic patient record to that CDSS.

We observe that approximately one third of all registered patient in the GP practices required some form of preventive actions to be undertaken. The percentage of preventive actions to be undertaken varied slightly between males and female (28.1% versus 29.1%). Our first conclusion is that if a GP was to use the CDSS it would have a significant impact on the workload that that physician. We would argue that our finding that so many patients would be eligible for additional preventive care highlights the need to tailor the workload the locally available resources.

In the design of the CDSS we limited ourselves to those recommendations that could be firmly concluded based on coded or structured information. That is, we ignored a number of recommendations that could not be reliably concluded from the data available in the medical record. As a result, our estimate of the workload might be an underestimate; if we were to include the currently ignored section of the guidelines, a further increase in workload would ensue.

It is important to underscore that our finding that the workload to GP increases significantly does not constitute a value judgement on the medical content of those guidelines. We merely argue that the designer of a CDSS faces the issue of the practical consequences of implementing of a collection of guidelines when these guidelines were never considered as a whole. The collective impact of the different guidelines may result in a situation that the CDSS is destined to fail because the consequences of translating the guidelines into actions cannot be dealt with within in the constraints of day-to-day care. We also propose that designers of CDSS should include in their endeavours to introduce decisions support in daily care some form of impact analysis that would aid in gauging the practical consequences of their system without having to decide on the medical content of the guidelines involved.

Limitations

Our study suffers from a number of fundamental limitations that need to be stressed in order to avoid misinterpretation.

Firstly, the general practitioner is not the sole provider of care. It is quite possible that some of the preventive care is proved by secondary or tertiary care providers. That is, the absence of a preventive action in the GP record does not necessarily mean that the action has not been conducted. It is important to stress, however, that if the CDSS would be introduced in the GP practice, the recommendation would be given to the GP. Although the actions might be supervised by some else, the GP would be confronted with the need to determine whether the activity had been performed. Secondly, although the CDSS requires coded or structured data, the GP might have recorded data in free text. If the GP records data in free text, we will not have identified that data. As a result, we could have overestimated the workload proposed by the system.

Table 2- The number and type of actions identified by the CDSS by gender

	Male		Female		Total	
	n	(%)	n	(%)	n	(%)
Total number of patients with actions	66941		71944		138885	
Actions by type						
Diagnosis	532	(0.8)	560	(0.8)	1092	(0.8)
History	43017	(64.3)	45919	(63.8)	88936	(64.0)
Physical Exam	66941	(100.0)	71944	(100.0)	138885	(100.0)
Laboratory investigation	31509	(47.1)	32497	(45.2)	64006	(46.1)
Medicine	21552	(32.2)	18561	(25.8)	40113	(28.9)
Referral	1137	(1.7)	1092	(1.5)	2229	(1.6)
Patient action	7046	(10.5)	5969	(8.3)	13015	(9.4)

Conclusion

We believe that out study is the first that address workload that will result from implementing a set of guidelines focusing on preventive activities in general practice. The workload that will result from the preventive activities, even in the most optimistic scenario, is substantial. We propose that further tailoring is needed in the activities, for example by disease profile. We aim to pursue this tailoring in the SUNRISE trial.

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References

[1] Garg AX, Adhikari NK, McDonald H, Rosas-Arellano MP, Devereaux PJ, Beyene J, et al. Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: a systematic review. JAMA. 2005 Mar 9;293(10):1223-38.

[2] van Wyk JT, van Wijk MA, Sturkenboom MC, Mosseveld M, Moorman PW, van der Lei J. Electronic alerts versus on-demand decision support to improve dyslipidemia treatment: a cluster randomized controlled trial. Circulation. 2008 Jan 22;117(3):371-8.

[3] Soumerai SB, McLaughlin TJ, Avorn J. Improving drug prescribing in primary care: a critical analysis of the experimental literature. Milbank Q. 1989;67(2):268-317.

[4] Grol R. Successes and failures in the implementation of evidence-based guidelines for clinical practice. Med Care. 2001 Aug;39(8 Suppl 2):II46-54.

[5] Knottnerus JA. The Role of the Electronic Patient Record in the Development of General Practice in the Netherlands. Methods of information in medicine. 1999;38(4/5):350-4.

[6] Kawamoto K, Houlihan CA, Balas EA, Lobach DF. Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. BMJ. 2005 Apr 2;330(7494):765.

[7] (NHG) DCOGP. NHG standaarden. 2007 [cited 2007 31 March 2007]; Available from: http://nhg.artsennet.nl/kenniscentrum/k_richtlijnen/k_nhgstandaarden.htm

[8] Schrijvers AJP. Health and Health Care in the Netherlands. A critical self-assessment of Dutch experts in medical and health sciences. Utrecht; 1997.

[9] Van der Lei J, Duisterhout JS, Westerhof HP, van der Does E, Cromme PV, Boon WM, et al. The introduction of computer-based patient records in The Netherlands. Annals of internal medicine. 1993 Nov 15;119(10):1036-41.

[10] Lamberts H, Oskam SK, Hoffmans-Okkers IM. Episodegegevens uit het Transitieproject op diskette. De gebruiksmogenlijkheden van TRANS. Huisarts en Wetenschap. 1994;37(4):421-6.

[11] Anonymous. ATC and DDC values. Geneva: WHO; 1996.

[12] Vlug AE, van der Lei J, Mosseveld BM, van Wijk MA, van der Linden PD, Sturkenboom MC, et al. Postmarketing surveillance based on electronic patient records: the IPCI project. Methods Inf Med. 1999;38(4-5):339-44.

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