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A New Quality Improvement Study Every Day? Using QTools to Build Quality Improvement Projects Around Primary Care Electronic Medical Record Systems

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Abstract

Greater and more appropriate use of information technology has been proposed by the US Institute of Medicine as one way in which the quality of health care can be improved. Electronic medical record systems offer particular advantages because they can support clinicians at the point of care as well as allowing patient care to be monitored over time. Developing quality improvement tools that make use of the electronic medical record can, however, be difficult and often requires special software. This paper describes a system called QTools that provides a range of general-purpose tools to support quality improvement work in Norwegian primary care. The paper discusses how QTools has been used in two studies involving over 100000 patient consultations and how it is supporting current work to improve the prescription of anti-hypertensive drugs. Features that have not yet been used in a quality improvement study are also discussed.

Keywords

Medical record systems, computerized; quality of health care; primary health care.

Introduction

Spending on health care, private and public, is growing faster than GDP in most rich countries. The USA leads the way: in 2001, it devoted almost 13.9% of output to health care. Norway spent 8.3% while the average for the European Union was 7.7% [1]. This is not surprising: as populations and countries get richer and older, they naturally want to spend more on health, as on other services. But governments and insurers are becoming much more interested in getting value for money, while patients among others are demanding more consistently high quality care. In the USA for example, the Institute of Medicine has written that there is not a gap but a chasm between the health care available and the health care that could be available [2].

The same authors recommended that information technology be used to much greater effect to improve the delivery of health care [2]. Electronic medical record systems (EMRS) in particular can help because they offer many possibilities for monitoring and improving the quality of care [3-7]. They can be a good source of routinely collected data and offer the possibility of studying population data collected at the patient level. Such data could, for example, be used to compare the patient profiles of individual practices, assess the health needs of various populations or to monitor the implementation of health policy. EMRS can be used to provide reminders, guidelines, on-line patient educational materials and decision support tools, interventions that can help to increase quality and reduce errors [8,9].

This paper describes a system called QTools that provides a range of general-purpose tools to support quality improvement work in Norwegian primary care. It is linked to the EMRS and is being developed by the Norwegian Centre for Health Services and the software company Mediata AS.

Materials and Methods

Electronic medical record systems in Norway

At least 90% of general practitioners in Norway use an EMRS [10]. There are essentially only three EMRS being used in Norway: Winmed, Profdoc Vision and Infodoc. All three systems are designed as multi-user systems to be run on a local network.

General practitioners and other practice staff use these systems during most contacts with patients and certainly during face-to-face consultations. Some of the data stored within the medical record is coded or standardised, other fields are left as free text. The International Classification of Primary Care (ICPC) system, for example, is used to code diagnoses and symptoms and is used in all Norwegian EMRS. ICPC also has process codes, which include diagnostic and therapeutic interventions. The Anatomical Therapeutic Chemical classification system is used to classify drugs. Some electronic messaging is also supported by the EMRS, for example, many hospitals can return the results of laboratory tests to practices electronically.

The QTools system

QTools is a collection of tools that aim to make it easier to use EMRS for quality improvement work. It currently runs with the Winmed and Profdoc Vision EMRS, with support for Infodoc planned. QTools has been developed in Visual Basic 6 and communicates with Winmed's FoxPro database or the Oracle database used by Profdoc Vision. QTools is separate from the EMRS but is installed in the EMRS folder on the server allowing each member of practice staff to access QTools from his or her own computer from the Windows Start button. A user can be a clinician, researcher or a member of an organisation with an interest in quality improvement work, for example a patient organisation or a professional association. To date, however, users

have primarily been researchers and the clinicians taking part in their research studies.

QTools is organised around Project groups, Projects and Programs. An overview of the QTools system is shown in figure 1, together with examples of projects and programs. A project group could be a collection of projects developed by a single organisation or a collection of projects that share a theme. Each project comprises one or more programs. QTools has five basic types of program:

- Extraction sheets
- Information pop-ups for the clinician
- Patient educational materials
- Supplementary data collection forms
- External programs

All QTools' project groups, projects and programs are managed via an administration system. With the exception of external programs, QTools programs are developed using a word processor or Microsoft Access (see below) and are currently loaded into QTools via floppy. For suites of programs developed for a particular condition (eg. treatment of diabetes) it is likely that a single diagnosis code will trigger more than one program. The administration system allows the user to set the priority of programs so that they are triggered in the order the user wants; he or she can also switch off programs.

Extraction sheets

Extraction sheets are created using a tool within QTools that lists the EMRS fields and other information such as the period to be covered by the extraction. The user selects the EMRS fields he or she wishes to extract and then sets selection criteria should these be required. Selection criteria use EMRS fields and make it easy to select groups of patients, eg. men over 60 with diabetes. Data can be extracted for a fixed or for a relative period (eg. the last year, starting from today) and data can be extracted for a whole practice or for a single clinician. Extraction sheets can be run together as extraction packages comprising two or more sheets or collected in libraries.

A user can choose to store extracted data as either flat ASCII or as a Microsoft Access database. These files are stored in a folder called 'Data' that is stored in the Mediata application folder, which in turn is located in the EMRS folder on the practice server. The user can also select one of three levels of anonymisation (patient completely anonymous, EMRS patient number and, finally, unanonymised). Finally, users can choose to transfer data to a floppy after extraction; data are compressed to .zip format prior to transfer. The use of floppies is necessary because of legal restrictions on the use of email and Internet on machines linked to the EMRS. Although secure health networks are being introduced only a small minority of general practitioners currently use them.

Information pop-up for the clinician and Patient educational materials

Information pop-ups for the clinician and patient educational materials are ways of providing reminders, guideline information and patient educational information at the point of care. Both are created using a word processor that supports the Rich Text format. These resources are linked to a diagnosis code and are 'triggered' when the clinician enters this code during the consultation. Tags are used to tailor information to an individual patient and to define the trigger. For example, to make a patient educational leaflet for influenza trigger on the ICPC diagnosis code for influenza (R80) or influenza-like illness (R801) requires:

#D#R80,R801

at the beginning of the Rich Text document. To make a sentence appear only if the patient is over 75 requires the line:
#Age>75#Text that will appear for patients over 75

The clinician prints out patient educational material for the patient and can choose to print out pop-ups that are meant primarily for the clinician. Simple clinical guidelines and reminders, which can be linked to a diagnosis code and tailored to the patient's age, sex, current drugs and to the time of year, can therefore be developed within a Rich Text document, saved onto floppy and loaded into QTools via the administration system.

Supplementary data collection forms

Supplementary data collection forms are created using Microsoft Access. The user can define new fields, add validity checking and define the trigger. As with the other elements of QTools, the trigger is currently limited to a diagnosis code. An additional condition can also be attached to the form, for example that the patient must be male, or under 17 years of age. Five fields can be defined per form and the forms can be run in series if required. Norwegian regulations do not allow these data to be stored in the EMRS so they are stored in a separate database in the Mediata application folder. The clinician has the option, however, of pasting the information into the patient's medical record.

External programs

An external program can be any Windows .exe file. These are not triggered automatically but are run from the QTools administration system. The ability to run external files means that special programs can be developed to support projects when QTools' more general tools are not sufficient.

Examples of use

QTools has been used in two research studies [11, 12] to extract data. In the first ('Best Possible Practice') QTools was used to extract data to evaluate an intervention for the treatment of sore throat and urinary tract infection. This national project aimed to support the implementation of Norwegian best practice guidelines for the treatment of these two conditions. In the second, QTools was used to study the completeness of some aspects of the EMRS. A third study, 'Rational Prescribing in Primary Care (RaPP)' [13] used QTools to extract data and manage two external programs. RaPP also uses elements of QTools to provide patient educational materials although these are not delivered via the QTools application. Once again, the project aimed to support the implementation of best practice guidelines.

In the 'Best Possible Practice' study [11] QTools was installed by practice staff and ran without problems at 113 of 120 general practices, the remaining seven practices had problems that were not solved during the lifetime of the study. Each of the 113 practices used QTools to export their anonymised data as an Access database to one or more floppies, which were then posted to our research group. More than 90% of the practices generated files that were less than 1.4 Mb. The databases were then combined manually for analysis. The problems experienced by the remaining seven practices were generally due to conflicts between QTools and other applications or disk problems. Data were extracted for a total of 26826 consultations and were used to show that the intervention had no significant effect on clinical practice. In other words, QTools helped to show that use of the guidelines was not supported by the intervention package. The second study [12] involved 14 practices around Oslo. QTools ran without problems at all 14 practices and extracted data for more than 100000 patient contacts. The study showed that Norwegian EMRS are often not used in the way that manufacturers intend them to be used, which has implications for interventions based on the content of the EMRS such as decision support. It also showed that the prescription of anti-hypertensive drugs did not follow best practice. The large international ALLHAT trial [14] showed that thiazides should be the first choice anti-hypertensive drug for uncomplicated hypertension. However, thiazides accounted for just 4% of such prescriptions at the 14 practices as shown in table 1. This information helped to initiate the RaPP study.

The RaPP study required QTools to be installed and run at around 120 general practices. QTools gave clinicians access to two programs. The first ran a study-specific data extraction that could not be done within QTools itself and which then transferred the data to QTools' general extraction system for compression and transfer to floppy. The second program converts a patient identifier to patient initials and date of birth. This is necessary because research staff will need to follow up specific patients but are not allowed to collect patient-identifiable data. Once the clinician has the patient initials and date of birth, he or she is able to answer a few simple 'yes/no' questions regarding whether risk assessment for heart disease was done prior to the initiation of treatment. By packaging these programs as part of QTools, clinicians can find and run them easily from the QTools administration system.

Table 1: Anti-hypertensive drugs prescribed at 14 general practices in Oslo. Data based on 3561 prescriptions to 1595 patients.

Drug	Mean % use	95% confidence interval
ACE inhibitors	26	19 - 33
Alpha channel blockers	3	2 - 5
Angiotensin II antagonists	25	14 - 35
Beta-blockers	19	14 - 23
Calcium channel blockers	23	18 - 29
Thiazides	4	2 - 6

The data from each practice were combined in a similar way to in the 'Best Possible Practice' study. By early 2004 data had been obtained from all but three practices and analysis had begun. QTools is, therefore, helping to show whether a complex intervention to improve the treatment of hypertension has achieved its goal. This is how we foresee QTools supporting quality improvement: by providing data that can be used for evaluation and by providing tools that can form part of an intervention package.

Discussion

Information technology has a great deal of untapped potential for transforming healthcare delivery and central to many information technology applications is the automation of patient-specific clinical information [2]. Quality improvement will increasingly become an ongoing activity that occurs as care is being provided and is part of routine care [8]. There is evidence to support the wider use of information technology. The provision of support and reminders at the point of care generally improves decision-making and adherence to best practice [9, 15] although it is not universally effective [11]. Computer-generated patient educational materials, apart from enabling patients to play a greater role in their own care, seem to also have a small, positive effect on professional practice [16].

There are, therefore, grounds to believe that EMRS should be used more actively for quality improvement work. The very high use of EMRS in Norwegian primary care is an excellent starting point but relatively little use has been made of this resource for quality improvement and research. QTools is a tool that can help. It offers a number of core tools that are likely to be of use in most quality improvement and research studies while being flexible enough to run study-specific programs that perform functions not possible within QTools itself. The extraction system in particular has already shown itself to be both powerful and easy to use [11, 12]. The RaPP study [13] will use another element of the QTools system, the administration system. The information pop-ups and patient education material parts of QTools will be used in future studies.

A strength of QTools is that a practice can build up a library of projects and programs over time, either independently or in association with other organisations. Moreover, an individual clinician can add his or her own programs and generally tailor QTools to his or her own requirements. Giving users control over the software installed on their machines, particularly with regard to reminder and pop-up systems, has been recommended for good user-centred design [17].

QTools is still under development and has a number of weakness, not least of which is that only diagnosis codes can be used to trigger programs. The data extracted by the software are also not currently presented to users in a way that is immediately easy to interpret. These and other weaknesses will be addressed in the future. The administration and extraction systems are, however, now sufficiently developed for our industrial partner Mediata AS to be considering commercialisation. This would widen the user base from primarily researchers to clinicians hoping to monitor and improve the quality of their own care provision.

Conclusion

General practice EMRS have a great deal of potential for quality improvement work and QTools is a flexible system that helps to

exploit this potential. It gives a clinician a great deal of control over the quality improvement projects installed on his or her computer and allows quality improvement to become a routine activity. We expect QTools to continue to make a valuable contribution to the improvement of Norwegian general practice.

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