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Monitoring Clinical Pathways

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Abstract

This paper describes the development of a monitoring system for Clinical Pathways. Data are collected from existing data sources, which proved much more efficient than manual data collection. The DBC, the recently introduced Dutch equivalent of the DRG, proved to be a useful data source. With the system it is possible to monitor several indicators for a given pathway.

Keywords:

critical pathways, quality indicators, total quality management, information storage and retrieval, diagnosis-related groups

Introduction

Health care organizations are seriously challenged to deliver cheaper and better services. To achieve this goal, improvement programs are launched on the local or national level. An example of a national improvement program is 'Sneller Beter', Dutch for 'Quicker Better', which was launched in the Netherlands in 2004 [1]. The program started out in 8 hospitals, with 16 more in the following two years. These 24 hospitals were selected to set examples of good practice for the other 80 hospitals in the Netherlands.

Improvement requires measurement[2]. In all quality improvement methods, like Six Sigma or TQM [3], measuring plays an important role. Measuring can be done either manually or with the help of a computer. Of course, if automation is possible, this will be much more efficient [4].

A widely accepted method of improvement of hospital care is the implementation of Clinical Pathways. Clinical Pathways (also referred to as Critical Pathways or Care Paths) are multi-disciplinary plans of best clinical practice for specified groups of patients with a particular diagnosis that aid the coordination and delivery of high quality of care [5]. Just like other improvement methods, this method requires measurement to assess the standards of care as they evolve during and after the Clinical Pathway implementation [6].

In the Netherlands, the interest for Clinical Pathways was boosted by the 'Sneller Beter' improvement program. Many hospitals have started to develop Pathways within or outside of the 'Sneller Beter' program. However, many hospitals also struggle with the measurements that are needed. If this is done by hand, this poses a serious question to available resources. What if this could be automated?

The VUmc Hospital is one of the eight hospitals that participated in Sneller Beter from the very first start. The question of automation of measurements for Clinical Pathways came up at the end of 2005, when several Pathways were implemented, but there was no permanent monitoring of results, because manual data collection was too labor-intensive.

In this article the method of constructing such an automated monitoring system is discussed, with the difficulties encountered, and the results are shown.

Methods

The construction of a monitoring system for Clinical Pathways comes down to the following steps:

1. Selection of patients
2. Calculation of indicators
3. Presentation of indicators

An additional step is necessary beforehand, if the data that is going to be used is not available in an easy-to-access database. In that case extractions need to be built, to load the data from one database into another. In the VUmc we could use the hospital data warehouse, therefore this extra step was not necessary.

The three steps will now be discussed in more detail.

1. Selection of patients

Many hospitals implement Clinical Pathways, but do not run an automated Clinical Pathway planning system. The VUmc is not an exception. This makes the first step of building a monitoring system the hardest one. Which patients are 'in' the pathway, and which patients are not? Only if a correct patient selection can be made, it is possible to calculate indicators for these selected patients. There are several data sources available to solve this question. In the VUmc we used the recently introduced DBC, the Dutch equivalent of the DRG. DBC stands for Diagnosis Treatment ('Behandeling' in Dutch) Code. Linking DBCs/

DRGs to Clinical Pathways is not uncommon [7]. Table 1 shows the items which are included in the DBC registration. An exception is the last item, the DBC Profile. This is a collection of procedure data, which is automatically linked to a DBC by a special algorithm. We include it here, because we will discuss its usability for the monitoring system.

Table 1 - DBC items

Item	Description
Patient ID	Unique patient number for the VUmc hospital
Treating Medical Specialty	E.g. internal medicine, gynaecology, orthopaedic surgery
Opening date	The date of the first encounter with the medical specialist
Closing date	The date the specialist refers the patient back to the GP or to another specialist
Type of Patient	Either new patient or known patient
Diagnosis	A classification of the disease of the patient, on a slightly higher level of granularity than ICD9 or ICD10
Treatment	Depending on the specialty, e.g. operation with hip replacement. This item includes the setting, e.g. inpatient or outpatient
DBC Profile	all the necessary procedures which were applied for this patient, between opening date and closing date, for this medical specialty. On the basis of the DBC profile, the hospital is able to calculate the average cost of a certain DBC.

For the patient selection, the items Treating Medical Specialty, Opening Date, Type of Patient, Diagnosis and Treatment were used. Only "new" patients were selected, and for some pathways only those patients with an inpatient treatment.

The dashboard shows the results only for patients from the current year, therefore selection is also made on Opening date.

For every particular pathway, the selection criteria of DBC-items should be identified that match the pathway. However, this is not a single-step-process. After a first selection is made, the selected patients should be matched with some other data source. In the VUmc it was possible to use spreadsheet-administrations of nurses who had been assigned this task. If there is no matching data source available, then a doctor or nurse who is strongly involved in the Clinical Pathway should check the DBC patient selection. This matching process can be the basis for a refinement of selection parameters. After a new selection is made, the result should be validated again. The process repeats itself until a sufficient level of confidence in the DBC selection method is reached.

The results of the matching process in the VUmc will be discussed in the results section.

2. Calculation of indicators

There are several types of indicators for Clinical Pathways [8].

The most important are Clinical, Financial and Process indicators. In the Sneller Beter program, process indicators were the main focus of the CP development. Examples of indicators are waiting time for an operation and length of stay.

Many of the indicators are shared between Clinical Pathways. This means that if an indicator is developed for one Pathway, it can be used by many other Pathways, if appropriate patient selection is applied.

We searched the hospital database for appropriate data items.

One of the difficulties encountered here, was that Clinical Pathways are, in fact, multidisciplinary. Therefore it was not possible to use only procedure data from the DBC profile. DBCs are monodisciplinary, so only procedures from a single medical specialty are part of it. For this reason, database selection needed to be extended beyond the DBC data.

Table 2 shows indicators and data sources from which they can be drawn.

Table 2 - Indicators and data sources

Indicator	Data sources
Access time to first encounter with specialist	DBC Opening date, Outpatient planning system
Time to diagnosis	DBC Opening date, Procedure data
Number of visits before admission	Procedure data, ADT data (admission-discharge-transfer)
Waiting time for admission	Inpatient planning system
Length of Stay	ADT data
Time between diagnosis and surgical operation	Procedure data, operating system data
Time between diagnosis and radiotherapy	Procedure data
Costs	DBC profile
Readmissions	ADT data

Of course, similar as with the selection of patients, the quality of the data sources should be checked before they can be used. If, for instance, procedures are not properly coded in the hospital, a lot of these indicators cannot be calculated. Fortunately in the VUmc the quality of these data sources was sufficient. The ‘Costs’ indicator was limited to the costs of the DBC, used for the patient selection.

For some indicators the problem is not data quality, but simply the availability in electronic format. This was the case for the indicator 'number of complications'. The VUmc does not yet run an organisation-wide complication registration system.

The indicators are first calculated per patient, and then an aggregation is made to the level of the Pathway. The aggregates are calculated on the basis of

- median values (e.g. waiting times, length of stay)
- percentages (e.g. operated patients, readmissions)
- totals (e.g. number of patients in the pathway)

3. Presentation of indicators

We developed a dashboard based on Cognos [9] and HTML technology. For management information, this type of dashboards already existed in the VUmc hospital, showing indicators like production rates, absence ratio of personnel and average waiting time for admitted patients. This dashboard is accessible through the intranet. An important feature of the system is the possibility to enter target values, e.g. a length of stay of 4 days. If reality shows that the median value for length of stay is more than 4 days, a "red flag" is shown, indicating that length of stay is above the target level.

In the results section three screen examples are shown.

Results

At the time of writing of this article (November 2006) dashboards have been developed for three Clinical Pathways, Head-Neck Oncology, Carotid Surgery and Abdominal Aorta Aneurysm repair. These Pathways showed a good agreement between manual and automated (DBC) data sets.

An important finding was the fact that manual data collection did cost the nurses, who were assigned this task, up to 4 hours a week for a single Pathway. The development of the dashboard system for the three Pathways did cost about 200 hours (mainly from the first author, a database specialist).

We show three examples from the application. The indicator values which are shown are not completely based on reality, but are only provided for illustration purposes.

Figure 1 shows an example dashboard for head-neck oncological patients. The report shows three subsections: Financial, Logistics (which contains the most indicators) and Clinical. Every indicator line displays name of the indicator, target value, current value and previous value. At the right part of the screen there are 2 hyperlinks, which give access to additional information.

Figure 1 –Monthly overview of indicators for a certain Pathway

Figure 2 shows an example of what shows up from the first hyperlink, a bar chart of indicator values for all the individual patients in the Pathway. This particular graph shows the number of visits to the outpatient clinic, before admission. This graph gives a good insight in the number of outliers. Notably, not for all patients a value is presented. This is due to the fact that for this Pathway included patients do not need an inpatient period. If no inpatient period is found, then the indicator “Number of visits until admission”, can not be calculated for this particular patient.

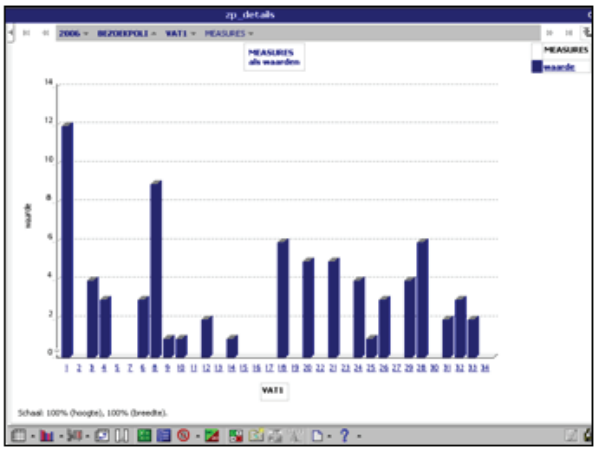

Figure 2 -Indicator scores per patient

Figure 3 shows the development of a certain indicator through the year, together with the target value (horizontal line). The values are based on aggregates (median values) for all patients from January up to the specific month. This example shows the access time for the outpatient clinic, which was seriously improved, but on aggregate still remained above the target of 7 days.

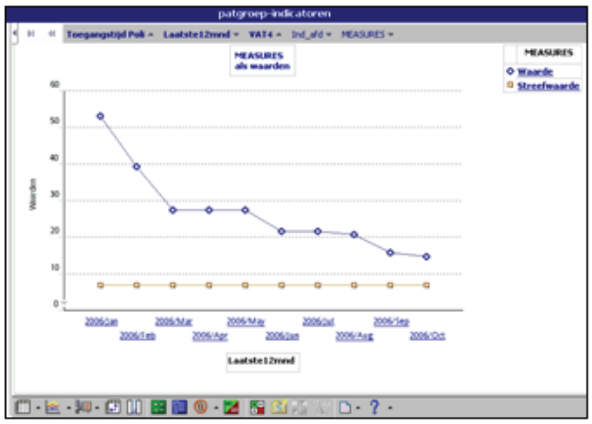

Figure 3 – Development of indicator through the current year

Discussion and future developments

From the hours estimated necessary for manual versus automatic data collection, it is clear that the investment in developing a system for automatic data collection is quickly returned. If for the three Pathways we estimate 10 hours of work a week by a nurse, then the 200 hours by the database specialist are returned in just 20 weeks. Moreover, the system can be used for additional Pathways, which will lower the cost per Pathway. As we described in the method section, once an indicator is developed, it can be used by all the Pathways defined in the system. However, additional effort will always be necessary for the first step of the process, setting up the right criteria for patient selection. The VUmc is planning to develop more than 100 Clinical Pathways in the coming five years.

A difficulty with the system is that it is not completely clear who its users are. Primary users of dashboards in general, are those who are responsible for the particular management unit. Because Clinical Pathways are multidisciplinary, it is not always easy to find an 'owner' of the Pathway, who is also a primary user of the monitoring system. This management question is still to be addressed by VUmc senior management.
Secondary users, who have an interest in the Pathways, but are not primarily responsible, are for example quality assurance staff, who are assisting with Clinical Pathway development, and senior management.

The system was first developed in the VUmc hospital, but another hospital, the Atrium in Heerlen, asked to do the same there. A prototype was developed, using the method as described above. The main difference was that the patient selection was not carried out on the basis of DBC data, but on planning data. However, no results are available from a matching analysis between automated and manually collected data, as carried out in the VUmc hospital.

A drawback of the system is that in the first part of the year, the number of patients will be relatively low, therefore indicator values will not be as reliable as in the second part of the year. This will be particularly true if registrations are lagging. For example, it can take a while before a DBC is completely coded. If this includes the items which are necessary for the selection for the dashboard, then the patient will be 'missed'. In the VUmc, the care administration staff has a major job in keeping the DBC registration up to date.

Conclusion

The monitoring system is a valuable tool for the VUmc to develop and maintain Clinical Pathways. Although in this case information technology does not bring any improvements to the care process itself, it does support the improvement potential of Clinical Pathway implementation. In this sense, it also contributes to the realization of a sustainable health care system.

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