Casemix Management Systems – An Overview of System Requirements

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Abstract

The introduction of casemix funding for health services has lead to an urgent need to improve support for management decision making regarding the efficient and effective delivery of health services. This need is being met by a number of vendors in a variety of ways. Agencies and health departments have put in a considerable effort to identify critical information needs which must be met by the system selected for purchase. In the process of developing an educational package to teach students how to use casemix data for decision making, the authors have collected both user defined system specifications and vendor descriptions of systems available for this purpose in Australia. This paper reviews some of the characteristics observed in the implementation of casemix management support systems and relates these to general information systems principles, the needs of decision makers, and a number of casemix decision support systems.

Introduction

> *We should recognize that already now programming is much more than an intellectual challenge: the art of programming is the art of organizing complexity, of mastering multitude and avoiding its bastard chaos as effectively as possible. (Dijkstra 1982)*

As part of the Commonwealth Governments Casemix Development Program the authors were funded to develop and implement education modules for use at the postgraduate level and for in service training. The modules in development will aim to improve the students knowledge of casemix funding and reporting, information system evaluation and selection, and finally how casemix can support decision makers in both the clinical and administration environments. These modules will be offered as part of Central Queensland University's extensive graduate and continuing education programs in 1995 in a subject called *Using Casemix Data for Decision Making*, and described in Hovenga and Whymark (1994).

In the process of collecting information for the course development the authors also gathered information on requirements for decision support in a casemix environment, detailed system requirements developed by health organizations operating in a casemix environment, and vendor descriptions of their software products. This information has been grouped into five major categories, and major required characteristics identified. The description may be a useful input to future implementation plans.

No attempt has been made to analyse particular offerings from vendors using the characteristics developed here. This would be inappropriate for a number of reasons. Firstly the brevity of the conference format would not allows it. Secondly, and more important, the evaluation of software can be very dependent on the particular application, is open to interpretation and the weighting of the different criteria. Lastly, the software industry moves too quickly and our review was never intended to provide a comprehensive list of vendors.

The paper consists of four sections. Section two reviews some general issues concerning management support systems and how the needs of decision makers vary. It provides an insight only into some of the principles from the general management literature that applies to this topic. Section three describes the characteristics for casemix decision support, providing a categorization as well as some detail. This is the major section of this paper. Section four provides some concluding remarks and an overview, and is followed by annexes containing a list of sources of data for this paper.

Management Support Systems (MSS) and the Needs of Management

The role of management needs and categories of MSS is discussed in detail elsewhere (, Whymark 1989, 1991; also Whymark in Hovenga et al, 1994), and so only the briefest summary is offered here.

The term decision support system (DSS) is used by many different groups in the computer industry, in management, and in operations research and it means different things to each group. However, no matter how it is viewed, the process of management is fundamentally one of decision making, and the process of making decisions and acting on them is the business of the management process.

The term Management Support system (MSS) is used here to refer to any computer based system that aims to support a manager or professional in a decision making environment. It is an extension of the older concept of a DSS to include a wider range of computer based systems. MSS are supported by the use of a variety of modelling methods and are intensely user oriented. MSS has a wider meaning than just the application of quantitative models that have traditionally been part of a DSS.

Any decision support system must contribute something tangible to the decision making process. It must either enable the manager to make the decision more efficiently, or enable the manager to make a more effective decision. Hence the increasing use of the term MSS to include any computer based system that supports a decision making process.

Management Levels

The term user oriented decision support systems has become popular in recent years (Thierauf 1988). Decisions are made by people, or the users if you prefer, and DSS are designed to support those users. Some of the work in the field categorises decision makers according to their place in the hierarchy, and according to the types of decision making that they engage in (Jaques 1976, Khadem 1986, Rockart 1988).

The information needed to support decision makers at opposite ends of the management hierarchy is fundamentally different. Thierauf (1987, Figure 3.2) divides it into *control information* and *planning information*. Lower management will spend almost of their time using control information which tends to be centred on the internal environmental factors. On the other hand, the information required by top management will largely be planning information that centres on the external environmental factors. Government guidance on financial expenditure is a good example of the latter in public administration.

Elsewhere, Thierauf (1988, page 36) categorises the decision maker according to the type of activity using a similar model to that first described by Jaques (1976). Lower management is concerned with operational control. Therefore the type of information required is often detailed and accurate, and is sourced from within the organisation. The middle manager, according to this model, is concerned with organising programs into systems of work and ensures that goals are being met. The activity is referred to as management control and is tactical in nature. Reports that support this type of activity need to be comprehensive and will include external information.

Consideration of the needs of different levels of management and the ability to provide for these differing needs is imperative in any computer system used to support modern management. The purpose of such systems is to provide clinicians and managers with the appropriate information to support informed decision making, and to facilitate the more efficient and effective use of resources.

Characteristics of Casemix MSS

The sources of data for this paper included 13 vendor descriptions of their systems, two system specifications prepared by health administration units, and a number of interviews and visits by the authors to hospitals in NSW, Victoria and Queensland. In brief, common requirements for a Clinical Costing Decision Support System include that it:

- offer advanced functionality designed to support financial and clinical management of health services,
- present a simple user-interface which protects the user from technical aspects of the system,
- be based upon proven hardware and software technology ensuring a high level of data integrity and security,
- provide reasonable reliability and performance,
- be capable of flexible and rapid implementation, and
- meet specific Australian State Health Department and Hospital requirements

In the information systems literature a broad framework for describing an MSS is provided by Sprague and Watson (1994) who maintain that any MSS can be described in terms of four major components. These are the database management system (DBMS), the model base management system (MBMS), the dialogue generation and management system (DGMS) and the user. This model, together with the specific health management issues, is used to structure the

description of the systems specifications for casemix systems. This approach not only helps to categorize the characteristics but also serves to emphasize the health industry specificity of these systems.

The following paragraphs briefly describe the characteristics identified, grouped into five major categories. These are the database management system, financial modelling, Dialog management and reporting, health management issues, and system management, accounting and security. There is a very small amount of duplicity contained in the list of criteria.

Database Management System

Integrated Databases

MSS require data to drawn from a wide range of discrete operational-level systems regardless of the vendor or type of system. The data is integrated into a comprehensive database view covering the financial and clinical activity of all areas of the hospital/region. This does not imply that all systems need to be enterprise wide, but simply that an integrated management view is available.

The facility for the inclusion of user-defined items is also required.

Data Import/Export

The need for an integrated environment means that the system requires the ability to move data between systems including PC based packages and enterprise systems. The ability to operate seamlessly between different systems as part of an integrated environment is also required.

Logical/Physical Data Independence

Data representation at a logical or abstract level should be separate from how the data may be physically stored. users need to be able to access and manipulate data by means of operations at this logical level. Sometimes this implies a second data base built purely to optimize the representation, manipulation and viewing for management support purposes.

External Database Views

The system should have the ability to present user(s) with external view(s) of data at the logical level which are subsets of the total database tailored to their specific requirements and authority. Individuals should be allowed access to manipulate data by means of operations defined on their respective view(s)

Data Integrity

Mechanisms which ensure that data integrity is maintained in terms of both structure and content during normal or abnormal system operation are essential. This does not negate the use of duplicate management support data bases providing they are used to report and analyse..

Financial Modelling

Costing Methodologies

A range of costing methodologies should be supported. These may be used to define and to report on cost components for each area of activity associated with the treatment process. Individual units require the ability to define cost components as fixed or variable, direct or indirect and to separately identify hospital overhead costs, departmental costs and patient-related costs.

Patient Costing

The expense account data from the General Ledger should be distributed to service events provided by hospital departments and the cost of individual patient episodes calculated so that costs are assigned to patients on the basis of only those service events specifically received by each patient during an episode of care. Each episode may include periods in different wards, different clinical units and services from multiple departments and costs should be assigned and reported accordingly.

Costs need to be reported for an individual patient episode or according to DRGs or other variables by which patients may be grouped, including hospital defined categories of patients.

Variance Analysis

The use of exception reporting is essential.

Analysis should include the tracking of variances of actual costs from budget in terms of components which identify the nature of the variance. The separate identification of controllable from non-controllable costs relevant to each area of activity associated with the treatment processes also necessary.

Reporting should include clinical and departmental variances at different reporting levels of a user-defined hierarchy appropriate to each perspective. Variances from each perspective can then be reconciled, taking into account work-in-progress and other adjustments.

Data Analysis

Systems need to support a wide range of clinical and financial analyses of data selected from the integrated database such as:

- analysis of operating costs, contribution margins, marginal costs,
- cost benefit/cost effectiveness analysis,
- trend analysis,
- resource utilisation analysis, and
- productivity analysis.

Tools to support the modelling, forecasting and budgeting process are essential.

Operations Research Models

The support of more complex modelling or the ability to link to modelling systems is highly desirable.

Dialog Management and Report Generation

Multi-Entity

There is a need to represent multiple service units providing different types of patient care, hospitals, community health centres, nursing homes, each having a separate general ledger and patient master index. These can then be reported as separate corporate entities (or cost centres) with their own internal reporting structures. Consolidated reports should use components of a user-defined hierarchical structure representing a higher order corporate entity such as a region.

Multidimensional modelling (MDM) and multidimensioanl data bases (MDDB) can be very useful in this respect, and are therefore often found in information support systems..

Program Management

Programs are discrete areas of activity either within a single corporate entity or across multiple health service entities. Budgets and reports of resource utilisation, treatment activity and costs should be prepared in terms of user defined aggregations of cost centres and account items and their related outputs to enable the support of program management. User-defined aggregations of patients and their related inputs should also be used in the budget and reporting processes.

Reporting Structures

Multiple hierarchical structures should be possible for reporting purposes. These may represent the organisational or clinical structures of the hospital in terms of their subordinate units or specialties, or represent user definable classifications of patients.

Management Oriented Standard Reports

Regional, hospital, departmental and clinical managers all need tools to access databases, to develop and integrate strategic and service-level plans which identify expected outputs and the resources required to achieve those outputs and, then, to monitor progress against those plans. The facilities provided vary greatly, and different types of managers require a different level of flexibility.

Greater flexibility is not necessarily better. Make the job as routine as possible for the manager or user, ensuring they can concentrate on the analysis rather than on the technology.

The system should allow the selection and execution of a specified range of standard reports designed for clinical, departmental, financial and corporate managers. Such reports are often described as comprehensive, but care should be taken to design them to suit the needs of the manager. Reports should allow managers to focus on analysing performance, controlling costs, improving quality of care, optimising resource utilisation and increasing productivity.

Flexible Report Writer

The system should support the design and execution of a variety of ad-hoc reports, allowing the user to define report formats in terms of columns and rows selected from an abstract view of the data and to specify additional columns and rows in terms of user-defined calculations. These report builders should not necessarily use relational logic.

Report Presentation

All systems require the ability to augment the display and presentation of reports using features such as graphics, drill-down, 'top-ten' highlighting, and exception reporting.

User-Interface Requirements

A user-interface which permits users to interact with the application without the need for specialist knowledge of computer systems and which supports users who have minimal understanding of the application is highly desirable. Equally desirable is efficient access to those users who acquire familiarity with the application.

The overall design and organisation of the interface should assist users to acquire a conceptual model of the system, and to select a course of action according to a user-oriented goal. It should also orient user activities in relation to each goal within that conceptual model and assist the user to be pursue these activities in a natural coherent manner.

A graphical user interface consistent with the Microsoft-Windows environment seems to be preferred by nearly everybody, but many times it is given too much importance. The important factor is user dialog and capability with other systems.

Health Management Issues

Clinical Budgeting

It is essential to be able to create clinical budgets based on the projected volume and mix of user-defined categories of patient cases and expected treatment practices in relation to these cases. Systems need the ability:

- to automatically calculate the effect of these budgets to the level of departments and the mix of products required from each department and to the level of general ledger cost centres and account items,
- to flex the budgets at each level to reflect variations in volume and mix resulting from the actual casemix of the hospital and the treatment activity affecting each department,
- to create financial budgets at the level of general ledger cost centres and account items using a range of methods and to push these budgets through to each department and its associated products and through to clinical budgets for user-defined categories of cases, and
- to reconcile/combine the results of both approaches to budgeting.

Hospital Continuous Quality Improvement

Health management needs support in a range of hospital quality assurance activities which address both the process and outcome of patient care for user-selected groups of patients, enabling measures of patient outcome to be related to measures of treatment practice. These include

- support the definition of standard treatment protocols and reporting of variations,
- monitor services and user-definable events on a daily basis during an episode of care, and
- support the definition and reporting of clinical indicators.

System Management, Accounting and Security

Audit Trails

Systems should have the capability to produce a range of standard and user-defined audit reports at both summary and detail level for all modules and datasets.

On-line and Batch Environment

Support is required for multiple processes operating concurrently in both the online interactive and batch modes. This requires an operating system that can define, store and execute batch programs which may be particularised to specific situations through parameters, and to ensure the integrity of such systems.

Feeder System Interfaces

All large organizations have many sources of transactional data and management support systems need to be very flexible in being able to accept data extracted from hospital feeder systems using a range of media and formats and to convert it into the format required using an easily managed process.

GOSIP Compliance

Although there are reports overseas of GOSIP compliances being relaxed, it is still an effective way of improving the enterprise system transparency. The Australian GOSIP requires compliance of file transfer protocols and network communications infrastructure. Most vendors can meet this compliance where relevant.

Concurrency

This is usually an operating system requirement, but in the context of MSS it is necessary to be included. Multiple users need access to the same or different dataset simultaneously in order to enter data, to run processes which produce or modify data, to define and produce reports using that data, such that these processes do not interfere with each other's operation in terms of their effects upon data integrity, the coherence of any user's view of the data or apparent concurrency, nor result in any outcome which would not occur in a single user system.

Maintenance and Operations Utilities

System management can be very expensive and is a major factor in determining system performance. Therefore a system which provide a comprehensive set of utilities to support the maintenance and operation of the system is essential. The form this takes will vary greatly and may include editors, file transfer and system interface, data manipulation, terminal and printer control, job control, system status, purge, backup/restore, transaction logging and more. Most important is the ability to manage data integrity and report and screen usage.

System Architecture and Application Design

These parameters, whilst essential to a successful implementation, are not unique to the management support function. we list some of the more important ones for completion.

- Scalability of the system platform
- Alternative architectures - central processing, client/server, distributed databases, WAN.
- Modularity- discrete modules each capable of independent implementation or dependent upon a minimum core set of modules.
- Integration - data and parameters entered in one module should be accessable by other modules without requiring explicit user action.
- Flexibility - the degree of flexibility and how it is achieved.
- Portability of data and programs as appropriate to other operating systems.

Security

All management systems require security management to be integrated, but more especially those in the health industry. These include the requirement for mechanisms which permit only authorised access to selected functions and data.

Specific users will require access to data which identifies individual patients and may be given privileges to perform all or a selected subset of application functions in relation to data about those patients. At the same time users should be restricted to only those records to which they have both the need and the right to access. The software should support user defined criteria to manage such access.

Access to account level data also needs inbuilt, user defined, security management.

Vendor Support

Vendors are expected to have the ability to provide comprehensive support by staff experienced in implementing such systems.

Conclusion

Neither space nor justice to individual products would allow us to discuss individual products in this paper. What has been provided is an outline of typical user requirements to consider when implementing a casemix management support system.

The further analysis of these criteria with respect to individual requirements is a large task. It is often dependent on the specific environment, but there is scope for further analysis. This could be conducted by examining the needs of different levels of management in the health industry (executive information systems, middle management support), and different types of manager (clinical support, administration).

The criteria presented have resulted from a combination of review of actual implementation specifications, vendor descriptions of available products, and the experience of the authors in both the general area of MSS and EIS and in the support of decision making in a casemix environment.

It is hoped that the criteria described here, although brief, will assist in the implementation of more systems that truly support the decision maker, and assist in mastering the multitude and effectively avoiding its bastard chaos.

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Annex A. Vendor System Descriptions Obtained (31 May 1994)

1. TC Health Administration - CaseMix, A computerised management system for fee for service accounting and DRG Reimbursement.
2. Health Computing Services (HCS) - CaseMix Reporter
3. Oracle System (Australia) P/L -
4. Cerner Corporation P/L -
5. McDonnell Douglas Information Systems - Trendstar, Decision Support System
6. IBA Healthcare P/L -
7. CONTINUUM Health - HCm's TEAMWORK - Clinical Costing and Decision Support System
8. HealthVISION Australia P/L - Clinical Management Information System (C/MIS) - Case Mix Management.
9. ICL Australia P/L (ACL Software) - Panacea
10. FHA Information Systems P/L - Ca$eMax, The Casemix Monitor
11. Landacorp Healthcare Management Systems (UK) - Case Mix Management System
12. HCC Hospital Cost Consultants (USA) - Decision Support Solutions
13. Cognos P/L - PowerPlay, EIS and DSS Applications

Annex B. System Specifications Obtained

1. Request for proposal decision support/patient costing systems for the Southern, Northern & North West Health Regions of Tasmania as prepared by the Casemix Development Unit, Community and Health Services (North), Launceston.
2. Request for proposal for computer-based clinical costing decision support system and associated services for regional pilots as prepared by the Regional Information Systems Unit, Queensland Health.

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