CASEMIX AT A CROSSROADS - MOVING TOWARDS AN EPISODE OF CARE APPROACH: A REPORT ON THE DEFINITION OF EPISODES PROJECT
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ABSTRACT
The Definition of Episodes project is concerned with the identification of components of care and the linkage of these into defined Episodes of Care which extend over several professionals and health care settings to reflect the totality of care received by patients. The project is developing a data model to enable an improved understanding of programmes (integrated packages) of care. The model should inform the capture of clinically relevant information in a structured manner such that components of care can be linked together. Current dependency on setting specific minimum datasets (mds) in the NHS (UK) makes comparisons of activity difficult as activities are often undertaken in different settings in different localities. Furthermore, the limited coverage of mds also makes it difficult to understand the outcomes, effectiveness and costs relating to care for specific conditions. The Episode of Care approach is intended to address these shortcomings. The paper reports on the findings of the work undertaken to date. The model is presented using a scenario based on the care given to a patient with diabetes. The project recognises the potential for an underlying data structure to enable effective retrieval of data from electronic clinical records. Furthermore, such an approach is intended to support the use of data for secondary purposes by providing a consistent framework that enables related activities to be linked together.

KEYWORDS: Episode of Care, casemix analysis, integrated packages of care, electronic clinical records, electronic patient records.

Acknowledgements
The authors wish to thank the following for their continuing support for the project work and for their assistance in reviewing this paper: Leonie Mountney, Dr Hugh Sanderson, Brian Merriman, Dr Dave Jones, Professor G Moon.

INTRODUCTION
This paper provides a brief review of the limitations of current casemix methods before considering UK policy initiatives which provide the context for informatics developments seeking to realise ‘joined-up information’. The Definition of Episodes project is such a project and the paper reviews the work to date, detailing aims, work undertaken and an overview of a proposed Episode of Care (EoC) model. The paper goes on to examine some of the practical implications arising from such an approach and concludes by highlighting the benefits for decision making and planning.

CASEMIX AT A CROSSROADS: LIMITATIONS OF CURRENT METHODS
Healthcare systems in industrialised nations are increasingly looking to contractual mechanisms as a means of controlling rising expenditure and seeking to ensure the cost-effectiveness of services. A standard measure of the care provided is central to this and interest has grown since the early 1980's in the development of casemix measures as a means of defining health care ‘products’.

In 1983 Diagnosis Related Groups (DRGs) were introduced in the USA by the state Medicare system as the basis of a prospective payment system for acute hospitals. More recently Healthcare Resource
Groups (HRGs) have been adopted as a costing unit within the NHS (England). However, concerns have been raised regarding the limitations of casemix approaches based on routine acute hospital datasets. In the USA, reimbursement practices based on diagnostic related groups (DRGs) have provided financial incentives for providers to shift services to the outpatient setting irrespective of the appropriateness of such shifts. Furthermore, concerns have been raised amongst both clinicians and managers regarding the limitations of casemix measures which focus on a single setting in isolation. When considering the ‘performance’ of services it makes sense to consider the total care provided to the patient from when they enter the system for care in relation to a problem to discharge. Performance in this context refers to any of the following dimensions: effectiveness, efficiency, quality, access.

Ambulatory (non-acute) care groupers have been developed in the US, Australia and a number of European countries (UK, Spain, France). These begin to address some of the limitations of the acute based groupers through extending the coverage of the care detailed. However, problems remain in relation to the need to link components of care together to provide a picture of the whole care for a problem. In the USA the availability of large claims based databases has enabled the development of ‘Episode of Care groupers’. These seek to bundle encounter claims data into Episodes of Care but have been reported to be inaccurate owing to the limitations of the source claims data in terms of linking services to diagnoses.

Changing patterns in treatment often involve the provision of services closer to the patients home. For example some procedures that were typically undertaken as inpatient events may now be carried out as day case and in some cases outpatient procedures. This ‘substitution’ effect is difficult to monitor in many countries owing to a reliance on setting specific minimum datasets. This limits the potential for consistent comparisons of data.

There is growing recognition of the need to develop casemix methods based on the totality of the care received by a patient for a particular condition. The Episode of Care concept was first suggested in the 1960s and was defined as ‘a block of one or more medical services received by an individual during a period of relatively continuous contact with one or more providers of service, in relation to a particular medical problem or situation’.

The benefits of the Episode of Care approach are identified as follows (adapted from Wingert):

1. Grouping together a sequence of services into an episode of care captures the natural history of health care
2. The episode of care could provide a basis for the information required for comprehensive economic analyses and in particular enables service substitution (switching activities from one setting to another) to be accounted for
3. An understanding of the entire process of care can be gained and quality issues can be studied
4. Reimbursement based on episodes of care will tend to encourage more efficient service provision - a bundled payment related to an episode of care provides an incentive to better manage resources.

POLICY CONTEXT

The move towards an Episode of Care approach is timely given the emphasis of current (UK) policy initiatives. The NHS White Paper, ‘Modern. Dependable’ introduces the concept of ‘programmes of care’, reflecting the total care received by a patient for a specific condition. More recently long-term service agreement (LTSA) guidance seeks to operationalise this approach by promoting integrated care pathways (ICPs) as the framework for establishing agreements.

Health improvement programmes (HiMPs) are concerned with the integration of services to maximise (population) health gain. The development of condition specific National Service Frameworks also supports the drive towards ‘joined-up care’. Clinical governance will require knowledge of what activities were undertaken to address problems and the context for that care.
The policies indicated above embrace a move towards fully integrated services. So does the UK information strategy, ‘Information for Health’ which seeks, in the long term, to establish electronic health records as integrated clinical records, available at all times on a need to know basis to ensure that patient information is available to clinicians. The strategy also re-emphasises that electronic records should be the source of data for analytical purposes.

The development of casemix and the policy context outlined above suggest a move away from encounter-based administrative data such as the current NHS minimum datasets and towards clinical records which support both shared care and aggregation for analytical purposes. The Episode of Care (EoC) approach is in keeping with this vision.

WORK ELSEWHERE ON EPISODES OF CARE BASED CLINICAL RECORDS.
In the UK there has been increasing recognition of the benefits of using an EoC structure in primary care electronic patient records[^8,9^], and most of the leading GP computer systems include support for EoC, some being comprehensive. Several acute trusts in the UK are also considering adopting an EoC structure for record keeping, in some cases as a result of using Integrated Care Pathways, which naturally generate an episode of care record covering the scope of the Pathway.

Elsewhere in Europe, the EoC concept is attracting considerable attention. Project team 30 of CEN Technical Committee 251 (http://www.centc251.org) is developing a draft European standard for an information structure to support the continuity of care, and is majoring on the EoC. In the Netherlands, EoC support is now a mandatory part of general practice systems, and is included in the national system specification.

DEFINITION OF EPISODES PROJECT

Project aims and objectives
The project is creating an EoC data model and associated definitions, on the basis of which improved data might be provided to support a broad range of analytical purposes[^1]. It supports ‘Information for Health’, by recognising the potential advantages of a coherent and clinically based model of Episodes of Care as a basis for structuring clinical records. Records with such a structure will assist carers (and therefore improve patient care) by:

- Enabling effective retrieval of data from electronic clinical records
- Providing a way into the electronic record
- Filtering the electronic record.

For these, reasons, the project has adopted the following underlying principles:

- The concepts must be clinically relevant
- In the longer term, data to populate the Episode of Care structure will be derived from operational clinical systems
- Definitions must be applicable to the same activity wherever/however it is delivered - the definitions must be as independent of setting as possible.

Implementation of the model is outside the scope of this initial phase of the project.

Review of the work of the Episode of Care project
Concepts identified through reviews of relevant literature - both formally published and ‘grey’ - have been used to inform developmental work which has led to the proposed model of the Episode of Care.

[^1]: Analytical purposes include clinical management processes (multi-disciplinary audit, clinical governance, research) and general managerial tasks (commissioning, needs assessment, performance monitoring, casemix)
The proposed model was tested through piloting work undertaken from June to September 1998. Pilot groups, comprising a broad range of healthcare professionals from a number of organisations and settings, reviewed the proposed model using their clinical records and knowledge of the tracer condition chosen. The tracer conditions were breast cancer, diabetes, normal pregnancy and stroke.

A full report on the pilot work - identifying the methodologies used to select pilot groups, the review process key findings, lessons learnt and implications of the work – is available on the Casemix Programme website (http://www.casemix.org.uk/projects/epi_intr.htm).

An initial consultation workshop, bringing together a wide range of key stakeholders, was held in April 1998 (London). Attendees participated in structured workgroup sessions to consider how models of episodes might be evaluated. The workshop highlighted a broad consensus on the need for improved definitions of episodes for the NHS community as a whole. The stakeholders also agreed that a clinical foundation to the project was essential and that the criteria used to assess models should be designed to ensure fitness for purpose. Potential users of the Episode of Care approach were diverse but supportive of the project aims. They also noted that the model should inform a variety of applications but not be constrained by any particular one. Further consultation is planned for the financial year 1999/2000.

Work is in progress to refine the proposed model in the light of feedback from key stakeholders, from consultation work and from reviews of related developments both in the UK and internationally (e.g. the European standards development work (CEN)). The project team have also provided feedback on the products of the CEN working group on the continuity of care. An opportunity was taken to explore EoC facilities in UK primary care systems, using the laboratory run by the Sowerby Centre for Health Informatics at Newcastle (SCHIN). The work has also been informed by the work of the European CHAINE project.

It is intended that additional consultation will take place to seek endorsement of the proposed model via a number of workshops with representatives of the professional associations. The project team also propose to develop a demonstrator to better communicate the key elements of the proposed Episode of Care model.

**Figure 1  Diabetes episode of care – problem / timeline view**

<table>
<thead>
<tr>
<th>Diabetes</th>
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<tbody>
<tr>
<td>- Hypoglycaemia</td>
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<td></td>
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<tr>
<td>- Diabetic retinopathy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Diabetic foot</td>
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</tbody>
</table>

TIME now
THE PROPOSED EPISODE OF CARE MODEL

The following two diagrams show an example of an episode of care dealing with diabetes, a chronic disease that is usually incurable. In this example, the patient also has several associated subproblems, one of which (hypoglycaemia) is recurrent. Figure 1 highlights the occurrence and duration of the major problem and its subproblems.

Figure 2 illustrates a central feature of the Episode of Care (EoC) approach, linkage of all ‘activities’ (here shown at the level of the encounter) to ‘problems’. Four providers are involved, a GP, practice nurse, podiatrist and the eye department of an acute trust. Some patient-carer encounters have dealt with more than one subproblem, for example in one encounter the GP dealt with diabetes in general, and hypoglycaemia in particular.

The Episode of Care (EoC) is defined as the total care provided to address a ‘health problem’. A graphical representation of the model (Figure 3) illustrates key aspects of the approach, namely the association of two elements; the ‘health problem’ with the interventions/care provided – the care components. Time is clearly of importance in this (starts and ends).

Figure 2 Diabetes episode of care - activity view

A detailed data model for the EoC has been developed. A simplified overview of this (figure 4) shows key concepts and the relationships between them. Appendix A contains definitions and examples of the concepts, plus a legend for the diagram.

The development of the model has utilised the knowledge and some of the outputs of the NHS Healthcare Modelling Programme (http://www.imc.exec.nhs.uk/hcm/index.htm).

The key features of the summary model are:

- The association of interventions (i.e. care components) with health problems
- Identification of sub-problems linked to the high level problem
- Recognition that an encounter may deal with several problems
- Coverage of all health care professionals’ activities, whatever the setting.
Figure 3

**Episodes of Care model**

The following episode of care relates to a single ‘health problem’.

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**Start of Episode of Care**
First contact between health professional and patient for a health problem

**End of Episode of Care**
Last contact

**Problem**

**Time**

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**Intervention**

**Start care component 1**

**End 1**

**Care Component 1**

**Start 2**

**End 2**

**Care Component 2**

**Start 3**

**End 3**

**Care Component 3**

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Figure 4  The Summary EoC Model
Further modelling work not shown here deals (amongst other things) with goals and outcomes, and allows a richer set of relationships between health problems. It is worth noting here that any feature of the patient, not just ill health, may play the role of a problem: a more general term might be ‘focus for care’.

This approach is essentially an extension of the problem oriented record approach common to several leading UK primary care systems, and first mooted by Weed in 1968. The extension is in terms of both the increased scope – increased to cover health care in all settings – and a greater emphasis placed on time – the problem becoming the focus of care within the episode with starts and ends identified as appropriate.

Structuring the electronic record using the EoC approach offers benefits for direct patient care and will make a significant contribution towards the goal of ‘joined-up’ care. The structure will also provide a framework for analytical purposes. Both of these key areas will require an agreed ontology to maximise benefits. The analytical purposes will furthermore require common rules for starts and ends. These are necessary to ensure consistent aggregation and sensible comparisons, cornerstones of many analytical purposes (including casemix).

Dispelling the myths about episodes of care based records.

If EoC-based patient records are to become common place, not only must they be of benefit to the carer and patient, they must also be easy for the user to generate and maintain. They must also deal with the realities of everyday care, such as the evolution of both the problem and clinicians’ understanding of it over time. There is a climate of opinion that this is difficult to achieve. This is not so, although many of the current clinical record keeping systems do not provide the necessary facilities. This misconception is the main reason why the Project has proposed the building of an EoC demonstrator. So what facilities are required of an EoC-based record keeping system?

The foundation is the ability to nominate a clinical statement in the record as a problem. It could be a sign, symptom, or diagnosis, but this is not mandatory. The problem may than be used as a heading under which to add the record items that are associated with it, generally as they are entered into the system, but possibly in retrospect. Subproblems can be registered by using the same mechanism, i.e. adding the subproblem under the heading of its parent problem.

An episode of care (as opposed to illness) is deemed to have started when the problem is first brought to the attention of a clinician, i.e. when the first encounter for it takes place. The user may wish to explicitly maintain the problem status, although this is not essential (see point 1 below). Recurrent problems (such as bouts of ‘flu’) can be indicated automatically by offering to end any preceding EoC when the user indicates occurrence of a new problem of the same type.

Where a problem evolves into a new form, the new problem has to be entered as the successor to the old one. Where the understanding of the problem evolves (breast pain becomes breast lump which is then found to be due to breast cancer), the label attached to the episode care will need to be changed (although the problem of breast pain per se may still exist, and be the subject of active care).

On output – viewing or extracting data - typical requirements are for:
1. A problem list. Such a list may include subproblems if the user so wishes, shown nested beneath their parent problem. A key requirement is the need to be able to quickly see the status of the problem (i.e. active, dormant or resolved). One way of achieving a similar effect without attaching a status to each problem is to display them in descending chronological order by the date of the last event associated with the problem, so that those at the top of the list are the most ‘active’.
2. A time line view of the problems, of the sort depicted in figure 1. A variant of this would be timeline plus activities / encounters (similar to figure 2), with the ability to click on an encounter and see the clinical entry(s) for it.
3. A comprehensive view of all the clinical record entries for a problem, usually in descending chronological order. The obvious way into this is via the problem list described in 1.
4. A shared problem / EoC ‘label’/ identifier which facilitates the tracking of problems across providers.

A clinical item associated on entry with one problem may be relevant to others. For example, blood pressures entered under hypertension will be equally relevant to the problems of diabetes and stroke. There is therefore a need to be able to hold a template for a problem type, which indicates which kinds of information (other than those explicitly linked to the problem) are to be displayed in any comprehensive view of the medical record content for that problem.

The good news is that some EoC-based systems are already available (particularly in primary care in the UK and Europe), and more are on the way. Looking across the primary care systems that the project reviewed, all the facilities mentioned above are present, and one system in particular provided an implementation that was almost complete. User friendliness has been materially improved by the increasing prevalence of mouse & windows-based interfaces, with point & click item selection and drag-and-drop facilities.

**The use of EoC records to inform casemix analyses**

Undoubtedly one of the major challenges in the use of EoC records to inform casemix analysis will be the apportioning of resources to episodes of care. Some resource usage can be readily inferred from the EoC record contents. For example, a test must have occurred prior to its results appearing in the record and prescriptions should be linked directly to the EoC involved. However, agreement will be needed on how to allocate clinicians time, and overheads and fixed costs, to care components and hence to EoCs. This is complex when more than one health problem (i.e. more than one EoC) is being addressed in a particular encounter. The question is one of how to split the encounter into more than one care components.

Counting the costs of care must not be the limit of our ambitions. Consideration will need to be given to the linkage of outcomes to EoCs for them to be of use in evaluating the cost-effectiveness and quality of care provided.

**CONCLUSION**

The development of casemix and the policy context outlined in this paper suggest a move away from encounter based administrative data such as the current NHS minimum datasets, towards a structured clinical record which both supports (and is a natural outcome of) shared care and provides a rich source of data for casemix grouping. The Episode of Care approach is in keeping with this vision.

The Project has developed and is refining a model to support the Episode of Care approach. Implementation of such a model in clinical record systems would, it is envisaged, go a long way towards redressing the limitations of current casemix methods outlined in this paper. An agreed ontology, for example a hierarchy of problems and related sub-problems, and common rules for defining units are necessary to ensure consistency in any data aggregation derived from EoC-structured patient records. One major challenge for the Project in the future will be to devise methods of attaching resource usage to (or deriving it from) the clinical information.

Putting the proposals into practice requires a change in record keeping culture, albeit one which has already started, certainly amongst users and system suppliers in general practice and the acute sector in the UK and Europe. NHS-wide implementation will require software development and education on a considerable scale. But the ends are worthy of the means: records using an episode of care structure could be the standard bearer for an ambition first made explicit by the Körner data management
initiatives of the early '80s but rarely realised nearly two decades later - the routine derivation of management and audit data from patient records.

BIBLIOGRAPHY

APPENDIX A
**Class Definitions**

**Agent**
A role played by a person or organisation.
*Examples:* General Practitioner Adrian Smith, Nurse Veronica Deeply-Caring, Podiatrist Ann Kells

**Care Component**
An activity undertaken to observe or alter the state of a subject of care (e.g. a patient).
*Examples:* Alice Springs' diphtheria/tetanus/pertussis vaccination on 21/7/1981, Mr Springs' blood pressure of 130/80 on 12/10/1992

**Encounter**
The context which enables other activities to take place that alter (immediately or in the future), or observe/infer, the state of the subject of care.
*Examples:* Mrs Spring's consultation with Adrian Smith at 0930, 1/1/1999, her telephone conversation with him at 1545, 30/12/1998, case conference about Peter Out held on 10/11/1976.

**Health problem**
A subject property which forms the high-level focus of an episode of care. It does not have to involve ill health.
*Examples:* Mr Springs' acute abdominal pain observed on 7/3/1989, Mrs. Spring's pregnancy diagnosed 10/4/1981, Alice Spring's childhood vaccinations

**Resource for Activity**
A resource that is intended to be/has been consumed by an activity
*Examples:* The 15 minutes of Dr Smith's time used by Mrs Springs' GP consultation on 1/1/1999, the dressing used to cover Mr Springs' laparotomy incision on 21/3/1989

**Subject of Care**
A subject being cared for. It may be a person or a group of people.
*Examples:* GP patient Alice Springs of 10 Windup Way, Bolton

**Subject Property**
An aspect of the state a subject.

**Timepoint**
A point or period in time.
*Examples:* 12:33 22/9/1976, 1984