

*The Case for Clinical Decision  
Support Systems to Support*

*the*

*Nursing Process*

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## **Introduction**

In many organisations, knowledge management is recognised as an essential requirement for business. However, the focus remains on operational and financial requirements and in many hospitals still stops short of clinical information required for quality improvements in regard to pathways etc. This is a short sighted view because managing clinical information, can provide insights that eventually lead to better patient outcomes and as a consequence improved cost management often follows.

In order to improve information management the implementation of a clinical decision support system enables improved methods of recording and reviewing patient outcomes as well as standardisation of care. This paper focuses on a decision support system that will largely be used by nursing staff. Clinical decisions support for nurses would seem to be the “poor cousin” to decision support systems for medical officers. An internet search of clinical systems will usually return many responses for systems such as physician order entry systems and clinical systems for doctors in general practice<sup>1</sup> but the range of systems available for nurses and the patient care planning process is much more limited. Some hospitals have implemented acuity systems as well as roster systems but neither of these systems can provide decision support for patient care.

Acuity systems used by nursing staff, however, focus mainly on patient acuity data to assist in staffing predictions and to support staffing decisions. These systems do not provide any clinical decision support nor does it provide any care functionality that successfully follows the nursing process. Some systems with limited Clinical Pathway functionality provide only a paper copy of the plan for use at the bedside and therefore no mechanism for developing evidence based on differing treatment modalities without significant manual research methods which are time consuming and can lack accuracy due to the difficulty of interpreting case note entries .

## **Length of Stay**

In the private sector, there is a very close link between length of stay and revenue. Tightening funding arrangements mean that increased lengths of stay result in net losses of revenue for each day a patient stays over the designated length of stay. The evidence that links length of stay to differing treatment modalities is difficult to extract from the paper based patient record. A clinical decision support system that enables systematic review of outcomes and length of stay can provide insights into what interventions and actions produce the best outcome and therefore the optimal length of stay.

## **Variances**

Many patients are placed on clinical pathways but variances are poorly recorded and extracting data on variances is a long and arduous task for any researcher. Wading through the handwritten paper based record takes many hours and involves a significant amount of subjective interpretation. A clinical decision support system that enables recording of variances and the subsequent ability to review those variances with out resorting to laborious research in paper based documents will enable nursing staff to build their evidence based practise models.

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<sup>1</sup> <http://www.informatics-review.com/decision-support/>

## Relief Staff

A clinical decision support system can provide relieving staff and novice clinicians with important cues to assist them with patient care. A decisions support system that provides alerts and suggestions as well detail on the care to be provided will encourage standardisation and adherence to best practise guidelines.

## ***What is Clinical Decision Support?***

The National Electronic Decision Taskforce<sup>2</sup> defines clinical decision support as

*“Access to knowledge stored electronically to aid patients, carers and service providers in making decisions on healthcare”*

Liaw<sup>3</sup> discusses the components of decision support which include:-

- A comprehensive and current knowledge base – based on high quality evidence
- An engine to implement decision rules
- A patient database on which the rules are applied
- Interfaces that allow mutual teaching, learning and feedback

## **Types of Decision Support**

Decision support models tend to be divided into two main groups<sup>4</sup>, qualitative or statistical models and quantitative or rules based support. Quantitative systems include models that use neural networks, fuzzy logic or probability formulas such as Baye’s formula or the Markov Model.

Neural networks were inspired by the design and structure of the human brain<sup>5</sup> and are designed to mimic the neural pathways. Neural networks are good for pattern recognition and can be “taught” but it can be difficult to keep track of errors.

Bearman<sup>6</sup> quotes Brasil who describes fuzzy logic as a methodology that can handle information in a systematics way and consists of a basic rule, membership functions followed by an inference procedure. It is considered useful for non – linear systems and to model complex systems where ambiguity and vagueness is common.

The probability based models such as Markov and Baye’s theorem use mathematical probability formulas to quantify relationships among particular events<sup>7</sup>. The US National Library of Medicine<sup>8</sup> defines Markov’s model as

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<sup>2</sup> National Decision Support Task Force

<sup>3</sup> Health Informatics An Overview - <http://www.infocom.cqu.edu.au/HNI/BooksOnline/>

<sup>4</sup> Chapter 16 *Clinical Decision Support Systems* - Handbook of Medical Informatics van Bommel and Musen (1997)

<sup>5</sup> [Margaret Bearman's Notes: Additional Computer Science Techniques for Modelling and Manipulating Information and Knowledge](#)

<sup>6</sup> Bearman ...et al

<sup>7</sup> van Bommel ..et al P 240

<sup>8</sup> <http://www.nlm.nih.gov/nichsr/hta101/ta101014.html>

*“A type of quantitative modelling that involves a specified set of mutually exclusive and exhaustive states (e.g., of a given health status), and for which there are transition probabilities of moving from one state to another (including of remaining in the same state). Typically, states have a uniform time period, and transition probabilities remain constant over time”*

Quantitative decision support systems differ from the formal mathematical systems and are usually based on clinical studies and typically use Boolean or symbolic logic.<sup>9</sup> These models can involve sequences of small decisions that can be applied by computer systems either simultaneously in decision tables, sequentially in flow charts or decision trees or expressed as a set of rules that produce a conclusion based on patient data and knowledge data.<sup>10</sup>

It is the latter form of clinical decision support that best supports nursing practise and the need to develop evidence-based practise in a continuing cycle that encourages review and feedback mechanisms.

## **The Nursing Process**

For a decision support system to be useful to nurses it must follow the accepted workflow and practises of the clinicians who will be using it and indeed assist them to streamline that workflow.

The Nursing Process is an accepted framework for patient care planning<sup>11</sup>. Much has been written about the nursing process but essentially it encompasses the following steps:

1. Assessment
2. Planning
3. Implementation
4. Evaluation

The nursing process is circular and continues until a problem, diagnosis or procedure reaches a conclusion. An essential part of the process is the documentation of the process. Regardless of the method of recording the prevailing theme is “if isn’t written down then you haven’t done it”.

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<sup>9</sup> van Bommel ..et al P 240

<sup>10</sup> van Bommel ..et al Pp 247 - 251

<sup>11</sup> <http://adt.curtin.edu.au/theses/available/adt-WCU20020812.105507/unrestricted/02Chapter1.pdf> P.3

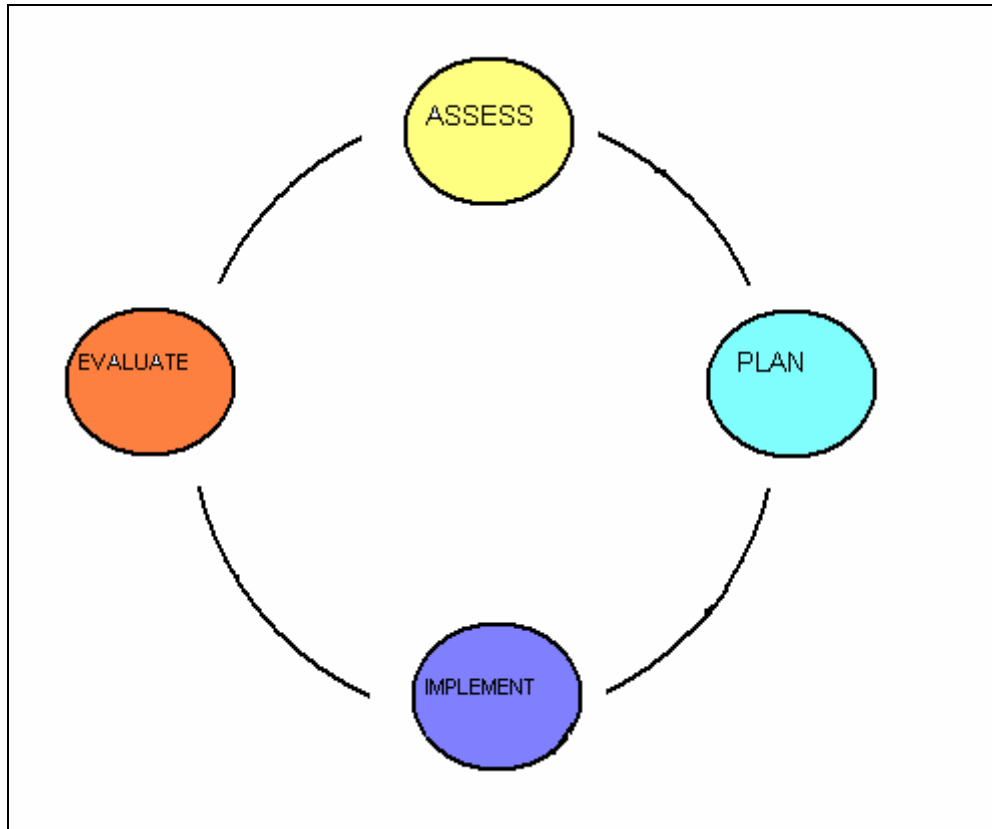


Diagram 1 – Representation of The Nursing Process – Caroline Lloyd 2005

A clinical decision support system that supports and enhances the nursing process must include the ability to encompass all these elements and provide a means to aid each step of the process. A decision support system that supports the nursing process will also need to provide the means to use the data gained from daily patient care and re-apply that evidence for future planning. A system that provides the means to build evidence as a result of the nursing process will fit in with the normal workflow of nurses and allow the collection of data as natural flow on from the daily application of the nursing process.

## ***Knowledge Representation***

### **Classification of Nursing Interventions**

It has long been identified that nursing needs to better document and classify what it does<sup>12</sup> in order to facilitate better research, quantify what they do in order to be better funded as well as to increase the visibility of what nurses do. Nursing outcomes are not always the same as medical outcomes because they will often encompass the functional aspects of a patient's illness rather than just the illness itself.

In Australia, the use of specific terminology or nomenclature systems has not been well taken up. Whilst in the United States, there is widespread use of the

<sup>12</sup> A Comparison of Nursing Minimal Data Sets. Goossen WT, Epping PJ, Feuth T, Dassen TW, Hasman A, van den Heuvel WJ. J Am Med Inform Assoc. 1998; 5(2): 152-163. PMID: 61286

systems developed by the University of Iowa “Nursing Intervention Classification” (NIC) and the Nursing Outcome Classification” (NOC)<sup>13</sup> they have not been embraced by Australian nurses. Other US systems of classification include the Nursing Minimum Data Set<sup>14</sup>, the OMAHA classification system and HHCC Home Health Care Classification. In Australia, the only Minimum Data Set specifically for nursing seems to be the Community Nursing Minimum Data set<sup>15</sup> which is largely a funding tool for providers. This data set does not describe what nurses do in the way that a classification tool such as NIC does.

Work is being done with regard to exploring and developing an International Minimum Data Set<sup>16</sup> but on the whole, a standardised language for describing nursing care in Australia, is a long way from reality. A search of journal articles returns a great deal of material in the realm of US academia but very little specific to Australia. So in the current climate, a clinical decision support system for nursing needs a great deal of flexibility to cope with multiple terminologies and data elements.

## The System

A successful clinical decision support system for nursing will reflect usual nursing practise and the nursing process. It will provide the ability to record and quantify what nurses do. The major business of hospitals is patient care and the major providers of that care are nurses. A decision support system for nurse could incorporate a number of other aspects including staffing predictions and fair workload allocation, however I will focus only on the patient planning and care aspect in this essay.

## Assessments (Assess)

Assessments need to be definable so that they are suitable for all clinical settings. Decision support should enable care elements to be linked to assessment results as well as alternative or additional assessments suggested depending on results. Assessments should be easy to navigate with drop down list selections, with easy tick boxes and buttons where able. Some free text entry should be available where required.

## Care Planning (Plan)

As a result of the completed Assessments, there should be a range of suggested care elements already available for the nurse to select. In addition to this, the nurse should be able to select other relevant care elements.

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<sup>13</sup> <http://www.ncvhs.hhs.gov/970416w6.htm> ,  
<http://www.nursing.uiowa.edu/centers/cnce/nic/nicoverview.htm>

<sup>14</sup> NURSING INTERVENTIONS CLASSIFICATION, 3RD ED NURSING OUTCOMES CLASSIFICATION, 2ND ED NURSING INTERVENTIONS: EFFECTIVE NURSING TREATMENTS, 3RD ED. CIN: Computers, Informatics, Nursing. 20(5):167,168-169, September/October 2002. *Ersek, Mary PhD, RN*

<sup>15</sup> [http://www.dva.gov.au/health/provider/community\\_nursing/guidelines/Sect2\\_8.htm](http://www.dva.gov.au/health/provider/community_nursing/guidelines/Sect2_8.htm)

<sup>16</sup> <http://www.inmds.org/PostNuke/html/index.php>

So for example, if an assessment is defined to determine Pressure Ulcer risk, then depending on the result, care elements with elements related to the patient's risk will be suggested to the user.

To assist the nurse both to save time and also ensure a standard level of care, care elements should be able to be grouped into standard care plans, which can then be further modified or added to individualise to a particular patient.

So for example a hospital might define a standard care plan for 'Admission for Elective Minor Surgery' and a range of activities that must be completed will form this care plan but if the patient has other pre-existing conditions, further elements can be added to the plan to account for care required. Diabetes might be a good example of this, whereby the management of blood sugar levels will need to be added to the patient's care plan in addition to their minor surgery care plan.

In situations where a course of treatment such as surgery can be more readily predicted, a clinical pathway can be used. Clinical pathways should be able to be defined by varying pathway milestones which may be a by day, by week by hour. Even though a patient is on a pathway additional care elements should still be able to be added to the plan in the same manner as previously mentioned.

### **Confirm Care (Implement)**

Once care is implemented, a record that the care has been undertaken is required. Traditionally, in the paper based record this has often involved a lengthy repetition within the clinical notes basically repeating what was in the care plan.

Variances have been traditionally associated with clinical pathways but it has been identified that a variance may occur with any care element. A study conducted by Professor Philip Darbyshire<sup>17</sup> indicated that nurses will not enter variances if there are too many steps / screens to use so variance entry needs to be via easy pick lists and tick boxes with the ability to add a free text note as well.

An electronic system should provide the ability to mark care whether care has been completed. If care has not been completed and intuitive link should provide the opportunity to record a variance as to why scheduled care was not undertaken.

### **Outcome Review (Evaluate)**

In order to evaluate care both from the viewpoint of the individual patients' progress, as well as monitoring trends in outcomes, an electronic care planning system needs to record patient outcomes. Outcomes need to be set for specific review times thus prompting nurses to evaluate the patient's care. At a more global level, recording outcomes for individual patients builds up evidence about nursing activities and the resultant outcomes for patients.

Outcome review ensures:

- \* evaluation of the nursing practice to be conducted by the clinicians.

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<sup>17</sup> Nurses' & Midwives' Understandings and Perceptions of Computerised Patient Information Systems and Related Informatics: A Focus Group Investigation Report prepared by Professor Philip Darbyshire, January 1999

- \* enforcement, so that care has to be evaluated.
- \* Allows for reports to be produced electronically.
- \* Allows for errors to be identified.

For example, if a ward was concerned that IV's were staying in longer than the 48 hours in their policy, and they had noticed an increase in infections, they could set up to measure this particular patient outcome every 48 hours and identify reasons why IV's were not being changed. By prompting user's, it will lead to improved compliance with changing of IV's and the rate of infections and the costs associated should be reduced.

### **Documentation**

As a part of the care planning process a degree of automated documentation should assist clinicians and reduce time spent recording care.

- ✓ Variances should be automatically recorded in the clinical record with time date and user stamps
- ✓ Use of templates should reduce repetitive documentation by using merge fields to pick up data elements that are already recorded such as demographic information as well as clinical data
- ✓ System should have the ability to link relevant DRG, IDC or other relevant coding conventions to care elements.

Some free text documentation will always be required and should be enabled, however, it should be acknowledged that this kind of documentation is difficult to gain useful data for research.

### **Difficulties Implementing the System**

At Hospital A, nurses are already used to using computer systems in the ward areas. In addition to the Patient Acuity system, they utilise the patient administration system to check on a variety of patient activities such as run Theatre Lists, print patient labels and perform bed transfers. So from a technical aspect, provided a new system has a standard Windows style user interface, most staff would be able to make use of it.

One of the major complaints with the existing system is that it is seen largely as a management tool but the onus of data entry is on the nurse. The average nurse sees no benefit to her workday from what is seen as additional work.<sup>18</sup> A system that provides care planning, information links as to how and why that care is performed and provides some automation of documentation, is likely to be viewed as more valuable to their nursing practise.

One of the challenges would be the gap between the paper record and information recorded electronically. Decisions would need to be made whether clinical notes were printed and filed in the paper record as well as stored electronically. If only one

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<sup>18</sup> Darbeyshire et al – in many places throughout the document.

group, such as nurses is using an electronic system, other health care providers such as Doctors and physiotherapists may miss important information if it is not stored in the paper record.

Another challenge for both the vendor and the nursing leaders is demonstrating a cost benefit to the organisation because systems that provide the level of detail and granularity required do not come cheaply. For many large private hospitals even though they are extremely busy in terms of the number of patients, bed days procedures etc, the profit margin is small. In that operating environment, a good business case needs to be presented in order to justify significant capital outlay. However, a system that provides clinical decision support has the potential to improve patient outcomes by

- Standardising care protocols
- Providing evidence on outcomes that can used to continually monitor and adjust care protocols
- Better clinical information on outcomes has the potential to reduce length of stay.
- Decision support that improves risk management

### **Impact on the knowledge management**

A system that provides the ability to explore patient outcomes and variances in detail will provide hospitals with a mechanism to continually improve patient care. The ability to interrogate data in an electronic system will provide information substantially quicker than is currently possible with manual methods thereby improving the hospital's ability to implement change.

## ***Conclusion***

Nurses are the biggest group of health care providers and whilst doctors are a very important part of the patient health episode, it is nurses who provide the bulk of care. It is puzzling therefore, that the move to provide nurses with sophisticated systems to manage patient care has been extremely slow. Early focus has been on managing nursing hours, driven by anxious financial officers who see only the size of the nursing budget. It makes good sense however; to provide the largest group of care providers with systems to enable them to provide the best possible care to patients and the ability to explore the data in order to further improve that care.

## ***Glossary***

DRG – Diagnostic Related Groups

ICD10 – International Classification Diseases