Analytics for Improving Patient Outcome by Utilising Comprehensive IoRN Assessment Scoring Metrics

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Abstract This paper outlines a method of analysing the outcomes for care using evaluation metrics based on the IoRN assessment method. The contribution this paper provides is identifying the socio-political drivers for change within the healthcare system, proposing a method of patient outcome and performance improvement to address the requirements of those drivers.

IoRN, Indicator of Relative Need, Improving Outcomes, Predicting Best Carer

1. INTRODUCTION

It is anticipated that the frail and elderly population will increase significantly in some European countries over the next 20 years. This is a particular challenge for Scotland where the aging population is increasing relative to the rest of the UK [1].

In particular, socio-economic factors can play an increasing role in the epidemiology of multimorbidity and this has implications within health and social care [2].

The UK Government Draft Care and Support Bill [6], Part 1, Clause 1 specifically identifies and outlines the concept and responsibility for local authorities in regard to “Promoting individual well-being”. The Draft Care and Support Bill continues within Part 1, Clause 2 in that it mandates: “A local authority must establish and maintain a service for providing people with information and advice relating to care and support for adults and support for carers.” [6]

There has been a drive towards the improvement in terms of efficiencies and outcomes for over a decade within home healthcare [7, 8, 9, 10].

Over ten years ago Bakken & Hripcsak, 2004 [9] identified the issues around the informatics infrastructure within health and social care including providing evidence-based practice to overcome challenges with the domains of:

- Data acquisition methods
- Healthcare standards
  - Standardised terminologies
  - Data repositories
  - Clinical event monitors
- Data-mining techniques
- Digital sources of evidence
- Communication technologies.

One readily accessible method for measuring relative needs and activities of daily living is the Indicator of Relative Need (IoRN) tool that draws on information about Activities of Daily Living (ADL) and mental well-being amongst other things [3]. The IoRN method uses an algorithm to assign people to a distinct IoRN group (A-I) based on their characteristics measured using a standard set of questions.

The original IoRN method was developed to draw on information collected by “Single Shared Assessment” (SSA), and as such was designed to be a common point of reference for a patient, while traversing a health and social care pathway.

Opportunities for realising the potential of the method have grown in recent years with a more fine-grained algorithm introduced for the community IoRN and the development of a hospital IoRN.

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This introduces the possibility of standard information flowing across the pathway as, for example, a patient is discharged from a hospital environment and requires rehabilitation within a social care setting.

In this scenario an IoRN assessment might be carried out at the transition from a hospital to a social care setting, and another IoRN assessment taken at the end of the re-enablement or re-habilitation period. The flow of information could potentially also be in the opposite direction.

Within the complexities of the health and social care system there is an ever increasing drive to increase efficiency, specifically for support provision of the frail and elderly [4,5]. The fundamental metric from this activity it to enhance and promote well-being.

This paper proposes and develops a method by which a care team leader or manager within health or social care can derive better efficiency and outcomes from exiting IoRN data. The method analyses patient data to predictively identify which carer might be better placed to provide care for that patient using evaluation metrics based on the IoRN assessment method.

2. PROCESS

The IoRN method in its most basic form relates an initial score (derived from the answers to a set of standard questions) to an IoRN Group. The ADL assessment within IoRN comprises of the following aspects of the patients well-being:

- Daily Living and Mobility.
- Personal Care.
- Food & Drink Preparation.
- Mental Well-being and Behaviour.
- Bowel Management.

Each of these domains has multiple assessment questions that are scored against specific criterion.

“The purpose of completing the SSA-IoRN is to allow practitioners to assign their client to a SSA-IoRN grouping. There are only two steps to this process: Step 1 is to allocate the ADL group (low, medium or high). Step 2 works out the SSA-IoRN group...” [3]

IoRN has an advantage over ADL, in that it assists in identifying patient requirements and helps focus care planning around more holistic needs of the patient, as indicated in Figure 1.

The value of the IoRN method can be extended if two or more assessments are taken for a patient within the same care pathway. Typically, this will be at the point of entry and exit of a care pathway, or at a particular review point. Comparative analysis of the two IoRN assessments can indicate not only relative improvement or the changing requirements of the patient, but also provides supporting information on the effectiveness of the treatment or care plan.

There are many factors that influence the efficiency or success of a care plan for the elderly within a social care setting, these may include:

- Patient willingness and attitude
- Family support
- Carer Skillset and knowledge
- Duration of care plan
- Early Identification and Assessment
- Access to treatments

The process of outcome prediction depends fundamentally on what data is captured and the quality of that data. The prediction outcomes proposed within this paper cannot be realised from an IoRN or ADL assessment alone, as additional data is required.

For the example discussed in this paper, the outcome prediction will be based on the performance of the caregiver or therapist involved with administering the patient care plan.

However, if appropriate other predictive indicators may be used. As this paper considers the caregiver, then details relating to the caregiver must be captured.

3. METHODOLOGY

The methodology that follows provides a mechanism to allocate the most appropriate practitioner based on the history of caregiving provided to patients by a practitioner, given the current patient’s initial IoRN score. This is essentially predicting which carer or practitioner will provide a good outcome (or will be least will reduce the risk of providing a poor outcome) for the current patient once that patient’s initial IoRN assessment has been completed.

The main historical data elements for outcome prediction based on practitioner or care-giver are:

- Patient IDs (no personally identifiable information).
- Practitioner or Caregiver ID (no personally identifiable information).
- Initial and Discharge IoRN Scores for each Caregiver’s previous patients. Note that in the example given here the original community IoRN grouping is used.
- Date of Initial assessment and Discharge of each Caregivers previous patients.
For the data collected to be valid:

- The care plan must remain stable between the assessment points for each patient.
- The same practitioner or caregiver should have administered the care plan during the assessment period for each patient.
- IoRN Assessments need to be scored using the same standards and assessor judgement for each patient.

**Risk score for IoRN**

Figures 2, 3, and 4 outline the three stages used to calculate a measure of risk of a practitioner having poor outcomes based on the patients’ initial SSA-IoRN score.

Stage 1 is shown in Figure 1 where the distribution of previous sample patients for each practitioner is given by their initial SSA-IoRN score (A-I), with column P showing the total patients for each practitioner, and Q the percentage. The Blank category is for patients where no practitioner had been recorded in the data set. The sample dataset used in this initial work has 233 patients in total, over 6 practitioners, with 53 patients unallocated.

Stage 2, as shown in Figure 2 is to calculate the percentage of sample patients in each initial SSA-IoRN group for each practitioner.

Stage 3, as shown in Figure 3 is to calculate a Risk score by initial SSA-IoRN score for each practitioner. To calculate the Risk a significance factor is used. The significance factor is an arbitrary weighting (described below) and the risk is calculated as product of the significance factor weighting and the percentage of the total allocation.

The significance factor weighting in the given example in Figure 3 is linear. Providing a scaling metric of 0.1 for an initial IoRN Assessment of “A” up to 10 for “I”. Thus a practitioner with patients who all fall into the “A” SSA-IoRN score is at low risk of those patients having a poor outcome (purely by the nature of the patients). Whereas a practitioner with patients who all fall into the “I” category is at high risk of those patients having a poor outcome (again purely by the nature of the patients).

Within the sample data set, a “traffic light” thresholding has been used to signify low risk (green) medium risk (amber) and high risk (red). For example Practitioner 5 has a high percentage of patients with initial assessment “I”, and is therefore at risk of those patients having poor outcome, whereas Practitioner 3 has a low or medium risk of poor outcomes. The data in Figure 3 can also be used to highlight carers with current experience of patients’ specific needs (i.e. within specific categories of the SSA-IoRN score).

**Predictive Patient Placement – Best Carer**

The next stage in the process is to compare the risk of poor outcome calculated from the initial SSA-IoRN score to the actual outcomes using a subsequent SSA-IoRN score. For this each patient is graded as being one of three levels: Improvement; No Change; and Decline. This is shown in Figure 5, and gives an indication of the overall loading and the detail of relative improvement the patients of each practitioner. The single metric is used to prioritise the patients that have declined while minimising the significance of those that have improved or (to a lesser extent) those who have remained the same. The key threshold is a judgement and can be set to reflect prevailing patient/carer conditions.

**Example**

To follow the example through:

1. A new patient is assessed with initial IoRN score of “I”.
2. Figure 4 suggests Practitioners 1, 2, 4 have managed IoRN “I” patients previously. The data also suggests that practitioner 4 is at a significantly increased risk of poor patient outcome score due to the number of dependant patients.
3. Practitioners 1, 2 and 4 are cross-referenced with Figure 5 which indicates that practitioner 4 has the lowest score, and hence the best outcomes overall. Practitioner 4 should receive the patient.
4. A check with Figure 1 provides additional information on individual practitioner loading. Although based on the evidence Practitioner 4 would be the best fit, a management decision to place the patient with Practitioner 1 could be made. Practitioner 1 has a similar success rating overall and has fewer challenging patients.

This example shows how to predictively place the patient to the practitioner with the best outcomes for the needs of the patient. Additionally, the data within the tables can be used for performance reviews and ascertaining training requirements.

**Carer Performance Evaluation**

It must be pointed out that while any system like this can highlight both good and bad performance, it is generally not good practice to use tools as a method of highlighting negative results where training or coaching has not been given.

The efficiency of most health care departments either community or institutional (NHS or GP) is reliant to a greater degree on the performance of the staff at its disposal.
Improving patient outcomes should be central to the strategic goals of a healthcare organisation. The performance of staff at the frontline of patient care and rehabilitation play an obvious role within the success criterion generally and patient outcomes specifically.

Monitoring and managing performance can be a very contentious issue, especially when the meaning of performance can be widely interpreted. The process and methods described above can be based on the actual findings available within data already available within monitoring systems, such as systems implemented by CM2000 and others.

The objective of the example that we have been working through is to identify and provide specific details that will help the individual carer or practitioner focus on the skills necessary that match the patient’s profile or realign skills with a changing local demographic. Additionally, it will provide a management overview on what are the dominant skills necessary for the local patient demographic and the outcomes performance that can provide an insight to the training needs and requirements of the carer.

Example

To provide carer performance feedback:

1. Each carer has patient outcome metrics, as detailed in Figures 5 and 6.

2. From Figure 6 it can be see that Practitioner 3 has a very high score, and indicates immediate investigation is needed. Practitioner 5 has an elevated score and a performance review could be initiated to identify training requirements.

3. Practitioner 3 should then be referenced against Figure 5, which indicates that almost 50% of assigned patients declined. Additionally, the patient numbers that Practitioner 3 saw are relatively very low (approx. seven percent) when compared to the group as a whole.

4. Figure 3 provides the initial condition and the relative difficulty of managing the patients' conditions. Practitioner 3 had a very low combined risk score of 23, which indicates patients with low dependence.

5. The evaluation is that Practitioner 3 should undergo additional training. The evidence points to a scenario where a significant number of low dependant patients had detrimental outcomes within a relatively low total workload.

4. CONCLUSIONS & FUTURE WORK

The proposed method endeavours to provide data analysis for a much-needed improvement of outcomes within a historically technically deficient environment. The use of this kind of data analytics is not currently available in most social care departments.

There are a number of issues that can arise from the utilisation of such a method that works on the basis of performance outcomes. Generally for a system of this nature great care must be taken to ensure that the data is accurate and verified. If a carer knows how the system operates and is instrumental in evaluating a patient, especially if it is their own patient, then it can be a temptation for the carer to distort the actual score into a more favourable one.

It is likely to become increasingly important to consider process changes when implementing performance-based evaluation. Process changes are outside the scope of this paper, however, they can result in substantial efficiency improvements if implemented with thought and consideration.

In future the use of scoring systems should not only include simply numerically based data, as these are the most easily distorted. Instead phrase based evaluation should be considered, where simple phrases are used as a scoring metric.

The method described provides the basis for a simple method of improved evaluation. Additional scoring methods could be used if IoRN is not implemented within a particular healthcare environment. For example, the Groningen Activity Restriction Scale (GARS) [11] or Bayer Activity of Daily Living (B-ADL) [12] are both examples of comprehensive domain based assessment scoring instruments.

5. REFERENCES


Figure 1: SSA-IoRN Grouping Diagram, reproduced with permission from [3]
### Figure 2: Initial IoRN Score

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### Figure 3: Initial IoRN Score (Across Practitioner)

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### Figure 4: Risk profile per initial IoRN Score per Practioner
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**Figure 5:** Practitioner Vs Relative Change

### Table 2: Scoring Metric

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**Key:**
- Green: <=1
- Yellow: >1.0001 <1.9999
- Red: >2

**Figure 6:** Scoring Metric using Significance coefficient