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Predicting demand for rehabilitation or GEM care from acute care data

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Aim of this project

To build a national model that predicts demand

…from acute inpatient activity

…for subsequent rehabilitation and GEM care.

...for initial application in Tas.

Model features:

- Based on the concept of rehabilitation-sensitive DRGs
- Quantifies "sensitivity“ rather than Yes/No
- Considers other relevant patient-level variables
- Concept of probability “tier” – high, medium, low or zero.

In our toolbox we had....

- Rehab-sensitive DRGs – Dr Lynette Lee.
- Some literature findings.
- National acute inpatient data (2 years) with subacute flags if <28 days in same hospital (2.6mill records).
- AROC benchmarking data.
- Clinical and technical expert advisors.
- Tasmanian inpatient data to test and apply the model.

The rehabilitation-sensitive DRGs

177 AR-DRGs (Version 5.2), grouped into 17 "functional loss" groups:

- Amputee
- Arthritis
- Arthritis after care
- Chronic pain (back and neck)
- Complex joint replacement
- Complex medical
- Fractured neck of femur
- Joint replacement
- Multi trauma and other
- Neurological conditions
- Non-traumatic brain dysfunction
- Other complex orthopaedic
- Other orthopaedic
- Rehabilitation/other
- Spinal cord dysfunction
- Stroke
- Traumatic brain dysfunction

Examples: rehab-sensitive DRGs

- Stroke
  - B69A TIA and Precerebral Occlusion w Cat or Sev CC
  - B70B Stroke w Severe CC

- Traumatic brain dysfunction
  - B02A Craniotomy w Cat CC
  - B78B Intracranial Injury wo Cat or Sev CC
  - B79Z Skull Fractures
  - B80Z Other Head Injury

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What did the literature say?

- Factors influencing referral for subacute care include;
  - Medical stability
  - Family and social supports
  - **Age**
  - Functional capacity
  - **Type of presenting condition**
  - **Acute onset of condition (especially injury)**
  - Cognition and willingness to participate.

Why only adult inpatient Rehab and GEM?

- There were too few <u>inpatient</u> episodes in the following groups to support statistical analysis;
    - Psychogeriatric
    - Palliative care
    - Paediatric subacute.

Our approach

- Iterative, with clinical advice and statistical analysis, each feeding the other.
- Clinical panel met initially to provide direction and at intervals throughout project.
- Wider clinical advice sought to test assumptions and findings of statistical analysis.

What was the clinical advice?

- This model approach was appropriate for predicting service demand for populations and should not be applied to individual patients.
- Agreed with the literature findings.
- The concept of ‘tiers’ of probability, low/ medium/ high (or none) was meaningful and useful.
- Patients with an inpatient LOS greater than 10 days would experience deconditioning and require some rehabilitation.

Regression analysis

To find the patient factors in acute episodes that best explain referrals to rehab or GEM care.

Would have been straight-forward if;

- Services were classified as rehabilitation or GEM consistently. Overlapping concepts of geriatric rehab and ‘slow stream’ rehab.
- We had national data with the acute care and subsequent rehabilitation or GEM episodes linked.
- All relevant data items were reliably collected in national data

……but this was not the case….

To counter these issues we;

- Combined the rehab and GEM data in the regression analysis and in the model output.
- Looked to other data sources to get some insight into what we were missing. This included AIHW publications and the Australasian Rehabilitation Outcomes Collaboration (AROC) data set.
- Used the variables that were available in the data set in the first instance and found that these had sufficient explanatory power.
  - The model may be refined later if the collection of patient risk factors such as family support is improved.

How could we predict what the missing data would have looked like?

- The AROC and AIHW aggregate data gave us a measure of the prevalence we would have had if we'd had the ideal dataset.
- ADRGs were notionally mapped to the impairment groups within AROC data set.
- Statistical techniques then used to modify the probabilities in the model as if we had complete data.
- In selected ADRGs, based on clinical advice, the probabilities were further boosted by flagging acute episodes with LOS greater than 10 days.

Building the model

- Logistic regression using the acute care data.
  - Significant variables - age and ADRG
- Probabilities identified by ADRG based on actuals.
- The 'tier' allocation assigned by clinicians also informed the model development and interpretation.
- **Model**:
  - A table of probabilities with ADRG as row and age group as column, and
  - A table of probabilities by MDC with tier as row and age group as column.

MDC/tier example

MDC 08 - Diseases and disorders of the musculoskeletal system and connective tissue

Tier	Age group				
	17-54	**55-64**	**65-74**	**75-84**	**85+**
low	0.004	0.013	0.024	0.063	0.102
medium	0.034	0.101	0.177	0.369	0.496
high	0.093	0.249	0.387	0.632	0.744

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MDC 08 ADRG examples

ADRG	Tier	Age group				
		17-54	**55-64**	**65-74**	**75-84**	**85+**
I17	low	0.002	0.007	0.013	0.032	0.050
I21	med	0.039	0.111	0.186	0.372	0.484
I31	high	0.134	0.326	0.470	0.696	0.784

Key assumptions in developing the model:

- It is appropriate to make predictions about the need for subacute care using acute episode of care data.
- The clinical/demographic profile of the flagged episodes in the acute data (60K) were an indicative cross section of patients who receive subacute care.
- It is clinically meaningful to combine rehabilitation and GEM in the model.

Assumptions cont.

- By using patient (rather than service) specific criteria we avoid having to account for different service delivery models.
- A mapping between the Adjacent DRG (ADRG) and rehabilitation impairment code in the AROC data is meaningful and appropriate.
- LOS in subacute care can be predicted meaningfully based on impairment code.

Applying the model

- Can apply to any aggregate data set that includes ADRG and age variables. Most useful to apply to a hospital cluster or LHD.
- Produces numbers of expected patient care episodes.
- Aggregate output by ADRG or MDC. Can group to;
  - Locally defined functional diagnosis groups for translation for service planning.
  - AROC (SNAP) impairment types (ie stroke, amputation, fractures etc).

Translating the model output

- Used the notional map between ADRGs and impairment groups.
- AROC data provided average length of stay for impairment groups.
- This enabled us to predict the required bed days.
- Assuming (eg 90%) occupancy throughout the year, convert bed days to beds.
- *Required services may be set up as inpatient or inpatient equivalents in a non-admitted or community setting – response must be in the context of local service delivery arrangements.*

A comparison between two populations

	Separations				Bed days			
	Provided		Predicted		Provided		Predicted	
Zone	Total	per 1,000 pop.	Total	per 1,000 pop.	Total	per 1,000 pop.	Total	per 1,000 pop.
Zone A	1,260	4.2	1,560	5.2	23,436	78	29,016	97
Zone B	560	2.8	1,300	6.5	11,256	56	26,130	131
Total	1,820	3.6	2,860	5.7	34,692	69	55,146	110

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What did the model analysis tell us?

- The utilisation of designated rehab and GEM services in Tas was significantly lower than other jurisdictions.
- Across Tas there was a requirement for an additional 114 rehab/GEM beds to meet the predicted demand.
- Most of this demand could be met by converting acute bed capacity to subacute beds (calculation based on selected short stay acute DRGs).
- The net deficit in rehab/GEM beds in Tas was only 13.
- Applied to the national data set the model also predicted 83 % of the actual total rehab and GEM activity.
- Powerful predictive tool.

Does it pass the pub test?

- It is big on assumptions!
- Was developed using data with significant limitations.

However…,

- It has been clinically validated and supported,
- It has produced meaningful and sensible results,
- Results can be interpreted in a local context.

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Thank you!

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