DEVELOPING A CASEMIX CLASSIFICATION FOR SPECIALIST MENTAL HEALTH SERVICES

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ABSTRACT

The Mental Health Classification and Service Costs (MH-CASC) Project aimed to determine whether patient factors predicted mental health service costs, and whether these could be used to build a patient classification that in turn could be used as a basis for the funding of specialist mental health services. Participants included all patients who received at least one hour of face-to-face service at a sample of services representing 25% of Australia's specialist mental health sector. Patient attribute data and resource use data were collected on all inpatient and community episodes of care undergone by these patients between 1 September and 30 November 1996. A total of 16,611 setting-specific episodes contributed to the class-finding analysis. An underlying classification was found, comprising 42 patient classes (23 for inpatient episodes and 19 for community episodes) which accounted for 78% of the variance in total episode costs. The classification explains 63% of the variance in inpatient episode costs and 15% of the variance in community episode costs. The classification had clinical logic, in that patients who would be expected to cost more were in fact found to cost more. The MH-CASC classification has considerable potential as the first version of a casemix system for mental health services. Ongoing refinement will be necessary.

Keywords: Mental Health, Psychiatry, Casemix, Classification, Episode Costs

Acknowledgments
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BACKGROUND

Mental health services worldwide are dealing with increasing demand and decreasing resources, coupled with a shift from isolated inpatient care to community care that is integrated with the general health care sector. Consequently, attention is focussing on costs of care, and funding services to ensure that resources match patient need. One of the objectives of Australia’s 1992 National Mental Health Strategy was to develop appropriate incentives to ensure that care is targeted to those most in need. There was no ready means to ‘reward’ services for treating more complex cases. Accordingly, the Mental Health Classification and Service Costs (MH-CASC) Project was funded to develop the first version of a casemix classification, with associated cost weights, for specialist mental health services.

The mental health sector has lagged behind the general health sector in casemix development. Several classifications exist, but all are based solely on diagnosis, perform poorly in predicting resource use, have an unwieldy number of classes and/or are limited to inpatient settings. Several studies have identified the following patient factors as predictive of resource use in mental health: Diagnosis, severity of symptoms, risk of harm to self or others, level of functioning and social support, co-morbidity, sociodemographic characteristics and stage of illness.

Objectives

The MH-CASC Project was undertaken to determine whether these and other patient factors predicted service costs, and whether a clinically-meaningful and resource-homogeneous patient classification could be developed. The study’s method and major findings are reported here. Further detail is provided in the final report.

Methods

Sites
Twenty two specialist mental health care organisations (‘sites’) from across Australia were purposively selected to participate. These reflected Australian specialised mental health practice, in terms of: being integrated; incorporating a range of service settings and types; being adequately resourced; engaging in ‘best practice’; and representing public/private, metropolitan/regional and State/Territory coverage.

Study sites represented approximately 25% of the Australian mental health sector in terms of inpatient beds, workforce numbers and expenditure.

Patients

Data were collected on all patients who received at least one hour’s face-to-face service at any site between 1 September and 30 November 1996.

Data collection and preparation

The data collection cycle revolved around episodes of care. For the purposes of data collection, an episode of care was defined by treatment setting; subsequent classification analysis examined alternative definitions. Movement to a new treatment setting (i.e., acute inpatient, non-acute inpatient or community) was defined as a new episode of care, and triggered a new data collection cycle.

Patient attribute data

Four types of patient attribute data were collected during a given episode: identifiers and sociodemographic, clinical and service details (see table 1).

Within each episode, there were three critical points in the data collection cycle. At the beginning of an episode, socio-demographic data and service details were collected on the Episode Registration Form. Every 14 days of the episode, clinical details were collected on Repeat Clinical Ratings Forms. At the end of the episode, a Final Clinical Ratings Form was completed, which included clinical and service details. Identifying data were collected on each form.
### Table 1. Core patient attribute data items

<table>
<thead>
<tr>
<th>IDENTIFIERS</th>
<th>SOCIO-DEMOGRAPHIC DETAILS</th>
<th>CLINICAL DETAILS</th>
<th>TREATMENT &amp; ILLNESS HISTORY</th>
<th>CURRENT EPISODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local UR number</td>
<td>Date of birth</td>
<td>Psychiatric service history</td>
<td>Principal psychiatric diagnosis&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Episode type</td>
</tr>
<tr>
<td>Service/facility code</td>
<td>Sex</td>
<td>Time since first psychiatric treatment</td>
<td>Additional psychiatric diagnoses&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Admission date</td>
</tr>
<tr>
<td>code</td>
<td>Country of birth</td>
<td>Clinical severity&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Other diagnoses</td>
<td>(Inpatient Episode s)</td>
</tr>
<tr>
<td>Name (of Key worker)</td>
<td>Aboriginality</td>
<td>Level of functioning&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Clinical status</td>
<td>First contact date</td>
</tr>
<tr>
<td>Ward/Team Code</td>
<td>Postcode</td>
<td>Focus of care&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td>(Community Episode s)</td>
</tr>
<tr>
<td></td>
<td>Interpreter required</td>
<td></td>
<td>Legal status&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Episode end date</td>
</tr>
<tr>
<td></td>
<td>Marital status</td>
<td></td>
<td></td>
<td>Reason for Episode end</td>
</tr>
<tr>
<td></td>
<td>Number of dependent children &lt;5 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pension status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Usual accommodation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plus for Child/Adolescent services only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plus for Child/Adolescent services only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living with Guardianship</td>
<td>Family Court involvement</td>
<td>Juvenile Justice involvement</td>
<td>Family income</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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a. Recorded using clusters of ICD-10 clinical terms that were organised into 16 major categories and 61 individual codes

b. Measured by the Health of the Nation Outcome Scales (HoNOS)<sup>31</sup> and an abbreviated version of the Life Skills Profile (LSP-16)<sup>32</sup> (for all patients in Adult services), with the addition of the Resource Utilisation Groups - Activities of Daily Living (RUG-ADL)<sup>33</sup> and the Resident Classification Instrument (RCI)<sup>34</sup> Behaviour Scale for patients aged over 65 or with chronic organic brain syndrome. Measured by
the Health of the Nation Outcome Scales for Children and Adolescents (HoNOSCA)\textsuperscript{(35)} and the Children’s Global Assessment Scale (CGAS)\textsuperscript{(36)} for all patients in Child/Adolescent services. Individual item scores (or subscale scores) and aggregate scores were assessed in terms of their ability to predict resource use. In the case of the LSP-16, the aggregate score excluded the three items comprising the Compliance subscale. The rationale for this approach was that the remaining three scales (Withdrawal, Self-care, Antisocial) were more clearly related to aspects of everyday functioning than compliance and co-operation with treatment. The aggregated LSP score is therefore referred to as the LSP-13.

c. Classified the patient’s primary need for treatment and the primary treatment objective as acute, functional gain, intensive extended or maintenance.

d. Classified the patient’s episode of care as either involuntary for any of the period rated, or voluntary for all of the period rated.

e. Gauged the degree of ‘complicating psychosocial factors’ that required additional input during the episode.

\textbf{Resource use data}

\textit{Staff Activity Forms} were completed daily by staff. Staff recorded four types of activities that could be attributed to specific patients (individual patient care; group-based care; visit to patient; services on behalf of patient), and four kinds of ‘non-patient attributable’ activities (teaching, training and research; consultation-liaison; services to unregistered patients; and community development). Residual time in a given shift for a given staff member was subsequently calculated and described as ‘general time’.

For patients in private hospitals, data on private psychiatrist use were extracted from the Australian Health Insurance Commission (HIC), the organisation responsible for the payment of private medical services.

Sites provided details regarding total direct and indirect expenditure over the study period (AUD at November 1996). The overall goal was to estimate the cost of care for any given patient on a given day (excluding pharmacy, imaging, pathology and capital costs).

Staff and overhead costs were distributed to the cost centre structure used by the site. Within each cost centre, costs were split according to four labour classes (medical; nursing; allied health; and other), then further split into six pools, in relation to the total time reported over the 3-month study period. Adjustments were made for structural differences in labour costs.

The first pool was patient attributable time (P) (the sum of all time reported on patient care events). This was allocated to individual patient attributable events in proportion to time reported per patient care event.

The second pool was non-patient attributable time (N) (the sum of all time reported on non-patient attributable activities). This was allocated to the four non-patient attributable products in proportion to total time reported for each over the study period.
The four remaining pools represented general time (G) (the sum of the residual total time not accounted for by P or N). Three of these were distributed to individual patient events on the basis of their inpatient status. For patients resident on a given ward corresponding to a given cost centre, the G pool was allocated in proportion to total bed days, with leave days excluded; for inpatients not resident on the particular ward and community patients, the G pool was allocated to individual patient events in proportion to ‘provider contact days’ (a day on which an occasion of service was provided to the patient by a unique staff member, with an upper limit of one contact per staff member per patient day). Each ‘provider contact day’ was assigned a weight based on its duration and the sum of the weights was used as the basis for allocation of the G pool. The final G pool was allocated to non-patient care activities in proportion to total time reported on these activities over the study period.

Overhead costs were initially split into two sub-pools, patient attributable and non-patient attributable, in proportion to time reported in each activity category by staff within the cost centre. Patient attributable overhead costs were allocated on the basis of bed days for inpatients. For community patients, the allocation was based on one share per day where a contact had occurred with a cost centre, regardless of the number or duration of contacts. Distribution of the non-patient attributable overhead pool to the non-patient care products was in proportion to total time reported over the study period for each of the four activities.

Data analysis

There were three components to the data analysis.

1. Descriptive analysis. This provided an overview of the total dataset.
2. Preparatory analysis. This involved refinement of cohorts to be used in the class-finding, and clarification of the dependent and independent variables.
3. Class-finding analysis. Four principles guided classification development: the classification defined patient classes by patient characteristics, not provider characteristics; minimum within-class variation and maximum between-class variation were sought; clinical factors were balanced against statistical criteria; and the classification variables had to be capable of routine collection, coding and data entry.

Development of the classification followed four stages:

1. Candidate predictor variables were identified using descriptive statistics and univariate regression analyses.
2. Exploratory class-finding was undertaken, using CART\textsuperscript{37}. CART determined which independent variable offered the best binary split, and then performed successive binary splits down each branch until there was no significant improvement to be made in terms of achieving further reduction of variance. PC-Group\textsuperscript{38} was used as an alternative modelling tool to assist in generating and confirming hypotheses.
3. The classification trees were then reviewed, and, where necessary, modified by ‘forcing’ or removing splits to improve clinical meaning. The revised tree was then modelled using SPSS\textsuperscript{39} and variance reduction statistics re-calculated for the overall tree and each of its branches.
Each class was trimmed by removing high cost outliers\textsuperscript{5}. Coefficients of Variation (CVs) and the overall Reduction in Variation (RIV) were recalculated for each final class using the trimmed dataset.

RESULTS

Descriptive analysis

Approximately 4,500 clinical staff participated in the study; 74\% were nurses, 14\% allied health workers, 9\% medical staff, and 3\% ‘other’.

Data were collected on 18,002 patients, in 20,553 episodes of care (5,449 in acute inpatient units; 1,055 in non-acute inpatient units; and 14,049 in the community). These episodes comprised a total of 318,309 patient care days. The majority of patients (90\%) had only one episode.

Staff reported 1.3 million hours of activity, spread across approximately 158,000 person days. In eight sites where routine payroll systems enabled actual time to be compared with expected time, compliance with activity recording was 87\%. Patient attributable activities accounted for 46\% of staff time; non-patient attributable activities for 7\%; general time for 47\%.

Total expenditure on ‘in scope’ activities by sites during the 3-month study period was $74.4m ($65.8m (88\%) on patient care activities; $8.6m (12\%) on non-patient care activities).

Average costs per day of patient care ranged from $95 in the community to $334 in the acute inpatient setting.

Preparatory analysis

Episodes in adult services were distinguished from those in child/adolescent units, and separate branches of the classification pursued for each. Inpatient episodes were reconceptualised, and dependent and independent variables were further clarified (see below).

Abandoning the distinction between acute and non-acute inpatient episodes in favour of complete and incomplete inpatient episodes

There was some overlap between acute and non-acute settings. The top 5\% of episodes in acute units were 54 days or longer, compared with a mean of 18 days. The bottom 10\% of episodes in non-acute inpatient units were 19 days or shorter, compared with an average of 73 days.

It was resolved that the classification analysis should separate inpatient episodes into those that were completed in the study period and those that were incomplete, rather than differentiate them on the basis of treatment setting. Those that were incomplete fell into three categories: (a) left censored (those that began before the study period but ended during it); (b) right censored (those that began during the study period but
ended after it); and (c) ongoing (those that began before the study period and ended after it).

**Defining the dependent variable**

*a. Completed inpatient episodes*

Study sites recorded 3,758 completed inpatient episodes, with a mean length of stay of 14.1 days (s.d.=13.4) and a mean daily cost of $343 (s.d.= $139). Variation in length of stay was double that of cost per day (CVs of 0.88 and 0.40, respectively), suggesting that differences between patients in length of stay were the main driver of variation in total episode costs.

For these episodes, total episode cost was selected as the dependent variable because:
(a) most variability was in the length of stay, so a classification based on completed episodes would be more likely to lead to normative practices and costs; (b) costs per day of treatment (e.g. days 1-3, days 4-10) were not sufficiently different to justify different ‘product lines’ within an acute inpatient stay; (c) stays were sufficiently short to fit within normal funding cycles; and (d) the approach was consistent with mainstream casemix classifications for acute inpatient services.

*b. Incomplete inpatient episodes*

In total, 2,746 incomplete inpatient episodes were recorded. These episodes had a mean ‘length of stay’ of 41.0 days (s.d.=33.9) and a mean daily cost of $304 (s.d.= $112). Again, variability in length of stay was double that of cost per day (CVs of 0.83 and 0.37, respectively). Treatment costs varied with stage of care, with slightly higher costs in the early weeks.

In determining the dependent variable for incomplete inpatient episodes, the approach adopted in other non-acute funding classifications was considered appropriate: an average daily cost calculated over a fixed period. An 8-week period was finally selected because: (a) it provided sufficient opportunity to incorporate high/low cost days of care for long-stay patients; (b) it allowed retention of 81% of the potential inpatient episodes in non-acute units in the analysis cohort; and (c) although the approach excluded 77% of left and right censored episodes, the majority of these were in acute units and were considerably shorter than 8-weeks.

This 8-week cut-off period produced a potential analysis cohort of 974 episodes from the total incomplete sample, subsequently described as ‘ongoing’ inpatient episodes. Only 21 child/adolescent episodes met the criterion, so these were excluded.

**Community episodes**

Of the 14,049 community episodes, 2,156 were completed and 11,893 were incomplete. The completed episodes tended to be short and intensive, with patients receiving care on each episode day; the incomplete episodes were characterised by longer-term ‘maintenance’ care, where the patient received regular but infrequent treatment over a long period.
The mean number of treatment days was 9.0 (s.d.=10.1), and the mean cost per treatment day was $98.74 (s.d.=$57.21). CVs for number of treatment days were approximately double those for cost per treatment day (1.12 compared with 0.58), and the number of community treatment days explained 79% of the variation in community episode costs, compared with 25% for cost per day.

Developing a classification on the basis of cost per treatment day or occasion of service would not have dealt adequately with the ongoing and chronic nature of mental illness in the community, nor reflected current treatment practices. The preferred approach was to use 8-week period costs as the dependent variable. For completed community episodes, and incomplete community episodes of more than 30 days, costs were scaled up or down to 8-weeks. Incomplete community episodes of 30 days or less were excluded. The 30-day cut-off was chosen because: (a) sufficient days were included to observe variations in patients’ service costs and patterns, from which to draw reasonable conclusions about their ‘typical costs’ over time; and (b) 85% of community episodes were included in the analysis for classification development, providing adequate sampling of the range of patients’ service patterns. Table 2 summarises the ‘rules’ for defining the dependent variable for each episode type.

Selecting the independent variables from the clinical rating cycle

Approximately 60,000 clinical ratings were submitted on the patient sample. Frequency of ratings varied by episode type, reflecting differences in episode duration. Sixty eight per cent of completed inpatient episodes had only one clinical rating (the final rating), reflecting the average length of stay for these cases of 14.1 days. By contrast, 99% of incomplete inpatient episodes and 72% of community episodes had more than one clinical rating.

### Table 2. Dependent variable definitions

<table>
<thead>
<tr>
<th>Episode Type</th>
<th>Inclusion Rule</th>
<th>Calculation of Episode Cost</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed Inpatient Episodes (Adult and Child/Adolescent cohorts)</td>
<td>All inpatient episodes starting and ending in the study period, regardless of acute/non-acute classification of inpatient unit.</td>
<td>Episode Cost = Total Cost for the inpatient stay, regardless of length</td>
<td></td>
</tr>
<tr>
<td>Total Episode Costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ongoing Inpatient Episodes (Adult cohort only)</td>
<td>All incomplete inpatient episodes (left censored, right censored, ongoing) ³ 56 days during the study period, regardless of acute/non-acute classification of inpatient</td>
<td>For episodes &gt; 56 days, total episode costs summed and scaled down to 56 days</td>
<td>Episodes &lt; 56 days costed and excluded from</td>
</tr>
<tr>
<td>Community Episodes (Adult and Child/Adolescent cohorts)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>8 week period cost</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Completed episodes:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All episodes included, regardless of episode length.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Completed episodes:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For episodes ( \leq 56 ) elapsed days, total costs for the episode = 8 week cost.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For episodes &gt; 56 elapsed days, total episode costs summed and scaled down to 8 weeks.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Incomplete episodes (left censored, right censored, ongoing):</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Episodes ( \geq 30 ) ‘elapsed days’, where elapsed days is defined as the number of days between episode registration and episode end.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Incomplete episodes:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For episodes &lt; 56 elapsed days, total episode costs summed and scaled up to 8 weeks.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For episodes &gt; 56 days, total episode costs summed and scaled down to 8 weeks.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Episodes &lt; 30 days costed and excluded from analysis.</td>
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</tr>
</tbody>
</table>

Deciding which rating to ‘take’ depended on the specific measure. For some variables, an *a priori* decision had been made with regard to when the variable should be measured, because they were considered to be relatively stable (e.g., sociodemographic measures collected on the *Episode Registration Form*) and/or summary measures (Principal Psychiatric Diagnosis and the LSP-16 collected on the *Final Clinical Ratings Form*).

Other clinical measures, however, were collected on multiple occasions throughout an episode. Some demonstrated little within-patient variation over the course of the episode (e.g., the HoNOS and Guardianship), and the first rating was used. Others varied over the course of the episode and were reduced to binary variables (e.g., Legal Status Indicator was reduced to ever involuntary vs never involuntary).
Table 3. Summary resource use statistics on the analysis cohorts

<table>
<thead>
<tr>
<th></th>
<th>Adult Cohorts</th>
<th>Child &amp; Adolescent Cohorts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Completed Inpatient Episodes</td>
<td>Ongoing Inpatient Episodes</td>
</tr>
<tr>
<td>Number of Episodes</td>
<td>3,613</td>
<td>949</td>
</tr>
<tr>
<td>Episode Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>$4,562</td>
<td>$14,201</td>
</tr>
<tr>
<td>Inter-quartile range</td>
<td>$1,351-$6,468</td>
<td>$11,414-$16,218</td>
</tr>
<tr>
<td>SD</td>
<td>$4,615</td>
<td>$4,590</td>
</tr>
<tr>
<td>CV</td>
<td>1.01</td>
<td>0.32</td>
</tr>
<tr>
<td>Length of Stay/Treatment Days$^a$</td>
<td>14.0</td>
<td>54.1</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inter-quartile range</td>
<td>4.0-20.0</td>
<td>52.9-56.0</td>
</tr>
<tr>
<td>SD</td>
<td>13.3</td>
<td>3.6</td>
</tr>
<tr>
<td>CV</td>
<td>0.95</td>
<td>0.07</td>
</tr>
<tr>
<td>Cost per Treatment Day$^b$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>$336</td>
<td>$263</td>
</tr>
<tr>
<td>Interquartile range</td>
<td>$257-$389</td>
<td>$209-$299</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>SD</td>
<td>$118</td>
<td>$84</td>
</tr>
<tr>
<td>CV</td>
<td>0.35</td>
<td>0.32</td>
</tr>
</tbody>
</table>

**Total Episode Time (hrs)**

<table>
<thead>
<tr>
<th>Mean</th>
<th>38.2</th>
<th>118.2</th>
<th>7.4</th>
<th>52.1</th>
<th>5.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interquartile range</td>
<td>8.9-47.2</td>
<td>74.5-142.1</td>
<td>1.8-8.9</td>
<td>14.4-70.4</td>
<td>1.7-6.2</td>
</tr>
<tr>
<td>SD</td>
<td>51.1</td>
<td>81.5</td>
<td>10.0</td>
<td>58.0</td>
<td>5.6</td>
</tr>
<tr>
<td>CV</td>
<td>1.34</td>
<td>0.69</td>
<td>1.35</td>
<td>1.11</td>
<td>1.11</td>
</tr>
</tbody>
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**Time per Treatment Day (hrs)**

<table>
<thead>
<tr>
<th>Mean</th>
<th>2.7</th>
<th>2.2</th>
<th>0.9</th>
<th>3.1</th>
<th>1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interquartile range</td>
<td>1.5-3.4</td>
<td>1.4-2.6</td>
<td>0.6-1.1</td>
<td>1.8-3.8</td>
<td>0.8-1.3</td>
</tr>
<tr>
<td>SD</td>
<td>1.8</td>
<td>1.5</td>
<td>0.6</td>
<td>1.7</td>
<td>0.5</td>
</tr>
<tr>
<td>CV</td>
<td>0.67</td>
<td>0.69</td>
<td>0.66</td>
<td>0.54</td>
<td>0.47</td>
</tr>
</tbody>
</table>

a. Length of Stay for Completed Inpatient Episodes refers to the number of days between admission and discharge. For Ongoing Inpatient Episodes, Length of Stay refers to the number of days the patient was in hospital during the 8-week period and therefore excludes leave periods. Treatment Days is relevant only for Community Episodes and ‘Bundled Episodes’ and indicates the number of days on which the patient received one or more services during the 8 week period.

b. Cost per Treatment Day is calculated by dividing Total Episode Cost by either Length of Stay (for inpatient episodes) or Treatment Days (for Community Episodes).

c. Total Episode Time refers to the total patient attributable time recorded for the patient during the episode.
d. Time per Treatment Day is calculated by dividing Total Episode Time by either Length of Stay (for inpatient episodes) or Treatment Days (for Community Episodes).

Class-finding analysis

A total of 16,611 setting-specific episodes were retained in the class finding analysis.

Table 4: Severity and level of functioning total scores by episode type

<table>
<thead>
<tr>
<th>Episode Type</th>
<th>Mean Total Score</th>
<th>SD</th>
<th>CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>HoNOS (Adults)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed Inpatient Episodes</td>
<td>21.2</td>
<td>6.5</td>
<td>0.31</td>
</tr>
<tr>
<td>Ongoing Inpatient Episodes</td>
<td>24.9</td>
<td>6.4</td>
<td>0.26</td>
</tr>
<tr>
<td>Community Episodes</td>
<td>20.0</td>
<td>6.3</td>
<td>0.31</td>
</tr>
<tr>
<td>HoNOSCA (Children/Adolescents)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed Inpatient Episodes</td>
<td>28.3</td>
<td>7.7</td>
<td>0.27</td>
</tr>
<tr>
<td>Community Episodes</td>
<td>24.1</td>
<td>6.6</td>
<td>0.27</td>
</tr>
<tr>
<td>LSP 13 (Adults)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed Inpatient Episodes</td>
<td>25.1</td>
<td>7.4</td>
<td>0.30</td>
</tr>
<tr>
<td>Ongoing Inpatient Episodes</td>
<td>34.3</td>
<td>8.7</td>
<td>0.25</td>
</tr>
<tr>
<td>Community Episodes</td>
<td>26.4</td>
<td>9.1</td>
<td>0.34</td>
</tr>
<tr>
<td>RUG-ADL (Adults ≥ 65years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed Inpatient Episodes</td>
<td>5.3</td>
<td>3.1</td>
<td>0.59</td>
</tr>
<tr>
<td>Ongoing Inpatient Episodes</td>
<td>7.5</td>
<td>4.9</td>
<td>0.66</td>
</tr>
<tr>
<td>Community Episodes</td>
<td>5.5</td>
<td>3.3</td>
<td>0.60</td>
</tr>
<tr>
<td>CGAS (Child/adolescent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed Inpatient Episodes</td>
<td>58.5</td>
<td>16.5</td>
<td>0.28</td>
</tr>
<tr>
<td>Community Episodes</td>
<td>63.2</td>
<td>15.6</td>
<td>0.25</td>
</tr>
</tbody>
</table>

a. HoNOS data: For the purposes of analysis, all original HoNOS scores have been transformed by adding 1 to remove the zero anchor point. Scores of 9 (“Not known or Not Applicable”) have been scored as 1. For consistency with the approach used in the class finding analysis, total score represents the sum of scores on scales 1 to 10 (scales 11-12 excluded) and has a minimum value of 10 and a maximum of 50.
b. HoNOSCA data: Scores have been transformed as per the HoNOS data. HoNOSCA Total refers to sum of all 14 items.
c. LSP data: For consistency with the approach used in the class finding analysis, total LSP score represents the sum of 13 of the 16 items on the abbreviated LSP. Scores on the 3 Compliance items have been excluded.

Variation in resource use and patient attributes

Table 3 summarises resource use data for each of the cohorts. There was limited variation between patients in terms of episode costs, indicated by relatively low CVs.
Table 4 summarises the variation in patient attributes across the analysis cohorts. Adult patients in ongoing inpatient episodes were rated as more severe in their overall level of symptoms and disability than their counterparts in completed inpatient episodes and community episodes.

For child/adolescent patients, completed inpatient and community episodes were similar in their clinical profiles, although the completed inpatient cohort tended to score slightly higher on some HoNOSCA scales.

**Summary of the MH-CASC classification**

Figure 1 presents a summary view of the MH-CASC classification. It comprises 42 classes, accounting for 78% of the variance in episode costs. Of these, 23 are inpatient episodes and 19 are community episodes (accounting for 79.8% and 20.2% of total expenditure, respectively).

**Adult completed inpatient episodes**

Figure 2 summarises the adult completed inpatient classification. The model assigns patients to 8 classes, accounting for 16.3% of variance. Classes are split on age, diagnosis, clinical severity, legal status and ADL dependency. Key features of the model include:

- The classes show a reasonable distribution in costs and lengths of stay. Fifty one per cent of cases are in the two low cost classes ($2,864 and $2,484), and the remaining cases are in classes with at least 53% higher than average costs (over $4,386).
- Those patients with higher levels of clinical severity and with involuntary status consume more resources than do those with lower levels of clinical severity and who were never involuntary. The most expensive diagnostic groups are Schizophrenia, Mood Disorders, and Eating Disorders.
- Higher costs are associated with patients aged over 65 years, with people over 85 years comprising the most expensive class.
- CVs range from 0.54 to 0.90, with most around the 0.7-0.8 level indicating that the costs within classes are homogeneous.
Figure 1: Summary of MH-CASC setting-specific classification

Summary view of MHCASC Setting-specific Classification

73.6% expenditure

12 cases split by
Age, legal status, Support and HQOSA item
Aggression/Disruptive behavior, BPD

7.4% expenditure

10 cases split by
Age, diagnosis, legal status, BPD

Gangrelated
RM=15.1%
(9.4% expenditure)

Community
RM=17.0%
(65.0% expenditure)

Private
RM=15.1%
(9.4% expenditure)

Adolescent
RM=18.3%
(27.3% expenditure)

Adult
RM=12.7%
(37.6% expenditure)

30 cases split by
Age, HQOSA Total, HQOSA item (School Problem), CGAS and Years in Detention

10 cases split by
Home abuse, legal status, BPD

30 cases split by
Age, diagnosis, legal status, BPD

12 cases split by
Age, legal status, Support and HQOSA item
Aggression/Disruptive behavior, BPD

20.7% expenditure

Adolescent
RM=18.3%
(27.3% expenditure)

Community
RM=15.1%
(9.4% expenditure)

Private
RM=12.7%
(37.6% expenditure)
Adult ongoing inpatient episodes

Figure 3 summarises the adult ongoing inpatient classification. The model proposes 12 classes, accounting for 19.1% of variance. Classes are split on age, diagnosis, legal status, aggressive/disruptive behaviour and ADL dependency. The classes display clinical logic, with the following key features:

- Younger patients are more expensive, reflecting current practice that to be admitted to a non-acute inpatient unit a person now must need intensive support.
- Patients with Schizophrenia or Organic Disorders are less expensive than patients with other diagnoses.
For the young and middle age group, higher aggression and legal status are associated with more expensive episodes.

- For the older group, patients with higher ADL scores are more costly.
- All classes have very small CVs (mostly around 0.2), pointing to very resource homogeneous classes. However, a defining characteristic of the adult ongoing inpatient cohort is the low level of variation between patients in costs (CV=0.32, untrimmed), severely restricting the scope for further variance reduction.

Figure 3: MH-CASC Classification Tree: Adult Ongoing Inpatient Episodes

12 classes, RIV=19.1% (trimmed), 8-week period costs=$13,722, Per Diem=$254
Adult community episodes

Explanation of variation in the community proved more difficult than in inpatient settings, possibly reflecting greater complexity and diversity of community care. A range of factors other than patient attributes may be important cost drivers in the community, such as availability of resources and core treatment programs (e.g., 24 hour crisis teams), variations in provider practice or the level of social and family support.

Figure 4 summarises the adult community episode classification. The model proposes 10 classes, with splits on focus of care, legal status, clinical severity and disability. Although there is an underlying clinical logic to the community episodes classification, and the classes/costs move in ‘the right direction’, the overall statistical performance is only moderate. The CVs are acceptable at around 0.8, but the RIV is 12.7%. This suggests the groups are internally homogeneous, but not sufficiently different from each other to achieve a high RIV.
Child/adolescent completed inpatient episodes

For child/adolescent completed inpatient episodes diagnosis and the disruptive/aggressive behaviour item of the HoNOSCA were used to create 3 classes.
The trimmed RIV of 14.5% was comparable with the other classification branches of the MH-CASC model. CVs were around 0.7.

Figure 5 summarises the key features of the model.

Figure 5: MH-CASC Classification Tree: Child and Adolescent Completed Inpatient Episodes

3 classes, RIV=14.5% (trimmed), Episode Cost=$6,048, LoS=16.6 days, Per Diem=$415

Child/adolescent community episodes

Figure 6 summarises the child/adolescent community episode classification. The model proposes 9 classes, with splits on age, severity, global functional, psychosocial complications and single HoNOSCA items (School Attendance Problems). The CVs were mostly around 0.6-0.7, and RIV was 18.8% (trimmed), considerably above that achieved in the adult community branch of the model.

Comparative performance of the MH-CASC classification

The AN-DRG3 classification\(^39\) offers the only benchmark for comparing the MH-CASC classification model, albeit restricted to acute inpatient settings. To place the MH-CASC findings alongside AN-DRG3, both adult and child/adolescent completed inpatient episodes were combined.

Table 5 summarises the comparison of the two classification approaches using completed inpatient episode costs as the dependent variable.

The RIV accounted for by the MH-CASC classification was 17.3%, compared with 9.9% for AN-DRG3. This is comparable with the published figure of 11.1%\(^40\), which used length of stay as the dependent variable, and drew on the national hospital
morbidity dataset including non-specialised mental health services. Same day admissions were included in the previous analysis, but excluded here.

CONCLUSIONS

There is a clinically logical relationship between patient attributes and resource use in specialist mental health services. Patients who would be expected to cost more almost invariably do cost more.
The MH-CASC classification outperforms AN-DRGs, but its statistical performance is relatively modest. This can be explained by the restricted variation between patients in terms of episode costs. This indicates that provider factors may play a significant role in resource consumption, over and above patient factors.

<table>
<thead>
<tr>
<th></th>
<th>AN-DRG</th>
<th>MH-CASC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of classes</strong></td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td><strong>Reduction in variance (RIV)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Untrimmed</td>
<td>3.8%</td>
<td>17.3%</td>
</tr>
<tr>
<td>• Trimmed</td>
<td>9.9%</td>
<td></td>
</tr>
<tr>
<td><strong>Range of Coefficient of Variance (CV)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Untrimmed</td>
<td>0.77 to 1.24</td>
<td>0.60 to 1.15</td>
</tr>
<tr>
<td>• Trimmed</td>
<td>0.63 to 1.15</td>
<td>0.54 to 0.90</td>
</tr>
</tbody>
</table>

Most variation occurred in community episodes, where the CV was 1.22 for adults and 1.24 for children/adolescents. By comparison, the overall variation in the untrimmed AN-DRG dataset collected in the wider health system (CV=3.3) is approximately three times that of the MH-CASC sample. In summary, there is less variability between patient costs in the mental health system than there is in the broader health system. This is unsurprising, but renders the RIV statistic low because there is less variation to explain.

Overall, however, the MH-CASC classification would appear to have considerable potential as the first version of a casemix system for mental health services. Obviously, ongoing refinement will be necessary. The major challenge for the mental health community is to ‘strengthen the signal’ so that there is a more normative pattern of services that differentiates the types of patients using specialised mental health services.

As a funding tool, the utility of the MH-CASC classification needs to be assessed against existing arrangements. Funders may not immediately embrace the MH-CASC classification, because of the comparatively low RIV. However, it performs better than
the AN-DRG mental health classification both in terms of its capacity to explain patient cost variation, and the statistical homogeneity of its classes. It also provides coverage of both inpatient and community services, avoiding perverse incentives to admit patients.

In its current form, the classification could be used for management information, benchmarking and outcome and quality review, in order to focus services more directly on the patterns of care being provided to different types of patients. Clinical protocols could be developed, in order to compare the identified type, level and cost of care provided to each of the patient classes with appropriate practice. Trials could be undertaken to model the impact of using the classification for funding purposes.

Classification development, refinement and implementation are iterative processes. The MH-CASC classification offers a base for many future developments in the mental health sector.

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