**TAGRA ACUTE MLC SUBGROUP By email**

**INDICATOR SELECTION RESULTS – PART 4**

**1. Background and Summary**

At the 13th meeting of the Subgroup in April 2016, results from the indicator selection process were discussed. Two decisions were made:

* To retain the diagnostic groups.
* To use a common index across all diagnostic groups.

In terms of the index options, it was decided that LLTI alone would lack face validity as compared to an index that also accounted for other factors such as premature mortality and ethnicity. The best-performing index options were the 4-variable models; however, concerns were raised over the DNA variable, which appeared in both of the 4-variable models considered in paper TAMLC47. It was decided that, due to the possibility of a perverse incentive to maintain high DNA rates if these were included in the model, the DNA variable should be excluded.

The analysts were asked to explore a further 4-variable model, consisting of LLTI, All-cause SMR <75, Ethnicity and Unpaid care, and to compare its performance with that of the remaining common index options – excluding LLTI alone and all options containing DNA.

In this paper, the final set of options for the needs index are analysed and compared in terms of explanatory and predictive power, and the Subgroup is asked to decide on the index to be adopted.

**2. Comparison of final needs index options**

In this section the performance of the different index options is examined. Section 2.1 looks at how well the different options explain variation in the 3-year cost ratios, and section 2.2 looks at how well the different options predict the future costs.

**2.1 Explanatory power: adjusted R2**

Table 1 shows the adjusted R2 values from the regressions using each of the index options. Values for LLTI alone are also shown, for reference.

*Table 1: Adjusted R2 for various index options. The highest value(s) for each diagnostic group are highlighted in bold and italics. LLTI-alone values are shown in red for reference.*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model** | **Cancer** | **Heart** | **Digestive** | **Injury** | **Other** | **Respiratory** | **Outpatients** | **Weighted**  **average** |
| [LLTI] | 9.7% | 21.6% | 39.3% | 26.8% | 46.7% | 38.2% | 51.1% | 37.9% |
| [LLTI, All-cause SMR <75] | ***10.9%*** | ***21.0%*** | 38.6% | ***26.0%*** | 45.1% | 38.2% | 49.3% | 36.9% |
| [LLTI, All-cause SMR <75, Ethnicity] | 10.7% | 19.5% | 39.3% | 23.9% | 46.3% | 37.3% | 51.5% | 37.4% |
| [LLTI, All-cause SMR <75, Unpaid care] | 10.6% | ***21.0%*** | ***39.5%*** | 24.8% | 46.7% | ***38.7%*** | 52.0% | ***37.9%*** |
| [LLTI, All-cause SMR <75, Ethnicity, Unpaid care] | 10.4% | 19.5% | ***39.5%*** | 23.0% | ***46.8%*** | 37.4% | ***53.2%*** | 37.8% |

There is no clear best option in terms of R2; three models, [LLTI, All-cause SMR <75], [LLTI, All-cause SMR <75, Unpaid care] and [LLTI, All-cause SMR <75, Ethnicity, Unpaid care], produce the highest R2 for three diagnostic groups each. The remaining model, [LLTI, All-cause SMR <75, Ethnicity], never has the highest R2 value, but there is not much difference between the results.

The final column of the table shows an average R2, using the spend within the diagnostic groups to weight the average; the highest weighted average is found to be for [LLTI, All-cause SMR <75, Unpaid care]. It is worth noting that all 3- and 4-variable models appear to be better than the current reference model [LLTI, All-cause SMR <75] when looking at the weighted average R2.

**2.2 Predictive power: RSS**

*Predictive* power is arguably more important than *explanatory* power, since the MLC adjustment is used to predict cost ratios in the year of allocation. To evaluate the models in predictive mode, predicted cost ratios are generated. These predictions are then compared with a 1-year cost ratio based on 2014/15 data. The 2014/15 cost ratio represents the ‘future’ observation which the model would be trying to predict.

Predicted cost ratios are calculated in the same way as in the NRAC formula: the coefficient of the needs index is obtained through a regression including the supply model, but the supply variables are not used in the prediction. In the case of Outpatients, the prison dummy variable (introduced in paper TAMLC43) is included in both the regression and the prediction.

As before, comparison of predictions with observations is done using the residual sum of squares (RSS): this is the sum of the squared differences between the predictions and the observations. Low RSS values indicate that the observations are relatively close to the predictions.

The RSS values are given in Table 2.

*Table 2: RSS obtained from comparing predictions derived from the index options with the 2014/15 cost ratios. Lower values indicate the predictions are closer to the observed value; the lowest value(s) for each diagnostic group are highlighted in bold and italics. LLTI-alone values are shown in red for reference.*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Model** | **Cancer** | **Heart** | **Digestive** | **Injury** | **Other** | **Respiratory** | **Outpatients** |
| [LLTI] | 3262 | 3601 | 2156 | 2842 | 807 | 3520 | 389 |
| [LLTI, All-cause SMR <75] | 3264 | ***3618*** | 2200 | **2852** | 828 | 3569 | 396 |
| [LLTI, All-cause SMR <75, Ethnicity] | 3271 | 3656 | 2143 | 2916 | 820 | 3626 | 395 |
| [LLTI, All-cause SMR <75, Unpaid care] | ***3262*** | 3620 | 2157 | 2866 | **808** | **3545** | **388** |
| [LLTI, All-cause SMR <75, Ethnicity, Unpaid care] | 3270 | 3658 | ***2134*** | 2921 | 816 | 3621 | 391 |

One of the 3-variable models, [LLTI, All-cause SMR <75, Unpaid care], produces the lowest RSS (not including the LLTI-alone values) for four diagnostic groups.

Since the diagnostic groups are not equally weighted, it is also useful to aggregate the predictions of the diagnostic groups, as will be done when the adjustment is implemented in the Formula, and compare those Acute-level predictions with an overall Acute-level cost ratio. Table 3 shows the results of doing this. In this analysis, [LLTI, All-cause SMR <75, Unpaid care] appears to make the most accurate predictions overall (again, excluding LLTI alone), followed by [LLTI, All-cause SMR].

*Table 3: RSS obtained from comparing predictions derived from the index options – aggregated to Acute level – with the 2014/15 overall Acute cost ratios. LLTI-alone values are shown in red for reference.*

|  |  |
| --- | --- |
| **Model** | **Aggregated diagnostic groups** |
| [LLTI] | 451 |
| [LLTI, All-cause SMR <75] | 461 |
| [LLTI, All-cause SMR <75, Ethnicity] | 471 |
| [LLTI, All-cause SMR <75, Unpaid care] | ***452*** |
| [LLTI, All-cause SMR <75, Ethnicity, Unpaid care] | 463 |

**3. TAGRA Core Criteria**

The following table provides comments on each of the models in relation to the TAGRA Core Criteria. Positive comments are highlighted in green, negative in red. These have been scored to provide a summary evaluation.

*Table 4. TAGRA core criteria evaluation for different variable combinations.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **LLTI, All-cause SMR <75** | **LLTI, All-cause SMR <75, Unpaid care** | **LLTI, All-cause SMR <75, Ethnicity** | **LLTI, All-cause SMR <75, Unpaid care, Ethnicity** |
| **Equity** |  | + Equity would perhaps favour either of 3 or 4-variable models over LLTI alone, since these models can pick up need relating to unpaid caregiving or ethnicity. | + Equity would perhaps favour either of the 3 or 4-variable models over LLTI alone, since these models can pick up need relating to unpaid caregiving or ethnicity. | + Equity would perhaps favour either of the 3 or 4-variable models over LLTI alone, since these models can pick up need relating to unpaid caregiving or ethnicity. |
| **Practicality** | Similar level of work involved in updating each index option | Similar level of work involved in updating each index option | Similar level of work involved in updating each index option | Similar level of work involved in updating each index option |
| **Transparency** |  | - The nature of the association between unpaid care and acute costs is not well understood. |  | - The nature of the association between unpaid care and acute costs is not well understood. |
| **Objectivity** | - This option has the lowest weighted average R2 value. | + The statistical analysis marginally favours this option. | - Overall the statistical analysis does not favour this option. |  |
| **Avoiding Perverse Incentives** | + The elements of this model are all demand side variables and are therefore not susceptible to variations in supply provision. |  | + The elements of this model are all demand side variables and are therefore not susceptible to variations in supply provision. |  |
| **Relevance** | + All variables have a strong theoretical / intuitive link to healthcare need |  | + All variables have a strong theoretical / intuitive link to healthcare need |  |
| **Stability** | + Keeping the current index would result in minimal changes to the target shares. |  |  |  |
| **Responsiveness** |  | - Patterns of unpaid care may change more rapidly than can be captured adequately by a 10-yearly census | - Would ethnic group demographics be expected to change more rapidly than can be captured adequately by a 10-yearly census? | - Would ethnic group demographics be expected to change more rapidly than can be captured adequately by a 10-yearly census?  - Patterns of unpaid care may change more rapidly than can be captured adequately by a 10-yearly census |
| **Face Validity** | + Since this is the current index, it has already been accepted and explained | - Is unpaid care a counter-intuitive indicator of health need? | + The processes through which these variables influence healthcare needs are well evidenced and understood | - Is unpaid care a counter-intuitive indicator of health need? |
| ***Overall evaluation*** | + + + + - | + + - - - | + + + + - - | + - - - - |

**4. Conclusion**

Statistically, the best of the four options under consideration is [LLTI, All-cause SMR <75, Unpaid care]. It has the highest R2 for three diagnostic groups (and the highest weighted-average R2), the lowest RSS for four diagnostic groups, and the lowest overall RSS.

The current reference model, [LLTI, All-cause SMR <75], is the second-best performing model statistically: it has the highest R2 for three diagnostic groups, the lowest RSS for two diagnostic groups, and the second lowest overall RSS. However, it is worth noting that its performance is the poorest of all the options when looking at the weighted average R2 (across all diagnostic groups).

Models with Ethnicity perform slightly less well than models including Unpaid care. However, it has already been established that non-statistical factors such as face validity can outweigh marginal differences in performance in the context of model selection. The TAGRA core criteria evaluation above highlights concerns about the transparency and face validity of the unpaid care variable: the mechanisms through which it is associated with healthcare costs are not well understood and would be difficult to explain to a lay person. (In contrast, the association between ethnicity and healthcare need is well understood and supported by the epidemiological literature.) There is also a concern about its responsiveness: it could only be updated every 10 years with a new census, and it is questionable whether geographical patterns of unpaid care would remain the same over that period, especially given the ongoing work to improve social care. As a result, the options including Unpaid care have more negative than positive evaluations in Table 4.

Of the two models that do not include Unpaid care – [LLTI, All-cause SMR <75] and [LLTI, All-cause SMR <75, Ethnicity] – the 2-variable model performs slightly better statistically, overall, although the weighted-average R2 of the 3-variable model is slightly higher. Table 4 queries how quickly population demographics would be expected to change in relation to ethnicity, and whether a 10-yearly update to the Ethnicity variable would adequately capture the patterns of need. However, this is less of a concern than for unpaid care, and on the positive side, including Ethnicity would better fulfil the ‘equity’ aspect of the core criteria.

AST consider that the potential improvement in equity from including Ethnicity outweighs both the slightly better statistical performance of the 2-variable model and the fact that as a census variable Ethnicity can only be updated every 10 years. As a result, AST recommend adopting the 3-variable model comprising LLTI, All-cause SMR <75 and Ethnicity.

**Q: The Subgroup is asked to endorse this recommendation.**

**Addition 29 April 2016:** Following further discussion among the sub-group this week regarding the unpaid care variable, clinical advice was sought and two published reports were found to inform this discussion[[1]](#endnote-1). As the needs index is a key decision in the Acute MLC review, it is important to consider the evidence, in order to understand unpaid care and its relationship with health costs.

The reports indicate that we should see a dose response relationship between unpaid care and higher acute health costs. However, our model does not show this. It is difficult to infer causation, rather that unpaid care may be a proxy for higher health needs in a population, reflecting a higher number of people requiring care. The reports suggest a relationship between unpaid carers and higher levels of self-reported poorer health. There is concern though that unpaid care may have a relationship with health costs in both directions, in that it does reflect a population with higher health needs but may decrease demand for unscheduled care and reduce delayed discharges through the support that carers provide.

During the Health Inequalities Impact Assessment workshop (see minutes of the 18th August 2015 meeting), carers were identified by the group as being a high profile group in current policy. Consideration of carers is relevant for their own healthcare needs and for the costs to the NHS if they become unable to care.

Following our recommendation above, of the 3-variable model comprising LLTI, All-cause SMR <75 and Ethnicity, the group are asked to consider whether the additional discussion on unpaid care could justify the inclusion of this variable in a 4-variable model (LLTI, All-cause SMR <75, Ethnicity and Unpaid Care).

1. Scotland’s Carers (<http://www.gov.scot/Resource/0047/00473691.pdf>) and Caring in Scotland: Analysis of Existing Data Sources on Unpaid Carers in Scotland (<http://www.gov.scot/Resource/Doc/319575/0102110.pdf>) [↑](#endnote-ref-1)