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Hospital mortality rates and changes in activity

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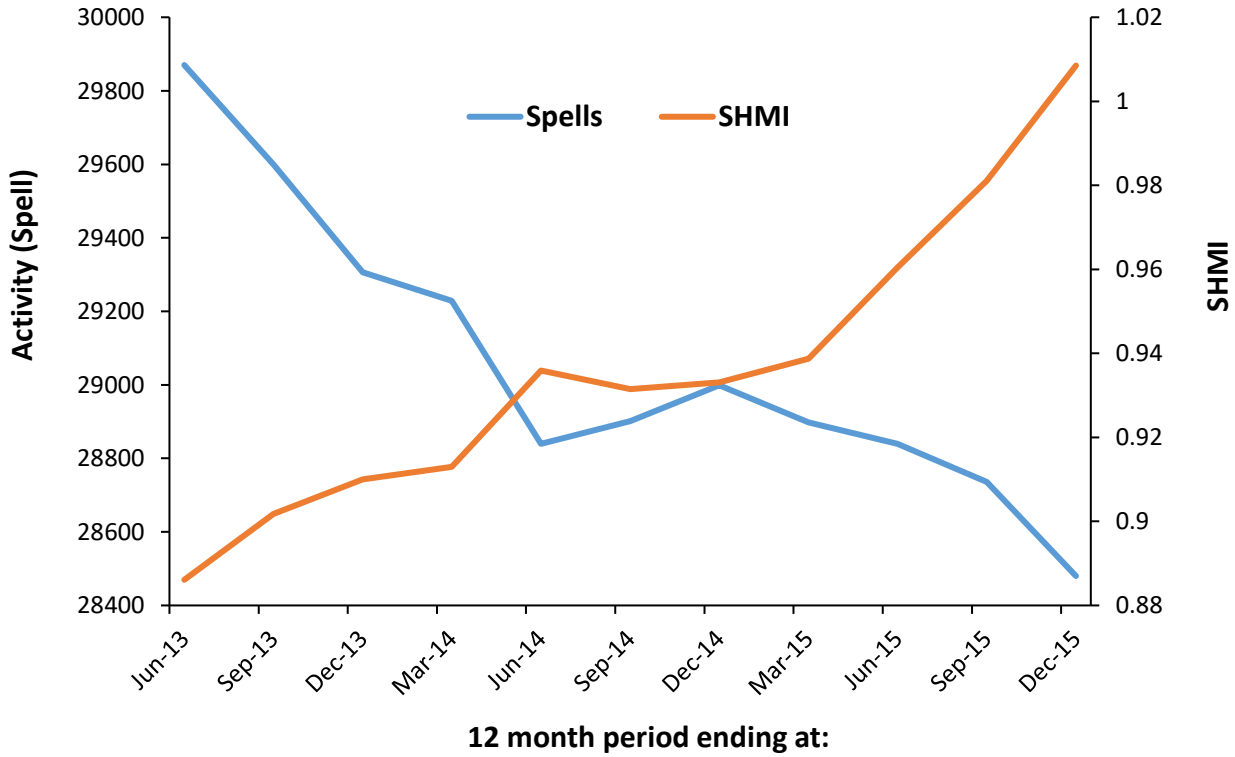
Further articles in this series can be found at http://www.hcaf.biz/2010/Publications_Full.pdf

A series of articles in BJHCM and elsewhere has been investigating potential flaws in the measurement of hospital mortality (Jones 2015a,b, 2016a-d). Hospital mortality models have been used to detect instances of poor care such as occurred in the Mid Staffordshire Hospital. However, shall we start with the assumption that all models are flawed; some are just more flawed than others.

Figure 1: Relationship between activity and SHMI score at Northern Devon Healthcare



Footnote: SHMI data is from the NHS Digital (formerly HSCIC) website

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For example, all models perform badly at the extremes, i.e. as the modelled behaviour moves further away from 'average'. This occurs because the process of minimizing the sum of squares (or equivalent) automatically draws the model to the more copious data lying closest to 'average' behaviour. For this reason, the SHMI score for English hospitals is restricted to 'non-specialist' hospitals. A previous article in this series suggested that SHMI could be manipulated downward by opening an assessment unit, i.e. dramatically increasing the number of same-day stay or low acuity admissions (Jones 2016d).

Figure 1 therefore investigates a possible relationship between activity (admissions) and SHMI using data from the Northern Devon Healthcare NHS Trust which is a combined acute and community healthcare organisation, i.e. it is a non-average healthcare organisation compared to the majority of acute hospitals comprising the SHMI score.

The SHMI data is comprised of 12 month periods which are updated on a quarterly basis. Hence any sudden or step change in service configuration affecting total activity will generate a series of ramps. Hence in Figure 1 activity starts at 12 months of admissions (29,870) for the period ending June 2013. A step-reduction in activity (to roughly 28,840) occurs shortly after June 2013 and this gradually dilutes the running total until a full 12 months of lower activity is available at June 2014. This reduction in activity causes a corresponding increase in the SHMI score from 0.886 (12 months ending June 2013) to 0.936 (12 months ending June 2014). There is a temporary increase in activity after June 2014, but there is another step-like reduction in activity just after December 2014 which leads to another step-like increase in SHMI from 0.933 (12 months ending December 2014) to 1.01 (12 months ending December 2015).

Is this rise in SHMI indicative of a trend to worsening quality of care? The answer is probably not; rather fundamental changes in service delivery are leading to a higher acuity fraction of patients being admitted into acute care (with the higher acuity not reflected in the measures of diagnosis used within SHMI). Hence the changes are more likely to be related to the particular set of flaws inherent in the SHMI model. For example, SHMI omits to include the known contribution from deprivation on the all-cause and hospital mortality rates (Ben-Shlomo et al 1996, Welch et al 2010), and levels of multi-morbidity (Charlton et al 2013).

The second example comes from the North Middlesex University Hospital NHS Trust. On December 9th 2013 the A&E department at Chase Farm hospital was closed and patients were forced to use either Barnet or North Middlesex hospitals as the next alternative. It is estimated that an extra 40,000 A&E patients descended upon the A&E at North Middlesex along with associated inpatient admissions. These additional inpatients will have had a different case-mix/acuity to that of the previous North Middlesex cohort. Hence as seen in Figure 2 activity slightly increases in the 12 months ending December 2013 (Chase Farm closed on the 9th December), hence a step-increase in activity from 29,625 (12 months ending October 2013, before the closure) to 45,833 (12 months Ending December 2014). SHMI makes a

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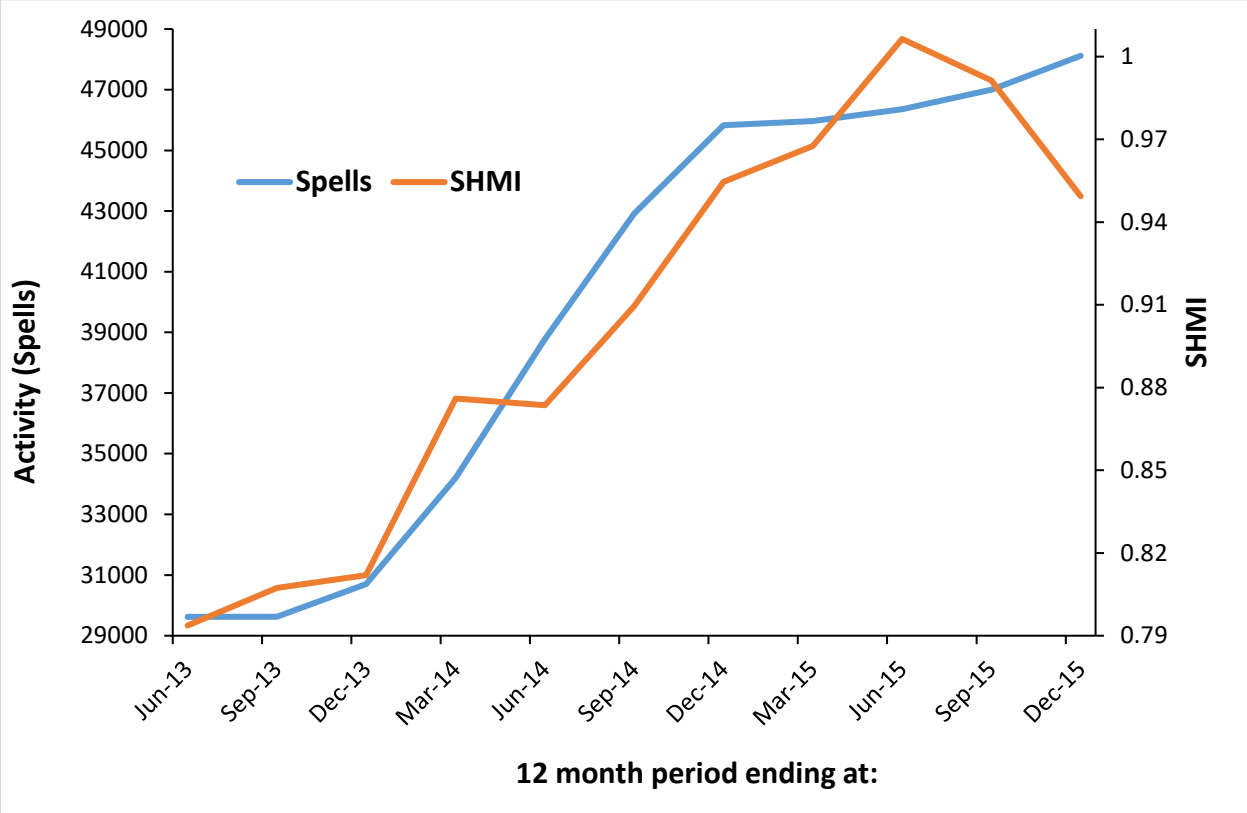
corresponding step-increase from 0.81 to 0.95, however, shows evidence of a further increase to 1.01 for the 12 months ending June 2015.

Figure 2: Relationship between activity and SHMI at North Middlesex University Hospital



Hence to what extent may poor care have contributed to these changes? In view of the proposed further closure of hospitals across England as part of the STP this is an interesting case study. Firstly, whoever did the planning around the changed flows to Barnet and North Middlesex clearly fell into the 'money saving' trap of grossly underestimating future patient flows (and associated staffing), and consequently overestimating potential 'savings'.

The sudden arrival of an extra 16,200 emergency inpatients per annum at North Middlesex clearly had an impact on patient safety. SHMI jumped from 0.807 (before the change) to 0.876 in the 12-month period ending Mar-14, i.e. 4 months of post change activity. Hence the immediate change in SHMI for the first four months was to rise to 1.014, i.e. a 26% step-like increase in the hospital mortality rate. Unfortunately, it would take complex analysis to unravel the contribution from the SHMI model (via a sudden change in patient case-mix and acuity) to enable an accurate determination of the contribution from poor care via overwhelmed medical and nursing services (Needleman et al 2011, McHugh et al 2013, Symons et al 2013, Griffiths et al 2016). However, if we were to apportion 50:50 we could estimate that at least 13% more people died in the initial stages of this service reconfiguration than may have done with adequate and realistic prior planning.

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It is somewhat pleasing to note that from around June 2015 onward SHMI appears to undergo a step-reduction indicating that additional resources have led to a reduction in mortality, with a likely SHMI of around 0.88 for the 12 month ending June 2016.

In conclusion, SHMI is sensitive to configuration changes, and appears to increase when the case-mix and acuity shift away from the 'norm', as is graphically illustrated in the events surrounding the closure of the Chase Farm A&E in December 2013. SHMI is therefore not a good tool to evaluate the contribution from any service change which is exclusively due to patient care.

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