Separation of systematic differences in casemix for better predictability of DRG classification in emergency hospitals

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Introduction
The somatic short-term care will go through a major structural reform within the coming years in Stockholm county council (SCC). The Karolinska University Hospital (KUH) will have an exclusive assignment with treatment with the most highly specialized care for the most complicated cases. The total number of admissions will, according to the plan, decrease with 20% from today's level. Excluded patients will be transferred to the other emergency hospitals (OEH) in SCC. These hospitals will also have new and diversified assignments, which will lead to low cost cases be transferred to outpatient care.
The cost of the KUH is much higher compared to the OEH. There also exist huge differences in casemix, distribution of costs and medical complexity between the KUH and the OEH. The reform will make these differences even larger. Thus there is a need for finding methods that more correctly will describe the care, including refinement of methods that can discriminate the casemix between hospitals, more appropriate trimming methods and calculation of relative cost weights, etc.
In a previous study we analyzed problems in the DRG system that remained after 5% trimming of high cost outliers. We found substantial variation in casemix index (CMI) between years, still asymmetric and skewed distribution after trimming and huge differences in cost between hospitals. This makes the DRG system less predictable.
In this study the objective is to describe and analyze differences in the characteristics of casemix distributions for a large University hospital with highly specialized care compared to other emergency hospitals. Another aim is a separate trimming of OEH after exclusion of KUH, in order to increase DRG system reliability and predictability by reducing some of the differences between the two hospital categories.

Methods
We used cost per patient data from the hospitals for 2013. For studying the difference in casemix between KUH and the OEH as well as the impact on the distribution within DRGs we used statistical measures such as skewness and coefficient of variation (CV) and mean combined with descriptive methods. More than 700 DRGs, including differentiation due to complication rate, are used for classification of in-hospital care. DRG is adjusted for difference in casemix between hospitals to improve comparability of costs, outliers, LOS, DRG complications or age, etc. Trimming is based on the quartile method and its effects on cost and medical homogeneity is measured with explanatory value (R²).

Results
267 000 in-hospital stays in six emergency hospitals in Stockholm County in 2013 were analyzed. With a single common casemix distribution we observed systematic differences between KUH and the OEH. After adjusting data for differences in casemix and trimming with 5% for high cost outliers KUH had 50% higher cost than the OEH. KUH had a 9% share of cost outliers compared to 2,5% for the OEH. The values of CV and skewness are higher for KUH even after trimming for cost outliers. Cost and hospital CMI for KUH differ compared to the OEH. The explanatory value after trimming is 68%.
A separate trimming of 163 000 cases in the OEH resulted in 155 500 remaining inliers. The explanatory value (R²) was 66,5% when trimming with 5% level for high cost outliers. The homogeneity of the casemix distribution improved, values of CV and skewness show more resemblance to a normal distribution after exclusion of the systematic different casemix of KUH. Maximum divergence between cost index for the OEH compared to their average decreased substantially and were very close to the mean. A strong correlation could be observed between index for cost and hospital CMI for the OEH.

Conclusions
Data shows substantial differences regarding distribution of costs between the major university hospital,
KUH, and the other emergency hospitals (OEH) in SCC, which deteriorates the predictability of the DRG model. Excluding systematic differences by separate trimming of the OEH resulted in substantial improvement in the characteristics of the DRGs of the OEH. With the cases from the KUH excluded the casemix distribution for the OEH became more homogeneous with 5% trimming for high cost outliers and represented a good approximation of a normal distribution. Improvement could be observed also after adjusting for casemix differences in most of the casemix properties. Average cost index and hospital CMI for the respective OEH were strongly correlated and showed only minor variation around their common average.

To control for and adjust for systematic differences in the casemix distribution are useful means for improving the homogeneity and the predictability of casemix and DRG distribution which gives a more reliable and comparable measure.

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