Description of a Revised Methodology to Predict Adult Open Heart Surgery Cases
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Background: The Certificate of Need (CON) Commission is tasked to identify the need for each of the services regulated by the CON program. In Open Heart Surgery Services, the Commission has adopted a mathematical methodology using inpatient discharge data provided thru the Michigan Inpatient Data Base (MIDB) to predict open heart procedures (cases). The methodology groups appropriate cardiac ICD-9-CM diagnosis codes into several diagnostic categories. Within each of these groups, the number of individuals discharged with a cardiac diagnosis is then compared with the number of those same individuals who received open heart surgery and a "weight" is produced (number of open heart procedures divided by the number of inpatient discharges for the diagnostic category). The weight, a decimal fraction, represents the ratio which is applied to estimate the number of cases each group of diagnoses can be expected to present. This basic methodology was adopted by the Commission in 1986.

Revised Methodology: Recently, the Commission has proposed to adjust the list of ICD-9-CM procedure codes that define what constitutes an open heart surgery procedure (consistent with the Open Heart Surgery Standards). This revised set of procedure codes was then incorporated into the computation of the replacement weights. The new weights were then used to calculate the projected number of open heart surgical procedures by hospital. Examination of this output, when matched against actual open heart surgical procedures at hospitals with open heart surgery programs, showed projections that are substantially less than the actual number of open heart procedures performed. Conversely, hospitals that did not have open heart surgery programs showed unrealistically high projections.

After analysis, it was determined that there were two principal causes for the discrepancy. First, the methodology combines both principal and non-principal diagnostic codes to calculate the weight for a given diagnostic category. There is no rationale supporting the assumption that the need for surgical intervention is the same for a non-principal as a principal diagnosis. Secondly, the development and use of new technology and treatment protocols in cardiac disease have significantly altered the circumstances under which an open heart procedure is necessary.

To address this weakness in the methodology, a revised methodology is proposed which utilizes two separate sets of weights: one for Principal Diagnosis and the other for Non-Principal Diagnoses. In addition, the computation of the weights is limited to using the data from only those hospitals that currently have open heart surgery programs. This strengthens the predictive value of the weights since they are directly associated with actual open heart procedures and discharge diagnoses. For the computation, the third major modification was the incorporation of all available procedure codes ("any mention") within each diagnostic code. The original methodology was limited to the first four codes from each set. This is problematic because after the "principal" code, the remaining codes were listed in no particular order.

The structure of the revised model was further enhanced by analyses of the diagnosis and procedure codes. The analysis showed the number of discharges and open heart procedures by three-digit diagnostic code. Three decision rules were developed to allow the categorization of the diagnostic codes. These three rules are applied in descending order.

The first decision rule applied to these codes was that there had to be at least 100 cases per year and the "weight" had to be greater than ten percent. This affirmed that the first four diagnostic categories were correct. The only exception was that code 421 – "Acute and Subacute Endocarditis" was moved from the "All Other Heart Conditions" category to the "Valve" category. This decision rule also identified that code 441 – "Aortic Aneurysm" should be separated from the

"All Other Heart Conditions" category to form a new separate group. Furthermore, this decision rule showed that two of the existing diagnostic groups ("Other Acute & Subacute Ischemic" and "Angina & Chest Pain") should also be moved to the "All Other Heart Conditions" category.

The other two decision rules were established to identify which codes should remain in the "All Other Heart Conditions" category. The second decision rule is that there must be at least ten cases per year and the weight greater than one percent. The third decision rule is that there must be at least 100 cases per year (no minimum weight criteria).

Further analysis was also done on the ICD-9-CM procedure codes that define open heart surgery procedure. This analysis showed that one additional code should be deleted. The code is: 37.77 – "Removal of lead(s) [electrode] without replacement."

The above adjustments were made and incorporated into the methodology. The methodology showed a statewide projection of 15,707 open heart procedures. The actual number of open heart procedures counted in the MIDB using the new codes that define open heart surgery is 13,195. This difference is due to the fact that the weights were calculated using only the hospitals with open heart surgery; the model was then applied to every hospital in the state. The difference between actual and projected represents an over estimation of the open heart procedures at non-open heart hospitals since actual open heart surgeries are not performed at these hospitals. The 2,512 procedures are then adjusted in order to match the number of actual open heart procedures that occur. This computation yields a statewide adjustment factor of .84 which, when applied to the projection of every hospital, will yield a total equivalent to the number of open heart procedures actually reported by the MIDB. This adjustment is calculated and applied at the separate HSA levels.

The revised model will be run annually dependent on the annual release of the MIDB data set.