Optimization of resource use becomes even more crucial in developing countries due to the scarcity of health care system financing sources. The Brazilian public health care system, Sistema Único de Saúde, SUS, is under construction since a health care reform a decade ago. Intense efforts are currently being made to further develop states' health care networks, family care teams, professionals' formation including specialists, aiming to improve access, equity and social justice.

Yearly, in Brazil, congenital heart defects are associated with near 100,000 hospitalizations out of 12 millions hospital admissions (0.10%). Detection and diagnosis of these conditions have increased 12% since the year 2000. Related long lengths of stays have motivated explanatory and management research, in a hope to find means for optimization of the use of scarce resources.

The Heart Institute/Clínicas Hospital of the São Paulo University Medical School, InCor/HC-FMUSP, is the major reference centre for congenital heart surgeries in Brazil and does receive, yearly, near 1,000 cases with congenital heart malformations. Most complex cases are referred to the InCor and congenital heart surgeries account for more than 10% of all surgical interventions done at the InCor.

Public and private payers are, thus, expecting transparent and rigorous account of the results for each investment. In the context of significant amounts of investment for the congenital heart surgery programs, risk stratification becomes an important instrument to demonstrate the complexity of these programs. Evaluation of the quality and the quantities of required resources may allow better planning for the InCor and for the payers, particularly for the government. In order to facilitate evaluations, the Heart Institute has developed an electronic medical record in an integrated information system.

Objective
This partial report aims to show the first results and to discuss the cost-effectiveness methods applied.

Methods
This is a prospective cohort study of consecutive congenital heart surgery cases, operated for repair or palliation, at the Heart Institute of the São Paulo University Medical School between January the 3rd and December 14th, 2005.

The integrated InCor Information System, SI3, imposed the designation of the primary procedure which is documented by the surgeon for each hospital admission. Procedures are designated as harmonized with the Society of Thoracic Surgeons, STS, Nomenclature, related and integrated to the administrative and reimbursement SI3 tables. Bar codes strings are assigned to each patient at the hospital admission and are also apposed to materials and medications.

Electronic records of diagnosis and clinical evolution, prescription of tests and drugs and bar code registration of dispensed materials and medications facilitate integral data collection.

Patients were classified into four groups of Risk level according to Aristotle Basic and Complexity Scales: level 1 with scores from 3 to 5.9, 2nd level with scores 6 to 7.9, 3rd level with scores 8 to 9.9 and level 4 for those having scores of 10 or more.

Morbidity events and mortality ('Assigned to this Operation' as defined by the STS) were documented in real time.

Micro-costs building methods were applied to estimate costs with local currency, where R$1=US $0.57, related to each particular event of care from admission to hospital discharge (materials, medications, multi-professional procedures, tests, rate per hour at the operating theatre and the ICU or ward bed rate per day. Physician fees were excluded from the evaluation). Before discharge, quality and quantities of resources used were cross-verified for data completeness and consistency.

After hospital discharge, a clinical team ensures life long post-operative follow-up, with periodic visits and facilitated access for all required care.

Results
Local, Persons & Time: This first study reports the experience of the 465 consecutive cases, who underwent congenital heart surgery, repair or palliation, at the Heart Institute of the São Paulo University Medical School between January the 3rd and December 14th, 2005.
Patients' average age and its variation were not significantly different between Aristotle strata for analysis.

- Aristotle Basic scores significantly underestimate patients' strata for analysis.
- According to Aristotle Complexity Scale Risk Levels Kaplan Meyer actuarial survival does not show differences between 1st and 2nd levels and demonstrates a trend of similarity between 3rd and 4th strata: showing a plateau without further deaths after the second year post-op.

Only 1 patient did not survive out of the 66 with scores lower than 6 and other 5 died from the 2nd stratum with 151 patients. At the highest strata, however we observed 9 and 21 deaths out of the 111 and 137 patients integrating the 3rd and 4th levels, respectively. Table 1. Figure 1. Figure 2. Figure 3. Figure 4.

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Table 1. Differential Distribution: Age variation / Risk Level / Aristotle Scales

Figure 1. Relative distribution of the number of cases comparing Basic or Complexity Scores / Aristotle Scales

Figure 2. Actuarial survival probability according to Aristotle Complexity Scale Risk Levels
Conclusions:

- The comprehensive Complexity score /Aristotle scale presented significant predictive value, hospital mortality being significantly correlated with the highest Aristotle score ($p = 0.024$).
- Patients with the highest scores, 4th stratum required the double of the length of stay and ICU use than the 2nd stratum, as well as more than double the number of diagnostic tests and therapeutic procedures required.
- Thus, costs for the hospital admissions have increased three fold from the 2nd stratum until the 4th level of scores. Fig 5.
- Presence of infection before surgery tripled costs regardless of age group or risk levels.
- Post-operative infection tripled costs for neonatal and adolescents and doubled it particularly for patients with the highest scores.
- Refinements of the complexity score may help to further discriminate diagnostic co-morbid categories and associated factors predicting use of resources and costs.

![Figure 3. Total costs variation / Complexity Scale Risk Levels](image1)

![Figure 4. Average cost center/categories / Complexity Scale Risk Levels](image2)
Discussion
This study is part of the team approach aiming to secure program assessment for improvements, to expand the access to care for children with complex disease and to participate in the international effort to build the Congenital Surgeries Registry. Further annual patients cohorts are being followed.

Although mainly the most complex patients are referred to the InCor, the InCor’s surgical team has succeeded to achieve outcomes comparable to the international standards. In order to overcome late referral issues, particularly, missed opportunities for the diagnosis of left-sided obstructive lesions, the InCor’s surgical team strongly engaged with medical graduation and post-graduation teaching. The higher rates of emergency hospital admissions associated with cardiogenic shock seen in our milieu are of note. To improve outcome in these high-risk patients, preoperative management should be optimized and repair should not be delayed.

Bibliography

Figure 5. Total Cost Estimates modification due to absence or presence of infection before or after the surgery per group of age and Aristotle Complexity Scale Risk Levels

CV of the author
- possui mestrado em Microbiologia e Imunologia - Universite de Montreal (1986) e doutorado em Avaliação e Incorporação de novas tecnologias no sistema de serviços de saúde brasileiro / Medicina Preventiva- FMUSP (2006)
- Atualmente é assessora em tecnologia/ Diretoria Executiva do Instituto do Coração-HC/ FMUSP e consultora voluntária do Ministerio da Saude do Brasil
- Tem experiência na área de Medicina, com ênfase em Avaliação de Tecnologias da Saúde, Economia da Saúde e Doenças Infecciosas e Parasitárias, atuando principalmente nos seguintes temas: microbiologia, avaliação de métodos de reprocessamento e esterilização de materiais médicos, hepatite b, transmissão, pertussis, vacinas, vigilância sanitária, tecnovigilância, avaliação de tecnologias para a saúde e economia da saúde

Publication: September - November/2009
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