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**EUROlinkCAT WP4 :**

**Costs associated with hospital stays for children with congenital anomalies up to the age of 5**

**Statistical Analysis Plan**

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In collaboration with WP2 team

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Statistical expertise and advice will be provided by Joan Morris (QMUL).

**Aim**

To assess costs of inpatient hospital stays and surgeries performed on children in the first five years of their lives

**Method**

The cost analysis is based on aggregate data on length of stay (LOS) in hospital and surgeries performed in children up to five years of age provided by 14 registries using a distributed analysis script produced by SGUL

The following congenital anomaly subgroups are included: **All anomalies,** Spina Bifida, Hydrocephalus, Severe microcephaly, Congenital cataract, **Congenital Heart Defects,** Severe CHD, Transposition of great vessels, VSD, ASD, AVSD, Tetralogy of Fallot, Pulmonary valve stenosis, Aortic valve atresia/stenosis, Mitral valve anomalies, Hypoplastic left heart, Coarctation of aorta, PDA as only CHD in term infants (GA +37 weeks), Cystic adenomatous malf of lung, Cleft lip with or without cleft palate, left palate, Oesophageal atresia with or without trachea-oesophageal fistula, Duodenal atresia or stenosis, Atresia or stenosis of other parts of small intestine, Ano-rectal atresia and stenosis, Diaphragmatic hernia, Gastroschisis, Omphalocele, Multicystic renal dysplasia, Cong hydronephrosis, Hypospadias, Limb reduction defects, Club foot – talipes equinovarus, Hip dislocation and / or dyspasia, Polydactyly, Syndactyly, Craniosynostosis, Down syndrome, Turner syndrome, Klinefelter syndrome. Isolated and all anomalies will be analysed separately.

**Calculating Costs using NHS Costs**

The costs of hospital stay and the costs of surgeries performed on children with any of the above anomalies will be assessed based on UK NHS costs for 2017/18 using a methodology developed by the UK healthcare resource group (HRG)[1]. All costs will be calculated using the NHS costs for 2017/18. This enables both comparisons across countries and also Pan European summaries to be done.

**Costs of Care in the NHS (UK)**

In the UK NHS a methodology has been developed which collates all possible interventions and diagnoses into common groupings called HRGs in order to set tariffs [3-8]. Each HRG is a clinically meaningful group of diagnoses and interventions that consume similar levels of NHS resources. HRGs are maintained by the Casemix Service at the NHS Information Centre, which also produces the grouper software to enable ICD-10 and OPCS-4 codes to be assigned to HRGs. There are tariffs for over 1,500 HRGs. Tariff prices have traditionally been based on the average cost of services reported by NHS providers in the annual reference costs collection. The introduction of best practice tariffs in 2010-11, and a commitment to expand them in future years, has seen tariffs increasingly determined by best clinical practice rather than average cost. HRGs provide a currency for payment for the average patient. Some patient’s care will vary a great deal from the average, for example because of an unusually short or long stay in hospital, or because of the need for specialised and therefore more expensive care. Therefore, adjustments are sometimes applied to the tariffs, including short stay emergency adjustments, long stay payments, and specialised service top-ups. Some best practice tariffs also offer additional payments. The tariff received by the provider is multiplied by a nationally determined market forces factor (MFF) unique to each organisation to reflect the fact that it is more expensive to provide services in some parts of the country than in others.

HRGs are split according to Complexity and Comorbidity (CC ) score, with the CC scores being grouped and the groups often being 0,1-2,3 or more. The file “HRG4+ 201718 Local Payment Grouper Code To Group v1.0” with spreadsheet “CC lists” gives the CC scores according to ICD10 codes and also the HRG they are undergoing. For example spina bifida has a CC score of 1 if the procedure is an eye operation, but a score of 2 if the procedure is surgery for congenital heart disease. Chromosomal conditions and severe heart disease tend to have CC scores of 2 and the average CC score for Q codes is 1.3. Therefore when analysing isolated anomalies it should be assumed that the overall CC score is greater than 1. When analysing all anomalies it should be assumed that the overall CC score is greater than 2.

**Length of Stay**

The median length of stay in hospital is available for specified anomalies (from WP4 Table 4B). The ICD10 Q codes for these anomalies will be assigned HRG4+ codes based on the spreadsheet “*Code To Group*” in the file “*HRG4+ 201718 Local Payment Grouper Code To Group v1.0*” and the relevant CC scores will be assigned in order to obtain an HRG4+ code with CC score.

The file “*Copy of 2\_-\_National\_schedule\_of\_reference\_costs\_v2*” with spreadsheet “*EL*” has National Schedule of Reference Costs for elective in patients according to HRG4+ codes. It also includes costs for additional days spent in hospital above that considered “normal” for the specified description, and the average length of stay in hospital in days.

For each country the costs will be calculated as the total cost for the “normal” length of stay plus an additional cost if the median length of stay is greater than the “normal” stay. The relevant CC codes will be assumed according to whether the anomaly is isolated or not. For the “All anomalies” group

the costs for the non-isolated CA subgroups will be calculated either using the median costs for the other anomalies or else using the general costs for neonatal or paediatric critical care costs as appropriate.

**Surgery**

Information is available on the occurrence of specific surgeries for specific anomalies (WP4;Table 5c) . For the Welsh data the relevant surgery codes (in OPCS4) have been identified. These codes will be identified in the spreadsheet “*Code To Group*” in the file “*HRG4+ 201718 Local Payment Grouper Code To Group v1.0*” and the relevant CC scores will be assigned in order to obtain an HRG4+ code with CC score.

The spreadsheet “1a APC & OPROC 17.18” in the file “Annex\_A\_-\_National\_tariff\_workbook” will be used to assign a cost to each surgery from the column “Ordinary elective spell” average unit costs

**Days in Intensive Care**

The costs will be calculated using the costs for neonatal and paediatric intensive care given in the spreadsheet “1a APC & OPROC 17.18” in the file “Annex\_A\_-\_National\_tariff\_workbook”

**Calculating Costs using WHO-CHOICE service delivery unit costs[2]**

The WHO-CHOICE project created a database of estimated unit cost values for service delivery for each country in the world that, in principle, can be thought of as 'average' values of unit costs for the country, based on specific assumptions regarding the organization of health services and operational capacity. Estimates are differentiated for levels of care. Inpatient Unit Costs are the estimated cost per hospital bed-day. These estimates represent the "hotel" component of hospital costs, i.e., excluding the cost of drugs and diagnostic tests but including costs such as personnel, capital and food costs. Outpatient Unit Costs presents the estimated cost per outpatient visit, and include all cost components except drugs and diagnostics. Estimates are in international dollars, local currency units and US$ for 2010. These estimates will be used to compare with the NHS costs estimated above

**Pan European Analysis**

Once the costs are calculated as described above, comparisons will be made across countries and also pan European estimates will be calculated using standard random effect models. Costs using NHS costing methods will be compared with those using just the WHO-CHOICE method.

**References**

1. J., Barker., *Interactive complexity and comorbidity splits in Health Resource Group 4+.* British Journal of Healthcare Management, 2015. **21**(9): p. 433-439.

2. Stenberg, K., et al., *Econometric estimation of WHO-CHOICE country-specific costs for inpatient and outpatient health service delivery.* Cost Effectiveness and Resource Allocation, 2018. **16**(1): p. 11.

3. Department of Health (2014a) NHS Reference Costs Publications. Available at: https://www.gov.uk/government/collections/nhs-reference-costs

4. Department of Health (2014b) NHS Reference Costs 2013/14 Publication, Organisation Level Source Data Part 3—Spells. Available at: https://www.gov.uk/government/publications/nhs-reference-costs-2013-to-2014

5. Health and Social Care Information Centre (2015a) HRG4+ 2013/14 Reference Costs Grouper Documentation. Available at: www.hscic.gov.uk/article/6227/Costing

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7. Health and Social Care Information Centre (2015c) HRG4 2014/15 Payment Grouper Documentation. Available at: www.hscic.gov.uk/article/3938/HRG4-201415-Payment-Grouper

8. Health and Social Care Information Centre (2015d) HRG4 2015/16 Payment Grouper Documentation. Available at: www.hscic.gov.uk/article/6103/HRG4-201516-Local-Payment-Grouper