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eHealth
Success Stories

European Commission
Information Society and Media

Health-e-Child

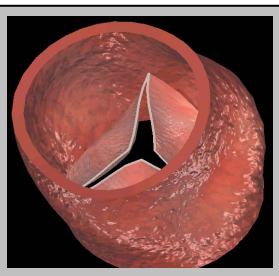
Improving Outcomes by Personalising Diagnosis and Therapy in Paediatrics

Tetralogy of Fallot is the most common cause of blue baby syndrome, a serious congenital heart disease requiring corrective surgery in infancy. As patients grow into their late teens and early adulthood they commonly suffer from severe pulmonary regurgitation. Clinicians facing the management of such conditions are confronted with complex treatment decisions, including pulmonary valve procedures in the majority of the cases.

The Health-e-Child project supports clinical decision making by improving disease characterisation and identifying similar cases across a network of leading hospitals:

- A personalised model of the anatomy is extracted from advanced imaging to enhance diagnostic accuracy.
- The patient's heart is compared against a large repository of previously treated patients with known outcomes.
- The morphology and dynamics of the pulmonary trunk help to determine whether a percutaneous pulmonary valve implantation (PPVI), a minimally invasive approach, can be attempted or whether surgical treatment is necessary.
- In the latter case, a more sophisticated electromechanical model of the patient's heart is used to virtually perform and evaluate the effects of the open-heart surgery.

The Health-e-Child project started in 2006 with the aim of developing a healthcare platform for European paediatrics, integrating traditional and emerging sources of biomedical information, from cell to tissue, organ, individual and population data. The focus areas of the project are congenital heart disease, arthritis and brain tumours in children. **It addresses the critical need to integrate, exploit and disseminate knowledge from leading paediatric centres through advanced IT tools that facilitate the searching and matching of complex clinical cases**.



Aortic Valve Model

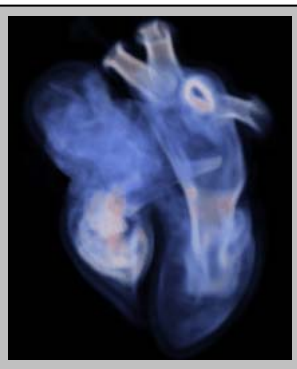
Health-e-Child goes beyond the traditional dependence on single-level or single-modality data and derives its analytical power from vertically integrated biomedical information from an unprecedented variety of sources. This new paradigm applies to all three paediatric domains addressed: cardiology, rheumatology and neuro-oncology. **It opens up an entirely new and broad support for medical practice and research, especially with respect to children**.

The project highlights and demonstrates the importance of large, heterogeneous repositories of clinically relevant data. Intervention and surgery planning benefit greatly from accessing and matching against previous cases, as already seen in the case of pulmonary valve implantation.

Health-e-Child has pioneered the development of dynamic models of fast moving cardiac valvular apparatus with unprecedented precision. Such models, combined with existing models of the electromechanical physiology of the heart contribute to better disease understanding and therapy planning, by providing a systemic view of the whole heart as a complex and long lasting pump.

The project has taken a major step towards the personalised management of juvenile idiopathic arthritis, by proposing the first MRI protocols to evaluate the progression of the disease, thus opening the potential for personalised treatment.

In addition, the project is furthering our understanding of childhood gliomas by developing a low cost chip that facilitates the analysis of 136 different mutations relevant to the formation and anamnesis of paediatric brain cancer. Many of these mutations are known to be related to the prognosis of the disease and predicting the response to treatment.



Complex Cardiac Hemodynamics revealed in Sim-e-Child

Taken together, these developments will directly contribute to European industry gaining a competitive advantage in both medicine and information technology.

The availability of Health-e-Child databases will enable researchers to conduct a new generation of epidemiological studies, based on much broader, better-integrated, and `cleaner' information. To reflect the results derived from such studies, European or national policies on medical issues may be modified thereby benefiting the lives of all citizens concerned.

The Health-e-Child platform has undergone a security assessment and has been in operation since 2008. It is currently securely and anonymously hosting the health records of patients enrolled for the project. Clinicians and researchers have since been making good use of its rich functionalities.

Socio-Economic Impact: Infant and childhood diseases are a large and under-appreciated public health problem. Given that these patients have long lives ahead of them, the burden and costs are substantial for both families and society. Health-e-Child sheds new light on paediatric disease management.

Availability of the **Health-e-Child** databases and infrastructure **can improve the success rates of resolving difficult medical cases and save children's lives**. Moreover, such improved medical decision-making can result in lower medical costs and treatment duration. Finally, the project makes advanced and information-intensive medical services affordable for smaller medical institutions and individual doctors. New developments in both medical research and information technology become usable by all parts of society fostering personalised medical care, medical education, and medical information dissemination.

Next Steps: As a follow-up project, **Sim-e-Child** will build on the results of Health-e-Child by interconnecting the project's database with new data from two ongoing multicentre studies in the USA, expand the network of hospitals, enhance and expand Health-e-Child heart models and integrate the Health-e-Child platform with new and advanced simulation tools.

One of the first results in Sim-e-Child is the pioneering computation of patient-specific complex hemodynamics and vorticities in a **live, beating heart** (watch the video[1]).

Health-e-Child

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  - Lynkeus SRL, Rome, (IT)
  - I.R.C.C.S. Giannina Gaslini, Genoa, (IT)
  - University College London – Great Ormond Street Children's Hospital, London, (UK)
  - Assistance Publique Hopitaux de Paris – Necker, Paris, (FR)
  - European Organisation for Nuclear Research (CERN), Geneva, (CH)
  - University of the West of England, Bristol, (UK)
  - University of Athens, Athens, (GR)
  - DISI University of Genoa, Genoa, (IT)
  - The French National Institute for Research in Computer Science and Control (INRIA), Sophia Antipolis, (FR)
  - European Genetics Foundation, Bologna, (IT)
  - Aktsiaselts ASPER BIOTECH, Tartu, (EE)
  - Gerolamo Gaslini Foundation, Genoa, (IT)
  - Maat G Knowledge, Toledo, (ES)
  - I.R.C.C.S Ospedale Pediatrico Bambino Gesù, Rome, (IT)
- Duration: From 01/06 to 04/10
- Cost: € 16.701.753
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  http://www.euronews.net/2009/06/17/new-frontiers-of-imaging-the-human-body

[1] http://ec.europa.eu/information_society/activities/health/video/patient_specific_heart_dynamics.avi