

BENEFIT

Advancing evidence-based medicine for better patient outcome

Impact highlights

- The Dutch SME Medis gained CE and FDA approval for its analysis that calculates pressure drop from X-ray images leading to a reduction of the excessive use of stents and the need for a disposable pressure wire of €500-1000, and thus saving costs.
- The Belgian SME FEops gained CE approval for its TAVIguide product and secured an investment injection of €6m for the FEops HEARTguideTM. FEops has grown from 4 to 15 employees.
- At the end of 2019, Philips sold over 250 copies of its new commercial tool AneurysmFlow for treating cranial aneurysms. Philips also created an automatic 3D detection of liver tumour feeding vessels, boosting detection accuracy by 26% and resulting in at least 20% less recurrence than with 2D feeder detection.
- Elekta gained CE and FDA approval for its Leksell Gamma Knife ICON system with Cone beam CT (CBCT). By September 2019, 107 systems have been installed and are clinically in use while 200 existing systems can be upgraded worldwide. The planning time for test cases is reduced significantly by around half.
- Linköping University (LiU) in Sweden has published a paper for functional MRI in PNAS (Proceedings of the National Academy of Sciences) in 2016, which has been covered by Science, The Economist, The New York Times, has been downloaded over 200,000 times and received over 1800 citations.
- The Dutch SME Quantib gained CE and FDA approval for its brain analysis software and secured €4.5m in fresh funding to support the company in its international expansion ambitions. Between July 2014 and end of 2019, Quantib grew from 6 to nearly 30 employees, developed 4 products including certification, has installations in over 20 countries and initiated partnerships with 3 top medical university centres in the Netherlands.
- In total, the project partners applied for 7 patents.

The BENEFIT project tackled three main challenges: the societal aspect of coping with the increasing number of minimally invasive image-guided interventions; the economic dimension of delivering care with quantified targets in terms of quantity, price and quality of care; demonstrating the technical feasibility of an integrated infrastructure that includes all relevant imaging and data sources, the modelling, analysis and presentation of these data and the integration into a Clinical Decision Support System. Current diagnostic and therapeutic solutions do not offer the flexibility, quality and integration to automatically extract all the relevant quantified data and process flows. The ITEA project BENEFIT aimed to support clinicians in selecting the optimal diagnostic and treatment pathway for patients.

Project results

BENEFIT focussed on tools and protocols for imaging and treatment and quantified data before/during/after treatment, supported by common IT tools for structured collection and analysis of these data. This generic approach was applied to five different clinical use cases: diagnosis and treatment of cardiac blood vessels, cardiac valves, brain vessels, brain tumours and liver tumours. The consortium of 3 large industries, 5 SMEs and 4 university hospitals covered scientific input, input from clinical end users, technical innovation and market access. This has resulted in new products and dissemination in 70 publications, 3 master theses, 2 PhD theses, 2 book chapters, 60 presentations at scientific and commercial conferences and 7 patent applications. Finally, integrated demonstrators of the collaborative and complementary work of the partners in all five use cases showed that BENEFIT has advanced evidence-based medicine by providing imaging tools, devices and a database for heterogeneous medical data. It has also prepared for a next step in healthcare, which is the adoption of AI based on such quantified clinical data. This has been incorporated in a new ITEA project called IMPACT.

Exploitation

Through the collaboration in BENEFIT, many achievements were realised by the different partners for the 5 use cases.

E.g. for **blood vessels**, a procedure called QFR® (Quantitative Flow Ratio) analysis developed by Medis calculates pressure drop from the X-ray images which are acquired anyway saving the costs of a separate disposable catheter for pressure and promoting widespread adoption of pressure analysis to further reduce excessive use of stents. For **cardiac valves**, BENEFIT also had a significant impact on FEops in terms of technology, funding and staffing; it secured an investment injection to help drive commercial adoption of the FEops HEARTguide™ and almost quadrupled its number of staff. For **brain vessels**, Philips has introduced a new commercial tool based on the research efforts performed within the scope of BENEFIT for the treatment of cranial aneurysms. It is the first interventional tool to visualise and quantify flow patterns in a vessel and an aneurysm. It predicts the chance of long-term treatment success while the patient is still on the operating table and the catheter is in place. This enables

the surgeon to take immediate additional action where the chance of success is too low, reducing the risk for the patient and the need for repeated treatment. For **brain tumour radiotherapy**, BENEFIT helped Elekta develop its Leksell Gamma Knife ICON system with Cone beam CT (CBCT) for optimal patient positioning. The CBCT positioning system allows frame and frameless workflow in radiotherapy such that patients do not need to wear a stereotactic frame for imaging before treatment planning, thus allowing more flexibility and efficiency in treatment planning for both clinicians and patients. Finally, for **liver tumours**, partners collaborated on different treatment alternatives. For reliable differentiation of healthy tissue and tumours Barco developed a colour calibration procedure for the whole chain of endoscopes and medical displays which can now be performed in less than 5 seconds. DEMCON has developed a CT guided needle positioning system (NPS), allowing more accurate needle placement; freehand placement required on average one additional placement. And during the BENEFIT project, UMC Utrecht set up a collaboration on method development with ErasmusMC, and useful contacts with companies as DEMCON and Quantib were established.

13031	PARTNERS		
BENEFIT	<u>Belgium</u>	<u>The Netherlands</u>	<u>Spain</u>
PROJECT LEADER	Barco ●	Demcon ○	Other side mirror ○
Herman Stegehuis, Philips	FEops ○	Erasmus MC ○	
		Leiden University Medical Center ○	<u>Sweden</u>
		Medis medical imaging systems ○	Elekta ●
		Philips Medical Systems Nederland ●	Linköping University ○
		Quantib ○	
		Utrecht University Medical Center ○	
PROJECT START	PROJECT END		
July 2014	December 2017		
PROJECT WEBSITE			
https://itea3.org/project/benefit.html			