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AI for the smart hospital of the future

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Implementation of Cost-Consequences Analysis As an Economic Evaluation Method for Artificial Intelligent (AI) Medical and Digital Technologies. The Case of HosmartAI (HORIZON 2020 FUNDED)

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Background

The international literature presents a plethora of studies exploring the differences between medical technology and pharmaceuticals products. However, literature on economic evaluation methods of AI and digital technologies scarce [1]. NICE UK recommends that the use of Cost-Consequences Analysis (CCA) should be the primary analytical approach to enable the disaggregated reporting of economic and clinical benefits [2].

At HosmartAI project following NICE recommendation a CCA was designed to assess the value of health digital technologies. HosmartAI creates a common open integration platform with the necessary tools to facilitate and measure the benefits of integrating digital technologies in the European healthcare system [3].

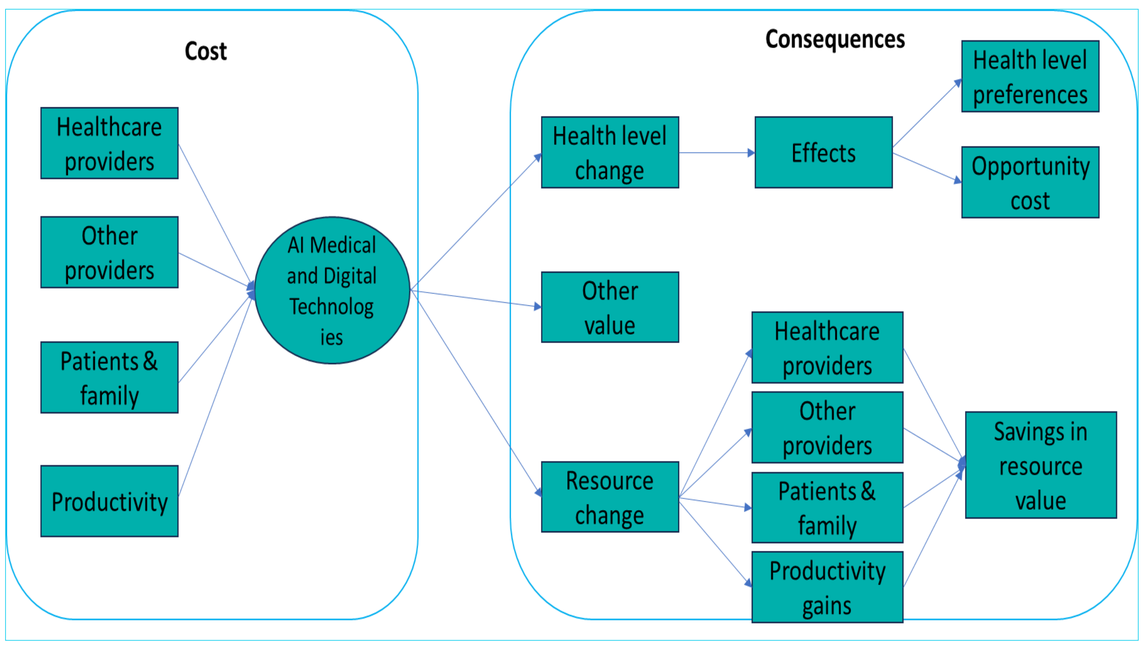
Objective

The study aims to analyze the implementation of CCA in the HosmartAI project.

Methods

- HosmartAI consists of 8 pilots with 11 medical scenarios and 1 administrative scenario. The diversity of technologies among pilots led to a variety of instruments for each specific technology on a proof-of-concept basis.
- A comprehensive selection of KPIs was performed, to capture the incremental difference between the current technology and the HosmartAI technology of each pilot and enable to perform the cost-consequence analysis of each technology.
- The practice of presentation various impacts of an intervention individually, rather than combining them into a single metric, is termed cost-consequence analysis (CCA). This approach enables a more holistic understanding of the effects, while leaving it to the decision maker to determine the relative significance of each aspect (Figure 1).

Figure 1. Components of costs and consequences in economic evaluation



Results

- Figure 2 presents the HosmartAI KPI Pillars which are used by pilots.
- In pillars Clinical Efficacy / Effectiveness, pilots chose patients' clinical data. Generic instruments were chosen for pillars PROMs and PREMs/UREMs. The pillar Productivity evaluated with number of persons contribute to procedure, duration of procedure in minutes or hour and mean monthly salary and Economic Efficiency pillar with direct medical or non-medical costs and indirect costs.

Figure 2: HosmartAI KPI Pillars

Clinical Efficacy / Effectiveness	• Vital signs, blood pressure, temperature, hydration, mini mental, oxygen, saturation, heart rate etc
Patient Reported Outcomes Measures (PROMs)	• EuroQol-5Dimension (EQ-5D), Geriatric Depression Scale (GDS) etc
Patient/User Reported Experience Measures (PREMs/UREMs)	• System Usability Scale (SUS), User Experience Questionnaire (UEQ) etc
Productivity (Hospital/Healthcare setting)	• Number of participating staff & duration of procedure
Economic Efficiency	• Direct medical / non-medical costs and indirect costs

Results *(continued)*

- In the HosmartAI project, the Cost-Consequence Analysis suited due to the evaluation of complex interventions. This kind of analysis allows different health and system-level outcomes may be presented alongside costs of interventions without aggregation of either costs or outcomes.
- In the Figure 3 is presented the planning of Cost-Consequence Analysis.

Figure 3. Planning of Cost-Consequence Analysis in HosmartAI

Comparator	• as a comparator was set the current technology and artificial intelligence technology was set as intervention
Effects	• all pilots chosen several clinical outcomes, generic questionnaires, such as improving health-related quality of life or evaluate the usability of AI technology and productivity gain
Costs	• the cost calculated by identifying, quantifying and valuing resource use associated with the interventions and comparator

- An incremental approach will conduct, involves estimating the incremental (or additional) cost and incremental effect of the artificial intelligence technology (intervention) compared to current technology. Table 1 presents an example of data collection for cost consequences analysis.

Table 1. Example of data collection for cost consequences analysis

PILOT's KPIs Results			
Pilot 1 Scenario 4			
Institution			
Name of Rapporteur			
Title of Study			
Number of patients (n=)			
First Patient First Visit (FPFV) Date Current Technology:		**Last Patient Last Visit (LPLV) Date Current Technology:**	
First Patient First Visit (FPFV) Date HOSMARTAI Technology:		**Last Patient Last Visit (LPLV) Date HOSMARTAI Technology:**	
KPIs Reported	**Score of Current Technology (considered as Baseline)**	**Score of HosmartAI technology**	**Difference**
Sensitivity of automatic detection of small bowel abnormalities			
Mean Time for completion of small bowel VCE reading (Duration for Non experienced physician <2years experience)			
Mean Time for completion of small bowel VCE reading (Duration for Experienced Physician>2years)			
Average SUS score			
Serious Adverse Events (write each of AE)			
Mild/Moderate Adverse events			
Days of hospitalization			
Medicines & doses consumed by patient during hospitalization/visit			
Number of Personnel involved (write separately n of physicians, nurses etc)			
Number Examinations performed to patient (ie.blood test, etc)			
COST & UTILIZATION OF CURRENT & HOSMARTAI TECHNOLOGIES			
Cost of Technology	€	€	
No patients to be treated with this technology per year			
No Years this technology will be used			

Conclusions

The CCA approach was selected as provides a simple broken-down summary of costs and effects and allows decision-makers to determine the potential impact of the intervention that is most relevant to their settings.

References

1. Voets M, et al. (2021). Systematic Review of Health Economic Evaluations Focused on Artificial Intelligence in Healthcare: The Tortoise and the Cheetah. Value in health.
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3. https://www.hosmartai.eu/

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