A patient's Diagnostic Journey

Detection of potential overuse of diagnostic tests through electronic health records

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Setting

- This project was conducted within the first Health Datathon conducted in Greece between the dates 16-18/05/2019
- The Datathon was organized by the Athens Medical Society, the Open Technologies Alliance (GFOSS) and the Hellenic Society of eHealth Services and Education. It was part of the scientific program of the 45^{th} Annual Panhellenic Medical Conference.
- Anonymized data sets from the Greek E-Prescribing System, running by the public Agency for e-Government in Social Security and Health, and the Business Intelligence System of the Ministry of Health were available at the Datathon.

The Data

- Three Datasets were available during the Datathon
- One coming from the E-Prescribing System, concerning prescriptions of diagnostics.
- One coming from the E-Prescribing System, concerning prescriptions of pharmaceutical treatments.
- The third database was concerned with data related to doctors' appointments
- All databases were spanning 3 months' data, Sep.- Oct. 2018

The problem

In order for healthcare systems to be sustainable, cost effectiveness is of paramount importance. There are many reasons that could jeopardize cost-effectiveness, but an important one is the overuse of diagnostic tests - including but not limited to imaging studies [1]. Such concerns have led to initiatives in the US [1], aiming at reducing the overuse of diagnostic tools and have been adopted by several countries [2]. Exploring the potential overuse of (expensive) diagnostic tests by utilizing electronic health records as the ones provided within the 1^{st} Datathon was deemed to be a relevant priority.

Within the context of the Datathon, we aimed at:

1. Developing a methodology for quantifying and visualizing the potential overuse of diagnostics, driven by cost
2. Identifying a case study in which to demonstrate our method
3. Explore usability and relevance in a real world context, by identifying necessary calibrations for the method to be useful

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Identifying case study

- The most expensive diagnostic is brain MRI
- Rarely conducted, but very expensive

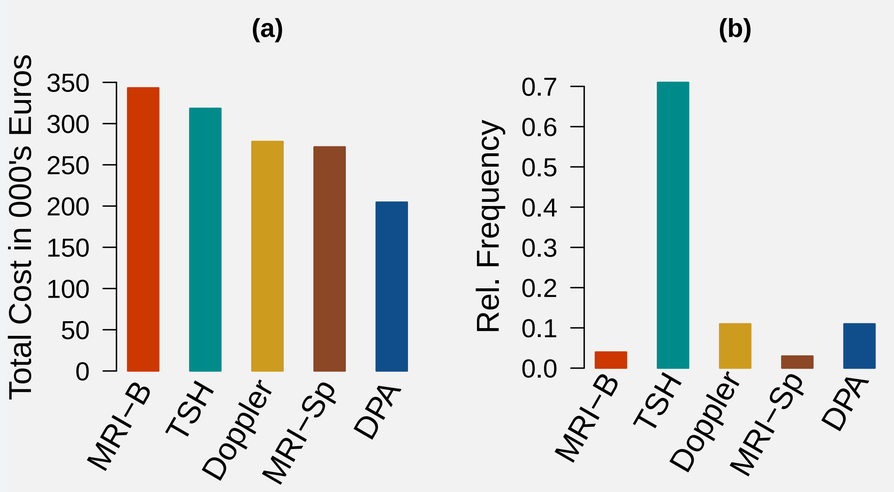


Figure: Total cost (a) and relative frequency (b) of five most common diagnostics

Methodology

- Patients that were referred for an MRI were classified into the most common indications
- The same patients were looked up in the medication prescriptions database and checked whether they were prescribed a pharmaceutical treatment at a point later in time

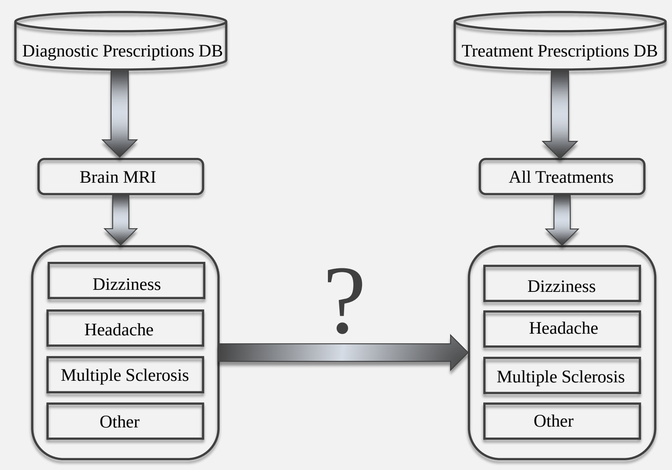
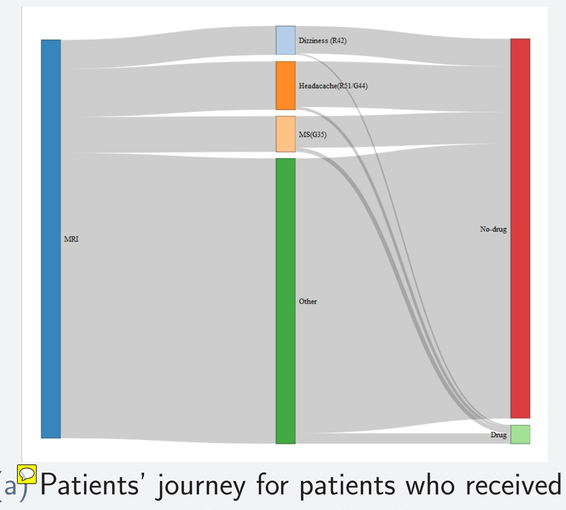
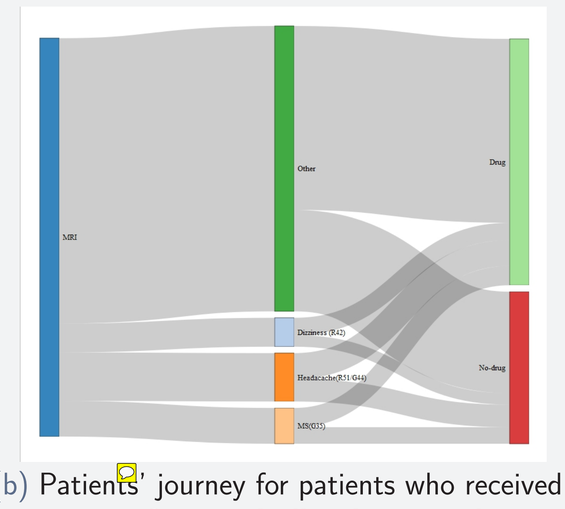


Figure: Flowgraph of methodology

Results



(a) Patients' journey for patients who received a treatment at a later time **for the same indication as the one they were prescribed brain MRI for**. Less than 1% of the patients per indication where prescribed treatment for the same indication



(b) Patients' journey for patients who received a treatment **for any indication at a later time**. Around 50% of the patients per indication where prescribed treatment for any indication

Further developments & Relevance

- Present results purely for demonstrative purposes - no firm conclusions
- Medical input in order to connect with diagnosis and treatment protocols
- Connection with related indications and relevant timelines
- Develop overuse indicators, e.g. $N \times C(1 - \pi_T)$, where N= # of prescriptions, C= cost, π_T= probability of treatment
- Breakdowns per gender, age groups, doctor's specialization
- Sensitivity analyses for cost effectiveness
- Relevant for:
  - Evaluating (cost) effectiveness of diagnostic protocols
  - Assessment of guidelines adherence
  - Epidemiological research
  - Market research

References

[1] A. B. Jones and J. M. Smith. The overuse of diagnostic imaging and the choosing wisely initiative. *Ann Intern Med.*, 157(8):574–6, 2012.

[2] S. Brownlee, K. Chalkidou, J. Doust, A. G. Elshaug, P. Glasziou, I. Heath, S. Nagpal, V. Saini, D. Srivastava, K. Chalmers, and D. Korenstein. Evidence for overuse of medical services around the world. *Lancet*, 390(10090):156–168, 07 2017.

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