



Case Study #3 – Antibiotics

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1. Going to the doctor for a child's (or your own) infection can be time and resource consuming. Describe at least 2 ways computational tools could help lower the barriers to evaluating patients for a condition such as sore throat?

- A. **Computational tools can help the patient to self-diagnosis diseases associated with sore throat.** In many scenarios, the patient or the young patient's parents lack the ability to visit a physician's office "physically" due to time, cost, or other difficulties (Palade & Bocaniala, 2006). Especially, for slight issues such as sore throat, it is rather possible that the patient can perform self-diagnosis with the guidance and help of healthcare provider (Anbarzadeh & Davari, 2015). Systems designed for diagnosis fulfill such needs. Such system have been designed and delivered using various computational methods. For example, Anbarzadeh et. al. and Ajavi et al. have implemented a fuzzy algorithm to help the patients to self-diagnosis sore throat into different suspected diseased and provide suggestions for the patient (Ajayi, Samuel, & Paulina, 2019; Anbarzadeh & Davari, 2015).
- B. **Computational tools can help health care providers to evaluate the patient with sore throat by providing Big Data derived information.** Big Data could be used to evaluate the health condition of a given patient using the number of times of sore throat symptoms happen on the said patient. Eren et. al. implemented a K-means algorithm application based on big data, which suggest correlations between sore throat with other potential and hidden diseases, including throat cancer. For example, individuals with healthy life-style have tendency to be affected less by sore throat (Ajayi et al., 2019).
- C. **Computational tools can help the patient to gain access to telemedicine physical examination to diagnose diseases associated with sore throat.** Computational tools can be used to develop telemedicine solutions, which allow patients to connect with healthcare providers remotely with basic internet devices such as photo camera and microphone. Although recent studies reveal that concordance between telemedicine and the actual in-person physical examination is still poor (Akhtar et al., 2018), the convenience provided by telemedicine indeed brought down the barriers for the treatment of slight conditions such as sore throat (Ellis, Mayrose, Jehle, Moscati, & Pierluisi, 2001).

2. What are some ways computational solutions could inform doctors to reduce inappropriate prescribing?

- A. **Computational based clinical decision support system (CDSS) can provide additional information to help the doctors to make decisions.** Conventional measurement upon a patient's visit, such as the patient's temperature, does not always provide sufficient information for a doctor to make decisions if prescribing antibiotics is necessary. Thus, additional CDSS system that generate results in a timely manner could be added in the clinic's daily procedure to help the

doctors to make decisions. For example, a CDSS system, which is related with a shared data base, that could provide the electronic health record for the doctor has been implemented in 39 clinics by Litvin et. al. (Litvin, Ornstein, Wessell, Nemeth, & Nietert, 2013) The application of the CDSS reduced 16.30% of broad spectrum antibiotics prescription for acute respiratory infections.

B. Computational tools can help health care providers to reduce inappropriate antibiotics prescription by using automated decision support system. Decisions made by the doctor right upon on the visit of the patient tend to be subjective, and enable prescription of antibiotics on personal will and/or judgement. A more objective method is to develop antibiotics prescription rules based on expert opinion, and mechanically execute such rules. Centre Hospitalier Universitaire de Sherbrooke in Canada implemented such an automated decision support system, which help to identify and alert mismatches between inappropriate antibiotics prescription using a series of expert rules [ref]. This system helped in rejecting 91% of the inappropriate antibiotics prescription (Beaudoin, Kabanza, Nault, & Valiquette, 2013).

C. Computational tools can help health care providers to reduce inappropriate antibiotics prescription by machine learning algorithm. Machine learning algorithm can be used to update rules and definition of inappropriate antibiotics prescription, which is an essential support for an automated system. Study performed by Beaudoin et. al. suggest that machine learning improved the automated decision support system, achieving better accuracy (Beaudoin et al., 2013).

3. What are some ways computational solutions could “catch and educate” patients when they are thinking of requesting antibiotics?

A. Computational tools can help to educate the patient on alternatives of antibiotics using big data. It has been repetitively discussed among the healthcare realm that the patients should be educated on antibiotics for relief and avoid antibiotic self-medication (Adededeji, 2016). Currently, big data have been applied on personalized internet search engine (e.g. for advertisement purpose) (Couldry & Turow, 2014). Thus, it is rather feasible to “catch and educate” patients, especially the patients that have history of requiring antibiotics, by showing alternative suggestions when they are looking for antibiotics online on internet-based searching engine such as Google ("Google.com,")

B. Computational tools can help to screen the patient that tend to request antibiotics on physician visits, and inform such information to the corresponding healthcare provider. Machine learning algorithms can be used to distinguish and label patients that actually need antibiotics and those that tend to practice antibiotic self-

medication. Sharing such information to their corresponding health provider could be helpful in patient educating, as patients tend to listen and follow the suggestions made by the PCP a nurse they are familiar with, rather than following other information source (Haas, Leiser, Magill, & Sanyer, 2005).

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