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?**
   1. Patients could also self-diagnose if they are diseased using computational tools. This method is of high value if the potential parents or their children cannot visit a doctor's office (Palade & Bocaniala, 2006). Specifically, for mild complications (such as a sore throat), patients can self-diagnose with, or without the guidance and assistance of a healthcare provider (Anbarzadeh & Davari, 2015). A computational system designed for diagnostics meets such requirements. For example, fuzzy algorithms have been implemented to help patients identify different sore throat sensitivities and advise patients with treatment methods (Anbarzadeh & Davari, 2015).
   2. Healthcare providers could utilize computational tools to evaluate the potential patients' voices by providing information derived from big data. Based on the potential patient’s voice, the health provider could use big data to estimate a given patient's throat condition. Based on the big data analysis, it has been found that people of healthy lifestyle tend to be less affected by sore throats. Another more detailed example is, a K-means algorithm has been applied, which finds the interaction between a sore throat and potential diseases and hidden health-related problems, such as laryngeal cancer (Ajayi, Samuel, & Paulina, 2019).
   3. Moreover, even if the potential patient and their children are visiting the health provider’s clinics, a computational too such as scenario-based clinical support systems (CDSS) can provide additional information in the assist of physicians. Often, in a regular patient visit, the healthcare provider is not able to access some regular information, such as the patient's temperature, do not give the doctor enough information to determine when the antibiotic is needed. On the other hand, the expanded CDSS system can deliver faster results and integrate it into clinical pathways to assist physicians. For example, a CDSS system compatible with the data center indicated that it would provide electronic records to physicians in 39 different clinics in Canada. Under the help of the CDSS system, the use of antibiotics for the treatment of respiratory illness has been reduced by 16.30% (Litvin, Ornstein, Wessell, Nemeth, & Nietert, 2013).
2. **What are some ways computational solutions could inform doctors to reduce inappropriate prescribing?**
   1. Virtual machines can help healthcare providers to reduce inappropriate antibiotic prescribing through automated support systems. It has been shown that the doctor tends to inappropriately prescribe antibodies the visiting patients, potentially due to the request from the patients. However, practitioner nurse which follow the protocol more strictly less tend to inappropriately prescribe antibiotics. The protocol on antibiotics are built on expert opinion and national regulations, and is thus more objective. In one study, such an objective system helps to eliminate 91% of inappropriate antibiotics (Beaudoin, Kabanza, Nault, & Valiquette, 2013).
   2. Healthcare providers could use machine learning algorithms to recover previously inherited medications. Machine learning algorithms can be used to improve rules and specifications of inappropriate antibiotics, which is an important support for effective programs. For example, label and find which kind of patients, which kind of diseases/patients, or even which doctor are more prone to perform inappropriately prescribe antibiotics. It has been shown that machine learning improves the automation support system and makes it more integrated (Beaudoin et al., 2013)
   3. The methods mentioned in sections 2.1 and 2.2 can both applied in telemedicine. Although recent studies reveal that telemedicine and the actual in-person physical examination can hardly agree (Akhtar et al., 2018), the convenience provided by telemedicine brought down the barriers for the treatment of slight conditions (Ellis, Mayrose, Jehle, Moscati, & Pierluisi, 2001).
3. **What are some ways computational solutions could “catch and educate” patients when they are thinking of requesting antibiotics?**
   1. Big data and machine learning can help to educate patients about their status quo of their disease (or the lack thereof). Study has suggested that in health care providers’ clinics, the patients tend to actively seek to relieve their problems, and thus tend to require antibiotics (Adedeji, 2016). Thus, big data and machine learning tools can help to label patients that tend to request who tend to request antibodies, based on the labeling from their PCP. After labelling, if such patient visits another physician, or other healthcare provider, they could be informed on the patient’s antibiotics-request tendency, and provide appropriate education.
   2. To date, online search engines have widely adopted big data and machine learning methods (e.g., advertising campaigns) (Couldry & Turow, 2014). Therefore, it is possible to use big data and machine learning tools to interact with internet-based search. For example, upon the potential patient searching antibiotics on internet, the searching engine could make suggestions in non-antibiotics-alternatives, and/or educational information for the potential patient.

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