1. **How could FHIR be used to help identify patients with Vaping-Associated Lung Disease?**
   1. Computer technologies such as machine learning can be used to recognize symptoms of the patients. Using a FHIR database built based on analysis of symptom of Vaping-Associated Lung Disease patients, and under the help of proper specialist whom could provide quantitative labeling of symptoms that are correlated with the risk of Vaping-Associated Lung Disease, a supervised learning classifier-based algorithm could be built. Such algorithm could help to screen patients with the possibility of suffering from Vaping-Associated Lung Disease. Various studies have used machine learning tools to help doctors to screen Vaping-Associated Lung Disease. For example, computed tomographic scan images of the chest from patients with Vaping-Associated Lung Disease has been collected. Specific image patterns related with Vaping-Associated Lung Disease, has been discovered as “basilar-predominant consolidation and ground-glass opacity, often with areas of lobular or subpleural sparing.” [ref] After more consensus on image patterns are made, and enough data are collected, a supervised machine learning classifier could be built to perform automatic evaluation of the potential risk of Vaping-Associated Lung Disease.
   2. Beyond using diagnosis algorithms to analysis measurable symptoms from FHIR information, patients with Vaping-Associated Lung Disease using can also be identified using data from social media. Xie et. al. implemented a Bidirectional Long Short-Term Memory Recurrent Neural Network, which was used to collect discussions between e-cigarette users [ref]. If vaping experience can be found in a patient’s social media history, the patient’s doctors should take the risk of Vaping-Associated Lung Disease into consideration.
2. **In addition to FHIR, what technologies would be needed to analyze medical charts to identify these patients automatically?**

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).

1. **Provide us with examples or ideas you have for communicating the risks of vaping to young people most effectively?**
   1. **Using natural language processing algorithms to analyze social media information**. Although that Medical studies have discovered many e-cigarette may cause adverse health events, currently, most existing clinical trials on the health risk of e-cigarettes are with limited results due to their small sample size and short duration [ref]. On the other hand, the number of social media has increases and many e-cigarette consumers are exchanging their information and experience. Thus, analyzing social media information on vaping become a valuable source for understanding e-cigarette user behavior, health effects, and risks. For example, Xie et. al. implemented a Bidirectional Long Short-Term Memory Recurrent Neural Network on discussions between e-cigarette users, and identified 1591 unique adverse events from their research [ref]. Such information could be promoted when communicating the risks of vaping to young people.
   2. **Use big data to educate the young people on risking and alternatives of vaping.** 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” young people that has a history of vaping (such data can be acquired using the natural language analysis model described above in **Section 3A**), then show them alternatives of vaping and/or suggestions on how should they quit vaping, when they are looking for e-cigarette products online on internet-based searching engine such as Google.
2. ===================================
   1. Furthermore, computational technology can help to improve the public health diabetes efforts. Currently, personalized Big data has been applied to Internet search engines (for example, for advertising purposes) [reference]. Therefore, by "discovering and educating" diabetic patients, especially those with a history of unhealthy lifestyles, the search engine may suggest healthier alternatives when the diabetes-risk users are looking for specific consumption (such as ordering unhealthy food online).
   2. **Machine learning and big data on FHIR records could also be used to identify potential patients with high risk of Vaping-Associated Lung Disease.** Being an unhealthy life habit, vaping could slowly deteriorate individual’s health, without directly causing Vaping-Associated Lung Disease. However, these individuals are exposed to high risk of Vaping-Associated Lung Disease, and their healthcare providers, as well as the patient him/herself, should be notified for such risk. Studies have revealed that vaping individuals will show certain symptoms, such as throat hit, without being diseased [ref]. With FHIR documenting such symptoms, and proper set up of big data analysis, a machine learning algorithmcan identify potential patients with Vaping-Associated Lung Disease on their physician visits, and inform such information to the corresponding healthcare provider. Doing so could be helpful in educating the patient to quit vaping, as patients tend to listen and follow the suggestions made by the PCP and nurse they are familiar with, rather than following other information source [ref].