elementary school education(42.5%, sd 8.0). pilgrims considered high risk (>60 years old or with chronic diseases) ranged from 28.4-43.5% per year (sd 10.9). the majority had hypertension (35-40%) or Diabetic (10-18%). One in three patients visited the Indonesian health posts in Saudi Arabia with more than 50% having respiratory complaints every year. Between 2500 to 3000 pilgrims are admitted to hospital with 25-30% due to cardiovasculair diseases and 18-22% respiratory diseases.

Conclusion: the yearly number of Indonesian pilgrims highlights the potensial for diseases spread. To minimize health problems such as cardiovasculair and respiratory diseases, screening was introduce in 2002 to identify pilgrims with chronic health conditions or of older age. Similarly, policy was introduced so that doctors accompany pilgrims to triage and provide support. This shows that the surveillance program has influenced the hajj health policy.

22.059 | A mobile phone application for pertussis classification based on machine learning

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Background: Early identification of pertussis cases is essential to control outbreaks. Although early stages of the disease resemble other infections, the cough often becomes more severe, and a paraoxysmal phase begins. This stage is characterized by bursts of coughs followed by gasps and a "whooping" sound. Experienced clinicians can easily identify these classic coughs. However, many clinicians have never seen a case, and thus may misdiagnose cases, especially early in an outbreak.

Objectives: The purpose of this project was to use mobile phone technology to expand our ability to collect and analyze cough files.

Methods and Materials: Previously, we developed a way to classify pertussis cases based on sound files. We collected a series of sound files representing pertussis and non-pertussis coughs and manually categorized them and extracted features for each category. The underlying machine learning algorithms approaches employ neural networks, k-nearest neighbor (KNN), and a 200 tree random forest (RF). Now, in addition, we have developed a mobile software application (app) for iOS (iPhone/iPad) that enables convenient anytime, anyplace collection and analysis of coughs. To collect cough data, a person simply holds the phone in front of his or her mouth when coughing.

Results: Using a variety of machine learning algorithms, over 90% of all pertussis coughs were properly classified, suggesting that we can build a robust classifier and identify pertussis cases with typical paroxysmal symptoms. In addition, our app can record sound files in a convenient fashion for users. These files can then be analyzed on the phone using our previously reported machine-learning based algorithms or on a remote server. The app can also transmit sound data, assessment results, and any user-supplied annotations, enabling development of a more substantial body of cough data.

Conclusion: The development of a simple mobile app combined with our cough classification algorithm represents a powerful tool for collection of pertussis (and non-pertussis) cough data. It enables data collection anywhere, anytime, and should improve our ability to classify coughs for pertussis and other disorders.

22.060 | Enhancement of existing infectious disease early warning system using a novel modeling approach in a resource poor setting: Pakistan

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Background: Infectious disease threats in developing countries are common due to lack of many public health resources and infrastructure, particularly in countries with poor disease surveillance mechanisms.

Effective preventive and control measures through early detection and rapid identification of infectious diseases are necessary to save lives, prevent diseases, and contribute to rationalizing resources and fulfilling global responsibilities significantly.

Objectives: The intended objective was to develop cost-effective online disease surveillance programme that prvoides ease in data transmission using technologies, possibilities for replicability of the system in other humanitarian settings and expanding the system into a more robust electronic system for public health surveillance in the longer future.

Methods and Materials: The existing surveillance system was enhanced with the development of online platform using both internet based on-line application and mobile phone based cellular technology for increasing efficiency of surveillance system in line with international health regulation recommendations. This electronic platform facilitates automatic compilation and analysis of data at district, provincial and national levels with automatic generation of SMS alert notifications for immediate response, based on defined criteria of surpassing median endemic index. Only verified SMS alert notifications are considered as true alerts.

Figure 1. Flow diagram showing functionality of electronic disease early warning system (eDEWS) in Pakistan.

Results: Overall percent reporting rates of eDEWS notifiable diseases remained >70% with steady increase to >80% in few months. eDEWS central database generated 25811 SMS alerts, of which 8540 SMS alerts were verified as true alerts and more than 80% of true alerts were investigated and responded within 24hours. Of these 8540 true alerts (positive predictive value [PPV] 33.1%), or about 31 true alerts per day, 1060 were confirmed as outbreaks. Prompt public response proved to be effective and efficient with early containment of detected outbreaks.

Conclusion: Despite the many challenges, the results of pilot project indicate that the online reporting system has helped in improving the disease surveillance capacity and capabilities in Pakistan through reducing the latency in data collection and collation using a novel modeling approach that involves transformation of complete and validated data from simple presentation to computer-based analysis, and mainly it facilitates the transformation of data into actionable information.

22.061 | Serological and cultural detection of *Brucella* infection in cameland its public health significance in selected districts of Afar region, Ethiopia

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Background: Brucellosis is a widespread zoonotic diseases mainly transmitted from food animals through consumption of contaminated raw animal products. In Ethiopia, the status of animal brucellosis and its public health consequences is unknown especially in the pastoral and agro-pastoral residential districts of the country.

Objectives: This study was delineated to investigate the prevalence of camel and human brucellosis in Afar region, Ethiopia, to assess the geographical distribution and the associated risk factors and to attempt the isolation of *Brucella* organism from raw camel milk.