ID01:
Statistical Methods for Infectious Disease Outbreak Detection in a Post-Pandemic World

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Infectious disease outbreaks can have a considerable impact on public health. Their timely detection helps to contain disease spread and reduce harmful consequences. Real-time monitoring is thus a key challenge for public health agencies, which requires robust algorithms, combined with expertise on epidemiology and data collection. A rich statistical literature and standard procedures like the Farrington algorithm for outbreak detection exist. Nonetheless, exchange with public health experts indicates a substantial gap between current methods and applied requirements. We will tackle three challenges, which we identified with collaborators at RKI and while supporting WHO guideline development on influenza surveillance.

(1) Standard outbreak detection algorithms do not account for delayed reporting, which can hamper sensitivity and timeliness. We will develop an adjustment scheme which is agnostic to the detection algorithm, computationally fast, interpretable and easy to communicate.

(2) Outbreak detection is usually conceived as constructing alarm limits for single time series, accepting a certain rate of false alarms. In practice, however, automated detection across many time series serves to direct limited human resources to patterns worth of investigation. Rather than binary flags, rankings of potential outbreaks by relevance are thus needed. We will conceive and compare ranking methods, and develop methods to assess their quality. (3) The COVID-19 pandemic has demonstrated a need to adjust outbreak detection algorithms after external shocks. We will perform a systematic analysis of changes in seasonal patterns across a comprehensive range of pathogens monitored by RKI. Based on these, we will develop and validate suitable extensions to outbreak detection techniques.

These challenges will be addressed in cooperation between KIT, Uni HD and collaborators from RKI, ensuring a close link between methods development and practical needs.


Prof. Dr. Melanie Schienle


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Special requirements for applicants:

• Advanced R programming skills and experience in larger programming projects.

• Advanced knowledge of mathematical and applied statistics, proven by suitable coursework. Experience with time series methodology is of particular relevance.

• Prior experience with infectious disease surveillance data is a strong asset.

• Experience in communicating of statistical concepts to non-statisticians is an asset.