Development of a bead-based multiplex immunoassay for detection of influenza infection and vaccination

We are looking for an enthusiastic master student for an internship at the RIVM in Bilthoven starting in October, for a period of 9 months.

Study description: Influenza virus is one of the most common causes for a respiratory infection and affects 10 to 20% of the population annually. Circulation of influenza shows a seasonal pattern which peaks in winter season and multiple infections occur during life. Every 8 to 41 years, a pandemic influenza virus emerge. These pandemics are often cause by influenza type A, while influenza type B can cause large epidemics but not pandemics.

Influenza A can be divided in subtypes based on different surface proteins (hemagglutinin (H) and neuraminidase (N)). There are 18 H-subtypes ad 11 N-subtypes of the influenza A virus, but the most common subtypes are H1N1 and H3N2. Of influenza B, there are two lineages based on the H protein (B-Victoria and B-Yamagata). Natural infection induce long-lasting protective immunity but is strain specific. Recurrent infections due to antigenic variation.

For many circulating pathogens, we developed a bead-based multiplex immunoassay (MIA) to measure IgG and IgA antibodies against specific pathogens This Luminex technology uses fluorescent microspheres as carrier for different antigens which makes it possible to detect multiple analytes in one single serum sample of low volume. For one of the most common causes for a respiratory infection, the influenza virus, an immunoassay is not yet developed completely.

Goal:

The aim of this study is to set up a multiplex immunoassay for the detection of different influenza antigens. This assay has to identify multiple influenza strains and subtypes (10-20 analytes) and should determine a recent infection, a recent vaccination but also overall immunity gained during lifetime.

Research questions:

Literature search:

- Identify relevant influenza strains anticipated to serologically dissect between recent infection, vaccination and overall immunity.

Methodology

- Build a prototype bead-based multiplex assay with up to 20 relevant influenza strains/analytes (commercially available, inhouse produced)
- Validate the assay with sera from infected and vaccinated persons; determine sensitivity and specificity, determine cross-reactivity, ….
- Determine which analytes to be selected for immune survey in the population

Specific study

- Determine influenza infection prevalence in the Dutch population (period 2021-2024) on the basis of the dynamics of antibody levels for the different strains

Data analysis

- Analysis of sensibility, specificity and accuracy of the multiplex assay
- Statistically modelling the sero-response data from the population survey to classify influenza infection and independent from vaccination using R
- If possible, provide an algorithm to determine levels of immune protection, guided by strain specific antibody levels and antibody waning

More information?

Channah.gaasbeek@rivm.nl