National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Factsheet Respiratory mucosal immune marker profiles
PIENTER 3 study results

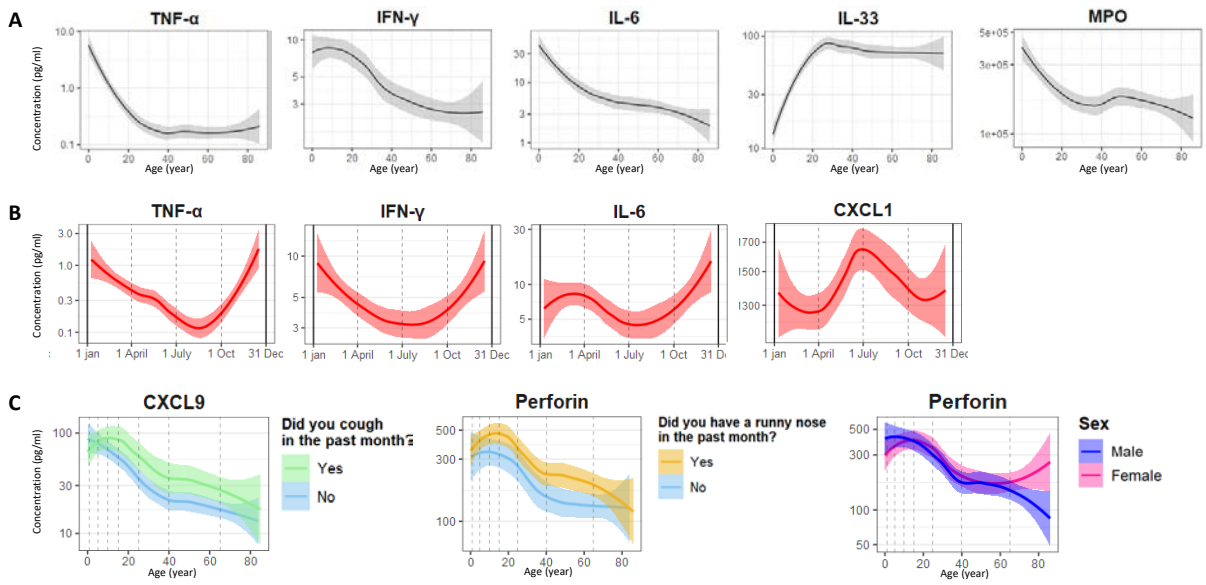
Background

The upper respiratory tract is continuously exposed to microorganisms and noxious elements which could lead to respiratory complaints. These exposures also result in local immune responses aimed to clear invading microbes and toxins. Such immune responses could also be induced by the elements and lead to aberrant immune responses that could result in complaints in reduced wellbeing. Respiratory immune responses involve the secretion of signalling molecules that recruit immune cells and regulate their responses as well as molecules with antimicrobial properties. These immune markers can be detected in mucosal samples such as nasopharyngeal swabs as collected in the PIENTER 3 study.
While several studies describe immune marker profiles in respiratory mucosal samples in defined patient cohorts, mucosal immune profiles from the general population during the different seasons are lacking. Such baseline profiles are essential to understand the impact of various exposures to the mucosal immune system throughout life.
To establish baseline, local upper respiratory mucosal immune profiles in the general population, and assess these profiles in regard to age, sex, seasonality, and basic health and lifestyle factors.

Results

From sex and age strata 951 participants (aged 0-86 years) were selected randomly for analyses of immune in nasopharyngeal swab samples. For this 35 immune markers involved in various immune processes including antiviral, antibacterial responses, inflammatory processes and tissue regeneration were selected. Participants with immunodeficiencies, HIV or tuberculosis infections, or those that had used antibiotics in the past three months were excluded prior to selection.
For most markers the samples were well within the detection limits of the assay, except for CCL3, IL-1β, IFN-λ2/3, and MRP8-14, of which more than 20% of the samples were out of range, which were therefore excluded from further analysis. Clustering analysis shows that the immune marker profiles clearly reflect immunological functions, such as tissue regeneration and antiviral responses. The concentrations of the immune markers changed strongly with seasonality and age, with almost all markers showing an overall decrease with age, except for CRP, IL-18, IL-33, CCL11, and CCL17. The most profound changes occurred in the first 25 years of life. The highest concentrations were observed during winter and the lowest concentrations during summer for the majority of markers. Immune markers were associated with sex, BMI, smoking, infection-induced symptoms, and chronic asthma and seasonal allergic rhinitis.

Figure 1. Selected immune markers levels by age (A), season (B) or by age stratified by coughing, runny nose or sex (C). Graphs show LOESS fit and 95% confidence intervals.



Conclusion / discussion

We show that immunological analyses of non-invasive mucosal samples provide insight into mucosal immune responses to microbial and noxious element exposures in the general population. These data provide a baseline for future studies on respiratory mucosal immune responses and for the development of mucosal immune-based diagnostics.

Publication

Effect of age and season on respiratory mucosal immune marker profiles.
Van Woudenbergh E, van Rooijen DM, Veldman-Wolf JJ, Nicolaie MA, Huynen MA, van der Klis FRM, de Jonge MI, den Hartog G.
Journal of Allergy and Clinical Immunology 2024; 153(6):1681-1691.e12.