University of Basel
Department of
Biomedical Engineering

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Master of Science – Biomedical Engineering
Thesis Proposal

Prediction of duration of hospital stay in children with bronchiolitis and obstructive bronchitis using breath metabolomics

Obstructive bronchitis and bronchiolitis are among the leading causes of hospitalization in young children, particularly during the infectious winter season [1]. Yet, current clinical phenotyping of wheezing children has limited value for predicting disease severity, response to treatment, or the need for closer monitoring and inpatient care. There is therefore a clear need for new, non-invasive biomarkers that help identify children at risk for more severe disease courses and support a more informative phenotyping approach [2].

Exhaled breath analysis offers a particularly attractive approach in this setting, as it is non-invasive and reflects rapid metabolic changes in the respiratory system. Using secondary electrospray ionization high-resolution mass spectrometry (SESI-HRMS), a broad range of breath-derived metabolites can be assessed at the bedside. In contrast to approaches focusing only on volatile organic compounds, SESI-HRMS captures a wider spectrum of metabolic signals and may therefore provide a more comprehensive view of disease-related biological processes.

The aim of this master's thesis is to investigate whether metabolic signatures in exhaled breath can be used to predict the length of hospitalization in children with obstructive bronchitis or bronchiolitis. Length of stay will be used as a proxy for treatment response and disease severity. The project will be based on an existing clinical dataset from children aged 0 to 3 years and will focus on programming and data analysis to develop, optimize, and evaluate predictive models based on breath-derived metabolic features.

Key questions include:

1. To what extent can hospital stay be predicted from breath metabolomic profiles?
2. Which prediction methods achieve the best performance?
3. How stable and robust are the resulting models?
4. Which breath features contribute most to the predictive signal?

Nature of the Thesis
Programming and data analysis: 80%
Documentation: 20%

Specific Requirements
Good programming skills, with familiarity in at least one of the following: R, Python, or MATLAB.
Genuine interest in a highly interdisciplinary project.

Supervisor
Prof. Dr. Pablo Sinues, Translational Medicine Breath Research (TMBR), University of Basel.
Dr. sc. med. Fabienne Decrue, Pneumology, UKBB

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References
1:Smyth et al, 2006; PMID: 16860701 | **2:** Makrinioti et al, 2024; PMID: 38843917

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