

Research Project

Individualized Drug Dosage Guided by Breath Analysis

Third-party funded project

Project title Individualized Drug Dosage Guided by Breath Analysis

Principal Investigator(s) [Sinues, Pablo](#) ;

Organisation / Research unit

Departement Biomedical Engineering / Translational Medicine Breath Research (Sinues)

Bereich Kinder- und Jugendheilkunde (Klinik) / Pädiatrische Umweltmedizin (Sinues)

Department

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Status Active

For a small fraction of all therapeutic drugs currently used, routine monitoring is crucial. The reason for this is that the gap between therapeutic and toxic concentration is very narrow. This, combined with the fact that there exists high inter-individual variability, has led to the need for therapeutic drug monitoring (TDM). The goal of TDM is to individualize the dosage to achieve maximum efficacy and at the same time minimize drug toxicity. TDM has obvious clinical benefits for patients and healthcare systems. However, TDM in children is particularly challenging. In addition, traditionally used venipunctures to determine drug concentrations are not well tolerated by children. The goal of this project is to address these challenges by providing a non-invasive and patient-specific solution, whereby drugs requiring TDM in children will be monitored in exhaled breath. We will use a cutting-edge analytical platform (i.e. secondary electrospray ionization-mass spectrometry) available at the University Children's Hospital Basel to detect drugs in breath with unparalleled speed, selectivity and sensitivity. Initially, we will measure simultaneously blood and breath concentrations of drugs routinely monitored in our hospital (e.g. anti-convulsants). We will then use this information as an input to develop pharmacokinetic computational models to predict blood concentrations based on the breath test read-out. During the final phase, we will validate these models in an independent group of patients to proof the clinical transferability of breath-based tests to guide drug dosage on an individual basis. This project will have a tremendous impact on current pediatric TDM clinical practice by: i) enabling a more personalized treatment, hence reducing ineffective doses and adverse effects; ii) improving patients' outcome; iii) saving hospital costs and iv) gaining new insights on pharmacokinetic aspects such as key parameters governing the diffusion of drugs in the lungs.

Keywords Breath Tests; Therapeutic Drug monitoring; Secondary Electrospray Ionization-High Resolution ; Drug Metabolomics; Pharmacokinetics

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