

## My Abstract:

Asthma is a heterogeneous disease that is the leading cause for hospitalization in Canadian children [1]. Preschoolers are particularly vulnerable, with almost a two-to-three fold higher rate of emergency department visits for asthma than other age groups.

Preschool asthma is difficult to diagnose and treat. Lung function testing can only be reliably performed in children over age 5 and, unfortunately, no alternative diagnostic gold-standards exist [2]. Moreover, little is known about which preschoolers with asthma or wheeze are likely to benefit from currently available therapies, highlighting the urgent need for discovery of validated biomarkers that would facilitate the transition from the current one-size-fits all approach to precision-based treatment.

Since asthma is composed of diverse phenotypes (observable clinical characteristics) and molecular endotypes (inflammatory mechanisms), our approach is based on finding new natural data representations from different 'omics systems' in the hopes of deriving biomarkers that may be useful in the diagnosis and treatment of preschool asthma.

Based on multi-omics data (i.e: genome, microbiome, transcriptome, and metabolome) originating from the Unbiased BIOMarkers for the PREdiction of Respiratory Disease Outcomes (U-BIOPRED) kids project, we utilize probabilistic graphical models (PGMs) that enables us to leverage prior knowledge through bayesian priors. This nouvel approach allows us to generate graphs that can explain key causal relationships between omic biomarkers and clinical variables, and reveal important causal pathways .

These relationships could highlight underlying pathways of complex disease phenotypes that may or may not be responsive to treatment, which can then be used for clinical decision-making, while avoiding a *black box* paradigm that would impede clinicians understanding of the disease.

[1] Loughheed MD, Garvey N, Chapman KR, Cicutto L, Dales R, Day AG, et al. The Ontario Asthma Regional Variation Study: emergency department visit rates and the relation to hospitalization rates. *Chest* 2006; 129:909-17.

[2] Ducharme FM, Tse SM, Chauhan B. Diagnosis, management, and prognosis of preschool wheeze. *Lancet* 2014; 383:1593-604.