Role of R in searching biomarkers for asthma and other respiratory diseases in early childhood

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ASTHMA ↑

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COMPUTING AND SYSTEMS

NON-INVASIVE METHOD FOR EARLY DIAGNOSIS OF ASTHMA

EARLY DIAGNOSIS OF ASTHMA

IDEAL BIOMARKER

VOLATILE ORGANIC COMPOUNDS (VOCs)

EARLY DIAGNOSIS OF ASTHMA → IDEAL BIOMARKER

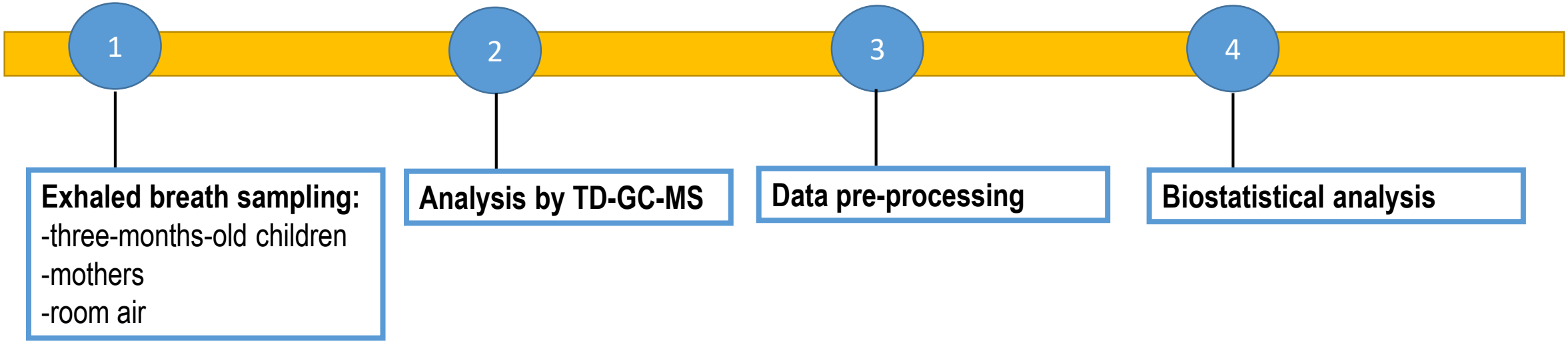
1. Minimally invasive
2. Easily measurable
3. Reproducible

HUMAN EXHALED BREATH

VOLATILE ORGANIC COMPOUNDS (VOCs)

-INTERPERSONAL VARIETY
-INTRAPERSONAL VARIETY

- therapeutic monitoring
- diagnosis of diseases
- detection of exposure to environmental pollution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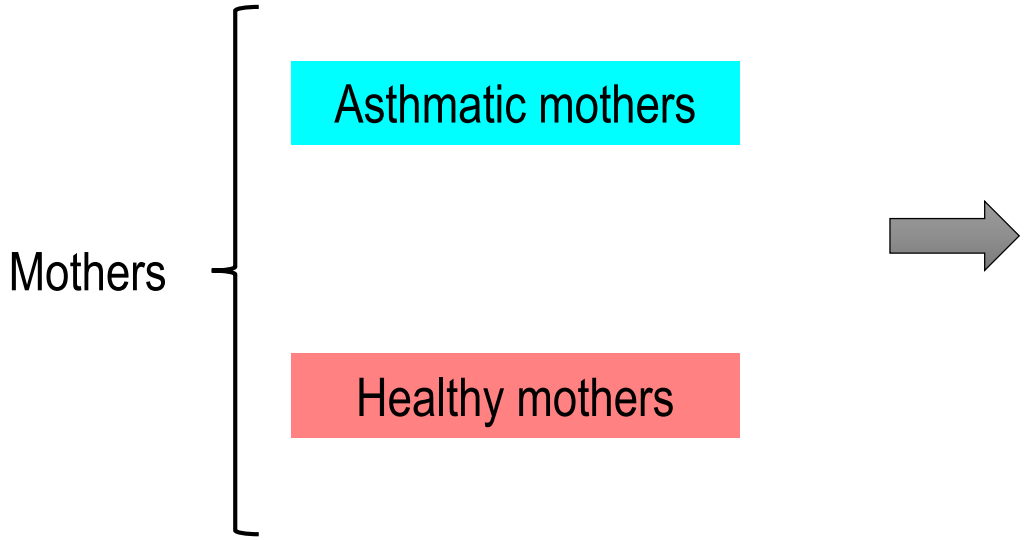
Exhaled breath sampling:
-three-months-old children
-mothers
-room air
Analysis by TD-GC-MS
Data pre-processing
Biostatistical analysis

1. **Exhaled breath sampling:**
   -three-months-old children
   -mothers
   -room air
2. **Analysis by TD-GC-MS**
3. **Data pre-processing:**
4. **Biostatistical analysis**

Biostatistical analysis

- **Qualitative variables**
  - -Multiple Correspondence Analysis (MCA)
  - -Chi-squared test
  - -Fisher's exact test
- **Quantitative variables**
  - **inferential statistics**
    - -t-test
    - -ANOVA
    - -Mann-Whitney U-test
    - -Kruskal-Wallis test
  - **multivariable statistics**
    - -Principal Component Analysis (PCA)
    - -logistic regression
    - -Receiver Operating Characteristic (ROC) curve analysis

Exploratory study → 472 three-months-old children and mothers



Children's diseases
COLD
COUGH
WHEEZING
RESPIRATORY SYMPTONS
BRONCHIOLITIS
ATOPIC ECZEMA
CHEST INFECTIONS

Exploratory study → 472 three-months-old children and mothers

Mothers
- Asthmatic mothers
- Healthy mothers

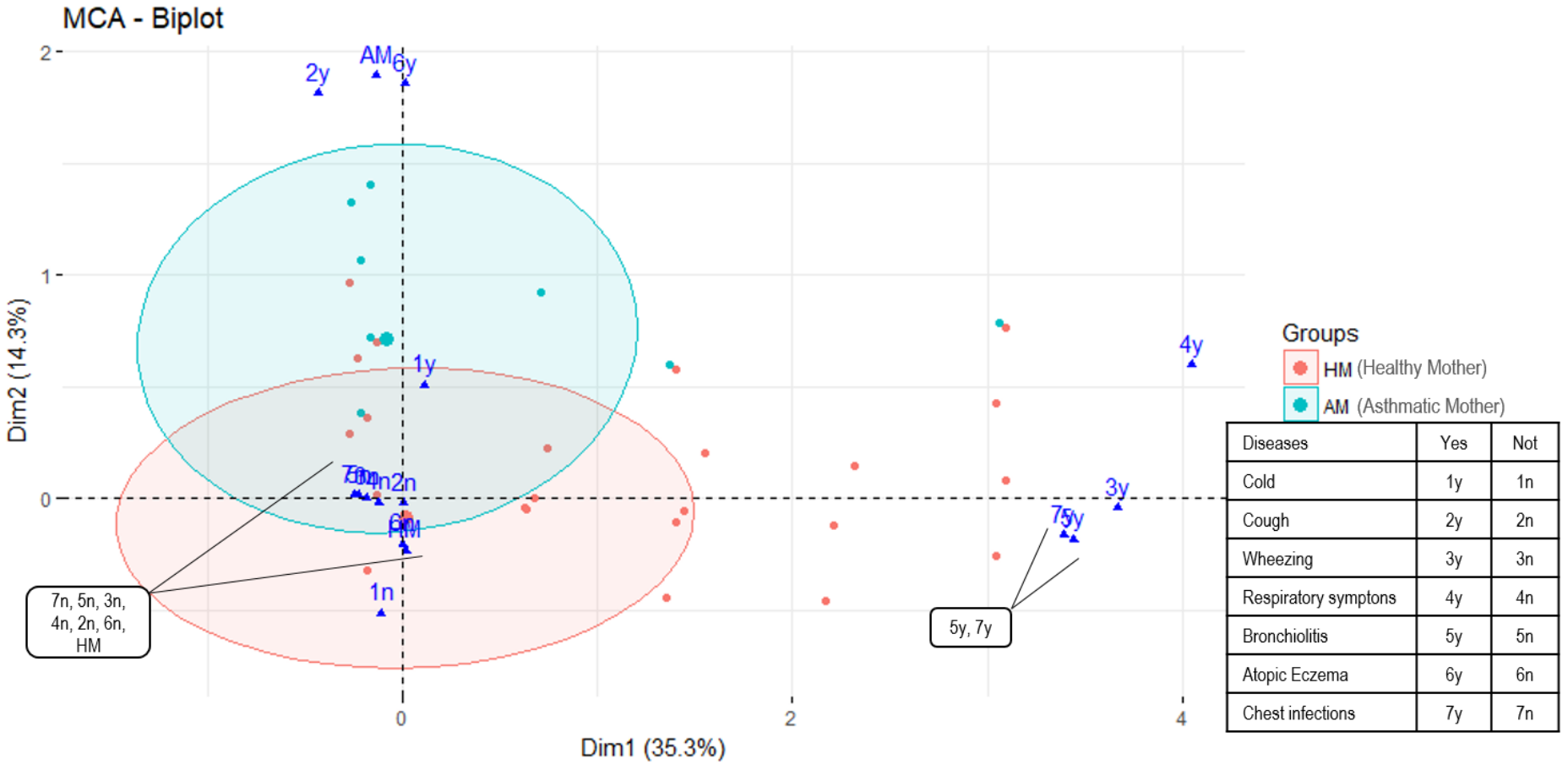
→

Children's diseases
COLD
COUGH
WHEEZING
RESPIRATORY SYMPTONS
BRONCHIOLITIS
ATOPIC ECZEMA
CHEST INFECTIONS

Biostatistical analysis → MCA + Fisher's exact test

Exploratory study → 472 three-months-old children and mothers

Multiple Correspondence Analysis (MCA)



Diseases	Yes	Not
Cold	1y	1n
Cough	2y	2n
Wheezing	3y	3n
Respiratory symptons	4y	4n
Bronchiolitis	5y	5n
Atopic Eczema	6y	6n
Chest infections	7y	7n

Exploratory study → 472 three-months-old children and mothers

Fisher's exact test

Children's diseases	p-value
COLD	0,19
COUGH	0,51
WHEEZING	0,50
RESPIRATORY SYMPTONS	0,66
BRONCHIOLITIS	0,76
ATOPIC ECZEMA	0,08
CHEST INFECTIONS	0,56

Exploratory study → 472 three-months-old children and mothers

Fisher's exact test

Children's diseases	p-value
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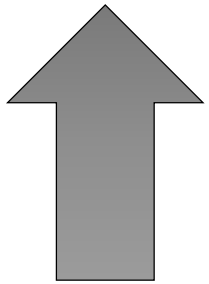
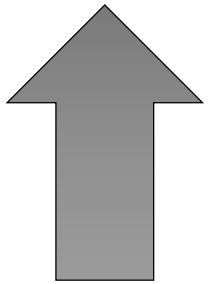
(Silverberg & Hanifin, 2013)



Atopic eczema
in adults



Asthma
in adults

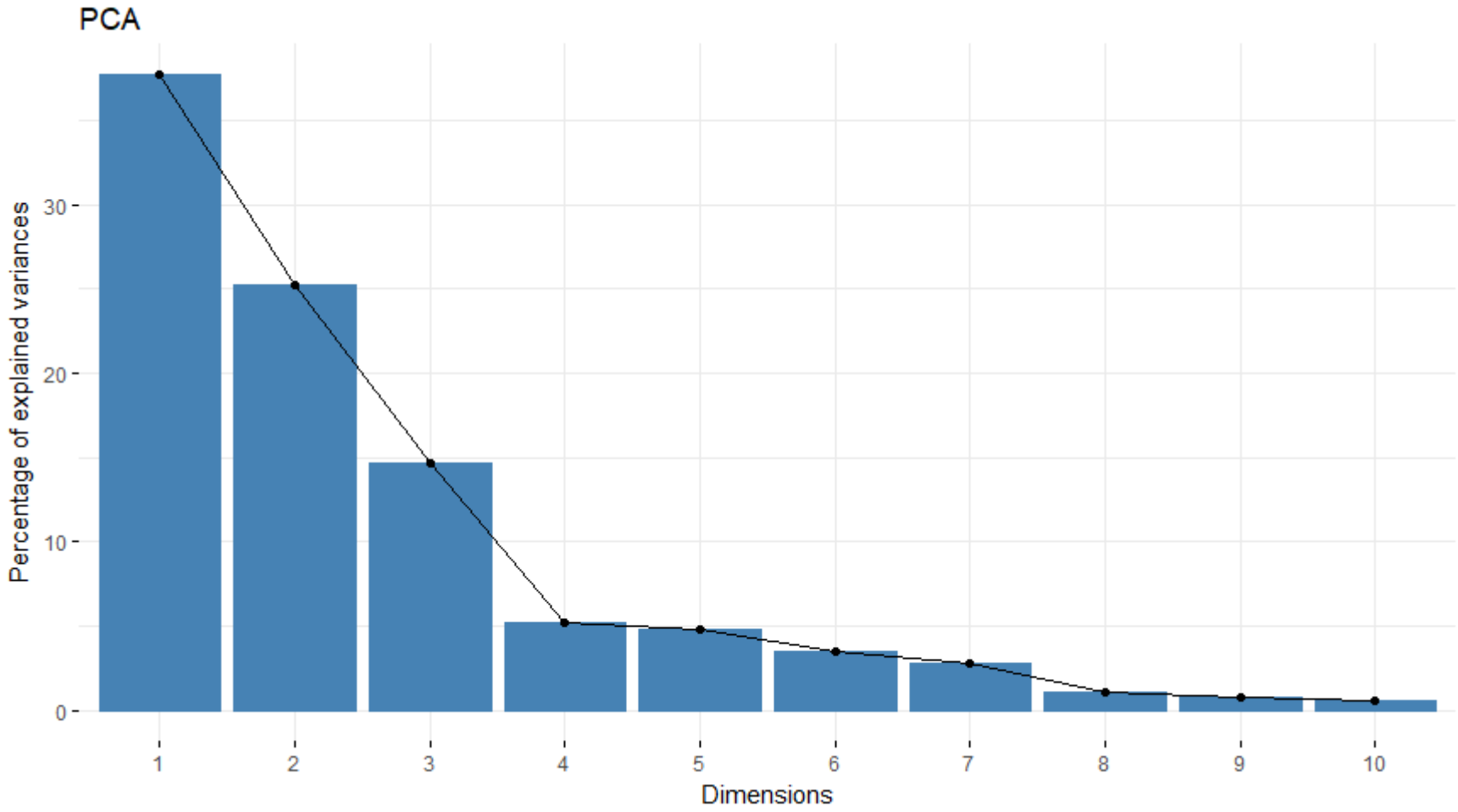
Preliminary study → 201 three-months-old children and mothers

1. **Exhaled breath sampling:**
   -three-months-old children
   -mothers
   -room air
2. **Analysis by TD-GC-MS**
3. **Data pre-processing:**
   -DBSCAN clustering and centroid's Euclidean distance
   -Machine Learning
4. **Biostatistical analysis**
   -PCA (package FactoMineR)
   -Mann-Whitney U-test

$\Delta AVOC = A_{breathVOC} - A_{airVOC}$

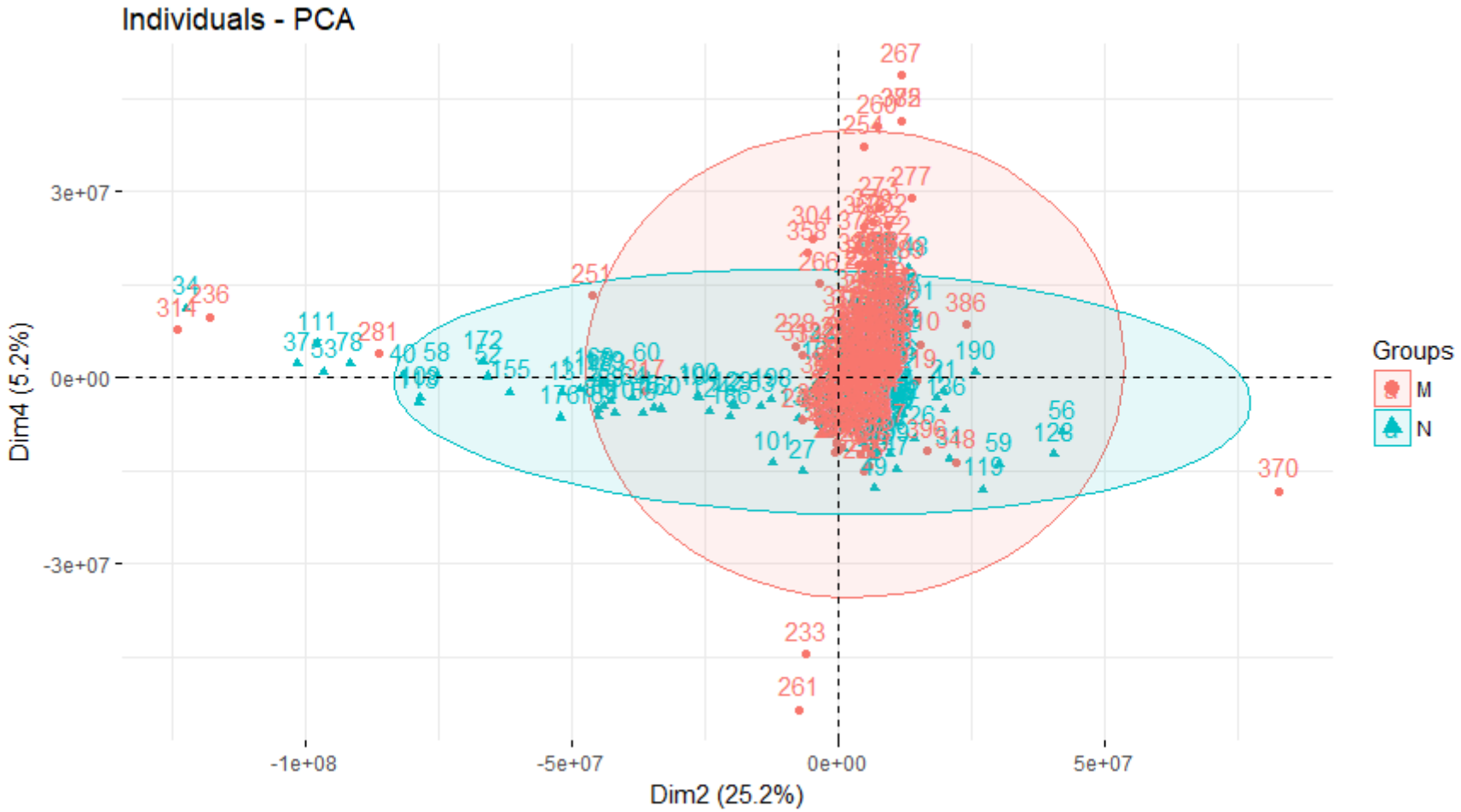
Preliminary study ➡ 201 three-months-old children and mothers

Principal Component Analysis (PCA)



Preliminary study ➡ 201 three-months-old children and mothers

Principal Component Analysis (PCA)



Preliminary study → 201 three-months-old children and mothers

-COMPONENT 2 → ISOPROPANOL

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CHILDREN

-COMPONENT 4 → ACETONE

↓

MOTHERS

Preliminary study

201 three-months-old children and mothers

-COMPONENT 2 → ISOPROPANOL

-COMPONENT 4 → ACETONE

CHILDREN

MOTHERS

ISOPROPANOL

MOTHERS

CHILDREN

Mann-Whitney U-test

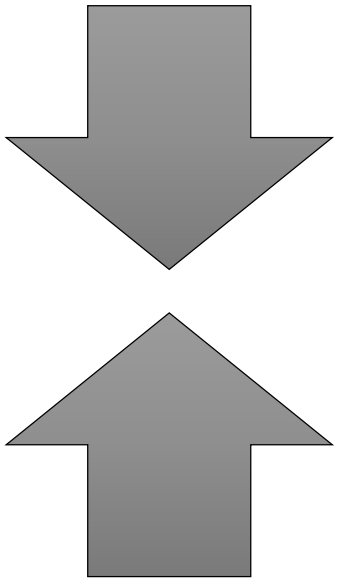
ACETONE

CHILDREN

MOTHERS

Stonner et al. 2018

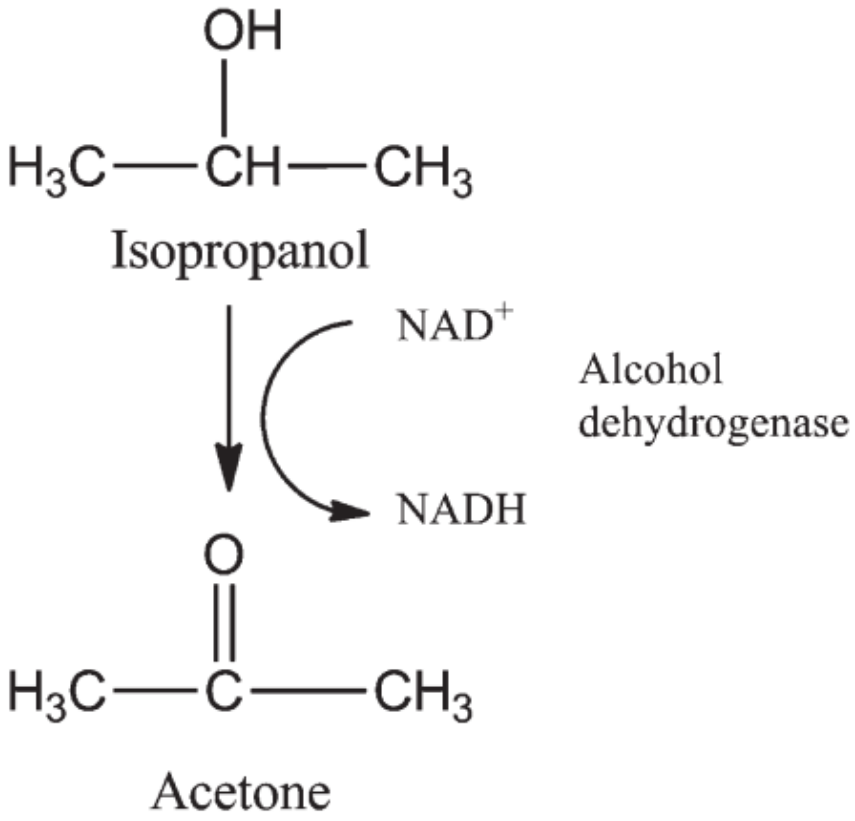
ACETONE



CHILDREN

ADULTS

Slaughter et al. 2014



ISOPROPANOL

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Renal elimination

ACETONE

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Elimination by exhaled breath

Slaughter et al. 2014

ISOPROPANOL

Cases of intoxication in children

-R is a fundamental in this project as pre-processing and biostatistical tool

-Specially, PCA and MCA of package "FactoMineR" are been used in analysis of VOCs in exhaled breath, owing to the large amount of the original variables (volatile organic components)

THANKS

NELA
Nutrition in Early Life and Asthma

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