



science and policy
for a healthy future

Asthma, COPD and skin irritation

Hanna Elonheimo
Finnish Institute for Health and
Welfare (THL)

Introduction to asthma

- One of the major noncommunicable diseases (NCD) affecting both children and adults worldwide
- In Europe, prevalence around 8 % in adults and 9 % in children (2015)
- Causes airway inflammation leading to reversible obstruction in bronchus
 - ✓ Other symptoms include producing of mucus, coughing, wheezing, shortness of breath and chest tightness
 - ✓ Asthma attacks and symptoms can be reversed with either time or treatment
- Common exposure agents include dusts, air pollution, allergies, tobacco and obesity

Chemicals and asthma

- Environmental chemicals increase the risk of asthma, and occupational exposures can predispose to asthma
- Of the HBM4EU prioritized substances, PAHs, diisocyanates, pesticides, phthalates and DINCH, PFASs, lead, mercury, cadmium, chromium VI and arsenic can be associated with the development of asthma

Diagnosing asthma

- There is not only one widely applicable diagnostic test for asthma
- Clinical diagnosis should be defined according to the guidelines of the Global Initiative for Asthma (GINA), which include various respiratory symptoms suitable for asthma and confirmed reversible airway obstruction
- Performing spirometry is the most common method for diagnosing new asthma cases
- Other common diagnostic methods include PEF-follow-up (Peak expiratory flow), FeNO (Fractional exhaled nitric oxide test), and exposure to methacholine

Introduction to COPD

- Chronic obstructive pulmonary disease (COPD) is a progressive, non-reversible obstructive pulmonary disease
- COPD is an under-diagnosed NCD affecting both men and women in older age groups (commonly over 50 years), but is more prevalent in men
- It is the third leading cause of death worldwide, and it caused approximately 3 million deaths in 2019
- In Europe, the prevalence of COPD among adults is 5-10 %
- Common exposure agents include tobacco, air pollution and mine dust

Chemicals and COPD

- Of the HBM4EU priority substances bisphenols, pesticides, diisocyanates, flame retardants, PAHs cadmium, chromium VI, arsenic, mercury and lead can have adverse health effects on pulmonary function
- Majority of studies focus on symptoms of COPD (cough, decreased pulmonary function)

Diagnosing COPD

- Clinical diagnosis includes symptoms typical for COPD and persistent airflow obstruction in spirometry
- The stages of COPD can be determined with the Global Initiative for Chronic Obstructive Lung Disease (GOLD Staging System) and the BODE Index
- The GOLD categorisation includes four stages using the FEV1 measurement ranging from mild to severe
- The BODE Index includes investigation of body mass, obstruction of airflow, dyspnea (difficulty of breathing) and exercise capacity; this index is used to understand prognosis

Symptoms and comorbidities

- COPD and asthma share common symptoms – cough, wheeze and breathing difficulties, and people can have both conditions
- In COPD, comorbidities include cardiovascular diseases, diabetes, depression, anxiety and cachexia
- In asthma, comorbidities include atopy, allergy, chronic sinusitis, reflux and obesity

Measuring asthma and COPD in HBM studies

- Spirometry, self-reported information by standardized questionnaires and administrative register data can be used
 - ✓ In Finland, prevalences of asthma and COPD are nearly equal based on self-reported information and register data (Laatikainen et al., 2020)
- Standardized questions for participants' self-reported information are available in HBM4EU and European Health Interview Survey (EHIS) questionnaires

ICD-10 codes

- Asthma: ICD-10 codes are J45 asthma and J46 status asthmaticus with subcategories
- COPD: ICD-10 code is J44 other chronic obstructive pulmonary disease with subcategories

Spirometry

Spirometry device



Performing spirometry



(Pictures from Wikipedia)

Measuring with spirometry

- Standardized protocol for spirometry has been presented in HBM4EU deliverable D11.3
<https://www.hbm4eu.eu/deliverables/>
- Spirometry is the most important diagnostic tool for measuring asthma and COPD
- Spirometry measures ventilation objectively; in what extent and how fast air flows into and out of lungs
- According to the results from spirometry, diseases can be classified as causing bronchial obstruction and lung restriction

Measurement protocol for spirometry in short

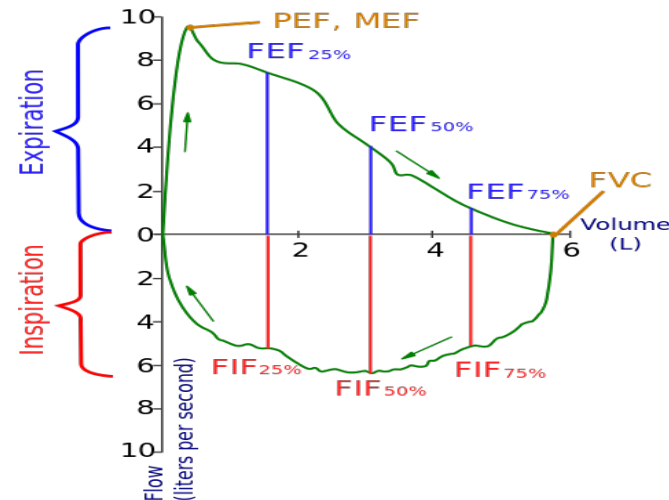
- Selection of the spirometry device should occur based on the requirements of each study
- The use of a computer driven flow-volume spirometry device is recommended
 - ✓ Procedure is nowadays quite complex, and using computer programs and following manufacturer`s instructions is crucial
- The most important reliability criterion is to follow the acceptability and reproducibility criteria for spirometry curves
- The spirometry procedure should be demonstrated for each study subject, and the procedure should be identical for all subjects

Performing spirometry

- The order is usually: spirometry, flow-volume loops, bronchodilation agent, 15-30 minutes break and repeating spirometry and flow-volume loops
- Participant sits in the chair with arm rests and without wheels, feet touching the floor, back touching the chair

Flow-volume spirometry loop

(Picture from Wikipedia)



Important values measured in spirometry

- FVC, Forced Vital Capacity
- VC, Vital Capacity
- FEV1, Forced Expiratory Volume in the first second
- FEV1%, FEV1/FVC ratio

Less common and uncertain values:

- PEF, Peak Expiratory Flow
- FEF (25-75), Forced Expiratory Flow
- FIF, Forced Inspiratory Flow
- FET, Forced Expiratory Time
- Vt, Tidal Volume

Introduction to skin irritation

- Skin is the largest organ in the body
- Skin diseases are major medical conditions globally and cause significant burden to patients
- Examples of the common skin diseases are atopic, contact and seborrheic dermatitis, acne vulgaris and urticaria

Chemicals and skin irritation

- Environmental chemical exposure is one the most common exposure sources for skin irritation and inflammation
- Especially industrial occupational workers might be exposed
- Of the HBM4EU prioritized substances chromium VI, PAHs, anilines, acrylamide, aprotic solvents, arsenic, diisocyanates and pesticides are suspected to cause skin irritation and inflammation

Measuring and diagnosing of skin diseases

- Skin diseases are challenging to diagnose, and different scoring systems are used to evaluate the severity of the disease
- The European Task Force on Atopic Dermatitis has suggested using The Scoring Atopic Dermatitis (SCORAD) Index
 - ✓ provides a cumulative index combining objective and subjective criteria
- Patch testing is used for patients with dermatitis to investigate if the condition is caused by contact allergy, hypersensitivity or mucosal conditions

Measuring skin irritation in HBM studies

- Using the clinical scoring systems, if possible
- Questions in HBM4EU questionnaire on:
 - ✓ Skin irritation, hyperkeratinisation and hyperpigmentation for Arsenic
 - ✓ Skin rashes for Mercury
- Register data

ICD-10 codes

- ICD-10 codes L00-L99 are for diseases of the skin and subcutaneous tissue
 - ✓ More detailed ICD-10 codes exist for dermatitis and eczema (L20-L30) and for urticaria and erythema (L49-L54)



Thank you for your attention!

Further inquiries:

Hanna Elonheimo (THL)

hanna.elonheimo@thl.fi



This project has received funding
from the European Union's
Horizon 2020 research and
innovation programme under
grant agreement No 733032.