

# The Danish National Database for Asthma

## Summary

*Aim of the database:* Asthma is the most prevalent chronic disease in children, adolescents and young adults. In Denmark (with a pop: 5.6 million citizens) > 400,000 persons are prescribed anti-asthmatic medication annually. However, undiagnosed asthma cases, dubious asthma diagnoses, and poor asthma management are probably common. Assessing the overall national quality of asthma management is difficult since patients with asthma are treated in both primary and secondary care.

The Danish National Database for Asthma aims to continuously collect data on all patients treated for asthma in Denmark and to monitor asthma occurrence and the quality of diagnosis and management.

*Study population:* Persons at the age of 6 years, with specific focus on 6 to 44 years (both included). The database presently links two existing nationwide registries of administrative records in the Danish health care system: the National Patient Register (NPR) and National Prescription Registry (NPrR). For each year, inclusion criteria will be a second purchase of asthma prescription medicine within a two-year period (NPrR), or a diagnosis of asthma (NPR). Patients with Chronic Obstructive Pulmonary Disease (COPD) are excluded, but smokers are not.

In the future it will include National Health Insurance Services Register (NHIS).

*Descriptive data:* A total of 366,471 prevalent asthma patients have been identified (year 2014 – as a preliminary test search). This number is in agreement with the estimates of around 400,000 inhabitants that are available of asthma patients in Denmark. Data encompass the following quality indicators: annual asthma control visits and pharmacological therapy,

*Main variables:* spirometry, tools used for diagnosis (including allergy testing), smoking status, height, weight, as well as acute hospital admissions and unscheduled hospital visits.

## Aim of the database

Asthma is the most prevalent chronic disease in children, adolescents, and young adults living in western societies.<sup>1</sup> In Denmark, according to prescription data the prevalence of asthma is over 400,000, with an estimated 30,000 new diagnoses per year. However, these figures are questionable, as population studies indicate that substantially more patients have asthma, but also that persons without asthma are incorrectly treated with anti-asthma medication. A diagnostic gold standard for asthma is lacking, although in a specialist setting most asthma cases will be characterised by respiratory symptoms and a positive asthma challenge, whereas primary care often diagnose asthma base on symptoms only.<sup>2-4</sup>

The survival rates of treated Danish lung cancer patients is presently the lowest amongst the Nordic countries. Therefore, one of the first established Danish databases was the lung cancer database. This database was established with the primary task to implement the updated national guidelines and furthermore, to secure valid registration of clinical baseline data and quality parameters with the aim of significantly improving the quality of lung cancer surgery.<sup>5</sup> The effects of this database have been clinically relevant and follow-up studies have shown an improved clinical practice and core results, reduced mortality, and reduced regional differences.<sup>6,7</sup>

These data illustrate the need of better quality in care of the patients with a chronic illness. The occurrence of respiratory symptoms and signs of reversible airway obstruction characterize asthma. Nevertheless, not all patients with respiratory symptoms, such as wheezing, exercise-induced shortness of breath, or cough, should be diagnosed with asthma.<sup>8</sup> Also a single spirometry is not sufficient to make a correct asthma diagnosis which preferably should be based on a thorough history of respiratory symptoms and documentation of airway obstruction variability<sup>9</sup>.

In Denmark, most prescriptions of anti-asthmatic drugs are made in primary care by general practitioners (GPs). However, large numbers of in- and outpatients with asthma are treated in tertiary specialist care, secondary care at hospital departments of pulmonology, internal medicine, and pediatrics. This makes it difficult to assess the overall quality of asthma management. To solve this, and in order to establish more accurate monitoring of asthma in the Danish population, in 2015 it was decided to establish a nationwide database of asthma cases in Denmark.

The Danish National Database for Asthma will provide a tool to continuously collect and monitor valid and complete data on the occurrence of asthma in Denmark for quality of diagnosis and treatment and provide a resource for future epidemiological research in the area of asthma. This database is expected to significantly contribute to the improvement of asthma care in Denmark and thus place Denmark on the international forefront of asthma care.

### **Study population**

The healthcare system in Denmark is almost universal and generally free of charge, covering all citizens. Since establishment of the Danish Civil Registration System (CRS)<sup>10</sup> in 1968 and all citizens of Denmark have been a unique personal identification number (CPR-number). All medical, social, and other administrative public records use this unique number to identify citizens, thus this number allows accurate linkage between registers. The database is based on existing administrative nationwide records in the Danish healthcare system and will be maintained by “The Danish Clinical registries (RKKP)” and will include all patients with asthma wherever they may be diagnosed, monitored, or treated for the disease.

The database presently links two existing nationwide registries of administrative records in the Danish health care system. Namely, the *National Patient Register(NPR)*<sup>11</sup> and the *National Prescription Registry (NPrR)*.<sup>13</sup>

- The coverage of the NPR database version 10 (ICD 10) is nearly 100% as reporting is compulsory and linked to the allocation of resources.
- The NPrR contains information on all prescriptions dispensed at Danish pharmacies. Each record contains among others the CPR-number of the individual filling the prescription as well as date, specific anatomical therapeutically codes (ATC) of the type of drug, and amount in dosage numbers.

In the future the database will also include the *National Health Insurance Services Register(NHISR)*<sup>12</sup>, which contains information on all services provided by GPs and specialist practitioners in Denmark. The aim of the register is to administrate reimbursement, thus providing precise service provision, but no information about patient diagnoses or test results. Procedure codes for conduction of spirometry with and without reversibility test and skin prick test for allergy are available within this registry.

*For each year the inclusion criteria for the database are:*

1. All persons above the age of 6 years will be included, however due to an overlap between symptoms of asthma and COPD specific focus will be given to the age group between 6-44 years (both included), at which COPD is very uncommon. Furthermore, the age group below 6 years have difficulties with performing lung function, and the pattern of symptoms may reflect other disease than asthma.
2. Second purchase of a prescription drug against asthma (ATC codes R03) within a two-year period.
3. A hospital record as outpatient, inpatient, or emergency room patient that is coded with either ICD-10 J45 or J46 (asthma) as primary diagnosis or J45 or J46 as secondary diagnosis in combination with JXX (any respiratory disease) or R06 (abnormalities in breathing) as primary diagnosis. With exclusion of all patients with records coded with J44 (COPD) as primary or secondary diagnosis. However, asthma patients who smoke will not be excluded, only those whom have developed COPD as the treatment of this disease and its lung biology differ from asthma. Individuals were classified as having asthma with a date of inclusion equal to the earliest dates recorded in the NPR or the NPrR. We will also use CRS to obtain information on date of death or emigration, of the patients.

In the future patient contacts with a GP will be defined using the *NHISR* and claim codes relevant for spirometry, and allergy tests.

### **Descriptive data:**

A total of 366,471 prevalent asthma patients have been identified for the year 2014, and similar findings are expected during the following years of data collection.

### **Main variables**

The data encompasses monitoring trends in the quality indicators, including firstly, conduction of annual asthma control visits, pharmacological treatment, FEV1, FVC, and asthma challenge testing. Secondly including, tools used for diagnosis in new cases and the proportion of skin prick tests performed or measurement of specific immune globulin E concentrations in new patients, and thirdly including annual assessment of smoking status, height and weight measurements as well as the proportion of patients with acute hospital treatment).

## **Follow-up**

Periodic assessments of the quality indicators will be carried out and published on a monthly basis in the regional information systems, where the clinical units (hospitals, hospital departments) can access their own results. All units can ensure real time registration and make usage of own results for the further development and quality assurance in the units respectively.

In the future the database aims to include asthma diagnosis codes and clinical data (FEV1, FVC, height, weight, and smoking status) registered by GPs and specialized practitioners. A computer software called Sentinel data capture (<http://www.dak-e.dk/flx/en/general-practice/sentinel-data-capture/>) is designed to collect these key data as they are entered into the GPs and specialist practitioners' electronic health record systems. The centralization and access to data collected by Sentinel in regards to patients with asthma is presently being revised.

## **Strengths and limitations**

The main strength of the database is that it centralizes important data pertinent for asthma from three almost complete databases covering the entire Danish population. This centralization provides a potential for quality assessment and research that has never previously been available in one single database.

The main limitation of the database is that in a given year Danes with asthma who do not fulfill the database's criteria are not included. However, these criteria are necessary for the database to include primarily patients for whom the asthma management requirements are fair. This is also why patients with asthma-COPD overlap syndrome are not included in the database. The restrictions are according to pharmaco-epidemiological studies<sup>14</sup>. This overlap between the two obstructive diseases might in the future change, as treatment modalities such as the new biological drugs towards e.g. the eosinophilic cells and the cytokines involved can be used, independent of asthma or COPD, and possibly also the overlap between the two diseases. The latter of which, will be solved in the future, as presently all pharmaceutical studies are directed towards either asthma or COPD. Another important issue is the lack of studies validating the asthma diagnosis codes in NPR. However, the database's additional data on tools used to make the asthma diagnosis will improve the validity of these records. Furthermore, validation studies on NPR diagnosis codes for other diseases such as COPD have proven a very high standard<sup>11,15</sup>

## Reference list

- 1 Thomsen SF, Ulrik CS, Kyvik KO, *et al.* The incidence of asthma in young adults. *Chest* 2005; **127**: 1928–34.
- 2 Nolte H, Nepper-Christensen S, Backer V. Unawareness and undertreatment of asthma and allergic rhinitis in a general population. *RespirMed* 2006; **100**: 354–62.
- 3 Hansen S, Strøm M, Maslova E, Mortensen EL, Granström C, Olsen SF. A comparison of three methods to measure asthma in epidemiologic studies: results from the Danish National Birth Cohort. *PloS one* 2012; **7**: e36328.
- 4 Hoffmann-Petersen B, Høst A, Toksvig Larsen K, *et al.* Prevalence of IgE sensitization in Danish children with suspected asthma. *Pediatric Allergy and Immunology* 2013; **24**: 727–33.
- 5 Jakobsen E, Palshof T, Osterlind K, Pilegaard H. Data from a national lung cancer registry contributes to improve outcome and quality of surgery: Danish results. *European journal of cardio-thoracic surgery : official journal of the European Association for Cardio-thoracic Surgery* 2009; **35**: 348–52; discussion 352.
- 6 Jakobsen E, Green A, Oesterlind K, Rasmussen TR, Iachina M, Palshof T. Nationwide quality improvement in lung cancer care: the role of the Danish Lung Cancer Group and Registry. *Journal of thoracic oncology : official publication of the International Association for the Study of Lung Cancer* 2013; **8**: 1238–47.
- 7 Green A, Hauge J, Iachina M, Jakobsen E. The mortality after surgery in primary lung cancer: results from the Danish Lung Cancer Registry†. *European journal of cardio-thoracic surgery : official journal of the European Association for Cardio-thoracic Surgery* 2016; **49**: 589–94.
- 8 Lund T, Pedersen L, Larsson B, Backer V. Prevalence of asthma-like symptoms, asthma and its treatment in elite athletes. *Scandinavian journal of medicine & science in sports* 2009; **19**: 174–8.
- 9 Boulet L-P, FitzGerald JM, Reddel HK. The revised 2014 GINA strategy report: opportunities for change. *Current opinion in pulmonary medicine* 2015; **21**: 1–7.
- 10 Pedersen CB. The Danish Civil Registration System. *Scandinavian journal of public health* 2011; **39**: 22–5.
- 11 Lynge E, Sandegaard JL, Rebolj M. The Danish National Patient Register. *Scandinavian journal of public health* 2011; **39**: 30–3.
- 12 Sahl Andersen J, De Fine Olivarius N, Krasnik A. The Danish National Health Service Register. *Scandinavian Journal of Public Health* 2011; **39**: 34–7.
- 13 Wallach Kildemoes H, Toft Sorensen H, Hallas J. The Danish National Prescription Registry. *Scandinavian Journal of Public Health* 2011; **39**: 38–41.
- 14 Davidsen JR, Søndergaard J, Hallas J, Siersted HC, Lykkegaard J, Andersen M. Increased use of inhaled corticosteroids among young Danish adult asthmatics: an observational study. *Respiratory medicine* 2010; **104**: 1817–24.
- 15 Thomsen RW, Lange P, Hellquist B, *et al.* Validity and underrecording of diagnosis of COPD in the Danish National Patient Registry. *Respiratory medicine* 2011; **105**: 1063–8.