



LEENA TUOMISTO

Asthma Programme in Finland  
– Management of Adult Asthma as Reflected  
by Referral Letters



ACADEMIC DISSERTATION

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the Faculty of Medicine of the University of Tampere,  
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UNIVERSITY OF TAMPERE

ACADEMIC DISSERTATION

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*To my family*



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# 1. List of original communications

This thesis is based on the following original articles, referred to in the text by their Roman numerals (I–V). In addition some unpublished data are presented.

- I Tuomisto L, Erhola M, Kaila M, Brander PE, Puolijoki H, Kauppinen R and Koskela K (2004): Asthma Programme in Finland: High consensus between general practitioners and pulmonologists on the contents of an asthma referral letter. *Prim Care Respir J* 13:205–210.
- II Tuomisto LE, Erhola M, Kaila M, Brander PE, Puolijoki H, Kauppinen R and Kekki P (2007): The Finnish National Asthma Programme: Communication in asthma care – quality assessment of asthma referral letters. *J Eval Clin Pract* 13:50–54.
- III Tuomisto LE, Kaila M and Erhola M (2007): Asthma programme in Finland: Comparison of adult asthma referral letters in 1994 and 2001. *Respir Med* 101:595–600.
- IV Tuomisto LE, Järvinen V, Laitinen J, Erhola M, Kaila M and Brander PE (2008): Asthma Programme in Finland: The quality of primary care spirometry is good. *Prim Care Respir J* 17:226–231.
- V Tuomisto LE, Erhola M, Luukkaala T, Puolijoki H, Nieminen MM and Kaila M (2010): Asthma Programme in Finland: Did the use of secondary care resources in asthma management become more rational? *Respir Med* Mar 4. Epub ahead of print.

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## 2. Abbreviations

ATS	American Thoracic Society
BMI	body mass index
BTS/SIGN	British Thoracic Society and Scottish Intercollegiate Guidelines Network
COPD	chronic obstructive pulmonary disease
ERS	European Respiratory Society
FEV1	forced expiratory volume in one second
FVC	forced vital capacity
GINA	Global Initiative for Asthma
GP	general practitioner
GPwSIs	General Practitioners with Specialist Interest
MAS	maximal acceptable standard of inadequacy
NICE	National Institute for Health and Clinical Excellence
OR	odds ratio
PEF	peak expiratory flow
UK	United Kingdom
WHO	World Health Organization
95% CI	95% confidence interval

### 3. Abstract

Good informational continuity is essential to health care with limited resources. Asthma is a prime example of a chronic disease for which all health care professionals should work according to a common strategy, providing consistent care. Asthma can be managed in primary care settings, but specialist consultation is needed in cases of an unclear diagnosis or unstable asthma. Optimal communication between physicians is necessary for specialists if they are to plan for further investigations and set a time frame with respect to urgency.

The Finnish National Asthma Programme (1994–2004) was published to enhance the early diagnosis of asthma and to re-organize the responsibility for its care. Referral letters offer a practical tool for measuring performance at the interface between primary and secondary care.

The aim of this thesis was to evaluate asthma management at the interface between primary and secondary care during the asthma programme. Medical record audits were used for this purpose. Quality criteria were developed for referral letters by a consensus-seeking expert panel on the basis of evidence from the literature and from the results of a national questionnaire review. The quality criteria for the spirometry curves were based on international guidelines. The main sources of data were adults' non-acute asthma-related referral letters and copies of primary care spirometry report sheets, which were prospectively collected from the referral letters sent to the respiratory departments of three study hospitals during 2001. Referral letters sent to one of the study hospitals in 1994 were also retrospectively collected so that the results of two years with a 7-year interval could be compared. Clinical profiles of the new asthma patients and the use of secondary care resources were also compared between the two years (1994 and 2001).

A high national consensus was reached about the content of an asthma-related referral letter between primary and secondary care physicians: 7 administrative and 14 asthma-specific criteria were selected. The expert panel defined the gradings of the referral letter quality. The referral letters (n=1289) from the three hospitals were of good quality against the administrative criteria in 96% of the cases in 2001. Asthma-specific quality was poor for 45% of the letters and good for 21%. The most frequently missing items were smoking (58%), medication (59%), peak flow follow-up results (53%), and spirometry with the results of a bronchodilation test (69%).

A comparison between the quality of the referral letters in 1994 (n=624) and that of the letters in 2001 (n=452) was made in one study hospital. The proportion of poor letters decreased (63% versus 44%), while that of good letters increased (7%

versus 22%). The visually assessed quality of the primary care spirometry curves (n=489) from 2001 was found to be good for 79% of the letters. Clinical data on respiratory medication and patient co-operation were frequently missing from the spirometry report sheets. The profile of the new asthma patients seems to indicate that those with milder asthma with more co-morbidities were referred in 2001 than 7 years earlier. Asthma was diagnosed after fewer physician visits in 2001 and the overall number of visits in secondary care was smaller.

Quality criteria to assess asthma-related referral letters were set on the basis of a high consensus between primary and secondary care physicians. The proportion of poor letters against the asthma-specific criteria was higher than expected, but the quality improved during the first 7 years of the National Asthma Programme. The quality of the primary care spirometry data was good. Secondary care resources were used more efficiently.

As reflected by the referral letters, primary care professionals took a more active role in asthma management during the National Asthma Programme.

*Key terms:* asthma, management of asthma, quality, communication, referral letter, primary and secondary care interface, primary care spirometry, programme evaluation

## 4. Tiivistelmä

Tehokas tiedonkulku on tärkeää, jotta terveydenhuollon rajalliset resurssit voidaan parhaiten hyödyntää. Astma on krooninen sairaus, jota tulisi hoitaa eri terveydenhuollon tasoilla sekä moniammatillisesti että yhdenmukaisesti. Perusterveydenhuollossa on valmiudet astmapotilaiden tutkimukseen ja hoitoon, mutta epäselvä diagnoosi tai huono hoitovaste voivat edellyttää erikoislääkärin konsultaatiota. Lähetetietojen perusteella erikoislääkäri arvioi hoidon kiireellisyyden ja tarvittavat lisätutkimukset.

Kansallisen astmaohjelman (1994–2004) tavoitteena oli aikaistaa astman diagnostiikkaa, tukea potilaan omahoidon toteutumista ja tarkentaa työnjakoa terveydenhuollossa. Lähetteen tietojen perusteella voidaan tarkastella potilaiden hoitoa hoitovastuun siirtyessä perusterveydenhuollosta erikoissairaanhoidon.

Tutkimuksen tavoitteena oli arvioida astman hoitoa ja siihen liittyvää tiedonkulkua kansallisen astmaohjelman aikana. Tutkimusmenetelmänä käytettiin potilaskertomusten arviointia (= medical record audit) lähetteen avulla. Asiantuntijaryhmä laati astmalähetteen laatukriteerit perustuen kirjallisuuteen, astman hoitosuositukseen sekä perusterveydenhuollon lääkäreille ja keuhkoylilääkäreille suunnattuun kyselyyn. Myös spirometriakäyrän visuaaliset laatukriteerit pohjautuivat kansainvälisiin suosituksiin.

Tutkimusaineisto kerättiin prospektiivisesti Hyvinkään sairaalan, Lappeenrannan ja Seinäjoen keskussairaaloiden keuhkoyksiköiden ajanvarauslähettestä koko vuoden 2001 ajalta. Kaikki läheteet, joissa lähettämisen syynä oli astmaepäily tai astma, kopioitiin liitteineen ja koottiin yhteen sairaalaan arviointia varten. Seinäjoen keskussairaalassa kerättiin retrospektiivisesti vastaavat läheteet vuodelta 1994. Uusien astmapotilaiden taudinkuvaa ja heidän erikoissairaanhoidon käyntejään verrattiin vuosien 1994 ja 2001 välillä.

Astmalähetteen sisältökriteereistä saavutettiin laaja yksimielisyys perusterveydenhuollon lääkäreiden ja erikoislääkäreiden kesken. Yleisiä sisältökriteereitä valittiin 7 ja astmaan liittyviä kriteereitä 14. Asiantuntijaryhmä määritteli hyvän, tyydyttävän ja huonon lähetteen näiden kriteereiden perusteella. Kolmen tutkimussairaalan lähetteen (n = 1289) laatu oli hyvä yleisten kriteerien suhteen. Astmakriteerien suhteen laatu oli huono 45 %:ssa lähettestä ja 21 % lähettestä oli hyviä. Oleellimmat lähettestä puuttuvat tiedot olivat tupakointi (58 %) ja lääkehoito (59 %). Uloshengityksen huippuvirtauskäyrän kopio puuttui 53 %:ssa ja kopio spirometriasta bronkodilataatiokokeella 69 %:ssa lähettestä. Verrattaessa vuoden 1994 (n = 624) ja vuoden 2001 (n = 452) läheteitä oli huonojen lähetteen osuus merkittävästi

vähentynyt (63 % vrt. 44 %) ja hyvien läheteiden osuus lisääntynyt (7 % vrt. 22 %). Vuonna 2001 79 % perusterveydenhuollon spirometriakäyristä (n = 489) oli visuaalisesti arvioituna laadultaan hyviä. Spirometrialomakkeista puuttuivat usein tiedot keuhkolääkityksestä ja maininta kooperaatiosta. Vuonna 2001 todetun astmapotilaan sairaus vaikutti lievemältä mutta heistä merkittävästi useampi oli ylipainoinen ja monisairas. Astmapotilaiden lääkärikäynnit ennen diagnoosin asettamista ja kokonaiskäynnit erikoissairaanhoidossa vähenivät vuonna 2001 verrattuna vuoteen 1994.

Tutkimuksessa laadittiin yhtenäiset astmaläheteiden sisältökriteerit ja arvioitiin läheteiden laatua. Hallinnollisten kriteerien perusteella läheteet olivat hyviä. Sairauskohtaisten kriteerien mukaan huonojen läheteiden osuus oli odotettua suurempi, joten läheteiden sisältöön tulee kiinnittää huomiota. Läheteiden laatu oli kuitenkin parantunut seitsemän ensimmäisen astmaohjelmavuoden aikana. Perusterveydenhuollon spirometriakäyrät olivat pääsääntöisesti hyvälaatuisia. Erikoissairaanhoidossa uusien astmapotilaiden hoito oli tehostunut.

Astmaläheteiden perusteella arvioituna aikuisen astmapotilaan hoito perusterveydenhuollossa on parantunut kansallisen astmaohjelman aikana.

*Asiasanat:* astma, astman hoito, arviointi, kommunikaatio, lähete, perusterveydenhuollon ja erikoissairaanhoidon rajapinta, perusterveydenhuollon spirometria

## 5. Introduction

The environment of the study was the Finnish health care system focussing on the interface between primary and secondary care. The health care system in Finland is one of the most decentralized in the world. Primary health care is provided by municipal health centres. Municipalities are also responsible for arranging specialized hospital care for their residents. Finland is divided into 20 hospital districts. Each municipality belongs to a particular hospital district, each of which contains a central hospital. Referral letters reflect one side of the interface that gives primary care physicians an opportunity to consult specialists. A referral letter sent across the interface can be regarded as a kind of report: “a statement of actions and events that have preceded the decision to refer” (Newton et al. 1994).

The Finnish health care system has undergone major changes during the last two decades: hospital inpatient care has been shifted to outpatient clinics, and the main responsibility of many chronic diseases has been turned over to primary care. One good example of this change is the management of asthma. Asthma is a common chronic, but well controllable disease. The cornerstone of asthma management is an early, precise diagnosis based on objective measurements, followed by adequate anti-inflammatory treatment, patient education, and regular follow-up. The Finnish National Asthma Programme (1994–2004) promoted the re-organization of the responsibility between primary and secondary health care and also that between physicians and nurses (Sosiaali- ja terveystieteiden ministeriö 1994, Asthma programme in Finland 1994–2004 1996). Primary care physicians were encouraged to diagnose asthma independently with only seldom specialist consultations.

Asthma has been mentioned as a good disease to audit (Neville 1995). Asthma-related referral letters and spirometries reflect real-life asthma management in primary care. In this study, a process evaluation of the Finnish asthma programme was conducted by using a medical record audit that focussed on the quality of information sent with the patient from primary care to the specialist.

## 6. Review of the literature

### 6.1 Management of adult asthma

#### 6.1.1 Asthma as a global health challenge

The true prevalence of clinical asthma is difficult to determine due to the lack of a single diagnostic test, seldom used objective lung function tests, and also differences in patients' perceptions and interpretations of their symptoms. The highest estimated prevalence of clinical asthma according to questionnaire studies of wheezing has been reported for the United Kingdom (UK) (15–18%), New Zealand (15%), Australia (15%), Canada (14%), and the United States (11%) (Masoli et al. 2004). In Western countries questions about “physician-diagnosed asthma” have been shown to have good specificity for the diagnosis of asthma, but the sensitivity has varied (Torén et al. 1993). Wheezing is not a symptom specific to clinical asthma, but it reaches a larger group of possible asthmatics than the concept of physician-diagnosed asthma (Court et al. 2002).

Increasing public and professional awareness of asthma and changes in diagnostic labelling may explain at least part of the rising trends in asthma prevalence during the 1980s and 1990s (Magnus and Jaakkola 1997, Lundbäck et al. 2001, Wieringa et al. 2001, Barraclough et al. 2002). After an over 2-decade increase in the occurrence of asthma, evidence from several recent studies indicates that at least the prevalence of adult asthma has plateaued or even decreased (von Hertzen and Haahtela 2005, Lötvall et al. 2009). The global burden of asthma, however, will be determined to a large extent by what happens in low-income countries (Weiland and Pearce 2004). Along with the westernization in developing countries, an increasing prevalence of asthma is also becoming a health problem.

Accumulating evidence shows that changes in the environment (i.e., westernization) increase the prevalence of both allergic sensitization and asthma (Kilpeläinen et al. 2002, von Hertzen and Haahtela 2006, von Mutius 2007). The development of atopy and asthma is also strongly linked to a genetic component (Sunyer et al. 1997, Laitinen et al. 1998). However, the importance of atopy as a cause of adult asthma may have been over-emphasized (Pearce et al. 1999, Court et al. 2002).

Asthma is primarily chronic in nature (Ekerljung et al. 2008). A correct diagnosis should be followed by personally tailored self-management and a regular review by health care professionals (Gibson et al. 2003). Asthma costs are largely due to uncontrolled disease (Barnes et al. 1996, Godard et al. 2002), and severe asthma causes about 50% of all direct medical costs (Beasley 2002). Good asthma control, a goal of management, has been defined as no day or nocturnal symptoms, no limitations of daily activities, no need for reliever treatment, normal or near-normal lung function results, and no exacerbations (GINA 2008).

Chronic diseases such as asthma, diabetes, depression, hypertension, chronic obstructive pulmonary disease (COPD), cardiovascular diseases, and cancer are a huge burden in developed countries and increasingly also globally. Disease management of chronic illnesses is defined as a system of coordinated health care interventions and communications for populations with conditions for which patient self-care efforts are significant (Disease Management Association of America, [www.dmaa.org](http://www.dmaa.org)). According to this definition disease management components include (1) population identification processes, (2) evidence-based practice guidelines (3) collaborative practice models that include physician and support-service providers, (4) patient self-management education, (5) process and outcome measurement, evaluation and management, and (6) routine reporting or a feedback loop.

Health care has been challenged to transform the predominant model of acute care to planned, population-based chronic care of good quality with reasonable costs. The strategy largely adopted to implement this change is called the Chronic Care Model, which includes an increase in clinical expertise and decision support, patient self-management, effective practice teams, and accessible clinical information (Wagner 1998, Bodenheimer et al. 2002). The goal of this model is to produce system reform in which informed, activated patients interact with prepared, proactive practice teams.

The World Health Organization (WHO) has also raised global awareness of the huge impact of chronic respiratory diseases (WHO 2002). On a worldwide basis, WHO has implemented the Practical Approach to Lung Health (PAL) strategy, which is a patient-centred approach to improve the quality of diagnosis and the treatment of common respiratory illnesses in primary care settings especially in low-income countries (WHO 2008). The Global Alliance against Chronic Respiratory Diseases (GARD), launched in 2006, is a voluntary international alliance of organizations, institutions, and agencies committed towards the goal of reducing the burden of respiratory diseases (GARD 2006). It acts in close collaboration with WHO.

### 6.1.2 Asthma as a diagnostic challenge in primary care settings

The effective management of asthma – as of all chronic diseases – begins with making an accurate and timely diagnosis. This step offers a challenge to the health care system since there is no gold standard for asthma and it is not possible to make clear evidence-based recommendations on how to diagnose the disease (British Thoracic Society and Scottish Intercollegiate Guidelines Network (BTS/SIGN 2009)). One commonly used description of asthma is based on the symptoms and functional consequences of asthma inflammation (Box 1).

***BOX 1** "Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. The chronic inflammation is associated with airway hyper-responsiveness (AHR) that leads to recurrent episodes of wheezing, breathlessness, chest tightness and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread, but variable, airflow obstruction within the lungs that is often reversible either spontaneously or with treatment" (GINA 2008).*

The clinical diagnosis consists of several components, the combination of which differs case by case (Li and O'Connell 1996). Asthma symptoms appear gradually or suddenly and are due to increased airway hyper-responsiveness and obstruction. The variable obstruction can be shown by a single spirometry measurement with a reversibility test or, more often, by a series of spirometry measurements or peak flow follow-ups. In some cases, the reversibility of obstruction has to be shown by a long-term trial with anti-inflammatory treatment. Asthma-supporting diagnostic

criteria based on lung function tests have been agreed upon globally (GINA 2008). In Finland, these criteria are published in the asthma guideline and literally followed due to the law of special reimbursement for chronic asthma medication (Asthma: Current Care Guideline 2000). Peripheral blood eosinophils and positive skin prick tests support the asthma diagnosis and clarify the profile and possible triggers of airway inflammation.

Dutch pulmonologists placed great emphasis on the “degree of certainty” about the diagnosis of asthma in a qualitative study of their views on asthma management (Schermer et al. 2003a). The diagnosis should be made early to prevent recurrent exacerbations and the possibility of permanent remodelling of the airways, the role of which is still rather obscure (James and Wenzel 2007). Early asthma, with periodic mild symptoms is particularly challenging with respect to being diagnosed in the primary care settings. It is not uncommon that the patient has been suffering from respiratory symptoms for years before being diagnosed as having asthma (Haahtela 1999, Halbert and Isonaka 2006, Yoo et al. 2007). It is preferred, however, that inhaled corticosteroids, not be started until the diagnosis has been made, if possible, or at least the severity of the airway obstruction has been evaluated (Dennis et al. 2002).

The clinical profile of asthma at the time of diagnosis varies significantly from mild to severe. Classic symptoms are cough, dyspnoea, wheezing, chest tightness, and sputum production. Chronic or allergic rhinitis often precedes and exacerbates asthma symptoms (Cruz et al. 2007). Features that increase or decrease the probability of asthma are listed in Table 1. Characteristic to asthma is the variable and provocative nature of the respiratory symptoms and their occurrence at night. Wheezing seems to be more specific to asthma than other symptoms (Nathell et al. 2002, Masoli et al. 2004). Self-reported wheezing has been shown to be the most predictive symptom of asthmatic airway obstruction (Teeter and Bleecker 1998). In elderly patients, wheezing in any situation or attacks of shortness of breath with wheezing have proved to be the best predictors of later asthma (Burrows et al. 1991). Widespread wheezing heard on auscultation of the chest increases the probability of asthma (BTS/SIGN 2009), but even barely audible wheezing heard during a forced expiratory manoeuvre, especially for non-smokers, suggests asthma. However, all of

these clinical signs are generally present only if the patient is examined during a symptomatic period without immediate bronchodilator use.

**Table 1.** *Clinical features that influence the probability that episodic respiratory symptoms are due to asthma in adults (modified from BTS/SIGN 2009).*

Features that increase the probability of asthma
More than one of the following symptoms: wheezing, breathlessness, chest tightness and cough, particularly if
symptoms are worse at night and in the early morning
symptoms occur in response to exercise, allergen exposure and cold air
symptoms occur after aspirin or beta blockers have been taken
History of atopic disorder
Family history of asthma or atopic disorder or both
Widespread wheezing heard in auscultation of the chest
Otherwise unexplained low FEV1 or PEF (historical or serial readings)
Otherwise unexplained peripheral blood eosinophils
Features that indicate a low probability of asthma
Prominent dizziness, light headedness, peripheral tingling
Chronic productive cough in the absence of wheezing and breathlessness
Repeatedly normal physical examination of the chest when symptomatic
Voice disturbance
Symptoms with colds only
Significant smoking history (i.e., > 20 pack-years)
Cardiac disease
Normal PEF or spirometry when symptomatic*

\* Normal spirometry when a patient is symptomatic does not exclude the diagnosis of asthma. Repeated lung function measurements are often more informative than a single assessment. FEV1, forced expiratory volume in one second; PEF, peak expiratory flow.

In primary care, a diagnostic and differential diagnostic process for respiratory problems and further procedures should be triggered not only by symptoms, but also by the patients' risk profiles or health problems that appear in their medical history (Derom et al. 2008). Among adolescents and young adults general practitioners (GPs) generally recognize asthma in the case of male sex, a previous diagnosis of acute bronchitis (during the past 5 years), and a family history of asthma (Kolnaar et al. 1994). Occupation may induce or worsen asthma. The attributable fraction of occupational factors in Finnish adult onset asthma was found to be 29% for an em-

ployed male population and 17% for women (Karjalainen 2001). In a population-based asthma study, 16% of all adult-onset asthma was caused by occupational exposure (Torén 2009).

Both over- and under-diagnoses of asthma occur commonly. GPs have been found to be good at excluding those who do not have asthma (specificity 99%), but not so good at correctly diagnosing those who actually have current asthma (sensitivity 59%) (Montnémery et al. 2002). On the contrary, 59% of the patients labelled asthmatics by a GP really have asthma (Marklund et al. 1999). In the Marklund et al. study, the GPs' diagnoses were based only on symptoms, and the use of only this criterion may explain the result.

Epidemiological studies have proved that there is a link between obesity and asthma (Sin and Sutherland 2008). Obese patients suspected of having asthma should be carefully evaluated to rule out other common co-morbidities, for example, heart failure and the obesity hypoventilation syndrome. In a recent study, 32% of those obese (body mass index (BMI)  $\geq 30$ ) and 29% of those not obese with physician-diagnosed (either family physician or specialist) asthma did not have asthma (Aaron et al. 2008). The authors concluded that over-diagnosis is best avoided if the asthma diagnosis is based on objective lung function tests – spirometry and also bronchial challenge tests if needed.

One of the leading explanations for the under-diagnosis of asthma is a patient's poor and variable perception of bronchial obstruction. Of 86 patients with objective airflow obstruction, as well as symptoms suggestive of asthma, 66% had not consulted their GP (Van Schayck et al. 2000). Among asthmatics, trends towards poor discriminators of symptoms and objective measures of airway obstruction have been found (Brand et al. 1992, Kendrick et al. 1993, Teeter and Bleecker 1998, Killian et al. 2000). Especially elderly patients have been found to be less aware of acute bronchoconstriction (Connolly et al. 1992), and the underutilization of spirometry can lead to a misdiagnosis of asthma among them (Wilson et al. 2005).

Among smokers, a differential diagnosis between asthma and COPD may be difficult (Pearson et al. 2006). In a recent survey, 80% of GPs and even 65% of respiratory specialists found it very or quite challenging to differentiate between asthma and COPD (British Lung Foundation 2008). The key variables for asthma or COPD among patients with prolonged cough were found to be current wheezing and dysp-

noea, symptoms elicited by allergens, prolonged expiration, cumulative smoking, and female sex (Thiadens et al. 1998). The comparison of symptoms showed a noteworthy difference between asthma and COPD only for expectoration and chest tightness (Lusuardi et al. 2006).

### 6.1.3 Lung function tests in primary care

Lung function tests in primary care are the key tools with which to show the variability and reversibility of airflow in attempts to meet diagnostic criteria (BTS/SIGN 2009). Spirometry with a reversibility test has improved the accuracy of the diagnosis and management of both asthma and COPD, without input from secondary care (Walker et al. 2006). Primary care spirometry is essential in assessments of respiratory symptoms or the monitoring of chronic respiratory disease, before later referral to a specialist or not. Normal spirometry excludes COPD but not asthma (Schneider 2009). The follow-up of PEF curves is more sensitive than either spirometry or the response to a bronchodilator in establishing the presence of abnormal airway function (Enright et al. 1994). However, PEF values are vulnerable to many measurement errors (Thiadens et al. 1999, McCormack and Enright 2008), and this vulnerability should be considered when results are interpreted.

Spirometry is recommended for all patients before the initiation of possible life-long therapy (Kaplan et al. 2009). Current British guidelines emphasize the use of spirometry measurement since its availability is good nowadays (BTS/SIGN 2009). Most of British primary care practices has a spirometer nowadays, in 2003 the proportion was as high as 82% of the practices (Bolton et al. 2005). In Finland, spirometry was feasible in 95% of all health care centres in 2001 (Erhola et al. 2003).

The use of spirometry varies in real-life studies from 33% to 86% (Jans et al. 1998, Bolton et al. 2005). In a European study, 45% of the adult asthma patients' reported that their lung functions had never been measured (Rabe et al. 2000). A reversibility test is not regularly used (Lusuardi et al. 2006). However, a lack of acute improvement with bronchodilator inhalation does not rule out asthma. In such cases, inhaled steroid medication (4–8 weeks) may reveal reversibility and confirm asthma (Enright et al. 2005, BTS/SIGN 2009). Trained GPs use spirometry especially in evaluations of the response to a recently initiated treatment with inhaled

steroids (Akhtar and Wilson 2005, Poels 2006a). One barrier to the use of spirometry has been the distance to the hospital: this problem emphasizes the importance of local primary care facilities (Jans et al. 1998). A major barrier to the use of spirometry is uncertainty in the interpretation of the results (Goeman et al. 2005, Poels et al. 2006b). In one study only 34% of the GPs were confident in their interpretation of the spirometry results (Bolton et al. 2005).

The quality of primary care spirometry has been a concern in previous studies, and it has activated many educational programmes (Eaton et al. 1999, Van Schayck et al. 2002, Schermer et al. 2003b, White et al. 2007). Technically inappropriate spirometry may lead to a false-positive test result and cause unnecessary stress for the patient, irrelevant treatment, and inappropriate referrals. Omitting the quality review and relying only on numerical results for clinical decision making is a common mistake, which is more easily made by those who are dependent upon computer interpretations (Pellegrino et al. 2005).

The main problem to be expected from technically inappropriate spirometry is a false-positive test result as a result of underestimating the FEV1 or the forced vital capacity (FVC) or both, the result being a false FEV1/FVC ratio (Derom et al. 2008). The American Thoracic Society (ATS)/European Respiratory Society (ERS) Task Force has harmonized the societies' previously published guidelines (Miller et al. 2005). The new guideline lists criteria for an acceptable FVC manoeuvre as follows: a rapid start of exhalation, a prolonged exhalation time, and a flow-volume loop without any significant artefact. In addition, the reproducibility should be within 5% or 150 ml for both the FEV1 and FVC for at least two of the three manoeuvres (Miller et al. 2005).

The first Finnish spirometry survey revealed a poor quality of measurement (Järvinen et al. 1990). A team of clinical physiologists published the first national guideline for spirometry and PEF measurements, called "Moodi", in 1995 (Sovijärvi et al. 1995). It has been widely implemented and has been updated nine times. "Moodi" includes recommendations for indicators and contraindicators, as well as guidelines for the practical performance of lung function tests, all of which are based on the ATS/ERS guidelines. In the second spirometry survey performed in 1998, almost 90% of the spirometers were found to be able to print flow-volume graphs, and the quality of spirometry was improved (Piiirilä et al. 2002).

#### 6.1.4 Asthma guidelines

Twenty years ago clinical guidelines for the management of common health conditions emerged. One of the first definitions for clinical guidelines was “systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances” (Field and Lohr 1990). The increasing number of asthmatics has led to the publication of numerous global and national asthma guidelines since the late 1980s (Woolcock et al. 1989, Hurd and Lenfant 1992). During the 1990s consensus guidelines started to be replaced by evidence-based guidelines, which are nowadays the cornerstones of the management of asthma and other chronic diseases (Evidence-based Medicine Working Group 1992).

Primary care has received the main responsibility for asthma management, even though only a few international guidelines directly refer to organizational views. Guidelines integrating respiratory disease management for primary care physicians have also been published recently (Levy et al. 2006). The implementation of asthma guidelines worldwide has only partly succeeded to change physician behaviour (Jans et al. 1998). Many patients, and even physicians, are not aware of the management goals for asthma, a situation which may lead to poor disease control and quality of life (Haughney et al. 2004, Rabe et al. 2004, Wijnhoven et al. 2004, Chapman et al. 2008).

GINA guidelines point out the following urgent needs for asthma management: (1) effective patient management systems, (2) more prompt diagnosis, (3) better implementation of guidelines, and (4) more appropriate referral and treatment, including the use of controller medications (Braman 2006). Local active asthma programmes and protocols using, for example, structured consultation prompts could possibly improve the implementation of asthma guidelines in practice (Feder et al. 1995, Grimshaw et al. 1995, Swanson et al. 2000).

## 6.2 The interface between primary and secondary health care

Health care systems differ between countries. In some countries like the United States, Germany, France, and Sweden, patients are allowed direct access to a specialist. In other countries such as Finland, the UK, Denmark, and the Netherlands, health care is divided into different levels and specialities, and this system has created the referral system. Between the levels of primary and secondary health care, there is the interface over which the responsibility of patient care shifts from the GP to the specialist or vice versa. The primary–secondary care interface is a concept rather than a physical structure: it is composed of multiple potential points of contact between the two sectors (Eccles et al. 1996).

A group from the European Working Party on Quality in Family Practice explored the quality of care at the interface from four perspectives (Table 2). The group called for actions such as the development of leadership, a shared care approach, and task division that should be built on a mutual consensus between local physicians, taking into account also patient perspectives (Kvamme et al. 2001).

Specialists have been found to be interested in collaborative care with respect to the regulation of the patient flow to secondary care, cooperation in the improvement of the quality of the referral, and the development of personal relationships (Berendsen et al. 2006). GPs prefer personal relationships and the importance of both-sided education (Berendsen et al. 2007). A patient's concept of care, both through the health care system and towards adjustment to a chronic disease may be appropriate indicators of health service performance (Preston et al. 1999). First contact and the coordinating role of GPs are valued by patients, although one fourth of them have reported difficulties in receiving specialty referral (Grumbach et al. 1999).

**Table 2.** *Perspectives of quality at the interface between general practitioners and specialists, with examples of tasks and actions to increase the quality of the interface (Kvamme et al. 2001).*

Perspective	Task	Action
System perspective	Meeting demands for access to care	Task division Improve quality of primary care
	Keeping down expenditures	Control of access to the secondary-care sector Logistics Communication Information systems
Perspective of medical quality	Combining the holistic and high technology approaches	Mutual guidelines
	Avoid iatrogenic risks, poly-investigation and poly-treatment	Family medicine approach
	Improving episodes of care	Clinical audit
Patient perspective	Coordinating chains of care	Measure patients' needs, priorities and evaluations Audit and benchmarking Logistics
	Meeting patients' rights	New laws Public information Dialogue
Provider perspective	Making providers more satisfied	Work conditions Collaborative conditions Preventing and handling conflicts
	Reducing fears and insecurity	Education Dialogue Networks

GPs have been profiled as gatekeepers who decide who is referred to specialist consultation. The referral system may contribute to the improvement of care quality by limiting over-medicalization, over-investigation, and over-treatment (Marinker 1988). GPs' decisions for referral have not only individual, but also economic, social, and political implications (Coulter 1992, Harju 1993, Coulter 1998, Lauslahti 2007). It has been recommended that management decisions should be regulated at the interface through the formulation of local guidelines (Kvamme et al. 2001, Starfield 2003, Varonen et al. 2005). GPs have been found to be more supportive in the development and adoption of such joint guidelines (Kasje et al. 2004). Secondary care professionals' commitment to local guidelines is crucial with respect to decreasing the unnecessary duplication of tests (Jankowski 2001).

The interface is an organizational boundary that has been challenged to organize the management of chronic diseases in different ways (Starfield 2003). Shared care is defined as “the joint participation of hospital consultants and GPs in the planned delivery of care for patients with a chronic condition, informed by an enhanced information exchange over and above routine discharge and referral letters” (Hickman et al. 1994). Outreach specialist clinics have been considered to help the access to specialist consultation (Bowling and Bond 2001). Sweeney (1994) has pointed out some of the dangers of and views on such development. The key role of the GP is to act as the interpreter of the interface between illness and disease. The GP accepts the responsibility for making an initial decision on every problem, and 90% of the problems are dealt with entirely within general practice. The referral system, rather than open access to specialists, enables the patient to have at least two opinions (i.e., the view of a specialist about a specific disease and the view of the GP who knows the whole context of the patient’s problem) (Sweeney 1994). In England, the General Practitioners with Specialist Interests (GPwSIs) framework has been a key component of the UK National Health Service modernization agenda (Department of Health 2000). GPwSIs programmes may decrease waiting times, but there has been a concern that referrals and costs may increase (Roland 2005, Gervas et al. 2007).

### 6.2.1 The Finnish health care system

Finnish health care is divided into three levels: primary, secondary, and tertiary care. Municipalities are obligated, by law, to maintain health centres for the provision of all primary health care services on their own or jointly with neighbouring municipalities (Primary Health Care Act 1972). The main work of health centre physicians is to provide primary curative, preventive, and public health services to patients of all ages together with other health professionals. Specialists, such as radiologists and internists, work in some larger health care centres mainly as consultants. In Finnish health centres, the role of nurses is essential, and this role is expanding both in acute care and in the care of chronic diseases. Secondary care obligated by law is also funded by the municipalities, it is provided by 20 hospital districts (excluding the Åland Islands) with a catchment population varying from 65 000 to 1.4 million inhabitants (Act on Specialized Medical Care 1989). Every hospital district has a cen-

tral hospital, five of which are university-level teaching hospitals offering a tertiary level of care. All major specialities are represented in every central hospital. In addition to municipal health care services, there are occupational and private health care units, which also receive partial public funding in Finland. Municipal health care comprised 71% of all outpatient visits to either primary or secondary care in 2005, occupational curative medical care visits accounted for 13%, and private health care visits amounted to 16%. Occupational health care can be provided by the employers themselves, or by municipalities or private practitioners. In 2005, 79% of all private care visits were specialist visits. (Vuorenkoski et al. 2008)

Transition from one health care level to another or from the private sector to secondary care needs a physician's referral letter except in cases of emergency. A referral letter can be written on any paper, but usually physicians use a structured referral letter, which originated in the 1960s. The layout of the Finnish referral letter has changed many times, but the main content has been the same. It includes the patient's and physician's contact information, the classification of urgency, and additional disease-related information. Electronic versions of referral letters have primarily the same form, but also structured electronic referrals have been tested in some regions.

New Finnish legislation on the time limits for accessing non-urgent treatment became active in 2005 (Sosiaali- ja terveystieteiden ministeriö 2005). In specialist care, an assessment of the required treatment must be arranged within 3 weeks of the date on which the referral letter arrived at the hospital outpatient department. The necessary hospital treatment must be accessible within 6 months. Experts from all main specialities defined the grounds for accessing medical care for the 193 most commonly referred disease entities, including asthma. These grounds comprise indicators for referral, tests and examinations made in primary care before referral, and content of the referral letter (Sosiaali- ja terveystieteiden ministeriö 2005).

## 6.2.2 Communication at the interface

The continuity of care is a fundamental principle of good quality health care with limited resources. The informational dimension of continuity supports the continuity through adequate medical records, follow-up, management plans, good referral sys-

tems, and feedback from hospitals (Rogers and Curtis 1980). Good informational continuity is achieved with the accurate assimilation, timely transfer, and sharing of essential patient information (including relevant information on past events and on patients' personal circumstances) among care providers (Haggerty et al. 2003, Berta et al. 2008). Physicians' mutual agreement on the referral and back-referral indicators and the content of the referral and discharge letters is the basis for seamless care (Schermer et al. 2003a). Poor communication may result in disruptions in the continuity of care, delayed diagnoses, unnecessary testing, and iatrogenic complications (Epstein 1995). Good professional communication is even more essential for older patients with many chronic diseases and complex medication (Epstein 1995). The quality of the letters for older patients (over 70 years) has been found to be alarmingly insufficient, especially concerning the activity of daily living, medication, and the patient's network (Garåsen and Johnsen 2007).

Face-to-face communication in educational or informal meetings is valuable and offers the possibility for physicians to become acquainted with each other. The importance of the existence of some degree of personal relationships between GPs and specialists has been reported in many communication studies (Marshall 1998, Hollins et al. 2000, Berendsen et al. 2006, Berendsen et al. 2007). Telemedicine offers a new mode of face-to-face communication, it provides the opportunity to make real-time, long-distant consultations. Patients' satisfaction was found to increase and further investigations decreased during virtual outreach consultations, as long as the patients had been appropriately selected and the service had been significantly re-organized (Wallace et al. 2002). A phone call to a specialist is still a good way to communicate in that it allows for interactive discussion. The accessibility of physicians by telephone has been a concern, and it should be improved (Berendsen et al. 2009).

Written communication, including documents like referral letters and reply letters, is still the commonest way of exchanging information, although currently the text is more often sent in electronic form. Deficiencies of communication between GPs and specialists have been a concern (Hull and Westerman 1986, Kentish et al. 1987, Westerman et al. 1990, Bowling and Redfern 2000, Berendsen et al. 2009). Altogether 63% of primary care physicians and 35% of specialists were found to be

dissatisfied with the current referral process, especially with the lack of timely information and the inadequate content of referral letters (Gandhi et al. 2000).

Studies of GPs' referral letters without adequate information have been published since the early 1960s (de Alarcon and Hodson 1964, McMullan and Barr 1964, Hansen et al. 1982, Newton et al. 1992, Jenkins 1993, Graham 1994, Newton et al. 1994, McConnell et al. 1999, Grol et al. 2003, Campbell et al. 2004, Jiwa et al. 2005). Hospital discharge letters have also been found to have insufficient information and are significantly delayed (Young et al. 1985, Mageaan 1986, Vehviläinen et al. 1996a, Grol et al. 2003). A meta-analysis of information absent from hospital discharge letters showed that discharge treatment, history, and examinations were all missing in over 40% of the letters (Hampson et al. 1996). A review of the communication deficits revealed that consultants' letters were available at the post-discharge visit for only 12–34% of patients (Kripalani et al. 2007). Views between GPs and specialists may differ as regards discharge letters. Specialists use them for archiving, and GPs like them to be used as an important tool for information transfer on the treatment to be followed (Berendsen et al. 2009).

The behaviour of the referring physician can influence the behaviour of the consultant. Communication from the referring physician will increase the probability of feedback from the specialist (McPhee et al. 1984, Bourquet et al. 1998). When the specialist starts the reply letter with a repetition of the specific request put forth by the GP, an explicit answer is formulated about four times more often by the specialist than when the reply letter lacks such repetition (Grol et al. 2003). Moreover, it has been recognized that both referral letters and replies can function as a means of educating both parties (Jacobs and Pringle 1990, Newton et al. 1992). The training of oncologists significantly improved their reply letters, but recipients' satisfaction increased only with respect to a few items (Tattersall et al. 2002). Dutch pulmonologists have discussed the fact that referral information does not always offer sufficient footing for decision making, and therefore once-only consultations are often impossible (Schermer et al. 2003a).

Westerman et al. (1990) have pointed out that communication can always be improved, and a good way to start is by measuring its deficiencies in that such a process can lead, at its best, to the development of protocols to enhance the improve-

ment. Increased degrees of collaboration speed up the referral process and facilitate the communication pathways between GPs and specialists (Berendsen et al 2009).

### 6.2.3 Referrals as a reflection of the interface

In a European referral study over 15 years ago, the referral rates varied between 2.6% (France) to 8.2% (Norway) (Fleming 1993). In the UK, GPs make about 5 outpatient referrals per 100 consultations (Coulter 1998). Referral has been found to be highly dependent on the morbidity burden of patients (Forrest et al. 2002a). In Finland, 3.8–6.1% of patients are referred to secondary care from normal and out-of-hours visits (Vehviläinen et al. 1996b, Toivanen 1997, Puhakka et al. 2003a).

The main reasons for referral in a study in the United States were advice on either diagnosis or treatment or both (52%), direct surgical management (38%), and direct medical management (26%) (Forrest et al. 2002b). In a British study, 35% of the patients were referred for particular treatment or an operation, 35% went for a specific investigation or diagnosis, and advice on management was the main reason for 14% (Coulter et al. 1989). In Finland, 39% of all referrals (n=189) contained a special diagnosis, and 61% did not (Puhakka et al. 2003b).

Referral to a specialist may be perceived as reflecting either good management or failure in treatment. The meaningful assessment of referral performance requires a measure of the referral quality, including the appropriateness of the referral decision and an assessment of the information in the referral letter (Jenkins 1993). It is important to note that the patient, the GP, and the specialist may have different perspectives on what constitutes an appropriate referral (Roland 1992). Coulter lists the following four criteria of an appropriate referral: (1) necessary for the particular patient, (2) timely, neither too early nor too late, (3) effective, the objectives of the referral are achieved, and (4) cost effective, the benefits justify the costs (Coulter 1998). In a large study of 3000 referrals, most of the cases were found to be appropriate. However, new protocols for common disorders were agreed upon, not to reduce referrals, but to improve the quality of referrals (Emmanuel and Walter 1989).

Inappropriate referrals can be divided into the following three categories: (1) referrals made to the wrong specialist, (2) referrals containing insufficient information, making it difficult to assess the urgency or relevance, (3) referrals that do not

conform to accepted guidelines (Davies and Elwyn 2006). A Dutch study demonstrated that about half of referrals have a clear medical indication (Knotterus et al. 1990). Fertig et al. (1993) found that only 16% of referrals were judged to be inappropriate according to local disease-specific guidelines. Surgical referrals have more often been found to be appropriate, whereas inappropriate referral letters were significantly more likely to contain incorrect information (Jenkins 1993). In a British survey, only 6% of the specialists reported inappropriate referrals “fairly or very often” (Bowling and Redfern 2000). In a Finnish case study of one health care centre, 68% of the referrals were appropriate (Puhakka et al. 2003a).

Wide variations in referral rates have been found, but there was no clear explanation for this behaviour (Wilkin and Smith 1987). In a Finnish study, the referring GP’s clinical experience, the speciality of general medicine, and age correlated with low referral rates (Vehviläinen et al. 1996b). In another Finnish study, clear disagreement between GPs and specialists was found concerning the appropriateness of referral letters (Toivanen 1997).

In a review, O’Donnell (2000) commented that data on the outcomes of referrals are needed if appropriateness is to be considered, and it is difficult to make any reliable judgements about referrals when the key group of patients is missed (i.e., patients with similar symptoms and conditions that were not referred). The referral decision-making process is complicated by many cofactors, which O’Donnell summarizes into four broad groups (Table 3).

**Table 3.** *Factors affecting a general practitioner's (GP's) referral decision (O'Donnell 2000).*

GP-associated factors
Personality
Knowledge
Interests
Personal knowledge of consultants
Tolerance of uncertainty
Relationship with patients and colleagues
Patient-associated factors
Sociodemographic characteristics
Expectations
Needs and values
Pressure for referral
Preferences
Case-specific factors
Type of condition
Perceived seriousness
Structural factors
Waiting lists
Practice organization
Proximity to hospital

Important determinants affecting referral rates have been the frequency of the problem as encountered in primary care (i.e., practice prevalence) (Forrest and Reid 2001) and higher degrees of patient co-morbidity (case mix) (Salem-Schatz et al. 1994, Sullivan et al. 2005). Unexplained variation still exists largely within practices even for patients with a similar age, sex, and morbidity group (Sullivan et al. 2005). This variation has been partly explained by the strong independent predictor of all physician behaviour, perceived patient pressure, and the patient's level of confidence in the GP (Armstrong et al. 1991, Little et al. 2004).

Faulkner et al. (2003) published a systematic review of the effects of primary care-based service innovations on the quality and patterns of referral to specialists. They suggested that professional interventions (education, information provision, and guidelines) frequently affect clinical behaviour in a manner that is in accord

with improvements in the process or quality of care. However, evidence for a consequent impact upon referral rates and patterns was less strong.

#### 6.2.4 Asthma management at the interface

Asthma is a prime example of a disease for which all health care professionals should work toward a common strategy that provides consistent care because of its variable nature and wide spectrum of severity (Neville and Higgins 1999). The continuity of care is especially important to asthma patients because the disease requires ongoing monitoring and decisions about when changes in therapy are appropriate (Love et al. 2000). Primary care professionals start the diagnostic process for asthma to reach an objective presentation of reversible bronchial obstruction. However, negative findings on serial measures of lung function tests (i.e., normal PEF and spirometry, absent of PEF variability) with the clinical suspicion of asthma is one of the relevant referral indicators (Schermer et al. 2003a).

Previously, in Finland, asthma was a common reason for referral in two studies from the years 1992 and 1997 (Vehviläinen et al. 1997, Puhakka et al. 2003b). In a large US study asthma patients with a diagnosis was seldom referred to a specialist, only 1.9% of 526 asthma visits led to referral (Forrest et al 2002a).

The role of a specialist in the case management of asthma highly depends on the circumstances. Intensive, multidisciplinary specialty intervention in cases of severe asthma has brought about a stability of the disease, as well as creating more time for educating the patient and intensive follow-up (Donohoe et al. 1999). Short but timely specialist consultations in cases of diagnostic and treatment problems or long-term shared care are the extremities of the strategy to ensure good and cost-efficient management of asthma at the interface between health care levels.

International asthma guidelines rarely encompass how the interaction between GPs and specialists can be best applied (Postma 2003). Some of them include lists of recommendations for the referral policy (Table 4). Adaptation of the guidelines to local resources is preferred, including also policies on referrals. Compliance with recommendations has been meagre, for example, only 17% of GPs complied with the referral recommendations for specialist care (Jans et al. 1998).

**Table 4.** *Criteria for a specialist referral of an adult patient with suspected asthma (BTS/SIGN 2009).*

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Diagnosis unclear
Unexpected clinical findings (i.e., crackles, cyanosis, cardiac disease)
Unexplained restrictive spirometry
Suspected occupational asthma
Persistent non-variable breathlessness
Monophonic wheezing or stridor
Prominent systemic features (myalgia, fever, weight loss)
Chronic sputum production
Chest X-ray shadowing
Marked blood eosinophils ( $> 1 \times 10^9/l$ )
Poor response to asthma treatment
Severe asthma exacerbation

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Patient request, allergen immunotherapy, and a single life-threatening asthma attack were the commonest reasons for consultations with pulmonologists or allergists, but it was found that some asthma patients who might benefit from consultation may not be referred (Li et al. 1999). Clear and clinically appropriate recommendations, satisfaction of the patient, and recommendations for future management were preferred as the most important characteristics of an asthma consultation (Li et al. 1999). Referral to an asthma specialist after a visit to an emergency room reduced further emergency visits and improved asthma outcome (Zeiger et al. 1991). Pulmonologists' views of referral and back-referral indicators were evaluated in a Dutch qualitative study (Schermer et al. 2003a). They preferred referral if the asthma diagnosis was obscure in spite of a repeating medical history, the elimination of possible trigger factors, and additional peak flow monitoring.

Asthma management at the interface can be organized in different ways (Eastwood and Sheldon 1996). Shared care is one option. It provides excellent communication, needs commitment from the parties to succeed (Grampian Asthma Study of Integrated Care 1994, Osman et al. 1996), and has also been accepted among GPs (Van Damme et al. 1994). The referring physician expected management to be shared in about 45% of the referrals to allergists and pulmonologists, while only 29% of all specialities expected shared care (Starfield et al. 2002). Another means is expertise asthma care, which has been justified by referring to earlier studies of

asthma mortality and morbidity (Bartter and Pratter 1996). Altogether 23% of respiratory referrals were considered to be suitable for a GPwSIs clinic (Gilbert et al. 2005).

The importance of specialist asthma nurses has been shown at many steps. Hospital-based nurses reduced morbidity by improving patient self-management behaviour after acute asthma attacks, which led to reduced symptoms, improved lung function, less time off work, and fewer consultations with health professionals (Levy et al. 2000). Unscheduled asthma visits of high risk patients were reduced by the active role of asthma specialist nurses (Griffiths et al. 2004). An active role of asthma nurses may also enhance communication at the interface (Johnson et al. 1998).

### 6.3 Asthma programme in Finland

The prevalence of asthma in Finland increased from the 1960s to the late 1990s. The prevalence of physician-diagnosed asthma has varied between 5.3% and 6.6% of the population of different ages (Hedman 1999, Pallasaho et al. 1999, Kotaniemi et al. 2001). The peak of new chronic asthma cases seems to have been reached in 1997, with a following plateau and a slow decrease during the last decade (Haahtela et al. 2006).

The very first Finnish guidelines for asthma management were published already in 1980 (Suomen itsenäisyyden juhluvuoden 1967 rahasto 1980). According to these guidelines, asthma diagnostics was very rigid and specialist centred. During the 1980s hospital admissions were common both due to the need to ensure the diagnosis and due to asthma exacerbations (Keistinen et al. 1993).

The Ministry of Social Affairs and Health recognized asthma as an important public health issue in the early 1990s, while the incidence was increasing. A working group was set to plan a national programme, with the main goal of lessening the burden of asthma on individuals and society. The Finnish National Asthma Programme was launched in 1994 (Sosiaali- ja terveystieteiden ministeriö 1994). The working group, including also representatives from primary care and patient organizations, based its actions on the following principles: (1) most patients have a mild type of

disease, (2) inflammation of the bronchial mucosa and lung function abnormalities can be detected early, (3) early intervention often leads to complete recovery, although disposition to asthmatic reactions remains. These views were based on studies of the pathogenesis of asthma, which revealed bronchus epithelial changes in mild asthma patients (Haahtela et al. 1991, Haahtela et al. 1994). The programme adopted five main goals and six measures towards achieving these goals (Table 5).

**Table 5.** *The main goals and measures of the Finnish National Asthma Programme 1994–2004 (Haahtela et al. 2001).*

Main goals
As many patients as possible with early asthma recover
Asthma patients should feel well, and their ability for work and their functional capacity should correspond with their age
The percentage of patients with severe and moderate asthma should decline from the current 40% to 20%
The number of bed days of asthma patients should decrease by 50% by the year 2000, that is to 50 000 a year
Annual treatment costs per patient should decrease by 50% as a result of more effective prevention and treatment
Measures to achieve the goals
Early diagnosis and active treatment
Guided self-management as the primary form of treatment
Decrease in respiratory irritants such as smoking and tobacco smoke
Implementation of rehabilitation combined with normal treatment, planned individually and timed appropriately
Increase in knowledge about asthma in key groups
Promotion of scientific research

Asthma is a common disease needing community solutions (Haahtela et al. 2001). Early diagnosis, active treatment, and self-management are not possible without the active role of primary care professionals. Hence the key for the implementation of the programme was a primary care network of local part-time asthma co-ordinators (one physician and at least one nurse) in each Finnish health care centre. These professionals were trained to be coordinators of local activities in their own municipalities, consulting and educating other local professionals. This government-driven initiative to educate primary care asthma physicians and nurses was among the first

globally (Partridge 2001). After 1997, also pharmacies were included in the programme, and a network of asthma pharmacists was created.

Primary care physicians were encouraged to make a diagnosis and start anti-inflammatory treatment, particularly in this order. Specialist consultation by phone or referral to hospital outpatient clinics was necessary if the diagnosis was uncertain or the response to medication was poor. Pulmonary specialists were responsible for developing regional guidelines together with primary care co-ordinators to adjust the programme to the local needs and resources. Nurses named as asthma co-ordinators were activated to carry out patient counselling and education. The training of the professionals also included an active use and interpretation of lung function measurements.

Local practice guidelines that follow the national programme but take also into account local resources and policy have been actively published. In 2001 16 out of 20 hospital districts had a regional asthma programme.

## 6.4 Evaluation of health care programmes

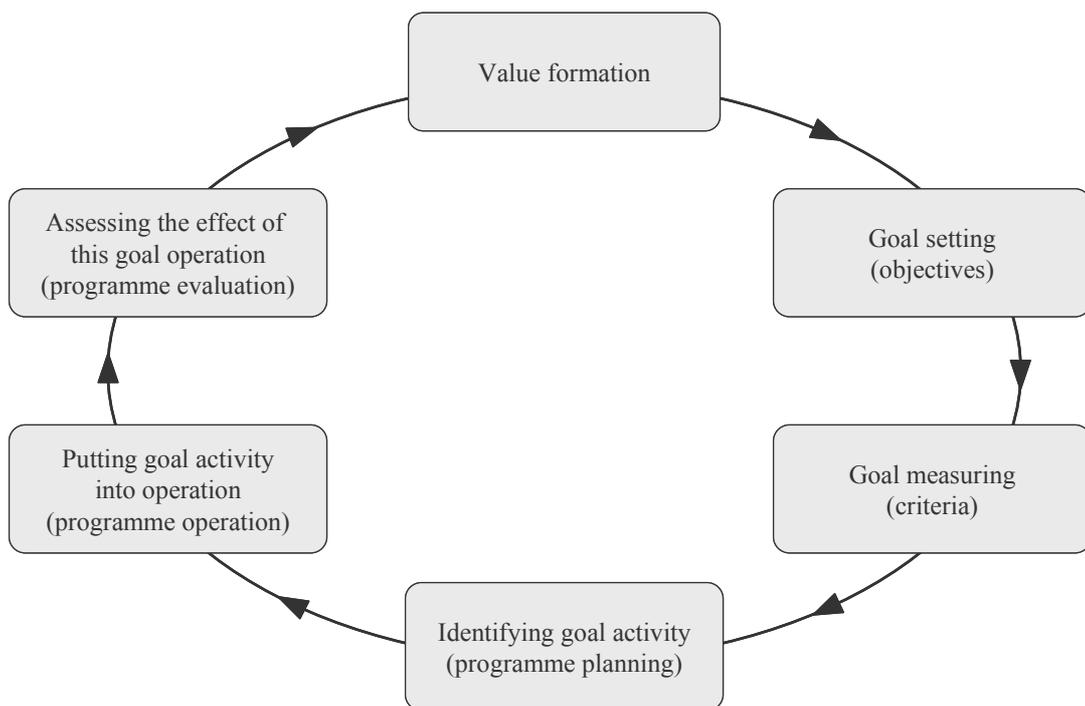
### 6.4.1 Roots of the evaluation science

Evaluation science was taking place already during the early years of the 20th century. After World War II, numerous large evaluation programmes in different fields of society were launched. By the end of the 1950s, program evaluation was commonplace, and, during the 1960s, the knowledge of evaluation research grew dramatically. In the early years, only social researchers were interested in the evaluation, but nowadays consumers of evaluations are policymakers, stakeholders, and programme planners. In the 1980s, development and qualitative evaluation approaches were preferred methods. In recent decades the control of health care costs has also increased government interest in the evaluation of health services.

Evaluation can be defined in many ways, one early definition being “Evaluation is the process of determining the value or amount of success in achieving a predetermined objective” (Suchman 1967). Suchman defined evaluative research as a

specific form of applied research, the primary goal of which is not the discovery of knowledge, but rather the testing of the application of knowledge. Non-evaluative research emphasizes interrelationships between variables rather than the ability to influence these relationships through interventions as in evaluative research. In programme evaluation, the emphasis is on judging the worth of a specific programme or project.

The evaluation process has been traditionally visualized as a circle, one of the first being published by Suchman (1967) (Figure 1). The evaluation circle starts from and ends at value formation. Values are defined by the users of the evaluation. Based on values, the second step is setting a goal or objective, which is the most identifying feature of evaluative research. An evaluator may come to the process at any point in the circle, nowadays rather already at the value formation step.



**Figure 1.** *The evaluation process as a circle (modified from Suchman 1967).*

Crucial questions of evaluation are (1) what is to be evaluated (definition of the intervention), (2) towards what (definition of objectives), and (3) at which time (Øvretveit 2002). Evaluation users and evaluators should specify the objectives of the intervention in clear, precise, and measurable terms (Shortell and Richardson

1978). In any evaluation setting, the fundamental activity has to be defined as a comparison between the actual situation and the stated measurable objectives. To measure this attainment of objectives, criteria and standards should be selected.

#### 6.4.2 Programme evaluation methods

Programme evaluation is a systematic collection and analysis of information to guide the making of programme judgements (Ferris et al. 1992). It can be divided into the following three basic stages: (1) specification of the objectives, (2) organization of resources for implementation, and (3) assessment of the performance (Shortell and Richardson 1978). The evaluation of programme implementation is called process evaluation, and outcome evaluations measure the effects of the programme. Such evaluation activities as needs assessment and programme implementation are better if the programme is new, and outcome evaluation is best suited for mature programmes (Shadish 2006).

Nowadays, evaluation is an inevitable part of a programme plan. One major subject in the planning of the evaluation of health care interventions or programmes is how to construct valid knowledge (Shadish et al. 1991). Internal and external validity issues should be considered when the evaluation design is chosen (Shortell and Richardson 1978). The evaluation perspective also affects which design is to be chosen. Øvretveit (1998) has described the four perspectives of evaluation as the following: experimental (test hypothesis), economic (measure resources), developmental (improve intervention), and managerial (monitor performance). In experimental evaluation studies, randomization controls all of the internal sources of invalidity, but randomization is rarely possible. Campbell and Stanley (1966) introduced the quasi-experimental design for experimental evaluation to control validity threats as well as possible without randomization.

The assessment of health care quality has been the most widely used form of evaluation. Quality assessment or assurance means different activities to different persons. Donabedian (2003) conceived quality in health care as the product of two factors, the science and technology of health care and the application of science and technology in actual practice. He described three basic approaches to the assessment of care quality as follows: defining structure, process and outcome (Donabedian

1966). *Structure* means material and human resources and organizational characteristics under which care is provided. *Process* comprises activities with the patient, including diagnosis, treatment, various types of communication, and the like. *Outcome* covers all changes (desirable or undesirable) in individuals and populations that can be attributed to health care, the most commonly used measures being morbidity and mortality. Donabedian pointed out that these approaches help to obtain information with which to assess quality, and they best suite the evaluation of clinical practice, often in combination with other approaches. Quality can also be seen from 3 perspectives, patient quality (service gives patients what they want), professional quality, and management quality (efficient and productive use of resources).

Programme evaluation and quality assurance differ in focus but are complementary (Ferris et al. 1992). Programme evaluation examines programmes in relation to stated objectives. It is concerned with identifying and evaluating the structure, efficiency, effectiveness, relevance, and impact of the programme. Quality assurance has a narrower but important focus on patient-specific practices and evaluates these with regard to the minimum standards expected by the peer group.

Six evaluation designs have been presented in Table 6. Audit design (type 2) is largely used in quality assurance to compare the programme objectives with the actual situation. The effects on health care organization or professionals (type 6) before and after an intervention can be measured. Type 6a considers the effect of intervention on health organisation, and type 6b also shows the impact of the change on the health service.

**Table 6.** Six main types of evaluation designs (Øvretveit 1998).

Process evaluations
1. Descriptive
2. Audit
Outcome evaluations
3. Effects on people before and after an intervention
4. Comparative before and after an intervention
5. Randomized controlled trial
6. Intentional change in organizations
a. Effects on providers
b. Effects on patients/population of intervention with respect to providers

As in any research setting, in disease management, the selection of the evaluation methods needs to consider the issues of reliability and, especially, validity (Linden et al. 2003). Reliability means that the same result can be achieved with repeated measurements. Validity refers to how precise the measure is in comparison with what was supposed to be measured. When a measurement method needs observers, inter-rater and intra-rater reliability should be measured statistically. Reliability is a precondition for validity. Validity assessment has the following five major types: face validity, criterion validity, content validity, concurrent validity, predictive validity, and construct validity, all of which include some form of judgement or consensus (Shortell and Richardson 1978).

Evaluations of disease management programmes dealing with chronic diseases have been challenging. Asthma programmes, for example, are always carried out in part in community settings, and this scenario complicates the use of randomized controlled trials. In such cases, other next-best methods should be chosen (Steuten 2009). In spite of which study design used, the process outcomes of asthma programmes (i.e., self-management skills) have been improved more often than other outcomes in the evaluations of asthma management programmes (Maciejewski et al. 2009).

### 6.4.3 Medical audit as a practical tool for real life

Quality assurance through the use of audits has a long history, especially in Great Britain. Medical audit and clinical audit are used interchangeably, but medical audit relates to practices initiated directly by physicians (Shaw and Costain 1989). Shaw and Costain (1989) define medical audit as a systematic approach to the peer review of medical care in order to identify opportunities for improvement and provide a mechanism with which to realize them. It has also been defined as a quality improvement process that seeks to improve patient care and outcome through the systematic review of care against explicit criteria and the implementation of change (NICE 2002).

A Cochrane review concluded that, when an audit and feedback are effective, the effects are generally small to moderate (Jamtvedt et al. 2006). The effectiveness of audit and feedback was likely to be greater when the baseline adherence to recom-

mended practice was low and when feedback was delivered more intensively. Even though there is no clear support showing that these tools can change practice, audit is one of the best ways to measure practice in order to know when change is needed (Benjamin 2008).

Audit is one type of evaluation which asks “Are we doing things right?” NICE (2002) has published a comprehensive, modern version of the audit cycle, within which are stages that follow a systematic process of establishing best practice, measuring care against criteria, taking action to improve care, and monitoring to sustain improvement (Figure 2). The spiral suggests that, as the process continues, each cycle aspires towards a higher level of quality.



**Figure 2.** *The clinical audit circle (published with the permission of NICE).*

Clinical audit criteria should be based on research evidence and be prioritized according to the strength of research evidence and the influence on outcome (Baker and Fraser 1995). They should also be clearly measurable and appropriate to the clinical setting. Attention should be paid to the selection of the audit criteria and also to methods of identifying and sampling patients and data collection performance (Khunti et al. 1999, Hearnshaw et al. 2003). Criteria can be categorized according to structure (what you need), process (what you do), and outcome of care (what

you expect). Process criteria refer to actions including, for example, communication, education, and investigation (NICE 2002). Process criteria are mentioned as being more sensitive measures of the quality of care than outcome is. Even though the ultimate target of an audit is to improve the quality of care, seldom do audit cycles end up implementing or evaluating change (Eccles et al. 1996).

Lembcke (1956) published one of the first studies using medical audit as a method of quality assessment. In Finland, the first studies using medical record audits were published in the 1970s (Riikonen 1972, Kekki 1979). The term “medical record audit” is used to describe activities concerned with evaluating the quality of diagnosis, treatment, or care through the screening of patient records. Medical recording as data source has deficiencies, such as incompleteness, doubtful veracity and interpretation difficulties (Donabedian 2003). Montalto (1995) points out that letters written for referral stand in contrast to the idiosyncrasy of the other forms of medical records. Referral letters are objective documents written to be read by others.

Medical record audit start by choosing an important, valuable topic and follow through by choosing criteria that are clear to adhere to and easy to find from medical records, gathering and analysing data, discussing the results (including validity discussion) to enhance improvement if needed, and, finally, repeating the audit.

Asthma has been mentioned as a good disease to audit (Neville 1995). The audit of medical records has also been commonly used in real-life asthma audits. Continuous quality improvement techniques are useful ways with which to introduce and monitor the effectiveness of asthma management and education programmes (Gibson and Wilson 1996). Recent versions of evidence-based asthma guidelines are integrated with the recommendations of audit tools (BTS/SIGN 2009).

## 6.5 Referral letters as a target of medical record audits

The quality of referral letters was a concern already in the early 1960s (de Alarcon and Hodson 1964, McMullan and Barr 1964). In 1964, McMullan and Barr wrote a comment that is still current: “Ideally a referral letter should epitomize the reason for seeking a consultant opinion and include information which may not be readily

available to the consultant, especially social and family background, and past treatment and response thereto”.

The following four important functions of a referral letter has been given: (1) it provides background information on the patient’s situation and the reason for referral, (2) it contributes to the assessment by reducing the likelihood of relevant information being overlooked, (3) it improves efficiency and the quality of care by reducing the unnecessary duplication of tests and providing a focus for history taking, and (4) it provides the groundwork for ongoing care and communication (McConnell et al. 1999). A good referral letter is a summary that includes necessary administrative, clinical, and social information on the patient with results of the primary care investigations. The quality and content of the referral letter also reflect the level of knowledge and performance of the primary care physician with respect to local disease-specific guidelines.

Montalto (1995) stated that referral letters are potential but underused tools for measuring performance. He highlighted the following five advantages of referral letters as a target for audit: (1) a large number of letters is easy to access and gather, (2) letters are acceptable for use in professional audits, (3) letters are objective documents that concisely summarize important diagnostic and management steps and demonstrate the GP’s pattern of thought, (4) consensus in standard settings can be set in co-operation with GPs and specialists, and (5) an impact of referral letters on the quality and efficiency of patient care is possible.

Newton et al. (1992) divided the literature on referral letters into two categories. The first category contains studies that consider the physicians’ personal views of the referral or discharge letter content. These are crucial since communication protocols or quality standards can be set to agree only after a consensus has been reached between physicians (Marinker et al. 1988). The second category is comprised of studies based on the collection of empirical material in the form of physicians’ views elicited by questioning and on those that analysed the content of the actual referral (Hansen et al. 1982, Lachman and Stander 1991, Jenkins 1993, Graham 1994, Newton et al. 1994, McConnell 1999, Campbell et al. 2004) (Table 7). Some studies belonged to both categories.

The same items of content were presented to GPs in two different studies at a 9-year interval (Campbell et al. 2004) (Table 7). The views of the included consultants

changed very little between 1992 and 2002, but the GPs attached greater importance to documenting three items (medical history, findings of the investigation, and whether or not the referral was new) in 1992 than they did in 2002. However, the consultants preferred items like the GP's examination findings, and investigation was less important than for the GPs in both years.

Hart and Marinker (1985) listed the following seven basic points of information that should be included in referral letters: (1) clear identification of the patient, (2) a succinct description of the patient's personality, (3) a statement about the present problem, (4) a summary of relevant past events, including the prescription of drugs and any reaction to these drugs, (5) the physician's formulation of the problem, (6) the physician's and patient's expectations of the referral, and (7) a statement of what the patient has been told. The three most important areas of communication that have been previously agreed upon by primary care physicians and specialists are (1) current medication, (2) reasons for referral, and (3) details that the patient him(her)self is not likely to supply to the consultant (Williams and Peet 1994).

GP's and specialists may have different attitudes towards the content of referral letters (Rosemann et al. 2006). Westerman et al. (1990) conducted a study in which 40% of the referral letters (n=144) were assessed as being good or excellent. However, poor interobserver agreement was found between the physicians, the GPs being more critical (Westerman et al. 1990). This phenomenon was discussed as a call for an effort to be made to reach a consensus about quality. In order to seek views about the content of referral letters and discharge summaries, a questionnaire including 4 administrative and 13 clinical items was sent to GPs and consultants (Newton et al. 1992). A high degree of consensus was found to exist between the physicians; 77% of the GPs (n=115) and 88% of the consultants (n=159) were in favour or strongly in favour of all of the suggested clinical items in the referral letter.

There is a clear discrepancy between the information desired and the information contained in referral letters. Previous audits of the content of referral letters with comparable items and also physicians' views of the content are presented as a part of the Table 7 (Campbell et al. 2004). The reason for referral and the history of the current problem were comprehensively documented. Major shortcomings were found for all of the other items. Jiwa et al. (2005) listed key items of referral to gastroenterologists; the average number of items was only 5.6 out of 18 preset items. In

a Finnish study, the quality of referral letters was roughly assessed and found to be good (51%), satisfactory (44%), or poor (5%) (Puhakka et al. 2003a).

Structured referral letters have been discussed as a means to improve the quality of referral, and, in some studies, discharge letters were also included in the discussion (Jenkins 1993, Rawal et al. 1993, Couper and Henbest 1996, Navarro et al. 2002). Structured referral letters were found to be strongly preferred by GPs, and they did not take a longer time to read (Melville et al. 2002). For referral letters with headings, present history, past history, drug history, and social history rated “good” for 56%, 40%, 54%, and in 29% of the letters, respectively (Salathia and McIlwaine 1995). For some form letters, headings for medication, allergies, relevant past history, and patient demographic details have been provided for more information (Jenkins et al. 1997).

**Table 7.** Previous studies of the content of referral letters. Fulfilment (%) of the content items.

	Campbell et al. 2004							Campbell 2004		
	Hansen et al. 1982 n=141	Lachman and Stander 1991 n=1143	Jenkins 1993 n=705	Newton et al. 1994 n=39	Graham 1994 n=80	McConnell 1999 n=89	Exeter n=134	Newcastle n=175	GPs' views of the referral letter content n=304	Specialists' views of the referral letter content n=174
<i>Item of content</i>										
Reason for referral	86%	77%	92%	95%	NR	79%	99%	80%	93%	96%
History of problem	90%	NR	89%	95%	56%	82%	99%	90%	97%	98%
Medical history	29%	52 %	72%	62%	31%	20%	63%	68%	98%	95%
Clinical findings /examinations	66%	45%	NR	36%	46%	16%	58%	38%	92%	74%
Findings on investi- gation/tests	45%	12%	77%	15%	20%	62%	49%	27%	90%	80%
Current medication	NR	28%	74%	56%	14%	21%	52%	65%	95%	87%
Sociopsychological matters	NR	NR	79%	18%	NR	16%	24%	29%	46%	59%
Known allergies	NR	NR	88%	8%	9%	NR	13%	12%	65%	58%
<i>Specialities</i>	10 different specialities	NR	13 medical, 17 surgical, 8 others	ENT and rheumatology	Oncology	Oncology	NR	NR		

NR, not reported; ENT, ear, nose and throat.

## 7. Aims of the study

The aim of the study was to evaluate the interface between primary and secondary care in regard to asthma management in Finland within the general framework of the National Asthma Programme

The detailed objectives of the study were:

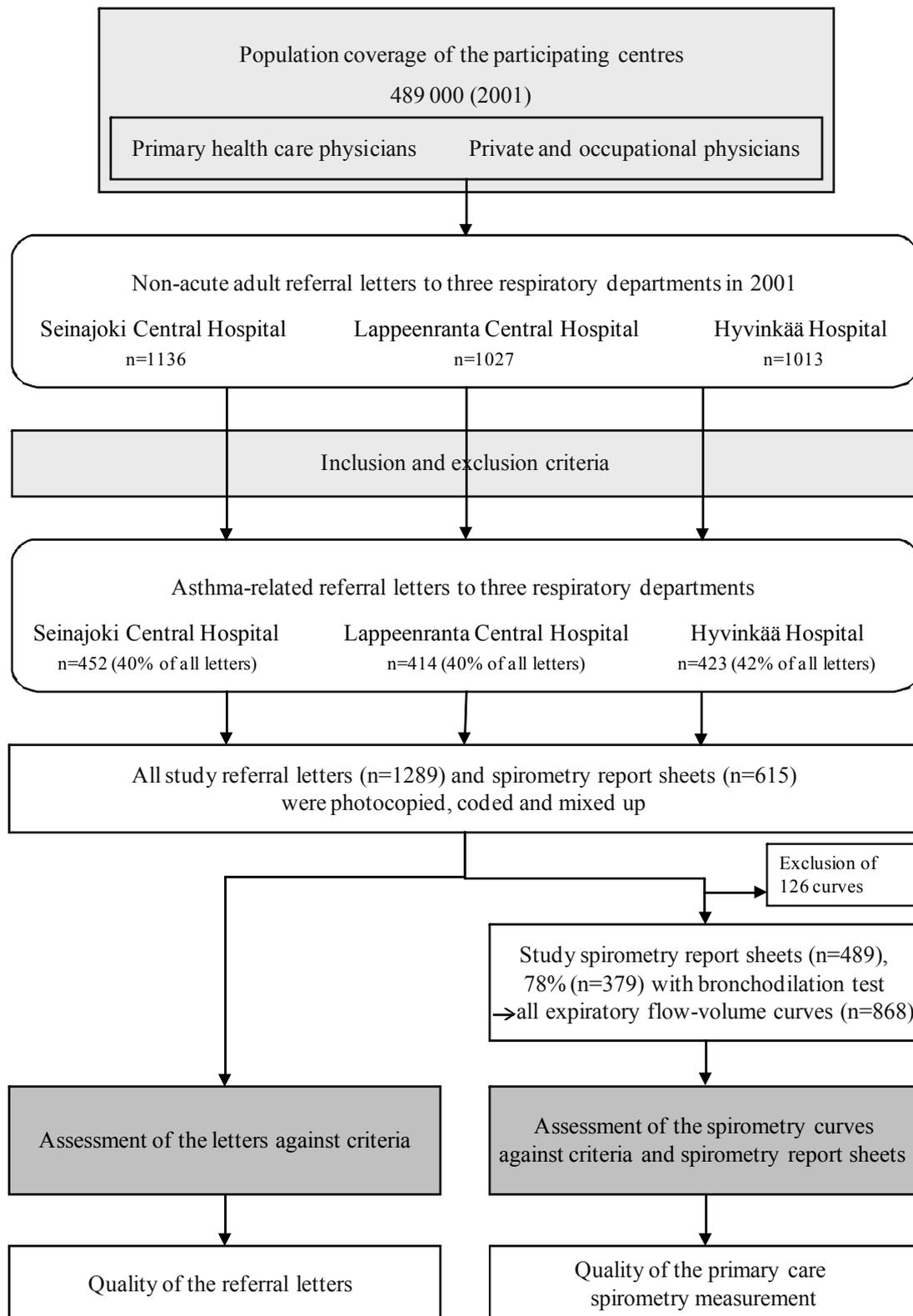
1. To define the quality criteria for adult non-acute asthma-related referral letters,
2. To determine the quality of adult non-acute asthma-related referral letters from primary care to the respiratory departments of three hospitals on the basis of the developed criteria,
3. To compare the quality of adult non-acute asthma-related referral letters at the launch of the National Asthma Programme and 7 years later in one central hospital region,
4. To assess the quality of the spirometry results sent as an attachment to the referral letters,
5. To describe the profile and secondary care case management of new adult asthma patients referred to one central hospital in two different years with a 7-year interval.

## 8. Materials and methods

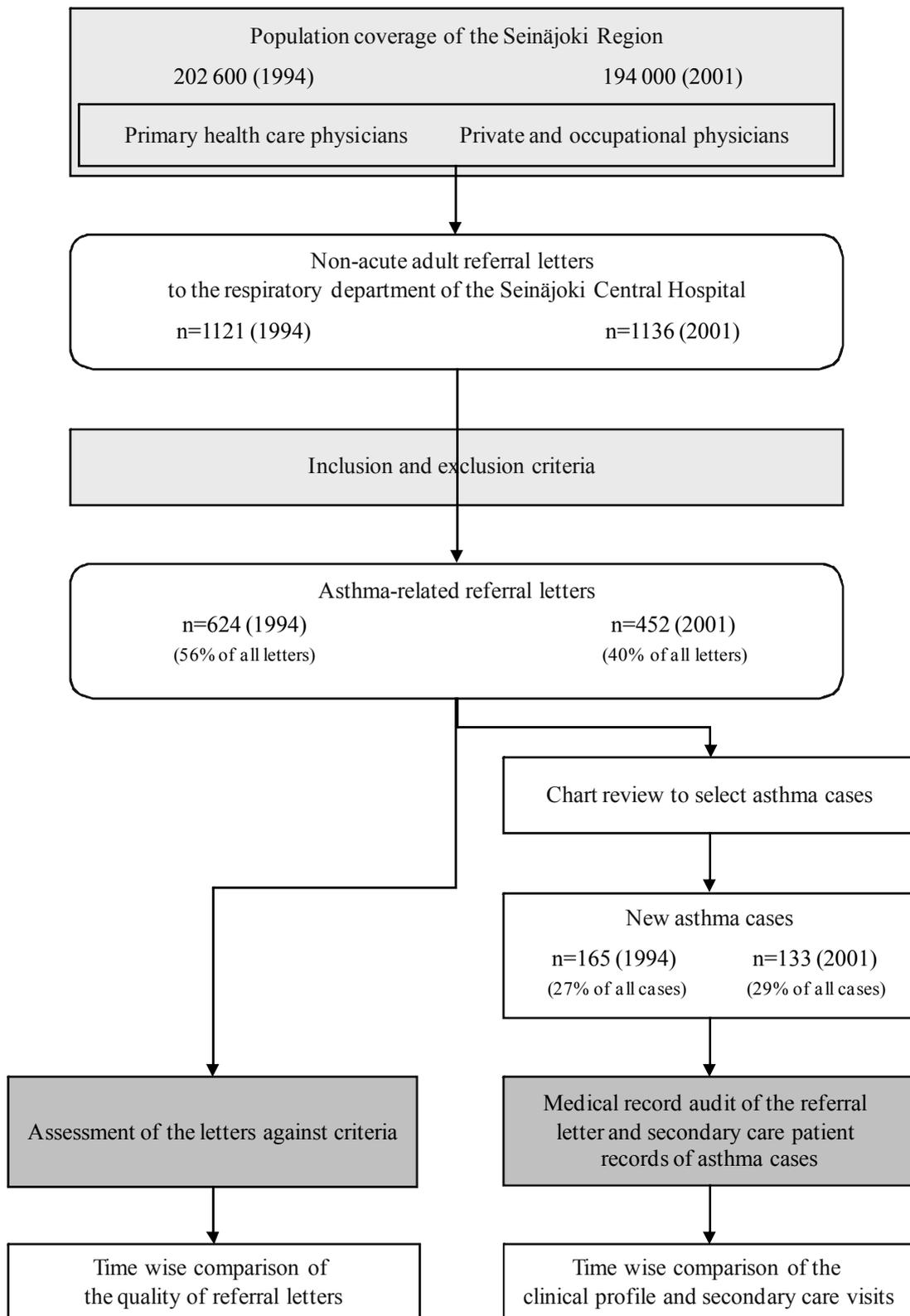
### 8.1 Study design and setting

All of the studies included in this thesis belong to the systematic evaluation of the Finnish National Asthma Programme, which was carried out with the use of medical record audit. The interface between primary and specialist care was the environment for assessing asthma management. The studies focussed on the referral letters themselves, rather than on the referral process in general or the appropriateness of the referrals. Firstly, the quality criteria of the referral letter audit were developed in study I. The quality of the referral letters and the primary care spirometries referred to three hospitals in 2001 was assessed in studies II and IV (Figure 3). In one central hospital, the quality of the referral letters in 1994 and 2001 were compared in studies III and V with respect to the audit criteria, clinical profile, and secondary care visits of new asthma cases (Figure 4).

Three respiratory departments of self-selected hospitals from different parts of Finland participated in the study (the Seinäjoki Central Hospital, the Lappeenranta Central Hospital, and the Hyvinkää Hospital). The combined population coverage of these centres is nearly 500 000 persons (i.e., 9% of the Finnish population). The number and size of the municipalities differed, as did the source of livelihood in the study regions. Details of the study regions and available resources in 2001 are given in Table 8 and Figure 5. All three regions have their own local asthma programmes. These programmes were evaluated before the study and found to be essentially similar, a logical finding since all of the programmes were based on the National Asthma Programme.



**Figure 3.** Design of studies II and IV.



**Figure 4.** Design of studies III and V.

**Table 8.** Details of the study regions and respiratory department resources available in 2001.

	Hyvinkää Hospital	Lappeenranta Central Hospital	Seinäjoki Central Hospital
Inhabitants	160 000	132 000	194 000
Number of municipalities	5	10	27
Inhabitants/municipality			
Range	17000–43000	1600–58000	1700–31000
Median	34000	5000	5100
Regional asthma programme (year)	1998	1999	1997
Patients with special reimbursement for asthma medication*	3.2%	4.2%	3.8%
Number of health care centres	5	10	18
Physicians in health care centres (% of all vacancies)	93 (98%)	79 (94%)	134 (89%)
Occupied vacancies of respiratory physicians	4.5 out of 5	3 out of 4	5 out of 8
Hospital beds in respiratory wards (per inhabitant)	20 (1/8000)	22 (1/6000)	33 (1/5900)

\* The Finnish Social Insurance Institution gives special reimbursement based on a physician's certificate for asthma medication after 6 months (Finnish statistics on medicines 2001 2002).



**Figure 5.** Locations and inhabitants of the study regions in 2001

## 8.2 Description of the medical record audit methodology

The method used in all of the studies was the medical record audit. The main source of data was asthma-related referral letters and primary care spirometry report sheets. The four different settings of the audits are presented in Table 9. Two evaluation designs were used: type 2 and 6A (See Table 6). Type 2, an audit against quality criteria, was used in studies II, IV, and V. Type 6A design, which measured the outcome of intervention with respect to health care professionals, was used in study III. The intervention measured was the Finnish National Asthma Programme, one of the key target groups of the programme was primary care physicians.

**Table 9.** *Content of the medical record audits.*

Study	Medical records	Development of audit criteria	Design	Conduction of the studies	Auditors
II	Referral letters	Asthma guidelines and programmes + a national questionnaire review + expert panel discussions = criteria	Cross-sectional, prospective	Three regional hospitals in 2001	Two independent respiratory nurses
III	Referral letters	Asthma guidelines and programmes + a national questionnaire review + expert panel discussions = criteria	Comparative, prospective and retrospective	One regional hospital in 1994 and 2001	One respiratory nurse
IV	Spirometry report sheets referred with the referral letters	ATS quality criteria + national guidelines + expert panel discussions = criteria	Cross-sectional, prospective	Three regional hospitals in 2001	Two independent clinical physiologists, one respiratory nurse
V	Referral letters and secondary-care medical records	Asthma guidelines and programmes + expert panel discussions = criteria	Comparative, prospective and retrospective	One regional hospital in 1994 and 2001	One respiratory nurse

## 8.3 Development of the quality criteria

### 8.3.1 Quality criteria of asthma-related referral letters (I)

A consensus-seeking expert panel and a national questionnaire review were the tools used to define the quality criteria of the referral letter audit. The panel consisted of seven health professionals in respiratory medicine, paediatrics, general practice, and administration, representing primary, secondary and tertiary health care in Finland. The panel decided to carry out two discussions, before and after the national questionnaire review, closely referring to a modified Delphi methodology (Campbell et al. 2002).

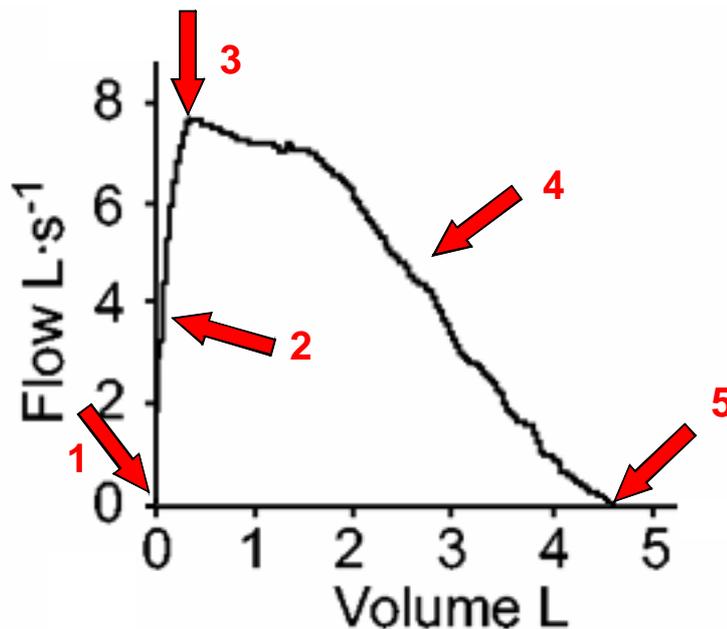
The literature and 21 asthma programmes [three international (NHLBI/WHO) 1995, British Asthma Guidelines Co-ordination Committee 1997, Dahl and Bjermer 2000), two national (Finnish National Asthma Programme (Sosiaali- ja terveystieteiden ministeriö 1994), and Asthma current Care Guideline 2000) and 16 available regional asthma programmes] were scrutinized for recommendations for the content of a referral letter in general and a specific asthma referral letter. Fifteen of the screened asthma programmes (71%) listed specific situations for which a patient should be referred to specialist care. They included diagnostic difficulties, severe disease, suspicion of an occupational disease, and pregnancy.

A literature research was made of Medline (1968–2001) using the terms “referral” and “consultation” from the Medical Subject Headings (MeSH). No papers concerning the content of an asthma referral letter or a referral letter to a respiratory department could be identified. Neither national nor international programmes had any recommendations for the content of an asthma-related referral letter. In eight regional programmes (38% of all of the reviewed programmes), a referral letter was discussed in detail, including all of the study regions’ programmes. Since only a few guidelines directly commented on the content of an asthma referral, the indicators for the case management of asthma, such as history, symptoms, and diagnostic tests, were reviewed as well in order to produce the provisional referral criteria. The provisional administrative criteria were based on two Finnish studies concerning general information included in all referral letters (Latva-Nevala et al. 1995, Ketola et al. 2001). The readability of the letter was a precondition required by the panel.

The list of the provisional criteria sent to the national review included 6 administrative and 19 asthma-specific criteria. The reviewers included all Finnish chief pulmonologists (n=32) and representatives of all Finnish health care centres (n=283), either the chief physician (n=143) or the local asthma co-ordinating physician (n=140). They were asked to grade the necessity of each suggested criterion to be included (score): very necessary (2), necessary (1), and unnecessary (0).

### 8.3.2 Quality criteria for expiratory flow-volume curves (IV)

The quality criteria for expiratory flow-volume curves were agreed by the study group and were based on ATS guidelines (ATS 1995). The flow-volume curves were graded good if all five criteria were present (Figure 6). These criteria were used for the visual assessment of the expiratory curves.



**Figure 6.** *Quality criteria used for the expiratory flow-volume loop.*

1 = start of the exhalation without delay, 2 = steep upslope of the expiratory flow, 3 = sharp PEF, 4 = no coughing during the exhalation, 5 = full exhalation obtained

The clinical data gathered from the spirometry referral sheets were based on the recommendations in the ATS guidelines (ATS 1995) and the Finnish national spirometry and PEF-measurement guideline (Sovijärvi 1995).

### 8.3.3 Grading of the quality (II–IV)

The fulfilment of the selected criteria determines and grades the quality of the referral letter. The expert panel graded the referral letter as good against administrative criteria if it was readable, contained a separately written referral text (not only copies of case notes), included the patient's name and identity data, and fulfilled at least two of four other criteria (see Table 11). The grading of the quality of the asthma-specific referral letter was based on the following two main conditions: graphics of either of the lung function tests (PEF follow-up or spirometry with bronchodilation) were present and other criteria were fulfilled (see Table 13). The quality of the spirometry was graded good if all five of the quality criteria were met (Figure 6).

## 8.4 Conduction of studies II and IV

### 8.4.1 Collection of the referral letters and spirometry report sheets

The study letters were derived from all of the adult (age over 15 years) patients' asthma-related referral letters that were sent to three respiratory departments in three hospitals (Hyvinkää, Lappeenranta, and Seinäjoki) during 2001 (Figure 3). Referral letters from primary care, private care, and occupational health care were prospectively screened by a member of the expert panel in each centre. Copies of the lung function measurements attached to the referral letter were also collected. The referral letter was included in the study if the reason for referral was asthma, suspicion of asthma, any symptom or finding suggestive of asthma, or an obstructive lung function test result. The referral letter was excluded if the reason for referral was snoring, sleep apnoea, haemoptysis, pulmonary infiltrates, suspicion of pleural or parenchymal lung disease or malignancy, a previous COPD diagnosis without additional suspicion of asthma, sarcoidosis, bronchiectasis, recurrent pneumonia, allergic rhinitis without suspicion of asthma, or hyposensibilization. Referrals from other departments of the same hospital and referrals for emergency asthma admission were also excluded.

According to the inclusion and exclusion criteria, 41% (n =1289) of all of the adult pulmonary referral letters (n=3176) to the three participating centres in 2001 were included (Figure 3). The final audit of the three hospitals' referral letters contained 1289 letters and 489 spirometry report sheets, 379 (78%) of which with a reversibility test. All of the included referral letters and spirometry report sheets were collected to the Seinäjoki Central Hospital, where the further processing of the documents took place.

#### 8.4.2 Assessment of the referral letters and spirometry report sheets

The standard for the asthma-specific quality of the asthma-related referral letters was set prior to the audit, and it was based on results found in the literature, reports of consulting specialists, and discussion within the expert panel. The maximal acceptable standard of inadequacy (MAS) developed by Williamson (1971) was set at 10% of the administrative criteria and 30% of the disease-specific criteria. MAS means that the expert panel was prepared to accept a specific maximum of poor-quality referral letters.

An audit manual was prepared, and two respiratory nurses were trained in its use. Firstly, a pilot study using 100 referral letters was conducted to test the feasibility of the asthma referral criteria, the manual, and the audit process. It revealed that the feasibility of the selected criteria for the referral letter was good, and it confirmed a central role for spirometry with a bronchodilation test in the quality assessment, which led to an additional expert panel discussion. There were three reasons why the expert panel adhered to the original idea of spirometry with bronchodilation test as an essential element of a good quality referral letter: (1) according to global guidelines, the diagnosis of asthma is based on documentation of reversible obstruction (NHLBI/WHO 1995), (2) the equipment for spirometry was available in 95% of the Finnish health centres and also actively used in 2001 (Erhola et al. 2003), and (3) the relevant experts consulted strongly recommended keeping this precondition. Additionally asthma programme also national programme for COPD included recommendations to increase the use of lung function measurements ( Laitinen LA et al. 1999) and guidelines for the spirometric procedure (Sovijärvi et al. 1995).

The study letters were arranged in random order before the handling. After the administrative criteria had been screened, all information permitting any identification of a patient was removed. The letters were screened against the criteria and scored by two respiratory nurses trained and supervised by LT. All of the criteria were given the value of 0 when not present and 1 when present. Two nurses independently scored an 8% sample of the letters to assess the inter-rater reliability using the  $\kappa$  statistic for each criterion. The intra-rater repeatability was also assessed after a recoding of a random 4% sample of the letters.

All of the spirometry report sheets were photocopied and coded. Only flow-volume curves, which were printed as final reports with specific spaces for clinical information concerning the patient and measurement circumstances, were included in the study. If both were available, the pre- and post-bronchodilation curves were assessed separately. Clinical information concerning the patient and the test session was collected by a trained respiratory nurse. The quality of the curves was assessed by two clinical physiologists against the five predefined criteria; both of the physiologists had over 20 years of experience in analysing lung function tests. One analysed 240 spirometries and the other processed 249. For the measurement of the intra-rater repeatability and the inter-rater reliability, both clinical physiologists blindly recoded 25 of the curves that they had originally reviewed, and 25 of the curves originally reviewed by their co-worker.

## 8.5 Conduction of study III

### 8.5.1 Collection of the referral letters

The design of this study is presented in Figure 4. In addition to the prospectively collected asthma-related referral letters, in the Seinäjoki Central Hospital region, referral letters from 1994 were also retrospectively screened from the hospital data records. Referrals with the same inclusion and exclusion criteria as those used in 2001 were collected and copied, along with the attached spirometry report sheets.

Between the study years, local implementation activities based on the National Asthma Programme took place, including publication of a regional asthma pro-

gramme in 1997. The regional programme included recommendations of when to refer an asthma or suspect asthma patient and what previous tests should be performed prior to the referral.

### 8.5.2 Assessment of the referral letters

The same audit manual was used as in study II. The asthma-related referral letters were otherwise handled and scored identically to the method described in section 7.4.2, but only data on disease-specific criteria were collected. Referral letters from the year 1994 were scored by one study nurse. The intra-rater repeatability of the study nurse was assessed in the recoding of a random 8% sample of the letters.

## 8.6 Conduction of study V

### 8.6.1 Diagnostic outcome of the referred patients

The study nurse made a chart review to gather all of the final diagnoses of the referred patients from 1994 and 2001. Thereafter, two referral letters from 1994 (one letter from another department of the same hospital and one letter included twice) and one from 2001 (included twice) were excluded. The final number of referrals was 622 in 1994 and 451 in 2001. The diagnostic outcomes of the referrals are presented in Table 10. In 1994, two diagnoses were missing (one referral was returned to the place of referral and one patient did not attend). In 2001, there was a shortage of pulmonologists in the Seinäjoki Central Hospital, with long waiting times. A total of 43 diagnoses remained unidentified – 22 referrals were returned to the referring physician with management recommendations, 19 patients did not attend the outpatient visit, and 2 referrals were re-referred to another speciality.

**Table 10.** *Diagnostic outcomes of all of the asthma-related referrals to the Seinäjoki Central Hospital in the study years. Number of patients and proportion (%) of all referred patients.*

Outcome diagnosis	1994 n=622		2001 n=451	
Asthma				
new	165	27%	133	29%
previous	63	10%	25	6%
Asthma suspicion	10	2%	35	8%
Rhinitis	86	14%	44	10%
Bronchitis	65	10%	40	9%
Dyspnoea	49	8%	52	12%
Tussis	50	8%	37	8%
COPD	38	6%	15	3%
Hyperventilation	12	2%	1	0.2%
Apnea somni	8	1%	0	0%
Sarcoidosis	2	0.3%	6	1%
Miscellaneous	72	12%	20	4%
Missing	2	0.3%	43	10%

### 8.6.2 Assessment of the new asthma cases in the secondary care

Copies of the newly diagnosed asthma patients' records from the first secondary care visit were collected and attached with the copy of the referral letter. A trained respiratory nurse collected the clinical data from these copies according to a prepared manual; thus the target of the audit was these data. The number of each patient's all non-emergency visits to and hospital stays in secondary care generated from the study referral, both before and after the asthma diagnosis, was counted. In order to estimate the use of respiratory department resources, every stay at the respiratory ward was counted as two outpatient visits. The study nurse recoded a 6% sample of the cases to assess the intra-rater repeatability using the  $\kappa$  statistic for each item in the clinical data.

## 8.7 Statistical analysis

A statistician was consulted during the planning of the studies, and the analysis was carried out by versions 10.1–16.0 of SPSS software®.

In study I, the proportion of the “very necessary” gradings for each of the 25 provisional criteria in the national questionnaire review was calculated separately for the three groups of physicians, and the differences between them were analysed by means of the chi-square test. In a case of a p-value of  $<0.10$ , a post-hoc analysis was performed, and the chief pulmonologists were compared with other physicians. The categories for the provisional criteria were coded as follows: very necessary = 2, necessary = 1, and unnecessary = 0. The sums of the codes for the different criteria groups were calculated, and the result indicated the overall assessment of necessity. For all 25 of the criteria, the possible range was 0–50. An analysis of variance (ANOVA) was used to compare the sums of the codes between the physician groups. Fisher’s test for the least significant difference (LSD) was used for the paired comparisons.

In studies II, III and V, intra-rater repeatability, and in study II also the inter-rater reliability, was assessed with the use of  $\kappa$  coefficients (Landis and Koch 1977). The chi-square test was used to test the associations between the categorical variables. Statistical significance was set at  $p < 0.05$ . The quality of the asthma referral letters is described with the use of percentages and exact 95% confidence intervals (95% CI) (based on binomial distributions).

In study IV, the categories for the quality criteria and clinical information were coded, and the sums of the codes for the different criteria were calculated. The sums indicated the overall assessment of the quality of the flow-volume curve and the amount of clinical information included on the flow-volume sheets. The intra-rater repeatability and inter-rater reliability of the clinical physiologists were assessed by raw agreement.

In study V, the results of the lung function tests carried out at the first visit were expressed in terms of medians with ranges, due to the skewed distributions, and tested with the Mann-Whitney test for differences between 1994 and 2001. Logistic regression was used to assess the determinants of the diagnosis at the first secondary care visit among the following factors: age, asthma in first-degree relatives, atopic

status, subjective and objective wheezing, blood eosinophils, use of asthma medication, symptom frequency, availability of primary care lung function results at referral, and a pre-diagnostic visit to a nurse. The numbers of secondary care visits and hospital admissions were studied with the use of a Kaplan-Meier analysis.

## 8.8 Ethics

The study was approved by the Ministry of Social Affairs and Health in Finland and also by the Ethics Committee of the Seinäjoki Central Hospital. The Helsinki declaration was adhered to. Individual informed patient consent was not considered necessary because the written material, referral letters, and copies of patient notes were handled anonymously.

## 9. Results

### 9.1 The finalized referral letter audit criteria (I)

The overall response rate to the national questionnaire sent to pulmonary chief physicians, local asthma co-ordinator physicians, and chief general physicians was 75%. The three groups of responding physicians had very similar gradings for the provisional criteria, most of which were considered very necessary. The chief pulmonary physicians considered all 25 of the criteria more necessary than the other groups did, but the difference between the groups did not reach statistical significance ( $p=0.24$ ). The mean necessary scores for all of the criteria were 40.0 (SD 6.1), 38.3 (SD 6.5), and 37.7 (SD 6.4) for the pulmonary chief physicians, local asthma co-ordinator physicians, and chief general physicians, respectively. Smoking was one exception; the chief pulmonologists scored it as being significantly more important than the primary care physicians did. For the administrative criteria, the difference between the groups was significant ( $p=0.029$ ), and the corresponding mean scores were 10.5 (SD 1.5), 9.7 (SD 1.4), and 10.0 (SD 1.4), respectively (Appendix). The pairwise comparisons indicated a significant difference only between the chief pulmonary physicians and the local asthma co-ordinator physicians ( $p=0.009$ ).

After the second expert panel discussion, the criteria considered as being very necessary by more than 50% of the respondents were included in the final criteria. Five disease-specific criteria (family history, thorax and sinus X-rays, blood eosinophils) were dropped. Spirometry with a bronchodilation test did not reach the borderline level, but the expert panel decided to include it in the final criteria. In addition, the classification of the urgency was included in the administrative criteria by the expert panel, even though the preset level was not reached. The expert panel considered it important from the administrative and legal point of view. Readability was also added to the criteria. The final set of criteria included 7 administrative and 14 asthma-specific criteria (Tables 11 and 12).

## 9.2 General description of the study referrals

### 9.2.1 Referrals in the cross-sectional study (II)

Most of the referral letters (n=1289) were written on the standard structured referral letter form; 16% were electronic letters, all from the region of Lappeenranta. The main reasons for referral were suspicion of asthma in 45% (n=578) of the letters, asthma-related symptoms in 31% (n= 403), and previously diagnosed asthma in 10% (n=125). Public health care physicians referred 70% (n=902) of the letters, and private practitioners (including private occupational health physicians) accounted for 28%. The letters were written by at least 427 different physicians (17 not identified). Altogether 3% of the referred physicians were pulmonary specialists. The mean age of the referred patients was 48 (range 14–92) years, and 61% of them were women.

### 9.2.2 Referrals in the comparative study (III)

The referral letters to the Seinäjoki Central Hospital in 1994 and 2001 were compared. The total number of all referrals to the respiratory department was nearly the same in both years (Figure 4). The proportion of asthma-related referral letters was smaller in 2001 – 56% (n=624) of all the referral letters in 1994 and 40% (n=452) in 2001. All of the study letters were written on the standard structured referral letter form. The reason for the referral was clearly mentioned in 88% (n=546) of the letters in 1994 and in 93% (n=418) in 2001. Suspicion of asthma accounted for 54% (n=339) of the referrals in 1994 and 48% (n=218) in 2001, asthma-related symptoms were reported for 36% (n=223) in 1994 and for 38% (n=178) in 2001, and previously diagnosed asthma was mentioned in 10% (n=58) in 1994 and in 6% (n=25) in 2001.

The public health care physicians referred 76% (n=474) of the patients in 1994 and 65% (n=292) in 2001, and private practitioners (including private occupational health physicians) wrote 20% of the letters in 1994 and 35% in 2001. The letters were written by 188 different physicians in 1994 (1 pulmonary physician and 11

unidentified) and by 162 different physicians in 2001 (5 pulmonary physicians and 4 unidentified).

The mean age of the referred patients was the same: 46 (range 14–87) years in 1994 and 46 (range 14–92) years in 2001. Altogether 59% of the patients in 1994 and 56% in 2001 were women.

### 9.2.3 Referrals in the spirometry study (IV)

The spirometries of the 489 referrals to the three hospitals in 2001 were assessed. The main indicators for these referrals were suspicion of asthma for 51% (n=251), asthma related symptoms for 25% (n=124), and previously diagnosed asthma for 6%. Public health care physicians referred 88% (n=429) of the patients in the spirometry study, and 11% (n=55) were sent from private practitioners. Altogether 62% of the patients were female, with a mean age of 48 (range 15–86) years. Reversibility tests were made in 379 (78%) of the cases. A significant bronchodilation of FEV1 response (12% or more) was observed in 20% of the cases.

## 9.3 Quality of the referral letters (II)

### 9.3.1 Administrative criteria

The fulfilment of the administrative criteria is shown in Table 11. All of the letters were readable, but 4% were hard to read. The quality of the asthma-related referral letters against the administrative criteria was good in 96% of the cases.

**Table 11.** *Fulfilment (%) of the six administrative criteria for the referral letter in 2001 (n=1289).*

Administrative criteria	
Readability	100%
Date of referral	99%
Separate referral text	96%
Clearly stated reason for referral	98%
Classification of the urgency rate	59%
Patient's contact data	
Name	100%
Address	99%
Social security number	100%
Telephone number	90%
Referring physician's contact data	
Name	99%
Address	73%
Telephone number	47%

### 9.3.2 Asthma-specific criteria

The fulfilment of each separate asthma-specific quality criterion is shown in Table 12. Information on current medication (for disorders other than asthma) was clearly age-related ( $p < 0.0001$ ).

The quality of the asthma-related referral letters according to asthma-specific criteria is presented in Table 13. There were no statistically significant differences between the three centres (data not shown). A total of 54% of the letters included either a sheet of PEF-follow-up or spirometry data accompanied a bronchodilation test (i.e., fulfilled the precondition for a good referral letter). The letters with either of the lung function tests were of better quality according also to other criteria. At least eight other criteria were fulfilled in 39% of the letters with and 33% of the letters without PEF-follow-up data or spirometry data with the results of a bronchodilation test attached ( $p = 0.017$ ).

**Table 12.** Fulfilment (%) of the 14 asthma criteria for the referral letter in 2001 (n =1289).

Asthma referral criteria		
<i>Basic history</i>		
Occupation		66%
Smoking		42%
Known allergies		47%
Other diseases		56%
Other current medication		41%
	Age over 60 years	65%
	Age 40–59 years	43%
	Age less than 40 years	18%
<i>Asthma symptom history</i>		
Onset of symptoms		80%
Dyspnoea		64%
	Specified dyspnoea*	54%
Cough		63%
	Specified cough*	53%
Wheezing		44%
Use of asthma medication		78%
<i>Objective tests as an attachment</i>		
Peak flow-follow-up		47%
Spirometry and bronchodilation test		31%

\*Specified dyspnoea and cough criteria consist of detailed description of these symptoms (for example dyspnoea during exercise, productive cough).

**Table 13.** Grading of the quality and the results of the assessment of 1289 asthma referral letters.

Quality of the letter	PEF-follow-up or spirometry with a bronchodilation test as an attachment	Number of other fulfilled criteria	Percentage of the letters	
			%	95% CI
Good	Yes	≥ 8	21	19 to 24
Satisfactory	Yes	6–7	34	31 to 37
	No	≥ 8		
Poor	Yes	< 6	45	42 to 47
	No	< 8		

## 9.4 Comparison of the quality of the referral letters at a 7-year interval (III)

The fulfilment of each separate asthma-specific criterion in 1994 and 2001 is shown in Table 14.

All of the items containing basic history information (except occupation) were present more often in 2001 ( $p=0.01$ ) than in 1994. The main asthma-related symptoms (dyspnoea, specified dyspnoea, specified cough, and wheezing) were mentioned equally often in both years. Lung function tests were rarely attached to the referral letters in 1994, and the difference between the years was significant ( $p=0.01$ ). Either of the lung function tests was sent as an attachment in 18% of the referrals in 1994 and in 50% of the referrals in 2001. The inclusion of information about current medication (for disorders other than asthma) was age-related ( $p<0.01$ ).

The quality assessment of the adult asthma referral letters in 1994 and 2001 is presented in Table 15.

**Table 14** Fulfilment (%) of the 14 asthma referral letter criteria in the letters in 1994 and 2001.

Asthma referral criteria	Letters 1994 (n=624)	Letters 2001 (n=452)	p-value
<i>Basic history</i>			
Occupation	82%	79%	0.14
Smoking	24%	39%	0.01
Known allergies	39%	54%	0.01
Other diseases	46%	54%	0.01
Other current medication	30%	38%	0.01
Age over 60 years	55%	68%	0.01
Age 40–59 years	29%	39%	0.01
Age less than 40 years	11%	17%	0.01
<i>Asthma symptom history</i>			
Onset of symptoms	72%	83%	0.01
Dyspnoea	69%	69%	0.91
Specified dyspnoea*	54%	59%	0.89
Cough	55%	63%	0.02
Specified cough*	48%	52%	0.06
Wheezing	53%	48%	0.17
Use of asthma medication	58%	72%	0.01
Bronchodilator	55%	67%	0.01
Preventive	14%	26%	0.01
<i>Objective tests as an attachment</i>			
Peak flow follow-up	14%	40%	0.01
Spirometry with a bronchodilation test	5%	32%	0.01
Either of the tests	18%	50%	0.01

\* Specified dyspnoea and cough criteria consist of detailed description of these symptoms (for example dyspnoea during exercise, productive cough). Differences between years were tested by Pearson Chi-square test.

**Table 15.** Quality of the adult asthma referral letters in 1994 and 2001. The differences between the years were tested with the use of the Pearson chi-square test.

Quality of the referral letter	Percentage of all referral letters in 1994 (n=624)		Percentage of all referrals letters in 2001 (n=452)		p-value
	%	95% CI	%	95% CI	
Good	7	5 to 9	22	18 to 25	0.01
Satisfactory	30	26 to 33	34	30 to 39	0.20
Poor	63	60 to 67	44	39 to 49	0.01

## 9.5 Quality of the primary care spirometries (IV)

### 9.5.1 Flow-volume curves

The fulfilment of the criteria for the spirometry data is shown in Table 16. The quality of all the flow volume curves (n=868) was found to be good for 79% of the curves. Two criteria, which were moderately difficult to adhere to, were a sharp PEF and full exhalation.

**Table 16.** *Fulfilment (%) of the five quality criteria for the pre- and post-bronchodilator curves.*

Fulfilment of the five quality criteria	Pre-bronchodilator curve (n=489)	Post-bronchodilator curve (n=379)
1. Start without delay	98%	99%
2. Steep upslope	95%	94%
3. Sharp PEF	90%	91%
4. No coughing	98%	99%
5. Full exhalation	90%	91%
All criteria fulfilled = good quality *	78%	80%

\* The quality of all flow volume curves (n=868) was found good in 79% of the curves.

### 9.5.2 Clinical information on the spirometry report sheets

The clinical information provided on the spirometry report sheets is shown in Table 17. The date of the spirometry testing, the identification of the technician, the reference values, and the height of the patient were found on almost all of the sheets, and smoking history appeared on more than two thirds. The location of spirometry testing (i.e., name of the health care centre or private practice where the spirometry was performed) was mentioned on 37% of the sheets, and the indicator for the measurement was listed in 15% of the cases. The use of respiratory medication and patient co-operation were commented on in one third of the sheets.

**Table 17** *Presentation (%) of clinical information on the spirometry report sheets (n=489).*

Date when the spirometry was carried out included	99%
Indication for spirometry mentioned	15%
The location where the spirometry was performed included	37%
Name/ ID of the spirometry technician included	97%
Height of the patient included	99%
Smoking history of the patient mentioned	87%
Duration of smoking (in years) mentioned	74%
Patients' respiratory medication mentioned	26%
Time of last dose of that respiratory medication taken mentioned	30%
Patient cooperation commented on	32%
Reference values included	100%
Source of the reference values referred (Viljanen et al. 1982)	96%

## 9.6 Comparison of the new asthma cases in the secondary care at a 7-year interval (V)

### 9.6.1 Clinical profile

The asthma patients in 2001 were older ( $p=0.031$ ) and more obese ( $p=0.002$ ) and had more co-morbidities ( $p=0.013$ ) than in 1994. The number of asthma patients with a body mass index (BMI) over 30 increased from 19% in 1994 to 33% in 2001 ( $p=0.011$ ). Two thirds reported chronic rhinitis in both years. Altogether 39% of the asthmatics were atopic in 1994, and 32% were atopic in 2001. The main symptoms were dyspnoea, cough, and wheezing, with no significant differences between the years. Expiratory wheezing observed by auscultation at the primary or secondary care physician's visit was less common in 2001. Symptoms occurred periodically more often than daily in 2001. Bronchodilator drugs were commonly prescribed in both years, but the use of anti-inflammatory drugs before the specialist consultation was more frequent in 2001. The median pre-FEV<sub>1</sub>% and pre-FEV% values did not differ between the years.

## 9.6.2 Visits to secondary care

Only a history of asthma in first-degree relatives [odds ratio (OR) 5.34, 95% CI 1.12–24.49] in 1994 and a visit to a nurse prior to the specialist visit (OR 3.13, 95% CI 1.17–8.37) in 2001 were shown in the logistic regression analysis to have enhanced the diagnostic process. Prior visits to a nurse were not used in 1994, but 60% of the asthmatics (n=80) visited a nurse initially in 2001. If this visit in 2001 was taken into account, the significant difference in the number of pre-diagnostic visits disappeared. There were fewer visits after the diagnosis in 2001 than in 1994 ( $p < 0.001$ ); 55% of the asthma patients visited a specialist three times or less after the diagnosis in 1994 versus 75% in 2001.

The quality of the referral letters was rated good more often in 2001 (25%) than in 1994 (10%). However the quality of the asthma referral letters did not seem to predict the possibility to make an asthma diagnosis at the first physician visit or the total number of visits before the diagnosis (data not shown). The small number of the good referral letters (n=33) may have weakened the result.

## 9.7 Reliability and repeatability

In study II, two nurses independently scored an 8% sample of the letters. The inter-rater reliability was assessed with the use of the  $\kappa$  statistic for each criterion. The median of all the  $\kappa$  values was 0.87 (mean value 0.82, range 0.61–0.91). The intra-rater repeatability was assessed on a further random sample of 4% of the letters, and the median  $\kappa$  was 0.87 (mean value 0.83, range 0.31–0.98).

In study III, the letters from 1994 were scored by one nurse, and intra-rater repeatability was assessed in a random sample of 8%. The intra-rater repeatability was assessed for each criterion, and the median  $\kappa$  was 0.93 (mean value 0.88, range 0.44–1.00).

In study IV, the intra-rater repeatability was assessed for both of the clinical physiologists by recoding 25 curves for each. The agreement was 98% for one and 99% for the other. Altogether 50 curves (of which 35 also included post-bronchodilator curves) were coded by both clinical physiologists to measure the

inter-rater reliability between the rates. This agreement ranged from 83% to 100%. The interpretation of the full exhalation most often caused the disagreement between the two reviewers.

In study V, the intra-rater repeatability for each item of the patient history and symptoms was assessed. The median of all the  $\kappa$  values was 0.73 (mean value 0.70, range 0.36–1.0).

# 10. Discussion

## 10.1 Main results of the studies

Finnish National Asthma Programme (1994–2004) shifted the responsibility of asthma management to primary care professionals to ensure an early diagnosis and treatment for an increasing number of asthma patients. As an evaluation effort of the programme, both a cross-sectional and a comparative study of the quality and content of the asthma-related referral letters were conducted. Medical record audit of asthma-related referral letters was the evaluation method used.

Audit criteria based on a high national consensus between primary and secondary care physicians were first set (study I). The consensus regarding the criteria indicates the success of the intensive educational effort of the asthma programme.

In the cross-sectional study of three hospital regions, the quality, against the asthma-specific criteria, was good for only one fifth of the referral letters, and nearly half of the letters (45%) were poor. The proportion of poor letters was higher (50%) than the preset standard of 30%. However, in the comparative study of one hospital region, the proportion of poor asthma-related referral letters significantly decreased from two thirds to less than half during the first 7 years of the programme. The improved quality of the letters can primarily be explained by the more active attachment of lung function test results. However, in 2001, the proportion of poor letters was still unacceptably high (44%).

Against the predefined criteria, eight out of ten of the flow-volume spirometry curves obtained in primary care were of good quality. The sharpness of the PEF and full vital capacity exhalation seemed to be the critical points of the spirometric testing. Some details of the clinical information, such as the use of respiratory medication, patient cooperation, and the location of spirometric testing, were frequently missing from the spirometry report sheets.

The newly diagnosed asthma patients in 2001 were older, more obese, and had more co-morbidities than those in 1994. The main asthma symptoms, such as dyspnoea, wheezing and cough, occurred equally in both years but were more often periodic than daily in 2001. The clinical profile data of the newly identified asthma cases refers slightly to milder asthma in 2001 than in 1994. Trends were found towards assigning a more active role on the part of primary care physicians and more rational use of secondary care resources in the management of asthma.

## 10.2 Discussion of the results

### 10.2.1 Consensus on the contents of asthma referral letters (I)

The adequate and timely transfer of information is essential when the responsibility of care is shifted from primary to secondary care. GPs writing and pulmonologists reading the referral letters should have a common view of the essential components, at least those concerning major chronic diseases. Asthma has been identified as a common lung health disease for decades in Finland, with education activities having taken place even before the launch of the National Asthma Programme. The programme drew the attention of both primary care physicians and specialists to the main aspects of the case management of asthma and seems to have largely united the views.

Smoking was the only item scored very necessary by over 90% of the chief pulmonary, whereas only 77% of the primary care physicians were of the same opinion. Surprisingly, only about half of all the physicians considered data on other current medication very necessary; however, data on asthma medication was very necessary for two thirds of the physicians. In a British study (Campbell et al. 2004), about 90% of both primary care physicians and specialists viewed current medication “always/usually important” (Table 7). British physicians seem to value findings of previous tests as being more important than Finnish physicians do.

The minimum essential 24 elements needed for an adult asthma referral letter have been published recently (Berta et al. 2008). Only one element, however, was

case-sensitive for asthma; hence the authors presented the opinion that the same elements could be used also in connection with other chronic diseases. In the present study, the content of the referral letter focussed more on symptoms and the results of objective lung function tests, cases of a suspicion of asthma, even though the same criteria are relevant also when patients with chronic asthma are referred.

### 10.2.2 Quality of the asthma referral letters (II)

Administrative data was well documented in the referral letters; only the referring physician's address (27%) and telephone number (53%) were missing quite often. Missing contact data makes immediate contact complicated. A clearly stated reason for referral was mentioned in almost all letters (98%), but the classification of urgency was missing in four out of ten letters. Asthma or a suspicion of asthma was the reason for referral in 55% of the letters.

Copies of PEF-follow-up measurements (47%) and spirometry data with the results of a bronchodilation test (31%) were included in the letters. However, more patients underwent lung function measurements prior to referral. At least an intention to measure PEF was mentioned in 78% of the letters. Spirometry was performed in 63% of the cases, and copies of the spirometry report sheet with or without bronchodilation test were included in 48% of the letters.

The fulfilment of the disease-specific criteria differed in some aspects from the GPs' (n=209) views in the national review questionnaire. Wheezing, smoking, allergies, and current medication were mentioned less often, only in less than half of the letters. One clinically very important discrepancy was found between items scored very necessary by physicians (chief pulmonologist, local asthma co-ordinator, chief general physician) and the actual content of the referral letter, the item being smoking (93%, 80%, 74% versus 42%, respectively). Discrepancies between the actual content of the referral letter versus the views of the physicians were also found in a previous study (Campbell et al. 2004) (Table 7). The rush in everyday work in health care centres often ruins the ideal way of documenting clinical information and composing a comprehensive referral letter. Part of the explanation missing items is probably due to the fact that everything that has been discussed with the patient is thereafter not recorded. A structured asthma referral letter would make it

easier to include all relevant items. There are no previous studies of the content of asthma-specific referral letters, but there are studies of referrals to other specialities (Table 7). As in the present study, a lack of information on clinical findings, primary care investigations, current medication, and allergies has been found also in these studies.

What is the value of a good referral letter; does it produce better consultant replies? Hansen et al. (1982) have shown that the quality of consultation reports increased directly with the amount of information originally sent to the consultant. Grol et al. (2003) found some correlations between the quality of the referral letter and the reply letters, but the relations were weak. In a Finnish study, a mutual relation between the quality of referral letters and the discharge summaries was found (Vehviläinen et al. 1996a). However, the content of the referral letter may have a different impact in different specialities, depending on the reason for referral. A short referral letter may be enough to produce a good reply, for example, if the patient is referred with a specific question or expectation of a diagnostic procedure (Jiwa et al. 2005). A specific referral diagnosis has predicted benefit from the specialist consultation (Puhakka et al. 2006).

Information in the referral letter is essential for the specialist if he or she is to make appropriate plans for the first secondary care visit and the classification of the urgency. Information on occupation, smoking, allergies, and the current asthma medication of the patient is important for the planning of further investigations. Specialists rely on the information given in referral letters when deciding when to schedule the patients for the outpatient department. The cases that physicians could have scheduled promptly have contained more information (Jiwa et al. 2009). A good referral letter also provides the opportunity to answer the referring physician straight without face-to-face contact with the patient, which can be the most cost-effective decision, and the visit to secondary care is avoided. Electronic referrals have made these short consultations more fluent.

### 10.2.3 Differences in the asthma referral letters at a 7-year interval (III)

At the launch of the National Asthma Programme in 1994, all primary care physician vacancies were occupied in the study region of the Seinäjoki Central Hospital. This occurrence may have facilitated the implementation process of the asthma programme. The total number of non-acute, external referral letters was the same in 1994 and 2001. The proportion of asthma-related letters out of all pulmonary referrals decreased from 56% in 1994 to 40% in 2001. Moreover, specialist consultations on problems of chronic asthma management decreased. Almost one out of ten patients referred had previous asthma in 1994, compared with only one out of twenty in 2001. These changes reflect the more active management of asthma in primary care. As well as the more active use of preventive asthma medication, mentioned more often in 2001 (26%) than in 1994 (14%).

The improved quality of letters is mainly explained by the attachment of graphics from PEF follow-up or spirometry to the referral letter more often in 2001 than in 1994. The major shortcoming in both years was the lack of a smoking history. Omitting smoking information may reflect a negligent attitude of physicians towards documenting patients' smoking habits; if so, it can be assumed that attitudes have changed since 2001.

### 10.2.4 Quality of the primary care spirometries (IV)

In the present study, the quality of the primary care spirometries referred to specialist care was good, and the reversibility test had been actively used. The quality was assessed with the use of a visual view of the expiratory flow-volume loops against the five quality criteria. The inter-rater agreement for the quality criteria between two clinical physiologists was also good, a finding that makes the method useful in further evaluations. Major technical problems can be verified by a visual review of the curve. If a poor-quality spirometry curve is attached to the referral letter, the consulting specialist may recommend repeating the test and reconsider the referral indication.

In many countries even the better availability of spirometry has not increased its use, barriers being a limitation of time and resources and physicians' problems in interpreting the results. The value of primary care spirometry has been recently discussed (Derom et al. 2008, Enright 2008), and new standards for especially diagnostic primary care spirometry have been published (Levy et al. 2009). In Finland, primary care spirometry has a long tradition, as the strict national diagnostic criteria for a special reimbursement of asthma medication have been based on lung function tests. The asthma programme was the first national incentive for all health care centres to purchase spirometry equipment.

The value of the clinical information given on the spirometry report sheets has seldom been discussed. However, the need for that information is obvious from the clinical perspective for the interpretation and comparison of the results. The previous use of bronchodilating asthma medication has short-term effects on forced lung volumes, and preventive asthma medication has long-term effects. All of the evaluated report sheets had specific space available for comments on patient cooperation and respiratory medication. However, mention of a previous use of respiratory medication was found on only one third of the study report sheets.

Smaller, cheaper, and user-friendly office spirometry equipment has partly replaced the standard flow-volume spirometry devices in primary care settings, but the instrumental properties have varied (Liistro et al. 2006). Spirometry devices for small offices provide only numerical values, which are practical in the screening and monitoring of obstructive pulmonary disease (Enright et al. 2005). However, especially for diagnostic purposes, it is recommended that spirometers which display flow-volume curves be used. The ability to see displayed flow-volume curves is an important part of both quality control and the interpretation of spirometry testing (Derom et al. 2008, Levy et al. 2009). It should also be possible to save the curves digitally in an electronic patient record system.

#### 10.2.5 Differences in the profile and management of the new asthma cases at a 7-year interval (V)

During the specialist visits in both 1994 and 2001, one third of the patients referred to the Department of Respiratory Diseases in the Seinäjoki Central Hospital were

diagnosed as having asthma (Table 10). Suspicion of asthma (symptoms not reaching the strict Finnish diagnostic criteria) seems to have been more common in 2001, it may explain the need to refer some patients for specialist consultation. The COPD cases were few, due to the exclusion of COPD referrals if asthma was not suspected. In addition, only a few other respiratory diseases were found; this finding reflects the successful inclusion and exclusion of the letters.

Asthma is a common disease with an ongoing trend towards milder, intermittent manifestations, which are likely to pose more diagnostic challenges for all health care professionals. From the epidemiological point of view, previously undiagnosed patients with asthma had less severe symptoms, better lung function, less reversibility to an inhaled bronchodilator, and less atopy, and current smokers were more common (Nathell et al. 2002). In the present study, the results were similar. The profile of the asthma cases referred to a specialist in 2001 was not so self-evident as to be easily diagnosed by a primary care physician. Obesity and co-morbidities were more common among new asthma patients in 2001, which may have also complicated the diagnosis in primary care.

Secondary care recourses were used more efficiently in 2001. The diagnosis was made at the first secondary care physician visit more often in 2001. Only one statistically significant factor explaining the difference in the diagnostic process in both years was identified: a history of asthma in first-degree relatives in 1994 and a visit to a nurse before the first specialist consultation in 2001. Hospital outpatient visits and admissions and days in the hospital, both before and after the asthma diagnosis, decreased between the two years. The asthma patients were transferred back to primary care sooner in 2001 than seven years earlier. The responsibility for long-term asthma care had clearly shifted to primary care.

### 10.3 Strengths and limitations of the studies

The strength of all the studies included in this thesis was the precise use of medical record audit principles and the representativeness of the samples, with three different respiratory departments participating. The limitation of this study, as in most programme evaluations, was the fact that rigorous inferences about the effects of the

asthma programme itself were not possible. Other co-factors in society during the 7-year period may have changed the results. For example, spirometry training was also included in the national COPD programme in 1997 (Laitinen et al. 1999) and especially to the guidelines for lung function tests in 1995 (Sovijärvi et al. 1995). In Finnish health care between the study years, more resources were directed towards active outpatient care, whereas the number of expensive hospital beds was decreased. These factors have also decreased asthma patients' inpatient care.

One major prerequisite for the interface audit is equal representation of both primary care and hospital physicians (Baker and Fraser 1995). The representation of primary care professionals could have been better, but the national review increased the contribution of the referring physicians.

In the national questionnaire only 37% of the physicians in all groups rated the attachment of copies of spirometry with bronchodilation test as very necessary for the referral letter. This value did not reach the preset threshold of 50% for inclusion in the final criteria. However, more than half of all the physician groups considered copies of PEF follow-up as being very necessary. Commonly experienced problems with primary care spirometry measurement and the interpretation of the curve may have influenced the opinions of the physicians. In the spirit of the asthma programme, the duty of the expert panel was to emphasize the role of spirometry in particular, since the panel knew that the test was easily available in 2001 (Erhola et al. 2003).

The study letters represented a good sample of Finnish non-acute asthma-related referral letters in many respects. The total population coverage of the three hospital regions provided a rather good representation of Finland, both geographically and demographically. All of the study regions have been active in implementing the National Asthma Programme, and local asthma programmes were composed together with the primary care representatives during the first four years of the programme. This activity may have affected the result, even though knowledge of asthma was being spread effectively throughout the whole country by the nomination of asthma contact professionals and by stepwise educational sessions held at the different health care levels (Haahtela et al. 2006). The number of letters was large, representing all asthma-related referral letters received by these hospitals during one year. The letters were written by 431 different physicians, and therefore provided a wide

view of the physicians' behaviour. Referral practice was similar in all of the regions. Nearly the same proportion (40–42%) of annual pulmonary referral letters was included in the study in all regions.

One third of the study referrals in 2001 originated from private health care, including also private occupational health care. The quality of the referrals from municipal health care versus that of the referrals made in the private sector was not compared. However, in the spirometry study, only 11% of the referrals were from the private sector. The private sector was found to use lung function tests less frequently also in another study (Brander and Salinto 2009). The results of study II might have been better if only the letters from municipal primary care had been assessed. However, the same criteria for the asthma-related referral letter pertain to all physicians referring a patient for specialist care.

The used quality criteria were based on a high degree of consensus, but as 45% of the referral letters were graded as being poor when compared with the asthma-specific criteria, it must be asked whether the grading between good, satisfactory, and poor was appropriate. Only 8 of 14 criteria were strictly asthma-specific. The remaining 6 criteria (onset of symptoms, occupation, smoking, known allergies, medication, and known diseases) are essential for referral letters, no matter what speciality. Was the precondition of attached lung function tests too strict? If this precondition had not been included, an additional 15% of the letters would have been rated as being good. This difference would not, however, have changed the proportion of poor referral letters; it would have remained the same at 45%. The referrals with a copy of either lung function test attached were also better against the other criteria. The same referral criteria developed in 2001 were used also for the letters in 1994. Spirometry with the results of a bronchodilation test might have been omitted had the criteria been developed in 1994.

In study IV, the visual method used proved to be a practical method for assessing and re-assessing the quality of primary care spirometry curves. The assessment of the full exhalation criteria, especially regarding the post-bronchodilator curves, created the most disagreement; this finding also appeared in the pilot study that was carried out. To obtain full exhalation is a frequent quality problem of spirometric testing (Eaton et al. 1999, Akhtar and Wilson 2005, White et al. 2007). The retrospective visual assessment of spirometry curves made it impossible to measure one

important quality criteria, namely the 5% repeatability of FEV1, which is a major limitation of the visual method.

It is not possible to assess what proportion of all suspected asthma or new asthma cases was referred to a specialist. The most severe acute cases were sent to the emergency department, and, in addition, obvious asthma cases were not sent to a specialist. Moreover, the sample of the spirometry curves in this study may not be the whole picture of the primary care spirometries, they were the curves and report sheets which were sent to specialists. It is possible that the worst ones were not sent at all.

## 10.4 Evaluation of the National Asthma Programme

The National Asthma Programme was the first Finnish health care action programme emphasizing the need for both community solutions and effective implementation in the management of asthma (Haahtela et al. 2001). The core solution was to educate, strengthen, and motivate primary care professionals, both physicians and nurses, to recognize, diagnose, educate, treat, and follow asthma patients and supply them with self-management skills.

Guided self-management was introduced as a primary form of treatment. It was an advanced approach at that time, the evidence of which was strengthened during the programme (Lahdensuo et al. 1996). Instruction of the patient in how to perform PEF-follow-up curves, use inhalation devices, and understand the nature of the disease is still a crucial part of good quality asthma management. Asthma nurses, both in primary and secondary care, have been the driving force empowering the patient to carry out the major responsibility for chronic disease control. Improvements in indicators of asthma patients' self-management skills have been often reported in evaluation studies of asthma programmes (Steuten et al. 2006), emphasizing the major role of respiratory nurses.

During the early 1990s, the evaluation plan was not a self-evident part of the development of Finnish health care programmes. Recently, integrated evaluation plans have been developed for large Finnish health care programmes for diabetes and allergies (Dehko 2001, Haahtela et al. 2008). The working strategy of the National

Asthma Programme included a precise plan for action; nevertheless a rigorous evaluation was not planned.

There are a few other evaluation studies of the programme, which were conducted at the midst of the programme and which focussed on different aspects of the programme. Asthma co-ordinating primary care physicians were interviewed regarding the attitudes, the nomination of local co-ordinators, and the feasibility of lung function tests (Erhola et al. 2003). In a large questionnaire study of chronic asthma patients' real life, medication use, co-morbidities, and arrangements for long-term follow-up were assessed in 2000 (Ikäheimo 2008). Annual evaluations of the local asthma programme in the Hyvinkää region have also been published (Brander and Salinto 2009). The final report of the asthma programme showed that the implementation of the programme increased the knowledge of asthma both in society and in health care (Haahtela et al. 2006). The impact of asthma on patients and society decreased when measured by the fewer days in the hospital, fewer daily allowances, and fewer disability pensions. Also total costs per patient have been estimated to be decreased 36% between the years 1993 and 2003.

What is the value of the present studies in the evaluation of the Finnish National Asthma Programme? One of the main objectives of the programme was to emphasize the role of primary care and strengthen the co-ordination of asthma management between different levels and professionals in health care. Referral letters are objective documents that concisely summarize important diagnostic and management steps and demonstrate even the GP's pattern of thought (Montalto 1995). The asthma-related referral letters in this study were letters representing the possibility of asthma; in half of the letters suspected asthma was clearly mentioned as a reason for the referral. Primary care physicians writing or dictating a letter condense information from previous medical records into one letter sheet. Medical record audit of referral letters worked as a window for looking at the everyday practice of asthma management in primary care.

Changes in the management of asthma were distinguishable in primary care. Even though the quality of only every fifth of the referral letters in 2001 was good, it was significantly better than in 1994 in one of the study regions. The quality criteria were strict and included lung function tests as a compulsory attachment. During the years of the asthma programme, the workload of primary care professionals increased, in part due to the shifting of the main responsibility for the management of

several chronic diseases to primary care. It is remarkable that, even during these years of increasing demands, the quality of asthma-related referral letters has improved and the proportion of asthma-related referrals has decreased considerably. The asthma programme called for the early treatment of asthma and recommended a simple medication regimen; preventive medication for asthma was more commonly used in 2001. The proportion of previously diagnosed asthma referrals was small (10%) in 1994 and even smaller in 2001 (6%). This finding may reflect better management of chronic asthma in primary care.

PEF measurement was at least mentioned in the letter, and spirometry had been carried out for two thirds of the patients. Half of the letters included a copy of the report sheet, one third of which with the results of a bronchodilation test. These facts reflect the active use of lung function tests in primary care. Eight out of ten spirometry curves were good in quality, and this finding can be considered a result of the long-term training and motivation of nurses and technicians.

The results of study V showed that secondary care resources were used more efficiently and the overall number of secondary care visits and hospital stays decreased between 1994 and 2001. Specialists were able to diagnose asthma earlier in most of the cases and back-refer the patient. During the fewer visits, asthma nurses work intensively to engage the patient in self-management and to encourage visits to occupational or primary health care professionals.

Evidence of improvement in chronic disease management can first be seen in terms of changes in patient and provider behaviour directly impacted by the programme; thereafter follows indirect improvements in clinical measures and finally possible decreases in the costs and use of health care resources (Linden et al. 2003). In this study, changes in provider behaviour were shown during the first years of the asthma programme. Accurately diagnosed and informed patients with self-management skills are a requisite for the cost-effective management of asthma, as also is the case for other chronic diseases.

## 10.5 Prospects for asthma management at the interface

An accurate asthma diagnosis has been raised as one of the major challenges for the next few decades of asthma management (Partridge 2007, Kaplan et al. 2009). Continuity of care, the availability of time in primary care per patient, and the willingness of the patient to engage in the diagnostic process have an impact on the likelihood of asthma being diagnosed (Dennis et al. 2009). Nurses specialized in respiratory diseases can, however, maintain continuity in primary care and schedule time to guide and motivate patients both in the diagnostic process and afterwards during long-term care. The role of nurses specialized in primary care became even stronger in a Dutch disease management programme, in which these nurses function as a liaison between primary and secondary care (Steuten et al. 2006). In Finland the role of respiratory nurses should be strengthened as case managers of the chronic care models.

Electronic referrals and referral agreements have been proposed as methods with which to improve care co-ordination at the interface (Bodenheimer 2008). Consultation through electronic referral may even reduce unnecessary face-to-face secondary care visits, if the content of the electronic referral letter is adequate and there is a possibility to interact with the consultant (Kim et al. 2009). Visits can be replaced by physicians' interactive discussions or consultant's reply letters with instructions for further steps. Compatible electronic health records will vastly improve the availability of health care information, such as patient medication, but they will not ensure that care is co-ordinated (Reid and Wagner 2008).

Referral agreements that outline the responsibilities of chronic diseases may decrease waiting times and increase interactive information flow (Murray 2002). British statements on a respiratory patient's care at the interface between primary and secondary care have been published, and they include remit recommendations for GPs and specialists (BTS statement 2008).

Agreements on including systematically pre-referral lung function tests in referrals for respiratory complaints will be beneficial for both parties – referrals will be more structured and based on accepted criteria, GPs who have performed spirometry will have better insight into the patient's lung function, and the chest physician will benefit from having the results at the initial consultation (Schermer et al. 2003b,

Poels et al. 2006b). Graphics of diagnostic primary care spirometry curves should, also in the future, be able to display so that their quality can be checked. Digitally saved curves will boost the transfer of original curves in the case of a consultation.

In Finland, a structured referral sheet has been widely used for decades. However, it is structured only according to administrative information, and the structure of the clinic information is less rigid. It could be feasible to develop referral letter forms for the clinical entities that handle significant public health problems. Information technology should be harnessed to serve this purpose as a part of the computerized decision support systems (Varonen et al. 2008). In a recent Cochrane review, the effectiveness and efficiency of interventions in changing referral rates or improving outpatient referral appropriateness was estimated (Akbari et al. 2008). Active local educational interventions involving secondary care specialists and structured referral sheets were the only interventions shown to have an impact on referral rates (Emslie et al. 1993, Bennett et al. 2001, Thomas et al. 2003).

A referral letter with adequate administrative and disease-specific data supports the informational continuity and timeliness of care, both are important in the management of chronic diseases. Organizational and technological solutions in the future may change interface communication (Davies and Elwyn 2006), and consultants may work more closely with primary care physicians and specialist nurses as an extended part of a care team (Gask 2005). Whether the consultation with specialists is made by telephone, by electronic letter, or face-to-face, the same crucial information is needed. In cases of suspected asthma, the referral items accepted and tested in this study are a practical tool for including relevant information in all kinds of consultations.

# 11. Conclusions

1. A high consensus was found for the content of asthma-related referral letters between primary and secondary care physicians; this finding reflects the mutual agreement of the main items dealing with asthma management. Quality criteria were set to assess asthma-related referral letters.
2. Asthma-related referral letters sent to three hospitals were evaluated against defined criteria. The administrative information was comprehensively available. The asthma-specific criteria were satisfyingly met even though only one fifth of the letters were graded as being good. Major shortcomings were the lack of information on smoking, allergies, and current medication. Copies of primary care lung function tests were included in only half of the referrals.
3. The quality of the asthma-related referral letters improved during the first 7 years of the National Asthma Programme in one hospital region, mainly due to the more active use of lung function tests. In addition, most of the other items of the asthma-related referral letter were found more often in 2001.
4. Against the visual criteria, the quality of the primary care spirometry curves sent with an asthma-related referral letter was good for 79% of the expiratory flow-volume curves included. Shortcomings were found in the clinical data contained on the spirometry report sheets.
5. Patients suspected of having asthma were more seldom referred to a specialist in 2001 than 7 years earlier. The profile of new asthma cases that were referred indicated milder disease in 2001. Trends were found towards the assignment of a more active role on the part of primary care physicians and a more rational use of secondary care resources in the management of asthma.

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Seinäjoki in April after a cold and snowy winter A.D. 2010

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# 13. References

Aaron SD, Vandemheen KL, Boulet LP, McIvor RA, Fitzgerald JM, Hernandez P, Lemiere C, Sharma S, Field SK, Alvarez GG, Dales RE, Doucette S and Fergusson D (2008): Canadian Respiratory Clinical Research Consortium. Overdiagnosis of asthma in obese and nonobese adults. *Can Med Assoc J* 179:1121–1131.

Act on Specialized Medical Care (1989): <http://www.finlex.fi/fi/laki/ajantasa/1989/19891062> (24.4.2010).

Akbari A, Mayhew A, Al-Alawi MA, Grimshaw J, Winkens R, Glidewell E, Pritchard C, Thomas R and Fraser C (2008): Interventions to improve outpatient referrals from primary care to secondary care. *Cochrane Database Syst Rev.* (4):CD005471.

Akhtar R and Wilson A (2005): A comparison of spirometry in general practice and a pulmonary function laboratory. *Prim Care Respir J* 14:215–220.

Armstrong D, Fry J and Armstrong P (1991): Doctors' perceptions of pressure from patients for referral. *BMJ* 302:1186–1188.

Asthma: Current Care Guideline (2000): Working group set up by the Finnish Medical Society Duodecim and the Finnish Respiratory Society, Helsinki, Finland. Finnish Medical Society Duodecim. Updated in 2006. [www.kaypahoito.fi](http://www.kaypahoito.fi) (in Finnish). (20.4.2010).

Asthma programme in Finland 1994–2004 (1996): *Clin Exp Allergy* 26:1–24.

ATS (American Thoracic Society) (1995): Standardization of spirometry: 1994 update. *Am J Respir Crit Care Med* 152:1107–1136.

Baker R and Fraser R (1995): Fortnightly review: development of review criteria: linking guidelines and assessment of quality. *BMJ* 311:370–373.

Barnes PJ, Jonsson B and Klim JB (1996): The costs of asthma. *Eur Respir J* 4:636–642.

Barracough R, Devereux G, Hendrick DJ and Stenton SC (2002): Apparent but not real increase in asthma prevalence during the 1990s. *Eur Respir J* 20:826–833.

Bartter T and Pratter MR (1996): Asthma: better outcome at lower cost? *Chest* 110:1589–1596.

Beasley R (2002): The burden of asthma with specific reference to the United States. *J Allergy Clin Immunol* 109:S482–S489.

Benjamin A (2008): Audit: how to do it in practice. *BMJ* 336:1241–1245.

Bennett K, Haggard M, Churchill R and Wood S (2001): Improving referrals for glue ear from primary care: are multiple interventions better than one alone? *J Health Serv Res Policy* 6:139–144.

Berendsen AJ, Benneker WH, Schuling J, Rijkers-Koorn N, Slaets JP and Meyboom-de Jong B (2006): Collaboration with general practitioners: preferences of medical specialists – a qualitative study. *BMC Health Serv Res* 6:155.

Berendsen AJ, Benneker WH, Meyboom-de Jong B, Klazinga NS and Schuling J (2007): Motives and preferences of general practitioners for new collaboration models with medical specialists: a qualitative study. *BMC Health Serv Res* 7:4.

Berendsen AJ, Kuiken A, Benneker WH, Meyboom-de Jong B, Voorn TB and Schuling J (2009): How do general practitioners and specialists value their mutual communication? A survey. *BMC Health Serv Res* 9:143.

Berta W, Barnsley J, Bloom J, Cockerill R, Davis D, Jaakkimainen L, Mior AM, Talbot Y, and Vayda E (2008): Enhancing continuity of information: essential components of a referral document. *Can Fam Physician* 55:624-625.e1-5.

Bodenheimer T. (2008): Coordinating care – a perilous journey through the health care. *N Eng J Med* 358:1064–1071.

Bodenheimer T, Wagner EH and Grumbach K (2002): Improving primary care for patients with chronic illness *JAMA* 288:1775–1779.

Bolton CE, Ionescu AA, Edwards PH, Faulkner TA, Edwards SM and Shale DJ (2005): Attaining a correct diagnosis of COPD in general practice. *Respir Med* 99:493–500.

Bourquet C, Gilchrist V, McCord G and the NEON Research Group (1998): The consultation and referral process. A report from NEON. *J Fam Pract* 46:47–53.

Bowling A and Bond M (2001): A national evaluation of specialists' clinics in primary care settings. *Br J Gen Pract* 51:264–269.

Bowling AJ and Redfern J (2000): The process of outpatient referral and care: the experiences and views of patients, their general practitioners, and specialists. *Br J Gen Pract* 50:116–120.

Braman S (2006): The global burden of asthma. *Chest* 130:4S–12S.

Brand PL, Rijcken B, Schouten JP, Koëter GH, Weiss ST and Postma DS (1992). Perception of airway obstruction in a random population sample. Relationship to airway hyperresponsiveness in the absence of respiratory symptoms. *Am Rev Respir Dis* 146:396–401.

Brander P and Salinto S (2009): The first ten years of a regional asthma programme – local treatment chain is working well. *Suom Laakaril* 64:712–718. (in Finnish).

British Asthma Guidelines Coordination Committee (1997): British guidelines on asthma management. *Thorax* 52:1–24.

British Lung Foundation (2008): Survey of GPs and respiratory specialists about their experiences of diagnosing patients with COPD and asthma. [www.lunguk.org](http://www.lunguk.org) (20.4.2010).

BTS/SIGN (British Thoracic Society and Scottish Intercollegiate Guidelines Network) (2009): British guideline on the management of asthma. [www.brit-thoracic.org.uk](http://www.brit-thoracic.org.uk) (20.4.2010).

BTS statement (2008): BTS statement on criteria for specialist referral, admission, discharge and follow-up for adults with respiratory disease *Thorax* 63:i1–i16. doi:10.1136/thx.2007.087627.

Burrows B, Lebowitz MD, Barbee RA and Cline MG (1991): Findings before diagnoses of asthma among elderly in a longitudinal study of a general population sample. *J Allergy Clin Immunol* 88:870–877.

Campbell B, Vanslembroek K, Whitehead E, Van de Wauwer C, Eifell R, Wyatt M and Campbell J (2004): Views of doctors on clinical correspondence: questionnaire survey and audit of content of letters. *BMJ* 328:1060–1061.

Campbell DT and Stanley JC (1966): *Experimental and quasi-experimental designs for research*. Rand McNally College Publishing Company, Chicago.

Campbell SM, Branspenning J, Hutchinson and A Marshall M (2002): Research methods used in developing and applying quality indicators in primary care. *Qual Saf Health Care* 11:358–364.

Chapman KR, Boulet LP, Rea RM and Franssen E (2008): Suboptimal asthma control: prevalence, detection and consequences in general practice. *Eur Respir J* 31:320–325.

Connolly MJ, Crowley JJ, Charan NB, Nielson CP and Vestal RE (1992): Reduced subjective awareness of bronchoconstriction provoked by methacholine in elderly asthmatic and normal subjects as measured on a simple awareness scale. *Thorax* 47:410–413.

Coulter A (1992): Interface between primary care and secondary care. In: Roland M, Coulter A, editors. *Hospital referrals*. Oxford University Press, Oxford. pp. 1–14.

Coulter A (1998): Managing demand at the interface between primary and secondary care. *BMJ* 316:1974–1976.

Coulter A, Noone A and Goldacre M (1989). General practitioners' referrals to specialist outpatient clinics. I. Why general practitioners refer patients to specialist outpatient clinics. *BMJ* 299:304–308.

Couper ID and Henbest RJ (1996): The quality and relationship of referral and reply letters. The effect of introducing a pro forma letter. *S Afr Med J* 86:1540–1542.

Court CS, Cook DG and Strachan DP (2002): Comparative epidemiology of atopic and non-atopic wheeze and diagnosed asthma in a national sample of English adults *Thorax* 57:951–957.

Cruz AA, Popov T, Pawankar R, Annesi-Maesano I, Fokkens W, Kemp J, Ohta K, Price D and Bousquet J (2007): ARIA Initiative Scientific Committee. Common characteristics of upper and lower airways in rhinitis and asthma: ARIA update, in collaboration with GA(2)LEN. *Allergy* 62:1–41.

Dahl R and Bjermer L (2000): Nordic consensus report on asthma management. *Respir Med* 94:299–327.

Davies M and Elwyn G (2006): Referral management centres: promising innovations or Trojan horses? *BMJ* 332:844–846.

de Alarcon R and Hodson JM (1964): Value of general practitioner's letter: a further study in medical communication. *Br Med J* 2:435–438.

Dehko – Development programme for the prevention and care of diabetes 2000–2010 Finnish Diabetes Association (2001): Gummerus Printing, Jyväskylä, Finland.

Dennis SM, Price JF, Vickers MR, Frost CD, Levy ML and Barnes PJ (2002): The management of newly identified asthma in primary care in England. *Prim Care Respir J* 11:120–122.

Dennis SM, Zwar NA and Marks GB (2009): Diagnosing asthma in adults in primary care: a qualitative study of Australian GPs' experiences. *Prim Care Respir J* pii: pcrj-2008-10-0101. doi: 10.4104/pcrj.2009.00046

Department of Health (2000): The NHS plan: a plan for investment, a plan for reform. Crown Copyright, London.

Derom E, Van Weel C, Liistro G, Buffels J, Schermer T, Lammers E, Wouters E and Decramer M (2008): Primary care spirometry. *Eur Respir J* 31:197–203.

Disease Management Association of America. [www.dmaa.org](http://www.dmaa.org) (20.4.2010).

Donabedian A (1966): Evaluating the quality of medical care. *Milbank Mem Fund Q* 44:166–206.

Donabedian A (2003): An introduction in quality assurance in health care. Oxford University Press, Oxford.

Donohoe MT, Kravitz RL, Wheeler DB, Chandra R, Chen A and Humphries N (1999): Reasons for outpatient referrals from generalists to specialists. *J Gen Intern Med* 14:281–286.

Eastwood AJ and Sheldon TA (1996): Organisation of asthma care: what difference does it make? A systematic review of the literature. *Qual Health Care* 5:134–143.

Eaton T, Withy S, Garrett JE, Mercer J, Whitlock RML and Rea HH (1999): Spirometry in primary care practice. The importance of quality assurance and the impact of spirometry workshops. *Chest* 116:416–423.

Eccles MP, Deverill M, McColl E and Richardson H (1996): A national survey of audit across the primary-secondary care interface. *Qual Health Care* 5:193–200.

Ekerljung L, Rönmark E, Larsson K, Sundblad BM, Bjerg A, Ahlstedt S, Dahlén SE and Lundbäck B (2008): No further increase of incidence of asthma: incidence, remission and relapse of adult asthma in Sweden. *Respir Med* 102:1730–1736.

Emmanuel J and Walter N (1989): Referrals from general practice to hospital outpatient department: a strategy for improvement. *Br Med J* 299:722–724.

Emslie CJ, Grimshaw JM and Templeton A (1993): Do clinical guidelines improve general practice management and referral of infertile couples? *BMJ* 306:1728–1731.

Enright P (2008): The use and abuse of office spirometry. *Prim Care Respir J* 17:238–242.

Enright PL, Lebowitz MD and Cockcroft DW (1994): Physiologic measures pulmonary function tests. *Am J Respir Crit Care Med* 149:S9–S18.

Enright PL, Studnicka M and Zielinski J (2005): Spirometry to detect and manage chronic obstructive pulmonary disease and asthma in the primary care setting. In: Gosselink R, Stam H, editors. *Lung function testing*. *Eur Respir Mono* 31:1–14.

Epstein RM (1995): Communication between primary care physicians and consultants. *Arch Fam Med* 4:403–409.

Erhola M, Makinen R, Koskela K, Bergman V, Klaukka T, Makela M, Tirkkonen L and Kaila M (2003): The asthma programme of Finland: an evaluation survey in primary health care. *Int J Tuberc Lung Dis* 7:592–598.

Evidence-based Medicine Working Group (1992): Evidence-based medicine. A new approach to the teaching of medicine. *JAMA* 268:2420–2425.

Faulkner A, Mills N, Bainton D, Baxter K, Kinnersley P, Peters TJ and Sharp D (2003): A systematic review of the effect of primary care-based service innovations on quality and patterns of referral to specialist secondary care. *Br J Gen Pract* 53:878–884.

Feder G, Griffiths C, Highton C, Eldrige S, Spence M and Southgate L (1995): Do clinical guidelines introduced with practice based education improve care of asthmatics and diabetic patients? A randomised controlled trial in general practices in east London. *BMJ* 311:1473–1478.

Ferris LE, Naylor CD, Basinski ASH, Williams JI, Llewellyn-Thomas HA and Cohen MM (1992): Program evaluation in health care. *Can Med Assoc J* 146:1301–1304.

Fertig A, Roland M, King H and Moore T (1993): Understanding variation in rates of referral among general practitioners: are inappropriate referrals important and would guidelines help to reduce rates? *Br Med J* 307:1467–1470.

Field MJ and Lohr KN (1990): *Clinical practice guidelines: directions for a new program*. Institute of Medicine, National Academy Press, Washington (DC).

Finnish statistics on medicines 2001 (2002): National Agency for Medicines and Social Insurance Institution, Helsinki. (in Finnish).

Fleming DM (1993). The European study of referrals from primary to secondary care. In: Fracchia GN and M. Theofilatou M, editors. *Health services research volume 1: biomedical and health research*. ISBN: 978-90-5199-136-9.

Forrest CB and Reid RJ (2001): Prevalence of health problems and primary care physicians' specialty referral decisions. *J Fam Pract* 50:427-432.

Forrest CB, Majeed A, Weiner JP, Carroll K, and Bindman AB (2002a): Comparison of specialty referral rates in the United Kingdom and the United States: retrospective cohort analysis. *BMJ* 325:370-371.

Forrest CB, Nutting PA, Starfield B and von Schrader S (2002b): Family physicians' referral decisions: results from the ASPN referral study. *J Fam Pract* 51:215-222.

Gandhi TK, Sittig DF, Franklin M, Sussman AJ, Fairchild D and Bates DW (2000): Communication breakdown in the outpatient referral process. *J Gen Intern Med* 15:626-631.

Garåsen H and Johnsen R (2007): The quality of communication about older patients between hospital physicians and general practitioners: a panel study assessment *BMC Health Serv Res* 7:133.

GARD (Global Alliance against Chronic Respiratory Diseases) (2006). Available from: <http://www.who.int/gard>. (20.4.2010).

Gask L (2005): Role of specialist in common chronic diseases. *BMJ* 330:651-653.

Gérvás J, Starfield B, Violán C and Minué S. GPs with special interests: unanswered questions (2007): *Br J Gen Pract* 57:912-917.

Gibson PG and Wilson AJ (1996): The use of continuous quality improvement methods to implement practice guidelines in asthma. *J Qual Clin Pract* 16:87-102.

Gibson PG, Powell H, Coughlan J, Wilson AJ, Abramson M, Haywood P, Bauman A, Hensley MJ and Walters EH (2003): Self-management education and regular practitioner review for adults with asthma. *Cochrane Database Syst Rev* (1):CD001117.

Gilbert R, Franks G and Watkin S (2005): The proportion of general practitioner referrals to a hospital respiratory medicine clinic suitable to be seen in a GPwSI respiratory clinic. *Prim Care Respir J* 14:314–319.

GINA (Global initiative for asthma) (2008): Available from: <http://www.ginasthma.org>. (20.4.2010).

Godard P, Chanez P, Siraudin L, Nicoloyannis N and Duru G (2002): Costs of asthma are correlated with severity: a 1-yr prospective study. *Eur Respir J* 19:61–67.

Goeman DP, Hogan CD, Aroni RA, Abramson MJ, Sawyer SM, Stewart K, Sanci LA and Douglass JA (2005): Barriers to delivering asthma care: a qualitative study of general practitioners. *Med J Aust* 183:457–460.

Graham PH (1994): Improving communication with specialists. The case of an oncology clinic. *Med J Aust* 160:625–627.

Grampian Asthma Study of Integrated Care (GRASSIC) (1994): Integrated care for asthma: a clinical, social and economical evaluation. *Br Med J* 308:559–564.

Griffiths C, Foster G, Barnes N, Eldridge S, Tate H, Begum S, Wiggins M, Dawson C, Livingstone AE, Chambers M, Coats T, Harris R and Feder GS (2004): Specialist nurse intervention to reduce unscheduled asthma care in a deprived multiethnic area: the east London randomised controlled trial for high risk asthma (ELECTRA). *BMJ* 328:144.

Grimshaw J, Freemantle N, Wallace S, Russell I, Hurwitz B, Watt I, Long A and Sheldon T (1995) Developing and implementing clinical practice guidelines. *Qual Health Care* 4:55–64.

Grol R, Rooijackers-Lemmers N, Van Kaathoven L, Wollersheim H and Mokkink H (2003): Communication at the interface: do better referral letters produce better consultant replies? *Br J Gen Pract* 53:217–219.

Grumbach K, Selby JV, Damberg C, Bindman AB, Quesenberry C Jr, Truman A and Uratsu C (1999): Resolving the gatekeeper conundrum: what patients value in primary care and referrals to specialists. *JAMA* 282:261–266.

Haahtela T (1999): Early treatment of asthma. *Allergy* 49:74–81.

Haahtela T, Järvinen M, Kava T, Kiviranta K, Koskinen S, Lehtonen K, Nikander K, Persson T, Reinikainen K, Selroos O, Sovijärvi A, Stenius-Aarniala B, Svahn T, Tammivaara R and Laitinen LA (1991): Comparison of a B<sub>2</sub>-agonist, terbutaline,

with an inhaled corticosteroid, budesonide in newly detected asthma. *N Engl J Med* 325:388–392.

Haahtela T, Järvinen M, Kava T, Kiviranta K, Koskinen S, Lehtonen K, Nikander K, Persson T, Selroos O, Sovijärvi A, Stenius-Aarniala B, Svahn T, Tammivaara R and Laitinen LA (1994): Effects of reducing or discontinuing inhaled budesonide in patients with mild asthma. *N Engl J Med* 331:700–705.

Haahtela T, Klaukka T, Koskela K, Erhola M and Laitinen LA (2001): Asthma Programme in Finland: a community problem needs community solution. *Thorax* 56:806–814.

Haahtela T, Tuomisto LE, Pietinalho A, Klaukka T, Erhola M, Kaila M, Nieminen MM, Kontula E and Laitinen LA (2006): A ten-year asthma programme in Finland: major change for the better. *Thorax* 61:663–670.

Haahtela T, von Hertzen L, Mäkelä M, Hannuksela M and Allergy Programme Working Group (2008): Finnish allergy programme 2008–2018 – time to act and change the course. *Allergy* 63:634–645.

Haggerty JL, Reid RJ, Freeman GK, Starfield BH, Adair CE and McKendry R (2003): Continuity of care: a multidisciplinary review. *BMJ* 327:1219–1221.

Halbert RJ and Isonaka S (2006): International Primary Care Respiratory Group (IPCRG) guidelines: integrating diagnostic guidelines for managing chronic respiratory diseases in primary care. *Prim Care Respir J* 15:13–19.

Hampson JP, Roberts RI and Morgan DA (1996): Shared care: a review of the literature. *J Fam Pract* 13:264–279.

Hansen JP, Brown SE, Sullivan RJ Jr. and Muhlbaier LH (1982): Factors related to an effective referral and consultation process. *J Fam Pract* 15:651–666.

Harju S (1993). Sairaanhoidon porrastus. Thesis. *Acta Universitatis Tamperensis se A* vol 372. University of Tampere, Tampere. (in Finnish).

Hart JT and Marinker M (1985): An exchange of letters. MSD Foundation, London.

Haughney J, Barnes G, Partridge M and Cleland J (2004): The living & breathing study: a study of patients' views of asthma and its treatment. *Prim Care Respir J* 13:28–35.

Hearnshaw HM, Harker RM, Cheater FM, Baker RH and Grimshaw GM (2003): Are audits wasting resources by measuring the wrong things? A survey of methods to select audit review criteria. *Qual Saf Health Care* 12:24–28.

Hedman J, Kaprio J, Poussa T and Nieminen MM (1999): Prevalence of asthma, aspirin intolerance, nasal polyps and chronic obstructive pulmonary disease in a population-based study. *Int J Epidemiol* 28:717–722.

Hickman M, Drummond N and Grimshaw J (1994): The operation of shared care for chronic disease. *Health Bull* 52:118–126.

Hollins J, Veitch C and Hays R (2000): Interpractitioner communication: telephone consultations between rural general practitioners and specialists. *Aust J Rural Health* 8:227–231.

Hull F and Westerman R (1986): Referral to medical outpatients department at teaching hospitals in Birmingham and Amsterdam. *Br Med J* 293:311–314.

Hurd SS, Lenfant C (1992): The National Heart, Lung and Blood Institute asthma program. *Chest* 101:359S-361S.

Ikäheimo P (2008): Asthma in Finnish adults – a register-based questionnaire study performed in the year 2000. Thesis. *Acta Universitatis Oulu D 965*. Oulu University Press, Oulu. (in Finnish).

Jacobs LG and Pringle MA (1990): Referral letters and replies from orthopaedic departments: opportunities missed. *BMJ* 301:470–473.

James AL and Wenzel S (2007): Clinical relevance of airway remodelling in airway diseases. *Eur Respir J* 30:134–155.

Jamtvedt G, Young JM, Kristoffersen DT, O'Brien MA and Oxman AD (2006): Audit and feedback: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev* (2):CD000259.

Jankowski RF (2001): Implementing national guidelines at local level: changes in clinicians' behaviour in primary care need to be reflected in secondary care. *BMJ* 322:1258–1259.

Jans MP, Schellevis FG, Van Hensbergen W, Dukkers Van Emden T and Van Eijk JTHM (1998): Management of asthma and COPD patients: feasibility of the application of guidelines in general practice. *Int J Qual Health Care* 10:27–34.

Järvinen K, Rekola M and Korhonen O (1990): Spirometriatutkimus – voiko tutkimukseen luottaa. *Suom Lääkäril* 31:2772–2773. (in Finnish).

Jenkins RM (1993): Quality of general practitioners referrals to outpatient departments: assessment by specialists and general practitioner. *Br J Gen Pract* 43:111–113.

Jenkins S, Arroll B, Hawken S and Nicholson R (1997): Referral letters: are form letters better? *Br J Gen Pract* 47:107–108.

Jiwa M, Coleman M and McKinley RK (2005): Measuring the quality of referral letters about patients with upper gastrointestinal symptoms. *Postgrad Med J* 81:467–469.

Jiwa M, Arnet H, Bulsara M, Ee HC and Harwood A (2009): What is the importance of the referral letter in the patient journey? A pilot survey in Western Australia. *Qual Prim Care* 17:31–36.

Johnson PH, Wilkinson I, Sutherland AM, Johnston ID and Hall IP (1998): Improving communication between hospital and primary care increases follow-up rates for asthmatic patients following casualty attendance. *Respir Med* 92:289–291.

Kaplan AG, Balter MS, Bell AD, Kim H and McIvor RA (2009): Diagnosis of asthma in adults. *Can Med Assoc J* 181:E210–220.

Karjalainen A, Kurppa K, Martikainen R, Klaukka T and Karjalainen J (2001): Work is related to a substantial portion of adult-onset asthma incidence in the Finnish population. *Am J Respir Crit Care Med* 164:565–568.

Kasje WN, Denig P, De Graeff PA and Haaijer-Ruskamp FM (2004): Physicians' views on joint treatment guidelines for primary and secondary care. *Int J Qual Health Care* 16:229–236.

Keistinen T, Tuuponen T and Kivelä SL (1993): Asthma related hospital treatment in Finland: 1972–86. *Thorax* 48:44–47.

Kekki P (1979): Lääkärintodistusten laatu diagnostisella lopputulosmenetelmällä arvioiden. *Suom Lääkäril* 21:1615–1621. (in Finnish).

Kendrick AH, Higgs CM, Whitfield MJ and Laszlo G (1993): Accuracy of perception of severity of asthma: patients treated in general practice. *BMJ* 307:422–424.

Kentish R, Jenkins P and Lask B (1987): Study of written communication between general practitioners and departments of child psychiatry. *J Roy Coll Gen Pract* 37:162–163.

Ketola E, Mäkelä J, Hagman E and Kupiainen Outi (2001): Yleislääkärikonsulttitoiminta Helsingissä. *Suom Lääkäril* 56:1297–1301. (in Finnish).

Khunti K, Baker R, Rumsey M and Lakhani M (1999): Approaches to the organization of multipractice audits in primary health care in the UK. *Int J Qual Health Care* 11:291–226.

Killian KJ, Watson R, Otis J, St Amand TA and O'Byrne PM (2000): Symptom perception during acute bronchoconstriction. *Am J Respir Crit Care Med* 162:490–496.

Kilpeläinen M, Terho EO, Helenius H and Koskenvuo M (2002): Childhood farm environment and asthma and sensitization in young adulthood. *Allergy* 57:1130–1135.

Kim Y, Chen AH, Keith E, Yee HF Jr and Kushel MB (2009): Not perfect, but better: primary care providers' experiences with electronic referrals in a safety net health system. *J Gen Intern Med* 24:614–619.

Knotterus JA, Joosten J and Daams J (1990): Comparing the quality of referrals of general practitioners with high and average referral rates: an independent panel review. *Br J Gen Pract* 40:178–181.

Kolnaar B, Beissel E, Van den Bosch WJ, Folgering H, Van den Hoogen HJ and Van Weel C (1994): Asthma in adolescents and young adults: Screening outcome versus diagnosis in general practice. *Fam Pract* 11:133–140.

Kotaniemi JT, Lundbäck B, Nieminen MM, Sovijärvi AR and Laitinen LA (2001): Increase of asthma in adults in northern Finland? A report from the FinEsS study. *Allergy* 56:169–174.

Kripalani S, LeFevre F, Phillips CO, Williams MV, Basaviah P and Baker DW (2007): Deficits in communication and information transfer between hospital-based and primary care physicians. *JAMA* 297:831–841.

Kvamme OJ, Olesen F and Samuelsson M (2001): Improving the interface between primary and secondary care: a statement from the European Working Party on Quality in Family Practice (EQuIP). *Qual Health Care* 10:33–39.

Lachman PI and Stander IA (1991): The referral letter – a problem of communication. *S Afr Med J* 79:98–100.

Lahdensuo A, Haahtela T, Herrala J, Kava T, Kiviranta K, Kuusisto P, Perämäki E, Poussa T, Saarelainen S and Svahn T (1996): Randomised comparison of guided self management and traditional treatment of asthma over one year. *BMJ* 312:748–52.

Laitinen T, Räsänen M, Kaprio J, Koskenvuo M and Laitinen LA (1998): Importance of genetic factors in adolescent asthma. *Am J Respir Crit Care Med* 157:1073–1078.

Laitinen LA, Koskela K and the Expert Advisory Group (1999): Chronic bronchitic and chronic obstructive pulmonary disease: Finnish national guidelines for prevention and treatment 1998–2007. *Respir Med* 93:297–332.

Landis JR and Koch GG (1977): The measurement of observer agreement for categorical data. *Biometrics* 33:159–174.

Lauslahti S (2006): Kunnan erikoissairaanhoidon kustannushallinnan keinot ja niiden käyttämisen esteet. Thesis. *Acta Universitas Tamperensis* 1216. University of Tampere, Tampere. (in Finnish).

Latva-Nevala A, Särmö A and Leisti S (1995): The quality of referral and consultation Etelä-Pohjanmaan malli, julkaisu 9. Etelä-Pohjanmaan sairaanhoitopiiri. (in Finnish).

Lembcke PA (1956): Medical auditing by scientific methods: illustrated by major female pelvic surgery. *JAMA* 162:646–655.

Levy ML, Robb M, Allen J, Doherty C, Bland JM and Winter RJ (2000): A randomized controlled evaluation of specialist nurse education following accident and emergency department attendance for acute asthma. *Respir Med* 94:900–908.

Levy ML, Fletcher M, Price DB, Hausen T, Halbert RJ and Yawn BP (2006): International Primary Care Respiratory Group (IPCRG) guidelines: diagnosis of respiratory diseases in primary care. *Prim Care Respir J* 15:20–34. [http://www.ipagguide.org/IPAG\\_copyright\\_draft.pdf](http://www.ipagguide.org/IPAG_copyright_draft.pdf) (20.4.2010).

Levy ML, Quanjer PH, Booker R, Cooper BG, Holmes S and Small IR (2009): Diagnostic spirometry in primary care proposed standards for general practice compliant with American Thoracic Society and European Respiratory Society recommendations. *Prim Care Respir J* 18:130–147.

Liistro G, Vanwelde C, Vincken W, Vandevoorde J, Verleden G, Buffels J and COPD Advisory Board (2006): Technical and functional assessment of 10 office spirometers: a multicenter comparative study. *Chest* 130:657–665.

Li JTC and O’Connell EJ (1996): Clinical evaluation of asthma. *Ann Allergy Asthma Immunol* 76:1–14.

Li JT, Sheeler RD, Offord KP, Patel AM and Dupras DM (1999): Consultation for asthma: results of a generalist survey. *Ann Allergy Asthma Immunol* 83:203–206.

Linden A, Adams J, Roberts N (2003): Evaluation methods in disease management: determining program effectiveness. Position Paper for the Disease Management Association of America (DMAA). [http://www.dmaa.org /pdf/Evaluation\\_Methods\\_in\\_DM.pdf](http://www.dmaa.org/pdf/Evaluation_Methods_in_DM.pdf) (20.4.2010).

Little P, Dorward M, Warner G, Stephens K, Senior J and Moore M (2004): Importance of patient pressure and perceived pressure and perceived medical need for investigations, referral, and prescribing in primary care: nested observational study. *BMJ* 328:444.

Lötvall J, Ekerljung L, Rönmark EP, Wennergren G, Lindén A, Rönmark E, Torén K, and Lundbäck B (2009): West Sweden Asthma Study: prevalence trends over the last 18 years argues no recent increase in asthma. *Respir Res* 10:94.

Love M, Mainous AG, Talbert JC and Hager GL (2000): Continuity of care and the physician-patient relationship. *Fam Pract* 49:998–1004.

Lundbäck B, Rönmark E, Jönsson E, Larsson K and Sandström T (2001): Incidence of physician-diagnosed asthma in adults – a real incidence or a result of increased awareness? Report from The Obstructive Lung Disease in Northern Sweden Studies. *Respir Med* 95:685–692.

Lusuardi M, De Benedetto F, Paggiaro P, Sanguinetti CM, Brazzola G, Ferri P and Donner CF (2006): A randomized controlled trial on office spirometry in asthma and COPD in standard. *Chest* 129:844–852.

Maciejewski ML, Chen SY and Au DH (2009): Adult asthma disease management: An analysis of studies, approaches, outcomes and methods. *Respir Care* 54:878–886.

Mageaan R (1986): Study of "discharge communications" from hospital. *BMJ* 293:1283–1284.

Magnus P and Jaakkola JJ (1997): Secular trend in the occurrence of asthma among children and young adults: critical appraisal of repeated cross sectional surveys. *BMJ* 314:1795–1799.

Marinker M (1988): The referral system. *J R Coll Gen Pract* 38:487–491.

Marinker M, Wilkin D and Metcalfe D (1988): Referral to hospital: can we do better? *BMJ* 297:461–464.

Marklund B, Tunsäter A and Bengtsson C (1999): How often is the diagnosis bronchial asthma correct? *Fam Pract* 16:112–116.

Marshall MN (1998): How well do general practitioners and hospital consultants work together? A qualitative study of cooperation and conflict within the medical profession. *Br J Gen Pract* 48:1379–1382.

Masoli M, Fabian D, Holt S and Beasley R (2004): Global initiative for asthma (GINA) program. The global burden of asthma: executive summary of the GINA Dissemination Committee report. *Allergy* 59:469–478.

McConnell D, Butow PN and Tattersall MHN (1999): Improving the letters we write: an exploration of doctor-doctor communication in cancer care. *Br J Cancer* 80:427–437.

McCormack MC and Enright P (2008): Making the diagnosis of asthma. *Respir Care* 53:583–589.

McMullan JJ and Barr A (1964): Outpatient letters: a study in communication. *J Coll Gen Pract* 7:66–75.

McPhee SJ, Lo B, Saika GY and Meltzer R (1984): How good is communication between primary care physicians and subspecialty consultants? *Arch Intern Med* 144:1265–1268.

Melville C, Hands S and Jones P (2002): Randomised trial of the effects of structuring clinic correspondence. *Arch Dis Child* 86:374–375.

Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, Crapo R, Enright P, Van der Grinten CP, Gustafsson P, Jensen R, Johnson DC, MacIntyre N, McKay R, Navajas D, Pedersen OF, Pellegrino R, Viegi G and Wanger J (2005): Standardisation of spirometry. *Eur Respir J* 26:319–338.

Montalto M (1995): Using referral letters to measure quality and performance in general practice. *J Qual Clin Pract* 15:45–50.

Montnémy P, Hansson L, Lanke J, Lindholm L-H, Nyberg P, Löfdahl C-G and Ädelroth E (2002): Accuracy of a first diagnosis of asthma in primary health care. *Fam Pract* 19:365–368.

Murray M (2002): Reducing waits and delays in the referral process. *Fam Pract Manag* 9:39–42.

Nathell L, Larsson K and Jensen I (2002): Determinants of undiagnosed asthma. *Allergy* 57:687–693.

Navarro CM, Miranda IA, Onofre MA and Sposto MR (2002): Referral letters in oral medicine: standard versus non-standard letters. *Int J Oral Maxillofac Surg* 31:537–543.

Neville R (1995): Two approaches to effective asthma audit. *Practitioner* 239:203–205.

Neville RG and Higgins BG (1999): Providing better asthma care: what is there left to do? *Thorax* 54:813–817.

Newton J, Eccles M and Hutchinson A (1992): Communication between general practitioners and consultants: what should their letters contain? *BMJ* 304:821–824.

Newton J, Hutchinson A, Hayes V, McColl E, Mackee I and Holland C (1994): Do clinicians tell each other enough? An analysis of referral communications in two specialties. *Fam Pract* 11:15–20.

NHLBI/WHO (National Heart, Lung and Blood Institute and the World Health Organization) (1995): Global strategy for asthma management and prevention. NHLBI/WHO Workshop Report.

NICE (National Institute for Health and Clinical Excellence) (2002): Principles of best practice clinical audit. NICE, London.

O'Donnell CA (2000): Variation in GP referral rates: what can we learn from the literature? *Fam Pract* 17:462–471.

Osman LM, Abdalla MI, Russell IT, Fiddes J, Friend JA, Legge JS and Douglas JG (1996): Integrated care for asthma: matching care to the patient. *Eur Respir J* 9:444–448.

Øvretveit J (1998): Evaluating health interventions. Open University Press, Maidenhead.

Øvretveit J (2002): Action evaluation of health programmes and changes. Radcliffe Medical Press, Oxon.

Pallasaho P, Lundbäck B, Läspä SL, Jönsson E, Kotaniemi J, Sovijärvi AR and Laitinen LA (1999): Increasing prevalence of asthma but not of chronic bronchitis in Finland? Report from the FinEsS-Helsinki Study. *Respir Med* 93:798–809.

Partridge M (2001): The profile of respiratory conditions: why government action is necessary. *Thorax* 56:744–745.

Partridge M (2007): Asthma 1987–2007. What have we achieved and what are the persisting challenges? *Prim Care Respir J* 16:145–148.

Pearce N, Pekkanen J and Beasley R (1999): How much asthma is really attributable to atopy? *Thorax* 54:268–272.

Pearson M, Ayres JG, Sarno M, Massey D and Price D (2006): Diagnosis of airway obstruction in primary care in the UK: the CADRE (COPD and Asthma Diagnostic/management REassessment) programme 1997–2001. *Int J Chron Obstruct Pulmon Dis* 1:435–443.

Pellegrino R, Viegi G, Brusasco V, Crapo RO, Burgos F, Casaburi R, Coates A, Van der Grinten CP, Gustafsson P, Hankinson J, Jensen R, Johnson DC, MacIntyre N, McKay R, Miller MR, Navajas D, Pedersen OF and Wanger J (2005): Interpretative strategies for lung function tests. *Eur Respir J* 26:948–968.

Piirilä P, Pietinalho A, Loponen M, Naumanen H, Nurminen M, Siukola A, Korhonen O, Koskela K and Sovijärvi A (2002): The quality of spirometric examinations in Finland: results from a national questionnaire survey. *Clin Physiol Funct Imaging* 22:233–239.

Poels PJ, Schermer TR, Jacobs A, Akkermans RP, Hartman J, Bottema BJ and Van Weel C (2006a): Variation in spirometry utilization between trained general practitioners in practices equipped with a spirometer. *Scand J Prim Health Care* 24:81–87.

Poels PJ, Schermer TR, Van Weel C and Calverley PM (2006b): Spirometry in chronic obstructive pulmonary disease. *BMJ* 333:870–871.

Postma DS (2003): Guidelines and shared care for asthma and COPD. *Neth J Med* 61:63–64.

Preston C, Cheater F, Baker R and Hearnshaw H (1999): Left in limbo: patients' views on care across the primary/secondary interface. *Qual Health Care* 8:16–21. Primary Health Care Act 66/1972 <http://www.finlex.fi/en/laki/kaannokset/1972/en19720066> (24.4.2010).

Puhakka M, Ryyänen O-P, Palomäki P, Anttonen V, Jukola R and Takala J (2003a): Terveyskeskuksesta kirjoitettujen läheteiden tarpeellisuus. *Suom Lääkäril* 58:2556–2561. (in Finnish).

Puhakka M, Ryyänen O-P, Palomäki P, Anttonen V, Jukola R and Takala J (2003b): Sairaalaan lähettämisen aiheet ja perusteet. *Suom Lääkäril* 58:2562–2566. (in Finnish)

Puhakka M, Ryyänen O-P, Palomäki P, Anttonen V, Jukola R and Takala J (2006): Lähete erikoissairaanhoidon. Lääkäripaneelin arvio läheteiden laadusta, seuraamuksista ja niiden tuottamasta hyödystä potilaalle. *Suom Lääkäril* 61:5205–5209. (in Finnish).

Rabe KF, Vermeire PA, Soriano JB and Maier WC (2000): Clinical management of asthma in 1999: the asthma insights and reality in Europe (AIRE) study. *Eur Respir J* 16:802–807.

Rabe KF, Adachi M, Lai CK, Soriano JB, Vermeire PA, Weiss KB and Weiss ST (2004): Worldwide severity and control of asthma in children and adults: the global asthma insight and reality surveys. *J Allergy Clin Immunol* 114:40–47.

Rawal J, Barnett P and Lloyd BW (1993): Use of structured letters to improve communication between hospital doctors and general practitioners. *BMJ* 307:1044.

Reid RJ and Wagner EH (2008): Strengthening primary care with better transfer of information. *Can Med Assoc J* 179:987–988.

Riikonen A (1972): Kokonaan korvattavia lääkkeitä koskevien lääkärintodistusten tarkoituksenmukaisuudesta. Thesis. Helsingin yliopisto. (in Finnish).

Rogers J and Curtis P (1980): The concept and measurement of continuity in primary care. *Am J Public Health* 70:122–127.

Roland M (1992): Measuring appropriateness of hospital referrals. In: Roland M and Coulter A, editors. *Hospital referrals* Oxford University Press, Oxford. pp. 136–149.

Roland M (2005): General practitioners with special interests – not a cheap option. *BMJ* 331:1448–1449.

Rosemann T, Wensing M, Rueter G and Szecsenyi J (2006): Referrals from general practice to consultants in Germany: If the GP is the initiator, patients' experience are more positive. *BMC Health Serv Res* 6:5.

Salathia K and McIlwaine WJ (1995): General practitioner and hospital letters. *Ulster Med J* 64:46–50.

Salem-Schatz S, Moore G, Rucker M and Pearson SD (1994): The case for case-mix adjustment in practice profiling. When good apples look bad. *JAMA* 272:871–874.

Schneider A, Gindner L, Tilemann L, Schermer T, Dinant GJ, Meyer FJ and Szecsenyi J (2009): Diagnostic accuracy of spirometry in primary care. *BMC Pulm Med* 9:31.

Schermer T, Smeenk F and Van Weel C (2003a): Referral and consultation in asthma and COPD: an exploration of pulmonologists' views. *Neth J Med* 61:71–81.

Schermer TR, Jacobs JE, Chavannes NH, Hartman J, Folgering HT, Bottema BJ and Van Weel C (2003b): Validity of spirometric testing in a general practice population of patients with chronic obstructive pulmonary disease (COPD). *Thorax* 58:861–866.

Shadish WR (2006): The common threads in program evaluation. *Prev Chronic Dis* 3:A03. [http://www.cdc.gov/pcd/issues/2006/jan/05\\_0166.htm](http://www.cdc.gov/pcd/issues/2006/jan/05_0166.htm) (20.4.2010).

Shadish WR, Cook TD and Leviton LC (1991): *Foundations of program evaluation: theories of practice*. SAGE Publications, Thousand Oaks (CA).

Shaw CD and Costain DW (1989): Guidelines for medical audit: seven principles. *BMJ* 299:498–499.

Shortell SM and Richardson WC (1978): *Health program evaluation*. CV Mosby Company, Saint Louis.

Sin DD and Sutherland ER (2008): Obesity and the lung: 4. Obesity and asthma. *Thorax* 63:1018–1023.

Sosiaali- ja terveystministeriö (1994): *Astmaohjelma 1994–2004*. Sosiaali- ja terveystministeriön työryhmämuistio 1994:16. (in Finnish).

Sosiaali- ja terveystministeriö (2005): *Yhtenäiset kiireettömän hoidon perusteet*. Yliopistopaino, Helsinki. 2005. (in Finnish).

Sovijärvi ARA, Piirilä P, Korhonen O, Louhiluoto E, Pekkanen L and Forstedt M (1995): Performance and evaluation of spirometric and PEF-measurements. *Moodi, offprint 3. Kliinisten Laboratoriotutkimusten Laaduntarkkailu Oy, KP-paino, Kokkola.* (in Finnish).

Starfield B (2003): Primary and specialty care interfaces: the imperative of disease continuity. *Br J Gen Pract* 53:723–729.

Starfield B, Forrest CB, Nutting PA and von Schrader S (2002): Variability in physician referral decisions. *J Am Board Fam Pract* 15:473–480.

Steuten L (2009): How to move from belief to proof? Articulating the value of chronic disease and care management programs for adults with asthma. *Respir Care* 54:844–846.

Steuten L, Vrijhoef B, Van Merode F, Wesseling GJ and Spreeuwenberg C (2006): Evaluation of a regional disease management programme for patients with asthma or chronic obstructive pulmonary disease. *Int J Qual Health Care* 18:429–436.

Suchman EA (1967). *Evaluative research.* Russell Sage Foundation, New York.

Sullivan CO, Omar RZ, Ambler G and Majeed A (2005): Case-mix and variation in specialist referrals in general practice. *Br J Gen Pract* 55:529–533.

Sunyer J, Antó JM, Kogevinas M, Barceló MA, Soriano JB, Tobias A, Muniozguren N, Martinez-Moratalla J, Payo F and Maldonado JÁ (1997): Risk factors for asthma in young adults Spanish Group of the European Respiratory Health Survey. *Eur Resp J* 10:2490–2494.

Suomen itsenäisyyden juhluvuoden 1967 rahasto (1980): *Astma. Tutkimus- ja hoitoohjelma N:o 5.* Helsinki. (in Finnish).

Swanson V, Wright S, Power KG, Duncan B, Morgan J, Turner E and Gordon D (2000): The impact of a structured programme of asthma care in general practice. *Int J Clin Pract* 54:573–580.

Sweeney B (1994): The referral system. *BMJ* 309:1180–1181.

Tattersall MHN, Butow PN, Brown JE and Thompson JF (2002): Improving doctors' letters. *Med J Aust* 177:516–520.

Teeter JG and Bleeker ER (1998): Relationships between airway obstruction and respiratory symptoms in adult asthmatics. *Chest* 113:272–277.

Thiadens HA, de Bock GH, Dekker FW, Huysman JA, Van Houwelingen JC, Springer MP and Postma DS (1998): Identifying asthma and chronic obstructive pulmonary disease in patients with persistent cough presenting to general practitioners: descriptive study. *BMJ* 316:1286–1290.

Thiadens HA, De Bock GH, Van Houwelingen JC, Dekker FW, De Waal MW, Springer MP and Postma DS (1999): Can peak expiratory flow measurements reliably identify the presence of airway obstruction and bronchodilator response as assessed by FEV1 in primary care patients presenting with a persistent cough? *Thorax* 54:1055–1060.

Thomas RE, Grimshaw JM, Mollison J, McClinton S, McIntosh E, Deans H and Repper J (2003): Cluster randomized trial of a guideline-based open access urological investigation service. *Fam Pract* 20:646–654.

Torén K, Brisman J and Järholm B (1993): Asthma and asthma-like symptoms in adults assessed by questionnaires. A literature review. *Chest* 104:600–608.

Torén K and Blanc PD (2009): Asthma caused by occupational exposures is common - a systematic analysis of estimates of the population-attributable fraction. *BMC Pulm Med* 9:7.

Toivanen A (1997): Referral to a hospital. Thesis. *Acta Universitatis Turkuensis ser C* 125. University of Turku, Turku. (in Finnish)

Van Damme R, Drummond N, Beattie J and Douglas G (1994): Integrated care for patients with asthma: views of general practitioners. *Br J Gen Pract* 44:9–13.

Van Schayck CP, Van der Heijden FMMA, Van den Boom G, Tirimanna PRS and Van Herwaarden CLA (2000): Underdiagnosis of asthma: is the doctor or the patient to blame? The DICMA project. *Thorax* 55:562–565.

Van Schayck CP, Loozen JM, Wagena E, Akkermans RP and Wesseling GJ (2002): Detecting patients at a high risk of developing chronic obstructive pulmonary disease in general practice: cross sectional case finding study. *BMJ* 324:1370.

Varonen H, Jousimaa J, Helin-Salmivaara A and Kunnamo I (2005): Electronic primary care guidelines with links to Cochrane reviews – EBM Guidelines. *Fam Pract* 22:465–469.

- Varonen H, Kortteisto T, Kaila M and the EBMeDS Study Group (2008): What may help or hinder the implementation of computerized decision support systems (CDSSs): a focus group study with physicians. *Fam Pract* 25:162-7.
- Vehviläinen AT, Kumpusalo EA and Takala JK (1996a): Feedback information from specialists to general practitioners in Finland. *Eur J Gen Pract* 2:55–57.
- Vehviläinen AT, Kumpusalo EA, Voutilainen SO and Takala JK (1996b): Does the doctors' professional experience reduce referral rates? Evidence from the Finnish referral study. *Scand J Prim Health Care* 14:13–20.
- Vehviläinen AT, Kumpusalo EA and Takala JK (1997): Reasons for referral from general practice in Finland. *Scand J Prim Health Care* 15:43–47.
- Viljanen AA, Halttunen PK, Kreuz KE and Viljanen BC (1982): Spirometric studies in non-smoking health adults. *Scand J Clin Lab Invest* 159:5–20.
- Von Hertzen L and Haahtela T (2005): Signs of reversing trends in prevalence of asthma. *Allergy* 60:283–292.
- Von Hertzen L and Haahtela T (2006): Disconnection of man and the soli: reason for the asthma and atopy epidemic? *J Allergy Clin Immunol* 117:334–344.
- Von Mutius E (2007): Asthma and allergies in rural areas of Europe. *Proc Am Thorac Soc* 4:212–216.
- Vuorenkoski L, Mladovsky P and Mossialos E (2008): Finland: health system review. *Health Syst Transition* 10:1–168.
- Wagner EH (1998): Chronic disease management: what will it take to improve care for chronic illness? *Eff Clin Pract* 1:2–4.
- Walker P.P, Mitchell P, Diamantea F, Warburton C.J and Davies L (2006): Effect of primary care spirometry on the diagnosis and management of COPD. *Eur Respir J* 28:945–952.
- Wallace P, Haines A, Harrison R, Barber J, Thompson S, Jacklin P, Roberts J, Lewis L, Wainwright P and Virtual Outreach Project Group (2002): Joint teleconsultations (virtual outreach) versus standard outpatient appointments for patients referred by their general practitioner for a specialist opinion: a randomised trial. *Lancet* 359:1961–1968.
- Weiland SK and Pearce N (2004): Asthma prevalence in adults: good news? *Thorax* 59:637–638.

Westerman R, Hull F, Bezember P and Gort G (1990): A study of communication between general practitioners and specialists. *Br J Gen Pract* 40:445–449.

White P, Wong W, Fleming T and Gray B (2007): Primary care spirometry: test quality and the feasibility and usefulness of specialist reporting. *Br J Gen Pract* 57:701–705.

WHO (World Health Organization) (2002): WHO strategy for prevention and control of chronic respiratory diseases. WHO, Geneva.

WHO (World Health Organization) (2008): Practical approach to lung health (PAL). Manual on initiating PAL implementation. WHO, Geneva.

Wieringa MH, Vermeire PA, Brunekreef B and Weyler JJ (2001): Increased occurrence of asthma and allergy: critical appraisal of studies using allergic sensitization, bronchial hyperresponsiveness and lung function measurements. *Clin Exp Allergy* 31:1553–1563.

Wijnhoven HA, Kriegsman DM, Hesselink AE, de Haan M and Stalman W (2004): Disease control in general practice patients with asthma. *Prim Care Respir J* 13:89–98.

Wilson DH, Appleton SL, Adams R and Ruffin RE (2005): Undiagnosed asthma in older people: an underestimated problem. *Med J Aust* 183:S20–S22.

Wilkin D and Smith AG (1987): Variation in general practitioners' referral rates to consultants. *J R Coll Gen Pract* 37:350–353.

Williams PT and Peet G (1994): Differences in the value of clinical information: referring physicians versus consulting specialists. *J Am Board Fam Pract* 7:292–302.

Williamson JW (1971): Evaluating quality of patient care. A strategy relating outcome and process assessment. *JAMA* 218: 564–569.

Woolcock A, Rubinfeld AR, Seale JP, Landau LL, Antic R, Mitchell C, Rea HH, Zimmerman P (1989). Thoracic society of Australia and New Zealand. Asthma management plan 1989. *Med J Aust* 151:650–653.

Yoo KH, Molis WE, Weaver AL, Jacobson RM and Juhn YJ (2007): The impact of electronic medical records on timeliness of diagnosis of asthma. *J Asthma* 44:753–758.

Young DW, Parkes J, Davis WA, Harman D and Williams RS (1985): Out-patient letters: requirement and contents. *Eff Health Care* 2:225–229.

Zeiger RS, Heller S, Mellon MH, Wald J, Falkoff R and Schatz M (1991): Facilitated referral to asthma specialist reduces relapses in asthma emergency room visits. *J Allergy Clin Immunol* 87:1160–1168.

# 14. Appendix

**APPENDIX** *Gradings of the administrative criteria between the three groups of physicians (score 2= very necessary. score 1= necessary. score 0= unnecessary).*

ADMINISTRATIVE CRITERIA	Score	Pulmonary chief physicians		Local asthma co-ordinator physicians		Chief general physicians		Total		p-value*
1 Separative referral text	2	20	69.0%	51	51.5%	57	53.3%	128	54.5%	0.24
	1	8	27.6%	46	46.5%	40	37.4%	94	40.0%	
	0	1	3.4%	2	2.0%	10	9.3%	13	5.5%	
	Total	29	100.0%	99	100.0%	107	100.0%	235	100.0%	
2 Clear reason for referral	2	23	79.3%	52	53.1%	69	63.9%	144	61.3%	0.029 (0.033)
	1	6	20.7%	46	46.9%	38	35.2%	90	38.3%	
	0	0	0%	0	0%	1	0.9%	1	0.4%	
	Total	29	100.0%	98	100.0%	108	100.0%	235	100.0%	
3 Patient's contact data	2	28	96.6%	95	96.0%	107	98.2%	230	97.0%	0.63
	1	1	3.4%	4	4.0%	2	1.8%	7	3.0%	
	Total	29	100.0%	99	100.0%	109	100.0%	237	100.0%	
4 Referring physician's contact data	2	26	89.7%	84	84.8%	95	87.2%	205	86.5%	0.77
	1	3	10.3%	14	14.1%	14	12.8%	31	13.1%	
	0	0	0%	1	1.0%	0	0%	1	0.4%	
	Total	29	100.0%	99	100.0%	109	100.0%	237	100.0%	
5 Classification of the urgency rate	2	13	44.8%	19	19.2%	36	33.0%	68	28.7%	0.011 (0.040)
	1	13	44.8%	75	75.8%	67	61.5%	155	65.4%	
	0	3	10.3%	5	5.1%	6	5.5%	14	5.9%	
	Total	29	100.0%	99	100.0%	109	100.0%	237	100.0%	
6 Date of the referral	2	24	82.8%	73	73.7%	82	75.2%	179	75.5%	0.61
	1	5	17.2%	25	25.3%	27	24.8%	57	24.1%	
	0	0	0%	1	1.0%	0	0%	1	0.4%	
	Total	29	100.0%	99	100.0%	109	100.0%	237	100.0%	

\*Comparing the three physician groups with respect to the proportion of the category of 'very necessary' = score 2 (Chi-square test). Comparison between pulmonary chief physicians vs all others is in brackets.



ORIGINAL RESEARCH

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## KEYWORDS

Asthma;  
Primary health care;  
Referral letter;  
Communication

## Summary

**Aims:** The purpose of the present study was to define quality criteria for an asthma referral letter using a national co-operative effort between general practitioners and pulmonologists.

**Methods:** A consensus-seeking expert panel representing primary and secondary health care merged evidence from the literature and existing national and local asthma programmes to produce 19 provisional criteria to be included in an asthma referral letter. These criteria were contained within a national questionnaire review which was sent out to groups of Finnish physicians. The target groups for the review were all chief pulmonologists in specialist care ( $n = 32$ ), and representatives of all Finnish health centres ( $n = 283$ ) - either the chief physician ( $n = 143$ ) or the local asthma co-ordinating physician ( $n = 140$ ).

**Results:** The overall response rate to the national questionnaire study was 75%. The three groups of responding physicians had very similar gradings on the necessity of the 19 provisional criteria, most of which were considered very necessary. 14 final disease-specific criteria for an asthma referral letter were derived as a result of this study.

**Conclusion:** The main result of this study is an agreed data set of essential information that needs to be included in an asthma referral letter. Importantly these criteria were developed by general practitioners and pulmonologists together.

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## Introduction

Finland was one of the first countries where a National Asthma Programme was launched in 1994 [1].

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✉ Deceased.

The main statements of the programme emphasised the role of primary health care in the prevention, diagnosis and long-term treatment of asthma. In order to optimise the management of asthma, measures to improve communication between health care professionals are needed.

A high-quality referral system is likely to contribute to the quality of care in different ways (a) by limiting over-medicalisation, over-investigation and over-treatment, (b) by permitting an appropriate division of tasks between generalists and many specialists, (c) by promoting technical progress by freeing specialists to develop their services further and (d) by ensuring economic progress by containing the costs of medical care [2]. It has been shown that the quality of the specialist consultation report improves in relation to the amount of referral information originally sent to the consultant [3].

Referral letters are an accessible, acceptable and objective source of information for evaluation of the communication between primary and secondary care [4]. In general, there is little information available on how evaluation criteria for referrals have been derived.

In Finland, there is a nationally endorsed structured referral letter form, which makes it easier to include information about the referring primary care physician (such as name and address), the patient (name, address, date of birth) and about the urgency when referring a patient. General quality criteria for Finnish referrals from general practice to secondary care were recently published [5,6].

The aim of the present study was to derive evaluation criteria for a national adult patient's asthma referral letter. These criteria will be used in the on-going evaluation of the Finnish Asthma Programme.

## Methods

### Consensus-seeking expert panel

The panel consisted of seven health professionals (Table 1). A modified Delphi technique was used to develop the evaluation criteria [7]. The panel merged evidence from the literature and existing national and local asthma programmes [1,8–11] to produce provisional criteria for a review (Figure 1, Table 2).

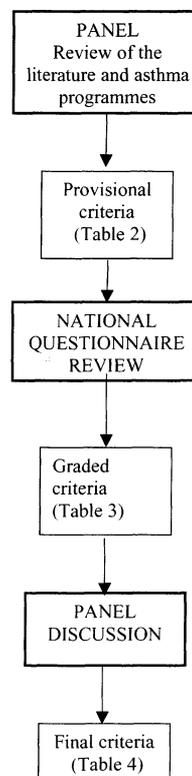
### The national questionnaire review

The provisional criteria were subjected to a national review. The reviewers included all Finnish chief pulmonologists in specialist care ( $n = 32$ ),

**Table 1** Members of the panel and their perspectives.

Pulmonologist, responsible researcher (LT)
Chief Physician in Primary Health Care, quality expert, representative of Finnish Lung Health Association (ME)
Chief Editor of National Current Care Guidelines, pathways of care (MK)
Chief Pulmonologist, regional pathways of care (PB)
Hospital District Chief Physician, administrative (RK)
Hospital District Chief Physician, management of asthma (HP)
Professor, implementation of guidelines, representative of Finnish Lung Health Association (KK)

and representatives of all Finnish health centres ( $n = 283$ ) - either the chief physician ( $n = 143$ ) or the local asthma co-ordinating physician ( $n = 140$ ). The reviewers were asked to grade the necessity of each of the 19 suggested criteria (Table 3) as being very necessary, necessary, or unnecessary. The national questionnaire survey was mailed in June 2001, followed by a reminder in August 2001.



**Figure 1** General outline of the study.

**Table 2** Provisional criteria for asthma referral letter.

Family history
Occupation
Onset of the symptoms
Dyspnoea
Specified dyspnoea
Cough
Specified cough
Wheezing
Smoking
Known allergies
Cardiorespiratory status
Peak flow-follow up
Spirometry and bronchodilatation test
Thorax X-ray
Nasal sinus X-ray
Blood eosinophils
Use of asthma medication
Other diseases
Other current medication

## Statistical analysis

The proportion of the "very necessary" gradings for each of the provisional criteria was calculated separately for the three groups of physicians, and the differences between them were analyzed by means of the chi-square test. In a case of a  $p$ -value less than 0.10, a post hoc analysis was performed and the chief pulmonologists were compared to other physicians. The categories for the provisional criteria were coded as follows: very necessary = 2, necessary = 1 and unnecessary = 0. The sums of the codes for different criteria groups were calculated, indicating the overall assessment of necessity. For all the criteria the possible range was 0–38. Analysis of variance (ANOVA) was used to compare the sums of codes between physician groups. Fisher's LSD test was used for paired comparisons. The data were analysed by means of SPSS (Version 10.1).

## Results

The overall response rate in the national review after two inquiries was 75%; 91% of the chief pulmonologists, 77% of the chief physicians and 71% of the local asthma co-ordinator physicians in primary health care responded. There was a difference between the response rates in the three groups of physicians ( $p = 0.054$ , Chi-Square test). The difference was significant when the chief pulmonologists were compared to the other physicians (91% vs

74%,  $p = 0.036$ , Chi-Square test). The three groups of physicians graded the criteria similarly. Most of the provisional criteria were considered very necessary (Table 3). The chief pulmonologists considered all criteria more necessary than the other groups, but the difference between the groups did not manifest statistical significance ( $p = 0.24$ ). The mean necessary scores were 40.0 (SD 6.1), 38.3 (6.5) and 37.7 (6.4) for chief pulmonologists, local asthma co-ordinator physicians and chief general physicians, respectively.

All provisional criteria considered very necessary for an asthma referral letter by more than 50% of the respondents were included in the final list. The expert panel included one additional criterion: spirometry and bronchodilatation test. The final set of criteria included 14 asthma-specific patient-related criteria (Table 4).

## Discussion

According to previous studies criteria to be used in health evaluation should (a) be based on evidence, (b) be prioritized according to the strength of research evidence and influence on outcome, (c) be clearly and precisely measurable and (d) be appropriate for the clinical setting [12,13]. The consensus-seeking expert panel worked to ensure that the final patient-related asthma referral criteria complied with these requirements. The specific task of the panel was to assess and interpret the literature, and international and regional guidelines, as well as the results of the national questionnaire review.

There are different methods by which consensus on the development of quality criteria can be attained in situations when evidence is insufficient. Methods used in health care research are: the Delphi process, the nominal group (expert panel) technique, and the RAND appropriateness method [7]. Variations of these methods have been used in order to adapt the method to the problem instead of adapting the problem to the method [14]. The study group chose a method whereby expert panel discussions and the national survey of both primary and secondary care physicians played a major role. General practitioners and pulmonologists should have a common view of the essential components of an asthma referral letter. Patient participation was not considered, since the main goal of the study was to keep the design simple, i.e. to evaluate communication between these two groups of physicians in the context of the National Asthma Programme. However, surveying patient and (for example) asthma nurse opinions on the 14 devel-

**Table 3** Gradings of the asthma referral letter criteria between the three groups of physicians (score 2= very necessary, score 1= necessary, score 0= unnecessary).

Asthma referral letter criteria	Score	Chief pulmonologists	Local asthma co-ordinator physicians	Chief general physicians	Total	<i>p</i> -value <sup>a</sup>
1. Family history	2	11 39,3%	23 23,5%	21 19,4%	55 23,5%	0.088 (0.036)
	1	17 60,7%	71 72,4%	82 75,9%	170 72,6%	
	0	0	4 4,1%	5 4,6%	9 3,8%	
	Total	28 100,0%	98 100,0%	108 100,0%	234 100,0%	
2. Occupation	2	18 62,1%	47 48,0%	53 48,6%	118 50,0%	0.38
	1	11 37,9%	50 51,0%	55 50,5%	116 49,2%	
	0	0	1 1,0%	1 ,9%	2 ,8%	
	Total	29 100,0%	98 100,0%	109 100,0%	236 100,0%	
3. Onset of the symptoms	2	23 79,3%	70 70,7%	74 67,9%	167 70,5%	0.49
	1	6 20,7%	29 29,3%	35 32,1%	70 29,5%	
	Total	29 100,0%	99 100,0%	109 100,0%	237 100,0%	
4. Dyspnoea	2	23 79,3%	73 74,5%	79 73,1%	175 74,5%	0.80
	1	6 20,7%	23 23,5%	28 25,9%	57 24,3%	
	0	0	2 2,0%	1 ,9%	3 1,3%	
	Total	29 100,0%	98 100,0%	108 100,0%	235 100,0%	
5. Specified dyspnoea	2	17 58,6%	71 71,7%	74 67,9%	162 68,4%	0.41
	1	12 41,4%	28 28,3%	35 32,1%	75 31,6%	
	Total	29 100,0%	99 100,0%	109 100,0%	237 100,0%	
6. Cough	2	20 69,0%	61 62,2%	55 50,5%	136 57,6%	0.096 (0.187)
	1	9 31,0%	36 36,7%	52 47,7%	97 41,1%	
	0	0	1 1,0%	2 1,8%	3 1,3%	
	Total	29 100,0%	98 100,0%	109 100,0%	236 100,0%	
7. Specified cough	2	16 55,2%	61 62,2%	50 45,9%	127 53,8%	0.061 (0.875)
	1	13 44,8%	35 35,7%	57 52,3%	105 44,5%	
	0	0	2 2,0%	2 1,8%	4 1,7%	
	Total	29 100,0%	98 100,0%	109 100,0%	236 100,0%	
8. Wheezing	2	20 69,0%	71 73,2%	71 65,1%	162 68,9%	0.46
	1	9 31,0%	26 26,8%	37 33,9%	72 30,6%	
	0	0	0	1 ,9%	1 ,4%	
	Total	29 100,0%	97 100,0%	109 100,0%	235 100,0%	
9. Smoking	2	27 93,1%	79 79,8%	81 74,3%	187 78,9%	0.085 (0.045)
	1	2 6,9%	20 20,2%	27 24,8%	49 20,7%	
	0	0	0	1 ,9%	1 ,4%	
	Total	29 100,0%	99 100,0%	109 100,0%	237 100,0%	
10. Known allergies	2	15 51,7%	65 65,7%	63 57,8%	143 60,3%	0.61
	1	13 44,8%	34 34,3%	46 42,2%	93 39,2%	
	0	1 3,4%	0	0	1 ,4%	
	Total	29 100,0%	99 100,0%	109 100,0%	237 100,0%	
11. Cardiorespiratory status	2	13 44,8%	48 48,5%	49 44,5%	110 46,2%	0.84
	1	15 51,7%	48 48,5%	59 53,6%	122 51,3%	
	0	1 3,4%	3 3,0%	2 1,8%	6 2,5%	
	Total	29 100,0%	99 100,0%	110 100,0%	238 100,0%	
12. Peak Flow-follow up	2	17 58,6%	54 54,5%	56 51,4%	127 53,6%	0.76
	1	12 41,4%	44 44,4%	50 45,9%	106 44,7%	
	0	0	1 1,0%	3 2,8%	4 1,7%	
	Total	29 100,0%	99 100,0%	109 100,0%	237 100,0%	

Table 3 (Continued)

Asthma referral letter criteria	Score	Chief pulmonologists	Local asthma co-ordinator physicians	Chief general physicians	Total	p-value <sup>a</sup>
13. Spirometry and bronchodilation test	2	11 37,9%	36 36,7%	41 37,6%	88 37,3%	0.99
	1	18 62,1%	55 56,1%	63 57,8%	136 57,6%	
	0	0	7 7,1%	5 4,6%	12 5,1%	
	Total	29 100,0%	98 100,0%	109 100,0%	236 100,0%	
14. Thorax X-ray	2	17 58,6%	39 39,4%	42 38,5%	98 41,4%	0.13
	1	12 41,4%	56 56,6%	65 59,6%	133 56,1%	
	0	0	4 4,0%	2 1,8%	6 2,5%	
	Total	29 100,0%	99 100,0%	109 100,0%	237 100,0%	
15. Nasal sinus X-ray	2	8 27,6%	20 20,4%	15 13,8%	43 18,2%	0.18
	1	21 72,4%	67 68,4%	81 74,3%	169 71,6%	
	0	0	11 11,2%	13 11,9%	24 10,2%	
	Total	29 100,0%	98 100,0%	109 100,0%	236 100,0%	
16. Blood eosinophils	2	5 17,9%	15 15,2%	18 16,5%	38 16,1%	0.93
	1	20 71,4%	62 62,6%	65 59,6%	147 62,3%	
	0	3 10,7%	22 22,2%	26 23,9%	51 21,6%	
	Total	28 100,0%	99 100,0%	109 100,0%	236 100,0%	
17. Use of asthma medication	2	19 65,5%	66 66,7%	59 53,6%	144 60,5%	0.13
	1	10 34,5%	32 32,3%	51 46,4%	93 39,1%	
	0	0	1 1,0%	0	1 0,4%	
	Total	29 100,0%	99 100,0%	110 100,0%	238 100,0%	
18. Other diseases	2	16 55,2%	49 49,5%	56 50,9%	121 50,8%	0.87
	1	13 44,8%	50 50,5%	54 49,1%	117 49,2%	
	Total	29 100,0%	99 100,0%	110 100,0%	238 100,0%	
19. Other current medication	2	14 48,3%	54 54,5%	62 56,4%	130 54,6%	0.74
	1	15 51,7%	45 45,5%	48 43,6%	108 45,4%	
	Total	29 100,0%	99 100,0%	110 100,0%	238 100,0%	

<sup>a</sup> Comparing the three physician groups with respect to the proportion of the category of 'very necessary' = score 2 (Chi-square test). Comparison between chief pulmonologists vs all others is in brackets.

oped criteria might give additional insight into the process.

In the national questionnaire, 315 physicians in total (general practitioners and chief pulmonologists) were asked to grade and comment on the 19 criteria we had proposed. The total response rate was good (75%). Differences between the groups were much smaller than we expected, which suggests that there exists a national consensus on the main features of the management of asthma. This could result from the previous intensive educational effort of the National Asthma Programme, with 25000 health professionals trained [15].

A criterion assessed in the national questionnaire was included in the final set if more than half of the respondents considered it very necessary. Spirometry and bronchodilatation test did not reach this threshold. However, the panel decided to include this criterion in the final list because, according to

Table 4 Final criteria for asthma referral letter.

Occupation
Onset of the symptoms
Dyspnoea
Specified dyspnoea
Cough
Specified cough
Wheezing
Smoking
Known allergies
Peak flow-follow up
Spirometry and bronchodilatation test
Use of asthma medication
Other diseases
Other current medication

our recent study, there are facilities for spirometry measurement in 95% of the health centres in Finland [16]. History-taking is always the main source of facts on which a diagnosis of asthma is based. However, as the National Asthma Programme recommends, lung function measurements should be a fundamental part of asthma management in primary health care. Measuring lung function adds a more objective set of data when considering the diagnosis of asthma in a given patient.

The development of audit criteria is only the first step in the audit cycle [17]. The main result of this study is an agreed data set on information that needs to be included in an asthma referral letter. The 14 patient-related disease-specific criteria ensure that important diagnostic and management steps related to this respiratory problem are summarized in the referral text. Although doctors may still hesitate to follow very strict standards of communication [18] the good response rate in the present study indicates willingness to participate in quality improvement efforts.

Whether we actually have succeeded in developing applicable criteria for asthma referral letters will only be proved once they have been used in an audit. Such a national evaluation study is currently in process.

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## References

- [1] Asthma Programme in Finland 1994–2004. *Clin Exp Allergy* 1996;26(Suppl 1):1–24.
- [2] Marinker M. The referral system. *J Roy Coll Gen Pract* 1988;38:487–91.
- [3] Hansen JP, Brown SE, Sullivan Jr RJ, Muhlbaier LH. Factors related to an effective referral and consultation process. *J Fam Pract* 1982;15(4):651–6.
- [4] Montalto M. Using referral letters to measure quality and performance in general practice. *J Qual Clin Practice* 1995;15:45–50.
- [5] Latva-Nevala A, Särkö A, Leisti S. The quality of referral and consultation (in Finnish). *Etelä-Pohjanmaan malli, julkaisu 9. Etelä-Pohjanmaan sairaanhoitopiiri* 1995.
- [6] Ketola E, Mäkelä J, Hagman E, Kupiainen Outi. General practitioners consulting in Helsinki (in Finnish). *Finn Med J* 2001;56:1297–1301.
- [7] Campbell SM, Branspenning J, Hutchinson A, Marshall M. Research methods used in developing and applying quality indicators in primary care. *Qual Saf Health Care* 2002;11(4):358–64.
- [8] NHLBI/WHO. *Global strategy for asthma management and prevention*. NHLBI/WHO Workshop Report. US National Heart, Lung and Blood Institute and the World Health Organisation, 1995.
- [9] Report: Nordic consensus report on asthma management. *Respir Med* 2000;94:299–327.
- [10] British Asthma Guidelines Coordination Committee. *British guidelines on asthma management*. *Thorax* 1997;52:1–24.
- [11] Haahtela T, Kaila M, Ahonen E, Kava T, Kinnula V, Klaukka T, et al. *Current Care Guideline for Asthma* (in Finnish). *Duodecim* 2000;116:2568–84.
- [12] Baker R, Fraser R. Fortnightly Review: Development of review criteria: linking guidelines and assessment of quality. *BMJ* 1995;311:370–3.
- [13] Hearnshaw HM, Harker RM, Cheater FM, Baker RH, Grimshaw GM. Are audits wasting resources by measuring the wrong things? A survey of methods used to select audit review criteria. *Qual Saf Health Care* 2003;12:24–8.
- [14] Linstone HA. *The Delphi technique Handbook of futures research*, Greenwood Press, Westport, CT, 1978.
- [15] Haahtela T, Klaukka T, Koskela K, Erhola M, Laitinen LA. Asthma Programme in Finland: a community problem needs community solution. *Thorax* 2001;56:806–14.
- [16] Erhola M, Makinen R, Koskela K, Bergman V, Klaukka T, Makela M, et al. The Asthma Programme of Finland: an evaluation survey in primary health care. *Int J Tuberc Lung Dis* 2003;7(6):592–8.
- [17] Ovretveit J. *Evaluating Health Interventions*. Buckingham, Philadelphia: Open University Press 1999.
- [18] Newton J, Eccles M, Hutchinson A. Communication between general practitioners and consultants: what should their letters contain? *BMJ* 1992;304:821–4.

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# The Finnish national asthma programme: communication in asthma care – quality assessment of asthma referral letters

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## Keywords

asthma, communication, primary care, programme evaluation, referral letter

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## Abstract

**Aims and objectives** The Finnish National Asthma Programme, which was launched in year 1994, considered the management of asthma as a community problem. The role of the primary health care in the management of asthma was emphasized. Optimal asthma management includes good communication between health care professionals. Referral letters are an accepted tool for evaluation of the communication process. The aim of this study was to assess the quality of asthma-related referral letters.

**Methods** All non-acute referral letters ( $n = 3176$ ) to three pulmonary departments were screened in 2001 and all those related to asthma were included ( $n = 1289$ ). The 14 previously derived asthma-specific criteria were applied: occupation, smoking, known allergies, current medication, other diseases, onset of symptoms, wheezing, dyspnoea, specified dyspnoea, cough, specified cough, use of asthma medication, peak-flow follow-up or spirometry with bronchodilatation test as an attachment. The study group was prepared to accept the maximum of 30% of the referral letters to be of poor quality.

**Results** Twenty-one per cent of the referral letters were graded good, 34% satisfactory and 45% poor. Information on wheezing, smoking habits and current medication was mentioned in 44%, 42% and 41% of asthma letters respectively.

**Conclusions** The Finnish National Asthma Programme calls for optimizing communication between doctors. The proportion of poor letters was 50% higher than the preset standard and clearly indicates a need for improvement. We found several issues, which need to be better communicated (smoking, lung function tests, wheezing, medication) when referring a patient with suspected asthma.

## Introduction

Asthma – owing to its variable nature and wide spectrum of severity – is a good example of a disease where all health care professionals should work according to a common strategy, providing consistent care [1]. Appropriate and adequate communication between doctors is a major part of this strategy. Measures to improve communication between health care professionals are needed in order to optimize the management of asthma.

Greene [2] defined medical audit as the assessment of the quality of medical care using process data from medical records.

According to Greene, the term medical audit can be said to have originated with the work of Lembcke from 1956 who audited records of patients on whom major gynecological surgery was performed with the intention of identifying unnecessary operations [3]. Since then medical audit has been used as a method to evaluate medical care. The referral letter forms a part of the medical record and it is an important element in the treatment chain between primary care and secondary care or between the patient's family doctor and the hospital specialist. Montalto considered referral letters as an accessible, acceptable and objective source of information for the evaluation of the communication between

these care levels [4]. A high degree of consensus among clinicians about the content of referral letters has been reported as well as the acceptance of assessing the referral letters for a professionally led medical audit [5].

The Finnish National Asthma Programme, established in 1994, considers the management of asthma as a community problem. The role of the primary health care (PHC) in the management of asthma was emphasized [6,7]. Recently, special efforts have been made to improve the involvement of the PHC in the diagnosis and treatment of asthma and to improve communication and referral processes between general practitioners (GPs) and specialists [8].

In our previous study we presented systematic development of quality criteria for an asthma referral letter [9]. These criteria were derived from three components: evidence from the literature, consensus-seeking panel discussions, and a national review. In the present study, we analysed the quality of all asthma-related referral letters received during 1 year from the PHC in three different pulmonary departments in Finland, using these previously described criteria.

## Materials and methods

All referral letters ( $n = 3176$ ) received during 2001 from the PHC to pulmonary outpatient units in three hospitals were scrutinized. The referrals originated from health care centres and additional private general practices. Combined population coverage of the participating centres (regions of Hyvinkaa, Lappeenranta and Seinajoki) is nearly 500 000 (i.e. 10% of the Finnish population) (Fig. 1). All referral letters were screened according to the reason of submission by a member of the study group in each centre (PB, RK, LT). The inclusion criteria were asthma or suspicion of asthma or any symptom/finding suggestive of asthma (such as: prolonged cough, wheezing, dyspnoea, sputum production, obstructive lung function tests). Internal referrals from other departments of the hospital and referrals for emergency asthma

admission were excluded. On this basis, a total number of 1289 (41%) out the 3176 letters were finally included into the audit.

The study design is illustrated in Fig. 2 (steps 1–3). Setting standards and defining the auditing criteria are the crucial parts of an evaluation study. Based on previous literature, consulting other specialists, and discussion within the group, the maximal acceptable standard of inadequacy (MAS standard) developed by Williamson [10] was set to 30%, which means that the study group was prepared to accept the maximum of 30% of the referral letters to be of poor quality. As criteria, the 14 previously derived [9] asthma-specific criteria (Table 1) were used. An auditing manual was prepared. Information permitting identification of the hospital and patient were removed. The disease-specific criteria were screened and scored by two respiratory nurses who were trained and super-

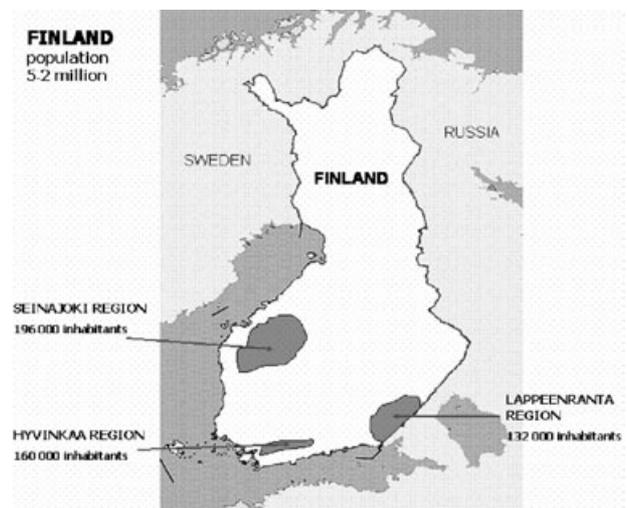


Figure 1 Participating centres.

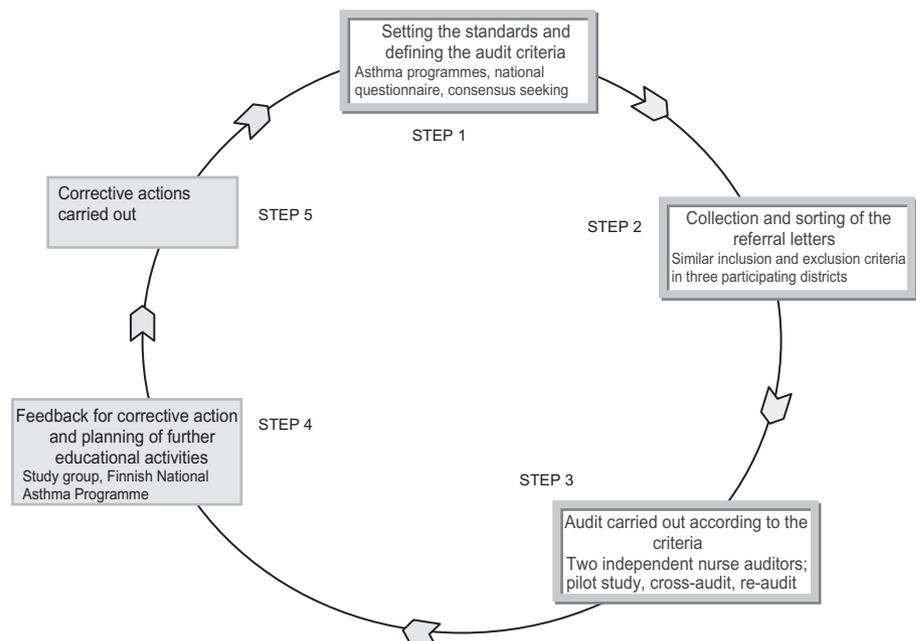


Figure 2 Study design illustrated as consecutive steps of an auditing circle.

vised by one of the authors (LT). Criteria were given the value of 0 when not present and 1 when present. Additional relevant information of the referral letter was collected.

Grading of the referral letter quality was based on two main conditions: first the presence of one of the lung function tests (graphics as an attachment) and second the fulfilment of other criteria (Table 2). A good referral letter contained either the peak expiratory flow (PEF) follow-up or spirometry with the bronchodilatation test, and eight or more other criteria. A letter was graded poor if less than eight criteria were present in the absence of lung function tests. Satisfactory letter contained at least six criteria in the presence of one of the lung function tests and eight or more criteria without them.

First a pilot study ( $n = 100$  letters) was conducted to test the feasibility of asthma referral criteria, the manual and the auditing process. It revealed that the feasibility of the selected criteria was good, the manual understandable and the auditing process fluent. After the pilot study two issues were addressed. Coding of two criteria (specified dyspnoea and specific cough) was made more precise. The pilot study showed that the spirometry with bronchodilatation test would have a pivotal role in grading the quality of asthma referral letters. Therefore, we debated again whether to keep the spirometry with bronchodilatation test as a precondition. There were three reasons why we adhered to the original idea of spirometry as an essential element of a good quality referral letter.

**Table 1** The fulfilment of the 14 asthma referral letter criteria in the audited letters ( $n = 1289$ )

Onset of the symptoms	80%
Use of asthma medication	78%
Occupation	66%
Dyspnoea	64%
Cough	63%
Other diseases	56%
Specified dyspnoea*	54%
Specified cough*	53%
Known allergies	47%
Peak-flow follow-up	47%
Wheezing	44%
Smoking	42%
Other current medication	41%
Spirometry with bronchodilatation test	31%

\*Specified dyspnoea and cough criteria consist of detailed description of these symptoms (for example dyspnoea during exercise, productive cough).

**Table 2** Quality of 1289 asthma referral letters

Quality of the letter	PEF follow-up or spirometry with bronchodilatation test as an attachment	Number of other fulfilled criteria	Percentage of the letters (%)	95% CI
Good	Yes	$\geq 8$	21	19–24
Satisfactory	Yes	6–7	34	31–37
	No	$\geq 8$		
Poor	Yes	$< 6$	45	42–47
	No	$< 8$		

See text and reference [9] for detailed information on quality criteria.

(1) According to global guidelines, the diagnosis of asthma is based on documentation of reversible obstruction [11]. (2) The equipment for spirometry is available in 95% of the health centres in Finland [8]. (3) The relevant experts we consulted strongly recommended keeping this precondition.

In the final study two nurses independently scored an 8% sample of the letters and we assessed inter-rater reliability using the  $\kappa$  statistic for each criterion. The median of all the  $\kappa$  values was 0.87 (mean value was 0.82, range 0.61–0.91). We assessed intra-rater reliability on a further random 4% sample of letters and found the median  $\kappa$  to be 0.87 (mean value was 0.83, range 0.31–0.98).

## Statistical analyses

The inter-rater reliability and intra-rater reliability were assessed by Kappa coefficients. The Chi-square test was used to test the associations between categorical variables. The quality of asthma referral letters are described with percentages and exact 95% confidence intervals (based on binomial distributions).

## Results

Most of the referral letters were written on the standard structured referral letter form; 210 (all from one centre) were electronic letters. The most frequent reasons for referring were suspicion of asthma (45%), asthma-related symptom (31%) and previously diagnosed asthma (10%). Most of the referral letters were received from the public health care centres (70%), the rest of the letters came from doctors working as independent private practitioners (16%) or in private occupational health care (12%). The median time elapsing between writing a non-electronic letter and its arrival to the hospital was 5 days (inter-quartile range 3–7, range 0–164). The mean age of the referred patients was 48 years (14–92) and 61% ( $n = 783$ ) of them were women.

The fulfilment of the each separate criterion is shown in Table 1. Information about smoking habits was mentioned in 42% of referral letters. Copies of spirometry with bronchodilatation test and PEF follow-up were enclosed in 31% (spirometry) and in 47% (PEF) of letters. Information on the current medication (for disorders other than asthma) was present in 41% of all the letters. The information was age-related ( $P < 0.0001$ ). Current medication was reported in 65% of letters for patients over 60 years, 43% for patients 40–59 years old, and 18% for patients less than 40 years old.

The results of the 1289 audited referral letters are presented in Table 2. There were no statistically significant differences between

the three centres (data not shown). Twenty-one per cent of the referral letters were graded as good, 34% satisfactory and 45% poor. Fifty-four per cent of the letters included either a PEF follow-up or spirometry with bronchodilatation test, that is, fulfilled the precondition for a good referral letter. The letters with either of the lung function tests were of better quality, including those based on other criteria. At least eight other criteria were fulfilled in 39% of letters with and 33% of letters without peak-flow follow-up or spirometry with bronchodilatation test attached ( $P = 0.017$ ).

## Discussion

The Finnish National Asthma Programme calls for improvement of communication between the primary and secondary health care. Until now we did not have national level data on the quality of the referral letters of asthma in real life. Our data showed that according to our preset criteria only 21% of the asthma referral letters were of good quality, 34% were satisfactory but acceptable, which leaves the total of 45% of the referrals classified as poor or unacceptable. This is 50% higher than the set MAS and clearly indicates a need for improvement.

The study referral letters represents well Finnish non-acute asthma-related referral letters in many respects. Total population coverage in the three participating centres gives an adequate representation of Finland, both geographically and demographically. The number of audited letters was large. All asthma referral letters received by these pulmonary departments during 1 year were included.

The quality criteria we used were based on a high degree of consensus between pulmonary doctors and general practitioners, and on evidence from the literature [9]. However, as 45% of the referral letters were graded as poor, we have to ask if the quality criteria we used between good and satisfactory and satisfactory and poor were appropriate. Only eight out of 14 criteria were asthma-specific in a strict way. The other six criteria (onset of symptoms, occupation, smoking, known allergies, medication and known diseases) are essential in all referral letters. Was the precondition of attached lung function tests too strict? Had we not included this precondition an additional 15% of the letters would have been graded good. This would not, however, have changed the proportion of the poor referral letters; it would have remained the same 45%. We thought that as suspicion of asthma is a familiar entity to every general practitioner, so would be these criteria. Part of the explanation probably is that everything that has been discussed with the patient is thereafter not recorded. As long as a structured asthma referral letter does not exist the percentage of good referral letters may not increase.

We have not found any previous studies focusing on the content or the quality of the asthma referral letters. There are some studies evaluating the content of referral letters but the number of letters analysed has been rather small [12–14]. Hansen *et al.* audited 141 referral letters to various specialties. Four out of nine required items were found in fewer than 50% of the letters. Past medical history was found in only 29%. Grol *et al.* reviewed the content of both referral and reply letters [15]. Only 35% of referral letters ( $n = 637$ ) met the quality criterion of clinical information. In a recent study of doctors' views of the content of referral letters, nearly all general practitioners considered documentation of medical history and current medication important, but these items were

documented in only 52–68% of referral letters originating from the same general practitioners [16]. According to our study, it is surprising that only 42% of the asthma-related referral letters included information on smoking status. Tobacco history is always crucial when respiratory symptoms are concerned. Omitting this information may reflect the neglecting attitude of doctors towards documenting patients' smoking habits.

Current medication, for reasons other than asthma, was mentioned in only 41% of the referral letters. However, in the letters concerning aged patients (over 60 years) medication was mentioned more often (65%). Many drugs provoke asthma symptoms, so it would be important to include information on the patient's entire medication in the referral letter. Lack of information on current medication has also been found in other, albeit smaller studies; in half of the referral letters to an Ear, Nose and Throat clinic and in 25% of the letters to rheumatology [14].

The referral system presents the everyday means of communication between the generalist and the specialist. It has been previously shown, that a good quality referral letter may partly enhance the communication process [12,15]. Consulting is mainly communication between professionals. Neville has appropriately stated, 'Good professional communication is not a courtesy, it is a necessity' [17]. The rapid evolution of the information technology is challenging the referral process. This puts stress on the content of the referral letter, and only essential information in the form of an agreed data set should be included. In Finland a structured referral sheet has been widely used for decades. However, it is structured only according to administrative information, but the structure of the clinic information is less rigid. It could be feasible to develop referral letter forms for those clinical entities that handle significant public health problems. Information technology should be harnessed to serve this purpose.

According to the basic quality improvement principles (Fig. 2), the findings of this process study should lead to the direction and priorities of actions to improve the outcomes measured or modification of the criteria [10]. Even though the criteria were carefully formulated and tested in a pilot study, the result of 45% of poor letters clearly indicates an urgent need for action to improve the quality of asthma referral letters. We found several issues that need to be better communicated (smoking, lung function test, wheezing, medication) when referring a patient with suspected asthma. Next, we need to proceed through steps 4 and 5 of Fig. 2 to complete the entire audit cycle and include the results of this analysis into a continuing education programme of general practitioners.

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## References

1. Neville, R. G. & Higgins, B. G. (1999) Providing better asthma care: what is there left to do? *Thorax*, 54, 813–817.

2. Greene, R. (1976) Assuring Quality in Medical Care. The State of the Art. Cambridge, MA: Ballinger Publishing Company.
3. Lembecke, P. A. (1956) Medical auditing by scientific methods. *Journal of the American Medical Association*, 162, 646–655.
4. Montalto, M. (1995) Using referral letters to measure quality and performance in general practice. *Journal of Quality in Clinical Practice*, 15, 45–50.
5. Newton, J., Eccles, M. & Hutchinson, A. (1992) Communication between general practitioners and consultants: what should their letters contain? *British Medical Journal*, 304, 821–824.
6. Asthma Programme (1996) Asthma programme in Finland 1994–2004. *Clinical Experimental Allergy*, 26 (Suppl. 1), 1–24.
7. Haahtela, T., Klaukka, T., Koskela, K., Erhola, M. & Laitinen, L. A. (2001) Asthma Programme in Finland: a community problem needs community solution. *Thorax*, 56, 806–814.
8. Erhola, M., Makinen, R., Koskela, K., Bergman, V., Klaukka, T., Makela, M., Tirkkonen, L. & Kaila, M. (2003) The Asthma Programme of Finland: an evaluation survey in primary health care. *International Journal of Tuberculosis and Lung Disease*, 7, 592–598.
9. Tuomisto, L., Erhola, M., Kaila, M., Brander, P. E., Puolijoki, H., Kauppinen, R. & Koskela, K. (2004) Asthma Programme in Finland: High consensus between general practitioners and pulmonologists on the contents of an asthma referral letter. *Primary Care Respiratory Journal*, 13, 205–210.
10. Williamson, J. W. (1971) Evaluating quality of patient care. A strategy relating outcome and process assessment. *Journal of the American Medical Association*, 218, 564–569.
11. NHLBI/WHO (1995) Global strategy for asthma management and prevention. NHLBI/WHO Workshop Report. US National Heart, Lung and Blood Institute and the World Health Organisation.
12. Hansen, J. P., Brown, S. E., Sullivan, R. J. Jr & Muhlbaier, L. H. (1982) Factors related to an effective referral and consultation process. *Journal of Family Practice*, 15, 651–656.
13. Graham, P. H. (1994) Improving communication with specialists. The case of an oncology clinic. *Medical Journal of Australia*, 160, 625–627.
14. Newton, J., Hutchinson, A., Hayes, V., McColl, E., Mackee, I. & Holland, C. (1994) Do clinicians tell each other enough? An analysis of referral communications in two specialties. *Family Practice*, 11, 15–20.
15. Grol, R., Rooijackers-Lemmers, N., van Kaathoven, L., Wollersheim, H. & Mokkink, H. (2003) Communication at the interface: do better referral letters produce better consultant replies? *British Journal of General Practice*, 53, 217–219.
16. Campbell, B., Vanslembroek, K., Whitehead, E., van de Wauwer, C., Eiffel, R., Wyatt, M. & Campbell, J. (2004) Views of doctors on clinical correspondence: questionnaire survey and audit of content of letters. *British Medical Journal*, 328, 1060–1061.
17. Neville, R. (1987) Notifying general practitioners about deaths in hospital: an audit. *Journal of Royal College of General Practice*, 37, 496–497.



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# Asthma Programme in Finland: Comparison of adult asthma referral letters in 1994 and 2001

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## KEYWORDS

Programme evaluation;  
Referral and consultation;  
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Asthma

## Summary

**Objectives:** The aim of the study was to evaluate the quality of asthma-related referral letters at the launch of the Asthma Programme in 1994 and 7 years later in 2001.

**Methods:** All referrals during 1 year ( $n = 1121$  in 1994,  $n = 1136$  in 2001) to one pulmonary department were screened in 2001. By the same inclusion criteria of asthma or suspicion of asthma, 624 letters (56% of all) from the year 1994 and 452 (40% of all) from the year 2001 were selected. The quality of study letters was assessed against the previously developed asthma referral letter criteria. Comparison of the referral letter quality in 1994 and 2001 was made.

**Results:** The proportion of poor letters decreased from 63% in 1994 to 44% in 2001, while that of good letters increased from 7% to 22%. Graphics of peak flow follow-up measurements (14% vs. 40%) and spirometry with bronchodilatation test (5% vs. 32%) were included significantly more often as an attachment.

**Conclusion:** Lung functions are being measured more often in primary care, indication a more active detection of asthma. The number of asthma-related referrals in relation to all pulmonary consultation referrals decreased and their quality improved during the years of the Asthma Programme.

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## Introduction

Enhancing the role of primary health care (PHC) in asthma management was the main focus of the National Asthma Programme, which was launched in Finland in 1994 for a 10-

year period.<sup>1</sup> This strategy was considered necessary to meet the challenge of early detection and treatment posed by the increasing number of asthma patients. Implementation of the programme was based on extensive and iterative training throughout the country. The first national evaluation halfway through the programme showed that the care of asthma patients was improving.<sup>2</sup>

Assessing the whole referral process and specifically the referral letters is one way to evaluate the effectiveness of

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the Asthma Programme. The content of the asthma-related referral letter may reflect changes in asthma management. The practice of measuring lung function before referral to specialist was used in an evaluation of a regional asthma programme (published in 1998) in one Finnish hospital district.<sup>3</sup> Monitoring of peak expiratory flow (PEF) and spirometry were carried out significantly more often by the primary care practitioners in 1999–2001 (PEF: 78%, and spirometry: 61%) than in 1997 (63% and 45%).

Asthma or asthma-like symptoms are a common problem in PHC. In a questionnaire survey 6% of adults reported having physician-diagnosed asthma, while 6.3% were using asthma medicines.<sup>4</sup> For historical reasons, until 1994 the first suspicion of asthma entitled the Finnish general practitioner to refer the patient to specialist care, mostly without performing lung function tests. The Asthma Programme has brought about an increase in diagnoses and commencing treatment in PHC.<sup>5</sup> If consultation is needed, optimal communication between PHC physicians and specialists is necessary for the specialist to plan further investigations, to set a time frame of urgency for the visit and in the end to reduce the overall costs of the management of asthma.

In an earlier study we analysed the quality of asthma-related referral letters sent to three Finnish pulmonary departments against previously developed criteria.<sup>6,7</sup> The specific aim of the present study was to measure possible changes in the referral process and the quality of the asthma-related referral letters received by the pulmonary department of one hospital in 1994 and 2001. This study belongs to a series of the evaluation efforts of the Finnish National Asthma Programme.

## Methods

The study was conducted at the Seinajoki Central Hospital situated in western Finland and covering a population of nearly 200 000 (4% of Finnish population) in both 1994 and 2001. There are 27 municipalities and 18 health care centres owned by one or more municipalities. These PHC centres provide the region's public health care together with occupational and private care units.

The study design is illustrated in Fig. 1 and presents, according to Øvretveit,<sup>8</sup> a 6A type evaluation of an intervention on a health organisation (Fig. 2). The local implementation activities of the Asthma Programme in the study region are also presented in Fig. 2. In 1997 a regional Asthma Programme was published with recommendations of the referring asthma or asthma suspicion, previous tests and information to be included in the referral letter.

Setting standards and defining the auditing criteria are the crucial parts of an evaluation study. The standard (acceptable quality level of the referral letters) was set according to the Minimal Acceptable Standard (MAS) principle at less than 30% poor referral letters.<sup>9</sup> Fourteen asthma-related referral letter criteria (Table 1) are based on international and national guidelines, a national survey and expert panel discussions.<sup>6</sup> The nationwide survey among general physicians ( $n = 209$ ) and chief chest physicians ( $n = 29$ ) revealed high consensus about the content of asthma-related referral letter. Expert panel came to a decision that the quality assessment was based on two main

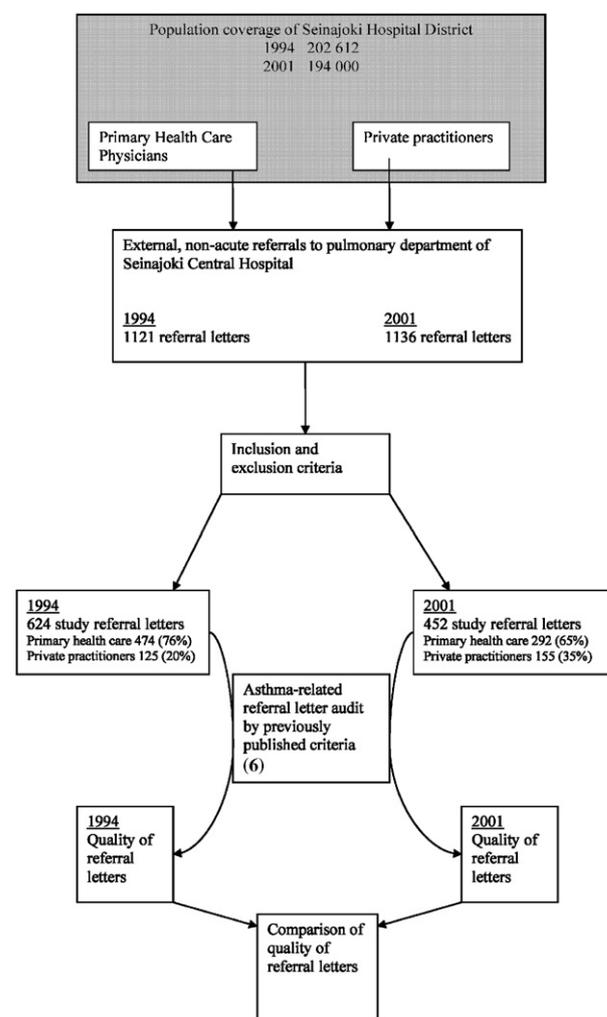


Figure 1 Study design.

conditions: the presence of a lung function test (graphics as an attachment), and the fulfilment of other criteria. The classification of the quality to good, satisfactory and poor referral letter is described in Table 2a.

Referral letters with attachments from 1994 were collected by screening all pulmonary referrals ( $n = 1121$ ) from the hospital data records by one of the authors (L.T.). During 2001 all referrals ( $n = 1136$ ) to the same clinic were screened prospectively by L.T. The inclusion criteria were the same: asthma or suspicion thereof, or any symptom or finding suggestive of asthma, such as prolonged cough, wheezing, dyspnoea, sputum production and obstructive lung function test. Internal referrals from other departments of the hospital and emergency asthma referrals were excluded. An auditing manual was prepared. The presence of disease-specific criteria was screened and scored by a respiratory nurse trained and supervised by L.T. Letters from 1994 were scored by one nurse. The auditing process is described in more details in our previous article.<sup>6</sup>

## Statistical analysis

We used SPSS 11.0 software. The quality of asthma referral letters is described using percentages and exact 95%

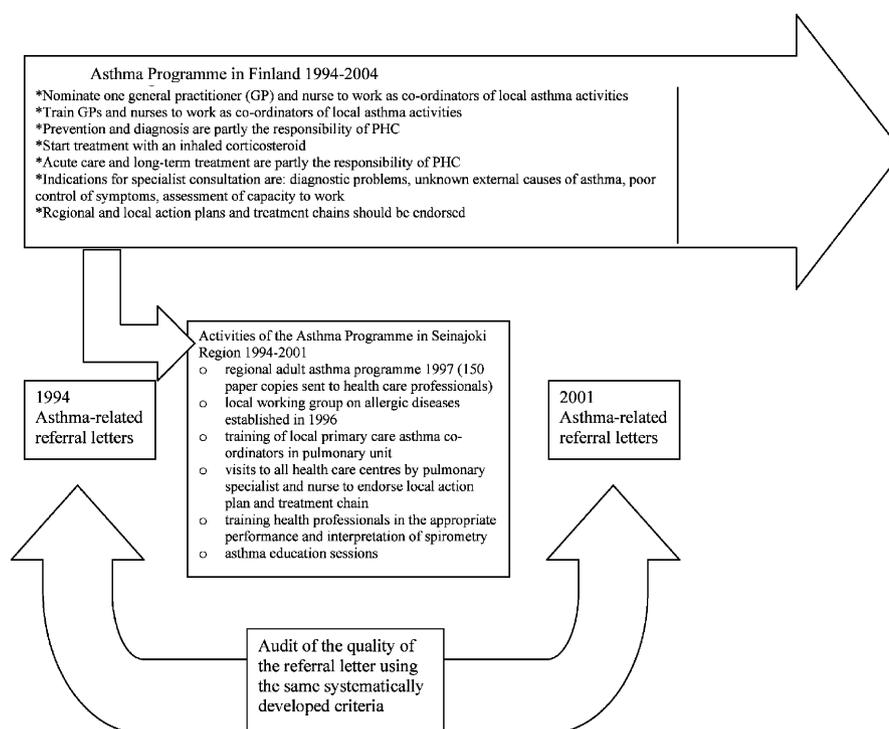


Figure 2 Local implementation activities in the study region.

Table 1 Fulfilment of the 14 asthma referral letter criteria in the letters in 1994 and 2001.

Asthma referral criteria	Letters in 1994 (n = 624) (%)	Letters in 2001 (n = 452) (%)	P
<i>Basic history</i>			
Occupation	82	79	0.14
Smoking	24	39	0.01
Known allergies	39	54	0.01
Other diseases	46	54	0.01
Other current medication	30	38	0.01
Age over 60 yr	55	68	0.01
Age 40–59 yr	29	39	0.01
Age less than 40 yr	11	17	0.01
<i>Asthma symptom history</i>			
Onset of symptoms	72	83	0.01
Dyspnoea	69	69	0.91
Specified dyspnoea*	54	59	0.89
Cough	55	63	0.02
Specified cough*	48	52	0.06
Wheezing	53	48	0.17
Use of asthma medication	58	72	0.01
Bronchodilator	55	67	0.01
Preventive	14	26	0.01
<i>Objective tests as an attachment</i>			
Peak flow follow-up	14	40	0.01
Spirometry with bronchodilatation test	5.3	32	0.01
Either of tests	18	50	0.01

\*Specified dyspnoea and cough criteria consist of detailed description of these symptoms (for example dyspnoea during exercise, productive cough). Differences between years were tested by Pearson  $\chi^2$  test.

**Table 2a** Grading of the quality of adult asthma referral letters according to the fulfilment of lung function attachment and other criteria.

Quality of referral letter	PEF follow-up or spirometry with bronchodilatation test	Number of other 12 criteria fulfilled
Good	Yes	8–12
	No	8–12
Satisfactory	Yes	6–7
	No	8–12
Poor	Yes	0–5
	No	0–7

**Table 2b** Quality of the adult asthma referral letters in 1994 and 2001.

Quality of referral letter	Percentage of all referral letters in 1994 ( <i>n</i> = 624)		Percentage of all referrals letters in 2001 ( <i>n</i> = 452)		<i>P</i>
	%	[95% CI]	%	[95% CI]	
Good	7	[5–9]	22	[18–25]	0.01
Satisfactory	30	[26–33]	34	[30–39]	0.20
Poor	63	[60–67]	44	[39–49]	0.01

Differences between years were tested by Pearson  $\chi^2$ .

confidence intervals (based on binomial distributions). The  $\chi^2$  test was used to test the associations between categorical variables and to compare the quality of the letters. The inter-rater reliability and intra-rater repeatability were assessed using Kappa coefficients.

The ethical committee of the study hospital and the Finnish Ministry of Social Affairs and Health approved the study.

## Results

The study referral letters comprised 56% (*n* = 624) of all pulmonary referral letters received in 1994 and 40% (*n* = 452) in 2001. While the total number of referrals were the same in both years, this change indicates less need of asthma-related specialist consultation. The reason for referral was clearly stated in 97% (*n* = 605) of the referrals in 1994 and in 93% (*n* = 420) in 2001. Reasons were: named suspicion of asthma 54% (*n* = 339) in 1994 and 48% (*n* = 218) in 2001; an asthma-related symptom 36% (*n* = 223) in 1994 and 38% (*n* = 178) in 2001; and previously diagnosed asthma 10% (*n* = 58) in 1994 and 6% (*n* = 25) in 2001.

The results of the quality assessment of adult asthma referral letters in 1994 and 2001 are presented in Table 2b. The proportion of poor letters decreased from 63% in 1994 to 44% in 2001 ( $P < 0.01$ ), while good-quality letters increased from 7% to 22%. The fulfilment of each separate criterion in 1994 and 2001 is shown in Table 1. Known allergies and smoking habits were also mentioned in referral letters significantly more often in 2001 ( $P < 0.01$ ). Lung function tests were rarely attached to referral letters in 1994. Either of the lung function tests was sent as an attachment in 18% of referrals in 1994 and in 50% of referrals in 2001. The main

asthma-related symptoms were mentioned equally often in letters from both years. The inclusion of information about current medication (for disorders other than asthma) was age-related ( $P < 0.01$ ).

The mean age of the patients referred remained the same:  $46 \pm_{SD} 17$  (range 14–87) years in 1994 and  $46 \pm_{SD} 16$  (range 14–92) years in 2001. Fifty-nine percent (*n* = 370) in 1994 and 56% (*n* = 252) in 2001 were women. Classification of the urgency rate (i.e. referring physicians estimation of how long the patient can wait for the consultation) was mentioned in 42% (*n* = 260) of the referrals in 1994 and in 39% (*n* = 178) in 2001.

Letters from 1994 were scored by one nurse. Intra-rater repeatability was assessed for each criterion and the median  $\kappa$  was found to be 0.93 (mean value 0.88, range 0.44–1.00). The letters from 2001 belonged to our larger study of three pulmonary departments,<sup>7</sup> in which two respiratory nurses audited the letters. Inter-rater reliability was assessed using the  $\kappa$  statistic for each criterion. The median of all  $\kappa$  values was 0.87 (mean value 0.82, range 0.61–0.91). Intra-rater repeatability was also assessed and found the median  $\kappa$  to be 0.87 (mean value 0.83, range 0.31–0.98).

## Discussion

Our results show that the proportion of poor asthma-related referral letters has significantly decreased during the National Asthma Programme. The improved quality of letters is mainly explained by the attachment of graphics from PEF follow-up and spirometry to the referral letter more often in 2001 than in 1994. However, in 2001 the proportion of poor quality letters was still unacceptably high when compared with the MAS of 30%. There is clearly still

room for improvement in communication between physicians in asthma care.

In previous studies the quality of referral letters and the quality criteria have been variable.<sup>10–13</sup> We have not found studies concerning asthma referral letters. In a recent study of the quality of referral letters about patients with upper gastrointestinal symptom, the quality criteria were based on available guidelines and agreement of general practitioners as in the present study.<sup>14</sup> We audited the asthma referral letters from 1994 and 2001 against the same criteria. It may be considered as a limitation that the criteria were developed retrospectively in 2001. This might have affected the result, although the basic document used in developing the criteria was the Asthma Programme. Spirometry with the bronchodilatation test might have been omitted had the criteria been developed in 1994. However in 2001, spirometry equipment is available practically at all health centres in Finland.<sup>5</sup> The present results indicate that the equipment is also in active use. Attaching graphics from lung function tests is essential because spirometric values alone do not disclose the quality of the measurement. Correctly instructed PEF follow-up and good-quality spirometry mainly depend on the training and motivation of the nurses. A central strategy of the Asthma Programme was to train one nurse, as well as a general practitioner, at each PHC centre to take the main responsibility for asthma management locally. These professionals have been the driving force in setting up the above activities.

In previous studies, frequently missing items in referral letters were clinical findings, allergies, medication and sociopsychological matters.<sup>10–13</sup> Information on the onset of asthma-related symptoms, known allergies and the use of asthma medication was found in the letters significantly more often in 2001 than in 1994. Smoking history is crucial in referral letters sent to pulmonary clinic. Still in 2001 only 39% (in 1994 24%) of the letters included information on smoking status, although 77% ( $n = 160$ ) of primary care physicians in our nationwide questionnaire graded smoking as a very necessary item.<sup>6</sup> Referral letter information on asthma-specific medication generally relates to short-acting bronchodilators. The use of preventive asthma medication has increased tremendously during the years of the Asthma Programme.<sup>15,16</sup> This was reflected also in the referral letters, as the use of preventive asthma medication was mentioned significantly more often in 2001 (26%) than in 1994 (14%). Other than asthma medication in elderly patients was included in 55% (30% of all patients) of referral letters in 1994 and in 68% (38% of all patients) of letters in 2001.

The total number of non-emergency, external referral letters to the pulmonary department was the same in 1994 and 2001. The number of diagnoses of asthma has been slightly increasing in the study region; special reimbursement for asthma medication among adults had 3.2% in 1994 and 4.0% in 2001.<sup>15,16</sup> Despite this, the proportion of asthma-related letters out of all pulmonological referrals has decreased. Also, specialist consultations in problems of chronic asthma management have decreased. Almost one in 10 patients referred had previous asthma in 1994, compared with only one in 20 in 2001. We assume that these changes reflect the more active management of asthma in PHC, especially when related to the clearly increasing number of asthmatics between the study years.

Does the improvement in the quality of referral letters have any effects on the specialist consultation? In a previous study better referral letters produced only partly better reply letters.<sup>10</sup> We assume that a good-quality asthma-related referral letter makes it easier to make an asthma diagnosis on the first visit based on information from primary care, e.g. function tests, or to plan supplementary tests before the first visit. Sixteen percent of new asthma diagnoses were made at the first visit in 1994. Significantly, the proportion had increased up to 42% by 2001. Preliminary findings seem to support our assumption as they indicate that also the total number of visits following a referral has decreased during this period.

During the years of the Asthma Programme, the workload in PHC has increased, in part due to shifting of the main responsibility for the management of several chronic diseases to PHC. It is remarkable that even during these years of increasing demands the quality of asthma-related referral letters has improved and the number of referrals decreased considerably. The clinical profile of a patient referred and the final outcome diagnosis of referrals will give us further information on overall changes in asthma management.

## Acknowledgements

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## References

1. Asthma Programme in Finland 1994–2004. *Clin Exp Allergy* 1996;**26**:1–24.
2. Haahtela T, Klaukka T, Koskela K, Erhola M, Laitinen L. Asthma programme in Finland: a community problem needs community solution. *Thorax* 2001;**56**:806–14.
3. Brander P. Astmapotilaiden tutkimukset ennen erikoissairaanhoidon lähettämistä [Assessment of asthma in primary care before referring to specialist care]. *Finn Med J* 2003; **58**:1919–23 [in Finnish].
4. Kotaniemi J-T, Lundbäck B, Nieminen MM, Sovijärvi ARA, Laitinen LA. Increase of asthma in adults in northern Finland? A report from the FinEsS study. *Allergy* 2001;**56**:169–74.
5. Erhola M, Makinen R, Koskela K, et al. The Asthma Programme of Finland: an evaluation survey in primary health care. *Int J Tuberc Lung Dis* 2003;**7**:592–8.
6. Tuomisto L, Erhola M, Kaila M, et al. Asthma Programme in Finland: high consensus between general practitioners and pulmonologists on the contents of an asthma referral letter. *Prim Care Respir J* 2004;**13**:205–10.
7. Tuomisto LE, Erhola M, Kaila M, et al. The Finnish National Asthma Programme: communication in asthma care—quality assessment of asthma referral letters. *J Eval Clin Pract* 2006, in press.
8. Øvretveit J. *Action evaluation of health programmes and change: a handbook for a user focused approach*. Radcliffe Medical Press; 2002 [p. 126].
9. Williamson JW. Evaluating quality of patient care. A strategy relating outcome and process assessment. *JAMA* 1971;**218**: 564–9.
10. Grol R, Rooijackers-Lemmers N, Kaathoven van L, Wollersheim H, Mokkink H. Communication at the interface: do better referral letters produce better consultant replies? *Br J Gen Pract* 2003;**53**:217–9.

11. Jenkins RM. Quality of general practitioner referrals to out-patient departments: assessment by specialists and a general practitioner. *Br J Gen Pract* 1993;**43**:111–3.
12. Tattersall MH, Butow PH, Brown JE, Thompson JF. Improving doctors' letters. *Med J Aust* 2002;**177**:516–20.
13. Campbell B, Vanslembroek K, Whitehead E, et al. Views of doctors on clinical correspondence: questionnaire survey and audit of content of letters. *BMJ* 2004;**328**:1060–1.
14. Jiwa M, Coleman M, McKinley RK. Measuring the quality of referral letters about patients with upper gastrointestinal symptoms. *Postgrad Med J* 2005;**81**:467–9.
15. *Finnish Statistics on Medicines 1994*. Helsinki: National Agency for Medicines and Social Insurance Institution; 1995 [in Finnish].
16. *Finnish Statistics on Medicines 2001*. Helsinki: National Agency for Medicines and Social Insurance Institution; 2002 [in Finnish].

## ORIGINAL RESEARCH

# Asthma Programme in Finland: the quality of primary care spirometry is good

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### Abstract

**Aims:** To assess the quality of primary care spirometry by visual inspection of the flow-volume expiratory curve and to study the quantity of clinical information provided on the spirometry report sheets.

**Methods:** Retrospective audit of 868 expiratory flow-volume curves referred to three pulmonary clinics assessed against five predefined quality criteria. Clinical information included on the spirometry report sheets was also collected.

**Results:** Quality was good in 78% of pre-bronchodilation curves and in 80% of post-bronchodilation curves. Obtaining a sharp PEF value and full vital capacity exhalation seemed to be the critical points of measurement. Inter-rater reliability of the curve assessment was mainly good. Data on where the spirometry took place, and comments on the use of respiratory medication and patient co-operation were often lacking.

**Conclusions:** The quality of primary care spirometry was good. Adequate clinical information on the report sheets would further improve the quality of this diagnostic process.

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**Keywords** asthma, primary care, spirometry, quality, flow-volume curve, assessment

See linked Discussion paper by Enright on page 238

## Introduction

Spirometry is the most frequently used basic diagnostic test in pulmonary medicine. Guidelines and programmes concerning obstructive airway diseases have led to the increasing availability and use of spirometry in primary care settings.<sup>1,2</sup> Spirometry seems to influence the general practitioner's (GP's) decision-making process not only by reducing diagnostic uncertainty, but also by increasing the use of additional diagnostic tests and referral to specialist care.<sup>3</sup> Diagnosis of asthma is often dependent on repetitive lung function tests

before and after initiation of anti-asthma treatment often started by a GP. When a patient with suspected asthma or poor asthma control is referred to specialist care, copies of previous high quality spirometry measurements with adequate clinical information enhance the management process.

The quality and interpretation of primary care spirometry measurements have been a concern in previous studies.<sup>4-6</sup> Training has been shown to (at least temporarily) enhance the test quality.<sup>4</sup> Spirometry interpretation should begin with an overview of the technical quality of the manoeuvre and the clinical information given on the report. Omitting the quality review and relying only on numerical results for clinical

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decision-making is a common mistake, which is more easily made by those who are dependent upon computer interpretations.<sup>7</sup> Good quality spirometry is the result of both acceptable performance of the maximal exhalation manoeuvre and regular calibration of the equipment. The key check points of the maximal exhalation manoeuvre are the start, upslope, peak, and end of the curve; in addition, clinical information on circumstances such as the co-operation of the patient, current respiratory medication, and smoking status are important.

The main objective of the Finnish asthma programme (1994-2004) was to increase knowledge and recognition of asthma in primary care.<sup>8</sup> One of the measures used to achieve this was to train nurses to perform, and GPs to use and interpret, flow-volume spirometry curves.<sup>9</sup> National guidelines for laboratories and primary care units on how to measure and assess spirometry curves were first published in 1995.<sup>10</sup> Thus, in 2001, spirometry was available in 95% of Finnish health care centres,<sup>11</sup> and was actively used. In a previous study of asthma-related referral letters, we showed that pre- and post-bronchodilation spirometry measurements were included with the specialist referral letter more often in 2001 than in 1994 (32% vs 5.3%);<sup>12</sup> furthermore, GPs prescribed asthma medication more actively, and preventive asthma medication was mentioned in 26% of letters in 2001.

Spirometry report sheets may provide important diagnostic clues to the specialist only if the quality of the spirometry curves is acceptable, and adequate information on the spirometry session and patient history are included. The aim of this study was to assess the quality of primary care spirometry from the consulting specialist's viewpoint by visual analysis of the expiratory flow-volume curves and by evaluating the quantity of clinical information on the report sheets provided with the referral letters.

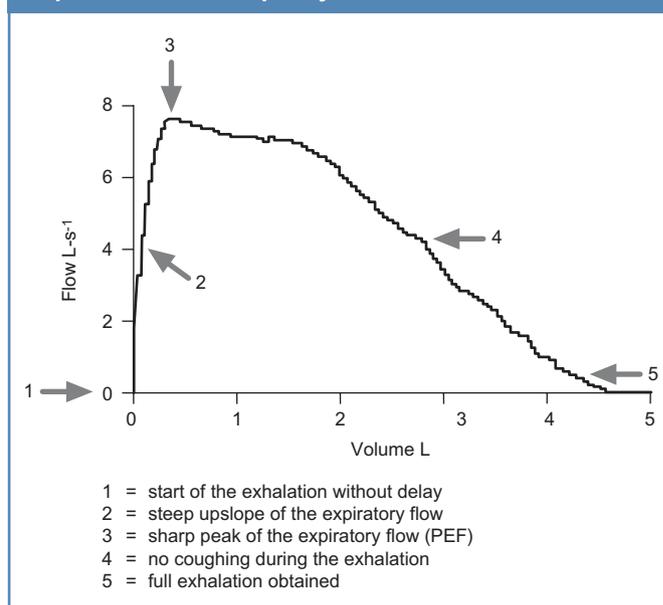
## Methods

This study is part of the systematic evaluation of the Finnish asthma programme.<sup>11-14</sup> The methodology is a retrospective medical record audit.

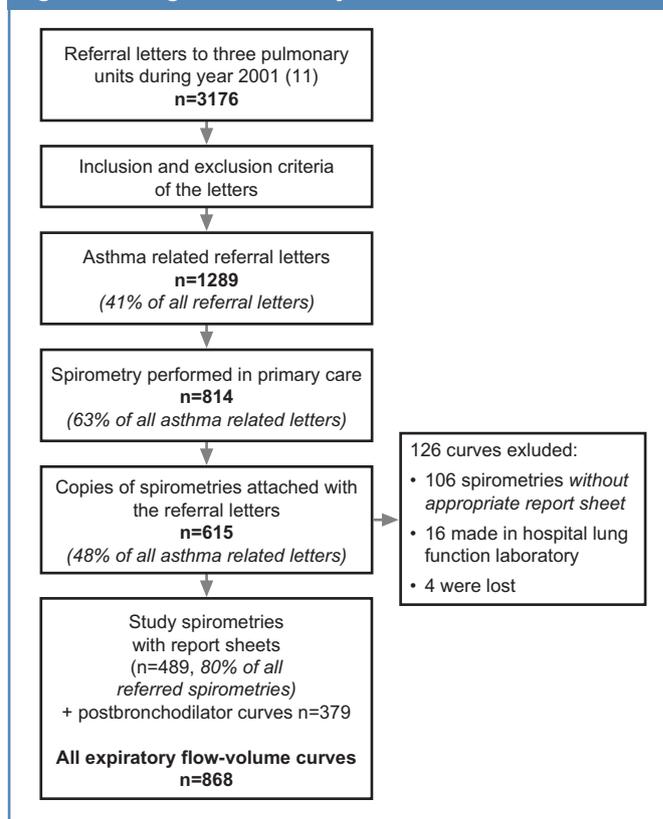
Quality criteria for the flow-volume curve based on American Thoracic Society quality criteria<sup>15</sup> were developed by the study group, which comprised six specialists representing four different specialities: clinical physiology (JL and VJ), pulmonology (PB and LT), primary care (ME) and allergology (MK). These criteria were used for visual assessment of the expiratory curves. The flow-volume curves were graded "good" if all five criteria were present (Figure 1).

Piloting of the feasibility of the quality criteria was performed. Two clinical physiologists (JL and VJ) and two pulmonary physicians (PB and LT) reviewed all five criteria of 36 spirometry curves; 14 of these included both the pre- and

**Figure 1. Quality criteria of the expiratory flow-volume loop (based on ATS quality criteria, 15).**



**Figure 2. Origin of the study flow-volume curves.**



post-bronchodilation curves from the same measurement session. The criteria were found to be mainly undisputable. Disagreement occurred most often in evaluating the sharpness of the peak expiratory flow (PEF) value

**Table 1. Clinical information presented on the spirometry report sheets attached to asthma-related referral letters (n=489).**

Clinical information on the spirometry report sheets	n=489
1. Date when the spirometry was performed included	99%
2. Indication for spirometry mentioned	15%
3. The location (ie the health care center or private practice) where the spirometry was performed included	37%
4. Name/ ID of the spirometry technician included	97%
5. Height of the patient included	99%
6. Smoking history of the patient mentioned	87%
7. Duration of smoking (in years) mentioned	74%
8. Patients' respiratory medication mentioned	26%
9. Time of last dose of that respiratory medication taken mentioned	30%
10. Patient cooperation commented	32%
11. Reference values included	100%
12. Source of the reference values referred (16)	96%

(disagreement in 10 out of 36 curves) and whether or not exhalation of the entire vital capacity volume had occurred (disagreement in 8 out of 36 curves). Disagreement was observed especially between the physiologists and the pulmonary physicians, the pulmonary physicians being more critical in their assessments.

The final audit contained 489 spirometry reports (80% of all referred spirometries). Figure 2 shows the origin of these spirometry reports. In our previous study,<sup>14</sup> all non-emergency referral letters (n=3176) to three Finnish pulmonary outpatient units sent during 2001 were scrutinised. The referrals originated from health care centres and private practices. We selected asthma-related referrals with 'asthma', 'asthma suspicion', 'asthma-related respiratory symptom', or 'obstructive lung function test result' being the original reason for the referral. On this basis 41% (n=1289) of all pulmonary referral letters from the study year were included. At least one spirometry measurement was attached with 615 (48%) of the referral letters. All attached spirometry readings were photocopied and coded. Only flow-volume spirometry curves which were printed as final reports, and which showed specific spaces to be filled in, with clinical information concerning the patient and the measurement circumstances, were included in the study. As the inspiratory manoeuvre was seldom performed, inspiratory flow-volume curves were not analysed, even if they were available. If several spirometry readings were provided with the same referral, we selected the latest one, or the one showing a bronchodilation reversibility test. The reversibility test was

**Table 2. Fulfilment of the five quality criteria in spirometries (78% included also postbronchodilator curve).**

Fulfilment of the five quality criteria	Prebronchodilator curve (n=489)	Postbronchodilator curve (n=379)
1. Start without delay	98%	99%
2. Steep upslope	95%	94%
3. Sharp PEF	90%	91%
4. No coughing	98%	99%
5. Full exhalation	90%	91%
All criteria fulfilled = good quality*	78%	80%

\* The quality of all flow volume spirometries (n=868) was found good in 79% of the curves.

included in 379 (78%) study readings. In these cases, both the pre- and post-bronchodilation curves were separately assessed. Therefore, a total of 868 spirometry curves from 489 spirometry reports were included in the quality assessment (see Figure 2).

The quality of the curves according to the five predefined criteria was assessed by two clinical physiologists, JL and VJ (with 30 years and 20 years of experience in analysing pulmonary function tests, respectively). They analysed 240 and 249 spirometry reports, respectively. In order to measure the intra-rater repeatability and the inter-rater reliability, both clinical physiologists blindly recoded 25 of the curves they had originally reviewed, and 25 of the curves originally reviewed by the other. Clinical information on the patient and the test session (see Table 1) shown on the spirometry report sheets (n=489) was separately collected by a trained nurse. Reference values used in the adult Finnish population were published in 1982.<sup>16</sup> The categories for the quality criteria and clinical information were coded, and the sums of the codes for different criteria were calculated. The sums indicate the overall assessment of flow-volume curve quality and the amount of clinical information included on the flow-volume sheets. The intra-rater repeatability and inter-rater reliability of the clinical physiologists were assessed by raw agreement.

## Results

We assessed the spirometry reports on 489 patients referred from primary care for pulmonary specialist consultation. Sixty-two percent of the patients were female, with a mean age (range) of 48 (15-86). The main indications for referral were: asthma suspicion (51%); asthma-related symptoms (25%); and previously-diagnosed asthma (6%). Bronchodilator reversibility tests were made in 379 cases. Significant bronchodilation response (12% or more) of forced expiratory volume in 1 second (FEV<sub>1</sub>) was observed in 20% of cases.

**Table 3. Agreement between the two clinical physiologists measured by reassessment of 50 spirometries; 35 of which included postbronchodilatation curve. (Yes = agreement, No = disagreement)**

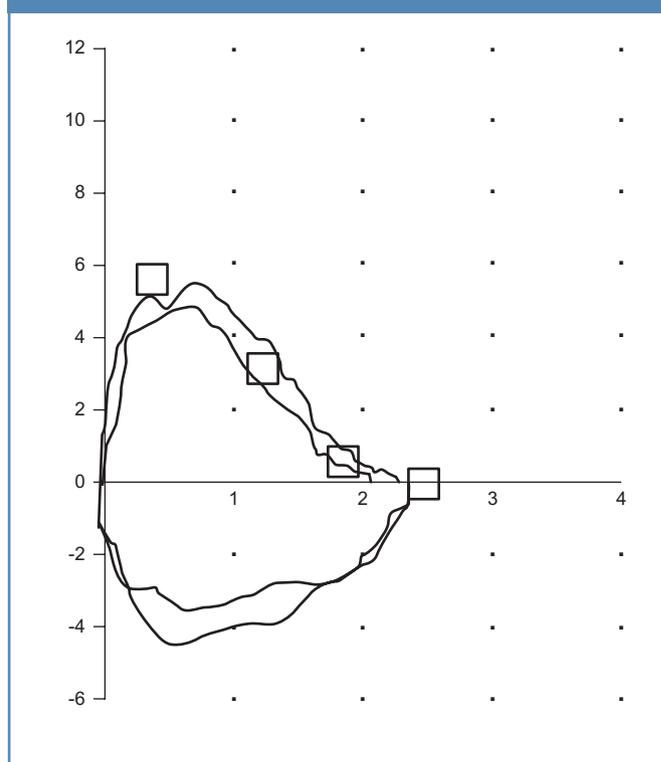
Prebronchodilatation curves n=50	Yes	No	Agreement
1. Start without delay	47	3	94%
2. Steep upslope	48	2	96%
3. Sharp PEF	46	4	92%
4. No coughing	46	4	92%
5. Full exhalation	44	6	88%
Postbronchodilatation curves n=35			
1. Start without delay	35	0	100%
2. Steep upslope	32	3	91%
3. Sharp PEF	32	3	91%
4. No coughing	35	0	100%
5. Full exhalation	29	6	83%

The fulfilment of the quality criteria of the pre- and post-bronchodilation curves is shown in Table 2. Each of the five criteria was fulfilled in at least 90% of curves. Sharp PEF and full exhalation were not achieved in 10% of the pre-bronchodilator curves (Figure 3). The quality of the curves was graded good (= all five criteria fulfilled) in 79% of all curves (n=868).

Intra-rater repeatability was assessed for both of the clinical physiologists by recoding 25 curves each. The agreement was 98% and 99%, respectively. Fifty curves (of which 35 also included post-bronchodilator curves) were coded by both clinical physiologists to measure the inter-rater reliability between the rates. This agreement ranged from 83% to 100%. Interpretation of the full exhalation caused the most disagreement between the two reviewers (Table 3).

Clinical information provided on the report sheets is shown in Table 1. The date of spirometry testing, identification of the technician, reference values and height of the patient, were found on almost all sheets, and smoking history on more than two-thirds. The location of spirometry testing (ie. name of the health care centre or private practice where the spirometry was performed) was mentioned on 37% of the sheets, and the indication for the spirometry measurement in 15% of cases. Use of respiratory medication and patient co-operation were commented on in a third of the sheets. If comments on patient co-operation, details of the use of respiratory medication, and data on the site where the spirometry took place were not counted, all other items were found on 84% of sheets.

**Figure 3. Example of a flow-volume curve where sharp PEF and full exhalation were not achieved.**



## Discussion

The quality of the flow-volume spirometry curves assessed using predefined criteria was good in 79% of the curves. Sharpness of the PEF value and full vital capacity exhalation seemed to be the critical points of the spirometry test. Obtaining full exhalation has been shown to be a common quality problem.<sup>4,6,17</sup> Clinical information such as the date of the test, patient height, and reference values were mentioned on almost all sheets. Details of the use of respiratory medication, patient co-operation, and the location of spirometry testing, were often missing.

Inter-rater agreement for quality criteria fulfillment between the two clinical physiologists was good. Assessment of the full exhalation criteria, especially regarding the post-bronchodilator curves, caused disagreement most often, which was also shown in our pilot study. On the spirometry sheets, the pre- and post-bronchodilation curves were partly overlaid, and repeated copying of the spirometry sheets may have decreased the visual quality of the curves (Figure 3). Interpretation of the full exhalation volume from these curves may be inconsistent if the forced vital capacity (FVC) obtained in the post-bronchodilation phase is smaller than the pre-bronchodilation FVC, even though both the curves may look appropriate. Usually, only the expiratory flow-volume curves were performed and reported. It would have been easier to

assess whether the full exhalation criteria were met consistently if the maximal inspiratory curves were also measured and reported.

The value of the clinical information given on the spirometry report sheets is seldom discussed. However, the need for that information is obvious from a clinical perspective. For example, comparison of the various curves can be difficult later on if information on the location and date of spirometry testing are missing. In order to get a reliable exhalation manoeuvre and test result, good patient co-operation is essential. Yet this information was mentioned on only one-third of the spirometry report sheets. Similarly, previous use of respiratory medication was found on only one-third of report sheets, although all the study spirometry flow-volume sheets had specific space available for comments on both patient co-operation and respiratory medication. In a recent study, trained GPs were shown to use spirometry to evaluate the response to recently-initiated treatment with inhaled steroids.<sup>18</sup> Interpretation of the test results and comparison with previous spirometries are not reliable without data on patient co-operation and recent use of both short-acting and long-term respiratory medication.

Walker *et al* have shown that the use of spirometry in primary care increases the rates of diagnosis of COPD and asthma, and leads to improvements at least in COPD treatment.<sup>19</sup> Use of bronchodilator reversibility testing in this setting may be important to avoid misdiagnosis and under-treatment. The present study has shown that bronchodilator reversibility testing was commonly combined with spirometry measurement in our primary care practices. In the majority (78 %) of the study spirometry sheets, post-bronchodilator curves were provided.

This study was specifically designed to evaluate the quality of primary care spirometry by visual assessment of the spirometry curves, and to study the quantity of clinical information provided with the spirometry report sheets. Evaluation of the actual value of performing spirometry in terms of clinical diagnosis was not in the scope of the study. Therefore, we did not try to analyse whether these spirometry measurements were useful in aiding the achievement of the correct diagnosis.

There were limitations in the study protocol. Since we assessed only spirometry reports enclosed with the referral letters from primary care to specialists, we do not know how well they represented all spirometry measurements in primary care. Reproducibility of the exhalation is an important additional quality criterion. This could not be evaluated by our retrospective analysis of the curves. We were not able to evaluate the adequacy of device calibration, either. Assessing the amount of clinical information gained from the spirometry sheets was one focus of this study. Therefore, only those flow-

volume report sheets with space left for this information were included. This might have improved the results, because adding information on the medication or patient cooperation is more likely to happen if there is available space. However, we know that this kind of spirometry report sheet is commonly used in our primary care setting.

In the future, smaller, cheaper and simpler office spirometers may replace the standard flow-volume spirometry machines in primary care settings. These various new machines, which often give only numerical values, may be practical in the screening of obstructive pulmonary disease. However, especially for diagnosis, it is essential to use high quality spirometers which display flow-volume curves; the ability to see displayed flow-volume curves is an important part of both the quality control and interpretation of spirometry testing. The curves should also be saved digitally in an electronic patient record system for later comparison during patient follow-up visits.

The quality of the spirometry curves enclosed with the asthma-related referral letters was good. Primary care spirometry measurements, especially with a reversibility test, offer additional high quality information when the patient is referred for a specialist consultation; the previous spirometry measurements can be compared with values obtained during the initial specialist consultation to aid the diagnostic process, and may even obviate the need for further spirometries. Continuous education and quality assurance should draw attention to the importance of providing adequate clinical information in order to improve further the usefulness of primary care spirometry to both GPs and specialists.

### Main discussion points

The quality of the primary care flow-volume spirometries assessed using predefined criteria was good in 79% of the curves. Sharpness of the PEF and successful exhalation of the entire volume seemed to be the critical points of the spirometry test. The ability to see displayed flow-volume curves is an important part of the quality control of spirometry testing. Value of the clinical information on the report sheet should also be emphasized. Interpretation of the test results and comparison to previous spirometries are not reliable without data on patient co-operation and recent use of both the short-acting and long-term respiratory medication.

### Conflicts of interest

None declared

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### References

1. National Institutes of Health. Global initiative for asthma. Global strategy for asthma management and prevention. Updated 2006. *NIH Publication*.

- <http://www.ginasthma.com/>
- Rabe KF, Hurd S, Anzueto A, et al. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD Executive Summary. *Am J Respir Crit Care Med* 2007;**176**:532-55. <http://www.goldcopd.com/>
  - Chavannes N, Schermer T, Akkermans R, et al. Impact of spirometry on GPs' diagnostic differentiation and decision-making *Resp Med* 2004;**98**:1124-30
  - Eaton T, Withy S, Garrett JE, Mercer J, Whitlock RML, Rea HH. Spirometry in Primary Care Practice. The importance of quality assurance and the impact of spirometry workshops. *Chest* 1999;**116**:416-23.
  - Schermer TR, Jacobs JE, Chavannes NH, et al. Validity of spirometric testing in a general practice population of patients with chronic obstructive pulmonary disease (COPD). *Thorax* 2003;**58**:861-6.
  - White P, Wong W, Fleming T, Gray B. Primary care spirometry: test quality and the feasibility and usefulness of specialist reporting. *Br J Gen Pract* 2007;**57**:701-05.
  - Pellegrino R, Viegi G, Brusasco V, et al. Interpretative strategies for lung function tests *Eur Respir J* 2005;**26**:948-68.
  - Asthma programme in Finland 1994-2004, with introduction by Haahtela T, Laitinen LA. Report of a Working Group. *Clin Exp Allergy* 1996;**26**:1-24.
  - Haahtela T, Tuomisto LE, Pietinalho A, et al. A Ten-year Asthma Programme in Finland: Major change for the better. *Thorax* 2006; **61**:663-70.
  - Sovijärvi ARA, Piirila P, Korhonen O, Louhiluoto E, Pekkanen L, Forstedt M. Performance and evaluation of spirometric and PEF measurements, offprint 3. KP-paino, Kokkola: Kliinisten laboratoriotutkimusten Laaduntarkkailu Oy; Moodi 1995 (in Finnish).
  - Erhola M, Mäkinen R, Koskela K, Bergman V, Klaukka T, Mäkelä M et al. The Asthma Programme of Finland: an evaluation survey in primary health care. *Int J Tuberc Lung Dis* 2003;**7**:592-8.
  - Tuomisto LE, Kaila M, Erhola M. Asthma programme in Finland: Comparison of adult asthma referral letters in 1994 and 2001. *Respir Med* 2007;**101**:595-600.
  - Tuomisto L, Erhola M, Kaila M, et al. Asthma Programme in Finland: High consensus between general practitioners and pulmonologists on the contents of an asthma referral letter. *Prim Care Respir J* 2004;**13**:205-10. doi:10.1016/j.pcrj.2004.04.001
  - Tuomisto L, Erhola M, Kaila M, et al. The Finnish National Asthma Programme: Communication in asthma care – quality assessment of asthma referral letters. *J Eval Clin Pract* 2007;**13**:50-4.
  - American Thoracic Society. Standardization of spirometry: 1994 update. *Am J Respir Crit Care Med* 1995;**152**:1107-36.
  - Viljanen AA, Halttunen PK, Kreus KE, Viljanen BC. Spirometric studies in non-smoking health adults. *Scand J Clin Lab Invest* 1982;**159**:5-20.
  - Akhtar R, Wilson A. A comparison of spirometry in general practice and a pulmonary function laboratory. *Prim Care Respir J* 2005;**14**:215-20. doi:10.1016/j.pcrj.2004.12.005.
  - Poels PJP, Schermer TRJ, Jacobs A, Akkermans RP, Bottema BAM, van Weel C. Variation in spirometry utilization between trained general practitioners in practices equipped with a spirometer. *Scand J Prim Health Care* 2006;**24**:81-7.
  - Walker PP, Mitchell P, Diamantea F, Warburton CJ, Davies L. Effect of primary care spirometry on the diagnosis and management of COPD. *Eur Respir J* 2006;**28**:945-52.

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## Asthma Programme in Finland: Did the use of secondary care resources become more rational?

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Asthma symptoms;  
Management of asthma;  
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care interface;  
Referral

### Summary

**Objectives:** The aims were to evaluate the profile of newly diagnosed adult asthma cases and the approach adopted to the secondary care management at the launch of the Finnish asthma programme in 1994 and seven years later, in 2001.

**Methods:** A retrospective medical record audit was made of non-acutely referred patients with asthma in 1994 ( $n = 165$ ) and in 2001 ( $n = 133$ ). Clinical profile data, numbers of out-patient visits and periods of in-patient care before and after asthma diagnosis were gathered from referral letters and secondary care records.

**Results:** The newly diagnosed asthma patients in 2001 were older, more obese and had more co-morbidities. The main asthma symptoms, such as dyspnoea, wheezing and cough, occurred equally in both years but were more often periodic than daily in 2001. Wheezing during auscultation was significantly less common in 2001. The diagnostic process was associated to a history of asthma in first-degree relatives (OR 5.34, 95% CI 1.12–24.49) in 1994 and a visit to a nurse prior to that to a physician (OR 3.13, 95% CI 1.17–8.37) in 2001. Secondary care visits per new case of asthma (7.3 in 1994 vs. 5.4 in 2001) and days in hospital (3.6 in 1994 vs. 0.95 in 2001) decreased significantly.

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*Conclusions:* The profile of asthma diagnosed in secondary care indicates milder disease with more co-morbidities in 2001 than in 1994. Trends towards assigning a more active role on the part of primary care physicians and more rational use of secondary care resources in the management of asthma were found.

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## Introduction

Good co-operation at the interface between the primary and secondary care sectors is important for a health care system with limited resources.<sup>1</sup> Changes in the organization and delivery of care can improve its quality and certain outcomes of chronic disease.<sup>2</sup> One model of chronic care predicts that increasing clinical expertise and decision support, improvements in patient self-management, increased effectiveness of practice teams and the existence of more accessible and useful clinical information can produce a system reform in which informed, activated patients interact with prepared, proactive practice teams.<sup>3</sup> The effective management of asthma – as of all chronic diseases – begins with making an accurate and timely diagnosis, after which continuous anti-inflammatory treatment, patient education in self-management and regular follow-up visits are the cornerstones of good management of chronic asthma.

In Finland as in other Nordic countries asthma symptoms caused by cold weather are common and many other environmental factors play a key role in the prevention and management of asthma.<sup>4</sup> Increased variability of asthma symptoms by environmental factors gives an additional diagnostic challenge for the health care professionals. The national asthma programme was launched in 1994 in Finland among the first nations, at a time when the number of asthmatics was increasing.<sup>5</sup> Since then the management of adult asthma has changed at all levels of care, with some regional variations (Table 1). Before 1994 asthma was considered a disease to be diagnosed by a specialist in pulmonary medicine with facilities for all lung function measurements. In Finland a 72% reimbursement is given on anti-asthma medication only if the recipient has physician-diagnosed chronic asthma which fulfils the prevailing criteria based on lung function measurements (peak expiratory flow (PEF) and/or spirometry and/or provocation test).<sup>9</sup> The asthma programme, together with later published evidence-based guidelines, encouraged primary care physicians to use simple, easily available diagnostic methods, including a careful history of symptoms, PEF measurements, spirometry with a bronchodilation test and in some cases observed steroid reversibility tests to reach the criteria for anti-asthma medication.<sup>6,10</sup> The main responsibility for adult asthma management was shifted to primary care, but referral to a pulmonary specialist was recommended in cases of unclear diagnosis or poor response to initial or long-term asthma treatment. During and after the programme, a new division of labour between primary and secondary care was defined. Asthma coordinators (one physician and at least one nurse) were nominated at each health care centre,<sup>11</sup> and asthma nurses took an active role in primary care and later also in

secondary care in the management of asthma, both before and after diagnosis.

In a previous study we audited non-acute asthma-related referral letters sent to the Department of Respiratory Diseases at Seinäjoki Central Hospital in 1994 and 2001.<sup>7</sup> Verification of a new asthma case was the reason for referral in 54% of the asthma-related letters in 1994 and 48% in 2001, but had the profile of these patients with asthma changed? Had there been any changes in the approach to the asthma management? Have the numbers of visits and hospital admissions for secondary care changed? To address these questions we reviewed the medical records of the new asthma cases in both years with the aims of defining the clinical profile and time to diagnosis of referred cases of asthma and assessing whether the use of secondary care resources had changed between 1994 and 2001.

## Materials and methods

### Setting

This study forms part of a systematic evaluation of the Finnish asthma programme, employing a retrospective medical record audit methodology. The work was conducted at the Department of Respiratory Diseases, Seinäjoki Central Hospital, which has a catchment area with a population of nearly 200 000 (4% of the total Finnish population), comprising 27 municipalities with 18 primary health care (PHC) centres. A regional asthma programme, based on the national one, had been published in 1997. The study design is illustrated in Fig. 1, and the origin of the non-acute referral letters is described in detail in our previous study.<sup>7</sup>

### Handling of referral letters and use of a preliminary visit to a nurse at the Department of Respiratory Diseases

It was agreed among the pulmonary specialists at the Department of Respiratory Diseases in 1996 that on receipt of a referral letter they would carefully plan all the necessary procedures before the patient's first visit to the department. Information in the referral letter (together with copies of previous lung function test results) has been found crucial for making the appropriate plans for secondary care visits, especially previous asthma medication usage. For most of the patients with suspicion of asthma, a visit to a respiratory nurse was arranged at least two weeks before the first physician visit to complete the referral information. At the visit the respiratory nurse discussed patient's recent symptoms and medication usage,

**Table 1** Management of adult asthma before 1994 and after 2001 and the division of labour between physicians and nurses in primary and specialist care in the region served by Seinäjoki Central Hospital (modified from the original table in Ref. 6).

	Before 1994	After 2001
<i>Primary care</i>		
General practitioner	<ul style="list-style-type: none"> <li>• No asthma guidelines</li> <li>• No local treatment chains</li> <li>• All asthma suspicions referred to a specialist without previous lung function tests</li> <li>• Poor-quality referral letters without any results of lung function measurements<sup>7</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Easy access to evidence-based guidelines and local treatment chains</li> <li>• Diagnosis of asthma by a GP</li> <li>• Short specialist consultations as needed</li> <li>• Better-quality asthma referral letters, including peak flow follow-ups and good quality spirometries with a bronchodilation test<sup>7,8</sup></li> </ul>
Nurse	<ul style="list-style-type: none"> <li>• Infrequent follow-up visits as needed</li> <li>• Asthma prescriptions renewed without a check-up</li> <li>• Only a reliever as needed while waiting for a diagnosis</li> <li>• All moderate and severe asthma exacerbations referred to hospital</li> </ul>	<ul style="list-style-type: none"> <li>• Annual follow-up visits</li> <li>• Anti-inflammatory treatment started without delay after diagnosis</li> <li>• Milder asthma exacerbations treated by self-management guidance, only patients with severe, repeated exacerbations referred to hospital</li> </ul>
<i>Specialist care</i>		
Specialist	<ul style="list-style-type: none"> <li>• Diagnosis of asthma</li> <li>• Some of the diagnostic tests performed during non-emergency hospital admission</li> <li>• Frequent follow-up visits for asthma patients</li> <li>• Majority of acute asthma care</li> </ul>	<ul style="list-style-type: none"> <li>• Only a portion of new diagnoses</li> <li>• All diagnoses at out-patient visits</li> <li>• Planning of the first specialist visit beforehand based on referral letters</li> <li>• Follow-up of severe cases only</li> <li>• Only asthma patients with the most severe or repeated exacerbations</li> </ul>
Nurse	<ul style="list-style-type: none"> <li>• Nurse present at visits to a doctor</li> <li>• Patient guidance in peak flow measurement and use of inhalers in conjunction with the specialist visit</li> </ul>	<ul style="list-style-type: none"> <li>• Visits to a nurse before the first visit to a specialist and after asthma diagnosis, with the possibility for specialist consultation</li> <li>• Patient-centred, systematic asthma education</li> </ul>

checked inhalation technique and guided a fresh 2-week PEF follow-up measurement. In case of severe symptoms immediate specialist consultation was available.

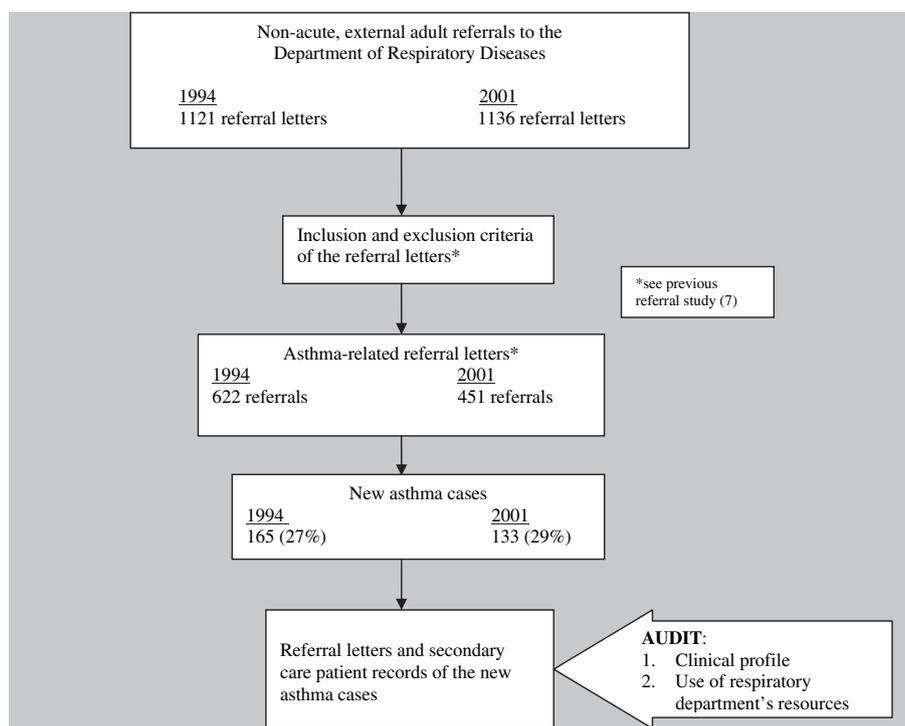
### Selection of cases

The nurse performing this survey gathered all the final diagnoses received by the patients referred to the department in each year into a summary chart (Fig. 1). New asthma had been diagnosed during secondary care visits in

165 cases (27% of all referrals) in 1994 and in 133 cases (29% of all referrals) in 2001. Copies of the asthma patient records from the first secondary care visit and of the spirometry report sheets were collected.

### Medical record audit

The auditing process included the following steps: definition of the items of clinical data to be collected and included (Tables 2 and 3), preparation of a manual for the



**Figure 1** Study design and origin of the referral letters.

collection of clinical data, training of a nurse to use it, extraction of the clinical data from the copies of the referral letters and patient records, counting of all secondary care out-patient visits, admissions and in-patient days before and after the diagnosis of asthma, and finally, recoded of a 6% sample of cases and assessment of the intra-rater repeatability for each item in the clinical data using the  $\kappa$  statistic. The median of all the  $\kappa$  values was 0.94 (mean value 0.75, range 0.36–1.0).

### Clinical profile

The clinical profile consisted of specified details of the patient's background, history, asthma medication prior to the first visit, symptoms, findings and results of lung function tests (Tables 2 and 3). Co-morbidity was coded as present in the case of hypertension, coronary disease or diabetes. Data were extracted both from the index referral letter and the record of the first specialist visit. In the event of a conflict between these, the most recent information was used. If there were no data either in the referral letter or the record of the first visit the case was coded as having the data missing.

### Timing of the asthma diagnosis and number of visits

Main reason for referral was to diagnose or exclude asthma. The timing of the asthma diagnosis was easy, the diagnostic visit was clearly defined in the patient records. The numbers of all specialist visits, hospital admissions and days in the respiratory ward were calculated before and after the diagnostic visit or stay. In order to obtain a better estimate of the use of respiratory department resources,

every non-acute hospital stay in the respiratory ward was counted as two out-patient visits. The patient records were screened for any visits up to six years after the index referral. The post-diagnosis visits of nine asthma patients in 2001 were excluded because their follow-up was complicated by other chronic diseases.

### Statistical analysis

Total numbers and percentages for the various items of clinical information, including the patient's background, history, asthma medication prior to the first visit, symptoms, findings and results of lung function tests, were calculated and compared between the two years, 1994 and 2001, with and without missing values. Pearson's Chi-Square or if expected counts were too low, Fisher's Exact tests were used for these comparisons. The results of the lung function tests at the first visit were expressed in terms of medians with ranges, due to the skew distributions, and tested with the Mann Whitney test for differences between the years 1994 and 2001. Logistic regression was used to assess determinants of the diagnosis at the first secondary care visit among the following factors: age, asthma in first-degree relatives, atopic status, subjective and objective wheezing, blood eosinophils, use of recent asthma medication (bronchodilator or preventive), symptom frequency, availability of primary care lung function results at referral and a pre-diagnostic visit to a nurse. The numbers of secondary care visits and hospital admissions were studied by Kaplan–Meier analysis, and intra-rater repeatability was assessed in terms of Kappa coefficients.<sup>12</sup> All the analyses were performed with SPSS 16.0 for Windows (SPSS Inc., Chicago, USA). Statistical significance was set at  $p < 0.05$ .

**Table 2** Background data on newly diagnosed asthma patients, their history and asthma medication prior to the first visit in 1994 and 2001, frequencies (*n*) with percentages (%). Differences between 1994 and 2001 were tested with ( $p_1$ ) and without ( $p_2$ ) missing cases.

	1994 <i>N</i> = 165	2001 <i>N</i> = 133	$p_1$	$p_2$
<i>Background</i>				
Female, <i>n</i> (%)	96 (58)	81 (61)		0.635
Age, mean (Sd)	42.2 (17.3)	46.5 (16.2)		0.031
BMI, <sup>a</sup> mean (Sd)	26.4 (4.7)	28.4 (5.7)		0.002
Missing, <i>n</i> (%)	28 (17)	6 (5)		
BMI over 30	26 (19)	42 (33)		0.011
<i>History</i>				
Family history of asthma, <sup>b</sup> <i>n</i> (%)			0.758	0.457
First-degree relatives	69 (42)	61 (46)		
Missing	25 (15)	20 (15)		
Smoking, <i>n</i> (%)			0.553	0.353
Never smoked	79 (48)	65 (49)		
Current smoker	30 (18)	31 (23)		
Missing	7 (4)	6 (5)		
Co-morbidity, <sup>c</sup> <i>n</i> (%)			0.010	0.013
Yes	24 (15)	37 (28)		
Missing	32 (19)	16 (12)		
Chronic rhinitis, <i>n</i> (%)			0.971	0.969
Yes	95 (58)	76 (57)		
Missing	22 (13)	19 (14)		
Atopy, <sup>d</sup> <i>n</i> (%)				0.425
Not tested	16 (10)	14 (11)		
Skin-prick test positive	64 (39)	43 (32)		
Dermatographism	3 (2)	6 (5)		
<i>Asthma medication prior to the first visit</i>				
Bronchodilator, <i>n</i> (%)	114 (69)	102 (77)	0.018	0.712
Missing	15 (9)	2 (2)		
Corticosteroid, <sup>e</sup> <i>n</i> (%)	7 (4)	40 (35)	<0.001	<0.001
Missing	15 (9)	2 (2)		

<sup>a</sup> Body mass index.

<sup>b</sup> At least one of the first-degree relatives (parent, sibling or child) had asthma.

<sup>c</sup> Co-morbidity includes hypertension, coronary disease or diabetes.

<sup>d</sup> Atopy defined as at least one positive skin-prick test for common allergens.

<sup>e</sup> Includes also three cases using combination asthma medication (long-acting  $\beta_2$  agonist and steroid).

## Results

### Clinical profile

The clinical profile of the new asthma cases at the first visit to secondary care is presented in Tables 2 and 3. Two thirds of the cases were women in both years. The asthma patients in 2001 were significantly older, more obese and had more co-morbidities than in 1994. The proportion of obese asthmatics (BMI > 30) increased significantly from 19% in 1994 to 33% in 2001 ( $p = 0.011$ ). Two thirds reported chronic rhinitis in both years, and practically one fourth were current smokers. Thirty-nine percent of the asthmatics were atopic in 1994 and 32% in 2001. The main symptoms were dyspnoea, cough and wheezing, with no significant differences between the years. Expiratory wheezing observed by auscultation at the primary or

secondary care physician's visit was significantly less common in 2001. Symptoms occurred periodically more often than daily or weekly in 2001. The smokers and ex-smokers had significantly more sputum production than those who had never smoked (88%, 71% and 62% respectively) in 1994 ( $p = 0.037$ ), but the difference only came near to significance (85%, 77%, 62%;  $p = 0.080$ ) in 2001. The smokers had not wheezed either subjectively or objectively more often than the non-smokers, however ( $p = 0.828$  in 1994, and  $p = 0.117$  in 2001).

Bronchodilator drugs were commonly prescribed in both years, but the use of anti-inflammatory drugs before the specialist consultation was significantly more frequent in 2001, one third of the cases ( $n = 40$ ) having received inhaled corticosteroids less than four weeks prior to the first secondary care visit. If anti-inflammatory medication had been prescribed before the first visit objective expiratory wheezing was documented either at the primary

**Table 3** Symptoms, findings and spirometry values in newly diagnosed cases of asthma in 1994 and 2001, frequencies (*n*) with percentages (%). Differences between 1994 and 2001 were tested with ( $p_1$ ) and without ( $p_2$ ) missing cases.

	1994	2001	$p_1$	$p_2$
	<i>N</i> = 165	<i>N</i> = 133		
<i>Symptoms and findings</i>				
Dyspnoea, <i>n</i> (%)			0.633	0.477
Yes	155 (94)	123 (93)		
Missing	1 (1)	0 (0)		
Cough, <i>n</i> (%)			0.024	0.079
Yes	118 (72)	94 (71)		
Missing	27 (16)	11 (8)		
Sputum production, <i>n</i> (%)			0.078	0.800
Yes	81 (49)	75 (56)		
Missing	54 (33)	28 (21)		
Subjective wheezing, <i>n</i> (%)			0.428	0.205
Yes	107 (65)	95 (71)		
Missing	23 (14)	17 (13)		
Expiratory wheezing by auscultation in primary or secondary care, <i>n</i> (%)			<0.001	0.001
Yes	76 (46)	34 (26)		
Missing	3 (2)	11 (8)		
Night-time symptoms, <i>n</i> (%)			0.085	0.650
Yes	69 (42)	46 (35)		
Missing	66 (40)	70 (53)		
Frequency of symptoms, <i>n</i> (%)			0.001	0.001
Daily	51 (31)	26 (20)		
Weekly	3 (2)	0 (0)		
Periodic	53 (32)	70 (53)		
Missing	58 (35)	37 (28)		
<i>Spirometry values at the first visit</i>				
Pre-FEV <sub>1</sub> %, <sup>a</sup> Md (Range)	81 (30–112)	81 (20–108)		0.398
Missing	1	7		
Pre-FEV %, <sup>b</sup> Md (Range)	74 (29–98)	76 (26–94)		0.411
Missing	1	8		
Post-FEV %, <sup>c</sup> Md (Range)	77 (37–99)	78 (29–93)		0.143
Missing	62	23		

<sup>a</sup> Pre-FEV<sub>1</sub>% = forced expiratory volume in 1 s, % of predicted.

<sup>b</sup> Pre-FEV% = ratio of forced expiratory volume in 1 s (FEV<sub>1</sub>) to forced vital capacity (FVC) measured before the bronchodilator test.

<sup>c</sup> Post-FEV% = as above, but measured after the bronchodilator test.

health care visit or at the first visit to specialist more often ( $p = 0.045$  in 1994 and  $p = 0.005$  in 2001), but the lung function parameters did not differ significantly between the groups who had or had not received anti-inflammatory medication recently (data not shown). The median pre-FEV<sub>1</sub>% and pre-FEV% values did not differ significantly between the two years, nor did the post-FEV% values differ, but 37% of these values were missing in 1994 and 17% in 2001. The blood eosinophil count was elevated in 24% of the asthmatics (missing in 10%) in 1994 and 23% (missing in 6%) in 2001.

### Secondary care visits

Comparison of the number of out-patient visits before confirmation of the asthma diagnosis was not straightforward, as 26% of the diagnoses were established during a non-acute hospital stay in 1994 and 8% in 2001 (Table 4). We compensated this by counting one hospital stay in the

respiratory ward as equivalent to two out-patient visits. When the diagnosis had been reached at the first out-patient visit without admission to hospital, this took place significantly earlier in 2001 and involved 45% of the diagnoses as compared with only 24% in 1994. By logistic regression analysis only a history of asthma in first-degree relatives (OR 5.34, 95% CI 1.12–24.49) in 1994 and a visit to a nurse prior to the specialist visit (OR 3.13, 95% CI 1.17–8.37) in 2001 significantly associated to the early asthma diagnosis. Nurse visit as a first visit to specialist care was not available in 1994. In 2001 specialist decided to call 60% of the asthmatics ( $n = 80$ ) to visit a nurse first. When this visit in 2001 was taken into account, the significant difference in the number of pre-diagnostic visits disappeared. The probabilities attached to the number of visits before asthma diagnosis in the two years are shown in Fig. 2. There were significantly fewer visits after the diagnosis in 2001 than in 1994 ( $p < 0.001$ ) (Table 4), so that where 55% of the asthma patients visited a specialist three

**Table 4** Use of respiratory department resources for asthma diagnosis.

	1994	2001	<i>p</i>
	New asthma <i>n</i> = 165	New asthma <i>n</i> = 133 <sup>c</sup>	
Asthma diagnoses made at an out-patient visit, <i>n</i> (%), including	121 (73)	122 (92)	< 0.001
those made at the first specialist visit, <i>n</i> (%)	29 (24)	55 (45)	
those made during a non-acute hospital stay, <i>n</i> (%)	43 (26)	11 (8)	
Out-patient visits to a doctor			
before asthma diagnosis, Md (Range)	2 (0–8)	2 (0–7)	0.741
after asthma diagnosis, Md (interquartile range)	3 (2–5)	2 (1–4)	<0.001
all, Md (interquartile range)	6 (4–7)	4 (3–6)	<0.001
Out-patient visits to a doctor, including non-acute hospital stays, <sup>a</sup> total number of visits per year per new asthma case	1208 7.3	599 4.8	
All out-patient visits, <sup>b</sup> including non-acute hospital stays, <sup>a</sup> total number of visits per year per new asthma case	1208 7.3	661 5.4	
Days of non-acute hospital stay			
total number of days before asthma diagnosis	536	101	
days before asthma diagnosis, Md (Range)	0 (0–25)	0 (0–19)	<0.001
total number of days in hospital	594	127	
total days, Md (Range)	0 (0–25)	0 (0–19)	<0.001

<sup>a</sup> One hospital stay in the respiratory ward was counted as two out-patient visits.

<sup>b</sup> Including visits to a nurse prior to the first specialist visit in 2001.

<sup>c</sup> Visits after diagnosis and total number of visits include only 124 new asthma cases.

times or less after the diagnosis in 1994 the figure was 75% in 2001. If both visits to a nurse and hospital stays (one hospital stay equivalent to two out-patient visits) are counted, the use of respiratory department resources in connection with the diagnosis of asthma can be estimated at 7.3 visits per new asthma diagnosis in secondary care in 1994 and 5.4 visits in 2001 (Table 4). The overall number of visits to secondary care did not differ in the case of the smokers (data not shown). Thirty-nine percent of the asthmatics (*n* = 64) were admitted to hospital electively in 1994 and 14% (*n* = 19) in 2001, and the number of days in hospital per new asthma diagnosis was also significantly higher in 1994 (3.6 vs. 0.95, respectively).

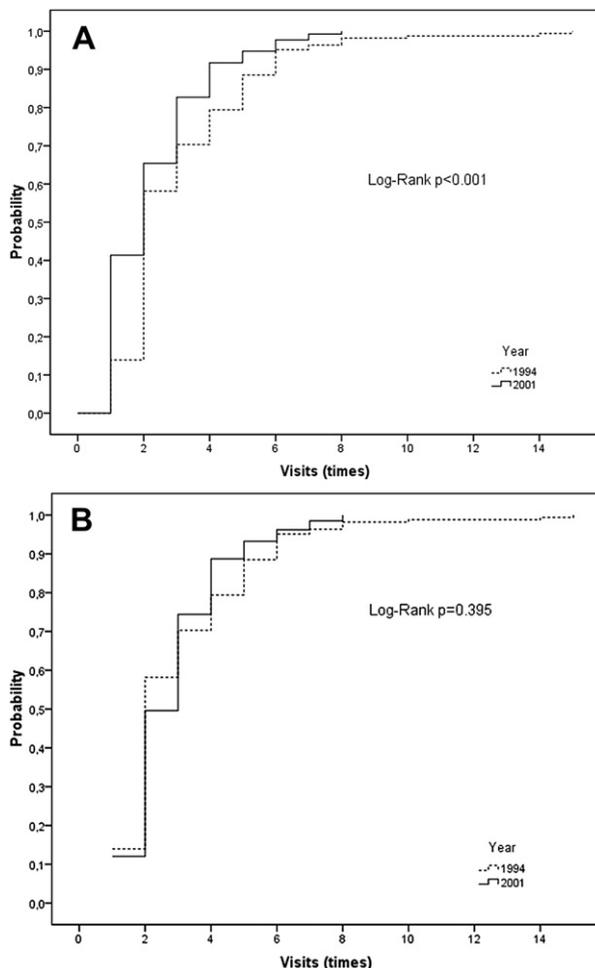
## Discussion

The clinical profile of the patients referred to the Department of Respiratory Diseases with newly diagnosed asthma was nearly the same in 1994 as in 2001, although milder asthma was implicated in 2001. The diagnosis was made at the first secondary care visit significantly more often in 2001 than in 1994, however. We identified one factor explaining the difference in the diagnostic process in each year, a history of asthma in first-degree relatives in 1994 and a visit to a nurse before the first specialist consultation in 2001. Hospital out-patient visits, admissions to hospital and number of hospital days both before and after the confirmation of asthma diagnosis decreased in 2001.

The leading symptoms of newly diagnosed asthma were the well-known ones: dyspnoea, wheezing and cough in both years, although objective expiratory wheezing was documented by a physician in almost half of the cases in 1994, but in less than every third case in 2001. Symptoms

were present daily significantly less often in 2001. Thus we could speculate that the asthma diagnoses were made by the primary care physician in 2001 if the patient had the typical chronic asthma symptoms and findings, including objective wheezing, but otherwise the probability of referral to a specialist increased. Even though there was no difference in lung function parameters between the years, we may presume that referral in 2001 was mild, early asthma with diagnostic difficulties. If an anti-inflammatory drug had been prescribed by the primary care physician, wheezing was found to be heard more often in 2001. This reflects the more active and timely therapeutic role of the primary care physician in 2001, even though later referring the patient to a specialist. Moreover, these asthma patients in 2001 represented 75% of all those who had received inhaled corticosteroid prescribed by a primary care physician prior to referral to a specialist.<sup>7</sup> In some cases, however, previous anti-inflammatory asthma medication might have prolonged the diagnostic process in secondary care, especially if no results of previous primary care lung function tests were available.

Finnish questionnaire study in 2000 reported that 63% (*n* = 2952) of its patients with asthma (mean age 54.4, SD 17.6 years) had at least one out of ten selected co-morbidities.<sup>13</sup> In the present study co-morbidities such as hypertension, coronary disease or diabetes were more common in 2001, partly associated with significantly increased obesity among asthmatics. Obesity has become one of the major health problems in Finland, as worldwide, with especially high incidence in the region concerned here, where there is also a high prevalence of type 2 diabetes.<sup>14,15</sup> A connection between obesity and asthma has been well documented, as recently reviewed.<sup>16</sup> Obesity may lead to overdiagnosis of asthma, which can be best



**Figure 2** Probability of given numbers of visits before asthma diagnosis. Out-patient visits to a doctor, including hospital stays,\* before asthma diagnosis (A) and the same *added with* one visit to a nurse prior to the first visit to a doctor (B).

avoided by using objective testing using spirometry and, if necessary, bronchial challenge testing to confirm asthma in patients with respiratory symptoms.<sup>17</sup>

Workload in the secondary care asthma management decreased between the study years. The total numbers of visits to hospital and days in hospital were significantly lower in 2001 than in 1994. The diagnostic process was promoted by means of a preliminary visit to a nurse and less specialist visits were required. In the final report of the Finnish asthma programme the overall costs per patient per year were decreased 36% between years 1993 and 2004.<sup>6</sup> One part of this cost savings was the reduction of hospitalization days (including acute and non-acute care) from 271/100 000 patients in 1993 to 120/100 000 patients in 2003. Two main objectives of the asthma programme were to increase common awareness of asthma and the early detection of asthma which seems to have decreased the overall hospitalization of asthma. Asthma programme was not the only promoting factor in this process, however. The overall trend in the Finnish health care for last two decades has been towards out-patient care in the management of all chronic diseases. Good availability of preventive asthma

medications with simple devices has also been one major reason for the decreased workload of all health care sectors.

A review of patient records entails some limitations because of the retrospective nature of the study design. Patient records reflect the everyday management of the disease, however, and its real-life documentation. Although the main symptoms were well documented in the present data, some important clinical information was missing in more than a third of the cases, e.g. night-time symptoms or the frequency of symptoms. The strength of the study lies in the fact that every asthma diagnosis was based on strict criteria and extensive use of diagnostic tests, reviewed by a specialist. The asthma profile we describe is not the whole picture of new asthma cases. Especially, in 1994 many new cases were diagnosed after acute hospital admission. Furthermore, we don't know what proportion of the newly diagnosed asthma cases was referred and how they differed from the non-referred ones. The reduction in non-acute admissions of asthma patients to hospital also reflects in part the overall trend towards out-patient management in health care. All the posts of physician in the health care centres of the region were occupied in 1994, whereas in 2001 only 80% were occupied, and there was also a shortage of physicians in secondary care in 2001 in particular, which made the waiting times longer. The reduced resources in terms of physicians on both sides of the interface forced the health care providers to consider a new division of labour between physicians and between physicians and nurses in both primary and secondary care, which also had an effect on referral policy.

Asthma is a common disease which involves even more common symptoms, and the trend towards milder, intermittent manifestations is likely to pose more diagnostic challenges for all health care professionals.<sup>18</sup> According to national asthma programme primary care professionals have the main responsibility for early asthma diagnosis, as well as for patient education and regular asthma follow-ups. In the future, however, primary care focusing programmes for chronic diseases will work only if primary care works. The recent worsening in the shortage of primary care physicians, as seen in 2001, has made it essential to consider even more rational use of nursing resources to take care of patients with asthma and certain other chronic diseases. In 2007 the Finnish Ministry of Social Affairs and Health explored the possibility of reorganizing health care in order to bring specialized medical consultation into primary health care, which together with advanced facilities for maintaining electronic patient records opened up new opportunities to enhance cost-effective communication and short consultations at the interface ([www.stm.fi](http://www.stm.fi)).

There are several factors affecting the primary care physician's referral decision in addition to diagnostic uncertainty,<sup>19</sup> including problems with the patient's self-management ability, allergy screening, work-related symptoms, difficulties in interpreting the lung function test results and a request on the part of the patient. Further training and consultation, especially in connection with the interpretation of lung function results, will enhance the accuracy of asthma diagnoses in a primary care setting in the future without referral of the patient. The diagnosis of chronic but mild asthma will remain

a challenge, however, as will the treatment of severe asthma. An appropriately framed and mutually agreed policy of referral to a specialist and back-referral to a primary care physician will be a crucial part of the more rational use of health care resources in the management of asthma.

### Conflict of Interest Statement

None declared concerning this article.

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### Supplementary data

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### References

1. Kvamme OJ, Olesen F, Samuelsson M. Improving the interface between primary and secondary care: a statement from the European Working Party on Quality in Family Practice (EQUIP). *Qual Health Care* 2001;**10**:33–9.
2. Wagner EH, Groves T. Care for chronic diseases. *BMJ* 2002;**325**: 913–4.
3. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness. *JAMA* 2002;**288**: 1775–9.
4. Dahl R, Bjermer L. Nordic consensus report on asthma management. *Respir Med* 2000;**94**:299–327.
5. Asthma Programme in Finland 1994–2004. *Clin Exp Allergy* 1996;**26**(Suppl. 1):1–24.
6. Haahtela T, Tuomisto LE, Pietinalho A, et al. A ten-year asthma programme in Finland: major change for the better. *Thorax* 2006;**61**:663–70.
7. Tuomisto LE, Kaila M, Erhola M. Asthma programme in Finland: comparison of adult asthma referral letters in 1994 and 2001. *Respir Med* 2007;**101**:595–600.
8. Tuomisto LE, Järvinen V, Laitinen J, Erhola M, Kaila M, Brander PE. Asthma programme in Finland: the quality of primary care spirometry is good. *Prim Care Respir J* 2008;**17**: 226–31.
9. *Finnish statistics on medicines 2007*. Helsinki: National Agency for Medicines and Social Insurance Institution; 2008 [in Finnish].
10. Haahtela T, Kaila M, Ahonen E, et al. Current care guideline for asthma. *Duodecim* 2000;**116**:2568–84 [in Finnish, updated 2006].
11. Erhola M, Makinen R, Koskela K, et al. The asthma programme of Finland: an evaluation survey in primary health care. *Int J Tuberc Lung Dis* 2003;**7**:592–8 [Abstract].
12. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics* 1977;**33**:159–74.
13. Ikaheimo P, Hartikainen S, Tuuponen T, Kiuttu J, Klaukka T. Comorbidity and medication load in adult asthmatics. *Scand J Public Health* 2005;**23**:88–94.
14. Tuomilehto J, Lindström J, Eriksson JG, et al. Finnish Diabetes Prevention Study Group. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med* 2001;**344**:1343–50.
15. Niemi M. *Winell K: diabetes in Finland (in Finnish) Stakes reports 8/2005 Helsinki*; ISBN 951-33-1648-3; 2005. p. 22.
16. Sin DD, Sutherland E. Obesity and the lung: 4. Obesity and asthma. *Thorax* 2008;**63**:1018–23.
17. Aaron SD, Vandemheen KL, Boulet LP, et al. Overdiagnosis of asthma in obese and nonobese adults. *CMAJ* 2008;**179**:1121–31.
18. Nathell L, Larsson K, Jensen I. Determinants of undiagnosed asthma. *Allergy* 2002;**57**:687–93.
19. O'Donnell CA. Variation in GP referral rates: what can we learn from the literature? *Fam Pract* 2000;**17**:462–71.