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Chronic Obstructive Pulmonary Disease

National Guidelines for Prevention and Treatment 1998–2007

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Summary

The national programme has the following goals: (a) a decrease in the incidence of chronic bronchitis, (b) the recovery by the greatest possible number of chronic bronchitis sufferers, (c) the maintenance of good working and general ability in chronic obstructive pulmonary disease (COPD) sufferers, (d) a decrease in the proportion of moderate and serious COPD sufferers, (e) an overall decrease of 25% in hospitalisation due to COPD, and (f) a decrease in annual costs per patient. The most important measures towards achieving these goals include (a) a reduction in smoking, (b) the reduction of occupational and outdoor pollutants and an improvement in indoor air quality, (c) increasing consciousness in risk groups of risk factors and improved treatment, (d) early diagnosis and active treatment, particularly of smokers, (e) the development of supervised self-treatment, (f) early, individually planned rehabilitation carried out as part of treatment and (g) encouragement of research into these diseases.

Key words

Bronchitis, chronic obstructive pulmonary disease (COPD)

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Foreword

Approximately 400 000 Finns suffer from chronic bronchitis or chronic obstructive pulmonary disease (COPD). The annual costs are estimated at FIM 5 billion. The foundation for the construction of a national prevention programme rests on the seriousness of the effects on national health and the economy, the increased knowledge of preventative measures and treatment possibilities, and synergy with the national asthma programme.

At the beginning of 1996, the Finnish Lung Health Association, Finnish Association of Specialists in Pulmonary Medicine, Association of the Pulmonary Disabled, and professors in pulmonary medicine from the universities of Helsinki, Kuopio, Oulu, Tampere and Turku suggested to the Finnish Ministry of Social Affairs and Health that a workgroup be set up to prepare a national COPD prevention and treatment programme. Initial investigations and programme outline planning were carried out by The Finnish Lung Health Association with funding allocated by the Finnish Ministry of Social Affairs and Health under the Tobacco Act.

Management of the preparation of the chronic bronchitis and COPD prevention and treatment programme 1998 – 2007 is in the hands of the board of the Finnish Lung Health Association. The board members are Professor Lauri A, Laitinen (Chairman), Jaakko Jylhä, Chancellery Counsellor, Ritva Kauppinen, Chief Physician, Eeva-Liisa Moilanen, LL.M, Professor Markku Nieminen, Professor Erkki O. Terho, and Juhani Törmä, Financial Director. Emeritus Professor Eero Tala has acted as a permanent expert advisor. The practical preparations and writing of the programme have been the responsibility of Rauni Ruohonen, Specialist Physician, and Kaj Koskela, Secretary General.

The Finnish Medical Society Duodecim's language committee considered the Finnish Lung Health Association's proposed term chronic obstructive pulmonary disease (COPD) to be appropriate, and so this has been used in the programme.

During preparation, the following experts were consulted: Antti Ahonen, Medical Director, Laakso Hospital; Eeva Ahonen, Chief Physician, Espoo Health Centre; Tari Haahtela, Chief Physician, Skin and Allergy Hospital; Kaija Hasunen, Special Advisor, Ministry of Social Affairs and Health; Emeritus

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Statements regarding the programme have been received from: the Ministry of the Environment, Social Insurance Institution, National Public Health Institute, Institution of Occupational Health/Finland, Slot Machine Association (RAY), Southern Finland County Administrative Board, Lapland Health Care Region, Tampere City Department of Social Services and Health Care, Vaasa Health Centre, Finnish Medical Association, Finnish Dental Association, Association of Finnish Pharmacies, Finnish Association of Municipal Doctors, National Union of Public Health Nurses, Finnish Centre for Health Promotion, Finnish Allergy and Asthma Association, Association of the Pulmonary Disabled, Samfundet Folkhälsan rf., Finnish Association of Specialists in Pulmonary Medicine, Finnish Association of Clinical Physiology, and Terveydenhuollon Lähipalvelusäätiö (Neighbourhood Health Care Association). The National Health Comission appointed by the Finnish Government has reviewed the programme.

The overall national programme is a recommendation for the prevention and treatment of chronic bronchitis and COPD. The rapid development of medical science, and particularly medical treatment, makes periodic review of the programme essential. Responsibility for treatment belongs to the individual patient and the healthcare professional and unit treating the patient.

The programme is based on results from numerous studies, investigations, and practical experiences. The text does not provide detailed references to the literature, but an appendix of the most important sources is provided.

The Ministry of Social Affairs and Health hopes that the programme will form a useful tool in the prevention of chronic bronchitis and COPD.

Jarkko Eskola
Director-General

Contents

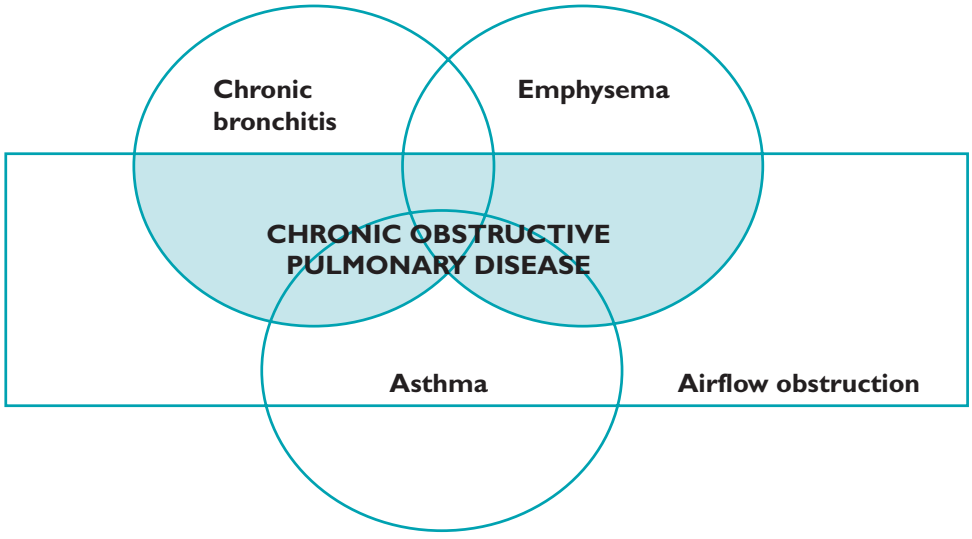
1

Public health and financial perspectives

1.1. Definitions

Pulmonary disease associated with lower airways obstruction is classified as chronic obstructive pulmonary disease (COPD) or asthma, on the basis of the clinical picture. COPD covers at least three factors: chronic bronchitis, emphysema and progressive obstruction of the small airways (Fig. 1).

FIGURE 1.
Schema of chronic obstructive pulmonary disease



Chronic bronchitis is defined as chronic production of mucus in the lungs for at least three months during at least two consecutive years, with no other underlying pulmonary or cardiac disease. Chronic bronchitis can occur with or without airways obstruction.

Chronic obstructive pulmonary disease (COPD) is characterized by slowly progressing, mainly irreversible airways obstruction and a decreased expiratory flow rate. The decreased flow rate is caused by varying degrees of airways obstruction and emphysema.

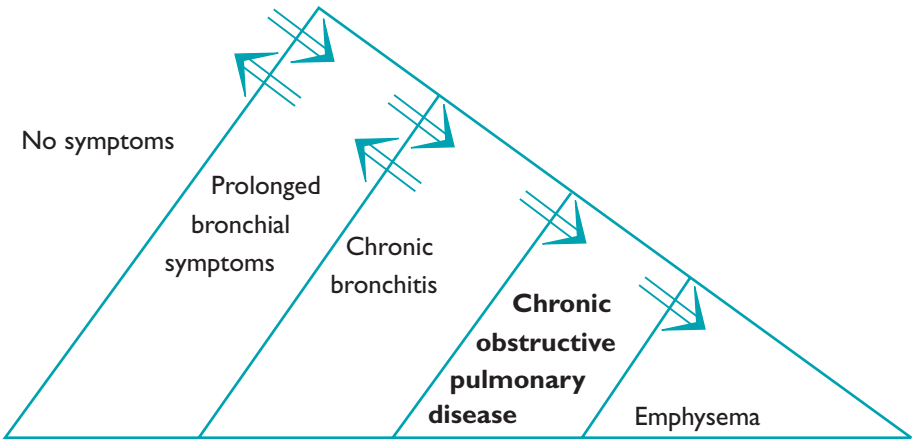
Emphysema is defined as permanent enlargement of the air spaces distal to the terminal nonrespiratory bronchioles, primarily the alveolar area, without obvious fibrosis.

Asthma is an inflammatory disease of the bronchial mucosa usually associated with varying degrees of bronchial obstruction, which subsides either spontaneously or in response to therapy. Specific characteristics of asthma and measures for improvement of the prevention and treatment of asthma are discussed in the National Asthma Programme for 1994 to 2004.

As far as the **course of disease** is concerned, chronic bronchitis is preceded by a phase of bronchial symptoms occurring in connection with, e.g., respiratory infections, exercise or exposure to allergens. In most individuals symptoms subside rapidly. Symptoms are considered prolonged if they persist for over six months. These conditions may become even more chronic. Some patients with chronic bronchitis develop COPD. This involves disorder of the small airways associated with varying degrees of emphysema. COPD can however sometimes result from emphysema with associated development of abnormalities in the small airways (Fig. 2).

The course of the disease can best be controlled during the initial phase, least well during the final phase. **To achieve the goals set for this programme and for prevention of the disease it is vital to focus on preventative measures, early diagnosis, and intensive treatment of the disease at an early stage.**

FIGURE 2.
Course of chronic obstructive pulmonary disease



1.2. Pathophysiology

The lower airways are divided into conductive airways (the trachea and bronchi) and gas-exchanging airways (alveoli). The most important changes in COPD occur at the margins of these areas, where small, membrane-like bronchioles become respiratory bronchioles and branch into alveolar ducts. Small bronchiolar walls have no cartilage. The bronchioles remain patent through support by the walls of the surrounding alveoli.

The inner surface of an alveolus is covered by a surfactant phospholipid membrane secreted by epithelial cells. In healthy individuals, this membrane continues at least up to bronchiolar level. The phospholipid membrane, epithelial cells and tight capillary network form the alveolar wall, supported by elastic fibres. The surfactant membrane itself is also an important alveolar support structure. Mucous glands in the bronchi secrete a mucous layer onto the membrane, and this layer is moved towards the trachea and larynx by epithelial cilia. Macrophages, lymphocytes, and protease inhibitors and anti-oxidants derived from circulating blood protect the most peripheral airways against microbes, allergens and chemical hazards. In healthy individuals, alveoli contain very few neutrophilic leukocytes.

1.2.1. Early stage

External irritants such as cigarette smoke cause bronchial reactions that vary from one individual to another. The cause of the reaction resulting in chronic bronchitis and the cause of development of asthma have not yet been established.

The mucosal surface in large airways is damaged, resulting in swelling of the internal structures and accumulation of inflammatory cells on the mucosa. The distribution and level of activity of inflammatory cells differ from those present in asthma, and the cells are often inactive.

Cigarette smoke reduces the surface tension of the phospholipid membrane and increases the numbers of macrophages and neutrophilic leukocytes in alveoli and respiratory bronchioles. Enzymes secreted by neutrophils, and, to some extent, by macrophages, against microbes begin to break down the elastic fibres of the alveolar walls. At the same time oxidants in cigarette smoke inactivate factors protecting the elastic fibres, such as alpha$_1$ antitrypsin. This is how destruction of alveolar walls surrounding bronchioles, i.e. emphysema, begins, simultaneously with the chemical inflammation and small airways disease.

1.2.2.
Symptomatic disease

Chronic bronchitis is a disorder of the large airways associated with cough and production of sputum. As a result of epithelial damage, ciliated cells are replaced by mucus-secreting goblet cells or, in the case of prolonged damage, by squamous epithelium. This impairs elimination of mucus. Concomitantly, inflammatory cells accumulate in the subepithelial mucosa, and mucous glands become enlarged and their number increases. This results in an increase in the amount of viscid mucus. The ability of mucous glands to excrete antibacterial enzymes is impaired and susceptibility to bacterial infection is increased. Bronchial smooth muscle sometimes also increases. Concomitant inflammatory changes of varying degrees occur in the small airways.

In COPD, the most important changes occur in small airways with diameters below 2 mm (bronchioles). These are essential for oxygen intake. Small airways become obstructed if their walls thicken as a result of inflammation, or they collapse during expiration because of loss of pulmonary tissue surrounding the airways as a consequence of emphysema. Prolonged inflammation leads to development of fibrous scarring beneath the mucosa and tissue loss. Loss of sites of attachment of bronchioles and alveoli leads to kinking of the airways and variation in their diameters. Smooth muscle thickening increases airways obstruction.

In emphysema, alveoli are destroyed, elasticity is lost and the capillary network responsible for oxygen transportation is reduced. The extent and severity of emphysema are the most important factors affecting the course of and prognosis in COPD. Small airways abnormalities alone are not likely to cause severe respiratory depression. When small airways abnormalities and emphysema co-exist, the ventilation/perfusion ratio is adversely affected: there is ventilation of non-perfused parts of the lung and perfusion of non-ventilated areas, which results in further reduction of oxygenation.

If smoking is discontinued before symptoms occur, the inflammatory reaction ceases or diminishes. Once COPD has progressed to a stage at which there are severe symptoms, discontinuation of smoking will not result in any significant reversal of structural damage but deterioration of lung function will be retarded, and symptoms will decrease.

1.2.3.
Degrees of severity

Significant airway obstruction is defined as a condition in which the ratio of forced expiratory volume in one second to vital capacity (FEV_1/VC) is less than 88% of the reference value (Viljanen et al. 1982) (ERS 1995). On the basis of international and recent Finnish epidemiological and clinical data, a rough estimate is that 60% of patients suffering from chronic bronchitis will have no airway obstruction but 40% will have developed COPD.

In terms of public-health workload, COPD can be divided into the following three groups, according to its degree of severity:

MILD disease, often without symptoms and undetected (75% of patients)
MODERATE disease, requiring medical treatment (20% of patients)
SEVERE disease, requiring annual hospital treatment (5% of patients)

On the basis of severity of airways obstruction, COPD can be divided into three groups, according to forced expiratory volume in one second (FEV_1) and mid-expiratory flow (MEF_{50}). The classification is based on distribution of FEV_1 and MEF_{50} values in healthy non-smokers in the reference-value material of Viljanen et al. (1982). The limit for mild change is the lower limit of the 95% confidence interval (2 SDs lower than the reference value). The limit for moderate change is 3.5 SDs and the limit for severe change 5.5 SDs lower than the reference value (Reference values: A. Viljanen et al. 1982; classification: A. Sovijärvi et al. 1994) (Table 1).

TABLE 1.
Degrees of severity of COPD.

MILD:	FEV_1 < 80% and/or MEF_{50} < 62% of reference value.
MODERATE:	FEV_1 < 65% and/or MEF_{50} < 35% of reference value.
SEVERE:	FEV_1 < 45% of reference value

1.3.
Occurrence

Prevalence

Chronic bronchitis and COPD are common in the industrialized world, particularly in men. Chronic bronchitis/COPD is the fifth commonest chronic disease in the world. In the developing countries, risk factors and prevalence of the disease differ from those in industrialized countries, the disease being commoner in women than in men. It has been estimated that only about 25% of cases are detected in industrialized countries. In developing countries the figure is considerably lower. Examples of international rates of occurrence of chronic bronchitis and COPD are given in Annex 1.

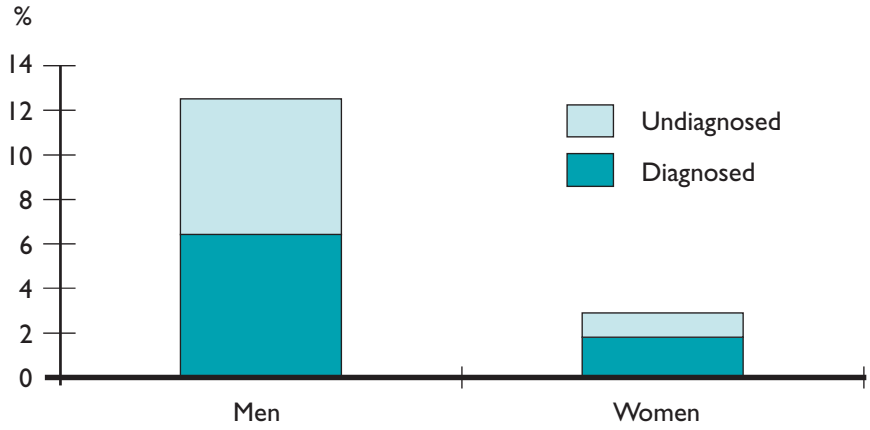
In the Mini-Suomi study, conducted by the Finnish Social Insurance Institution from 1978 to 1981, the prevalence of chronic bronchitis increased with age in men over 30 years of age from 15 to 27%, the prevalence of COPD from 2 to 19%. In women, prevalence and effects of age on prevalence were lower, from 5 to 8% and 1 to 8%, respectively. There are regional differences in prevalences of chronic bronchitis (Table 2). The differences probably largely relate to differences in smoking habits. A cold climate may increase the adverse effects of smoking.

TABLE 2.
Prevalences of chronic bronchitis by sex and region according to the Mini-Suomi study (%)

Region	Men	Women
South-west Finland	18.5	5.7
South Finland	16.6	6.3
West Finland	18.5	6.9
East Finland	24.2	6.7
North Finland	25.3	8.2

According to a recent FinEsS study, 10% of the adult population in Lapland had chronic bronchitis, and COPD occurred in 50% of these patients. In addition, 8 to 10% of the population had latent, undiagnosed COPD. The prevalence of chronic bronchitis increased with age, from 7 to 13% in men and from 5 to 12% in women over 20 years of age. The recent data suggest that prevalence in men is decreasing and that in women is approaching the figures observed in men.

FIGURE 3.
Prevalence of chronic obstructive pulmonary disease in population over 65 years of age by sex (%).



R. Isoaho et al. 1994

The prevalence of chronic bronchitis in Finnish children is estimated to be between 2 and 4%. In the elderly, the prevalence of COPD is considerably higher than that suggested by the number of cases detected. Almost 50% of cases in the elderly remain undiagnosed (Fig. 3). Most suffer from mild to moderate COPD. One third of patients suffer from severe dyspnoea resulting in the patients seeking medical attention.

Aging of the population, especially now that the baby-boom generation is reaching old age, is increasing prevalences of both chronic bronchitis and COPD. Improved treatments also increase the life expectations of patients. On the other hand, reduction of smoking in men reduces the occurrence of new cases. In future, incidence will be affected by increases in smoking, in adolescents and women, in particular.

Applied in proportion to the Finnish population as a whole, the results of the Mini-Suomi study suggest that there are 400 000 individuals in Finland with chronic bronchitis, of whom at least 175 000 have symptomatic COPD. On the basis of the results of the study conducted in Lapland, the number of individuals with latent COPD may be even double the number of cases of symptomatic COPD. On the basis of to smoking statistics there would appear to be over 200 000 patients suffering from COPD.

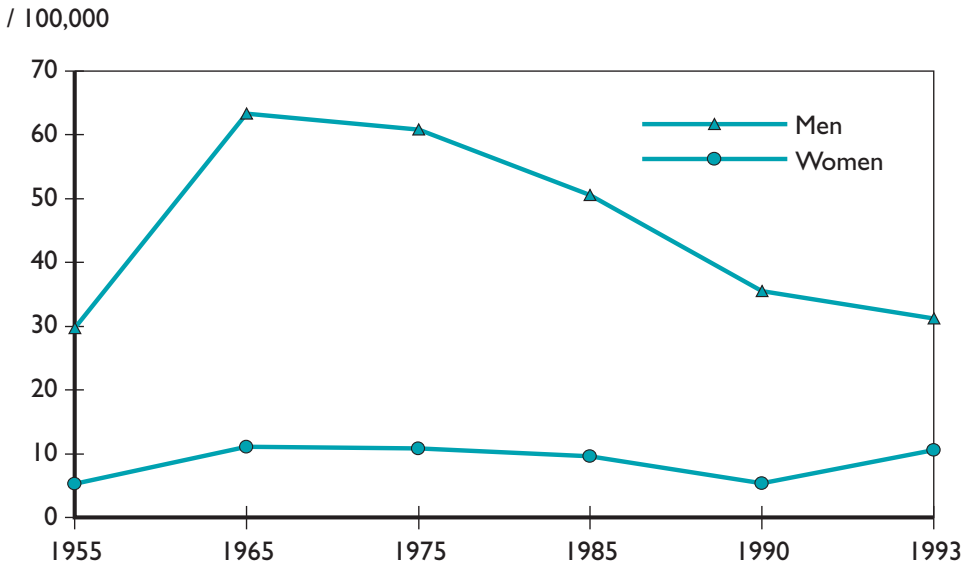
Mortality

In 1996, COPD was the fifth commonest cause of death in the world. It is estimated that it will become the third commonest cause of death by 2000. There are marked differences in mortality from COPD between countries. Some of the differences may be associated with differences in risk factors, some with differences in practices relating to the complilation of death

certificates. Mortality has increased in many countries since the 1960s. However, in many industrialized countries, mortality in men has decreased, mainly as a result of decreased smoking. Mortality in women over 55 years of age is on the increase. In European mortality statistics, Finland is approximately in the middle.

In Finland, 750 to 1000 individuals die from COPD annually. According to the East-West Study, patients with COPD die from lung cancer more frequently than others, and from heart disease at a younger age than others. Men outnumber women in mortality statistics by five to one. Mortality is greatest in the 70 to 85-year age group. Mortality decreased in the 1970s and 1980s in almost all age groups. However, in the past few years, mortality in women has increased, in the 65- to 75-year age group in particular (Fig. 4).

FIGURE 4.
Mortality from chronic obstructive pulmonary disease per 100 000 inhabitants in Finland from 1955 to 1993, by sex.



R. Peto et al. 1994

Hospital workload

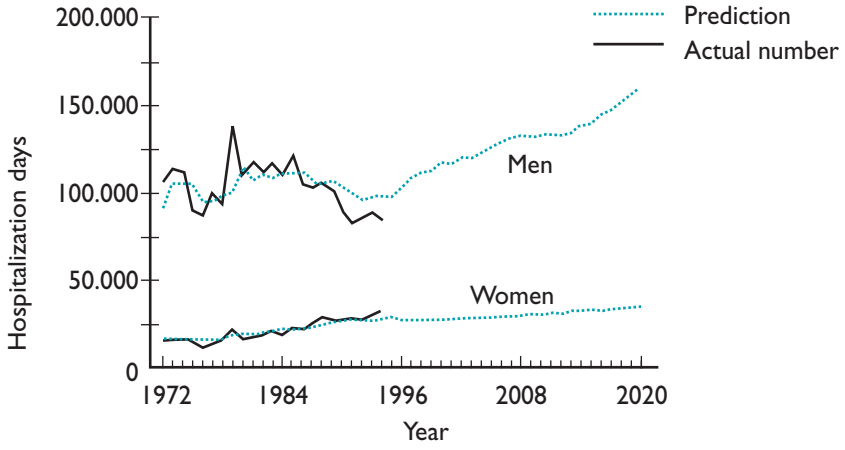
In 1972, the number of COPD-related **hospitalizations** in Finns over 34 years of age was 123 000 (60.6 days/1000 inhabitants). In 1994 the corresponding figure was 119 000 days (43.0 days/1000 inhabitants). The average **length of stay** fell during this period, from 16 to 9 days.

According to a forecast based on change in age structure, treatment periods and hospitalization days may increase by 2010 by up to 55% for men and 12 to 24% for women, as compared with the current situation. By 2020, hospitaliza-

tion days for men could increase by up to 94% (Fig. 5). However, increase in hospitalization is likely to be somewhat smaller than that indicated by the forecast having regard to the fact that smoking in men has decreased since the 1970s.

There appear to be substantial regional differences in organization of treatment. In some hospital districts, patients with COPD account for a relatively small proportion of hospitalizations. In others they account for a substantial proportion of hospital workload.

FIGURE 5.
Actual and predicted numbers of hospitalization days of chronic obstructive pulmonary disease from 1972 to 2020, by sex.



T. Keistinen et al. 1995

Outpatient-care workload

There are no exact data about annual numbers of outpatient visits as a result of chronic bronchitis and COPD. Patients with mild COPD (approximately 130 000 individuals) seek outpatient medical attention because of respiratory infection and production of mucus one to four times a year. Patients with moderate COPD (approximately 35 000) visit a specialist two to three times a year during the initial stage of the disease. In outpatient departments for pulmonary diseases, patients with COPD account for 10 to 20% of outpatient visits overall, depending on the hierarchy of health services. In addition to needing medical attention, patients need considerable amounts of guidance and advice from other health-care staff. They pay from one to four visits to public-health nurses annually. Patients with severe COPD (approximately 10 000) require continuous monitoring and medication. Ten per cent (approximately 1000 patients) receive long-term oxygen therapy at home. These patients require hospital and outpatient services most. Specialized health care

workers visit patients on oxygen therapy one to three times a year, in addition to visits by patients to outpatient clinics. In summary, it is estimated that nearly one million outpatient visits are paid annually because of chronic bronchitis and COPD.

1.4. Causes and risk factors

Chronic bronchitis and COPD are caused by environmental factors and host-related factors (Table 3).

TABLE 3.
Risk factors for chronic bronchitis and COPD.

Degree of certainty	Environmental factors	Host factors
ESTABLISHED	• Cigarette smoking • Some occupational exposures	• a_1-antitrypsin deficiency
GOOD EVIDENCE	• Air pollution (particularly SO_2 and particulates) • Poverty, low socio-economic status • Alcohol • Environmental tobacco smoke in childhood • Other occupational exposures	• Low birth weight • Childhood respiratory infection • Atopy (high IgE) • Bronchial hyperresponsiveness • Family history

N.M.Siafakas et al. 1995

1.4.1. Host factors

Alpha$_1$-antitrypsin deficiency is a hereditary metabolic disorder, the commonest manifestation of which is development of severe emphysema at young age. Sixty per cent of patients develop symptoms under the age of 40. Some patients with alpha$_1$-antitrypsin deficiency are at risk of COPD. In Finland, the number of individuals of ZZ phenotype suffering from alpha$_1$-antitrypsin deficiency is estimated to be 1000.

Birth weight has been found to affect FEV_1 in adulthood. If birth weight is low, FEV_1 will also be low. Development of the bronchi ends during the 16th week of gestation, development of the alveoli primarily at age 2 to 3 years. Early foetal disorders affect the bronchi, later disorders the alveoli. Reduction in airways always limits the number of subsequent alveoli, and there cannot therefore be compensation later for early disorders.

Respiratory infections before age 12 months (severe pneumonia, bronchiolitis and whooping cough) may impair pulmonary function later in life, and predispose to obstructive lung disease. Infections of the lower respiratory tract in early childhood are commoner in individuals with low birth weight than in other individuals.

Reduced pulmonary function is detectable several years after pneumonia or other lower respiratory infection in **adulthood**. However, such infections have not been found to cause decreases in FEV_1. Antibodies to pulmonary chlamydial infections are markedly more frequent in severe COPD, and in men, than in mild COPD or in women. However, the role of chronic chlamydial infection in the pathogenesis of the disease remains unclear.

Atopy may be an endogenous factor predisposing to chronic bronchitis, COPD and asthma. In Finnish farmers, chronic bronchitis has been found to be twice as common in atopic individuals than in non-atopic individuals, irrespective of smoking. An analysis based on Finnish twin registry data also suggests that atopy may be a risk factor. However, international findings are conflicting. In many studies, no connection between atopy and COPD has been found when asthma patients have been excluded from the material.

COPD is often associated with increased**bronchial reactivity**. However, structural changes in the airways may themselves result in hyperreactivity, which may be further increased by inflammation. Increased reactivity can therefore be a result of anatomical changes caused by the disease as well as a risk factor for development of the disease.

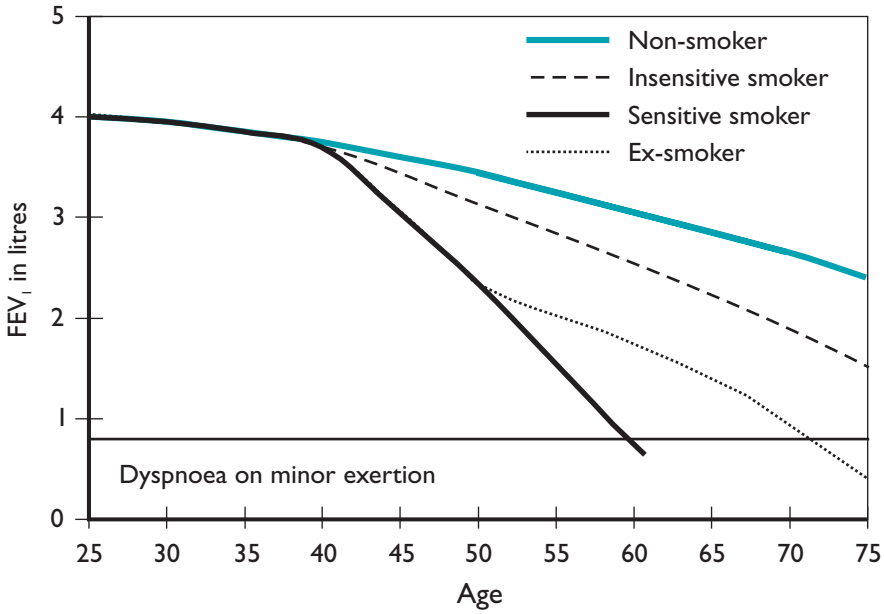
Smoking-related diseases have been found to **run in families**, suggesting hereditary susceptibility to adverse effects of smoking. ABO blood group and genetically determined ability to secrete ABO antigens into body secretions have been studied as possible contributing factors.

1.4.2. Environmental factors

Smoking is the most important factor causing COPD. It delays normal development of lung function in children and accelerates deterioration of lung function in adults (Fig. 6). Fifty per cent of smokers exhibit symptoms of chronic bronchitis, and one (sensitive smoker) in five develops COPD. In

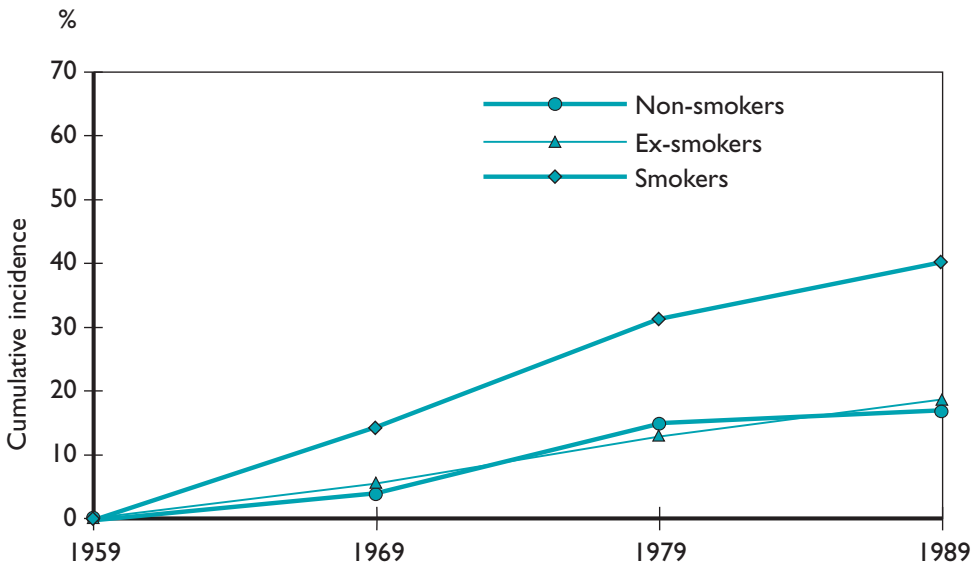
individuals who have stopped smoking, the incidence of chronic bronchitis and risk of COPD decrease in 10 years to the levels observed in non-smokers (Fig. 7).

FIGURE 6.
Effects of smoking on forced expiratory volume in one second (FEV_1).



C.Fletcher 1977

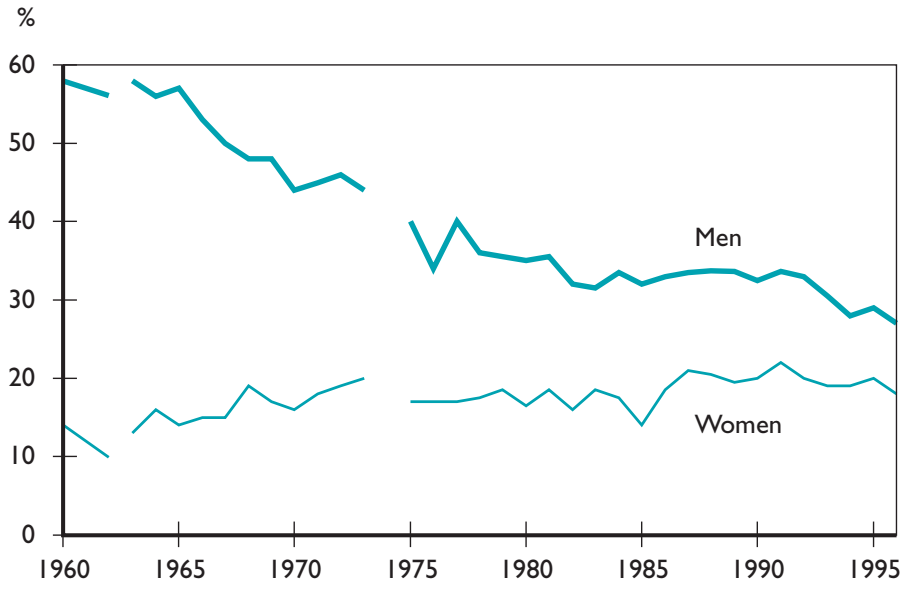
FIGURE 7.
Cumulative incidence of chronic obstructive pulmonary disease in men on the basis of the 1959 smoker grouping (East-West study).



M.Pelkonen

As far as mortality from COPD is concerned, 80 to 90% of cases are attributed to smoking. In 1996, 27% of men and 18% of women over 14 years were smokers (Fig. 8).

FIGURE 8.
Proportion of 15- to 64-year-old daily smokers in 1960 to 1996, by sex (%).



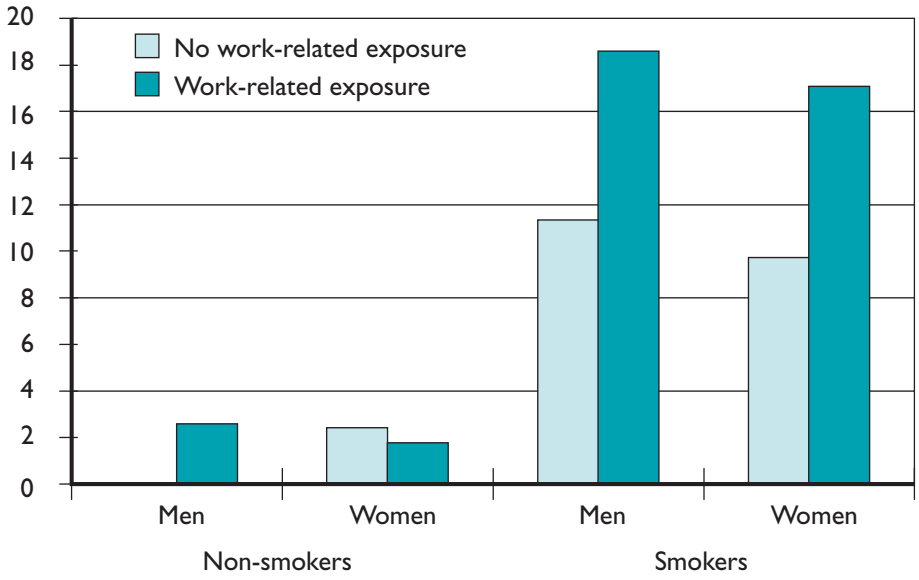
Ministry of Social Affairs and Health 1996

Working environment affects the incidence of chronic bronchitis. Quartz, asbestos, wood dust and fluorides are important predisposing factors. In some studies, associations have been found between sulphur dioxide, metal gases, aluminium, glass wool and high temperature and chronic bronchitis. In addition to work in iron or steel foundries, welding and textile work, risky work includes farming and handling of grain. Cadmium has been found to cause emphysema. Exposure to dust is associated with a greater risk than exposure to gases or smoke.

In Finland, the prevalence of chronic bronchitis is three times higher in farmers than in the rest of the population, even though they smoke less. The prevalence is higher in animal husbandry than in grain husbandry. Handling of grain used for feed seems to be associated with the highest risk. Farming also involves other air pollutants that may affect development of chronic bronchitis, e.g. fumes, gases, moulds, bacteria, animal epithelium and endotoxins. Individuals with farmer's lung have been found to have bronchial obstruction. Over 20% of such individuals develop emphysema.

Evidence of the importance of exposure to work-related irritants in relation to development of COPD is increasing. The effects of such exposure are evident indirectly in the population aged 65 years or over (Fig. 9).

FIGURE 9.
Prevalence of chronic obstructive pulmonary disease in the population over 65 years of age, according to exposure to work-related dust and smoking habits.



R. Isoaho et al. 1994

Air pollutants and a cold climate are known to aggravate symptoms of chronic bronchitis and COPD. Increases in levels of sulphur and nitrogen oxides in the air markedly increase hospitalizations, with a delay of one to three days. High ozone levels also increase symptoms. In cold, dry air even low levels of irritants can have adverse effects on the bronchi. Outdoor air pollution has decreased in Finland during the past few years and is expected to decrease further.

As far as **indoor air pollutants** are concerned, the most important risk factor for COPD is exposure to cigarette smoke in the environment, or passive smoking. More information about the roles of airborne microbes such as moulds and bacteria in the pathogenesis of chronic bronchitis and COPD is expected to become available soon. Recent investigations have revealed that damage caused by moisture and moulds, and poor quality of indoor air is very common in Finnish buildings, including schools and day-care centres.

Morbidity and mortality from COPD are higher in the **lower social classes** than in the upper social classes. Adverse effects of smoking, and exposure to work-related risk factors and impurities in indoor air accumulate in individuals and families belonging to the lower social classes. The effects of poverty on nutritional status may contribute to susceptibility to infection and development of the lungs in infants and children. Preventive education and health services do not reach the lower social classes to the same extent they reach upper social classes. Decreased functional ability associated with COPD can also lead to social regression of a patient.

Heavy drinking increases chronic bronchitis and impairs lung function. The effects of alcohol and smoking are synergistic. Drinking also has an effect via other risk factors, such as social regression. The consumption of alcohol in Finland overall is about average for industrialized countries. Drinking habits have changed only little over the past few decades. According to a study on drinking habits conducted in 1992, 22% of men and 5% of women between 15 and 69 years of age (approx. 400 000 individuals) could be classified as risk consumers, and 200 000 individuals as heavy drinkers.

In addition to foetal malnutrition, **smoking by a mother** can play an important part in foetal pulmonary development. Forced vital capacity (FVC), which reflects alveolar status is affected by **passive smoking**, respiratory infection during infancy and weight at age 12 months. It would therefore seem to be programmed during infancy.

1.5. Costs

Direct and **indirect** costs related to chronic bronchitis and COPD result in substantial losses to the public economy. Direct costs most commonly arise from use of health services and medicines, changes required in working environments, and health education directed towards patients and the population as a whole. Indirect costs are associated with loss of working efficiency and capacity for work, sick leave, restrictions on daily functional abilities of patients, and adverse social and psychological effects. Indirect costs are higher than direct costs.

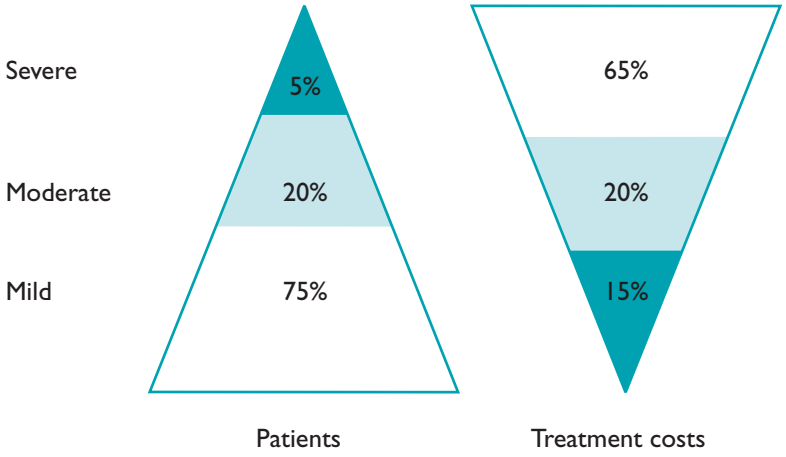
Most direct costs relate to hospital treatment of patients with severe COPD. There are approximately 175 000 patients with COPD in Finland. Five per cent (10 000 patients) suffer from **severe** COPD and symptoms requiring hospital treatment annually. Half of these patients are entitled to special reimbursement (75%) for prescriptions for medicines, and 10% use oxygen-concentrator therapy at home. Annual costs of treatment can be as high as FIM 85 000 per patient. Terminal care costs on average FIM 65 000 per patient. Some 20% of patients (35 000) have **moderate** COPD. Because of their symptoms, these patients require regular monitoring and advice, and hospital treatment from time to time. Reimbursement for prescriptions of medication for symptoms is usually 50%. Annual treatment costs in this group are roughly FIM 7000 per patient. Approximately 75% of patients (130 000) suffer from **mild** COPD. Mild forms of the disease do not give rise to regular hospital or medicine costs. Patients visit occupational health services, health centres or

private practitioners because of respiratory infections and are often prescribed antibiotics, as well as cough mixtures and sick leave. Annual treatment costs per patient are FIM 1000, on average. It is difficult to assess the impact of the disease on work efficiency and its contribution to loss of work.

Chronic bronchitis without airways obstruction occurs in approximately 220 000 individuals. Costs in terms relating to the national economy result primarily from visits to doctors, courses of antibiotics, and preventive measures such as education about smoking and measures to improve dusty environments. The costs are also shared with other disease groups, such as asthma and heart disease. Annual treatment costs in this patient group are estimated to be FIM 200 million.

Total costs of chronic bronchitis and COPD in Finland are some FIM 5 thousand million. Treatment costs account for approximately FIM 1.5 thousand million. Indirect costs are estimated to be roughly 3–3.5 thousand million. Distribution of treatment costs according to degree of severity of COPD is shown in Fig. 10.

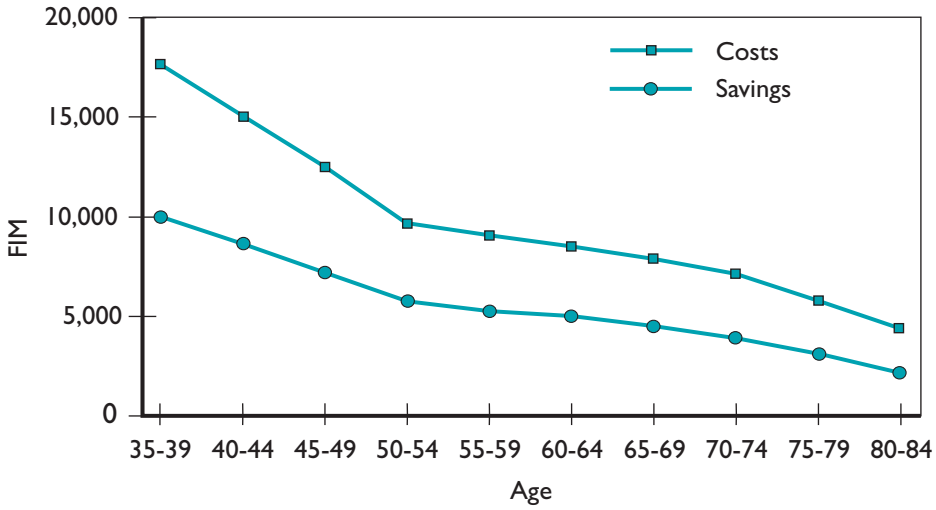
FIGURE 10.
Annual treatment costs of chronic obstructive pulmonary disease according to severity of disease.



According to a recent Finnish investigation, lifetime treatment costs related to COPD are FIM 160 000 per patient, at current prices. Treatment is more expensive than treatment of other tobacco-related diseases such as lung cancer and coronary heart disease. On the other hand, loss of production is less than for other tobacco related diseases. If patients with COPD stopped smoking treatment costs would be expected to decrease significantly (Fig. 11).

FIGURE 11.

Expected life-time costs caused by smoking-induced chronic obstructive pulmonary disease, and savings achievable if smoking were stopped in men by age.



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Costs will increase in the near future unless prevention of these diseases improves substantially. An estimate of costs of COPD-related hospitalization illustrates the trend. In 1994, costs of hospitalization days were FIM 178 million. According to an estimate based on aging of the population, costs of hospitalization of patients with severe COPD could rise to FIM 280 million in 15 years. How matters develop depends essentially on the age at which smokers are made stop smoking, and on how successfully smoking among adolescents can be prevented.

2

Goals of prevention and treatment

The goals for prevention and treatment of chronic bronchitis and COPD and rehabilitation of patients from 1998 to 2007 are shown in Table 4. The most important measures for achievement of these goals are recorded in Table 5 and discussed in detail in Chapters 3, 4 and 5.

TABLE 4.
Goals for prevention and treatment of chronic bronchitis and COPD and rehabilitation of patients.

1. Decrease in occurrence of chronic bronchitis.
2. Recovery of as many patients as possible with chronic bronchitis.
3. Maintenance of capacity for work and functional capacity of patients with COPD.
4. Reduction in the percentage of patients with moderate to severe COPD.
5. Twenty-five per cent decrease in number of days spent by COPD patients in hospital.
6. Decrease in annual costs per patient.

TABLE 5.
Measures for achievement of goals of programme for prevention of chronic bronchitis and COPD.

1. Reduction in smoking.
2. Reductions in work-related and outdoor air pollutants and improvement of quality of air indoors.
3. Increase in knowledge about risk factors and treatment of the diseases in key groups.
4. Promotion of early diagnosis and active treatment, among smokers in particular.
5. Improvement of guided self-care.
6. Early commencement of rehabilitation, planned individually and mainly implemented as an element in treatment.
7. Encouragement of scientific research.

3

Prevention of development and exacerbation of the disease

3.1. Prevention

The risk of development of the disease can be reduced through measures aimed at changing the health behaviour of individuals and avoiding environmental exposure (**primary prevention**) and stepping up early diagnosis and initial treatment (**secondary prevention**). Correct timing and appropriate targeting of rehabilitation can help reduce the handicap caused by the disease to individuals (**tertiary prevention**). (Tables 6, 7 and 8).

Prevention strategies are aimed at specific **risk groups** and the **population in general**. In the former case preventive methods are targeted at individuals at high risk of developing chronic bronchitis or COPD, such as smokers. The aim of the population-direct strategy is to reduce air pollutants, cigarette smoke in particular - both in respect of the entire population and the environment.

TABLE 6.
Prevention of development of chronic bronchitis and COPD (primary prevention).

- Abstinence from smoking, avoidance of cigarette smoke during pregnancy and lactation in particular
- Smoke-free homes, day-care places, school and working environments
- Prevention of young people from starting smoking
- Encouragement of breast feeding and implementation of vaccination programmes
- Prevention of recurrent respiratory infections in children
- Balanced diet and adequate physical activity
- Prevention of exposure to harmful dusts in the working environment
- Improvement of quality of indoor air and air in communities

TABLE 7.
Detection and control of chronic bronchitis and COPD at an early stage (secondary prevention).

- Cessation of smoking
- Avoidance of work involving risk of exposure
- Use of face-masks during short-term tasks involving exposure to dust
- Fitness exercise and preventive physical therapy
- Initial measures directed at risk groups
- Early diagnosis
- Good initial treatment and guidance
- Improvement of the quality of outdoor air and indoor air, at home and in places of work and public facilities

TABLE 8.
Prevention of exacerbation of COPD (tertiary prevention).

- Cessation of smoking
- Avoidance of dust and cigarette smoke in the environment
- Maintenance of good general condition, physical exercise training
- Correction of defective diets
- Pneumonia and influenza vaccinations
- Good treatment of respiratory infection
  Anti-inflammatory medication if necessary
  Justifiable symptomatic medication
- Protection against air-pollution peaks and cold weather
- Rehabilitation and use of respiratory care devices

3.2.
Risk groups and initial measures targeted at risk groups

Initial measures targeted at risk groups allow early diagnosis of the disease and implementation of measures to cure or alleviate it. In this context, pregnant women are also considered to constitute a risk group because their behaviour affects the risk of the disease in the subsequent generation. Reduction of the

risk of COPD helps reduce incidences of other diseases, such as cardiovascular disorders and cancer. Recent studies have shown that reduced lung function is a significant risk factor for coronary heart disease mortality, comparable to high blood cholesterol.

Primary risk groups and corresponding initial measures are shown in Table 9. Important symptoms and findings and recommended initial measures are listed in Table 10. Examples of nicotine dependence test and mini-intervention are given in annexes 2 and 3.

TABLE 9.
Primary risk groups for chronic bronchitis and COPD, and recommended measures.

Risk group	Measures
Smokers	Symptom questionnaire, nicotine dependence test, spirometry
Pregnant women	Smoking questionnaire, carbon monoxide measurement
Children with unexplained chronic cough and production of mucus	Investigation of the environment, physical examination, smoking questionnaire
Young people trying smoking	Smoking questionnaire, carbon monoxide measurement
Individuals with recurrent respiratory infection	Smoking questionnaire, carbon monoxide measurement
Individuals with chronic cough at work	Smoking questionnaire, spirometry, investigation of working environment and tasks, symptom diary
Individuals exhibiting dyspnoea below age 40	Symptom questionnaire, smoking questionnaire, ECG, spirometry, oximetry, chest X-rays, physical examination, $alpha_1$-antitrypsin determination

TABLE 10.
Significant abnormal symptoms, and findings and measures to be taken in relation to such symptoms and findings.

Finding	Measure
Smoking, experimenting with smoking	Guidance, mini-intervention, planning for stopping smoking
Prolonged production of mucus	Physical examination
Recurrent haemoptysis	Examination by a specialist in pulmonary diseases
FEV_1 below 80% and/or MEF_{50} below 62% of reference value	Physical examination
FEV_1 below 65% and/or MEF_{50} below 35% of reference value	Examination by a specialist in pulmonary diseases
Problems in diagnosis or treatment	Examination by a specialist in pulmonary diseases

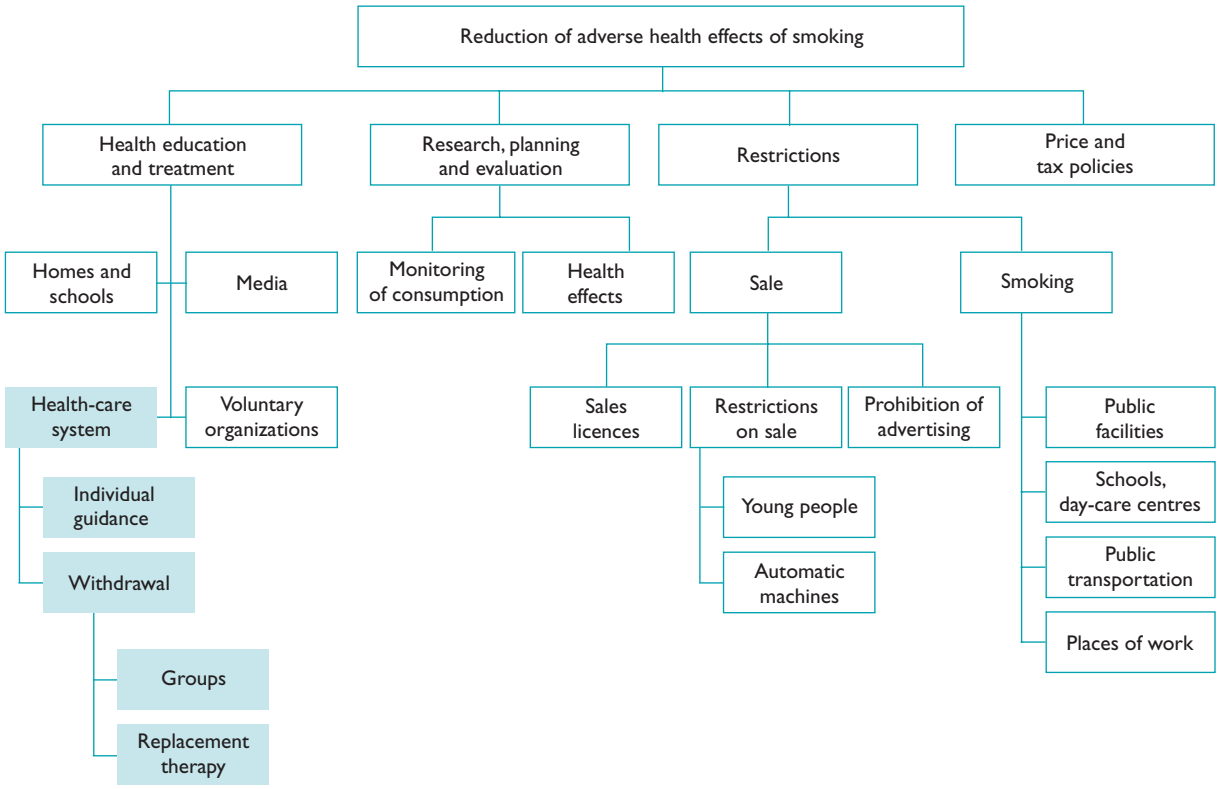
3.3.
Measures directed at individual health behaviour

3.3.1.
Prevention of smoking

Primary measures directed towards prevention of smoking at population level supported by the health-care system are shown in Table 12. In Finland, the Act concerning measures directed towards reduction of smoking (Act 693/76) and its revision (Act 765/94) are demonstrations of a will to take measures to reduce the adverse health effects of smoking. The programme focuses on the most important tasks for the health-care system in relation to prevention of smoking, namely guidance and help with stopping smoking.

Prevention of smoking should be an integral and continuing element in the activities of all health-care staff. Smoking can be compared with other signifi-

FIGURE 12.
Reduction of adverse health effects of smoking.



cant public-health risk factors. Various health-care units, such as child-welfare centres, school health-care and dental-care units, doctor's surgeries and occupational health units should screen on a continual basis. When risk factors are observed, guidance and, if necessary, treatment should be provided. Response to treatment should always be monitored.

Starting, often also stopping, smoking is a long-term process. The first phase consists of **observation**. A child makes observations relating to smoking and attitudes towards smoking in his or her environment. The second phase is one of **experiment**. During this phase, a young individual will usually smoke less than one cigarette a week. At this stage direct and indirect advertising of cigarettes encourages preservation of the habit resulting in social and psychological dependence. Experimentation with smoking can lead to **habitual smoking,** which is associated with the development of strong physical and mood-related dependence on nicotine. Pharmacological, social and psychological factors affect different individuals differently and withdrawal consequently needs to be planned individually.

Basic methods of provision of guidance and information, and the nature of information given to children and young people are summarized in Tables 11 and 12.

TABLE 11.
Prevention of smoking in connection with small children and their parents.

Method	Nature
Ask and listen	Smoking at home and in day-care centres. Plans and experience in relation to stopping smoking. Nicotine dependence test. Recording of principal facts.
Discuss and encourage	Positive effects of smoke-free air on child health. Adverse health effects of cigarette smoke, as appropriate: • risk of miscarriage or premature delivery, low birth-weight • recurrent respiratory infections, chronic inflammation of the middle ear (otitis media) • stopping of smoking by parents and support required • follow-up visits relating to individuals trying to stop smoking.
Control and thank	Situation in relation to smoking after pregnancy and breast-feeding. Progression of stopping smoking and support required. Non-smoking status, smoke-free home. Success in stopping smoking.

TABLE 12.
Prevention of smoking in adolescents and stopping them experimenting with smoking.

Method	Nature
Ask and listen	Experimentation with smoking and smoking habits of adolescents and their siblings and friends. Successes and problems at school. Experimentation with alcohol and drugs. Attitudes of close relations towards smoking. Plans and experience in relation to stopping smoking. Nicotine dependence test. Recording of principal facts.
Discuss and encourage	Benefits of not smoking, and reduction of smoking in the population. Skills required to be able to decline to smoke. Control of social pressures and personal life. Misleading points of view in cigarette advertisements. Bad breath, gingival and dental problems, smelly clothes and hair. Deterioration of dermal health and waste of money. Attitudes and discussions about smoking at school and with friends. Sports and other hobbies, decreased sporting performance. Encouragement of stopping experimentation with smoking. Stopping smoking, and referral to a withdrawal or social-support programme, if necessary. Help and support as wanted by the adolescent. Follow-up visits for those experimenting with smoking or trying to stop.
Control and thank	Smoking situation. Progression of withdrawal and support required. Non-smoking status, non-smoking friends, successful stopping of experimentation with smoking /smoking.

Most smokers want to stop. Half will have considered stopping smoking, and will have attempted it seriously during the preceding 12 months. Most stop smoking by themselves, without help. Some turn to close relations, smoking-withdrawal groups and, in particular, health-care staff. In 1996, only one smoker in four reported having been advised to stop smoking by a health professional. The figure has remained unchanged over the past decade (Fig. 13).

TABLE 13.

Phases and measures in relation to stopping smoking.

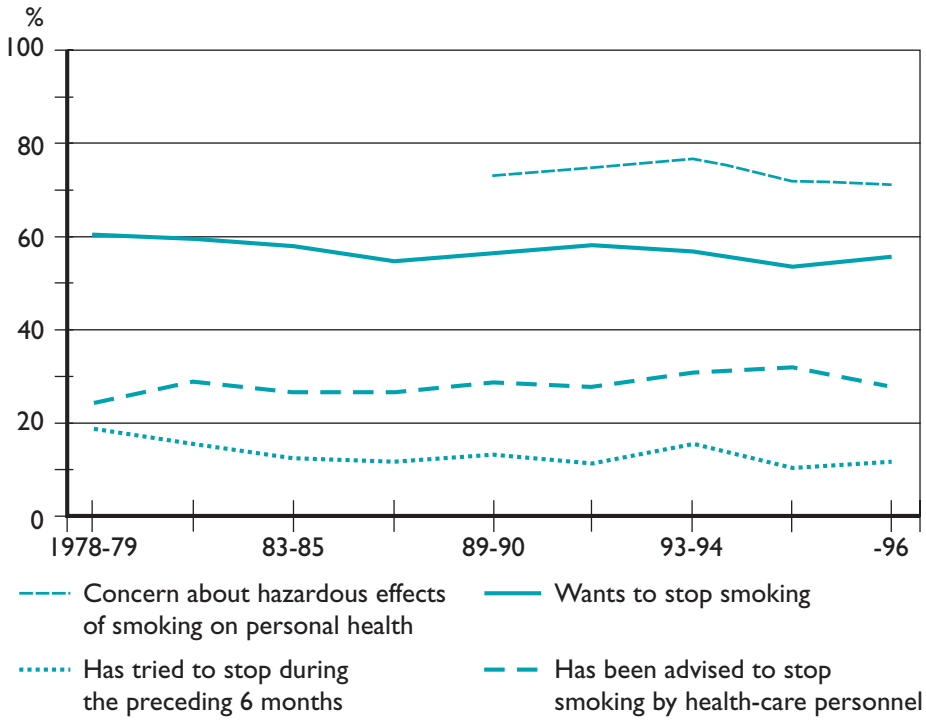
Phase	Measure
Preliminary phase	Motivation. Distribution of material. Nicotine dependence test. Explicit advice to stop smoking. Arrangement of follow-up visit.
Preparatory phase	Motivation. Guidance in relation to means of stopping smoking. Review of previous experience. Distribution of self-care material, referral to a withdrawal group if necessary. Recording of goals. Agreement on day of stopping. Arrangement of follow-up visit.
Stopping phase	Support and guidance. Management of difficulties and withdrawal symptoms. Nicotine supplementation if necessary. Arrangement of social support. Arrangement of follow-up visit.
Staying non-smoker	Thanking. Support and guidance to aid preservation of permanent non-smoking status. Management of risk situations. Prevention of weight gain.

TABLE 14.

Common problems in stopping smoking and suggested solutions.

Problem	Solution
Weight gain	Avoidance of high-calorie foods. Regular physical exercise.
Withdrawal symptoms	Symptomatic treatment and guidance. Relaxation, exercise and adequate hydration. Nicotine supplementation
Recommencement of smoking	Analysis of problem situations and discovery of solutions. Teaching of new models of behavior.
Lack of social support	Involvement of those in environment (e.g. family members) in withdrawal. Behaviour therapy.

FIGURE 13.
Opinions of smoking men about smoking, their attempts at stopping smoking, and advice to stop smoking given by the health-care personnel in 1978 to 1996.



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The individual situations of patients trying to stop smoking need to be taken into account. Some patients will not yet have given serious thought to stopping smoking (preliminary phase), some will already have considered it seriously (preparatory phase), some will already be trying to stop, and some will already have stopped. Cessation of smoking in adults is described in Table 13. Possible solutions to common problems are listed in Table 14. Implementation of nicotine supplementation is described in Annex 4.

3.3.2. Prevention of infection

Important research into vaccines and work on improvement of infection control have been conducted in Finland. In international terms, the population has taken a very positive stand towards vaccination. Preservation of this attitude is an important goal of health education.

In children who suffer more than 4 to 6 episodes of respiratory infection a year, reasons for recurrence of infection should always be investigated, in

addition to providing acute therapy. It is recommended that such children, and children with chronic bronchitis, be immunized against both influenza and pneumococcal infections.

Patients suffering from moderate to severe COPD are at risk of influenza and should be given vaccinations every autumn. Vaccination reduces influenza morbidity and mortality by 70 to 80%. It can also help reduce the occurrence of sequelae of influenza, such as pneumonia.

Vaccination against pneumococcal infections is recommended in patients with COPD because it provides protection for several years, and reduces risk of the pneumococcal infections becoming severe.

Pulmonary chlamydial infections have been shown to be considerably more frequent in patients with COPD than in normal populations. However, causality is still unclear. In future, prevention and treatment of chlamydial infections may prove useful in the treatment of COPD.

3.3.3. Nutrition

A balanced diet can help reduce risks and symptoms associated with chronic bronchitis and COPD. Vitamin and mineral supplements are of no value unless patients exhibit marked deficiencies. Dietary recommendations supportive of the prevention and treatment of chronic bronchitis and COPD are given in Annex 5.

Patients with severe COPD often suffer from prolonged undernutrition. In some COPD patients, respiratory function may be impaired by obesity. Correction of nutritional status forms an integral part of treatment. In addition to changing diet, it is important to find and implement suitable forms of physical exercise.

3.3.4. Physical exercise

Physical exercise has both direct and indirect effects. The physical and psychological effects of exercise improve self-esteem, general condition and the resistance of the organism. A good general condition reduces susceptibility to respiratory infections and accelerates recuperation from such infections. Regular physical exercise helps prevent desire to smoke and increases mucus secretion and elimination of mucus from the airways. The effect of increased exercise on the lungs as such is less marked but it increases the strength and endurance of respiratory muscles, pulmonary ventilation, respiratory effi-

ciency, and energy metabolism in muscles. Physical exercise also helps reduce the increased risk of bone loss in patients with COPD. It also increases opportunities for social contact.

In addition to spontaneous physical activity and health-promoting exercise, physical exercise can be implemented in the form of guided training or as therapeutic physical exercise prescribed by a doctor. Guided training can even be organized in the context of public services relating to physical exercise. Recommendations in relation to the nature, extent and duration of physical exercise are given in Table 15.

TABLE 15.
Recommendations in relation to physical exercise for patients with chronic bronchitis and COPD.

Chronic bronchitis and mild to moderate COPD:
Practice of correct breathing technique
Exercise increasing endurance
- about 30 minutes until the patient gets out of breath, preferably daily
- daily exercise can be implemented in 2 to 3 phases
- suitable forms of exercise: walking, skiing, cycling, swimming, dancing

Exercise improving muscle fitness

Severe COPD:
Daily exercise at appropriate level of exertion
Exercise helping to maintain muscle strength
- short exercises involving 8 to 10 contractions of different groups of muscles
- exercise of the respiratory muscles and accessory respiratory muscles
- strengthening of the abdominal muscles to improve expiration and coughing
- strengthening of the upper and lower back muscles to improve posture
- strengthening and stretching of the neck and shoulder muscles
- strengthening of the muscles of the upper and lower extremities to improve coping with daily activities and hobbies

Exercise to improve movement of the thorax
Patients with COPD should only participate in physical exercise that can be safely interrupted at any time.

In planning physical exercise, each patient should be helped to find suitable and enjoyable forms of exercise. Increase in physical activity in adults is facilitated by the fact that children and young people are being instructed to adopt physical exercise as an integral part of their everyday lives both at school and at home. In providing guidance about increasing exercise, attention should be paid to an individual's age, any diagnosis of cardiovascular disease, physical condition and previous physical activity. The possible impact of concomitant coronary heart disease on the safety of physical exercise (exertion level) should be assessed. Dyspnoea restricts levels of exertion in patients with severe COPD. Methods of reduction and improved management of exercise-induced dyspnoea are described in Table 16.

Physical examination and clinical exercise testing before increasing physical activity are recommended for all individuals with cardiac, pulmonary or metabolic disease, and for symptomless individuals over 40 years of age at high risk because of several risk factors.

TABLE 16.
How to reduce and control exercise-induced dyspnoea in patients with COPD.

- Ensure adequate stretching and warming-up, and gradual increase of exertion
- Good treatment of the disease, medication before exercise
- Learning an economic method of breathing, pursed-lips breathing
- Sufficient intake of fluids, keeping warm
- Taking exercise periodically and changing levels of exertion
- Protection of the face and warming of inspired air in cold weather
- Gradual decrease in levels of exertion during each exercise, and stretching at the end
- Taking of physical exercise with friends

3.3.5. The environment

Clean outdoor air furthers prevention and treatment of chronic bronchitis and COPD. New standard values for air quality, including odorous sulphur compounds, came into force in Finland on 1 September 1996. Impurities in outdoor air may be involved in development of the disease, and aggravate symptoms. Communal-air pollutants can also be found indoors. Inorganic and organic dusts in air indoors can provoke symptoms in sensitive individuals. Smoking

is the most important indoors problem and predisposes individuals to harmful effects of outdoor air. The main problems and suggestions for reduction of adverse effects are stated in Table 17. Most measures suggested also require official measures, revision of relevant rules and regulations, and international cooperation. In 1997, the Ministry of Social Affairs and Health published a report entitled Adverse Health Effects of Indoor Air and Suggestions for their Reduction.

TABLE 17.
Problems caused by airborne impurities in the environment and measures for reduction of their adverse effects.

Problems	Measures
Smoking indoors	Smoke-free home. Enforcement of provisions of the Tobacco Act in public facilities and workplaces. Non-smoking sections in restaurants. Health education, information and guidance.
Work-related exposure	Improvement of methods of work and cleanliness of the working environment. Technical and hygiene-related solutions to reduce exposure.
Emissions from traffic and microparticles	Reduction of emissions from individual cars. Promotion of walking, cycling and rail transport. Information, advice and restrictions.
Extreme cold and smog	Improvement of information about air pollutants. Avoidance of exposure to outdoor air during extreme cold and peak pollutant levels.

4

Diagnosis

4.1.

Symptoms and reasons for seeking medical attention

The first symptom of chronic bronchitis is **cough and production of mucus** in the morning. Symptoms often become worse during episodes of the common cold in winter, resulting in purulent sputum, possibly dyspnoea and wheezing and, occasionally, elevation of body temperature. **Common colds** readily progress to bronchitis and pneumonia.

In children, symptoms of chronic bronchitis include unexplained cough, wheezing on expiration, production of mucus and decreased bronchoconstriction threshold. Since children often swallow their sputum, mucus hypersecretion and the increased amounts of sputum detectable in adults often remain unobserved. If chronic bronchitis is suspected, a child must be referred to a specialist.

As the disease progresses, exacerbations become increasingly frequent and healthy periods between exacerbations become shorter. Cough and production of mucus occur throughout the 24 hours of a day. **Dyspnoea,** associated with narrowing of the airways and/or worsening of emphysema, is primarily exertional dyspnoea. Patients become accustomed to the symptom and do not appreciate it until it imposes severe limitation on work and other activities. In severe COPD, dyspnoea can occur even during dressing, bending or working with the hands.

Patients are often fearful and depressed because of their symptoms. **Undernutrition** and weight loss is common. Hypoxaemia in the brain resulting from impaired oxygen uptake causes **irritation, depression, memory impairment and difficulties in concentrating**. Accumulation of carbon dioxide as a result of decreased pulmonary ventilation can cause **morning headache**. **Peripheral oedema** associated with undernutrition or impaired cardiac function may also occur.

At an early stage, when intervention can still have a significant effect on the course of the disease, **patients often present for examination and treatment for reasons other than the symptoms commonly associated with chronic bronchitis or COPD**. When patients seek medical attention because of symptoms clearly associated with COPD, over 20 years

will usually have elapsed since onset of the disease. The commonest reasons for which patients seek medical attention are listed in Table 18.

TABLE 18.
Reasons for seeking treatment in chronic bronchitis and COPD.

Chronic bronchitis and mild CODP:

- No pulmonary symptoms, patient seeks medical attention for other reasons
- Cough and production of mucus in the morning
- Repeated respiratory infection
- Prolonged cough
- Haemoptysis

Moderate to severe COPD:

- Dyspnoea on mild to moderate exertion
- Cough and hypersecretion of mucus and episodes of bronchitis

4.2.
Diagnosis and examination

Primary and occupational health-care services

Diagnosis of **chronic bronchitis without narrowing of the airways** is based on a history of risk factors and symptoms. A thorough interview should be carried out to investigate exposure factors at home and in the working environment, exacerbation of symptoms in the winter and during infections, and the durations and frequency of such exacerbations. A general examination should be conducted to exclude other illnesses. Pulmonary auscultation findings and results of lung function tests are usually normal. Determination of inflammatory factors in sputum may soon provide a key to improved early diagnosis.

Progression of the disease from chronic bronchitis to **COPD** can be detected at an early stage only with the help of lung function tests. Spirometry is the most important aid to diagnosis and determination of severity of disease. The examination requires experience on the part of the clinician, and active collaboration of the patient is important if reliable results are to be obtained. Measurements must be well standardized. A new recommendation relating to conduct of spirometry and assessment of results was issued in 1997. Forced

expiratory volume in one second (FEV_1) is decreased in bronchial obstruction but can also be diminished in other pulmonary diseases. Obstruction of the small airways developing at an early stage in COPD can be detected with the help of a flow-volume spirometer. A rapid decrease of forced vital capacity (FVC) with FEV_1 can be a result of air trapping in the small airways. FEV_1/FVC below the reference value confirms airways obstruction.

In **moderate** COPD, decreased arterial partial pressure of oxygen can occur. Oxygenation of arterial blood and tissues decreases as the disease progresses. High haemoglobin and haematocrit values can be signs of chronic hypoxia, for example, during the night. Impaired oxygen intake is manifest in a bluish discoloration (cyanosis) of the skin and mucosa when arterial oxygen saturation (SaO_2) is below 80%. Oxygen saturation can be measured with the help of, e.g., a pulse oximeter, using a finger or ear transducer. If the device is equipped with memory it can be used for long-term monitoring of oxygenation, for example during the night.

In **severe** COPD, pronounced airways obstruction and emphysema result in air trapping and increased inflation of the lungs and aggravation of hypoxia in arterial blood and tissues. Respiratory sounds diminish, heart tones are distant, expiration is prolonged and diaphragmatic motion is decreased. In the most severe cases, a barrel-chested appearance develops. Marked use of accessory respiratory muscles or pursed-lips breathing may be seen. In some patients, increased resistance of the pulmonary circulation results in development of failure of the right side of the heart, leading to increased pressure in the superior and inferior vena cava, hepatic enlargement and peripheral oedema. Changes observed in chest X-rays may include depression and tenting of the diaphragm, increased retrosternal air space, pronounced hilar vessels and attenuation of peripheral vascular markings. **However, a normal X-ray does not exclude COPD or emphysema**.

In **differential diagnosis**, asthma, pulmonary fibrosis, lung cancer, tuberculosis and many other disorders of lung tissue should be taken into account. Tests used to exclude asthma include spirometry, monitoring of peak expiratory flow (PEF) at home and in the working place to determine reversibility of and fluctuation in airways obstruction, and trial of steroid therapy. In COPD, PEF is decreased only in advanced cases and the decrease is usually irreversible. Eosinophilia suggests asthma, but asthma and COPD can coexist.

An association of chronic bronchitis with **work** should be considered if a patient suffers from persistent dry cough, or cough with production of mucus that has started during employment involving exposure to risk factors. The symptoms have a quantitative relationship to periods of work, and on the basis of examinations they are not associated with common lung and respiratory diseases. Atopy appears to increase occurrence of symptoms. Smoking complicates assessment of causal relationships.

Course of the disease is monitored with the help of repeated FEV_1 measurements. A decrease in FEV_1 (normally about 28 ml/year) exceeding 50 ml/year indicates rapid progress of the disease. Response to medication is monitored with the help of bronchodilation test, PEF measurements and trials of oral corticosteroid therapy (more in Section 5.3.2 Drug therapy). Several questionnaires have been prepared for monitoring quality of life but at present, use of such questionnaires is limited primarily to scientific studies.

During **exacerbation**, wheezing sounds or rhonchi may be audible during forced expiration, and expiration may be prolonged. Haematological tests provide indications of possible aetiological factors. Sputum culture is often unnecessary. Chest X-rays are important to exclude pneumonia and pneumothorax. In severe COPD, severity of exacerbation can be estimated roughly on the basis of respiratory frequency, pulse rate, use of accessory respiratory muscles, cyanosis, dysfunction of respiratory muscles (uncoordinated movement of the thorax or paradoxical abdominal movement and retraction of lower intercostal spaces), and tiredness.

The tasks of primary care and occupational health services in relation to diagnosis of chronic bronchitis and COPD include early diagnosis, identification of moderate and severe COPD and referral of patients to specialized medical care for assessment, and intensive monitoring of patients. Examinations to be conducted in primary health care and occupational health care are shown in Table 19.

TABLE 19.

Examinations in primary health care and occupational health care.

Basic examinations

- History-taking, charting of risk factors
- Auscultation of the lungs, including forced expiration.
- Examination of paranasal sinuses and the adenoid
- Chest X-ray, ECG
- Bacteriological and cytological sputum tests, if considered appropriate
- Flow-volume spirometry and bronchial dilation test
- Monitoring of diurnal fluctuations in PEF values

Follow-up examinations

- Clinical examination
- Spirometry

Examinations during exacerbation

- History-taking, clinical examination
- Haematological tests for infection
- Chest X-ray, ECG
- Pulse oximetry

Specialized medical care

In specialized medical care, latent COPD in smokers should be taken into account in connection with all contacts with patients, irrespective of the speciality. Apart from this, the main tasks in the area of pulmonary disease include diagnosis of moderate to severe COPD, and investigation of the degree of emphysema associated with the disease, the prognosis of the disease, and the presence of any coexisting disease significantly affecting treatment.

Inflammation of the bronchial mucosa is not visible on chest X-rays and cannot be detected via routine blood tests. Bronchoscopy provides direct information about the condition of the mucosa. Bronchoscopic examinations are limited primarily to diagnostic problems, investigation of bronchitis in children and adolescents, and cases in which work-related disease is suspected.

The severity of emphysema can be assessed by means of measurement of diffusing capacity. Although the examination is not specific to emphysema, it often helps in distinguishing patients with emphysema from, e.g., asthmatic patients, who do not usually exhibit low diffusing capacities. The examination can be conducted in a clinical physiology laboratory, or in a laboratory of a unit specializing in pulmonary disease.

In patients with COPD, the arterial partial pressure of oxygen (P_aO_2) decreases because of uneven distribution of pulmonary ventilation. A low diffusing capacity usually reduces P_aO_2 only on exertion. P_aO_2 reflects the oxygenation of the entire organism and is affected by many factors other than COPD and emphysema, such as diffuse pulmonary diseases causing fibrosis, and shunts. Monitoring of arterial blood gases for impairment of gas exchange is necessary. A decrease in P_aO_2 to below 8.0 kPa and an increase in the arterial partial pressure of carbon dioxide (P_aCO_2) to more than 6.5 kPa are signs of respiratory insufficiency.

Exercise testing can be used to determine basic physical condition before physical exercise is started, to determine the pulse level to be used for improvement of physical condition, and to allow capacity for work and any coexisting diseases, such as coronary heart disease, to be evaluated. Assessment of tolerance of exercise is particularly important if dyspnoea appears to be excessive in relation to forced expiratory volume in one second (FEV_1).

Deficiency of $alpha_1$-antitrypsin should be suspected if a young patient has developed emphysema following relatively minor smoking.

Measurement of respiratory muscle strength is recommended if a patient's nutritional status is poor, if steroid-induced muscle weakness is suspected, or if dyspnoea or P_aCO_2 increase is excessive in relation to changes in FEV_1.

It should also be borne in mind that P_aO_2 decreases during sleep. Thorough

oximetric determinations during sleep is necessary if pulmonary heart disease or increased red cell mass occurs in association with mild airways obstruction and if concomitant sleep apnoea is suspected.

Severe COPD is often associated with increased resistance of the pulmonary circulation, and with pulmonary heart disease, the severity of which affects the prognosis. Pulmonary arterial pressure can be measured by means of echocardiographic examination and catheterization of the right side of the heart. However, these examinations are not undertaken routinely because the overall prognosis can be fairly readily assessed via lung function tests, blood gas analyses, chest X-rays and ECGs.

Recommendations regarding examinations to be conducted in connection with specialized medical care are given in Table 20.

TABLE 20.
Examination of COPD patients under specialized medical care.

Basic examinations:

- History-taking and status
- Chest X-ray (if necessary)
- Flow-volume spirometry and bronchodilator response (if necessary)
- Monitoring of diurnal fluctuations of PEF values (if necessary)
- Blood count (if necessary)
- Diffusing capacity
- Arterial blood gas analysis
- Exercise test
- In children, immunoglobulin levels (IgA in particular)

Tests in special cases:

- $Alpha_1$-antitrypsin
- Volume spirometry, body plethysmography
- Spiroergometry
- Computerized tomography (HRCT)
- Bronchoscopy
- Measurement of respiratory muscle strength
- Assessment of respiratory disturbances during sleep
- Measurement of pulmonary arterial pressure

5

Improvement of treatment

5.1.

Goals and means of treatment

If treatment is to be successful, and the disease is to be cured, it is important that patients with chronic bronchitis or COPD know and understand the causes of the disease and the possibilities for and results of treatment. It is also important for patients to trust themselves, and the treatment organization. Goals of treatment in patients with chronic bronchitis and COPD are shown in Table 21. Means of achieving these goals are listed in Fig. 14.

TABLE 21.
Goals of treatment in patients with chronic bronchitis and COPD.

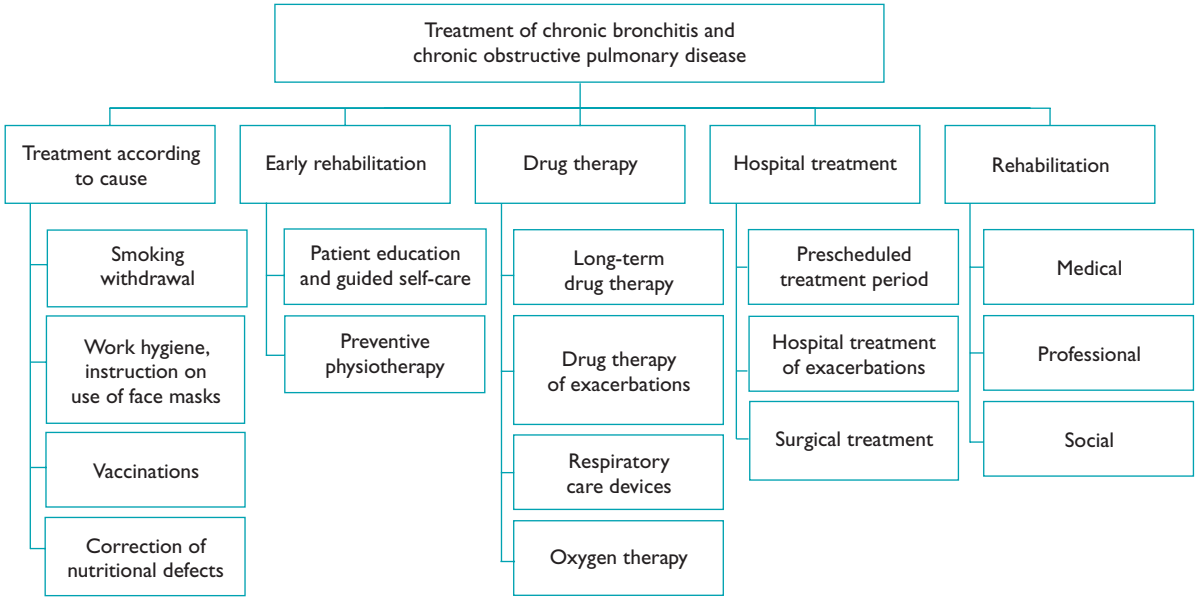
1. Recovery of patients with chronic bronchitis.
2. Maintenance of capacity for work and functional ability at as high levels as possible.
3. Decrease in frequency or severity of symptoms of the disease, and of exacerbations.
4. Cessation of or decline in rate of deterioration of pulmonary function.
5. Reduction in complications of the disease or alleviation of symptoms caused by such complications.
6. Improvement of quality of life.

Treatment should **depend on the cause** of the disease, and should be focused on factors causing or aggravating the disease.

Early rehabilitation improves the facility of individuals to make appropriate use of existing resources. In severe COPD, patients should be instructed to employ their diminished physical resources appropriately, and in economic ways.

Drug therapy is important in alleviating symptoms and improving quality of life. Respiratory care devices can be used, if necessary, to enhance drug therapy. **Hospital treatment** is necessary during severe exacerbations and surgical treatment. In addition, a prescheduled period of hospitalization can be used to intensify overall treatment and to give patients and their families an

FIGURE 14.
Methods of treatment of chronic bronchitis and chronic obstructive pulmonary disease.



opportunity to rebuild resources. Commencement of **rehabilitation** at an early stage should form an element in treatment overall.

There is no reliable evidence that **alternative therapies** are of significance in chronic bronchitis and COPD.

Stopping smoking, measures directed towards the working environment, vaccination and nutrition have been discussed in Chapter 3. The following sections focus on early rehabilitation, drug therapy, hospital treatment and rehabilitation in general.

5.2.
Hierarchy of referrals for treatment

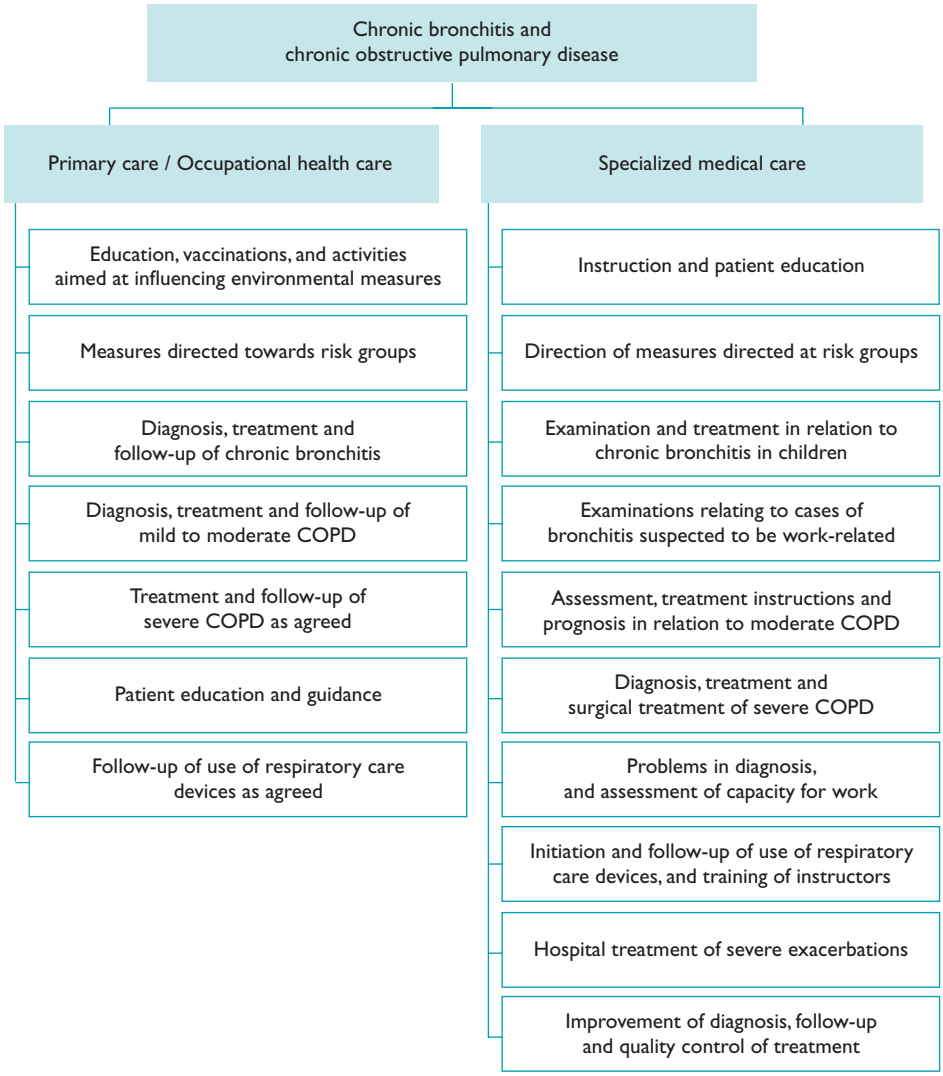
Chronic bronchitis and COPD are prevented and treated via regional collaboration between personnel working in primary health care, specialized medical care and other bodies. Primary responsibility for prevention and treatment is borne by the primary care system, flexibly supported by the specialized medical care sector. The specialized medical care sector is primarily responsible for regional planning, training of instructors, and quality control in relation to measures for prevention and treatment. Hospital districts and health centres should ensure that the various levels of the health-care system are capable of appropriate performance of tasks assigned to them.

It is recommended that each hospital district appoints a specialist to be in **charge** of prevention and treatment of chronic bronchitis and COPD. The

individual concerned should be responsible for establishment and maintenance of regional know-how, and the quality of prevention and treatment. In primary care, local **contacts** should be appointed to distribute information, coordinate training and promote collaboration with, e.g., dental personnel. Regional individuals in charge are responsible for the organization of regional training and consultation within the specialized medical care sector, and should monitor the success of prevention and treatment in their region with local contacts. Such a system has already been created in connection with the National Asthma Programme, and **it would be most appropriate that the individuals in charge and acting as contacts were also responsible for issues concerning asthma**.

FIGURE 15.

Division of work between primary health care and specialized medical care systems in the prevention and treatment of chronic bronchitis and chronic obstructive pulmonary disease (COPD).



The primary health-care system is responsible for treating patients, unless their treatment has temporarily been transferred to the specialized medical care sector (Fig. 15). The starting point is for the attending physician to arrive at a diagnosis, and start appropriate treatment and follow-up. Successful scaling of treatment requires good collaboration, rapid and flexible admission of patients and good flows of information between different levels of health care. These activities should be supported by appropriate service and treatment chains.

5.3. Treatment

5.3.1. Early rehabilitation and guided self-care

The aim of early rehabilitation is to maintain the capacity of individuals for work and their functional abilities or to prevent them from diminishing. Activities to maintain capacity for work (TYKY) have already been organized within the occupational health care sector. They include preventive activities for healthy employees. Early rehabilitation should be increased in other health-care sectors. As far as forms of early rehabilitation in relation to treatment of individual patients are concerned, physical exercise training has been discussed in Section 3.3.4. In this Section, patient education and preventive physical therapy are discussed. Appropriate guided self-care, with the patient assuming responsibility for his or her health at an early stage, can help towards optimization of treatment results.

Patient education and guided self-care

Chronic illness always involves a period of adaptation. Defence and adaptation strategies vary between individuals, and can manifest themselves in different ways. A patient may deny the existence of a disease and its impact on his or her life, completely or partially, or may exaggerate problems.

Patient education is fairly time-consuming. It should focus primarily on helping patients analyse their life situations, manage disease and cope with changes caused by disease. Patients, relatives and their work communities should be advised to provide support for patients. Successful patient education is based on good communication between patients and educators. The success

of education can be verified immediately on the basis of personal feedback from patients, subsequently by monitoring how patients implement instructions and advice given in their daily lives. **However, education alone will not produce results or change patient behaviour. It needs to be accompanied by practice.**

In guided self-care, patients are given basic information about chronic bronchitis and COPD. The phases and prognosis of the disease, its effects on family and working life, and means of reducing risks of exacerbation are explained to the patient. Guidance should be given in accordance with the severity of each patient's condition. The nature and effects of treatment, the purposes and side effects of drug therapy, and the fundamental nature of guided self-care should be explained to patients (Table 22). Crisis plans for exacerbations should be prepared individually, taking account of each patient's social environment. It is important to predict aggravation of situations. Rescue medication kept at home, such as antibiotics and corticosteroid tablets, can help prevent aggravation of a situation at an appropriate time. It is important to reserve adequate time for discussion with a doctor or nurse.

During follow-up a patient's subjective condition should be examined, and progression of treatment checked as well as the development in physical and social activities, medication (doses, technique) and treatment instructions. Guidance should be repeated in relation to areas in which progress has been poor, necessary prescriptions (including prescriptions for rescue medication) issued to the patient, and the goals and a date for the next appointment fixed.

Successful self-care requires individual patient care and a good patient-provider relationship and treatment organization (Table 23). In children, self-care will be successful only if the whole family participates. Patients should never be left to their own devices. Rapid access to assessment by a nurse, or a doctor if necessary, should be ensured at all times.

TABLE 22.
Basic elements of guided self-care.

- Stopping smoking
- Independent exercise to improve physical condition and muscle strength
- Crisis plans
- Appropriate vaccinations
- Ensuring correct nutrition
- Control of long-term medication

TABLE 23.
Prerequisites for successful guided self-care.

- A flexible treatment organization responsible for direction and follow-up of care
- Individual, thorough and repeated education
- Clear self-care material (instructions concerning stopping smoking, instructions regarding action in different situations, teaching material relating to COPD)
- A patient who is active in taking care of his or her personal wellfare

Preventive physiotherapy

The goals of physiotherapy are shown in Table 24, measures required for achievement of these goals in Table 25. Implementation of physical therapy requires participation by and responsibility on the part of the patient.

TABLE 24.
Goals of physiotherapy in the treatment of chronic bronchitis and COPD.

1. For the patient to be physically active and aware of the possibilities allowed and limitations imposed by the disease.
2. For the patient to master the correct breathing techniques at rest, during physical activity and during attacks of dyspnoea.
3. For the patient to know how to remove secretions from the lungs.
4. For the patient to know how to prevent or correct incorrect posture and to maintain or improve movement of the thorax.
5. For the patient to be familiar with at least one relaxation technique.

TABLE 25.
Physiotherapy measures in the treatment of chronic bronchitis and COPD.

1. Maintenance and improvement of physical condition
   – Discovery of a suitable form of physical exercise
2. Breathing pattern
   – Correct breathing pattern, breathing training
   – Positions promoting relaxation and facilitating breathing
3. Prevention of incorrect posture
   – Muscular relaxation
   – Exercises to increase movement of the thorax
4. Removal of lung secretions
   – Physical activity
   – Deep breathing movement combined with correct coughing technique
   – Abdominal muscle exercises
   – Breathing against counterpressure
   – Inhalation therapy
5. Relaxation exercises
6. Charting of respiratory care devices

In **mild to moderate** COPD, the primary task in physiotherapy is to instruct and motivate patiens to take physical exercise and to use correct breathing techniques, at rest and during exercise, Changing from "chest out – stomach in" type of breathing to a technique involving correct use of the diaphragm and intercostal muscles is a long-term process requiring independent daily practice by the patient. Muscle exercises can help increase the strength of the diaphragm and accessory respiratory muscles.

In **severe** COPD, patients need to know what they are capable of, but also what their limitations are. The aim is to find solutions to problems encountered in coping with daily tasks at home. The patient should learn to control breathing even under difficult conditions such as exertion or exacerbation of the disease. Relaxation and breathing techniques and pursed-lips breathing can be used to improve lung function and reduce airways resistance. Unfavourable positioning of the diaphragm can be corrected by, e.g. leaning forwards, and by pursed-lip breathing. Needs for respiratory care devices should be investigated and their correct use checked. The patient should be given moral support and encouraged to take independent action.

5.3.2.
Drug therapy

The aim of drug therapy is elimination of symptoms and improvement in quality of life. In COPD, medication rarely results in normalization of lung function because airway obstruction is only partially reversible. In severe COPD, in particular, changes in symptoms and quality of life are more important for assessment of response to treatment than results of lung-function tests. Table 26 shows the indications for the most important drugs used to treat chronic bronchitis and COPD. The strategy for drug therapy is described in Fig. 16.

Inhaled drugs are central to drug therapy. However, in patients with COPD such drugs are often poorly distributed to the minute branches of peripheral airways. Before starting, and changing or increasing drug therapy it is necessary to be sure that the drug will be delivered to areas important in relation to treatment. Conditions for the effective use of inhaled drugs are shown in Table 27. In treatment of chronic bronchitis in children, the whole family should be instructed in use of the medicines.

TABLE 26.
Drugs used in the treatment of chronic bronchitis and COPD, and the purposes of their use.

Drug	Purpose
Bronchodilators • $Beta_2$ agonists • Anticholinergic agents • Theophylline	• Smooth muscle relaxation in airways • Improvement of ciliary function • Reduction of effects of exertion and cold weather • Increasing the strength of the diaphragm
Anti-inflammatory drugs • Inhaled corticosteroids • Oral corticosteroids	• Prevention and correction of mucosal damage
Antibiotics	• Treatment of bacterial infection
Oxygen	• Compensation of temporarily or permanently impaired oxygen intake • Improvement of impaired functional ability • Reduction of elevated pulmonary artery pressure • Reduction in increased red cell mass

FIGURE 16.
Drug therapy of chronic bronchitis and chronic obstructive pulmonary disease (COPD).

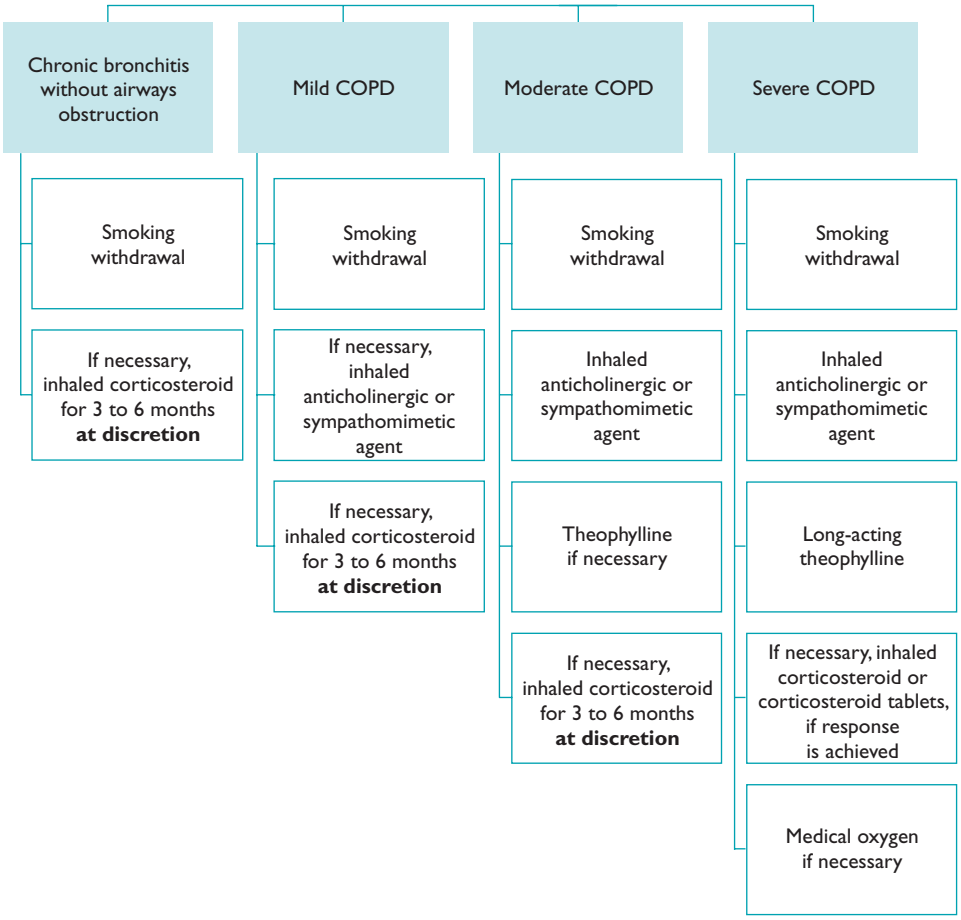


TABLE 27.
Factors reducing the effects of inhaled drugs in COPD, and measures directed towards elimination of such factors.

Problem	Solution
Smoking	Smoking withdrawal
Mucus obstructing the bronchi	Physical exercise Physiotherapy Antibiotics if necessary
Poor inhalation technique	Checking of technique and guidance Use of inhalation devices
Weak respiratory muscles	Physiotherapy Independent regular muscle exercises
Poor patient compliance	Patient education Charting of mental state and social situation

Response to **bronchodilator therapy** should be tested with the help of spirometry and PEF measurements at home. In most patients with COPD, testing of bronchodilation shows improved FEV_1 values. Lack of response in a single test should never be a reason for discontinuation of treatment.

Beta$_2$ agonists (e.g. salbutamol) have a direct effect on bronchial smooth muscle, and dilate the bronchi. When symptoms of dyspnoea occur only on exertion or in cold weather, short-term beta$_2$ agonists rapidly alleviate or prevent symptoms. Long-term beta$_2$ agonists can be useful in reducing morning symptoms, in particular. Beta$_2$ agonists also improve ciliary function, and consequently, bronchial clearance. The efficacy of medication increases with dose. However, side effects such as muscle tremor, cardiac symptoms and arrhythmias prevent use of high doses. Oral beta$_2$ agonists should be avoided.

Anticholinergic agents (e.g. ipratropium bromide) dilate the bronchi and reduce secretion of mucus. They may also protect the bronchi against the reflex constriction caused by cold weather. Medication should be taken regularly, 3 to 4 times a day. In patients exhibiting symptoms daily, anticholinergic agents can be more effective than beta$_2$ agonists. They have practically no side effects. On exacerbation of symptoms, efficacy of treatment can be increased by combining an anticholinergic agent with a beta$_2$ agonist.

Theophylline dilates the bronchi, reduces non-specific sensitivity of the bronchi, stimulates breathing and facilitates removal of mucus from the bronchi. In long-term use it may increase the strength of the diaphragm in patients with COPD. Theophylline also enhances cardiac function. Exercise tolerance may improve without improvement in the results of lung function tests. The tablet formulation is easy to administer and is recommended especially when delivery of inhaled drugs is poor because of anatomical factors or a patient's poor ability to inhale a drug. A long-acting form taken at night reduces early-morning symptoms. A suitable dose can be determined by measuring the blood theophylline concentration. If theophylline is of no help, medication should be discontinued to avoid side effects such as stomach problems and headache.

The status of **anti-inflammatory drugs** in the treatment of chronic bronchitis and COPD remains controversial, and is the subject of extensive study. During and after exacerbations prolonged inflammation of the bronchi that can persist for months and may be associated with hyperreactivity is often observed. In some patients inhaled corticosteroid therapy (for 3 to 6 months) helps alleviate the inflammation. Treatment is more effective in the early stages of the disease, when airways obstruction is mild. Even in severe COPD, 10 to 20% of patients react favourably to oral corticosteroid therapy, and one in four of these patients are believed to benefit from inhaled corticosteroids. **Response to treatment should be assessed by means of spirometry and treatment should be continued only in patients with objective**

response. Patients should also be informed that inhaled steroids do not protect against the adverse effects of cigarette smoke. In some patients, benefit from the medication may be linked with the asthmatic component associated with the disease. Inhaled corticosteroids have proved safe to use. Local side effects (thrush and hoarseness) can be reduced by stopping smoking, rinsing the mouth and pharynx after taking the medicine, and using a spacer.

In patients with severe COPD, the value of continuous corticosteroid therapy should be assessed by trying oral corticosteroid therapy (30 to 40 mg of prednisolone/day) for 2 to 3 weeks. If results of lung function tests improve (over 10% increase in FEV_1 and an absolute increase of at least 200 ml) the patient may benefit from regular therapy with an inhaled corticosteroid. A very good response (FEV_1 increases of over 20%) suggests asthma rather than COPD alone. If long-term regular systemic steroid therapy is necessary in exceptional cases, dosage should be low (5 to 10 mg of prednisolone/day).

New drugs, affecting pathogenesis and disease development are being developed for the treatment of chronic bronchitis and COPD. These drugs will probably result in better means of treatment of these diseases.

The role of **mucolytic agents** in treatment is controversial. A new-generation mucolytic appears promising. Its status in treatment seems likely to be established in the near future. Cough suppressants should be used with care.

Outpatient treatment of exacerbations

In treating exacerbations of symptoms, reasons for them should be investigated (Table 28). In elderly patients with severe COPD, in particular, acute episodes of co-existing disease often result in sudden aggravation of pulmonary symptoms.

TABLE 28.
Differential diagnosis of exacerbations of chronic bronchitis and COPD.

- Viral or bacterial infection
- Pulmonary embolism
- Myocardial infarction
- Aggravation of heart failure
- Spontaneous pneumothorax
- Medication (hypnotics and other drugs with CNS effects, beta blockers)
- Metabolic disorders (e.g. diabetes, electrolyte disturbances)
- Muut sairaudet (esim. refluksitauti, suolistovuoto)
- Incorrect oxygen therapy

In COPD, symptoms often subside rapidly on addition of bronchodilator medication administered using nebulizers. Corticosteroid and theophylline therapies are also useful. In patients with severe COPD oxygenation may be temporarily impaired. Administration of oxygen via nasal cannulae at a rate of one to two l per minute usually provides relief, often without significant accumulation of carbon dioxide.

Exacerbations are often caused by a virus, but viral infection can also lead to spread of colonized bacteria to the lower airways, resulting in active bacterial infection. Bacterial infection is most frequently caused by *Streptococcus pneumoniae*, *Haemophilus influenzae* and *Moraxella catarrhalis*. A course of wide-spectrum antibiotic (10 to 20 days) can be started without bacterial culture and is usually sufficient.

Respiratory care devices

There are several kinds of medical devices that support drug therapy and breathing of COPD patients (Table 29). In Finland approximately 2000 patients administer drugs with regular nebulizers or positive pressure devices and over 1000 patients are using domiciliary oxygen therapy.

TABLE 29.
Medical devices for medication and respiratory support of COPD patients

Devices used in inhalation therapy
- Metered-dose inhalers and spacers
- Dry powder inhalers

Nebulizers
- Jet nebulizers
- Ultrasonic nebulizers

Intermittent positive pressure therapies
- Jet nebulizing (or oxygen) and intermittent positive pressure breathing
- Nasal intermittent positive pressure ventilation (NIPPV)

Oxygen delivery systems
- Oxygen concentrators
- Gaseous oxygen in high-pressure cylinders
- Liquid oxygen systems

The routine therapy of choice is inhalation therapy, either with a metered-dose inhaler combined with a spacer or a dry powder inhaler. If peak expiratory flow (PEF) values of COPD patients are permanently below 200 l/min or the inspiratory flow is low, the effective use of inhalation therapy may be difficult. Problems in using inhaler therapy may also be caused by difficulties in co-ordinating breathing or changes in finger joints. In such cases it may be necessary to use compressor-driven nebulizers in long-term therapy. Patients who benefit from nebulizer therapy can be identified only through clinical trials. Treatment is considered useful if home PEF values improve by over 15% and the patient's general condition improves during 3 to 6 weeks of therapy. Some patients benefit from combined use of a nebulizer and inhalers.

Intermittent positive pressure breathing (IPPB) means respiratory therapy in which the device provides ventilatory assistance during inspiration, either automatically or as initiated by the patient. Both volume- and pressure-controlled ventilators are available. A nebulizer or an oxygen flow source can be attached to an IPPB device. Using IPPB for drug administration has not clearly been shown to be more effective than using nebulizers or inhaler therapies. Severe COPD with respiratory insufficiency may be treated by nasal intermittent positive pressure ventilation (NIPPV) through a nose mask.

Intermittent positive pressure therapy should be considered as domiciliary care only after other treatments alone have proven insufficient and additional therapy seems necessary on the basis of long-term follow-up and acquaintance with the patient. Indications for domiciliary IPPB and nebulizer therapies are shown in Table 30. Before providing the patient with the equipment, it has to be assured that the patient is able to use, assemble and clean the device and administer the drugs.

TABLE 30.
Indications for use of nebulizers and intermittent positive pressure devices

- Low respiratory volume and high respiratory frequency
- Substantial inspiratory effort, intensive use of accessory respiratory muscles
- Poor alveolar ventilation (carbon dioxide retention)
- Excessive viscous mucus in the airways
- The patient needs inhaled medication, but is unable to use an inhaler Administrating a drug with a nebulizer attached to a positive pressure device is found to be the most effective therapy in an individual case.
- COPD patients with sleep apnoea are better treated by intermittent positive pressure breathing than the regular continuous positive pressure treatment of obstructive sleep apnoea.

Oxygen therapy

Following development of chronic respiratory failure, domiciliary oxygen therapy can improve survival and the quality of life of patients. Need for continuous oxygen therapy should be assessed during specialized medical care, after optimum treatment and intensive rehabilitation. In domiciliary oxygen therapy, oxygen should be administered for at least 15 hours daily if the long-term prognosis is to be improved. Criteria for initiation of domiciliary oxygen therapy are shown in Table 31. If therapy is started on the basis of these criteria, the patient and his or her relatives should be prepared for the therapy to be lifelong.

TABLE 31.
Criteria for initiation of domiciliary oxygen therapy in advanced COPD (FEV_1 < 1 litre).

- **Chronic hypoxaemia with P_aO_2 < 7.3 kPa on repeated measurement**
- **Chronic hypoxaemia with P_aO_2 < 7.3 to 7.9 kPa on repeated measurement and**
  - cor pulmonale
  - polycythaemia (haematocrit > 55%)
  - marked hypoxaemia on exertion
  - neuropsychological symptoms caused by hypoxaemia, reversible with oxygen therapy
  - significant nocturnal hypoxaemia reversible with oxygen therapy and not caused by concomitant sleep apnoea
- **Desired response with oxygen therapy (P_aO_2 > 8.0 kPa)**
- **Cessation of smoking by the patient**

Oxygen flow-rates in oxygen systems are determined on the basis of arterial blood gas levels. The aim is to raise the arterial partial pressure of O_2 to over 8 kPa or oxygen saturation to over 90%. The oxygen flow rate during exertion can be one to 2 l/min higher than the flow at rest and the need for oxygen during sleep may also be greater than the basic need. The flow rate to be used should be determined carefully in a hospital by monitoring blood oxygen and carbon dioxide levels. A continual increase in carbon dioxide level should be avoided. If a patient exhibits headache or drowsiness in the morning the situation should be checked.

Oxygen systems available for domiciliary oxygen therapy include oxygen concentrators, oxygen cylinders and liquid oxygen. In Finland, over 90% of patients receiving domiciliary oxygen therapy use concentrators. Oxygen concentrators require electricity, and the patient may need a reserve of oxygen cylinders for use in, for example, a summer cottage. Use of liquid oxygen allows employment of relatively light-weight, low-pressure devices that can be carried by the patient even when outdoors. Portable oxygen containers markedly increase the opportunities of patients to participate in social life. All forms of oxygen therapy (oxygen concentrators, liquid and pressurized oxygen containers) must be prescribed and supervised by the specialized medical care sector, irrespective of who is paying for the therapy. The greatest risks in domiciliary oxygen therapy relate to fire- safety issues associated with the administration and storage of oxygen. Patients' relatives and other care providers should be warned about hazards of smoking near oxygen apparatus.

Patients receiving oxygen therapy often feel tied to the apparatus, and withdraw socially. Feelings of fear and lack of exercise associated with dyspnoea are central problems in such patients. Provision of overall support to the patient is an integral part of oxygen therapy. Particular attention should be paid to the psychosocial situation. Health-care personnel should be readily available. Home visits by a rehabilitation instructor or physiotherapist 2 to 3 times a year help ensure successful home therapy, increase patients' feelings of safety and reduce needs for hospitalization.

5.3.3. Hospital treatment

The onset of an exacerbation of COPD is rarely sudden. In most cases, aggravation of the situation is gradual. Dyspnoea and mucous secretions increase and sleep is disturbed at night. Intensification of treatment in a primary-care ward at such a juncture should increase a patient's trust in the health-care system, make the patient feel more safe and shorten the duration of hospital treatment. In patients suffering from repeated exacerbations, a **prescheduled treatment period** of one to 2 weeks, involving intensification of all areas of treatment including physiotherapy, patient education and nutrition, may reduce needs for acute treatment and facilitate the overall coping of the family. Indications for hospital treatment in COPD are shown in Table 32. Table 33 outlines an example of initial treatment of exacerbation of severe COPD. Division of work between primary care and specialized medical care wards is described in Table 34.

TABLE 32.
Indications for hospitalization of patients with COPD.

- Poor response to outpatient treatment
- Previously ambulatory patient unable to walk
- Patient unable to sleep or eat because of dyspnoea
- Patient unable to cope at home (personal opinion, opinion of family or doctor)
- High-risk co-morbid condition (e.g. pneumonia)
- Prolonged symptoms of exacerbation
- Mental changes
- Increased hypoxaemia or hypercapnia
- Development or exacerbation of cor pulmonale
- Other aggravating factors (e.g. broken rib or vertebral fracture)
- Planned surgery or diagnostic procedure requiring general anaesthesia, or medication that will impair pulmonary function
- Planned treatment, assessment of the situation, or need for respiratory care devices

TABLE 33.
Initial treatment of exacerbation of severe COPD.

- Rapid clinical assessment of the overall situation and **reassurance** of the patient and family
- **Oxygen**
  – usually 1 to 2 l/min through nasal cannulae
  – care should be taken to avoid increase in P_aCO_2 at high flow rates
- **Nebulizer** therapy with
  – sympathomimetic (salbutamol 5 to 10 mg or fenoterol 1 to 2 mg or terbutaline 10 to 20 mg) plus ipratropium 0.5 mg
  – inhaled medication may be repeated after one hour, subsequently every 3 to 4 hours
- **Blood oxygen saturation** or P_aO_2 and P_aCO_2 measurements
- **Chest X-ray and ECG**
- **Corticosteroids**
  – intravenously, preferably as single doses or side infusion 4 to 6 times a day (hydrocortisone 200 to 400 mg or methylprednisolone 40 to 80 mg)
  – prednisolone 30 to 60 mg or methylprednisolone 24 to 48 mg orally daily
- **Theophylline**
  – single dose of 100 to 400 mg administered over 10 to 20 minutes in 100 ml of 0.9% saline
  – continuation of infusion at 0.5 mg/kg/hour (max. 1000 mg/day)
  – oral theophylline must not be administered during infusion
  – reduced doses in elderly patients and patients with heart or liver disease
- **Antibiotics**
- **Assisted ventilation if necessary**

TABLE 34.
Tasks of primary care and specialized medical care in relation to ward therapy.

Primary care	Specialized medical care
• Hospital treatment of exacerbations • Continuation of treatment of severe exacerbations • Prescheduled treatment • Long-term hospital treatment of COPD	• Hospital treatment of severe exacerbations • Prescheduled treatment • Assessment of need for respiratory care devices • Surgical or diagnostic procedures causing temporary impairment of breathing • Hospital treatment in difficult situations among patients using respiratory care devices • Primary health care consultation

Surgical treatment

COPD patients with significant emphysema may have isolated, large emphysematous bullae. Removal of such bullae can sometimes improve a patient's overall condition and lung function. In patients with severe respiratory failure, removal of larger emphysematous areas is also possible. This promotes the functioning of healthier lung tissue and the diaphragm. In isolated cases of severe emphysema, lung transplantation may be performed. This applies primarily to young patients whose lungs have been destroyed as a result of alpha$_1$-antitrypsin deficiency.

Intensive care

The results of studies indicate that there is no ethical obstacle to consideration of intensive care in any patient suffering from COPD, if necessary. Nevertheless, overt very poor basic lung function, poor nutritional status, severely limited activity and continual decrease of lung capacity may warrant abstention from intensive care. However, any decision to refrain from intubation and mechanical ventilation should be based on open discussion between the attending physician, patient and patient's family in advance, in a phase in which the patient's condition is still stable.

Terminal treatment

Care, moral support and good symptomatic treatment must be provided to a patient even after COPD has progressed to a stage at which death is inevitable and it is not possible to restore the quality of life in accordance with the patient's wishes by any treatment measure. Treatment of fear and pain are the primary concerns. The patient must be treated through achievement of mutual understanding with the patient and his or her family, in accordance with the Act on patient care.

5.4. Rehabilitation

The aims of rehabilitation are to increase patients' overall resources, to reduce handicaps caused by illness or disability in individual patients, and to allow integration in society in accordance with an individual's abilities and age. Successful rehabilitation requires initiative and an active contribution from both the patient and the body providing rehabilitation. Rehabilitation has proved useful in many ways, especially when rehabilitation in hospital or other institutions has been combined with long-term continual rehabilitation at home (Table 35).

TABLE 35.
Benefits of pulmonary rehabilitation.

- Decrease in respiratory symptoms
- Diminution of feelings of fear and depression and improvement of self-esteem
- Increase in ability to deal with daily activities
- Improvement in physical condition
- Improvement in quality of life
- Decrease in number of days in bed
- Prolongation of survival in some patients (oxygen therapy)

On the basis of the results of the Mini-Suomi study conducted by the Social Insurance Institution, it has been estimated that there are roughly 100 000 individuals of working age whose capacity for work has decreased because of chronic bronchitis or COPD. The number of disabled individuals is estimated to run to tens of thousands. The potential target group for early rehabilitation would include 200 000 individuals.

5.4.1.
Medical and social rehabilitation

According to the Primary Health Care Act (Act 66/72 as amended) and the Act on Specialized Medical Care (Act 1062/89), the municipal health-care system bears primary responsibility for medical rehabilitation and must provide medical rehabilitation as an element in medical care (Decree 1051/91).

Rehabilitation can be implemented primarily on an outpatient basis. Early rehabilitation, which forms an element in medical rehabilitation, was discussed in Section 5.3.1. However, periodic institutional rehabilitation is necessary, particularly in children, in connection with the acquisition of respiratory care devices, in patients with severe COPD, and in assessing of functional ability and needs for rehabilitation. Forms of medical rehabilitation are listed in Table 36.

TABLE 36.
Forms of medical rehabilitation.

1. Provision of instruction, guidance and support relating to treatment of the disease by the health-care system, including instruction regarding use of respiratory care devices, and lending and maintenance of such devices.
2. Organization or purchase of adaptation training by hospitals and health centres, and therapies and measures to improve functional ability.
3. Implementation of rehabilitation instruction, organized or purchased by the health-care system in hospital districts.
4. Interval and periodic rehabilitation in health-care institutions.
5. Support by the Social Insurance Institution of adaptation training and rehabilitation courses organized on an outpatient or institutional basis.
6. Organization by the Social Insurance Institution of occupationally oriented medical rehabilitation (ASLAK) courses
7. Outpatient and institutional medical rehabilitation of severely disabled individuals.

Social rehabilitation forms an integral part of medical rehabilitation activities. Social rehabilitation is also promoted by various group activities, and by adaptation training and rehabilitation courses. At present, courses directed towards patients with COPD are organized primarily for pensioners by the Finnish Slot Machine Association, rehabilitation research units in hospitals, and various organizations. Short-term courses and outpatient services are also provided.

The Social Insurance Institution organizes patient-group-specific rehabilitation courses on the basis of an allowance ratified in the governmental budget. They are implemented primarily in collaboration with rehabilitation institutions and organizations as medical rehabilitation of severely disabled individuals or rehabilitation based on assessment of needs. Outpatient medical rehabilitation of severely disabled individuals can also include supported physical therapy, as allowed by relevant legislation. Patient associations and public-health organizations organize several rehabilitation courses annually. The Social Insurance Institution pays for the courses at its discretion.

Occupationally-oriented medical rehabilitation (ASLAK) is a form of early rehabilitation organized by the Social Insurance Institution for the population of working age. It aims at long-term improvement in and maintenance of capacity for work in individuals in whom risk of decreased capacity for work is already apparent. ASLAK courses are organized for specific vocational groups in the form of national, regional or in-company courses. In the case of individuals with chronic bronchitis and COPD, it is very important for rehabilitation to be focused also on other life-habit-related issues in addition to physical activity, such as cessation of smoking, nutrition, mental health and respiratory care devices. A course of occupationally-oriented medical rehabilitation directed specifically towards patients with respiratory symptoms should be developed.

5.4.2. Occupational rehabilitation

Responsibility for occupational rehabilitation is shared between many sectors. On the basis of the legislation relating to labour services passed on 1 January 1994 it is partly the responsibility of work administration. Under the Rehabilitation Act, the Social Insurance Institution is responsible for organizing the vocational training required by patients with chronic bronchitis or COPD whose capacity for work and means of earning their livings have decreased markedly because of their illnesses, unless such training has been organized by virtue of the legislation relating to labour services, labour-policy adult vocational education or employment pension, or provisions relating to special instruction (Act 610/91). In practice, vocational training organized for patients with COPD on the basis of the above-mentioned provisions has been rare, because in most patients the disease becomes severe only on the eve of their retirement.

The Social Insurance Institution organizes activities for maintaining and improving capacity for work (TYK) in elderly individuals. If necessary, the Social Insurance Institution can support assessment of needs for rehabilitation of populations of working age and research into rehabilitation.

Under employment pension legislation, employment pension agencies can organize occupational rehabilitation, and medical rehabilitation to support it. Early rehabilitation can also be provided.

A problem with the occupational rehabilitation of individuals with chronic bronchitis is that current sets of criteria for occupational diseases do not recognize work-related chronic bronchitis, although it has also been shown in Finnish studies, especially in farmers, that work-related exposure plays a role in the development of chronic bronchitis.

5.5. Social security

The purpose of social security is to ensure effective treatment of patients with chronic bronchitis and COPD and the livings of individuals and families in the case of incapacity for work and disability and costs resulting from treatment of illness. General reimbursements prescribed by social security legislation include costs of medicines and respiratory care devices, costs of medical care and rehabilitation, daily allowances, disability pensions, and services and support provided in the context of welfare of the disabled.

Legislation relating to occupational diseases ensures better social security in cases of illness than other legal provisions. The occupational diseases criteria in relation to chronic bronchitis and COPD need to be revised. Costs of treatment of exacerbations or sick leave caused by work-related factors can already be reimbursed in the same way as those resulting from occupational diseases.

The number of individuals with COPD entitled to special reimbursement for costs of medicines is estimated as 4 500. Precise estimation is difficult because patients with asthma and COPD have been included in statistics under the same heading since 1994. Nevertheless, the figure is clearly too low, considering that there are roughly 10 000 patients with severe COPD needing repeated hospital treatment annually. In practice, the justification for granting special reimbursement for the costs of medicines in chronic obstructive airways disease is demonstration that medication improves lung-function test results or a decrease in lung function to the level of severe disability. The principal aims of drug therapy in COPD include elimination of symptoms and improvement of the quality of life of the patient, and these are not necessarily demonstrable via lung function measurements.

The number of individuals receiving a disability pension because of COPD is roughly 2 500. In 1992 and 1994, the Social Insurance Institution granted rehabilitation allowances to approximately 90 and 180 COPD patients,

respectively. The corresponding figures for asthma patients were 3 100 and 4 000. Numbers of disability pensions and rehabilitation allowances are low compared with estimated needs (see Section 5.4). At present, the most important social benefits for patients with COPD include rehabilitation allowances for the severely disabled and various care allowances and home and residential services, reflecting defects in early diagnosis and early rehabilitation.

6

Information, training, research and follow-up

6.1. Information and training

Implementation of the Programme for Chronic Bronchitis and Chronic Obstructive Pulmonary Disease will necessitate training and dissemination of information to key groups, and provision of continual guidance. Key groups include individuals at high risk of COPD (smokers), those who suffer from chronic bronchitis or COPD, those who participate directly in treatment and rehabilitation (doctors, nurses, rehabilitation personnel), those who can influence the nature and extent of exposure (dental-care personnel, designers, decision-makers, teachers), those who distribute information about matters relating to health and illness (journalists, representatives of various organizations, the pharmaceutical industry), and those who decide on allocation of resources (municipal and governmental decision-makers).

Responsibility for information and training could be shared between organizations such as the Allergy and Asthma Federation, Folkhälsan (a non-governmental health and social organization for the Swedish-speaking population in Finland), the Finnish Lung Health Association, the Association of the Pulmonary Disabled, and the Finnish Indoor Air Association. These could distribute information to their members, and to some extent to the general public. They also produce suitable material for patient education, and health education material relating to COPD for schools, in collaboration with health, education and environmental authorities. However, these activities require financial support from society, e.g. the grants from the Finnish Slot Machine Association.

The Social Insurance Institution plays a key role in disseminating information relating to reimbursement of costs of medicines, rehabilitation and social security. The authorities, in turn, are responsible for dissemination of information to professionals and for their training in collaboration with different organizations and associations, such as the Finnish Association of Specialists in Pulmonary Medicine, the Finnish Association of Clinical Physiology, the Finnish Association of Municipal Doctors, the Finnish Society of Paediatricians, the Finnish Medical Association, the Finnish Dental Association, the

Finnish Society of Internists, the National Union of Public Health Nurses, the Union of Health Professionals in Finland and the Association of Finnish Pharmacies. Regional direction and training are the responsibilities of hospital districts and provincial governments. Health centres are in charge of local direction and training. The social and health authorities bear primary responsibility for implementation and follow-up of the Programme.

The media as a whole, and medical journalists and editors in particular, as well as editors of professional journals, are in key positions to stimulate discussion on the general principles of the Programme and promote achievement of its goals.

Examples of areas of information and training important in relation to implementation of the Programme in the near future are given in Table 37.

TABLE 37.
Information and training necessary for implementation of the Programme.

Information and training	Time	Agent
Preliminary information and information for key groups	1998 – 2000	Ministry of Social Affairs and Health, Finnish Lung Health Association
National discussions and training	1998 – 1999	Ministry, Finnish Lung Health Association, other organizations
National COPD days	1997, 1999 etc.	Ministry, organizations, Finnish Association of Specialists in Pulmonary Medicine
National respiratory care devices days	1998, 2000 etc.	Terveydenhuollon Lähi-palvelusäätiö, organizations
Regional training	1998 – 1999	Hospital districts, provincial governments, Regional Institutions for Occupational Health, organizations
Local training	1998 – 2000	Health centres, occupational health units, pulmonary disease units
Spirometer operator training	1998 –	Specialized medical care units
Guidance in appropriate use of medicines	1998 –	Treatment units, pharmacies, the pharmaceutical industry
General information	1998 –	Media
Articles in organizational, professional publications	1998 –	Organizations, experts
Provision of material	1998 – 1999	Organizations, authorities and the pharmaceutical industry
Supplementary information and training	– 2007	Authorities and organizations

6.2.
Research and follow-up

In Finland, research into chronic bronchitis and COPD has been carried out by universities, the Social Insurance Institution, health-care institutions, various organizations, the pharmaceutical industry, and individual investigators and groups of investigators.

Few extensive population studies exist on the prevalences of the diseases. Those that do exist have helped correct estimates relating to prevalences and causes of chronic bronchitis and COPD, and their effects on the national economy. However, data on incidences, changes in distribution of degrees of severity, significances of risk factors other than smoking, and effects of early diagnosis, early rehabilitation and prevention are inadequate. Epidemiological studies on risk factors relating to COPD and the effects of COPD on public health, and intervention studies to improve prevention and guided self-care, should be intensified, and financial support for such studies secured. Studies on preventive measures should form integral parts of research into COPD. Multidisciplinary research projects should be promoted. Areas of research central to the Programme are listed in Table 38.

Implementation of the Programme will necessitate a well-planned, well-functioning and continual quality control and direction system. Particular attention should be paid to appropriate conduct of lung-function tests, implementation of the programme for the prevention of smoking, and assessment of the effects and cost-effectiveness of the Programme.

Existing mortality and hospital discharge records could be used to monitor achievement of the overall goals of the Programme. Regional models should be developed for follow-up of activities in the outpatient care sector. These models could be used for sample-based assessments.

The Ministry of Social Affairs and Health has appointed a monitoring group responsible for supporting and evaluating of the implementation of the National Asthma Programme. A similar procedure could be adopted in relation to the Programme for the Prevention and Treatment of Chronic Bronchitis and COPD. **A practicable option would be to combine follow-up and support of the Programme with the work of the Asthma- Programme Monitoring Group that has been appointed or with that of the Public-Health Advisory Board.**

TABLE 38.
Needs for research and follow-up in relation to the Programme for Chronic Bronchitis and COPD.

- Prevalences and incidences of the diseases
- Early diagnosis and treatment
- Environmental factors causing the diseases: descriptions and evaluations of risks
- Significance of the environment during the foetal stage and infancy
- Indicators of mucosal inflammation
- Impact of rehabilitation on health-care costs
- Creation of extensive systems for follow-up

7

Costs of the Programme

The costs of the Programme for the Prevention and Treatment of Chronic Bronchitis and COPD will arise mainly from provision of information and training, and the system for quality control and direction. However, these will not be additional costs but costs relating to normal activities of the health-care system and organizations, and improvement of such activities. Dissemination of information, training and preparation of materials in relation to the launch of the Programme, and to planning of strategies (approximately FIM 5 million) should be supported financially by, for example, health-promotion grants as set out in the Tobacco Act, funds from the Finnish Slot Machine Association, and the rehabilitation funds of the Social Insurance Institution. The Ministry for Social Affairs and Health and the Finnish Slot Machine Association have provided grants towards launch of the Programme. Apparent additional costs of measures directed towards risk groups will be offset by savings in costs arising from these and other diseases (e.g. coronary heart disease, lung cancer and asthma).

Implementation of the Programme and improvement of quality of prevention and treatment would make it possible to treat patients with chronic bronchitis and COPD at decreasing costs. If the Programme is not implemented, the costs paid by society are bound to rise as severe forms of COPD become increasingly prevalent.

8

Summary

1. A national recommendation for the promotion of prevention, treatment and rehabilitation in relation to chronic bronchitis and COPD from 1998 to 2007 has been prepared on the basis of extensive collaboration by order of the Ministry of Social Affairs and Health. The Programme needs to be revised as necessary, because of rapid developments in medical knowledge, and in drug therapy in particular.

2. Chronic obstructive pulmonary disease (COPD) is a disease characterized by slowly progressing, irreversible airways obstruction. Over 5% of the population suffer from symptomatic forms of the disease. It is estimated that a further 5% of the population may suffer from latent COPD. Most patients (75%) suffer from mild forms of the disease. The disease is often preceded by chronic bronchitis. A total of 400 000 Finns suffer from chronic bronchitis or COPD. Occurrence of these diseases in future will be particularly affected by decreased smoking by men, increased smoking by the young and by women, and ageing of the population.

3. In 1997, the annual treatment costs of chronic bronchitis and COPD were estimated to be FIM 1.5 thousand million, total costs FIM 5 thousand million. Without intensification of measures to prevent and treat the diseases, costs will rise significantly. Costs arising from severe COPD (5% of patients with COPD) account for roughly 65% of costs overall and are primarily related to hospitalizations.

4. The goals of the Programme for the Prevention and Treatment of Chronic Bronchitis and COPD are as follows: (a) to decrease the incidence of chronic bronchitis, (b) to ensure that as many patients as possible with chronic bronchitis recover, (c) to maintain capacity for work and functional capacity of patients with COPD, (d) to reduce the percentage of patients with moderate to severe COPD, (e) to decrease the number of hospitalization days of COPD patients by 25% overall, and (f) to decrease annual costs per patient.

5. The following means are suggested for achieving the goals: (a) reduction in smoking, (b) reduction in work-related and outdoor air pollutants and improvement of quality of indoor air, (c) enhancement of knowledge about risk factors and treatment of the diseases is in key groups, (d) promotion of early diagnosis and active treatment, in smokers in particular, (e) improvement of guided self-care, (f) early commencement of rehabilitation, individual planning and implementation, primarily as an element in treatment, and (g) encouragement of scientific research.

6. COPD and exacerbation of its symptoms can be prevented through choices relating to life habits, such as not smoking, maintaining good general condition, and protection against exposure to dusts. The Programme gives examples of such measures and appeals to various authorities and voluntary organizations to increase their cooperation. Preventive methods should be individualized, and based on due consideration.

7. Chronic bronchitis and COPD should be diagnosed at early stages, and treated appropriately from the outset. Treatment consists of (a) treatment according to causes, such as stopping smoking and work hygiene, (b) early rehabilitation such as patient education and guided self-care, (c) drug therapy, (d) hospital treatment, and (e) rehabilitation.

8. The hierarchy of referrals in the treatment of COPD should be revised to accord a greater role to the primary health care sector. Good exchanges of information and cooperation between the primary health care and specialized medical care sectors will all be necessary if this hierarchial model is to have the desired effect.

9. Hospital districts and health centres should ensure that different levels of the health-care system are capable of fulfilling the tasks assigned to them appropriately. One specialist in each hospital district should be given charge of prevention and assembly of know-how relating to treatment, and of quality of treatment at regional level. In the primary health care sector, contact individuals should be appointed to disseminate information, coordinate training and promote cooperation with, for example, dental-care personnel. It would be best if individuals in charge and acting as contacts were the individuals responsible for the National Asthma Programme. Prevention and treatment of chronic bronchitis and COPD should be matters for regional cooperation.

10. Rehabilitation of patients with chronic bronchitis or COPD should cover all forms of rehabilitation: medical, occupational and social. Rehabilitation should prevent exacerbation of disease, support self-care, increase patient resources and improve quality of life, reducing needs for hospitalization. Early rehabilitation should be increased, and guidance and advice should form integral elements in treatment. Rehabilitation should be implemented on an outpatient basis as far as possible.

11. Information and training should be directed primarily towards key groups, such as patients and their families, health-care personnel, and individuals responsible for environmental issues. Organizations should disseminate information to members and, if necessary, produce general material needed for health and patient education relating to chronic bronchitis and COPD, and training material, in cooperation with the authorities. The Social Insurance Institution should disseminate information about reimbursement for medicines and social security. The pharmaceutical industry and pharmacies will play key roles in supporting information and training. Regional direction and training will be the responsibilities of hospital districts, provincial governments and local health centres. The Ministry of Social Affairs and Health will also be responsible for implementation of the Programme, its follow-up and, if necessary, its revision. The media will play an important role in the dissemination of in-depth information about prevention and treatment of COPD.

12. Research should focus on (a) population studies on prevalences of the diseases, risk groups and risk factors, and (b) studies aiming at improvement of prevention and guided self-care.

13. If the Programme for the Prevention and Treatment of Chronic Bronchitis and COPD for 1998 to 2007 is implemented, the increasing numbers of patients who will suffer from COPD will be treatable at current costs. If not, costs paid by society will increase rapidly. Implementation of the Programme will not result in significant additional costs. The costs of initiating the Programme will be approximately FIM 5 million.

TABLE 1.
Prevalence of chronic bronchitis in different areas, by age group and sex (%).

Place, year	Age group	Men	Women
Glamorgan, UK1957	25–74	13.9	8.8
New Hampshire, USA 1962	25–75	13.8	9.4
Tecumseh, USA 1982	16–64	13.0	4.1
Uppsala, Sweden 1968	30–64	2.2	1.5
Norrbotten, Sweden 1989	35–66	10.4	7.4
Busselton, Australia 1968	20–74	6.3	2.5
Busselton, Australia 1985	18–80	21.4	17.2
Delhi, India1977	35–74	12.0	5.0
Nigeria 1977	31–70	0.3	0.2

TABLE 2.
Prevalence of COPD in different areas, by age group and sex (%).

Place, year	Age group	Men	Women
New Hampshire, USA 1962	25–75	8.6	8.1
Tecumseh, USA 1982	16–64	5.2	2.5
Copenhagen,Denmark1983	40–59	9.5	8.6
Framingham, USA 1984	Adult	9.5	6.8
Busselton, Australia 1985	18–80	13.5	3.9
Cracow, Poland 1986	19–70	8.5	4.9
Hordaland, Norway1988	15–70	5.6	5.2

NICOTINE DEPENDENCE TEST
(Fagerström Dependence Scale 1997).

1. How soon after waking up do you smoke your first cigarette?	Less than 6 min	☐	3
	6 – 30 min	☐	2
	31 – 60 min	☐	1
	more than 60 min	☐	0
2. How many cigarettes do you smoke daily?	10 or fewer	☐	0
	11 – 20	☐	1
	21 – 30	☐	2
	more than 30	☐	3
Total score			

Score 0 – 1 : Low dependence. Stopping smoking should be fairly easy.

Score 2 : Moderate dependence. Guidance and nicotine replacement therapy by means of transdermal patch or 2 mg chewing gum may help with stopping smoking.

Score 3 : High dependence. Guidance and nicotine replacement therapy required. Nicotine replacement may be implemented using transdermal patches, 4 mg chewing gum or nasal spray.

Score 4 – 6 : Very high dependence. Stopping smoking may be difficult. Long-term support probably needed. Nicotine replacement therapy by means of 4 mg chewing gum, nasal spray or a combination of, e.g. transdermal patch and chewing gum.

ANNEX 3

EXAMPLE OF INTERVENTION BY A DENTIST TO PREVENT SMOKING

At the beginning of a routine school dental examination, the dentist asks a pupil whether he or she smokes. The following measures are implemented depending on the answer.

1. Pupil does not smoke:
Dental status is examined as usual and the pupil receives positive feedback for not smoking. After the examination, a series of photographs showing dental staining caused by smoking is shown to the pupil. He or she is then allowed to check with the help of a mirror whether he or she has stained teeth.

2. Pupil smokes:
Dental status is examined as usual. After the examination, a series of photographs showing dental staining caused by smoking is shown to the pupil. He or she is then allowed to check with the help of a mirror whether he or she has stained teeth.

NICOTINE REPLACEMENT THERAPY

- **The efficacy of nicotine replacement therapy can be significantly increased by support and follow-up.**

- **Nicotine chewing gum:** Treatment should be started using a gum strength corresponding to the number of cigarettes smoked by the individual and level of nicotine dependence. The latter can be assessed by means of the Fagerström's Dependence Scale (Annex 2). A piece of gum should be chewed slowly 5 to 10 times until a burning, peppery taste is experienced. The gum should then be placed between the teeth and the cheek. The taste will disappear after a few minutes. Chewing should be repeated and intermittent chewing continued for about 30 minutes. Chewing gum should be used whenever there is an urge to smoke, usually 10 to 15 pieces of gum a day. Treatment should be gradually withdrawn after 3 months of use. Treatment can be stopped when the dose is one to 2 pieces of gum a day. Treatment for more than one year is not recommended.

- **Patch:** Treatment should be started using a patch strength corresponding to the number of cigarettes smoked by the individual, applying one patch a day. The area of application should be varied daily. The strength may be reduced at one-month intervals if necessary. Duration of treatment is approximately 2 to 3 months. In individuals with high nicotine dependence, a combination of nicotine chewing gum and patch treatment may be necessary.

- **Nasal spray:** Used for the treatment of high nicotine dependence as directed by a doctor. May be used as adjunctive therapy with patches or chewing gum.

- **Possible side effects:** Nausea, abdominal problems, headache, sore throat, tenderness of the jaw joints, skin reactions at the sites of application of patches, insomnia. Irritation of the nasal mucosa in connection with use of nasal spray. Abdominal symptoms can be prevented by concomitant administration of antacids.

- **Contraindications:** Smoking and temporary smoking. Recent myocardial infarction or cereberovascular disorder. Variable or increasing angina and severe arrhythmias. Hypersensitivity to nicotine. **Caution required in:** individuals under 18 years of age, pregnant and lactating women (intake of nicotine should be completely avoided).

- **Interactions:** Smoking is prohibited during nicotine replacement therapy. Stopping smoking also during replacement therapy can affect levels and efficacies of certain drugs (e.g. theophylline, oestrogen and the anticoagulant warfarin).

ANNEX 5

DIETARY RECOMMENDATIONS TO SUPPORT PREVENTION AND TREATMENT OF CHRONIC BRONCHITIS AND COPD

- Diet should be balanced.
- In obese individuals, total dietary energy content should be reduced in accordance with desired weight level. The energy content of a normal diet aimed at weight reduction is 1200 to 1500 calories a day.
- In correcting undernutrition, total energy and proteins should be increased. If carbohydrates account for a high proportion of total energy effects may be harmful.
- Dietary fats should account for no more than 30% of total energy (in men, approximately 80 g/day, in women, 60 g/day). Amount of dietary fat can be increased in patients with COPD suffering from undernutrition.
- Saturated fats (i.e. milk fats and other animal fats and solid vegetable oils) should not account for more than one third of total fat intake (10% of total energy).
- Reductions in saturated fats should be compensated for by increases in use of mono- and polysunsaturated fats (especially fish fat).
- Intake of dietary fibre and antioxidants should be increased by increasing consumption of vegetables, fruits, berries and grain products.
- Alcohol consumption should be restricted, in men to no more than 2 to 3 and in women to one to 2 units a day.
- Daily salt intake should be below 5 g.

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