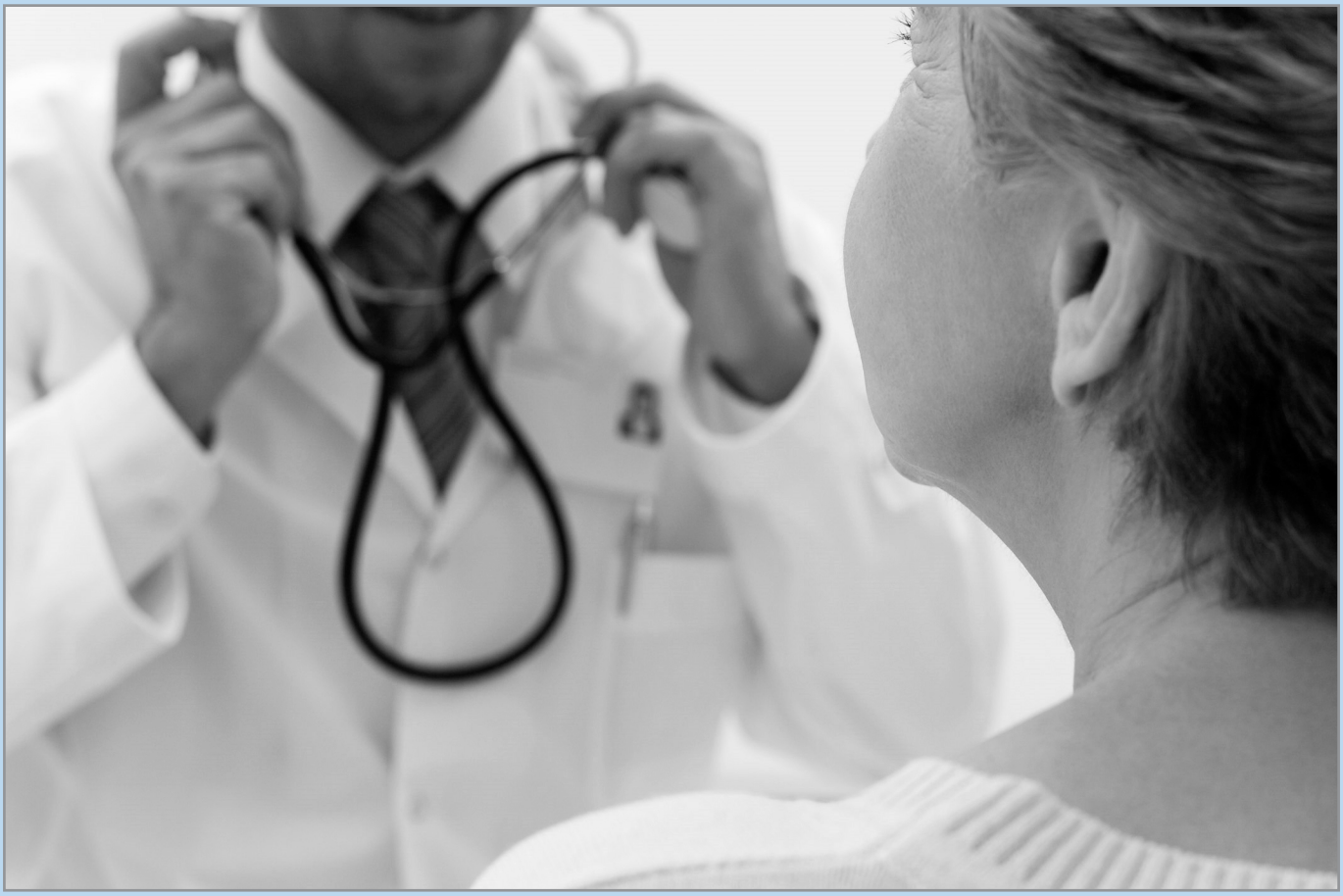
COPD Healthcare Atlas

Use of health services in connection with chronic obstructive pulmonary disease in Norway, 2013-2015



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Foreword

Northern Norway Regional Health Authority

The COPD Healthcare Atlas from the Centre for Clinical Documentation and Evaluation (SKDE) provides new and important information about the population's use of health services in connection with COPD. According to WHO, the prevalence of the disease is increasing rapidly worldwide. In 2020, COPD will be the third leading cause of death worldwide. The main cause is smoking. At least 200,000 Norwegians suffer from COPD.

The big picture is that the healthcare atlas shows geographical, but not much unwarranted, variation in the population's use of health services in connection with COPD. That is positive. Does this mean that the atlas gives the health services for this group of patients a clean bill of health? Not really.

Lung function testing using spirometry is the 'gold standard' examination for determining whether or not a person has COPD, and for monitoring the disease's development. The healthcare atlas shows variation between geographical areas in the proportion of persons with COPD who have undergone spirometry. Moreover, the proportion seems to be too low in all the hospital referral areas.

Many persons with COPD experience acute exacerbations that require hospital admission. Some of them will need help to breathe (respiratory support). The COPD Healthcare Atlas identifies unwarranted variation in the use of respiratory support in connection with emergency admissions for COPD. This means that there are individual patients who do not receive the most adequate healthcare they should have.

Persons admitted with COPD exacerbations have a high risk of being readmitted within 30 days and of dying within one year. The most important thing to do to improve the treatment offered to this patient group is to address the unwarranted variation that the COPD Healthcare Atlas identifies and to establish a common best practice. In addition, there are many indications that it is a good idea to ensure that people get help before the disease has become very serious. It is important to initiate treatment of acute COPD exacerbations quickly in order to avoid hospitalisation. The second most important thing is to increase patients' possibility of maintaining as optimal a lifestyle as possible and to avoid situations that could exacerbate the disease. Patient education and coping services are a sound and reasonable investment. This will also help to reduce the load on the hospitals that provide emergency medical services.

Historically speaking, COPD has been regarded as a low-status disease by patients, as well as by the health services and society at large. Health problems that can be lifestyle-related or for which few treatment options are available have not been at the top of the health service's ranking, and cancer, heart disease and other acute conditions receive more attention. It is my hope that the COPD Healthcare Atlas will, in an informed manner, draw attention to the treatment offered to

a large group of people who deserve to receive good help for their significant long-term health problems. This is in the best interests of the people in question, the health service and society at large.

Lars Vorland
Managing Director
Northern Norway Regional Health Authority

The Norwegian Respiratory Society

The health service's primary function, in addition to preventing and curing diseases, is to relieve suffering and prevent premature deaths. We have substantial funds at our disposal, but society's resources are not inexhaustible. As doctors, we constantly make big and small decisions that entail expenses for the public purse. This means that we have an obligation to use our knowledge to maximise the health benefit per krone spent.

The treatment options available for COPD have improved considerably in the past two decades. As a result, patients live longer and the use of health services thereby increases. This is a big patient group, and it is therefore important that we make wise decisions when we assess, treat and follow up these patients. Comparing the way in which health services are organised in one's own and other organisations can encourage a critical fresh look at the prevailing practices.

The key is to ensure that the measures that deliver health benefit with reasonable resource use, such as lifestyle intervention, rehabilitation and spirometry monitoring, are actually implemented. However, making wise decisions also means refraining from measures that lack documented effect.

This COPD Healthcare Atlas can help us pulmonologists to understand where the problems lie in our field. The healthcare atlas can encourage us not only to reconsider our procedures, but also to make an effort to improve cooperation with the primary healthcare services, for example in the form of teaching. It focuses on the simple, but important, measures that can and should be carried out by primary care physicians to follow up COPD patients, and on how to select the right patients for referral to the specialist health service.

Some interesting variations between the different health trusts' hospital referral areas are pointed out. Examples include the use of outpatient services, length of stays and non-invasive ventilation (NIV). This gives rise to many new questions. There is no strong correlation between the number of outpatient contacts and emergency admissions. Could it be that the quality of routine check-ups of COPD patients is good enough in the primary healthcare service? Could some hospitals cut the length of stays and maintain the same level of quality, for example by improving their cooperation with the municipal health service? Is NIV overused in some places, while other hospitals have a low threshold for admitting patients and therefore less need for NIV? Or is this an indication of under-registration? The material forms a basis for many interesting discussions.

We would have liked to have figures for more areas, for example for the use of long-term treatment with oxygen and nebulisers, which probably also varies between different hospital referral areas, but those figures are not available in the same way. A COPD register with high coverage would be desirable.

The Norwegian Respiratory Society appreciates the good work done in this context. This publication collects a lot of knowledge about COPD and provides extensive data that will be useful in further work for this group of patients.

Trond Bjørge
Deputy leader
The Norwegian Respiratory Society

The National Register for Patients with Chronic Obstructive Pulmonary Disease

COPD is a very serious disease that is very common in Norway. The treatment provided to patients with COPD by Norwegian hospitals may seem random and unsystematic. Patients are spread between different hospital departments, and the care pathways are often not good enough.

Despite the increasing attention given to COPD by the media, politicians and patient organisations in recent years, there is still a great need for more knowledge about the condition. The COPD Healthcare Atlas contributes important knowledge about the prevalence of COPD in the primary and specialist health services and about the condition's geographical distribution in Norway. The figures also illustrate how seriously ill patients are upon emergency admissions for COPD exacerbations. Previously, we have not had an overview of the geographical distribution of participation in pulmonary rehabilitation in connection with COPD.

The COPD Healthcare Atlas is based on data from the Norwegian Patient Registry (NPR) and the control and payment of reimbursements to health service providers (KUHR) database. These data sources contain no clinical information about, e.g., lung function or blood tests results, nor information about quality of life, vaccination status and patient-reported outcome measures. Norway has a National Register for Patients with Chronic Obstructive Pulmonary Disease (the COPD Register) that contains such detailed information about patients admitted to hospital for COPD exacerbations. Despite the fact that reporting data to the COPD Register is compulsory, not enough departments and hospitals do so at present. In their current form, data from the COPD Register cannot therefore be used in the COPD Healthcare Atlas or in any other way serve as national figures for how people with COPD exacerbations are cared for by the Norwegian health service. This important knowledge will only become available once all health trusts report data about relevant patients to the COPD Register.

Gunnar Reksten Husebø
Discipline manager
The National Register for Patients with Chronic Obstructive Pulmonary Disease

Norwegian Heart and Lung Patient Association

It is important to highlight, both in relation to the medical community and the population at large, that COPD is one of the most widespread diseases in Norway. In recent years, the Norwegian Heart and Lung Association (LHL) has made active endeavours to attract media coverage of the disease by organising campaigns and awarding an annual COPD prize. Since the authorities closed down the national COPD council under the Norwegian Directorate of Health, LHL has established its own national COPD council.

The COPD Healthcare Atlas is a good contribution to the work on raising awareness and increasing knowledge about COPD. The knowledge base in the COPD area must be strengthened, and LHL believes that the register work on COPD must be improved. In LHL's opinion, a register must be established that covers both primary healthcare and the specialist health service. It is also important that regular GPs carry out more lung function measurements of high-risk patients than they presently do. It is important to diagnose COPD as early as possible so that further loss of lung function resulting from the disease can be slowed down or stopped.

LHL is a patient and user organisation whose membership includes COPD patients. It endeavours to look after the interests of COPD patients in the best possible way. LHL has a good peer counselling service, and 500 peer-based exercise groups all over Norway where COPD patients participate in adapted exercise activities. As a partner that cooperates with the public health service, LHL also operates treatment and rehabilitation services for COPD patients, e.g. at the Glittre Clinic, and shortly also at our new hospital at Gardermoen. The COPD Healthcare Atlas is important for LHL because it gives hope that COPD will eventually be given the priority that such a serious disease deserves.

John Normann Melheim
Chair of the Board
Norwegian Heart and Lung Patient Association

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Chapter 1

Summary

It is an overriding goal in Norway's health policy that the whole population should have equitable access to health services regardless of where they live. The purpose of the COPD Healthcare Atlas is to map the use of health services for COPD during the period 2013–2015 in order to shed light on whether health service provision for persons with COPD is equitable. The analyses are based on the hospital referral areas where the patients live, and thus indicate whether the regional health authorities do enough to fulfil their responsibility to provide healthcare. The main data sources are the KUHR register (control and payment of reimbursements to health service providers) for analyses of the use of regular GP and emergency primary healthcare services, and the Norwegian Patient Registry (NPR) for analyses of the use of specialist health services.

COPD is a common condition both in Norway and in the rest of the world. Based on estimates from population surveys, it is assumed that at least 200,000 people in Norway suffer from COPD. How the prevalence of COPD breaks down between different hospital referral areas is not known. However, we do know that there is geographical variation in the incidence of lung cancer, which, like COPD, is strongly related to smoking. We have therefore used geographical differences in the incidence of lung cancer, measured as the number of new cases per 10,000 population, as an indirect measure of geographical differences in the prevalence of COPD.

Each year, approx. 49,000 people visit their regular GP or emergency primary healthcare services due to COPD. Around 20,600 persons had outpatient contact with hospitals or specialists in private practice under public funding contracts, and about 10,500 persons had emergency admissions for COPD exacerbations. Persons with COPD have a considerable need for health services.

Some of the observed geographical variation in the use of health services for COPD can be explained by the expected COPD prevalence in the different hospital referral areas. There is a strong correlation between the incidence of lung cancer and the use of regular GP and emergency primary healthcare services, outpatient services and emergency admissions for COPD. Some of the observed variation in the use of health services in connection with COPD can therefore be characterised as warranted.

There is unwarranted variation in assessment for and treatment of COPD, however. For example, our findings show unwarranted variation between hospital referral areas in regular GPs' use of spirometry. Spirometry, which measures lung function, is the most important examination in connection with the assessment and monitoring of COPD. At least one third of COPD patients had not had annual lung function tests, neither at their regular GP's nor in the specialist health service, despite the fact that national guidelines state that spirometry should be done at least once a year.

Ventilation support, i.e. breathing support using positive-pressure ventilation delivered via a mask,

is an effective treatment for severe COPD exacerbations. The findings show unwarranted variation in the proportion of emergency admissions for COPD where ventilation support was provided. Some of this variation may be due to differences in the availability of equipment and qualified personnel.

Pulmonary rehabilitation is one of the few measures for COPD that improve quality of life and reduce the need for hospital admissions without any undesirable side effects. The findings suggest that there is unwarranted variation in the provision and use of pulmonary rehabilitation for COPD.

Some COPD exacerbations are preventable. There were significantly fewer emergency admissions for COPD in winter 2013/2014 than in the preceding and following years. Influenza activity was low in Norway that winter, and there were few notifications of flu outbreaks in health institutions and nursing homes. More focus on influenza vaccination of persons with COPD could be a useful preventive measure against COPD exacerbations that result in hospitalisation.

Chapter 2

Introduction

2.1 Chronic obstructive pulmonary disease

Chronic obstructive pulmonary disease (COPD) is a very common condition both in Norway and in the rest of the world (Corlateanu et al. 2016; Brown and Martinez 2016; Tockman et al. 1987). Based on estimates from population studies, it is reasonable to assume that at least eight per cent of the around 2,500,000 people living in Norway who are 40 years or older have COPD (Vollmer et al. 2009; Hvidsten et al. 2010; Waatevik et al. 2013; Leivseth 2013). That corresponds to at least 200,000 people. There are no official figures for how many people suffer from COPD in different geographical areas in Norway. We do have good figures for the incidence of lung cancer, however. By incidence is meant the number of new cases of lung cancer in a given population within a defined period of time. Geographical variation in the incidence of lung cancer can be used as an indirect measure of the geographical variation in the prevalence of COPD, since both conditions are strongly related to smoking. Figure A.1 in Appendix A (page 72) shows the number of new lung cancer cases per 10,000 population broken down by the different health trusts' hospital referral areas.

COPD is associated with a high level of morbidity with significant functional impairment and a high mortality rate (Soriano et al. 2017). Lung function measurements using a spirometer are necessary in order to diagnose and assess morbidity in connection with COPD (GOLD 2017). The main symptom is shortness of breath. In mild cases, breathlessness is often only a problem in connection with physical activity. Patients with severe COPD can experience shortness of breath even at rest. Many persons with COPD also have a chronic cough with or without mucus. The disease can lead to secondary problems, such as anxiety, depression, nutritional problems, weight loss, muscle wasting and fatigue (GOLD 2017; Corlateanu et al. 2016). The main cause of COPD is exposure to harmful gases and particles, particularly in the form of cigarette smoke. Few people under the age of 40 develop COPD. In 2015, COPD was the world's third most frequent single cause of death (Wang et al. 2016).

People who experience respiratory symptoms usually contact their regular GP, unless the symptoms are acute and serious. The GP can refer them to the specialist health service if necessary. The main purpose of the specialist health service's outpatient services is to assess people with suspected COPD and optimise treatment. These services can also be provided by specialists in private practice under a contract with a regional health authority.

Episodes of increased respiratory problems, known as COPD flare-ups or exacerbations, are another characteristic of COPD. Symptoms of COPD exacerbations include increasing shortness of breath, coughing and increased mucus production. A COPD exacerbation requires intervention,

and exacerbations are often categorised on the basis of the intensity of the measures required (Norwegian Directorate of Health 2012). Most patients with COPD exacerbations can be treated by their regular GP or the emergency primary healthcare services (Husebø et al. 2014). Sometimes, and particularly in people with very poor lung function or comorbidity, COPD exacerbations are so serious that they require hospital treatment (Melbye et al. 2012). Supplementary oxygen may be required, and some patients also need non-invasive ventilation (NIV), where breathing support is provided via a facial mask (GOLD 2017).

The specialist health service is also responsible for offering rehabilitation to persons with COPD. The main purpose of rehabilitation is to prevent further deterioration and improve the patient's health (Spruit et al. 2013). The term 'pulmonary rehabilitation' should be reserved for programmes that, as a minimum, include exercise, patient education and help to stop smoking, nutritional advice and psychosocial support (Norwegian Directorate of Health 2012). Such services should be provided by an interdisciplinary team that comprises at least a doctor, a nurse and a physiotherapist. Sufficient expertise and resources will normally only be available in the specialist health service. Pulmonary rehabilitation is provided at some hospitals and private rehabilitation institutions. It is an advantage if municipalities and city districts offer more basic rehabilitation services consisting of exercise and patient education. It is a political goal that a greater proportion of the rehabilitation services offered to persons with COPD should be provided by the municipalities.[1].

Among other things, Appendix B provides a thorough description of the symptoms, prevalence and mortality associated with COPD, as well as of the treatments available for COPD in the primary healthcare and specialist health services.

Norway has a National Register for Patients with Chronic Obstructive Pulmonary Disease (the COPD Register)[2]. Unfortunately, the Norwegian health trusts have not reported sufficient data for the COPD Register to be used as a basis for the analyses in the COPD Healthcare Atlas. The COPD Register is described in more detail in Appendix C.

2.2 Why a COPD Healthcare Atlas?

It is an overriding goal in Norway's health policy that the whole population should have equitable access to health services regardless of where they live (cf. the Specialist Health Service Act,[3] the Patients' and Users' Rights Act,[4] and the Health and Care Services Act[5]). The regional health authorities have a responsibility to provide satisfactory specialist health services to the population in their catchment area (cf. the Specialist Health Service Act Section 2-1a and Section 2-2). This responsibility forms the basis for the analyses of variation in the use of health services in the healthcare atlases. A high level of unexplained or unwarranted variation could indicate that this responsibility to provide is not sufficiently addressed. A more thorough introduction to variation in the use of health services can be found in the Healthcare Atlas for the Elderly in Norway (Balteskard et al. 2017) and in the report Indikatorer for måling av uberettiget variasjon.[6] Previous healthcare atlases have found significant, and in some cases unwarranted, variation in the use of health services.[7].

[1] Escalation plan for habilitation and rehabilitation: Opptrappingsplan for habilitering og rehabilitering (2017–2019)

[2] The National Register for Patients with Chronic Obstructive Pulmonary Disease: https://www.kvalitetsregistre.no/registers/nasjonalt-register-kols

[3] The Specialist Health Service Act: https://www.lovdata.no/dokument/NL/lov/1999-07-02-61

[4] The Patients' and Users' Rights Act: https://www.lovdata.no/dokument/NL/lov/1999-07-02-63

[5] The Health and Care Services Act: https://www.lovdata.no/dokument/NL/lov/2011-06-24-30

[6] Report: Indikatorer for måling av uberettiget variasjon ('Indicators for measuring unwarranted variation' – In Norwegian only)

[7] Helseatlas: www.helseatlas.no

The COPD Healthcare Atlas is the first diagnosis-specific healthcare atlas. The fact that COPD is a chronic condition that little can be done to cure or reverse, in addition to the fact that it is often regarded as self-inflicted through tobacco smoking, means that some people consider COPD to be a low-status disease (Grue et al. 2015). The COPD Healthcare Atlas studies in depth the different health services for persons with COPD – regular GPs and emergency primary healthcare, outpatient services, emergency admissions and rehabilitation. We also try to see the use of these health services in the context of the expected prevalence of COPD in the population.

The healthcare atlases are intended as tools for the management and planning of health service provision for the population. In order to be able to provide satisfactory health services, we should know how many people need these services. Based on population studies, it is assumed that at least 200,000 people in Norway suffer from COPD, although there is considerable uncertainty associated with this estimate. The COPD Healthcare Atlas provides figures for how many persons with COPD used different health services during the period 2013–2015. COPD required the use of significant resources both in primary healthcare services and in the specialist health service.

Chapter 3

Method

3.1 Data sources

Here, we provide a brief description of the data sources used in the COPD Healthcare Atlas. A detailed description can be found in Appendix D.

3.1.1 The Norwegian Patient Registry

The description of the use of specialist health services is based on data from the Norwegian Patient Registry (NPR). NPR has disclosed indirectly identifiable personal health data for the years 2013–2015 to SKDE pursuant to the Personal Health Data Filing System Act Section 20 under a licence from the Norwegian Data Protection Authority. The COPD Healthcare Atlas uses data from public hospitals, private rehabilitation institutions and specialists in private practice under public funding contracts. Where relevant, a date of death from the Central Population Register is linked to the activity data. The main analyses include data from the period 2013–2015, while the time trend analyses also include data from 2012. The authors have sole responsibility for the interpretation and presentation of the disclosed data. NPR has no responsibility for analyses or interpretations.

3.1.2 Control and payment of reimbursements to health service providers

The description of the use of regular GP and emergency primary healthcare services is based on data from the settlement system for control and payment of reimbursements to health service providers (KUHR). SKDE has aggregate figures for the number of patients and contacts with RGPs and emergency primary healthcare services for persons aged 40 years and older. These data were disclosed by the Norwegian Labour and Welfare Administration (NAV). The main analyses include data from the period 2013–2015, while the time trend analyses also include data from 2012.

3.1.3 Statistics Norway

SKDE has retrieved population figures for Norwegian municipalities (Table 07459) and city districts (Table 10826) from Statistics Norway's StatBank. In the analyses, the population figures are used as the denominator for the number of persons or events per 10,000 population, and for gender and age standardisation.

3.2 Hospital referral areas

The regional health authorities have a responsibility to provide satisfactory specialist health services to the population in their catchment area (cf. the Specialist Health Service Act Section 2-1a and Section 2-2[1]). In practice, it is the individual health trusts and private providers under a contract with a regional health authority that provide and perform the health services. Each health trust has a hospital referral area that includes specific municipalities and city districts. Different disciplines can have different hospital referral areas, and for some services, functions are divided between different health trusts and/or private providers. The COPD Healthcare Atlas takes the hospital referral areas for emergency care as the point of departure for its analyses.

Table 3.1 shows the health trusts or hospitals for which hospital referral areas have been defined and the short versions of the names used in the COPD Healthcare Atlas. Table F.1 (page 87) in Appendix F shows a complete list of the municipalities and city districts that fall under the different hospital referral areas. With some exceptions,[2] the hospital referral areas are defined in the same way as in the annual SAMDATA reports (Rønningen et al. 2016).

Table 3.1: Hospital referral areas and short names used in the text and figures

Hospital referral area for:	Short name in text	Short name in figures
Northern Norway RHA		
Finnmark Hospital Trust	Finnmark Hospital	Finnmark
University Hospital of Northern Norway Trust	UNN	UNN
Nordland Hospital Trust	Nordland Hospital	Nordland
Helgeland Hospital Trust	Helgeland Hospital	Helgeland
Central Norway RHA		
Helse Nord-Trøndelag health trust	Helse Nord-Trøndelag	Nord-Trøndelag
St. Olavs Hospital Trust	St. Olavs hospital	St. Olavs
Helse Møre og Romsdal health trust	Helse Møre og Romsdal	Møre og Romsdal
Western Norway RHA		
Haraldsplass Diaconal Hospital	Haraldsplass	Haraldsplass
Helse Førde health trust	Helse Førde	Førde
Helse Bergen health trust	Helse Bergen	Bergen
Helse Fonna health trust	Helse Fonna	Fonna
Helse Stavanger health trust	Helse Stavanger	Stavanger
South-Eastern Norway RHA		
Østfold Hospital Trust	Østfold Hospital	Østfold
Akershus University Hospital Trust	Akershus University	Akershus
Oslo University Hospital Trust	Hospital OUS	OUS
Lovisenberg Diaconal Hospital	Lovisenberg	Lovisenberg
Diakonhjemmet Hospital	Diakonhjemmet	Diakonhjemmet
Innlandet Hospital Trust	Innlandet Hospital	Innlandet
Vestre Viken Hospital Trust	Vestre Viken	Vestre Viken
Vestforld Hospital Trust	Vestfold Hospital	Vestfold
Telemark Hospital Trust	Telemark Hospital	Telemark
Sørlandet Hospital Trust	Sørlandet Hospital	Sørlandet

[1] The Specialist Health Service Act: https://www.lovdata.no/dokument/NL/lov/1999-07-02-61

[2] The COPD Healthcare Atlas defines separate hospital referral areas for Helse Bergen health trust and Haraldsplass Diaconal Hospital. Unknown city districts in Oslo are allocated to Oslo University Hospital's referral area. Unknown city districts in Bergen are allocated to Helse Bergen health trust's hospital referral area.

3.3 Population

The COPD Healthcare Atlas presents the use of health services for persons with COPD aged 40 years or older. The analyses are based on the health trusts' hospital referral areas and where the patients live.

In the period 2013–2015, there were, on average, about 2.52 million people aged 40 years or older in Norway. Women made up 51% of this group, and the average age was 59.0 years. The size of the hospital referral areas varied considerably, with as many as 242,000 inhabitants in this age group in Vestre Viken hospital referral area and only 38,000 in Finnmark Hospital's referral area (Figure 3.1). The proportion of women varied from 52% in the hospital referral areas of Vestfold Hospital and Diakonhjemmet to 47% in Lovisenberg Hospital's referral area. The average age varied from 60.4 years in Helse Førde hospital referral area to 55.1 years in the Lovisenberg area.

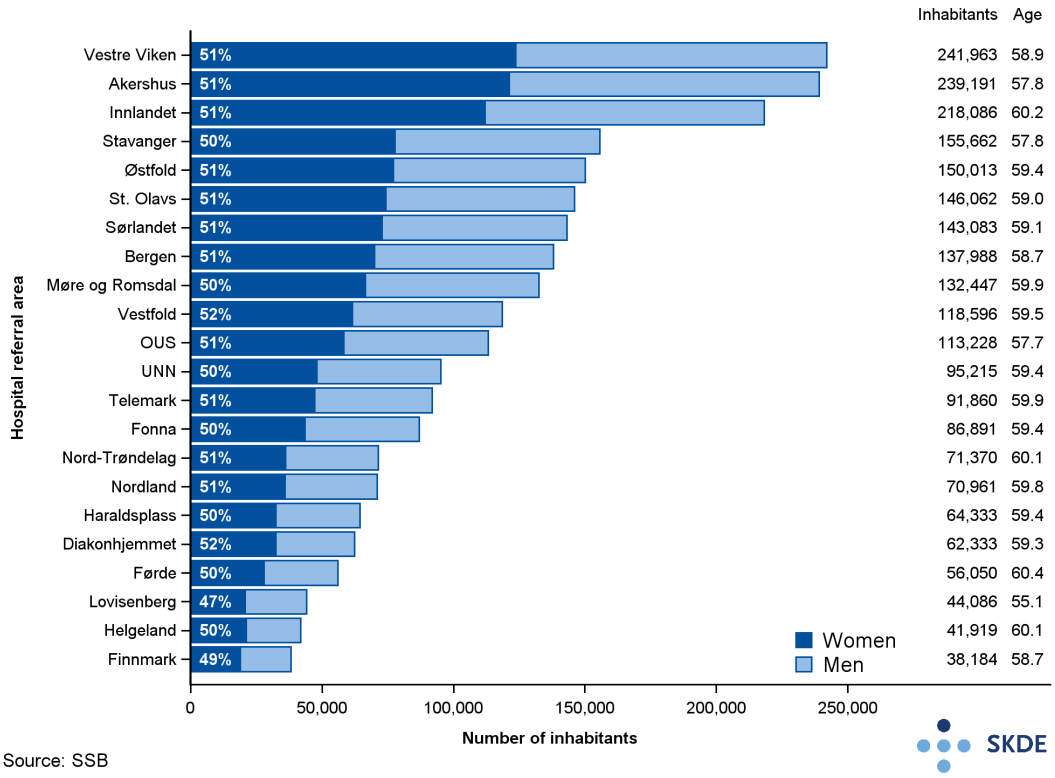


Figure 3.1: Gender distribution, average age and population aged 40 years or older in the different health trusts' hospital referral areas. Average for the years 2013–2015.

3.4 Gender and age standardisation

In order to compare the number of events in different hospital referral areas, the actual numbers have been standardised by age and gender. The standardisation was based on the direct method using the Norwegian population aged 40 years or older in 2014 as the reference population.[3] The analyses show the number of events per 10,000 population that the hospital referral areas would have had

[3]The age groups are defined in such a way that there are about the same number of events in each age group. The division into gender and age groups will therefore vary between different samples.

if the population composition had been the same all over Norway, given the actual distribution of events in each gender and age group in the hospital referral areas.

The standardised number of events per 10,000 population in hospital referral area j is calculated as follows:

$$10,000 \times \sum_{i=1}^{K} \frac{n_{ij}}{N_{ij}} \times a_i \tag{3.1}$$

with n_{ij} er being the actual number of events in hospital referral area j and gender and age group i, N_{ij} being the population of hospital referral area j and gender and age group i, a_i being the national proportion that gender and age group i makes up of the Norwegian population, j being the number of hospital referral areas and K being the number of gender and age groups.

Proportions standardised by gender and age are presented in some analyses. In these cases, gender- and age-standardised numbers per 10,000 population are used in both the numerator and denominator. For example: the proportion for spirometry carried out by regular GPs (see Figure 4.6) is calculated as the number of persons whose regular GP has conducted a spirometry examination of them (standardised by gender and age per 10,000 population) divided by the number of persons with COPD seen by regular GPs or emergency primary healthcare services (standardised by gender and age per 10,000 population).

3.5 Correlation analyses

Spearman's rank correlation coefficient (rho) is used as a rough measure of the correlation between the incidence of lung cancer and the use of health services for COPD, and between outpatient contacts and emergency admissions for COPD. No correlation gives rho=0, perfect positive correlation gives rho=1, and perfect negative correlation gives rho=-1. A correlation of 0.5 or more is considered strong.

3.6 Assessment of variation

A more through introduction to variation in the use of health services can be found in the Healthcare Atlas for the Elderly in Norway (Balteskard et al. 2017) and in the report *Indikatorer for måling av uberettiget variasjon*[4].

There is no single measurement that can tell us whether observed variation is large or small, or warranted or unwarranted. The ratio between the extremes is often used as an indication of whether the observed variation is large or small. If there is twice as much of something in one hospital referral area as in another, that will often be described as large or substantial variation. At the same time, the number of events must be taken into consideration. Small numbers mean a big element of random variation.

The assessment of whether the variation observed is warranted or unwarranted is based on what it would be reasonable to expect if all the observed variation is warranted. For example, it is reasonable to expect the number of persons admitted as emergencies for COPD per 10,000 population to

[4]Report: Indikatorer for måling av uberettiget variasjon ('Indicators for measuring unwarranted variation' – In Norwegian only)

reflect the prevalence of COPD in a hospital referral area. We thus do not expect the same number of persons per 10,000 population to be admitted as emergencies for COPD in all the hospital referral areas, since we know that the prevalence of COPD varies between geographical areas in Norway. It is also reasonable to expect the proportion of emergency admissions for COPD where the patient has received ventilation support to be the same in all hospital referral areas if persons with COPD receive equitable services regardless of where they live. When the observed variation does not tally with these expectations and the element of random variation is not too large, we can assume that some of the observed variation is unwarranted. The term *unwarranted variation* designates the part of the observed variation that is not caused by coincidence, patient preferences or differences in the underlying prevalence of the disease. The overall assessment includes elements of common sense and discretionary judgement.

Chapter 4

RGP and emergency primary healthcare services

COPD is a disease that develops over the course of many years. Some people see their regular GP for chronic airway complaints at an early stage of the disease, while others have their first contact in connection with a respiratory tract infection. Persons with COPD are at increased risk of lower respiratory tract infections with coughing, mucus and fever. When neither the patient nor the doctor knows that the patient has COPD, the disease will often be diagnosed as acute bronchitis. Some people with undiagnosed COPD will avoid seeing a doctor because they assume that their problems are linked to a smoking habit that they are not ready to change.

A spirometer, which is a device used to measure lung function, is need to diagnose COPD (Norwegian Directorate of Health 2012). All GP surgeries and emergency primary healthcare facilities should have access to a spirometer and have personnel capable of administering the test and interpreting the results.

Once someone has been diagnosed with COPD, the patient will normally be prescribed medication to relieve their breathing difficulties. Smokers will be advised to stop smoking, and some will be prescribed medication to help them to do so. There is no tradition of regular check-ups, as is the case for patients with diabetes or hypertension, despite the fact that this is recommended in the national guidelines (Norwegian Directorate of Health 2012). Persons with COPD will therefore normally contact their regular GP or the emergency primary healthcare services in connection with lower respiratory tract infections or COPD exacerbations.

It is important to start treatment with antibiotics and/or corticosteroids early in order to limit the severity of exacerbations (Norwegian Directorate of Health 2012). Patients with COPD exacerbations should therefore be given a doctor's appointment right away. Most COPD exacerbations will abate without hospitalisation. Correct treatment initiated at an early stage and followed up by the patient's regular GP can prevent hospitalisation even for severe exacerbations. The quality of the cooperation between the patients and their regular GPs or emergency primary healthcare services probably has a bearing on the frequency of admission in connection with exacerbations.

Some people who experience frequent exacerbations are given a supply of antibiotics and corticosteroids to keep at home so that they can start the treatment themselves. However, their GP must also make sure that patients are not given unnecessary courses of antibiotics and corticosteroids. The reason for this is the risk of antibiotic resistance and the serious potential side effects of corticosteroids.

Persons with COPD often have other chronic diseases, such as hypertension and diabetes. If these

patients see their GP for other problems, their COPD will often be deprioritised (Sandelowsky et al. 2016). A standard consultation is often too short.

When further assessment or treatment is required, regular GPs should refer the patient to the specialist health service (Norwegian Directorate of Health 2012). GPs should also be aware of the rehabilitation services for persons with COPD offered at the municipal level and by the specialist health service, and they should know when to refer patients for rehabilitation.

Some GPs will prefer to follow up their own patients with COPD until their disease has become very severe, while others will refer them to the specialist health service for more moderate COPD. Some variation in the frequency of contact between regular GPs and the COPD patients on their list is therefore to be expected. For the same reason, it is also not unlikely that there will be geographical variation in the frequency of consultations and referrals.

4.1 Sample and definitions

Data source: Data from the KUHR database for the period 2012–2015.

Sample: Persons aged 40 years or older who have at least one regular GP (RGP) or emergency primary healthcare consultation registered with the International classification of primary care second edition (ICPC-2) code R95 *Chronic obstructive pulmonary disease*. Consultations for which at least one of the following tariff codes were registered are included:

- 2ad *GP consultation (daytime)*
- 2ae *E-consultation with an RGP*
- 2ak *GP consultation (evening)*
- 2fk *Consultation and supplement for call-out to surgery for emergency care while on out-of-hours emergency primary healthcare duty when a means of transport was used, for first patient*
- 11ad *Home visit by GP (daytime)*
- 11ak *Home visit by GP (evening)*

Person with COPD: A person registered with at least one RGP or emergency primary healthcare consultation for COPD during the course of one year. On average, two persons and eight consultations per year were registered with unknown municipality of residence. These data were excluded from further analyses.

Spirometry: Spirometry is defined by the tariff codes 507c *Dynamic spirometry (flow-volume-curve)* and 507d *Repeat examination following bronchiolytic medication*.

4.2 Findings

4.2.1 Use of RGP and emergency primary healthcare services

On average, 24,534 women (2.0% of the female population) and 24,553 men (1.9% of the male population) aged 40 years or older were registered with the diagnosis COPD by RGPs or emergency primary healthcare services each year (Figure 4.1 and Figure 4.2). Two-thirds of them were aged

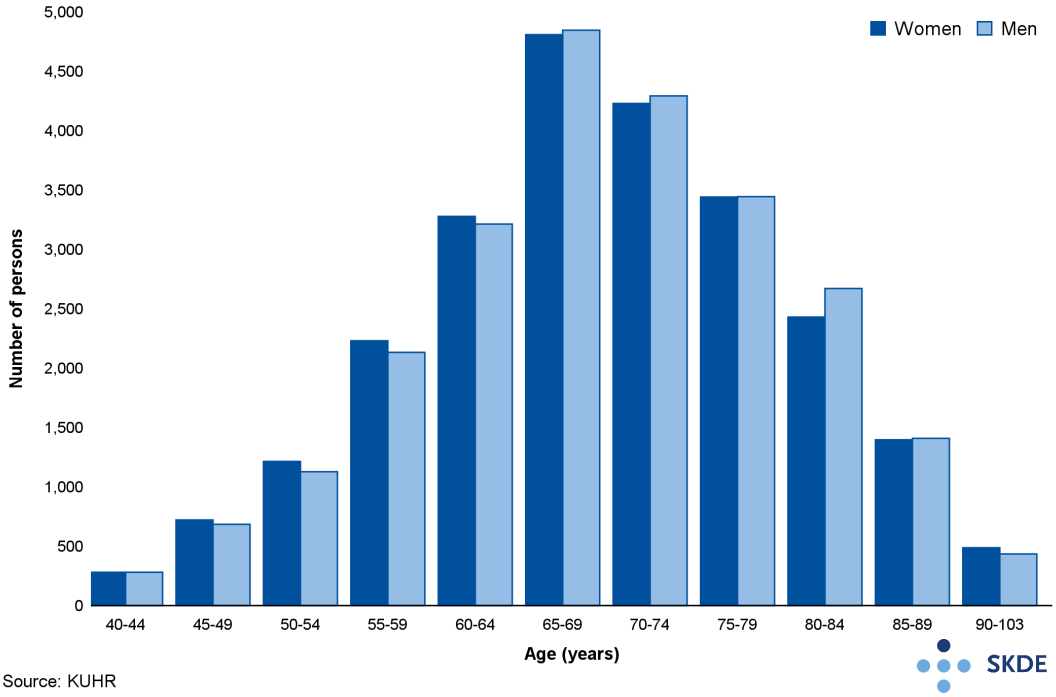


Figure 4.1: Number of persons with COPD seen by RGPs or emergency primary healthcare services. Average per year for the period 2013–2015.

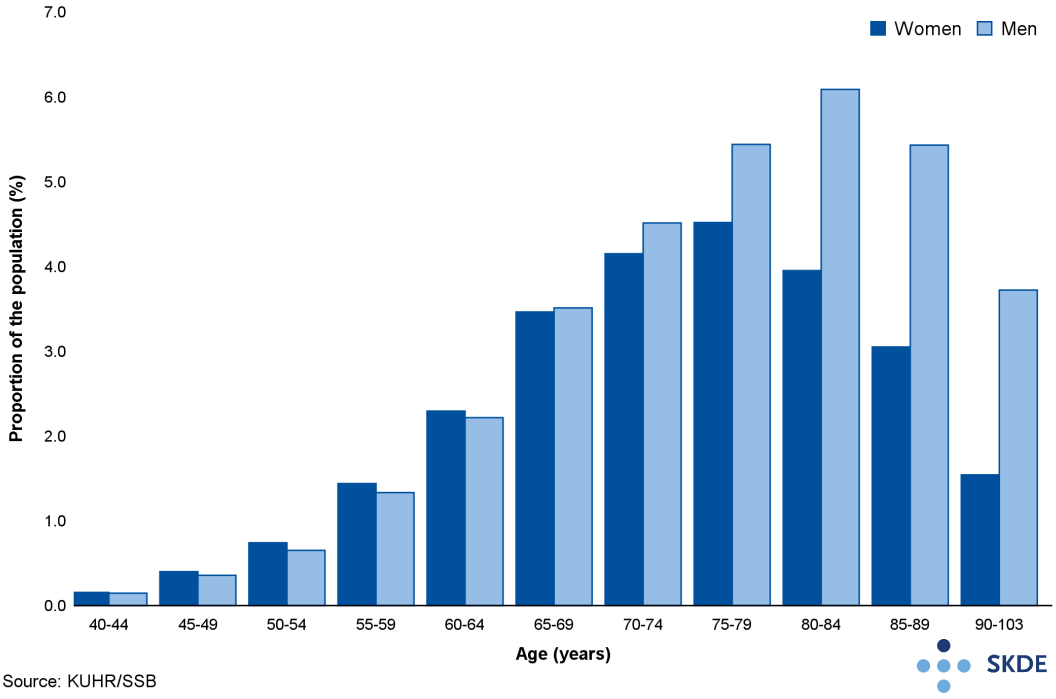


Figure 4.2: Persons with COPD seen by RGPs or emergency primary healthcare services as a percentage of the population. Average per year for the period 2013–2015.

60 years or older. About 3.6% of all women and 5.5% of all men aged 75 years or older were registered with the diagnosis COPD by their RGP or the emergency primary healthcare services.

Table 4.1 shows unadjusted figures per year for persons registered with the diagnosis COPD by RGPs or the emergency primary healthcare services during the period 2013-2015. Of the 49,087 persons who were registered with COPD by RGPs or the emergency primary healthcare services, 42,087 (85.7%) were registered with COPD only by their RGP, 2,333 (4.8%) only by the emergency primary healthcare services, and 4,667 (9.5%) both by their RGP and by the emergency primary healthcare services.

Table 4.1: Persons with COPD seen by RGPs or emergency primary healthcare services.

	2013	2014	2015	Average
RGP or emergency primary healthcare services				
Persons, n	46,764	48,426	52,071	49,087
Percentage of the population	1.9	1.9	2.0	1.9
Consultations for COPD, n	126,713	131,830	142,889	133,811
Consultations independent of diagnosis, n	377,053	388,552	412,062	392,556
Persons who underwent spirometry at RGP's, %	36.6	37.4	36.6	36.9
Persons who underwent spirometry at emerg., %	0.6	0.6	0.6	0.6
RGP				
Persons, n	44,391	46,170	49,701	46,754
Consultations for COPD, n	115,585	120,969	131,338	122,631
Consultations independent of diagnosis, n	341,220	352,177	373,725	355,707
Emergency primary healthcare				
Persons, n	6,992	6,770	7,237	7,000
Consultations for COPD, n	11,128	10,861	11,551	11,180
Consultations independent of diagnosis, n	35,833	36,375	38,337	36,848

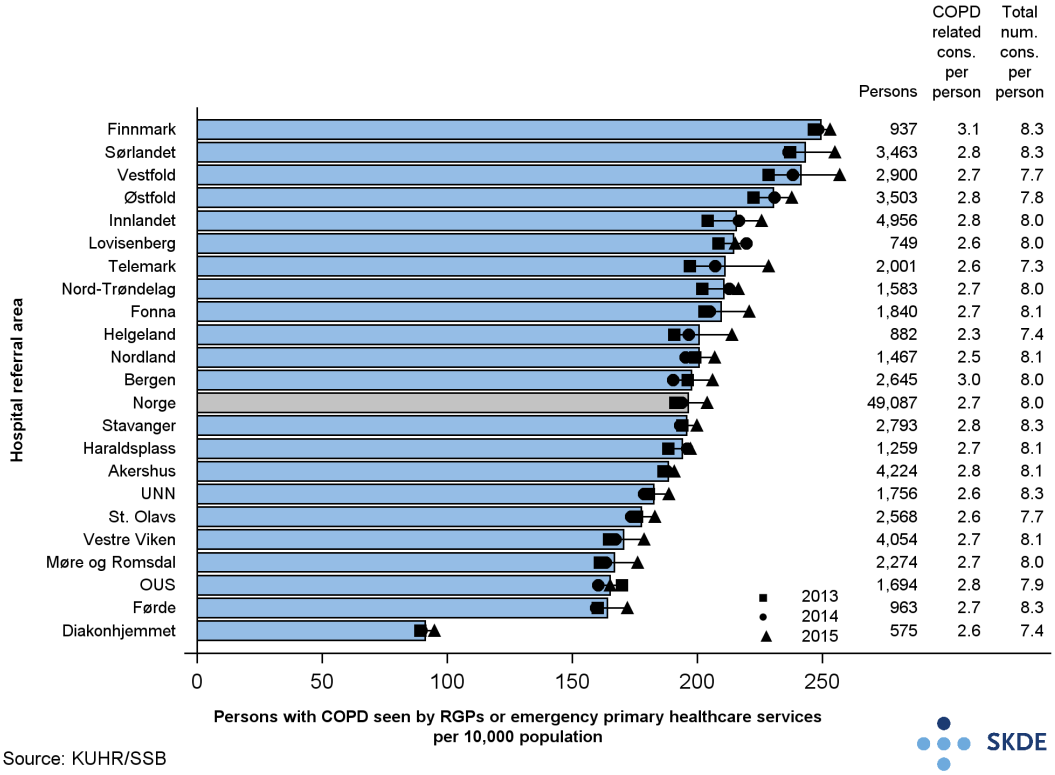


Figure 4.3: Number of persons with COPD seen by RGPs or emergency primary healthcare services. The bars show the figures standardised by gender and age per 10,000 population. Average per year for the period 2013–2015.

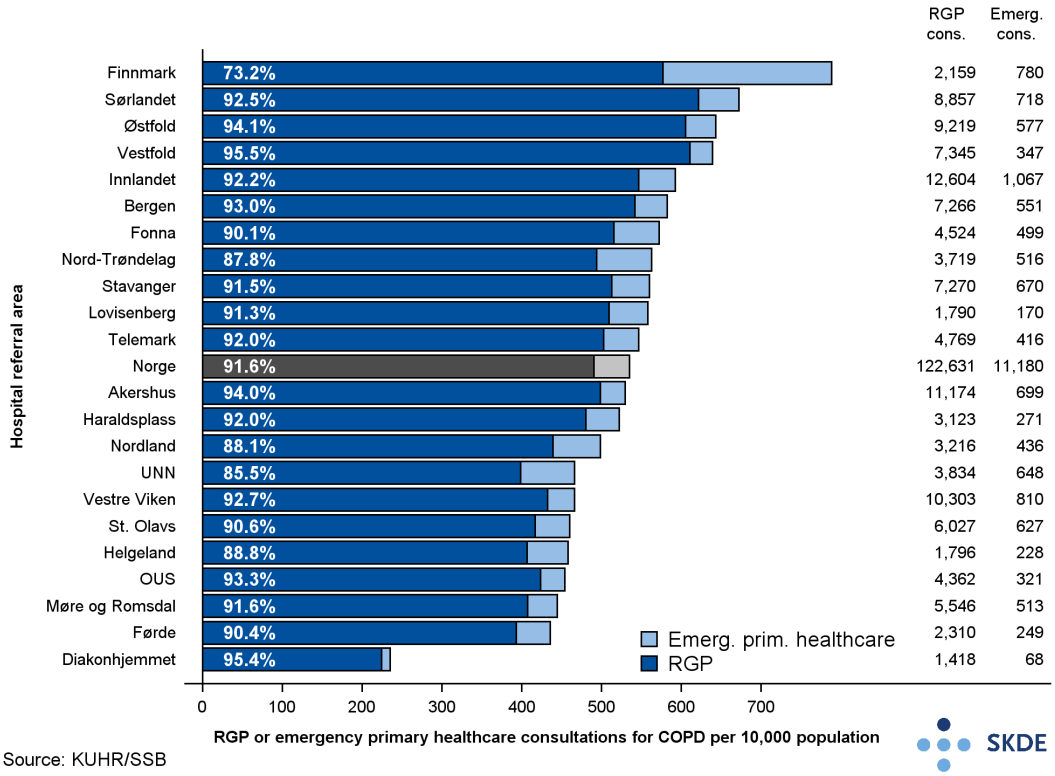


Figure 4.4: Number of RGP or emergency primary healthcare consultations for COPD. The bars show the figures standardised by gender and age per 10,000 population. Average per year for the period 2013–2015.

On average, 196 persons per 10,000 population in Norway were registered with the diagnosis COPD at least once in the course of a year during the period 2013-2015. Each year, these persons had 2.7 COPD-related consultations and a total of 8.0 consultations independent of diagnosis (Figure 4.3). The number of persons with COPD varied from 91 per 10,000 population in Diakonhjemmet's hospital referral area to 249 per 10,000 population in Finnmark Hospital's referral area. The number of consultations per person related to the COPD diagnosis varied from 2.3 in Helgeland Hospital's referral area to 3.1 in Finnmark Hospital's referral area. The total number of consultations per person for this group of patients varied from 7.3 in Telemark Hospital's referral area to 8.3 in the hospital referral areas of Finnmark Hospital, Sørlandet Hospital, Helse Stavanger, UNN and Helse Førde.

During the period 2013-2015, there were an average of 535 consultations each year for COPD per 10,000 population in Norway, of which 490 were RGP consultations and 45 emergency primary healthcare consultations (Figure 4.4). The number of consultations varied from 236 (225 RGP and 11 emergency primary healthcare consultations) per 10,000 population in Diakonhjemmet's hospital referral area to 788 (577 RGP and 211 emergency primary healthcare consultations) per 10,000 population in Finnmark Hospital's referral area. RGP consultations accounted for 91.6% of all COPD-related RGP and emergency primary healthcare consultations. The proportion varied from 73.2% in Finnmark Hospital's referral area to 95.5% in Vestfold Hospital's referral area.

Figure 4.5 shows the number of persons with COPD per 10,000 population seen by their regular GPs or emergency primary healthcare services during the period 2012–2015 for each hospital referral area. The dotted line shows the average for Norway. Generally speaking, there was little variation between years within each hospital referral area, although some areas showed a slightly increasing trend.

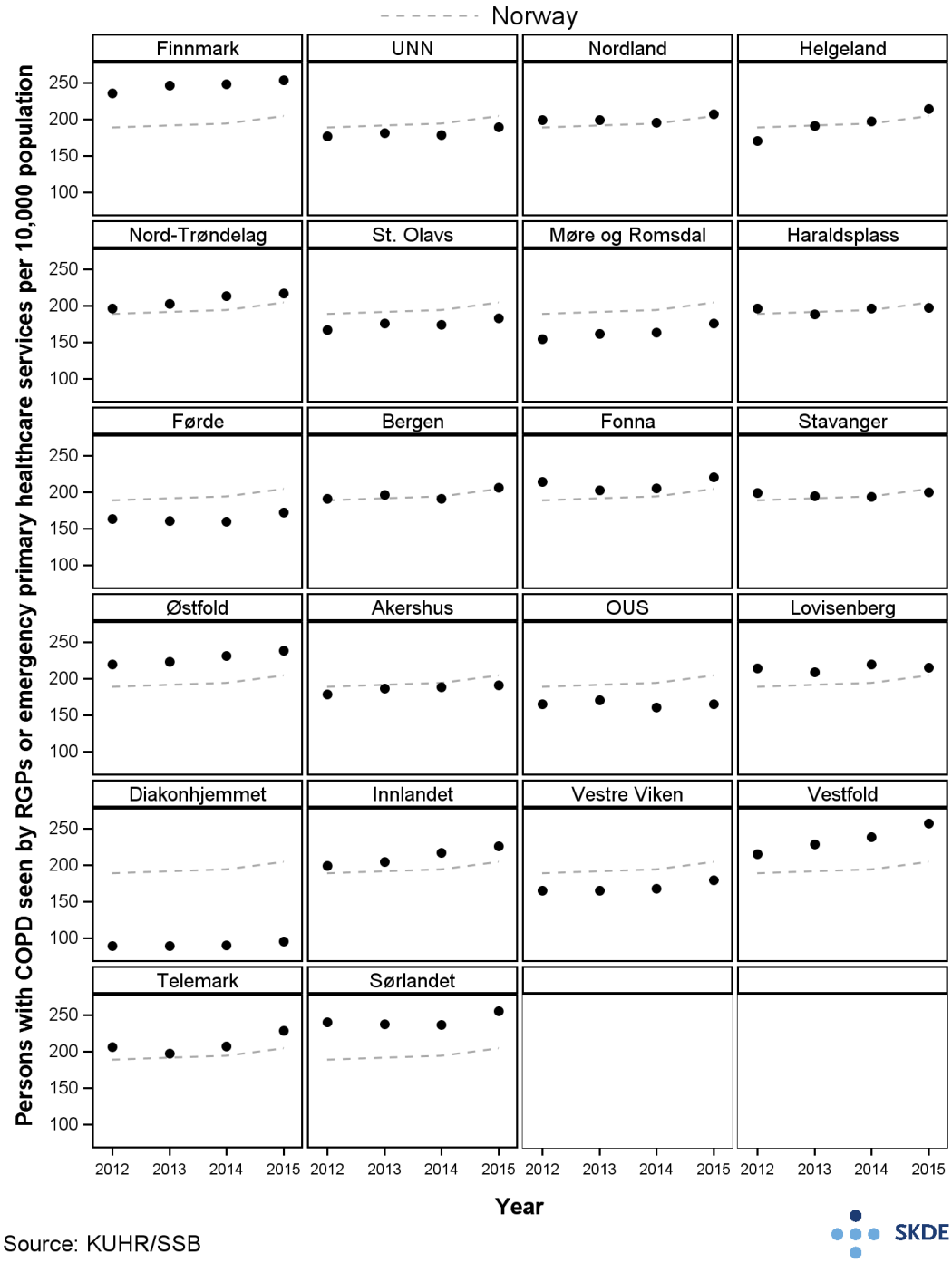


Figure 4.5: Persons with COPD seen by RGPs or emergency primary healthcare services per year during the period 2012-2015. The numbers are standardised by gender and age and per 10,000 population.

4.2.2 Spirometry

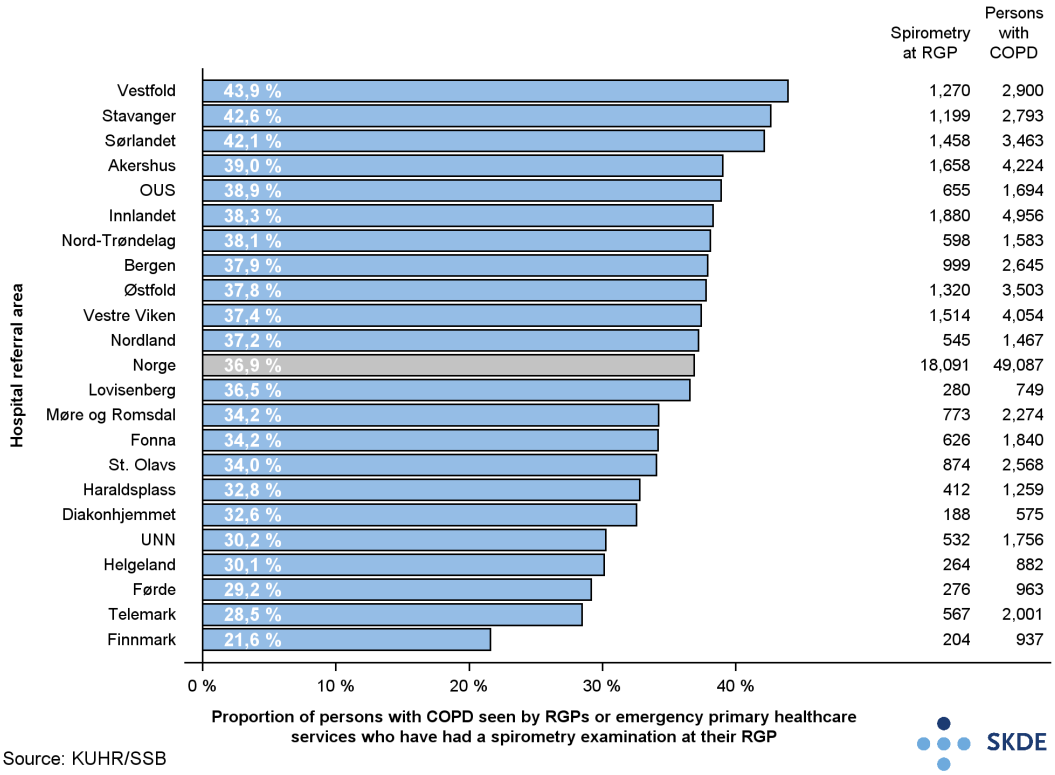


Figure 4.6: Proportion of persons with COPD seen by RGPs or emergency primary healthcare services who have had a spirometry examination at their RGP's during the year. The bars show proportions standardised by gender and age. The bars and columns show averages per year for the period 2013–2015.

Of 49,087 persons with COPD seen by RGPs or emergency primary healthcare services each year, 18,091 persons (36.9%) had at least one spirometry examination at their GP's (Figure 4.6). The proportion varied from 21.6% in Finnmark Hospital's referral area to 43.9% in Vestfold Hospital's referral area.

4.3 Comments on the findings

About 49,000 persons aged 40 years or older were registered with the diagnosis COPD by RGPs or emergency primary healthcare services each year (Table 4.1 and Figure 4.3).This number is consistent with estimates from a previous study that identified just under 63,000 adults with COPD in Norway in 2009 on the basis of data from the Norwegian Prescription Database (Halvorsen and Martinussen 2014). As expected, the figures from the COPD Healthcare Atlas are somewhat lower than the estimates from the above-mentioned study. Among the reasons for this are that the COPD Healthcare Atlas includes persons from the age of 40, and that not all persons with COPD need to see their regular GP or emergency primary healthcare services every year.

The differences between different geographical areas in Norway in the number of persons with COPD per 10,000 population and their RGP or emergency primary healthcare consultations (Figure 4.3 and Figure 4.4) could partly be due to differences in the prevalence of COPD. Finnmark has the highest proportion of smokers[1] and the highest incidence of lung cancer (Figure A.1, page 72).

[1] Statbank Table 07662: www.ssb.no/statistikkbanken

There is generally a strong correlation between the incidence of lung cancer and the number of persons with COPD seen by RGPs or emergency primary healthcare services per 100,000 population (Spearman's rho = 0.75). This could indicate that most of the observed variation is warranted.

Around 8% of the COPD-related consultations were emergency primary healthcare consultations. It is reasonable to assume that most of these consultations concerned COPD exacerbations. Residents of Finnmark Hospital's referral area used emergency primary healthcare services much more than residents of other hospital referral areas. This could be related to the way in which GP services are organised in Finnmark, since this is true for all use of emergency primary healthcare services and is not specific to COPD[2].

RGPs' use of spirometry varied significantly between hospital referral areas and was generally much lower than recommended in the national guidelines (Norwegian Directorate of Health 2012). In Vestfold Hospital's referral area, more than two out of every five COPD patients had had their lung function measured by their regular GP during the course of a year. The corresponding proportion for Finnmark Hospital's referral area was one in five. This variation may be partly due to financial incentives that could result in higher use of spirometry in private practices than in positions with a fixed salary. Fixed-salary positions are a common form of practice in rural municipalities.

While about 49,000 persons with COPD were seen by RGPs or emergency primary healthcare services, about 20,500 persons per year had outpatient contact for COPD with the specialist health service (Figure 5.3, page 32). Of the latter group, 84.2% had undergone an outpatient spirometry examination during the course of the year (Figure 5.6, page 35). It is possible that it was not necessary for the RGPs to carry out spirometry on all COPD patients because some of them have had outpatient spirometry examinations. However, we do not have personally identifiable data that would enable us to check who had spirometry examinations both as outpatients and at their regular GP's. If we assume that the persons who have had outpatient spirometry examinations are not the same persons who have had spirometry examinations at their GP's, we are still left with one third of the persons registered with COPD by RGPs or emergency primary healthcare services who have not had a spirometry examination in the course of a year (data not shown). There will still be unwarranted variation between hospital referral areas. It is in any case a challenge that so many persons with COPD do not have their lung function measured every year.

[2]Management data for the municipalities: https://helsedirektoratet.no/statistikk-og-analyse/styringsdata-for-kommunene

Chapter 5

Outpatient services

Regular GPs can provide sufficient follow-up for patients with mild and moderate COPD without complicating additional diagnoses. In some cases, patients will need to be assessed by a specialist in diseases of the lungs or internal medicine. Patients can be referred to the specialist health service when it is necessary to clarify their diagnosis, optimise treatment of serious illness or additional conditions, or in connection with starting pulmonary rehabilitation or long-term oxygen therapy.

Lung function examinations are often compulsory in connection with outpatient contacts, and it is an important task for outpatient clinics to consider alternative diagnoses. Patients who are seen at outpatient clinics are often in a stable phase of their disease. It is therefore reasonable to assume that COPD diagnoses made through outpatient contact with a specialist are more accurate that diagnoses made in connection with emergency admissions or by RGPs or emergency primary healthcare services.

5.1 Sample and definitions

Data source: Data from the Norwegian Patient Registry (NPR) on outpatient contacts and day patient treatments at public somatic hospitals and specialists in private practice under public funding contracts for the period 2012–2015. The following activities were excluded:

- Activity at rehabilitation departments and coping and learning centres
- Outpatient contacts with health personnel other than doctors and nurses
- Outpatient contacts for which at least one of the following medical procedure codes have been registered:
  - A0099 *Group-oriented patient education* (Norwegian special code)
  - OBAB00 *Physical exercise with guidance and instruction*
  - WPCK00 *Coping and learning activities relating to the condition in question*
  - ZWWA30 *Procedure targeting a group of patients*
  - ZWWA40 *Procedure targeting parents/next of kin*
- Outpatient contacts with the LHL clinics Glittre and Feiring (14 contacts per year on average).

Sample: Persons aged 40 years and older. COPD is defined by the ICD-10 codes J40.x-J44.x (bronchitis, emphysema and COPD) as the primary diagnosis or R06.0 (dyspnoea), J09.x-J11.x (influenza), J12.x-J18.x (pneumonias), J20.x (acute bronchitis), J22.x (lower respiratory infection), J46.x (acute severe asthma) or J96.x (respiratory failure) as the primary diagnosis when J40.x-J44.x is coded as a secondary diagnosis. Table G.1 in Appendix G (page 91) shows the number of contacts coded with the relevant ICD-10 codes. Information about the municipality of residence was missing for an average of 194 contacts per year, and they were analysed as if the patient were resident in the hospital referral area of the hospital or private practice under a public funding contract where the contact took place. Correspondingly, information about the patient's personal identity number was missing for 15 contacts at public hospitals and 505 contacts with specialists in private practice under a public funding contract, which made it impossible to track the patients in question between institutions and from one year to the next. Contacts where information about the patient's sex is missing (fewer than one contact per year) were excluded from the analyses.

Outpatient contacts: The term 'outpatient contact' covers both outpatient contacts and day patient treatment. An outpatient contact is a contact where the admission date and the discharge date are the same, and the patient must have been discharged alive.

Public and private treatment providers: Treatment at public hospitals, including Lovisenberg, Diakonhjemmet and Haraldsplass hospitals, is defined as 'public'. Treatment provided by specialists in private practice under public funding contracts is defined as 'private'.

Spirometry: A patient is assumed to have undergone spirometry when the following procedure codes have been registered: GDFC00 *Spirometry*, GDFC05 *Spirometry with inhalation of a fast-acting bronchodilator*, GDFC10 *Spirometry with inhalation of a slow-acting bronchodilator*, GDFC20 *Spirometry with oscillometry to measure peripheral airway resistance*, GDFC25 *Spirometry with pharmacological provocation*, or GDFC30 *Spirometry with physical exercise*. In the case of contacts with specialists in private practice under public funding contracts, patients are also assumed to have undergone a spirometry examination when the tariff codes 502a or 507c *Dynamic spirometry (flow-volume-curve)* have been registered.

5.2 Findings

5.2.1 Outpatient contacts

Each year, 9,907 women (0.77% of the female population) and 10,713 men (0.86% of the male population) aged 40 years or older had outpatient contact for COPD, and four out of five of them were 60 years or older (Figure 5.1 and Figure 5.2). About 1.3% of all women and 2.1% of all men aged 75 years or older had outpatient contact for COPD per year.

Table 5.1 shows unadjusted figures per year for persons who had outpatient contact for COPD during the period 2013-2015.

On average, 82 persons per 10,000 population in Norway had outpatient contact for COPD at least once in the course of one year in the period 2013-2015, and these persons each had 1.5 contacts for COPD per year (Figure 5.3). The number of persons who had outpatient contact for COPD varied from 58 per 10,000 population in Helse Nord-Trøndelag's hospital referral area to 133 per 10,000 population in Sørlandet Hospital's referral area. The number of outpatient contacts for COPD per person per year varied from 1.3 in the hospital referral areas of Helse Fonna, Nordland Hospital and Helse Førde to 1.7 in the hospital referral areas of Sørlandet Hospital, Lovisenberg, Akershus University Hospital and Vestre Viken.

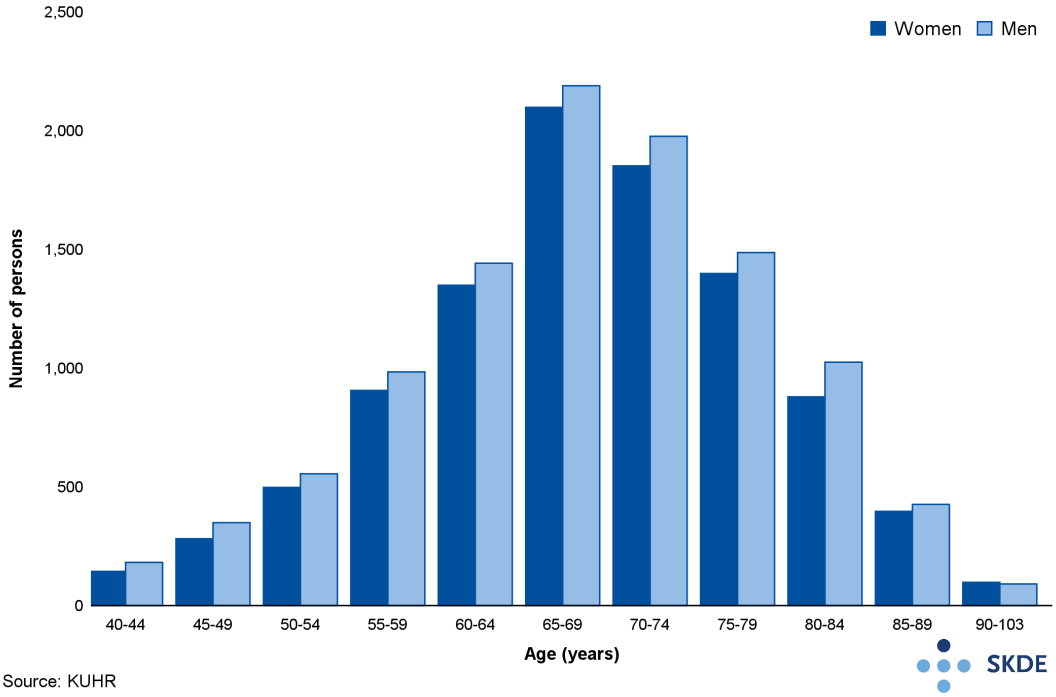


Figure 5.1: Number of persons who had outpatient contact for COPD with a hospital or a specialist in private practice under a public funding contract. Average per year for the period 2013–2015.

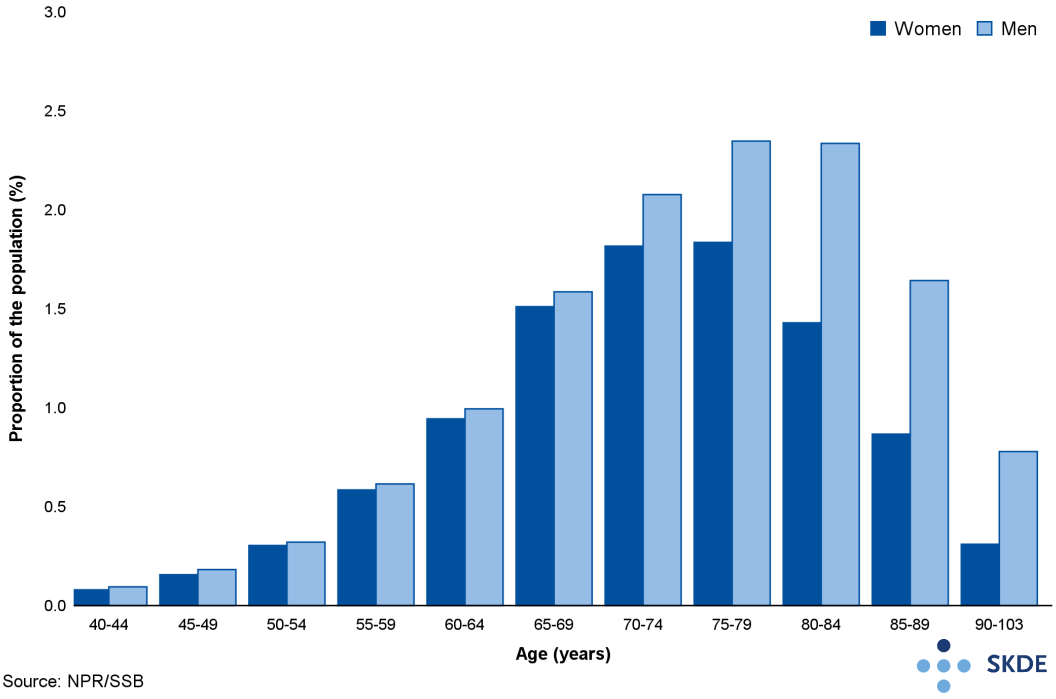
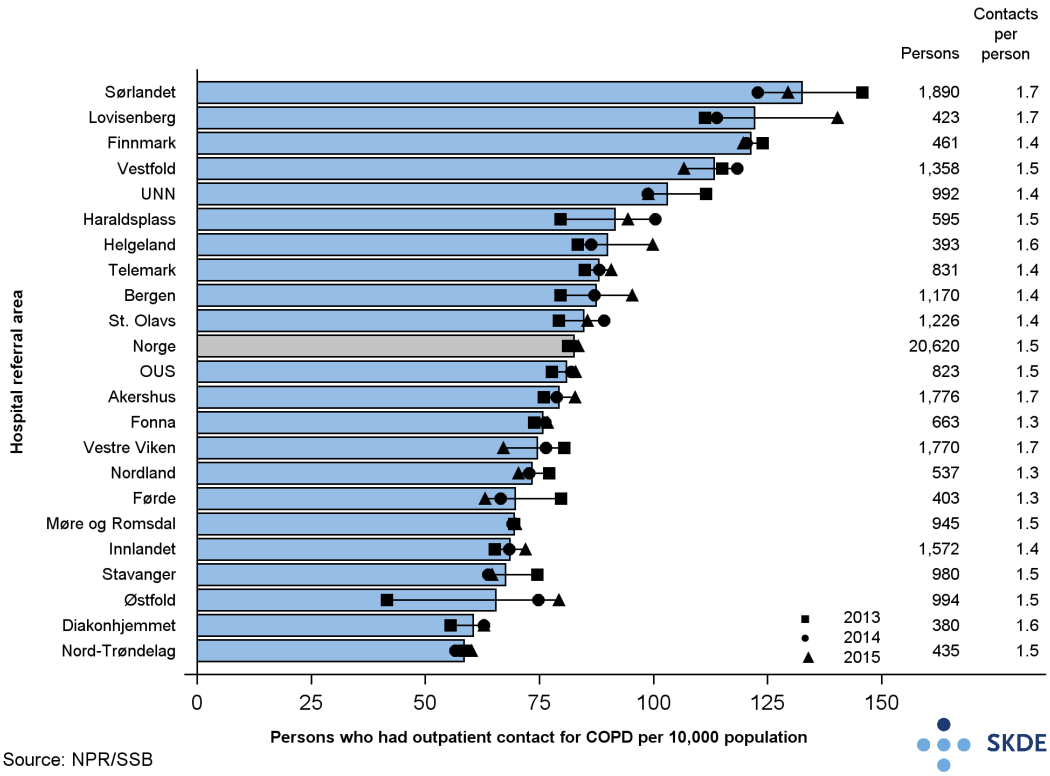
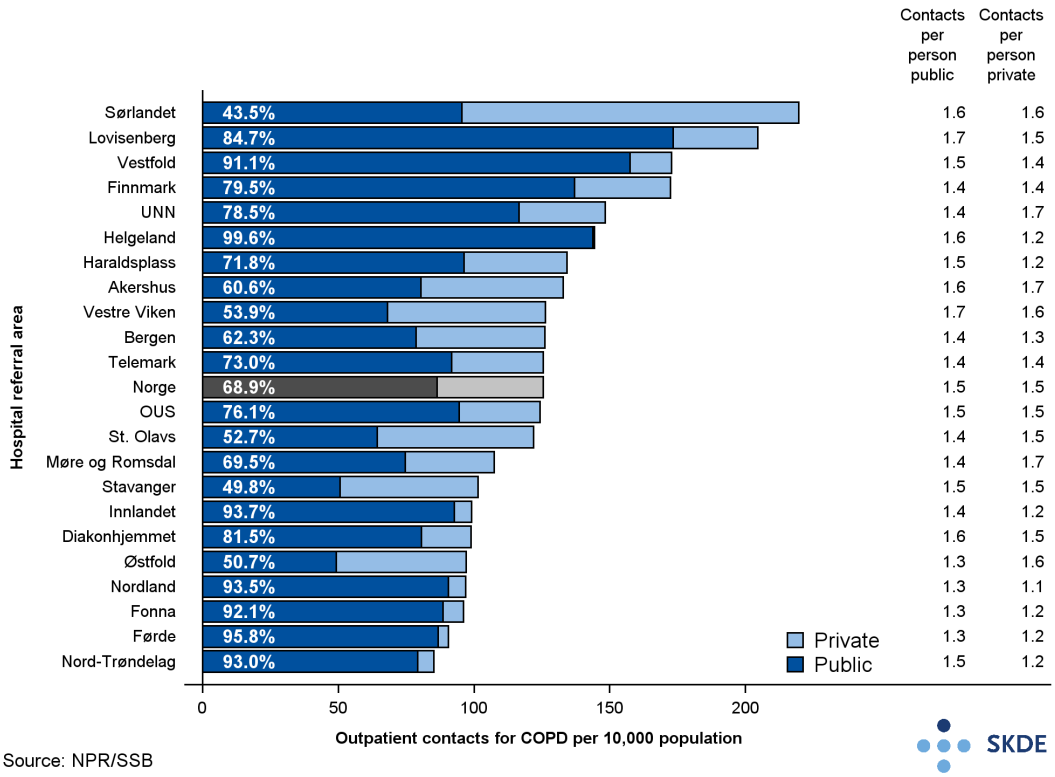


Figure 5.2: Persons who had outpatient contact for COPD with a hospital or a specialist in private practice under a public funding contract as a percentage of the population. Average per year for the period 2013–2015.



Source: NPR/SSB

Figure 5.3: Number of persons who had outpatient contact for COPD. The bars show the figures standardised by gender and age per 10,000 population. Average per year for the period 2013–2015.



Source: NPR/SSB

Figure 5.4: Number of outpatient contacts for COPD broken down by public or private treatment provider. The bars show the figures standardised by gender and age per 10,000 population. Average per year for the period 2013–2015.

Table 5.1: Persons with outpatient contact for COPD per year.

	2013	2014	2015	Average
Total				
Persons with outpatient contact for COPD, n	19,851	20,669	21,340	20,620
Percentage of the population	0.80	0.82	0.84	0.82
Contacts for COPD, n	30,572	31,585	31,958	31,372
Contacts per person, n	1.5	1.5	1.5	1.5
Persons who underwent spirometry, %	84.5	84.1	84.0	84.2
In hospital				
Persons with outpatient contact with hospitals for COPD, n	14,158	14,694	15,343	14,732
Hospital contacts for COPD, n	20,885	21,524	22,432	21,614
Persons who underwent spirometry in hospital, %	78.9	78.1	78.2	78.4
At private practices under public funding contracts				
Persons with outpatient contact for COPD, n	6,182	6,554	6,609	6,448
Contacts for COPD, n	9,687	10,061	9,526	9,758
Persons who underwent spirometry, %	95.2	94.8	95.0	95.0

An average of 68.9% of the outpatient contacts took place at public hospitals (Figure 5.4). The proportion varied from 43.5% in Sørlandet Hospital's referral area to 99.6% in Helgeland Hospital's referral area. At public hospitals, the average number of contacts per patient was 1.5, varying from 1.3 in the hospital referral areas of Østfold Hospital, Nordland Hospital, Helse Fonna and Helse Førde to 1.7 in the Lovisenberg and Vestre Viken areas. The average number of contacts with specialists in private practice under public funding contracts was also 1.5, with the number of contacts varying from 1.1 in Nordland Hospital's referral area to 1.7 in the hospital referral areas of UNN, Akershus University Hospital and Helse Møre og Romsdal.

Figure 5.5 shows the number of persons per 10,000 population who had outpatient contact for COPD during the period 2012–2015 for each hospital referral area. The dotted line shows the average for Norway. Generally speaking, there was little variation between years within each hospital referral area, although some areas showed a slightly increasing or decreasing trend.

5.2.2 Spirometry

On average, 84.2% of the persons who had outpatient contact for COPD had undergone spirometry during the course of the year. The proportion varied from 75.9% in Akershus University Hospital's referral area to 90.0% in Vestfold Hospital's referral area (Figure 5.6). For public hospitals, the corresponding proportion averaged 78.4%, varying from 66.2% in Akershus University Hospital's referral area to 90.3% in Vestfold Hospital's referral area. For specialists in private practice under public funding contracts, the proportion averaged 95.0%, varying from 66.0% in Helgeland Hospital's referral area to 98.9% in St. Olavs Hospital's referral area.

5.3 Comments on the findings

We have no information about the lung function or respiratory symptoms of the more than 20,500 persons who had one or more outpatient contacts for COPD. However, since these persons had outpatient contacts with the specialist health service, it is reasonable to assume that many of them had serious or very serious COPD and a significantly heavier burden of disease than persons with COPD who are only treated by their regular GP (Nielsen et al. 2011; Erdal et al. 2016; Erdal et al. 2014).

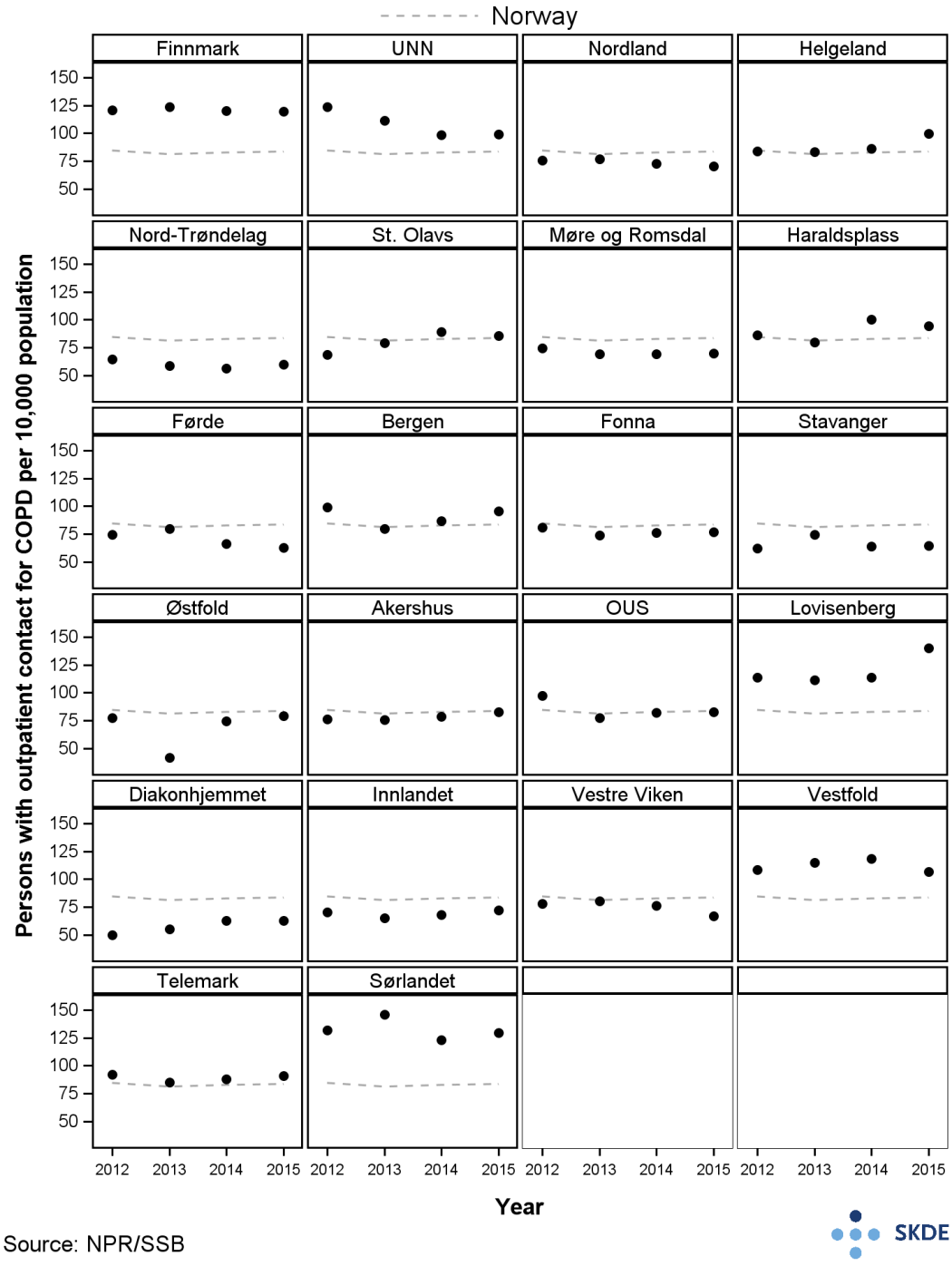


Figure 5.5: Number of persons with outpatient contact for COPD per year during the period 2012-2015. The numbers are standardised by gender and age and per 10,000 population.

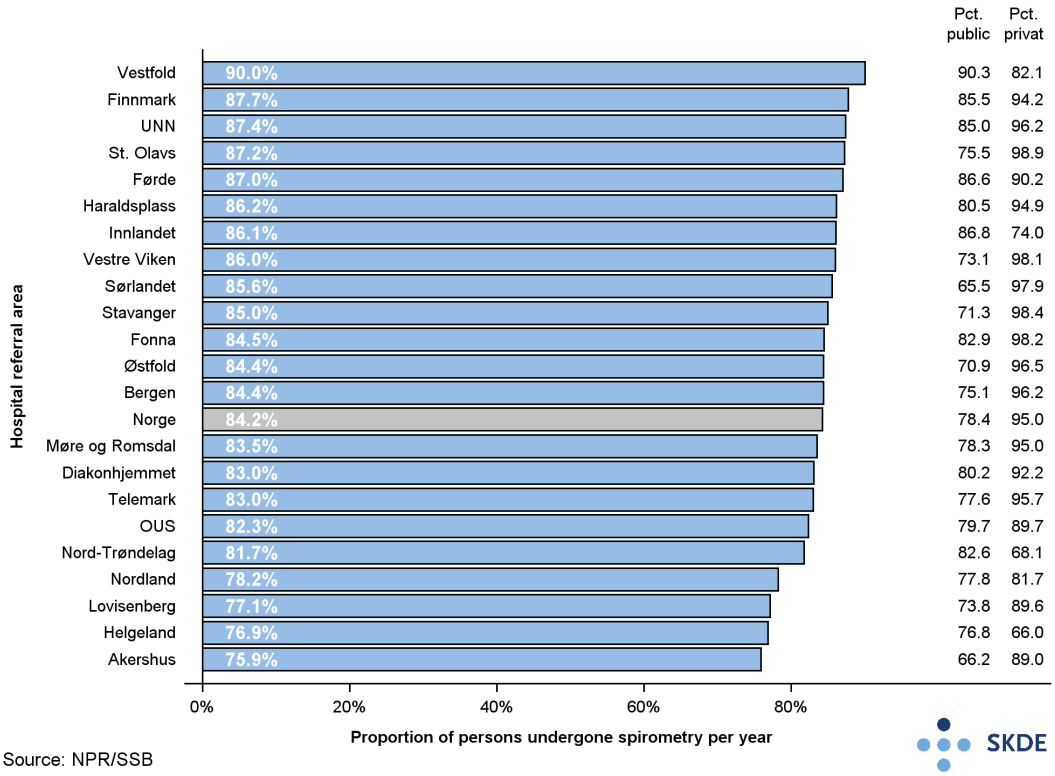


Figure 5.6: Number of persons with outpatient contact for COPD who have undergone spirometry during the course of a year. The bars and columns show proportions standardised by gender and age. Average per year for the period 2013–2015.

There is significant geographical variation in how many persons per 10,000 population had outpatient contact for COPD with the specialist health service (Figure 5.3). There is generally a strong correlation between the incidence of lung cancer and the number of persons who are in contact with outpatient services for COPD per 10,000 population (Spearman's rho = 0.54). The exceptions to this rule are the hospital referral areas of Østfold Hospital and Helse Stavanger, which have relatively few persons with outpatient contact for COPD and a relatively high incidence of lung cancer. This suggests that the prevalence of COPD and random variation probably cannot explain the whole variation. There may also be differences between hospital referral areas in the scope of outpatient services, the number of specialists available, waiting times, and the type and amount of health services provided. Such factors can also influence referral practices, but we have no data that can describe this.

Hospital referral areas with a high number of contacts per 10,000 population also seemed to have the highest number of contacts per person (Figure 5.3). There was no difference in the average number of contacts per person between public outpatient clinics and specialists in private practices under public funding contracts (Figure 5.4). In addition to a general shortage of pulmonologists in Norway in general, the specialists in pulmonary medicine who work in private practices under public funding contracts are very unevenly distributed over the country.[1] [2] [3] [4]. There are no specialists in pulmonary medicine in private practice under public funding contracts in the hospital

[1] Northern Norway Regional Health Authority: https://helse-nord.no/behandlingssteder/private-avtalespesialister/
[2] Central Norway Regional Health Authority: https://helse-midt.no/behandlingssteder/avtalespesialister
[3] Western Norway Regional Health Authority: https://helse-vest.no/behandlingsstader/avtalar-med-private
[4] South-Eastern Norway Regional Health Authority: https://www.helse-sorost.no/helsefaglig/samarbeid/avtaler-med-private/avtalespesialister

referral areas of Nordland Hospital, Helse Fonna, Helse Førde and Helse Nord-Trøndelag. Residents of these hospital referral had the lowest use of outpatient services for COPD. This could indicate that the availability of outpatient services for COPD to a certain extent governs their use. A potential consequence of inadequate outpatient services could be an increase in the number of emergency admissions, which could be the case for the hospital referral areas of Helse Fonna and Helse Nord-Trøndelag (Figure 6.4, page 41).

Several examinations are relevant when assessing and monitoring persons with COPD, but, except for spirometry, we lack good data about them. Spirometry is the most important examination in COPD assessment and monitoring, however. Four out of five people who had outpatient contact for COPD had undergone a spirometry examination in the course of the year, and there was little variation between hospital referral areas (Figure 5.6). On the other hand, the percentage of persons with COPD who had a spirometry examination during the year was higher for specialists in private practice under public funding contracts (95.0%) than for outpatient contact at hospitals (78.4%). Differences in financial incentives and coding practices between specialists in private practice under public funding contracts and hospital doctors could explain this. Even though there is some variation, the figures indicate that spirometry is both widely available and frequently carried out in connection with outpatient contacts with the specialist health service in all the hospital referral areas.

Chapter 6

Emergency admissions

COPD is characterised by episodes of increased respiratory problems known as COPD flare-ups or exacerbations (GOLD 2017). The main symptoms of COPD exacerbations are increased coughing and shortness of breath, and a generally reduced level of functioning. The airways contract, mucus production increases, the mucus changes colour, and patients find it difficult to move air in and out of their lungs. A COPD exacerbation is often triggered by a respiratory tract infection. The underlying cause can be viral or bacterial, and is often a combination of the two. A COPD exacerbation will usually require some form of intervention, and one common basis for categorising the severity of exacerbations is to consider the treatment required (Norwegian Directorate of Health 2012). A mild COPD exacerbation requires no treatment other than increasing the dosage of the patient's regular medication and/or other necessary medication. A moderate COPD exacerbation requires treatment with antibiotics or corticosteroids in tablet form. A severe COPD exacerbation requires hospitalisation. Patients with severe COPD exacerbations often experience respiratory failure with a reduced level of oxygen in the blood (type 1 respiratory failure). Some patients also have increased levels of carbon dioxide in the blood (type 2 respiratory failure). Respiratory failure may require oxygen therapy or ventilation support. A fairly liberal approach is taken to the use of antibiotics to treat respiratory tract infections in persons with COPD, since the underlying condition can result in infections becoming more serious than in persons with healthy lungs. It is also common to give medication to alleviate contractions of the bronchi. Such medication is usually administered as inhalation treatment, but can also be administered intravenously.

COPD exacerbations, particularly those that require hospital admission, can have great significance for how the disease develops. In addition to reduced quality of life (Seemungal et al. 1998), persons with frequent exacerbations also experience a faster decline in lung function compared to persons with few or no COPD exacerbations (Donaldson et al. 2002; Halpin et al. 2012). Several studies have also shown that frequent COPD exacerbations are associated with increased mortality (Soler-Cataluna et al. 2005; Suissa et al. 2012). Persons with COPD often have other diseases that can increase the need for hospitalisation (Westerik et al. 2017). Comorbidity in COPD patients is associated with a poorer prognosis (Garcia-Sanz et al. 2017).

In persons with COPD, it is often impossible to distinguish between pneumonia and a COPD exacerbation. The figures in the report include emergency admissions for COPD based on the IDD-10 codes specified below. The definition of COPD exacerbation is relatively broad and takes account of the possibility that coding practices may differ. Many persons admitted to hospital with other conditions also have COPD. These episodes are not discussed in this report.

6.1 Sample and definitions

Data source: Department stay files from NPR from which activity at rehabilitation departments has been excluded for the period 2012–2015. Dates of death from the Central Population Register.

Sample: Persons aged 40 years or older who have been admitted as an emergency case for COPD. COPD is defined by the ICD-10 codes J40.x-J44.x (bronchitis, emphysema and COPD) as the primary diagnosis or R06.0 (dyspnoea), J09.x-J11.x (influenza), J12.x-J18.x (pneumonias), J20.x (acute bronchitis), J22.x (lower respiratory infection), J46.x (acute severe asthma) or J96.x (respiratory failure) as the primary diagnosis when J40.x-J44.x is coded as a secondary diagnosis. Table G.2 in Appendix G (page 92) shows the number of department stays coded with the relevant ICD-10 codes. Information about the municipality of residence was missing for an average of 39 emergency admissions per year, and they were analysed as if the patient were resident in the hospital referral area of the hospital where the treatment took place. Correspondingly, information about the patient's personal identity number was missing for 45 emergency admissions, making it impossible to track the patients in question between institutions and from one year to the next, and, if they have died, we do not know their date of death.

Emergency admissions: The analyses are based on department stays where the patient is registered as an emergency admission for COPD, and is registered with at least one bed day or discharged as dead. Continuous hospital episodes where the patient is admitted to more than one department or hospital and the time that passes between the department stays is less than eight hours, are considered a single admission or 'episode of care' (Hassani et al. 2015). When an episode of care consists of two or more department stays, it will be registered as an emergency admission for COPD in cases where at least one of the department stays is registered as an emergency admission for COPD. Emergency admissions are registered by the year of discharge.

Bed days: The number of bed days is reckoned from the date of admission to the date of discharge for one emergency admission for COPD.

Ventilation support: The analysis for ventilation support presents the proportion of emergency admissions for COPD where non-invasive ventilation (NIV) has been administered with medical procedure code GXAV20 *Bilevel Positive Airway Pressure treatment (BiPAP)*.

Primary admissions and readmissions: Primary admissions are emergency admissions for COPD where the patient has not died during or within 30 days of the admission without having had a readmission during this period. Primary admissions thus only include persons who are at risk of readmission. When a person is readmitted as an emergency case within 30 days of being discharged from a primary admission for COPD, this is considered a readmission regardless of the reason for the readmission. When a readmission is a new emergency admission for COPD, this admission will be classified both as a readmission and as a primary admission in relation to a potential new readmission. The analyses of readmissions include primary admissions with discharge dates from 1 December 2012 until and including 1 December 2015. All readmissions with an admission date up to and including 31 December 2015, which is 30 days after the discharge date for the last primary admission, are included. Years mostly refer to the year of discharge, but the year has been staggered somewhat as described above. For example, figures for 2015 will include primary admissions with a date of discharge from 1 December 2014 until and including 30 November 2015. This time staggering has been done in order to include all readmissions up to 30 days after discharge from a primary admission.

Mortality: Three analyses are carried out of mortality in connection with emergency admissions for COPD. The first analysis presents the proportion of persons admitted as emergency cases for COPD in a calendar year who die within 30, 90 and 365 days of the admission date. The second

analysis presents the proportion of emergency admissions for COPD where the patient died in hospital. The third analysis presents the number of bed days for emergency admissions for COPD during the patients' final year before death.

6.2 Findings

6.2.1 Emergency admissions

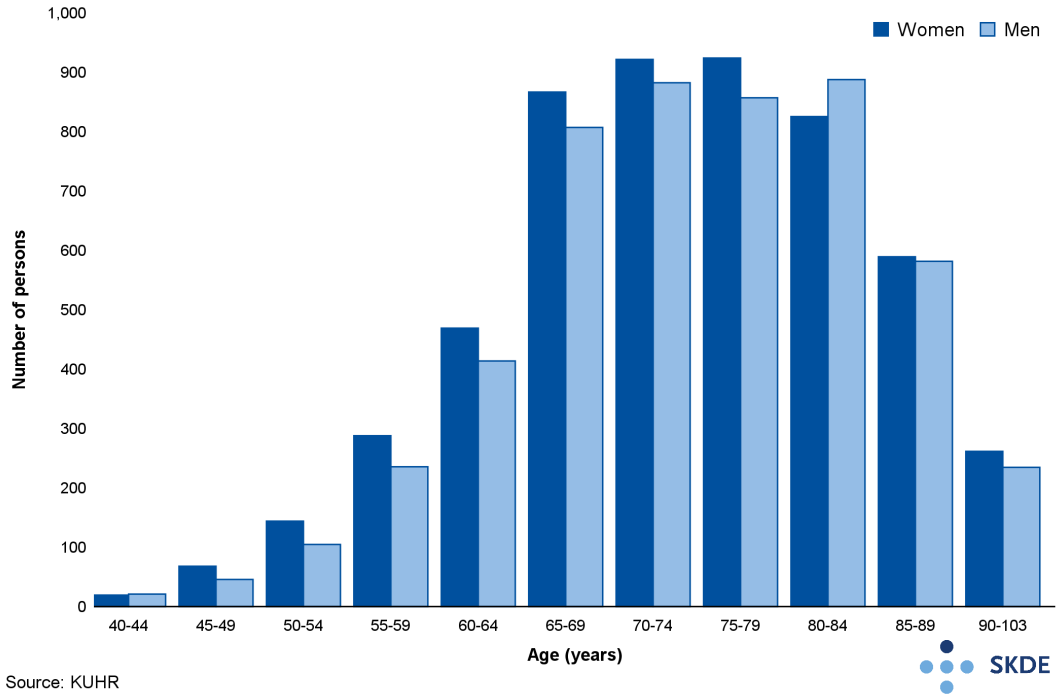


Figure 6.1: Number of persons admitted as emergency cases for COPD at public hospitals. Average per year for the period 2013–2015.

On average, 5,380 women (0.42% of the female population) and 5,074 men (0.41% of the male population) aged 40 years or older were admitted as emergency cases for COPD per year (Figure 6.1 and Figure 6.2). Nine out of ten emergency admissions for COPD concerned patients aged 60 years or older. About 1.9% of all women and 2.9% of all men aged 75 years or older were admitted as emergency cases for COPD per year.

Table 6.1 shows unadjusted figures per year for persons admitted as emergency cases for COPD during the period 2013-2015. The number of emergency admissions for COPD varied throughout the year, with fewer admissions in summer than in winter (Figure 6.3).

On average, 42 persons per 10,000 population in Norway had at least one emergency admission for COPD in the course of one year during the period 2013-2015, and these persons each had 1.6 emergency admissions for COPD per year (Figure 6.4). The number of persons admitted as emergency cases for COPD varied from 23 per 10,000 population in Diakonhjemmet's hospital referral area to 59 per 10,000 population in Lovisenberg's referral area. The number of emergency admissions per person for COPD varied from 1.4 in Helgeland Hospital's referral area to 1.9 in Lovisenberg's area.

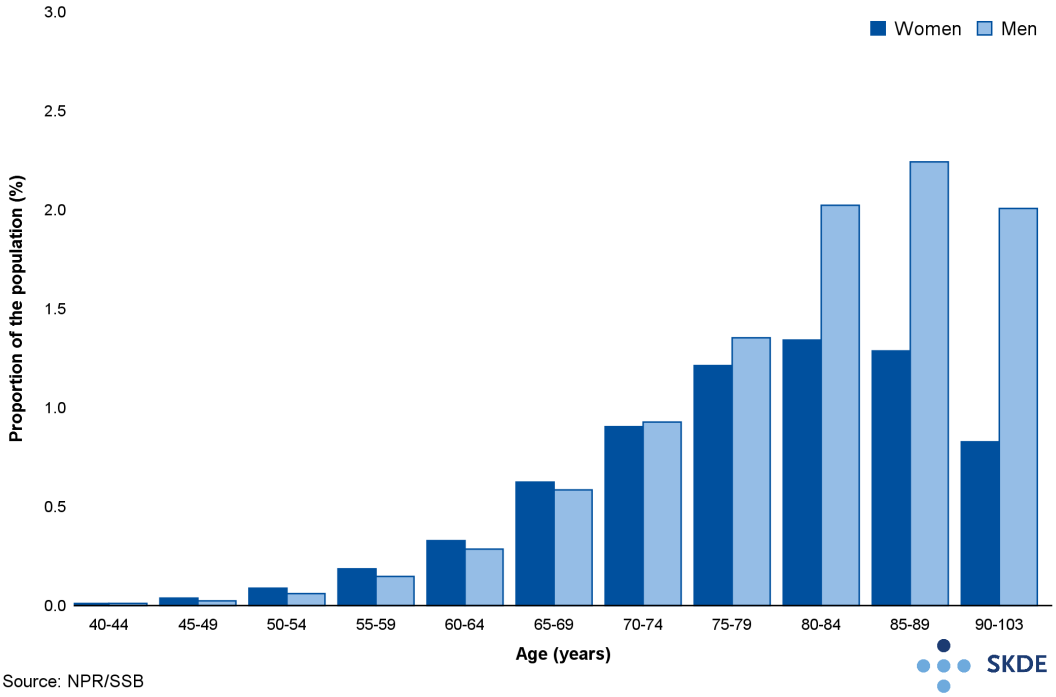


Figure 6.2: Persons admitted as emergency cases for COPD to public hospitals as a percentage of the population. Average per year for the period 2013–2015.

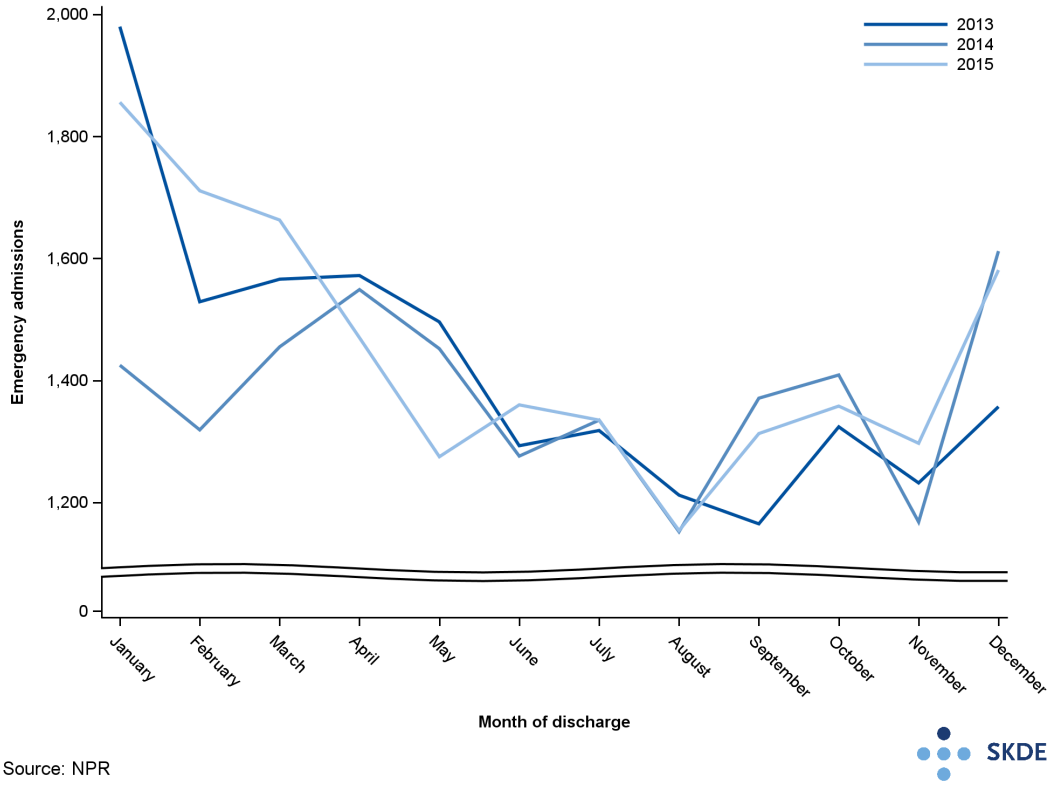


Figure 6.3: Number of emergency admissions per year broken down by month of discharge.

Table 6.1: Persons admitted as emergency cases for COPD per year.

	2013	2014	2015	Average
Emergency admissions				
Persons admitted as emergency cases for COPD, n	10,468	10,077	10,819	10,455
Emergency admissions, n	17,005	16,524	17,386	16,972
Emergency admissions per person, n	1.6	1.6	1.6	1.6
Bed days				
Bed days in total, n	105,780	99,714	105,942	103,812
Bed days per person, n	10.1	9.9	9.8	9.9
Bed days per emergency admission, n	6.2	6.0	6.1	6.1
Ventilation support				
Em. admissions where the patient received ventilation support, %	18.1	18.7	18.4	18.4
Readmissions				
Primary admissions, n	16,034	15,174	16,104	15,771
Primary admissions with subsequent readmissions, n	4,648	4,570	4,641	4,620
Primary admissions with subsequent readmissions, %	29.0	30.1	28.8	29.3
Readmissions that were emergency admissions for COPD, %	73.1	73.0	71.8	72.6
Mortality				
Deaths within 30 days of date of admission, %	12.1	11.9	12.0	12.0
Deaths within 90 days of date of admission, %	17.4	17.3	17.0	17.2
Deaths within 365 days of date of admission, %	28.4	29.0	28.3	28.6
Em. admissions where the patient died during the stay, %	5.3	4.9	5.3	5.2
Persons who died in hospital, %	8.6	8.1	8.5	8.4

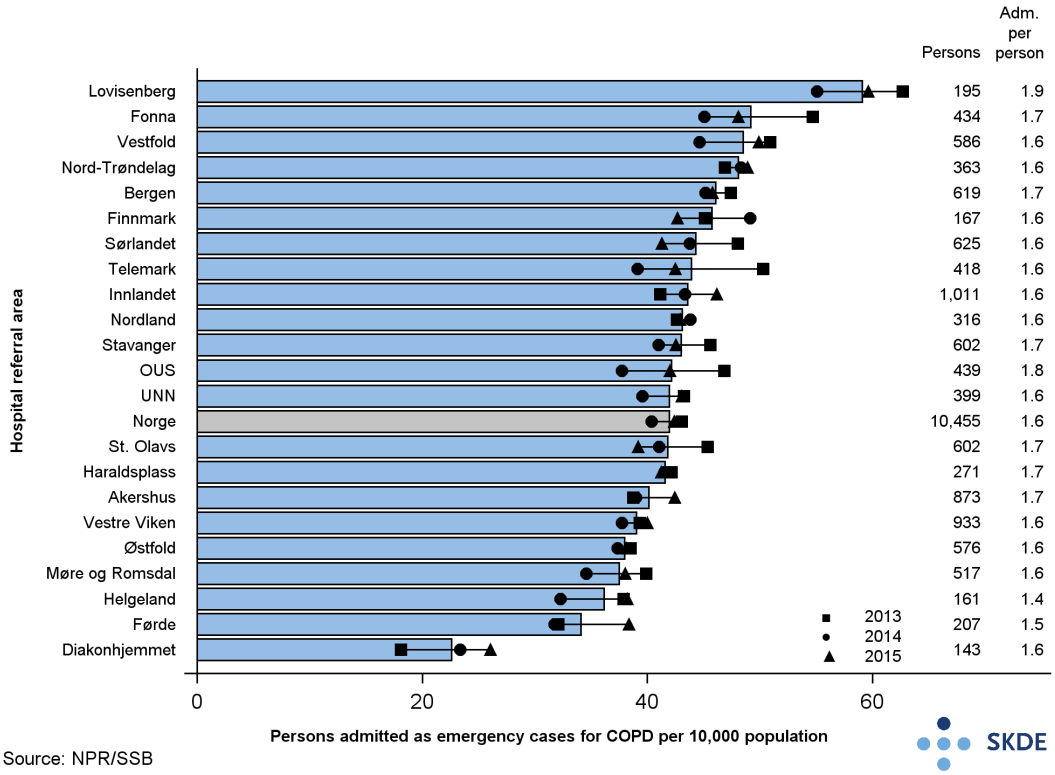


Figure 6.4: Number of persons admitted as emergency cases for COPD. The bars show the figures standardised by gender and age per 10,000 population. Average per year for the period 2013–2015.

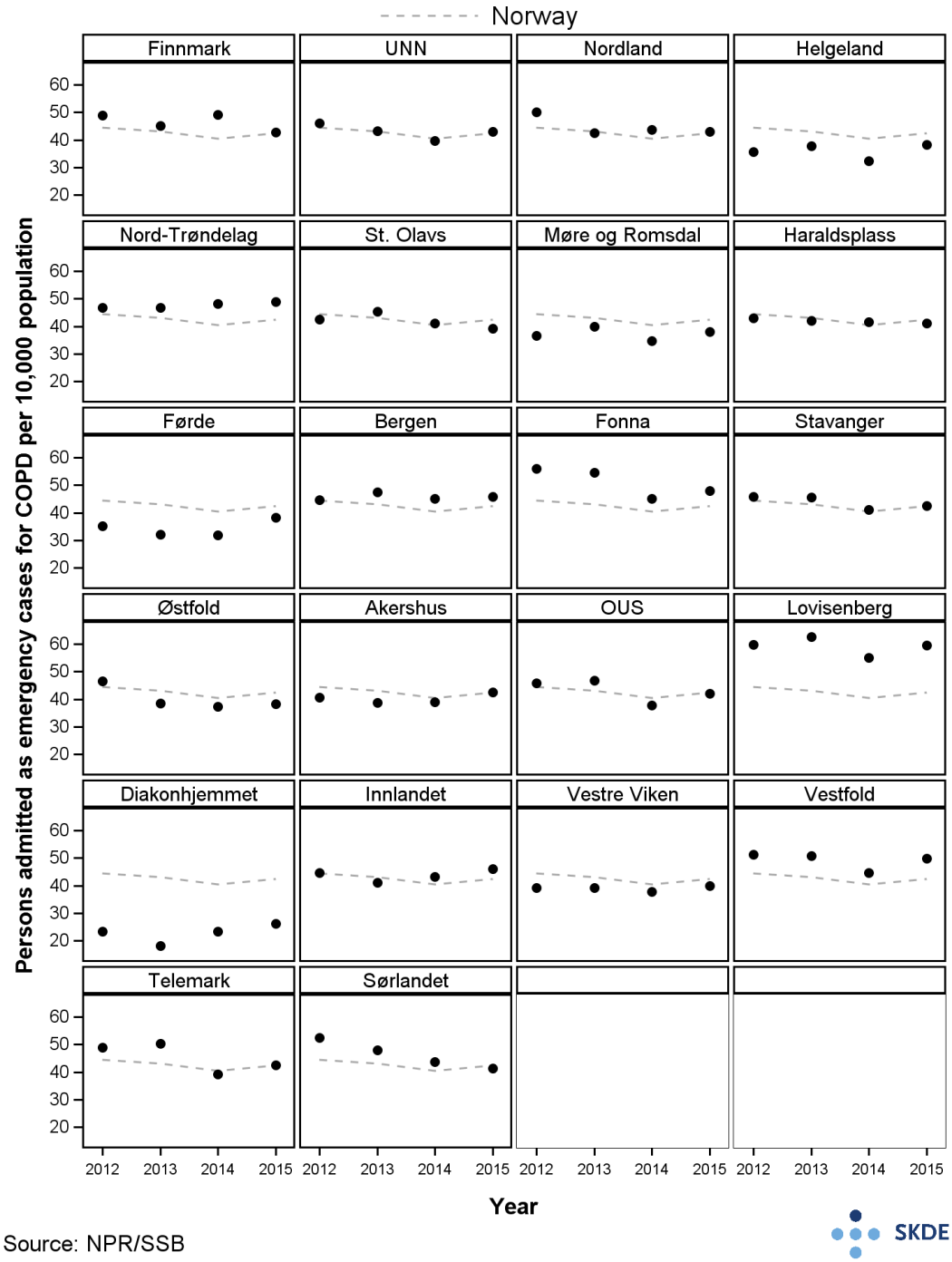


Figure 6.5: Number of persons admitted as emergency cases for COPD per year during the period 2012–2015. The numbers are standardised by gender and age and per 10,000 population.

Figure 6.5 shows the number of persons admitted as emergency cases for COPD per 10,000 population during the period 2012-2015 for each hospital referral area. The dotted line shows the average for Norway. Generally speaking, there was little variation between years within each hospital referral area, although some areas showed a slightly increasing or decreasing trend.

6.2.2 Bed days

On average, there were 417 bed days in connection with emergency admissions for COPD per 10,000 population per year in Norway, and the numbers varied from 226 per 10,000 population in Diakonhjemmet hospital referral area to 602 per 10,000 population in Lovisenberg's referral area (Figure 6.6). The average number of bed days per person was 9.9, and the number varied from 8.2 in Sørlandet Hospital's referral area to 12.2 in the OUS area. The average number of bed days per emergency admission for COPD was 6.1, and the number varied from 5.3 in Sørlandet Hospital's referral area to 7.1 in Finnmark Hospital's referral area.

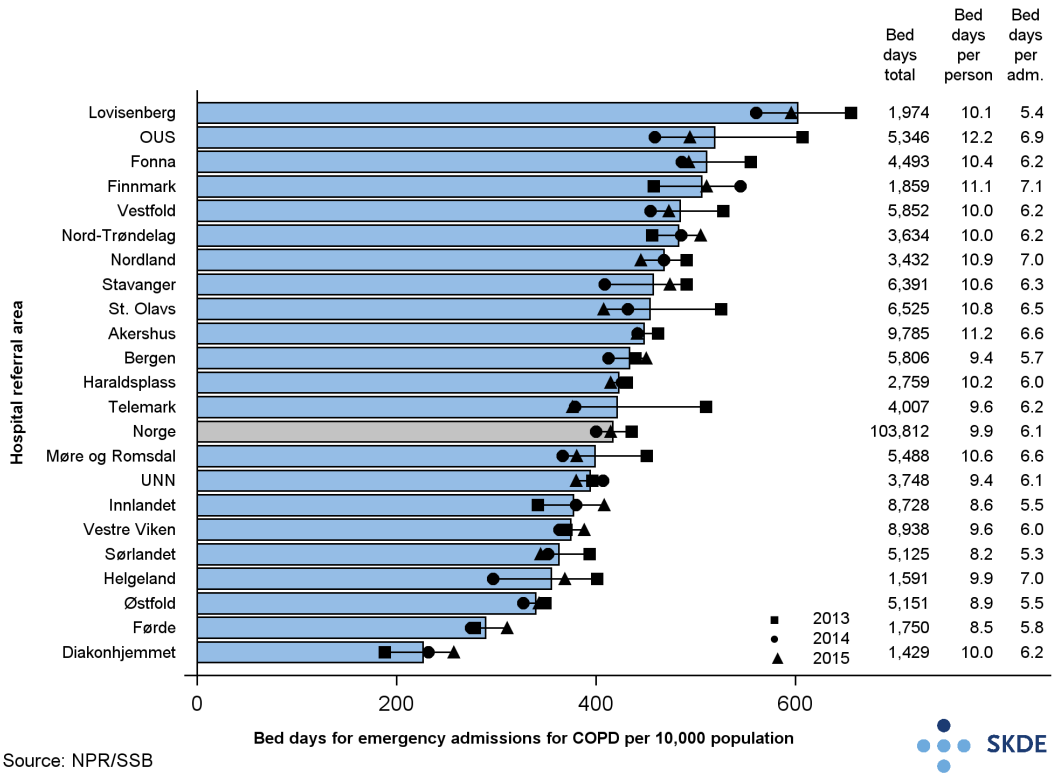


Figure 6.6: Bed days for emergency admissions for COPD. The bars show the figures standardised by gender and age per 10,000 population. Average per year for the period 2013–2015.

Overall, 5.7% of all bed days in connection with emergency admissions of persons aged 40 years and older concerned admissions for COPD (Figure 6.7). The proportion varied from 8.5% in Vestfold Hospital's referral area to 4.0% in Diakonhjemmet hospital referral area. If we include bed days in connection with planned admissions in the denominator, the proportion of bed days due to emergency admissions for COPD is 4.4%. The proportion varied from 6.1% in Vestfold Hospital's referral area to 2.9% in the Helse Førde area (data not shown).

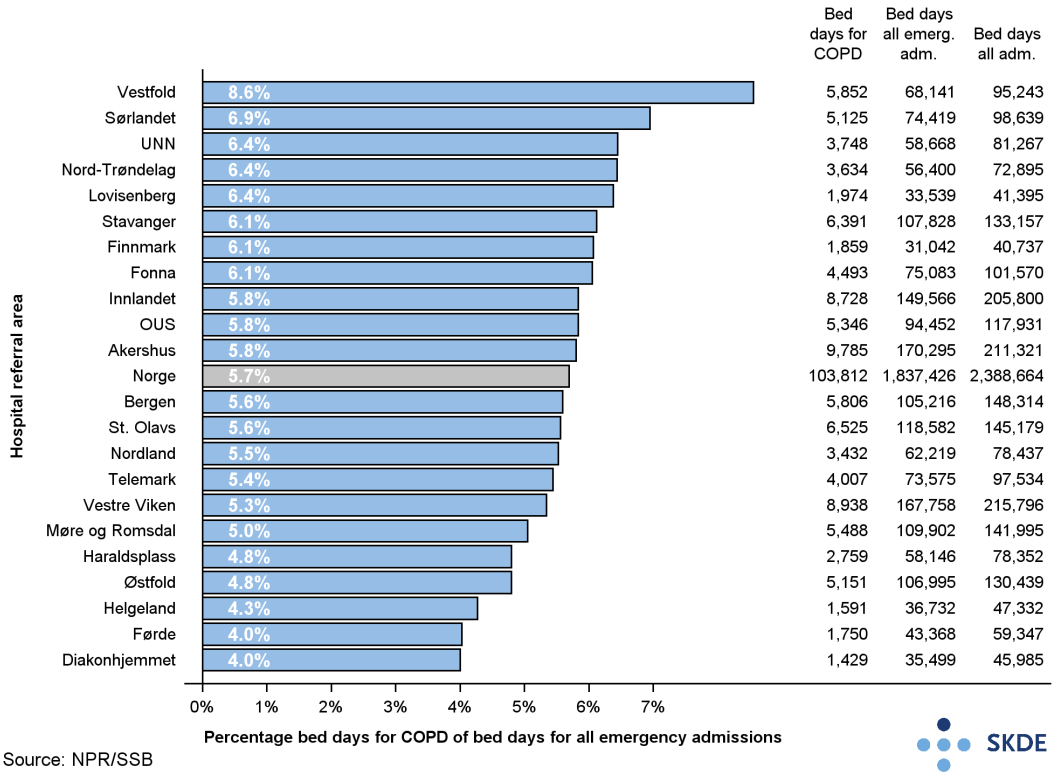


Figure 6.7: Bed days for emergency admissions for COPD in relation to bed days for all emergency admissions for persons aged 40 years or older. The bars show proportions standardised by gender and age. Average per year for the period 2013–2015.

6.2.3 Ventilation support

Ventilation support was administered in connection with 18.4% of the 16,972 emergency admissions for COPD per year (Figure 6.8). The proportion varied from 13.7% in the OUS hospital referral area to 26.4% in Vestfold Hospital's referral area.

6.2.4 Readmissions

On average, 29.3% of all primary admissions were followed by a readmission within 30 days (Figure 6.9). The proportion varied from 25.0% in Helgeland Hospital's referral area to 38.2% in Lovisenberg's hospital referral area. Nearly three quarters of the readmissions (72.6%) were new emergency admissions for COPD. This proportion varied from 64.9% in Helse Nord-Trøndelag's referral area to 75.7% in St. Olavs Hospital's referral area. The average number of bed days for primary admissions was 6.0, and the number varied from 5.1 in Lovisenberg's hospital referral area to 6.8 in the hospital referral areas of OUS, Nordland Hospital and Helgeland Hospital (data not shown).

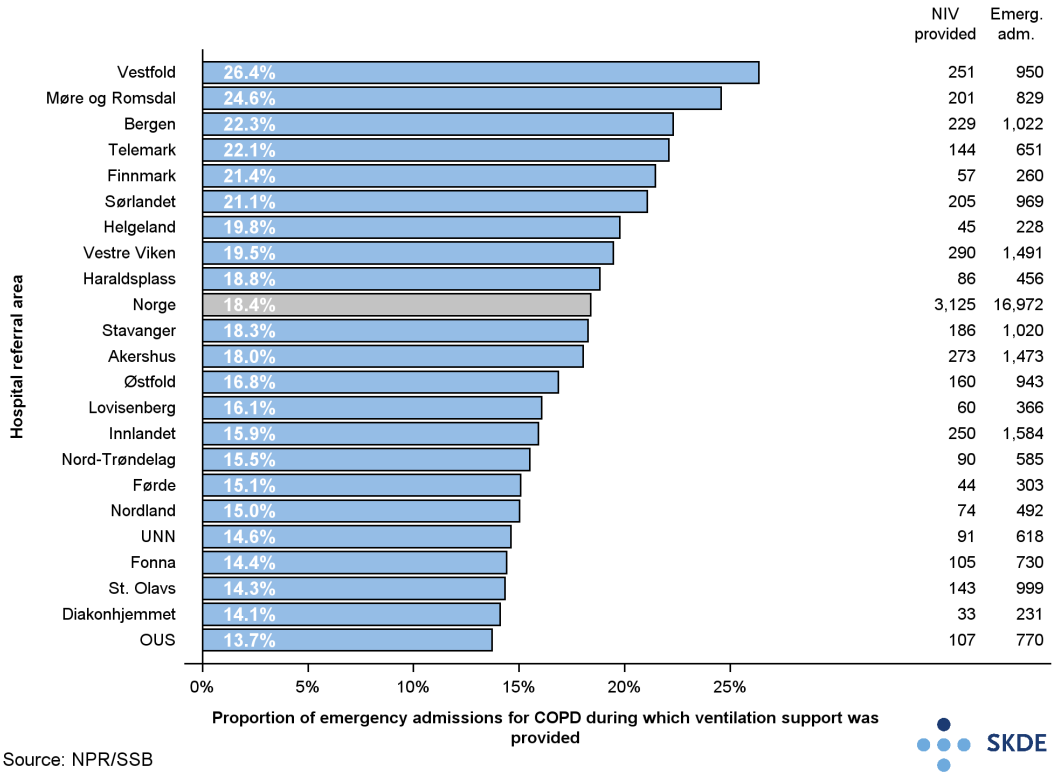


Figure 6.8: Proportion of emergency admissions for COPD during which ventilation support was provided. The bars show proportions standardised by gender and age. Average per year for the period 2013–2015.

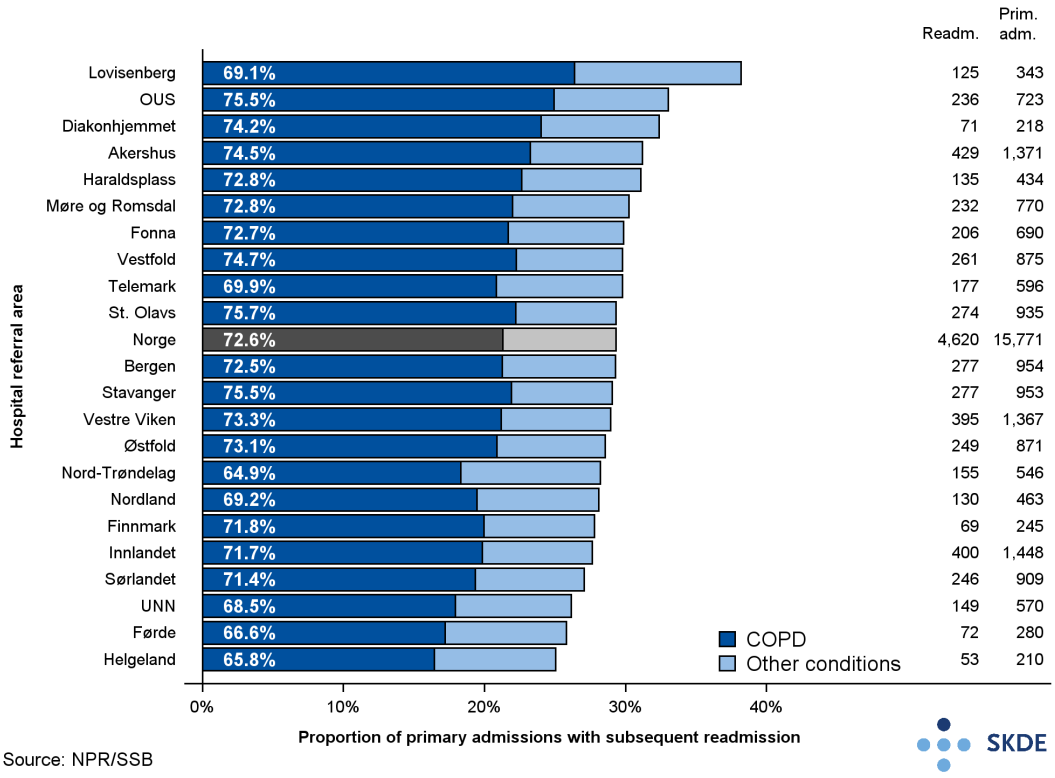


Figure 6.9: Proportion of primary admissions with at least one subsequent readmission within 30 days. The bars show proportions standardised by gender and age. Average per year for the period 2013–2015.

6.2.5 Mortality

Of the 10,455 persons admitted as emergency cases for COPD per year, 11.9% died within 30 days, 17.1% died within 90 days, and 28.4% died within 365 days of the date of their final admission (Figure 6.10). The 365-day mortality rate varied from 20.3% in Haraldsplass hospital referral area to 32.3% in Telemark Hospital's referral area.

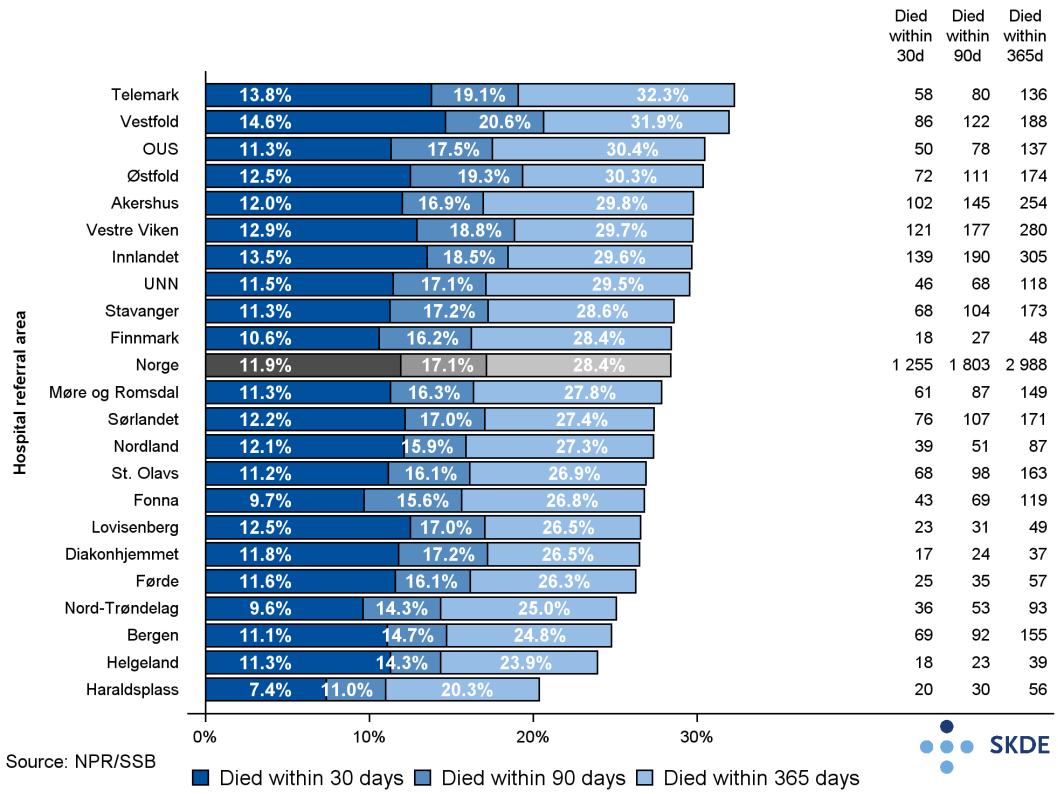
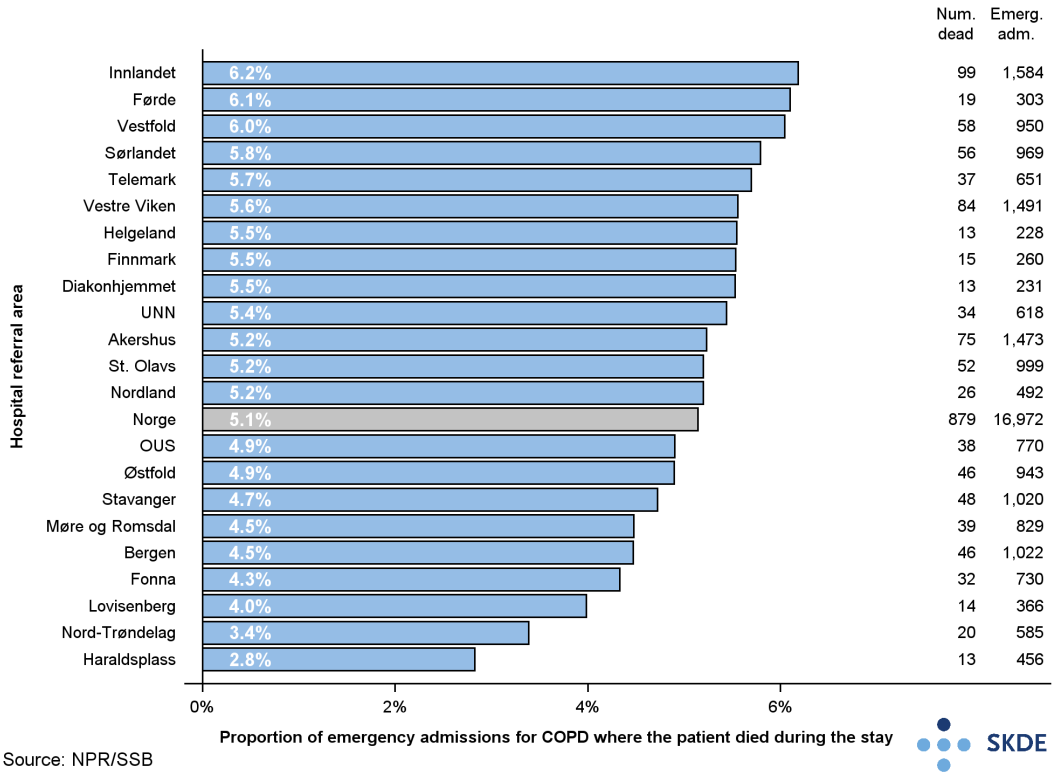


Figure 6.10: The proportion of persons admitted as emergency cases for COPD who died within 30, 90 or 365 days of the date of their final admission. The bars show proportions standardised by gender and age. Average per year for the period 2013–2015.

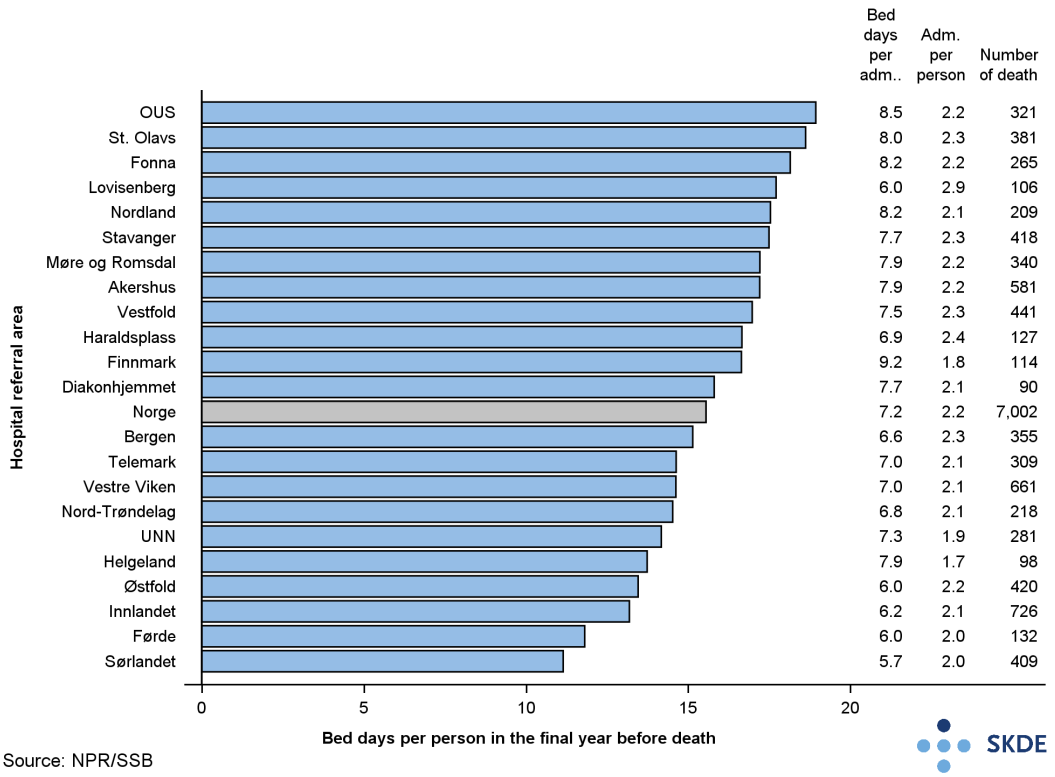
The patient died in hospital in 5.1% of the 16,972 emergency admissions for COPD (Figure 6.11). The proportion varied from 2.8% in Haraldsplass hospital referral area to 6.2% in Innlandet Hospital's referral area. Of the 10,455 persons who were admitted as emergency cases for COPD, 8.4% died in hospital during their final emergency admission (data not shown). The proportion varied from 4.8% in Haraldsplass hospital referral area to 9.8% in Vestfold Hospital's referral area.

During the period from 1 January 2013 to 31 December 2015, 7,002 persons who had been admitted as emergency cases for COPD in these years died. On average, each of these persons had spent 15.5 bed days in connection with emergency admissions for COPD during the final year before their death (Figure 6.12). The number of bed days per person varied from 11.1 in Sørlandet Hospital's referral area to 18.9 in the OUS area. The average number of bed days per emergency admission for COPD was 7.2, and the number varied from 5.7 in Sørlandet Hospital's referral area to 9.2 in Finnmark Hospital's referral area. The average number of emergency admissions per person in their final year before death was 2.2, and the number varied from 1.7 in Helgeland Hospital's referral area to 2.9 in Lovisenberg hospital referral area.



Source: NPR/SSB

Figure 6.11: Proportion of emergency admissions for COPD where the patient died during the stay. The bars show proportions standardised by gender and age. Average per year for the period 2013–2015.



Source: NPR/SSB

Figure 6.12: Number of bed days per person in the final year before death for persons who had been admitted as emergency cases for COPD and died during the period 2013-2015. The bars show numbers standardised by gender and age.

6.3 Comments on the findings

Coding practices for emergency admissions for COPD exacerbations vary between Norwegian hospitals. We have taken account of this in our sample criteria by including some other primary diagnoses when COPD is coded as a secondary diagnosis (Table G.2, page 92). The figures presented in the COPD Healthcare Atlas will therefore be higher than figures from other sources that only include admissions where COPD is coded as the primary diagnosis.

Persons with COPD exacerbations spent more than 100,000 days in Norwegian hospitals per year (Table 6.1 and Figure 6.6), and are thus one of the biggest patient groups treated in hospitals.[1] Despite only about one in twenty persons with COPD being admitted to hospital as an emergency case each year, they account for a substantial proportion of the resources used in connection with hospital admissions. As many as 6% of all bed days in connection with emergency admissions of persons aged 40 years and older concerned COPD exacerbations (Figure 6.7). This means that the prevention of COPD exacerbations could result in considerable savings on emergency treatment costs (Nielsen et al. 2009). The prevention of COPD exacerbations will also prevent loss of physical function and quality of life, in addition to lost years of life (Seemungal et al. 1998; Suissa et al. 2012).

How many persons with COPD exacerbations are admitted to Norwegian hospitals depends on the prevalence of COPD, the threshold for admission and preventive treatment practices. Appendix A provides more information about the prevalence of COPD in different hospital referral areas. There is generally a strong correlation between the incidence of lung cancer and the number of persons admitted as emergency cases for COPD per 10,000 population (Spearman's rho = 0.52), but some hospital referral areas stand out. Østfold Hospital's referral area has a relatively high incidence of lung cancer and a relatively low number of persons admitted as emergency cases for COPD per 10,000 population. Helse Nord-Trøndelag hospital referral area, on the other hand, has a relatively low incidence of lung cancer and a relatively high number of persons admitted as emergency cases for COPD per 10,000 population. The criteria for treating COPD exacerbations are assumed to be fairly uniform throughout Norway, but the threshold for admission may vary depending on the capacity of individual hospital departments, the clinical judgement of regular GPs and ambulance personnel, patient preferences and logistical issues in the hospital referral area in question. It is possible to prevent COPD exacerbations, for example through vaccination, pharmacological treatment and rehabilitation (GOLD 2017). It is also possible to avoid hospitalisation once a COPD exacerbation has occurred by the municipal health service providing sufficient emergency treatment, for example in municipal emergency bed units and nursing homes. The quality of care and treatment provided in connection with emergency hospital admissions can also have a bearing on the need for readmission.

More than 10,000 persons were admitted as emergency cases for COPD per year during the period 2013–2015 (Table 6.1). Several studies have shown that fewer people suffer COPD exacerbations in summer than in winter (Rabe et al. 2013; Donaldson et al. 2012; Jenkins et al. 2012). Figure 6.3 clearly shows that this is also the case in Norway, since there were considerably more emergency admissions for COPD during the period from November to April compared with the rest of the year. The relatively low number of emergency admissions towards the end of 2013 and early in 2014 can possibly be explained by the relatively low influenza activity in the 2013–2014 season (Hauge et al. 2014). This underpins what is known about how important flu vaccinations are in preventing acute COPD exacerbations (Bekkat-Berkani et al. 2017).

Each patient had 1.6 emergency admissions for COPD per year on average (Figure 6.4). About 70% had only one, 17% had two, 6% had three, and 7% had four or more (data not shown). On average,

[1] Statbank Table 10261: www.ssb.no/statistikkbanken

each patient spent 6.1 days in hospital per emergency admission for COPD (Figure 6.6), which is well above the overall average for Norwegian hospitals of about 4.4 bed days (Rønningen et al. 2016). The reason for these relatively long stays could be that persons with COPD are often elderly people who also have other conditions. The number of bed days per emergency admission varies from 5.3 to 7.1 between hospital referral areas, which could indicate a potential for rationalising patients' care pathways at some hospitals. At the same time, the desire to reduce the length of stays must not be fulfilled at the expense of patient needs or the quality of treatment. There will also be differences in the services that municipalities offer to patients who need help or care following a hospital stay. For example, if short-term nursing home beds are in short supply, this could result in more hospital bed days. There has been a steady decrease in the length of stays at Norwegian hospitals in recent years (Rønningen et al. 2016). This is possibly a result of the increased focus on efficient care pathways at Norwegian hospitals and the increased availability of short-term nursing home beds and home nursing care. However, the shorter stays could also reflect increased pressure on Norwegian hospitals resulting in a desire to discharge patients to make room for others. If that is the case, we would expect to see an increase in the number of readmissions.

Nearly one third of all persons admitted as emergency cases for COPD were readmitted within 30 days (Figure 6.9), which is a far higher proportion than for other conditions and for elderly people in general[2]. Lovisenberg hospital referral area stands out with the highest 30-day readmission rate for persons admitted for COPD. A possible explanation for this is that a relatively high proportion of the population in Lovisenberg's referral area have low socioeconomic status, which is often associated with a high level of tobacco consumption and lifestyle diseases[3]. Another possible explanation is that the average length of stay for primary admissions was only 5.1 bed days, which is the shortest in the country. The national average was 6.0 bed days (data not shown).

A recurring issue in hospital departments that treat persons with COPD exacerbations is whether patients discharged early are more likely to be readmitted within 30 days. The number of bed days for primary admissions varied from 5.1 to 6.8 (data not shown), but there was no apparent correlation between short hospital stays and increased readmission rates (data not shown). More than a quarter of the readmissions within a 30-day period concerned conditions other than COPD, which indicates that persons with COPD often have other conditions and generally a heavy burden of disease. The proportion of primary hospital stays with subsequent readmission was highest in the hospital referral areas of the health trusts in Oslo and Haraldsplass (Figure 6.9). One possible explanation is that there may be particularly high pressure on these areas, which could result in a high threshold for primary admission and a low threshold for discharge. A higher threshold for emergency admissions will mean that patients are more unwell on admission and therefore at greater risk of readmission.

The 30-day readmission rate is a much used, but controversial, quality indicator[4](Fischer et al. 2014). There are several reasons why it is inexpedient as a quality indicator for COPD. A COPD exacerbation in itself increases the risk of new exacerbations within a short space of time, and particularly for sub-groups of persons with COPD who already suffer very frequent exacerbations that are difficult to prevent (Hurst et al. 2010). On the other hand, a high readmission rate could indicate that there is room for improvement of the quality of treatment and for rationalisation of the care pathway. It is not self-evident where in the care pathway or treatment chain improvements and rationalisation will have the greatest positive effect. For example, improving the quality of nursing home services may reduce the number of readmissions without this telling us anything about the quality of the hospital services.

[2]Quality indicators: https://helsenorge.no/Kvalitetsindikatorer
[3]Public health profiles: https://www.fhi.no/hn/helse/folkehelseprofil
[4]See footnote 2

Figure 6.8 shows the number and proportion of emergency admissions for COPD where the patient received ventilation support. Ventilation support may be administered in connection with COPD exacerbations for several different reasons, but the main indication is acute type 2 respiratory failure, which impairs the ability to eliminate carbon dioxide. The proportion of emergency admissions where the patient received ventilation support was twice as high in Vestfold Hospital's referral area as in the OUS hospital referral area. It is challenging to interpret these figures, since the analyses have not taken account of the degree of respiratory failure upon admission. It is nevertheless natural to assume that there is an underuse of ventilation support in several hospital referral areas. This assumption is supported by figures from the COPD Register, which show that the use of ventilation support varies from 10 to 40 per cent of admissions for COPD exacerbations[5]. Some of the variation could be explained by different hospitals having different traditions and guidelines for administering ventilation support, even though clear, evidence-based recommendations exist for when patients should be offered ventilation support in connection with COPD exacerbations (GOLD 2017). Ventilation support is a resource-intensive form of treatment, as it requires advanced equipment, the capacity to monitor the patient closely and highly trained personnel. The available ventilation support resources may vary significantly between hospitals. Another potential explanation is that different hospitals may have different thresholds for admitting persons with severe COPD, which could result in some hospitals having sicker patients, who will thus need more ventilation support, than other hospitals. The analysis only includes BiPAP, which is the recommended form of ventilation support for persons with severe COPD (Norwegian Directorate of Health 2012). However, there are other forms of non-invasive ventilation support, such as continuous positive airway pressure (CPAP), as well as invasive ventilation support, such as ventilator treatment. These types of ventilation support are so rarely used that the figures are too low for analysis. We cannot rule out the possibility that hospital referral areas with low use of BiPAP could be using other types of ventilation support more, or that there are variations in whether treatment that has been administered has been registered in the patient administration system.

Many persons who are hospitalised for COPD exacerbations are so ill that they will soon die. As many as 28% died within one year of their last admission (Figure 6.10), and in connection with one in twenty admissions, the patient died in hospital (Figure 6.11). Correspondingly, figures from the COPD Register show that fewer than half of the patients are alive five years after their first admission for a COPD exacerbation (Govertsen et al. 2016). There was considerable variation in the number of bed days in connection with emergency admissions for COPD for persons in their final year before death (Figure 6.12). Variation in mortality cannot be used as a measure of the quality of hospital treatment, however. Firstly, the figures do not reflect how seriously ill the individual patients were on admission, as a result of COPD or other diseases. Secondly, there are differences between hospital referral areas in whether persons with COPD receive treatment and care from primary healthcare services or the specialist health service in the final phase of their lives. The variation observed indicates that health and care services for seriously ill COPD patients are organised differently in different parts of Norway.

[5]The results will be published in future annual reports: The National Register for Patients with Chronic Obstructive Pulmonary Disease

Chapter 7

Rehabilitation

Non-pharmacological measures may be as effective as or more effective than pharmacological treatment. There is considerable variation between hospital referral areas in the rehabilitation services offered by health trusts or private rehabilitation institutions in the specialist health service. Some municipalities also provide rehabilitation services for persons with COPD, and it is a political goal that a larger proportion of the rehabilitation services should be provided by the municipalities in future[1].

There is more than one definition of rehabilitation, and most of them emphasise educating patients about their condition, physical exercise with the emphasis on what the patients themselves can do, and nutritional advice (Spruit et al. 2013). There is a distinction between general rehabilitation and pulmonary rehabilitation. Pulmonary rehabilitation is disease-specific, and smoking cessation is a very important measure for smokers. The rehabilitation services must be interdisciplinary and comprise at least a doctor, a nurse and a physiotherapist. The team will often also include a psychologist, a clinical nutritionist and/or a social worker.

Pulmonary rehabilitation is in practice provided as day patient treatment, even though patients sometimes stay at the institution. Education and physical exercise can take place in groups or individually. The rehabilitation period can last from a matter of days to several weeks. Participants often experience an improved level of functioning during the rehabilitation period. The main goal of pulmonary rehabilitation is to make permanent lifestyle changes. This includes increasing physical activity, a diet adapted to everyday needs, personalised medication, and, if relevant, help to stop smoking. Rehabilitation of persons with COPD has proven to have long-term positive effects on their level of physical functioning and quality of life (Puhan et al. 2016; Spruit et al. 2013).

It is challenging to gain a full overview of the rehabilitation services available to persons with COPD in Norway. The content of rehabilitation services varies considerably, and rehabilitation is organised by different providers in different hospital referral areas. There are no diagnosis or procedure codes that are specific to pulmonary rehabilitation in connection with COPD. This also makes it a challenge to distinguish between specific pulmonary rehabilitation and more general rehabilitation measures. As regards rehabilitation in general, some health trusts and private rehabilitation institutions have been miscoding day patient treatment as inpatient treatment for years (Mangerud et al. 2016). The extent of such miscoding in relation to pulmonary rehabilitation for COPD in 2015 is uncertain, but we have chosen not to distinguish between day patient and inpatient rehabilitation in our main analyses. Only the departments and private rehabilitation institutions that offered pulmonary rehabilitation for persons with COPD in 2015 are included in the analyses. This minimises

[1]Escalation plan for habilitation and rehabilitation:: Opptrappingsplan for habilitering og rehabilitering (2017–2019)

the risk of the sample including activities other than pulmonary rehabilitation for COPD. However, it is highly likely that the concrete content of pulmonary rehabilitation services differs significantly between locations.

7.1 Sample and definitions

Data source: Data from the Norwegian Patient Registry (NPR) on outpatient contacts, day patient treatments and inpatient stays at public somatic hospitals and private rehabilitation institutions under a contract with a regional health authority. Due to inconsistent coding practices over a period of several years (Mangerud et al. 2016; Rønningen et al. 2016), only data for 2015 are included in the analyses concerning rehabilitation.

Sample: Persons aged 40 years and older with COPD. COPD is defined by the ICD-10 codes J40.x-J44.x (bronchitis, emphysema and COPD) as the primary or secondary diagnosis. Appendix G shows the number of day patient treatments (Table G.3, page 92) and inpatient stays (Table G.4, page 93) for rehabilitation coded with the relevant ICD-10 codes. Information about the municipality number or the patient's personal identity number was not missing for any of the episodes of care.

Only activities at hospital departments and private rehabilitation institutions that offered pulmonary rehabilitation for persons with COPD in 2015 (Table H.1, page 96 and Table H.2, page 97 in Appendix H) are included.[2] Activities at the relevant hospital departments must also be coded with at least one of the following codes:

- The ICD-10 code
  - Z50.x *Care involving use of rehabilitation procedures* as a primary or secondary diagnosis
- The procedure codes
  - A0099 *Group-oriented patient education* (Norwegian special code)
  - OBAB00 *Physical exercise with guidance and instruction*
  - WPCK00 *Coping and learning activities relating to the condition in question*
- Outpatient contact carried out by a physiotherapist or occupational therapist

Day patient treatments: Episodes where a patient was admitted and discharged on the same day.

Inpatient treatment: Episodes where a patient was admitted for at least one night.

Public and private treatment providers: Treatment at public hospitals, including Lovisenberg, Diakonhjemmet and Haraldsplass hospitals, is defined as 'public'. Treatment at private rehabilitation institutions under a contract with a regional health authority is defined as 'private'.

[2] Based on information received from the regional health authorities.

7.2 Findings

7.2.1 Pulmonary rehabilitation

A total of 1,343 women (0.10% of the female population) and 1,181 men (0.09% of the male population) aged 40 years or older with COPD participated in pulmonary rehabilitation (Figure 7.1 and Figure 7.2). Four out of five were aged 60 years or older. About 0.13% of all women and 0.21% of all men aged 75 years or older participated in pulmonary rehabilitation for COPD in 2015.

Table 7.1 shows unadjusted figures per year for persons with COPD who participated in pulmonary rehabilitation as day patient treatment or inpatient treatment in 2015.

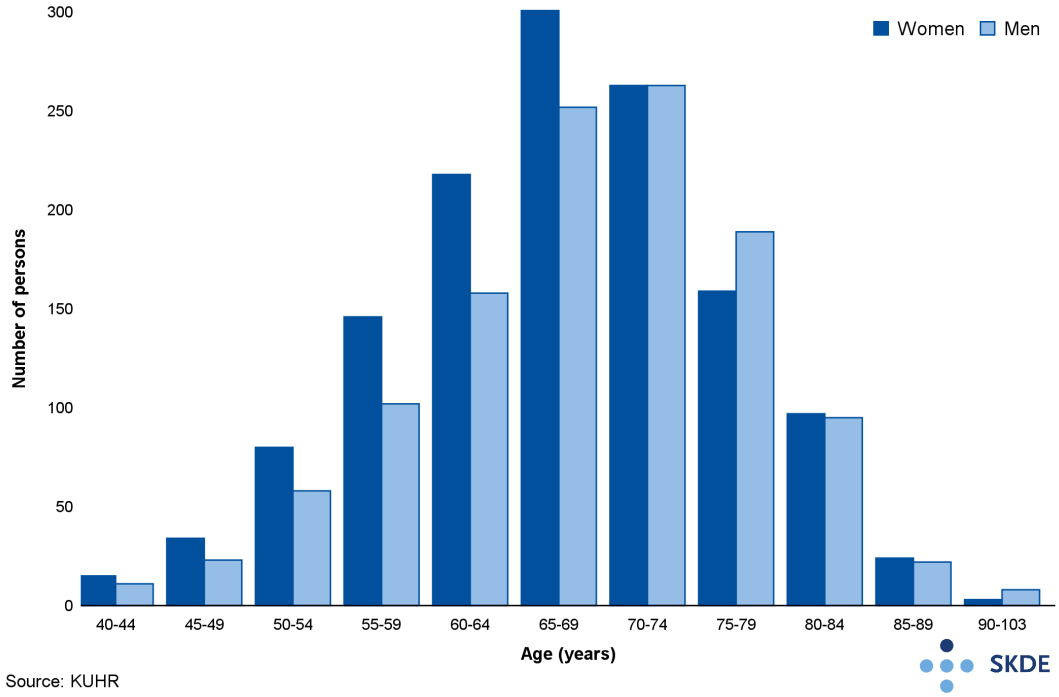


Figure 7.1: The number of persons who participated in pulmonary rehabilitation in 2015.

Table 7.1: The number of persons with COPD who participated in pulmonary rehabilitation in 2015.

	Private	Public	At least one alternative
Day patient treatment			
Persons, n[a]	59	759	813
Day patient treatments in total, n	821	6,561	7,382
Day patient treatments per person, n	13.9	8.6	9.1
Inpatient treatment			
Persons, n[a]	604	1,198	1,789
Rehabilitation days in total, n	15,073	27,360	42,433
Rehabilitation days per person	25.0	22.8	23.7

[a] Some people participated in both private and public pulmonary rehabilitation, and some received both day patient and inpatient treatment. The figures in the table are therefore not directly comparable with the figures in Figure 7.3 which does not distinguish between day patient and inpatient treatment.

In Norway, 10 persons per 10,000 population participated in pulmonary rehabilitation for COPD in 2015 (Figure 7.3). The number varied from 18 per 10,000 population in St. Olavs Hospital's

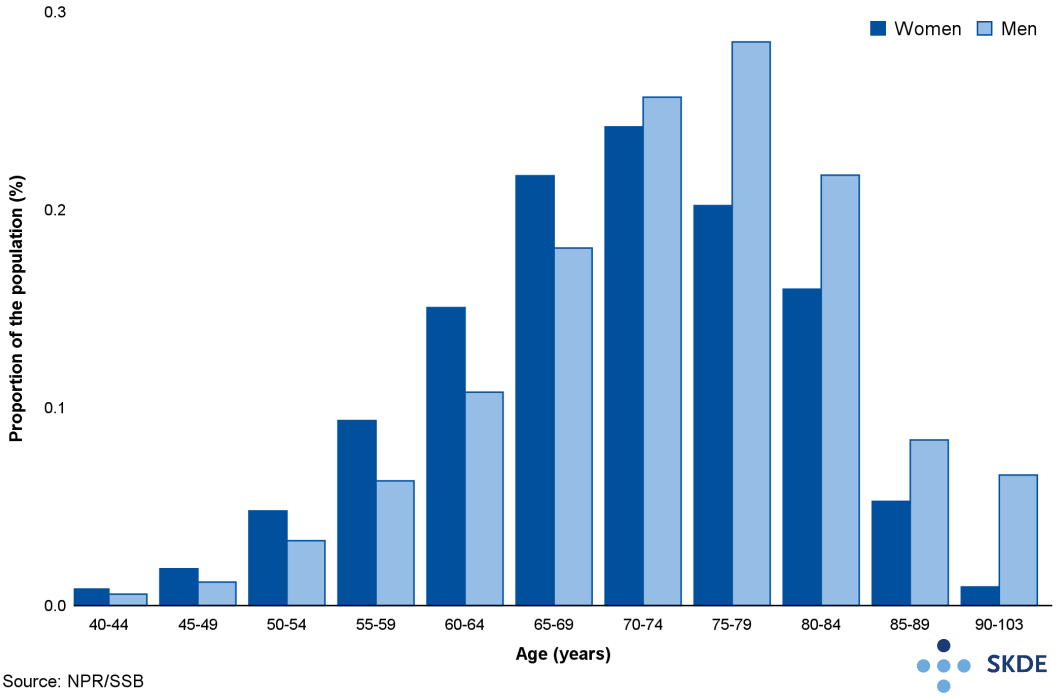


Figure 7.2: Persons who participated in pulmonary rehabilitation in 2015 as a percentage of the population.

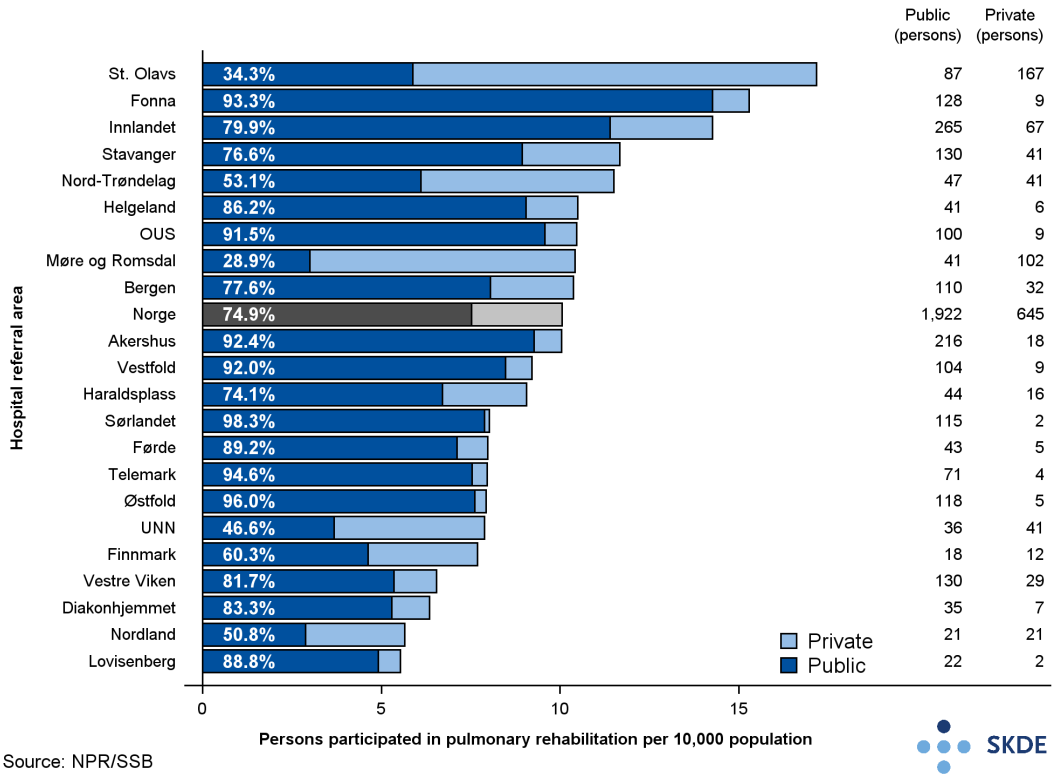


Figure 7.3: The number of persons who participated in pulmonary rehabilitation in 2015 broken down by public or private treatment provider. The bars show the figures standardised by gender and age per 10,000 population.

referral area to 6 per 10,000 population in Lovisenberg's referral area. Of all persons with COPD who participated in pulmonary rehabilitation, 74.9% received this treatment at a public hospital. The proportion varied from 28.9% in Helse Møre og Romsdal hospital referral area to 98.3% in Sørlandet Hospital's referral area.

7.3 Comments on the findings

The analyses of rehabilitation should be interpreted with caution. They assume that the regional health authorities have provided accurate information about which departments and private rehabilitation institutions provided pulmonary rehabilitation for persons with COPD in 2015. The analyses also assume that rehabilitation has been coded in such a way that it falls within the sample criteria. Moreover, it is important to be aware that not all rehabilitation programmes comprise the same activities, and therefore they are not all equally effective. Since the numbers are so small, random variation can have a considerable impact. Gender and age standardisation can also result in uncertain estimates when numbers are small. In these analyses, however, the difference between the standardised and unstandardised estimates is very small. Despite these reservations, the analyses yield important information about geographical variation in rehabilitation services for persons with COPD. The analyses are based on data from 2015, but there is generally little variation from one year to the next. Most hospital referral areas offer the same pulmonary rehabilitation services in 2017 as they did in 2015.

There was significant geographical variation in how many persons per 10,000 population participated in pulmonary rehabilitation for COPD in 2015 (Figure 7.3). For most hospital referral areas, there was little correlation between the incidence of lung cancer (Figure A.1, page 72) and participation in pulmonary rehabilitation for COPD (Spearman's rho=-0.058). It is especially striking that the hospital referral areas of Finnmark Hospital and Lovisenberg had high expected COPD prevalence and low participation in pulmonary rehabilitation. Correspondingly, St. Olavs Hospital's referral area had a relatively low expected prevalence of COPD and the highest participation in pulmonary rehabilitation.

The use of pulmonary rehabilitation services does not necessarily reflect their availability. Some persons with COPD turn down concrete offers of rehabilitation for various reasons, including a feeling of guilt, fear of being judged by others, low self-esteem, or a reluctance to ask for or receive help (Harrison et al. 2015).

Pulmonary rehabilitation is one of the few measures for COPD that improve quality of life and reduce the need for hospital admissions without undesirable side effects (Puhan et al. 2016; Spruit et al. 2013). Establishing and developing rehabilitation services for persons with COPD is a measure with the potential to reduce the number of emergency admissions.

Chapter 8

Discussion

There are no reliable statistics for the prevalence of COPD in Norway, but population surveys indicate that at least 200,000 adults suffer from this condition (Vollmer et al. 2009; Hvidsten et al. 2010; Waatevik et al. 2013; Leivseth 2013). In the COPD Healthcare Atlas, we found that 25% of these people (49,000 persons) were in contact with their regular GP or the emergency primary healthcare services, 10% (20,600 persons) had outpatient contact with the specialist health service, and 5% (10,500 persons) were admitted as emergency cases for COPD per year during the period 2013-2015. This shows both that COPD is an underdiagnosed condition and that persons diagnosed with COPD have a considerable need for health services.

Nor do we have reliable national figures for how the prevalence of COPD is developing. The prevalence of COPD is strongly related to tobacco smoking. The sharp drop in the number of daily smokers over the past 20 years might give reason to expect a reduced prevalence of COPD and a corresponding decrease in the use of health services. We did not find a general reduction in this patient group's use of health services from 2013 to 2015, however. On the contrary, we saw a slight increase in the use of regular GP and outpatient clinic services. Studies show that the amount of resources spent on COPD is unlikely to decrease in the near future, and that the primary cost driver is emergency admissions for COPD exacerbations (Nielsen et al. 2009).

8.1 Limitations in the basic data and method

There are challenges associated with analysing historical register data. The coding systems are modified from one year to the next, coding practices and coding cultures vary, and there is a risk of miscoding upon registration. Thorough quality assurance, adaptation and harmonisation of the data are required before and during the analysis work. In the COPD Healthcare Atlas, thorough work has gone into defining the samples in such a way that data from different treatment institutions are comparable. The details for each sample are provided in separate sub-chapters under each topic. The reference group has provided important input that has resulted in significant adjustments from the first preliminary samples to the final samples presented in this report. For example, preliminary analyses showed that persons with COPD in one hospital referral area had 3.7 outpatient contacts with public hospitals per year, while the national average was 1.7. A thorough check of the data showed that a lot of the activity apparently coded as ordinary outpatient contacts was actually rehabilitation. This is the basis for excluding rehabilitation-like activities from the analyses of outpatient services. Identifying rehabilitation in data from NPR is a particularly challenging exercise. The main problem is that rehabilitation is not always coded using rehabilitation codes, and there are big differences in coding practices between different treatment institutions. Therefore,

the sample for Chapter 7 *Rehabilitation* was defined by contacting the regional health authorities to request information about which departments and private rehabilitation institutions offered pulmonary rehabilitation for persons with COPD in 2015. Without this information, it would have been impossible to define a sample of persons who had undergone pulmonary rehabilitation.

The analyses concerning the use of regular GP (RGP) and emergency primary healthcare services are based on aggregate data from the KUHR (control and payment of reimbursements to health service providers) database. It was not possible for us to quality assure these data ourselves, and we had to trust the quality assurance carried out by others. There is general uncertainty about the quality of diagnosis coding in KUHR. Some computer systems will automatically register the diagnosis from the preceding consultation if it is not overwritten by a new diagnosis, and there may be limitations on the number of diagnoses reported to KUHR. In the COPD Healthcare Atlas, we included persons registered with the diagnosis COPD by an RGP or the emergency primary healthcare services at least once during the course of a year. We therefore assume that we have identified the vast majority of persons who have actually consulted their GP or the emergency primary healthcare services for COPD during the year. The greatest element of uncertainty is how many of the consultations in the year in question were actually due to COPD. Some persons with mild COPD will not need to contact their GP for their COPD every year. This means that there will be persons in Norway diagnosed with COPD who are not included in the 49,000 persons per year who were in contact with RGPs or the emergency primary healthcare services for COPD.

Patients' diagnoses are registered in health institutions' computer systems using codes from medical coding systems such as ICD-10 and ICPC-2. Register data, which are retrieved from these computer systems, do not contain information about the basis for the registered diagnoses. When the data contain a code for COPD, we must assume that a doctor has diagnosed the patient in question with COPD, but we have no possibility of verifying the doctor's assessments. Patients undergoing assessment will be registered with a temporary diagnosis. This diagnosis can then be confirmed or disproven on the basis of, e.g., test results. Since COPD is a chronic disease with objective diagnostic criteria, it is unlikely that the data contain a high number of patients mistakenly registered with a code for COPD.

Coding practices for emergency admissions for COPD exacerbations vary between Norwegian hospitals. For example, a lower respiratory tract infection in a person with COPD can be coded with the code for pneumonia or lower respiratory tract infection as the primary diagnosis combined with the code for COPD as a secondary diagnosis, or only with the code for COPD with acute lower respiratory tract infection as the primary diagnosis. Previous versions of the rules and guidelines for the use of clinical coding systems in the specialist health service[1] have not been unambiguous as regards how COPD exacerbations should be coded, and miscoding occurs. In the COPD Healthcare Atlas, we wish to describe hospital activities regardless of whether the coding is in accordance with the coding rules. We want to identify all persons who have been admitted as emergency cases for COPD. That is why we have included alternative ways of coding the same clinical condition (Table G.2, page 92). As a result, the number of persons admitted as emergency cases for COPD is higher in the COPD Healthcare Atlas than in other sources that only include admissions where COPD is coded as the primary diagnosis.

Defining the samples that describe the use of GP services and specialist health services for COPD has been a demanding process. We believe that our endeavours to minimise systematic errors have ensured that the findings presented are reliable. Random errors are probably evenly distributed and are unlikely to affect the comparisons between hospital referral areas.

As regards the primary healthcare service, we only have data for the use of RGP and emergency

[1] Coding rules: Regelverk og veiledning for bruk av kliniske kodeverk i spesialisthelsetjenesten 2017

primary healthcare services. The primary healthcare service also provides other services for persons with COPD, for example physiotherapy, municipal rehabilitation services, home care services and nursing home services.

The COPD Healthcare Atlas does not give a complete picture of the services that the primary healthcare service provides for persons with COPD.

The COPD Healthcare Atlas presents the observed variation in the use of health services. We describe probable connections, but cannot draw definite conclusions about cause and effect. It is therefore desirable that future research projects examine the reasons for the observed variation and map the quality of treatment available in different locations in Norway.

8.2 Unwarranted variation?

COPD is diagnosed and treated by both the primary healthcare service and the specialist health service. This can give rise to challenges when it comes to interpreting findings, since the division of functions between the primary healthcare service and the specialist health service is unlikely to be identical in all the hospital referral areas. We are not aware of any systematic differences between hospital referral areas in this division of functions, however. When interpreting the findings, it should nevertheless be taken into account that variation that can appear unwarranted at first glance may be perfectly rational if it is a result of an intentional division of labour.

For the COPD Healthcare Atlas, we cannot assume that the underlying prevalence of the disease is uniform throughout Norway, as we could for the previous healthcare atlases[2]. We have used the incidence of lung cancer as an indirect measure of the prevalence of COPD, since both conditions are strongly related to prolonged smoking. We have examined the correlation between the incidence of lung cancer and the use of health services for COPD in different hospital referral areas. The correlation between the incidence of lung cancer and the number of persons with COPD per 10,000 population who consulted their RGP or the emergency primary healthcare services (Spearman's rho=0.75), had outpatient contact for COPD (Spearman's rho=0.54), and had emergency admissions for COPD (Spearman's rho=0.52) is strong. This indicates that differences in the underlying prevalence of COPD explain some of the variation observed in the use of health services. The findings must be interpreted with caution, and assessments of whether observed variation is unwarranted must take into account that the prevalence of COPD differs between hospital referral areas.

8.2.1 Outpatient services

For most hospital referral areas, there was a high level of correspondence between the expected prevalence of COPD and the number of persons per 10,000 population who had had outpatient contact with the specialist health service for COPD (Figure 5.3, page 32 and Figure A.1, page 72). The hospital referral areas of Østfold Hospital and Helse Stavanger, on the other hand, had a relatively high incidence of lung cancer and relatively few persons per 10,000 population who had outpatient contact for COPD. This suggests that the prevalence of COPD is probably not the sole explanation for the variation between hospital referral areas, and that there might be some unwarranted variation in the use of outpatient services for COPD.

[2]Helseatlas: www.helseatlas.no

8.2.2 Spirometry

Spirometry is the most important examination in COPD assessment and monitoring. According to the national guidelines, the patients' lung function should be measured by their GP at least once a year (Norwegian Directorate of Health 2012). We expect COPD patients to have the same need for and to benefit equally from having their lung function measured regardless of where they live. However, the proportion of COPD patients who had been given a spirometry examination by their GP in the past year varied considerably between hospital referral areas (Figure 4.6, page 27). More than twice as large a proportion of COPD patients had their lung function measured during the course of a year in Vestfold Hospital's referral area as in Finnmark Hospital's referral area. This indicates unwarranted variation that reflects differences in the quality of follow-up that persons with COPD receive from their regular GPs.

In the specialist health service, 84.2% of all patients who had outpatient contact for COPD had a spirometry examination during the year (Figure 5.6, page 35). There was little variation between hospital referral areas, but a significantly higher proportion of patients had their lung functions measured at specialists in private practice under public funding contracts (95.0%) than in hospitals (78.4%). If some of the check-ups currently carried out in the specialist health service are to be taken over by RGPs, the use of spirometry in RGP practices must be increased.

8.2.3 Emergency admissions

There are many emergency admissions for COPD. More than 10,500 patients triggered a total of nearly 17,000 emergency admissions per year (Chapter 6 *Emergency admissions*). Preventing COPD exacerbations is an important part of the effort to reduce the number of emergency admissions. The analyses indicate that frequent outpatient contacts do not prevent emergency admissions, since there is little or no correlation between outpatient contacts and emergency admissions (Spearman's rho=0.2).

It is an interesting finding that the known higher frequency of emergency admissions for COPD in winter was significantly less pronounced in the winter 2013/2014 than in the preceding and following winters (Figure 6.3, page 40). The frequency hardly increased at all during that year's flu season. Influenza activity was unusually low in Norway that winter, and there were few notifications of flu outbreaks in health institutions and nursing homes (Hauge et al. 2014). This could indicate that more focus on influenza vaccination of persons with COPD could be useful in preventing COPD exacerbations, and a recently published systematic review supports this conclusion (Bekkat-Berkani et al. 2017).

If the threshold for emergency admission for COPD were uniform throughout Norway, it would be reasonable to expect the length of stays in different parts of Norway to be more or less identical. The number of bed days per emergency admission for COPD does indeed not vary much either (Figure 6.6, page 43). Nevertheless, a variation from 7.1 bed days in Finnmark Hospital's referral area to 5.3 bed days in Sørlandet Hospital's referral area is not insignificant given that the availability of emergency beds is currently under pressure. It would also be natural to expect little variation in the treatment provided, but our analyses show the opposite to be the case. The proportion of emergency admissions where ventilation support was administered varied from 13.7% in the OUS hospital referral area to 26.4% in Vestfold Hospital's referral area (Figure 6.8, page 45). This variation can hardly be explained by differences in patient composition alone, and must be therefore be regarded as unwarranted.

On average, 29.3% of all primary admissions were followed by a readmission within 30 days (Figure 6.9, page 45). In general, there was little variation between hospital referral areas. The excep-

tion was Lovisenberg, which had a somewhat higher readmission rate. Nor was there any significant variation in mortality following emergency admissions for COPD, which was 11.9% after 30 days and 28.4% after 365 days for Norway as a whole (Figure 6.10, page 46). The high proportion of patients who were readmitted or died shortly after a hospital stay reflects the fact that persons admitted as emergency cases for COPD are seriously ill.

8.2.4 Rehabilitation

Pulmonary rehabilitation is one of the few measures for COPD that improve quality of life and reduce the need for hospital admissions without any undesirable side effects (Puhan et al. 2016; Spruit et al. 2013). There was considerable variation between hospital referral areas in terms of how many persons with COPD per 10,000 population had undergone pulmonary rehabilitation (Figure 7.3, page 54), and there was no correlation between the incidence of lung cancer and participation in pulmonary rehabilitation (Spearman's rho=-0.058). Despite the fact that we must be cautious when interpreting these findings because the numbers are small and it is challenging to gain an overview of the rehabilitation services available to persons with COPD, there can be little doubt that there is unwarranted variation between hospital referral areas in pulmonary rehabilitation for COPD.

8.3 Developments in the prevalence of COPD

It is difficult to estimate the need for health services for COPD in future. During the period 2013-2015, nine out of ten persons admitted as emergency cases, four out of five who attended outpatient clinics and two out of three who consulted their RGP or emergency primary healthcare services for COPD were aged 60 years or older. Figure 8.1 shows population projections for the age groups 40-59, 60-74 and 75 years and older based on estimates from Statistics Norway.[3] Even though Norway will have more elderly people in future, we cannot expect a corresponding increase in the number of persons with COPD. One of the reasons for this is the great change in smoking habits and exposure to other forms of pollution during the past 40 years. In 1973, 42% of persons between the ages of 16 and 74 years were daily smokers, and 9% smoked occasionally.[4]. The corresponding percentages for 2016 were 12% and 9%, respectively. Figure 8.2 shows how the Norwegian population's smoking habits have changed since 1973. The fact that fewer people smoke is expected to have a significant effect on the future prevalence of COPD. Since COPD is usually the result of long-term exposure to tobacco smoke or other forms of pollution, it may take decades before the changes in smoking habits are reflected in the use of health services for COPD. The analyses in this healthcare atlas show a slight increase in the number of persons with COPD seen by RGPs, emergency primary healthcare or outpatient services, and in the number of persons with COPD admitted to hospital as emergency cases from 2013 to 2015. This could indicate that the reduction in smoking has yet to have a noticeable effect on the prevalence of COPD.

[3]The population projection figures are taken from Statistics Norway ('Table 11168: Projected population on 1 January, by gender and age, in nine alternatives' and Tønnessen et al. (2016)), where the projections are based on different scenarios as regards fertility rates (Syse et al. 2016a), life expectancy (Syse et al. 2016b), and immigration and emigration (Cappelen et al. 2016).

[4]Smoking habits: https://www.ssb.no/royk

[5]The medium (main) alternative is based on medium development in fertility, life expectancy and immigration. The figures for 'weak ageing' are based on high fertility, a slight increase in life expectancy and high immigration. 'Strong ageing' is based on a considerable increase in life expectancy, low fertility and low net immigration.

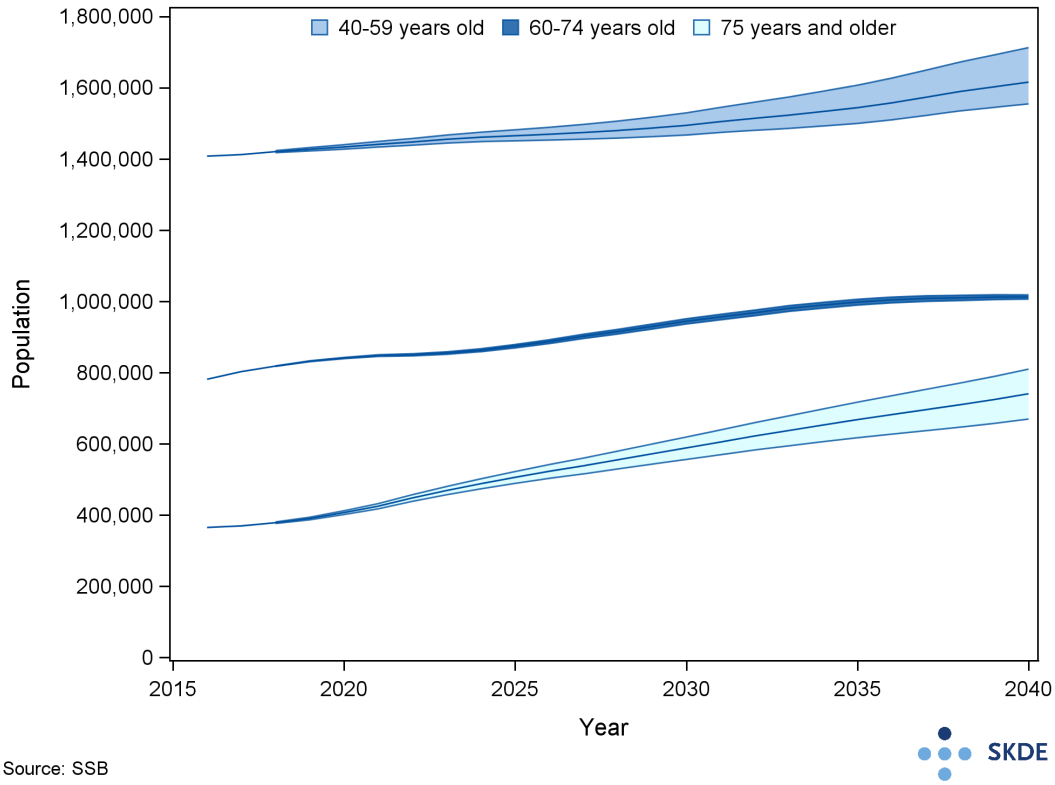


Figure 8.1: The population in the age groups 40-59 years (light blue), 60-74 (dark blue) and 75 years and older (turquoise) from 2017 to 2040 based on estimates from Statistics Norway. The population projections are divided into the scenarios 'strong ageing' (top line), 'weak ageing' (bottom line) and a medium alternative (middle line).[5]

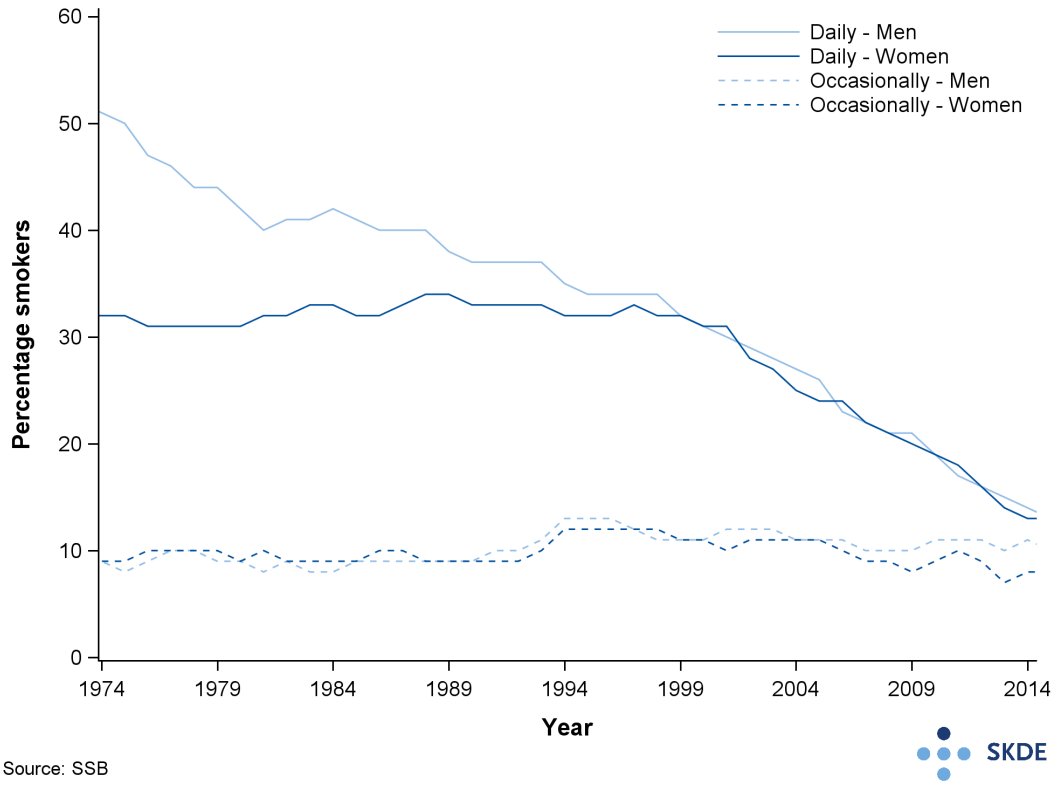


Figure 8.2: Smoking habits among men and women from 1973 until 2016. Statistics Norway's Table 05307.

8.4 Summary

- Spirometry is the most important examination in COPD assessment and monitoring. At least one third of COPD patients had not had annual measurements of their lung function, despite the fact that national guidelines state that spirometry should be performed at least once a year. The findings show unwarranted variation between hospital referral areas in RGPs' use of spirometry.
- There were significantly fewer emergency admissions for COPD in winter 2013/2014 than in the preceding and following years. Influenza activity was unusually low in Norway that winter, and there were few notifications of flu outbreaks in health institutions and nursing homes. More focus on influenza vaccination of persons with COPD could be a useful preventive measure against COPD exacerbations that result in hospitalisation.
- Ventilation support is an effective form of treatment for severe COPD exacerbations. The findings show unwarranted variation in the proportion of emergency admissions for COPD where ventilation support was provided.
- Persons admitted as emergency cases for COPD are seriously ill. Just under one third of these patients were readmitted within 30 days, and more than a quarter of the readmissions were related to conditions other than COPD. Nearly one third of such patients died within one year. The degree of severity serves as a reminder of the importance of good follow-up upon discharge and of close cooperation between the primary healthcare and specialist health services.
- Pulmonary rehabilitation is one of the few measures for COPD that improve quality of life and reduce the need for hospital admissions without any undesirable side effects. The findings suggest that there is unwarranted variation in the provision and use of pulmonary rehabilitation for COPD.

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Appendices

Appendix A

Incidence of lung cancer as an indirect measure of the prevalence of COPD

There are currently no official figures showing how many people suffer from COPD in different geographical areas of Norway. Since COPD is related, among other things, to smoking habits and pollution, its prevalence is probably not evenly geographically distributed in the Norwegian population. The COPD Healthcare Atlas presents the observed variation in the use of health services. For it to be possible to assess whether the observed variation is warranted or not, we need to know the geographical distribution of COPD.

Prolonged smoking is one of the main causes of COPD. Nor are good figures available for smoking habits over time in different geographical areas of Norway. However, there are good figures for new cases, or the incidence, of lung cancer, which is also strongly related to prolonged smoking. The figures from the Cancer Registry of Norway have been adapted by the Norwegian Institute of Public Health in its municipal health statistics databank[1]. The gender-adjusted and age-adjusted data for new lung cancer cases per 100,000 population per year in the period 2006-2015 for all municipalities and counties in Norway, as well as for city districts in Oslo and Bergen, were downloaded from this statistics databank. For municipalities for which information about new lung cancer cases was missing, the figures for the county where the municipality is located were used. In order to estimate the number of new lung cancer cases per year per 10,000 population in the health trusts' hospital referral areas, the figures from the Cancer Registry were adjusted in relation to the population of municipalities and city districts and aggregated per 10,000 population.

The geographical distribution of the incidence of lung cancer is an expression of smoking-related morbidity and can be used as an indirect measure of the geographical distribution of the prevalence of COPD (Figure A.1). These figures form the backdrop to interpreting variations in the use of health services for persons with COPD.

[1] Municipal health statistics databank: khs.fhi.no/webview/

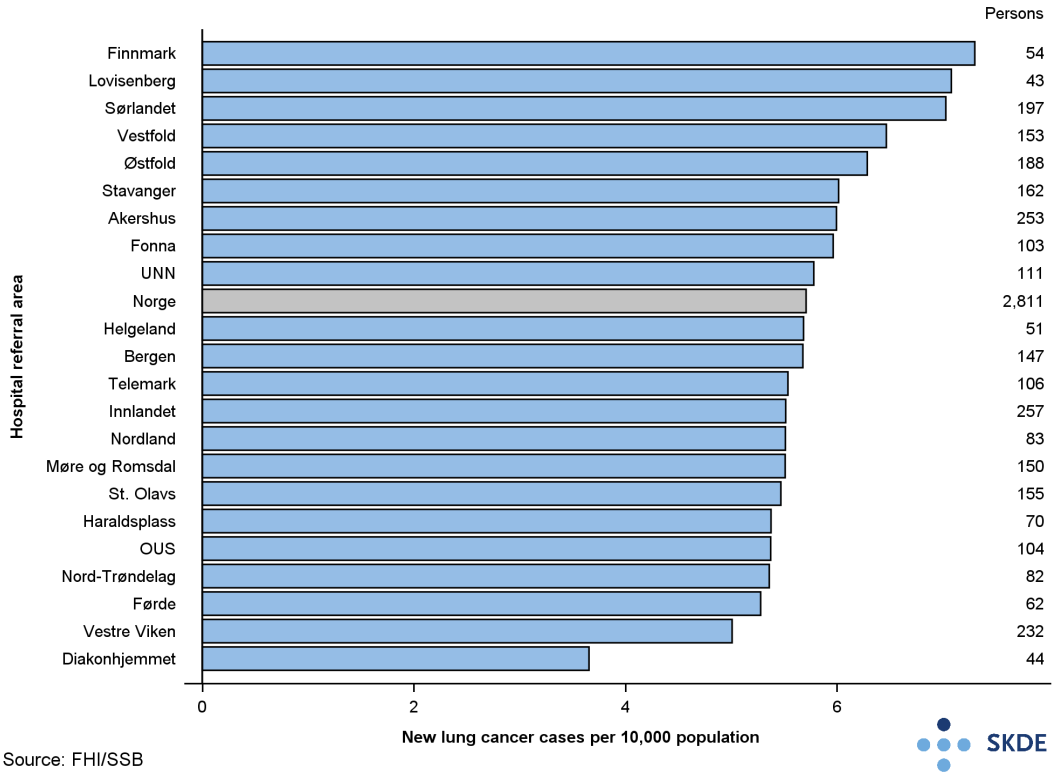

Figure A.1: Average number of new lung cancer cases per 10,000 population per year during the period 2006–2015. The column shows the average number of new lung cancer cases per year.

Appendix B

Chronic obstructive pulmonary disease

B.1 Definition and severity

According to the international Global Burden of Disease Study, chronic obstructive pulmonary disease (COPD) was the world's third most frequent single cause of death in 2015 (Wang et al. 2016), and the World Health Organization has calculated that COPD will still hold this position in 2030.[1]. It is nevertheless difficult to give a specific description of precisely what COPD is (Rabe and Watz 2017). COPD is a collective term for conditions that obstruct airflow out from the airways. Conditions that partly overlap with this diagnosis include chronic bronchitis, emphysema and asthma. Several possible definitions exist: The official Norwegian guidelines from 2012 (Norwegian Directorate of Health 2012) were based on the version of the guidelines from the Global Initiative for Chronic Obstructive Lung Disease (GOLD) in force at the time. GOLD describes COPD as a disease that is characterised by persistent respiratory symptoms and airflow limitation caused by exposure to noxious gases and particles (GOLD 2017). The condition is both preventable and treatable. What is not clearly stated in this definition is that the exposure to agents harmful to the airways must have been of a sufficient extent to damage the lung tissue. In practice, this means that COPD is rarely a relevant diagnosis for persons under the age of 40. The exceptions to this rule are persons with a genetic predisposition, for example alpha-1-antitrypsin deficiency, and persons who have been subject to particularly extensive harmful airway exposure. Other diagnoses must always be considered when diagnosing a patient with COPD. Cardiovascular diseases, in particular, have many of the same risk factors and symptoms as COPD.

Lung function measurement using a spirometer is necessary in order to diagnose and assess morbidity associated with COPD (GOLD 2017). A spirometer measures the volume and speed of air the patient can exhale after having fully filled his or her lungs with air. Persons with COPD exhale less than 70% of the volume it is possible for them to exhale within the first second. In medical terminology, a patient is described as having an obstructive spirometry pattern if *Forced Expiratory Volume in the first second (FEV1) / forced vital capacity (FVC)* < 0.7. The spirometry examination should preferably be repeated, ideally after a bronchodilator has been administered. Such medication will often normalise the impaired lung function of patients with asthma, and the test can thereby be used to distinguish between COPD and asthma.

There are also several other conditions that may impair lung function. This means that spirometry

[1] WHO Projections of mortality and causes of death: http://www.who.int/healthinfo/global_burden_disease/projections/en/

alone is not sufficient to diagnose a patient with COPD or to decide the correct treatment. Most persons with COPD have been exposed to substances that are harmful to the airways, either in the form of tobacco smoke or other air pollution. If this is not the case, alternative diagnoses should be considered. Normal ageing will in itself reduce the airflow speed. Elderly patients' spirometry values can therefore be similar to those of persons with COPD. It is important to take sufficient account of the overall symptoms, other diseases and risk factors for developing COPD in order to avoid misdiagnosing healthy elderly people.

COPD occurs with different degrees of severity. Persons with mild COPD may experience such vague symptoms that they do not seek medical help, and may therefore be unaware that they have COPD. In severe cases, COPD can seriously impair the patient's level of functioning because of breathing difficulties. Traditionally, COPD has been graded on the basis of spirometry alone, but, in recent years, greater emphasis has been placed on the overall symptoms and the number of exacerbations during the past year (GOLD 2017). The international expert community is working on developing even better ways of grading COPD that can take greater account of differences in patients' health situation, for example diagnostic imaging, blood tests, and microorganisms in the airways and lungs.

B.2 Symptoms, exacerbations and other diseases

COPD causes a range of different symptoms, but not all persons with COPD exhibit all the symptoms (GOLD 2017). Shortness of breath is one of the main symptoms. In mild cases, breathlessness is often only a problem in connection with physical activity. Patients with severe COPD can experience shortness of breath even at rest. Many persons with COPD also have a chronic cough that may be accompanied by bothersome amounts of mucus. The disease often leads to secondary problems such as anxiety, depression, nutritional problems, weight loss, muscle wasting and fatigue (GOLD 2017; Corlateanu et al. 2016).

Episodes of increased respiratory problems, known as COPD flare-ups or exacerbations, are another characteristic of COPD. These episodes often take the form of increased shortness of breath, coughing and mucus production. A COPD exacerbation often requires intervention, and exacerbations are often categorised on the basis of the intensity of these measures (Norwegian Directorate of Health 2012). COPD exacerbations are discussed in more detail in Chapter 6 *Emergency admissions*.

Persons with COPD often have concomitant diseases (GOLD 2017; Corlateanu et al. 2016). The risk factors for developing COPD are the same as for cardiovascular diseases, and persons with COPD are at increased risk of coronary disease such as heart attacks and angina, heart failure and arrhythmia. Persons with COPD also often have other diseases, such as diabetes, osteoporosis, sleep apnoea and mental health problems. Persons who develop COPD are also at increased risk of developing lung cancer, regardless of the extent of tobacco smoking (Houghton 2013).

B.3 Prevalence of COPD

COPD is a very common condition both in Norway and in the rest of the world (Corlateanu et al. 2016; Brown and Martinez 2016; Tockman et al. 1987). Calculations show that 11.7% of the world's population aged 30 years and older had COPD in 2010 (Adeloye et al. 2015). The COPD Healthcare Atlas contains figures showing how many persons have been in contact with the health service for COPD, but there are many persons with undiagnosed COPD who have neither been

assessed nor treated by the Norwegian health service. Several population surveys have looked into COPD in Norway. The biggest ones are the Nord-Trøndelag Health Study (the HUNT Study)[2], the Hordaland Health Studies (the HUSK study)[3] (Buist et al. 2007) and the Tromsø Study[4]. Many people have undergone spirometry examinations, including persons with healthy lungs and persons with respiratory tract symptoms. The population surveys have used different criteria for the diagnosis COPD, which reflects the discussions in the international expert community of the diagnostic criteria for COPD (GOLD 2017). For example, spirometry has been carried out both with and without medication being inhaled in advance, and the degree to which other conditions and/or symptoms are emphasised varies. The different studies show that between 4 and 20% of the adult population have spirometry values consistent with COPD (Vollmer et al. 2009; Hvidsten et al. 2010; Waatevik et al. 2013; Leivseth 2013). Taking into consideration that some studies underdiagnose COPD while other overdiagnose it, it is a reasonable estimate that at least 8% of the approximately 2,500,000 persons aged 40 years or older in Norway actually suffer from COPD. That corresponds to at least 200,000 people.

Even though the Norwegian population studies are of high quality, like all studies, they have some flaws. Firstly, it is difficult to create a representative sample of the population, particularly in terms of geography and socioeconomic factors. Secondly, population surveys tend to underestimate the importance of a clinical diagnosis. Population studies of COPD are based solely on spirometry, for example. Some of the participants with spirometry values consistent with COPD have not been given, and perhaps should not be given, a clinical diagnosis. Even though some of them display symptoms, it is not possible to know for certain whether they actually have COPD based on the data from the population survey.

B.4 Mortality, costs and sickness absence

COPD is Norway's third most common cause of death after cardiovascular diseases and cancer[5]. The Norwegian Cause of Death Registry has previously estimated that 2,000 deaths per year are caused by COPD[6], but this is an uncertain estimate. Even among persons with severe COPD, half of the deaths have a cause other than COPD (Calverley et al. 2007; Jensen et al. 2006). The risk of dying from COPD depends on how severe it is. A person with mild COPD without significant symptoms will have a virtually normal life expectancy, while persons with such severe COPD that they sometimes need to be hospitalised will be at significantly increased risk of dying (Soler-Cataluna et al. 2005; Vanasse et al. 2017). Both international literature and data from the National Register for Patients with Chronic Obstructive Pulmonary Disease have shown that fewer than half of the persons admitted as emergency cases for COPD exacerbations are alive five years after their first admission (Govertsen et al. 2016; Chung et al. 2010).

The burden of disease associated with a condition can also be measured by studying its social costs. It has been estimated that the costs of treating COPD in Norway totalled NOK 1.1 billion in 2006 (Nielsen et al. 2011). However, this does not include what are known as productivity costs, or costs related to impaired work capacity. During the period in question, only 55% of persons with COPD between the ages of 40 and 67 years were in work (Erdal et al. 2014). The same study shows that, compared with persons without COPD and adjusted for age, gender, education and smoking habits, persons with COPD missed six extra work days per year. The productivity loss of persons

[2]HUNT: https://www.ntnu.no/hunt
[3]HUSK: https://husk.b.uib.no/
[4]The Tromsø Study: Tromsøundersøkelsen
[5]Causes of death for 2014: https://www.fhi.no/nyheter/2015/dodsarsaker-for-2014-kreft-stabilt-/
[6]Statistics Norway's causes of death for 2012: https://www.ssb.no/helse/statistikker/dodsarsak/aar/2013-11-01

with COPD who had been treated by the specialist health service was more than 50% higher than that of other persons with COPD.

B.5 COPD treatment in the primary healthcare service

Persons who suffer from shortness of breath or suspect that they might have COPD should contact their regular GP. Nearly all GP surgeries have the equipment required to make a fairly certain COPD diagnosis: a spirometer (to measure lung function), a pulse oximeter (to measure oxygen saturation in the blood), and an electrocardiograph (to measure the electrical activity of the heart with a view to detecting heart disease). Blood tests can help to determine the severity of COPD exacerbations.

The patient's regular GP can give advice on smoking cessation and other lifestyle changes. If necessary, the RGP can prescribe antibiotics, corticosteroids or other medication to relieve breathing difficulties. Patients who need to be hospitalised in connection with serious COPD exacerbations, or undergo outpatient assessment in the specialist health service, are usually referred by an RGP or the emergency primary healthcare services (Melbye et al. 2012).

Some municipalities offer rehabilitation with the focus on exercise, diet and smoking cessation. In recent years, municipalities have developed rehabilitation services for persons with COPD that partly correspond to services that have traditionally been provided by hospitals or private rehabilitation institutions. It is a political goal that a larger proportion of the rehabilitation services offered to persons with COPD should be provided by the municipalities.[7].

B.6 COPD treatment in the specialist health service

There is a clear distinction between emergency care and elective activities in the specialist health service's treatment of persons with COPD. In practice, exacerbations account for all emergency admissions for COPD, while elective admissions are rare except in connection with rehabilitation. Most patients with COPD exacerbations can be treated by their regular GP or the emergency primary healthcare services (Husebø et al. 2014). Sometimes, and particularly in people with very poor lung function or comorbidity, COPD exacerbations are so serious that they require hospital treatment. Supplementary oxygen may be required, and some patients also need non-invasive ventilation (NIV) where breathing support is provided via a facial mask (GOLD 2017). In rare cases, intubation under general anaesthesia and more extensive intensive care are necessary. In addition, many persons hospitalised for COPD exacerbations are treated with antibiotics, nearly all are given medication administered by inhalation to dilate the airways, and many receive corticosteroids to reduce inflammation of the airways. Endeavours are also made to facilitate rehabilitation and lifestyle changes, including increased physical activity, smoking cessation and improved nutrition.

The specialist health service also run comprehensive outpatient activities aimed at assessing persons with suspected COPD and optimising treatment. These services can also be provided by specialists in private practice under a contract with a regional health authority. The regional health authorities have a responsibility to provide the necessary health services to the population in their catchment area, but they are free to choose whether they wish to provide these services at their own hospitals or to buy them from specialists in private practice or other private providers.

The specialist health service is also responsible for offering rehabilitation to persons with COPD. The term rehabilitation can in practice be replaced by 'lifestyle change assistance', since the main

[7]Escalation plan for habilitation and rehabilitation:: Escalation plan for habilitation and rehabilitation (2017–2019)

goal is to prevent further deterioration and improve participants' health. In summary, the most important components of a rehabilitation programme are information about and guidance on smoking cessation, appropriate physical activity, improved diet and coping through insight in one's own disease (Spruit et al. 2013). The most important components are non-pharmacological measures, but rehabilitation programmes will often include a medication review and instruction in the correct use of medication. Rehabilitation programmes often last for several days or weeks. The rehabilitation stay is expected to have an effect in itself, but the main goal is to help the patients to help themselves and thereby make the lifestyle changes permanent. The term 'pulmonary rehabilitation' should be reserved for programmes that, as a minimum, include exercise, patient education and help to stop smoking, nutritional advice and psychosocial support (Norwegian Directorate of Health 2012). Such services should be provided by an interdisciplinary team that comprises at least a doctor, a nurse and a physiotherapist. Sufficient expertise and resources will normally only be available in the specialist health service. Pulmonary rehabilitation is provided at some hospitals and private rehabilitation institutions.

Appendix C

The National Register for Patients with Chronic Obstructive Pulmonary Disease

The National Register for Patients with Chronic Obstructive Pulmonary Disease (the COPD Register) was established as a local register in 2004, gaining national status in 2006, and it has been run as an electronic register since 2011[1]. As of October 2017, 16 Norwegian hospitals used the COPD Register.

The main purpose of the COPD Register is to improve and document the quality of the services provided to persons with COPD admitted to hospital with acute COPD exacerbations. The COPD Register is also intended to form a basis for COPD research and comparison of the health effects of different treatment regimes. The COPD Register includes persons with COPD exacerbations admitted to hospital registered with the ICD-10 codes *J44.0 Chronic obstructive pulmonary disease with acute lower respiratory infection* or *J44.1 Chronic obstructive pulmonary disease with acute exacerbation, unspecified*. If all health trusts had reported data, as they are obliged to, the COPD Register would have been a good sources of epidemiological data about persons with severe COPD. So far, the COPD Register does not include persons with COPD who only receive healthcare at outpatient clinics and/or are in a stable phase of the disease.

The COPD Register contains personal data such as age, sex, height, weight, smoking habits, other conditions and diseases, as well as the number of previous admissions for COPD exacerbations. Information about the municipality of residence and date of death is retrieved from the Central Population Register. The COPD Register also contains specific information about individual hospital admissions, including blood test values, whether antibiotics and respiratory support were necessary, blood gas values upon admission and discharge, symptoms that serve as a measure of health-related quality of life, pre-discharge spirometry and COPD-related pharmacological treatment after discharge. It is registered whether the patient has been checked for and received information about correct inhalation technique. Information about vaccination, smoking cessation and rehabilitation is also registered. Results from the COPD Register clearly show how serious a COPD exacerbation that requires hospital treatment is (Govertsen et al. 2016). The mortality exceeds that for heart attack and cancers, among other things. Moreover, results from the COPD Register show that many patients do not receive sufficient ventilation support during their hospital stay, and that many are discharged with too few or the wrong type of inhalation medication. In addition, too few patients

[1]The National Register for Patients with Chronic Obstructive Pulmonary Disease: https://www.kvalitetsregistre.no/registers/nasjonalt-register-kols

receive guidance on the correct use of medication for inhalation and help with lifestyle changes.

Unfortunately, the COPD Register's coverage is at present too low to provide figures for the prevalence of severe COPD in Norway or an adequate description of the quality of the treatment provided for serious COPD exacerbations. Nor is it possible to obtain relevant clinical information from sources other than the COPD Register. The COPD Healthcare Atlas provides information about the use of outpatient services, emergency admissions, rehabilitation and some forms of examination and treatment based on data from the Norwegian Patient Registry (NPR) and the KUHR (control and payment of reimbursements to health service providers) database, but most of the clinical information of relevance to measuring treatment quality is not available in these sources. Contributory causes of the low coverage include the requirement for informed written consent from each patient, data protection requirements that make it difficult to establish efficient IT solutions, and failure to give sufficient priority to quality and register work.

Appendix D

Data sources

D.1 The Norwegian Patient Registry

The main purpose of the Norwegian Patient Registry (NPR) is to provide a basis for the administration, management and quality assurance of the specialist health service (see the Norwegian Patient Registry Regulations[1]). NPR contains administrative information and health information about people who are waiting for or have received treatment by the specialist health service.[2] This includes data from public and private hospitals, private rehabilitation institutions and specialists in private practice under public funding contracts. Given the main purpose of NPR, only public activities are reported. Consequently, data from NPR contain no information about private activity in the specialist health service.

NPR has disclosed indirectly identifiable personal health data for the years 2012-2015 to SKDE pursuant to the Personal Health Data Filing System Act Section 20 under a licence from the Norwegian Data Protection Authority (ref. 15/00271-2/CGN and 16/00289-2/CGN). The permits are limited to activity data for the somatic specialist health service, including public and private hospitals, private rehabilitation institutions and specialists in private practice under public funding contracts. SKDE has no national data for referrals or mental healthcare. The authors have sole responsibility for the interpretation and presentation of the disclosed data. NPR has no responsibility for analyses or interpretations based on the disclosed data.

Administrative information includes the patients' year of birth, sex, municipality of residence, time and place of contact with the health service, priority level upon admission, and which type of health personnel carried out the contact. Health information includes diagnosis codes and codes for medical and surgical procedures. NPR does not contain clinical information from patient records, for example laboratory or radiology results, or patient-reported outcome measures (PROMs) or experience measures (PREMs).

Activity data are linked to the patient's personal identity number or D number, so that persons can be tracked between institutions and from one year to the next. This makes it possible to link data from NPR with data from other registers, for example the Central Population Register. In 2015, a personal identity number or D number was reported for 99.1% of the episodes of care at somatic hospitals (Mangerud et al. 2016) and 92.5% of contacts with somatic specialists in private practice under public funding contracts (Lützen et al. 2015). When no personal identity number or D number is reported, the institution treating a patient will assign him or her a unique identity

[1] The Norwegian Patient Registry Regulations: lovdata.no/dokument/SF/forskrift/2007-12-07-1389
[2] The Norwegian Patient Registry: https://helsedirektoratet.no/norsk-pasientregister-npr

number for one calendar year. The same patient will be assigned a new identity number if treated at another institution or in another calendar year. When personal identity numbers or D numbers are missing, there is a risk that the number of unique patients may be overestimated, and it is not possible to link information from other registers to these episodes of care.

Data from NPR, and the possibility of linking them with information in other registers, make it possible to describe the use of specialist health services in Norway with an accuracy that other countries have reason to envy. Unfortunately, there are also some limitations in how the data from NPR can be used. Although we have complete reporting of many variables, reporting errors or quality deficiencies may occur (Mangerud et al. 2016; Lützen et al. 2015). In addition, coding practices may differ between treatment institutions. Administrative and medical coding systems are modified from year to year.[3] Moreover, services can be organised differently in different areas. The data from NPR are complex and require thorough quality assurance, adaptation and harmonisation before they can be used in analyses. It is an advantage to have thorough knowledge of the service and the data in order to minimise the incorrect use of data.

The COPD Healthcare Atlas uses data from hospital department stays, private rehabilitation institutions and specialists in private practice under public funding contracts, which, where relevant, are linked to a date of death from the Central Population Register. The analyses mostly include data from the period 2013-2015. The time trend analyses also include data from 2012.

D.2 Control and payment of reimbursements to health service providers

The settlement system for control and payment of reimbursements to health service providers (KUHR) was initially established to administer regular GPs and other health personnel who provide services that are reimbursed by the National Insurance scheme.[4] Only data that entitle them to reimbursement are reported to KUHR. The KUHR register contains data about reimbursement claims for treatment provided by GPs, RGPs, physiotherapists and other providers of municipal health and care services. It also contains data from specialists in private practice under public funding contracts and other service providers in the specialist health service under a contract with a regional health authority for direct settlement with the Norwegian Health Economic Administration (HELFO), as well as data from other service providers, including dentists, chiropractors and speech therapists.

All invoices contain information about the sender (identity, type of enterprise and municipality number), the patient (personal identity number or D number, sex, age, and municipality and city district number), and the treatment (time, rates and diagnosis codes, among other things). The data received are checked and quality assured through rule engines for automatic control. In 2015, 99.7% of the invoices from RGPs, emergency primary healthcare services and specialists in private practice under public funding contracts contained correct information about the patient's personal identity number or D number.[5]

SKDE has aggregate figures for the number of patients and contacts with RGPs and emergency primary healthcare services for persons aged 40 years and older. These data were disclosed by the Norwegian Labour and Welfare Administration (NAV). The COPD Healthcare Atlas largely uses data for the years 2013–2015. The time trend analyses also include data for 2012.

[3] Coding system: volven.no and finnkode.ehelse.no

[4] Proposition No 106 to the Storting (Bill) (2015–2016): Endringer i helseregisterloven m.m ('Amendments to the Personal Health Data Filing System Act etc.')

[5] Information in an email from NAV case officer Vegard Håvik sent on 19 May 2017.

D.3 Statistics Norway

Statistics Norway (SSB) is a professionally independent institution charged with gathering, producing and publishing public statistics on, e.g., the Norwegian population.[6] SKDE has retrieved population figures for Norwegian municipalities (Table 07459) and city districts (Table 10826) from Statistics Norway's website. In the analyses, the population figures are used as the denominator for the number of persons or events per 10,000 population, and for gender and age standardisation. The figures presented for the different hospital referral areas will therefore be comparable, regardless of the size and the gender and age composition of their populations.

[6] Statistics Norway: http://www.ssb.no/en/omssb/om-oss

Appendix E

The reference group and other contributors

SKDE would like to thank everyone who contributed to the COPD Healthcare Atlas. The COPD Healthcare Atlas is based on the Ministry of Health and Care Services' assignment document to the regional health authorities, and it has had professional support from a reference group consisting of representatives from all the health regions in Norway (Table E.1). The reference group has provided important input and reflections in all phases of the project. The writing team consisted of reference group members Gunnar Husebo, Hasse Melbye and Rune Gronseth in addition to SKDE's project manager Linda Leivseth.

It would not have been possible to prepare the COPD Healthcare Atlas without suitable basic data. Our thanks go to case officers Parvinder Kaur and Heidi Jensberg of NPR and Vegard Havik at NAV, and to the Norwegian Directorate of Health for their good cooperation and service in connection with applications for and disclosure of data.

We would also like to thank the staff of the regional health authorities and health trusts who provided information about where pulmonary rehabilitation for COPD was provided in 2015. It was not easy to find this information, and we greatly appreciate that an overview is now available.

Table E.1: The reference group for the COPD Healthcare Atlas.

Name	Position	Employer
John Normann Melheim	Chair of the Board	Norwegian Heart and Lung Patient Association
Hasse Melbye	Professor	University of Tromsø
Terje Tollåli	Head of the department of pulmonology and haematology	Nordland Hospital Trust
Elena Titova	Senior Consultant	St. Olavs Hospital Trust
Synnøve Sunde	Head of department for nursing services	St. Olavs Hospital Trust
Gunnar Reksten Husebø	Senior consultant, PhD candidate and discipline manager for the COPD Register	Helse Bergen health trust and the University of Bergen
Rune Grønseth	Doctor and postdoctoral fellow	Helse Bergen health trust
Øistein Svanes	Doctor and PhD candidate	University of Bergen
Trond Bjørge	Senior Consultant	Østfold Hospital Trust
Ingvil Berger	Section senior consultant	Oslo University Hospital Trust

Appendix F

Definition of hospital referral areas

Table F.1: The municipalities and city districts that make up the different hospital referral areas.

Hospital referral area	Municipalities/city districts
Finnmark	2002 Vardø, 2003 Vadsø, 2004 Hammerfest, 2011 Kautokeino, 2012 Alta, 2014 Loppa, 2015 Hasvik, 2017 Kvalsund, 2018 Måsøy, 2019 Nordkapp, 2020 Porsanger, 2021 Karasjok, 2022 Lebesby, 2023 Gamvik, 2024 Berlevåg, 2025 Tana, 2027 Nesseby, 2028 Båtsfjord, 2030 Sør-Varanger
UNN	1805 Narvik, 1851 Lødingen, 1852 Tjeldsund, 1853 Evenes, 1854 Ballangen, 1902 Tromsø, 1903 Harstad, 1911 Kvæfjord, 1913 Skånland, 1917 Ibestad, 1919 Gratangen, 1920 Lavangen, 1922 Bardu, 1923 Salangen, 1924 Målselv, 1925 Sørreisa, 1926 Dyrøy, 1927 Tranøy, 1928 Torsken, 1929 Berg, 1931 Lenvik, 1933 Balsfjord, 1936 Karlsøy, 1938 Lyngen, 1939 Storfjord, 1940 Kåfjord, 1941 Skjervøy, 1942 Nordreisa, 1943 Kvænangen
Nordland	1804 Bodø, 1837 Meløy, 1838 Gildeskål, 1839 Beiarn, 1840 Saltdal, 1841 Fauske, 1845 Sørfold, 1848 Steigen, 1849 Hamarøy, 1850 Tysfjord, 1856 Røst, 1857 Værøy, 1859 Flakstad, 1860 Vestvågøy, 1865 Vågan, 1866 Hadsel, 1867 Bø, 1868 Øksnes, 1870 Sortland, 1871 Andøy, 1874 Moskenes
Helgeland	1811 Bindal, 1812 Sømna, 1813 Brønnøy, 1815 Vega, 1816 Vevelstad, 1818 Herøy, 1820 Alstahaug, 1822 Leirfjord, 1824 Vefsn, 1825 Grane, 1826 Hattfjelldal, 1827 Dønna, 1828 Nesna, 1832 Hemnes, 1833 Rana, 1834 Lurøy, 1835 Træna, 1836 Rødøy
Nord-Trøndelag	1632 Roan, 1633 Osen, 1702 Steinkjer, 1703 Namsos, 1711 Meråker, 1714 Stjørdal, 1717 Frosta, 1718 Leksvik, 1719 Levanger, 1721 Verdal, 1724 Verran, 1725 Namdalseid, 1736 Snåsa, 1738 Lierne, 1739 Røyrvik, 1740 Namsskogan, 1742 Grong, 1743 Høylandet, 1744 Overhalla, 1748 Fosnes, 1749 Flatanger, 1750 Vikna, 1751 Nærøy, 1755 Leka, 1756 Inderøy
St. Olavs	1567 Rindal, 1601 Trondheim, 1612 Hemne, 1613 Snillfjord, 1617 Hitra, 1620 Frøya, 1621 Ørland, 1622 Agdenes, 1624 Rissa, 1627 Bjugn, 1630 Åfjord, 1634 Oppdal, 1635 Rennebu, 1636 Meldal, 1638 Orkdal, 1640 Røros, 1644 Holtålen, 1648 Midtre Gauldal, 1653 Melhus, 1657 Skaun, 1662 Klæbu, 1663 Malvik, 1664 Selbu, 1665 Tydal

Hospital referral area	Municipalities/city districts
Møre og Romsdal	1502 Molde, 1504 Ålesund, 1505 Kristiansund, 1511 Vanylven, 1514 Sande, 1515 Herøy, 1516 Ulstein, 1517 Hareid, 1519 Volda, 1520 Ørsta, 1523 Ørskog, 1524 Norddal, 1525 Stranda, 1526 Stordal, 1528 Sykkylven, 1529 Skodje, 1531 Sula, 1532 Giske, 1534 Haram, 1535 Vestnes, 1539 Rauma, 1543 Nesset, 1545 Midsund, 1546 Sandøy, 1547 Aukra, 1548 Fræna, 1551 Eide, 1554 Averøy, 1557 Gjemnes, 1560 Tingvoll, 1563 Sunndal, 1566 Surnadal, 1571 Halsa, 1573 Smøla, 1576 Aure
Haraldsplass	1242 Samnanger, 1252 Modalen, 1253 Osterøy, 1256 Meland, 1260 Radøy, 1263 Lindås, 1264 Austrheim, 1265 Fedje, 1266 Masfjorden, the following city districts in 1201 Bergen; 01 Arna, 02 Bergenhus, 08 Åsane
Førde	1401 Flora, 1411 Gulen, 1412 Solund, 1413 Hyllestad, 1416 Høyanger, 1417 Vik, 1418 Balestrand, 1419 Leikanger, 1420 Sogndal, 1421 Aurland, 1422 Lærdal, 1424 Årdal, 1426 Luster, 1428 Askvoll, 1429 Fjaler, 1430 Gaular, 1431 Jølster, 1432 Førde, 1433 Naustdal, 1438 Bremanger, 1439 Vågsøy, 1441 Selje, 1443 Eid, 1444 Hornindal, 1445 Gloppen, 1449 Stryn
Bergen	1233 Ulvik, 1234 Granvin, 1235 Voss, 1238 Kvam, 1241 Fusa, 1243 Os, 1244 Austevoll, 1245 Sund, 1246 Fjell, 1247 Askøy, 1251 Vaksdal, 1259 Øygarden, the following city districts in 1201 Bergen; 03 Fana, 04 Fyllingsdalen, 05 Laksevåg, 06 Ytrebygda, 07 Årstad, Unspecified city district Bergen
Fonna	1106 Haugesund, 1134 Suldal, 1135 Sauda, 1145 Bokn, 1146 Tysvær, 1149 Karmøy, 1151 Utsira, 1160 Vindafjord, 1211 Etne, 1216 Sveio, 1219 Bømlo, 1221 Stord, 1222 Fitjar, 1223 Tysnes, 1224 Kvinnherad, 1227 Jondal, 1228 Odda, 1231 Ullensvang, 1232 Eidfjord
Stavanger	1101 Eigersund, 1102 Sandnes, 1103 Stavanger, 1111 Sokndal, 1112 Lund, 1114 Bjerkreim, 1119 Hå, 1120 Klepp, 1121 Time, 1122 Gjesdal, 1124 Sola, 1127 Randaberg, 1129 Forsand, 1130 Strand, 1133 Hjelmeland, 1141 Finnøy, 1142 Rennesøy, 1144 Kvitsøy
Østfold	0101 Halden, 0104 Moss, 0105 Sarpsborg, 0106 Fredrikstad, 0111 Hvaler, 0118 Aremark, 0119 Marker, 0122 Trøgstad, 0123 Spydeberg, 0124 Askim, 0125 Eidsberg, 0127 Skiptvet, 0128 Rakkestad, 0135 Råde, 0136 Rygge, 0137 Våler, 0138 Hobøl
Akershus	0121 Rømskog, 0211 Vestby, 0213 Ski, 0214 Ås, 0215 Frogn, 0216 Nesodden, 0217 Oppegård, 0221 Aurskog-Høland, 0226 Sørum, 0227 Fet, 0228 Rælingen, 0229 Enebakk, 0230 Lørenskog, 0231 Skedsmo, 0233 Nittedal, 0234 Gjerdrum, 0235 Ullensaker, 0237 Eidsvoll, 0238 Nannestad, 0239 Hurdal, the following city districts in 0301 Oslo; 10 Grorud, 11 Stovner, 12 Alna
OUS	The following city districts in 0301 Oslo; 03 Sagene, 08 Nordre Aker, 09 Bjerke, 13 Østensjø, 14 Nordstrand, 15 Søndre Nordstrand, 17 Marka, Unspecified city district Oslo
Lovisenberg	The following city districts in 0301 Oslo; 01 Gamle Oslo, 02 Grünerløkka, 04 St. Hanshaugen, 16 Sentrum
Diakonhjemmet	The following city districts in 0301 Oslo; 05 Frogner, 06 Ullern, 07 Vestre Aker
Innlandet	0236 Nes, 0402 Kongsvinger, 0403 Hamar, 0412 Ringsaker, 0415 Løten, 0417 Stange, 0418 Nord-Odal, 0419 Sør-Odal, 0420 Eidskog, 0423 Grue, 0425 Åsnes, 0426 Våler, 0427 Elverum, 0428 Trysil, 0429 Åmot, 0430 Stor-Elvdal, 0432 Rendalen, 0434 Engerdal, 0436 Tolga, 0437 Tynset, 0438 Alvdal, 0439 Folldal, 0441 Os, 0501 Lillehammer, 0502 Gjøvik, 0511 Dovre, 0512 Lesja, 0513 Skjåk, 0514 Lom, 0515 Vågå, 0516 Nord-Fron, 0517 Sel, 0519 Sør-Fron, 0520 Ringebu, 0521 Øyer, 0522 Gausdal, 0528 Østre Toten, 0529 Vestre Toten, 0533 Lunner, 0534 Gran, 0536 Søndre Land, 0538 Nordre Land, 0540 Sør-Aurdal, 0541 Etnedal, 0542 Nord-Aurdal, 0543 Vestre Slidre, 0544 Øystre Slidre, 0545 Vang

Hospital referral area	Municipalities/city districts
Vestre Viken	0219 Bærum, 0220 Asker, 0532 Jevnaker, 0602 Drammen, 0604 Kongsberg, 0605 Ringerike, 0612 Hole, 0615 Flå, 0616 Nes, 0617 Gol, 0618 Hemsedal, 0619 Ål, 0620 Hol, 0621 Sigdal, 0622 Krødsherad, 0623 Modum, 0624 Øvre Eiker, 0625 Nedre Eiker, 0626 Lier, 0627 Røyken, 0628 Hurum, 0631 Flesberg, 0632 Rollag, 0633 Nore og Uvdal, 0711 Svelvik, 0713 Sande
Vestfold	0701 Horten, 0702 Holmestrand, 0704 Tønsberg, 0706 Sandefjord, 0709 Larvik, 0714 Hof, 0716 Re, 0719 Andebu, 0720 Stokke, 0722 Nøtterøy, 0723 Tjøme, 0728 Lardal
Telemark	0805 Porsgrunn, 0806 Skien, 0807 Notodden, 0811 Siljan, 0814 Bamble, 0815 Kragerø, 0817 Drangedal, 0819 Nome, 0821 Bø, 0822 Sauherad, 0826 Tinn, 0827 Hjartdal, 0828 Seljord, 0829 Kviteseid, 0830 Nissedal, 0831 Fyresdal, 0833 Tokke, 0834 Vinje
Sørlandet	0901 Risør, 0904 Grimstad, 0906 Arendal, 0911 Gjerstad, 0912 Vegårshei, 0914 Tvedestrand, 0919 Froland, 0926 Lillesand, 0928 Birkenes, 0929 Åmli, 0935 Iveland, 0937 Evje og Hornnes, 0938 Bygland, 0940 Valle, 0941 Bykle, 1001 Kristiansand, 1002 Mandal, 1003 Farsund, 1004 Flekkefjord, 1014 Vennesla, 1017 Songdalen, 1018 Søgne, 1021 Marnardal, 1026 Åseral, 1027 Audnedal, 1029 Lindesnes, 1032 Lyngdal, 1034 Hægebostad, 1037 Kvinesdal, 1046 Sirdal

Appendix G

Diagnosis codes

Table G.1: Number of outpatient contacts coded with relevant ICD-10 codes as the primary diagnosis.

Code	Text	2013	2014	2015	Average
J44	Other chronic obstructive pulmonary disease (COPD)	27,737	28,513	28,986	28,412
J43	Emphysema	1,494	1,307	1,357	1,386
J42	Unspecified chronic bronchitis	163	164	134	154
J41	Simple and mucopurulent chronic bronchitis	422	315	224	320
J40	Bronchitis, not specified as acute or chronic	168	138	118	141
R06.0[a]	Dyspnoea	419	433	425	426
J09-J11[a]	Influenzas	11	7	14	11
J12-J18[a]	Pneumonias	198	228	197	208
J20[a]	Acute bronchitis	20	21	17	19
J22[a]	Unspecified acute lower respiratory infection	42	45	19	35
J46[a]	Acute severe asthma	2	2	2	2
J96[a]	Respiratory failure, not elsewhere classified	537	560	541	546
Total[b]		**31,213**	**31,733**	**32,034**	**31,660**

[a] In combination with a secondary diagnosis of J40-J44.
[b] The total figures are higher than the actual number of contacts because some contacts are coded with more than one of these codes in the two primary diagnosis fields.

Table G.2: Number of emergency admissions coded with relevant ICD-10 codes as the primary diagnosis.

Code	Text	2013	2014	2015	Average
J44	Other chronic obstructive pulmonary disease (COPD)	9,749	9,663	10,173	9,862
J44.0	COPD with acute lower respiratory infection	3,102	2,958	3,202	3,087
J44.1	COPD with acute exacerbation, unspecified	4,732	4,850	5,294	4,959
J44.8	Other specified COPD	141	198	207	182
J44.9	COPD, unspecified	1,774	1,657	1,470	1,634
J43	Emphysema	75	89	100	88
J42	Unspecified chronic bronchitis	26	15	14	18
J41	Simple and mucopurulent chronic bronchitis	21	13	11	15
J40	Bronchitis, not specified as acute or chronic	61	58	48	56
R06.0[a]	Dyspnoea	59	59	62	60
J09-J11[a]	Influenzas	236	138	384	253
J12-J18[a]	Pneumonias	6,291	6,032	6,398	6,240
J20[a]	Acute bronchitis	96	83	82	87
J22[a]	Unspecified acute lower respiratory infection	302	296	281	293
J46[a]	Acute severe asthma	6	14	8	9
J96[a]	Respiratory failure, not elsewhere classified	1,046	906	802	918
Total[b]		**17,968**	**17,366**	**18,363**	**17,899**

[a] In combination with a secondary diagnosis of J40-J44.

[b] The total figures are higher than the actual number of contacts because some emergency admissions are coded with more than one of these codes in the two primary diagnosis fields.

Table G.3: Number of day patient treatments for rehabilitation coded with relevant ICD-10 codes as primary or secondary diagnosis in 2015.

Code	Text	Private	Public
J44	Other chronic obstructive pulmonary disease (COPD)	821	6,524
J44.0	COPD with acute lower respiratory infection	0	4
J44.1	COPD with acute exacerbation, unspecified	47	1
J44.8	Other specified COPD	147	3
J44.9	COPD, unspecified	632	6,516
J43	Emphysema	50	32
J42	Unspecified chronic bronchitis	0	4
J41	Simple and mucopurulent chronic bronchitis	0	2
J40	Bronchitis, not specified as acute or chronic	0	0
Total[b]		**876**	**6,562**

[b] The total figures are higher than the actual number of day patient rehabilitations because some day treatments are coded with more than one of these codes in the two primary diagnosis fields.

Table G.4: Number of inpatient stays for rehabilitation coded with relevant ICD-10 codes as primary or secondary diagnosis in 2015.

Code	Text	Private	Public
J44	Other chronic obstructive pulmonary disease (COPD)	655	1,254
J44.0	COPD with acute lower respiratory infection	22	66
J44.1	COPD with acute exacerbation, unspecified	22	151
J44.8	Other specified COPD	85	32
J44.9	COPD, unspecified	529	1,011
J43	Emphysema	14	108
J42	Unspecified chronic bronchitis	1	2
J41	Simple and mucopurulent chronic bronchitis	0	2
J40	Bronchitis, not specified as acute or chronic	0	2
Total[b]		**673**	**1,374**

[b] The total figures are higher than the actual number of inpatient stays because some inpatient stays are coded with more than one of these codes in the two primary diagnosis fields.

Appendix H

Pulmonary rehabilitation providers

Table H.1: Hospital departments that offered pulmonary rehabilitation to persons with COPD in 2015.

Health trust or hospital	Day patient treatment at	Inpatient treatment at
Northern Norway RHA		
Finnmark Hospital	Not available	Not available
UNN	Therapist department (48000)	Physical and Rehab. Medicine (50000)
Nordland Hospital	Physical and Rehab. Medicine (52009)	Not available
Helgeland Hospital	Not available	Department of Medicine (300/3000)
Central Norway RHA		
Helse Nord-Trøndelag	MEDP01 (3051) LUNP21 (3251) MEDP10 (3952)	REHAS01(5010)
St. Olavs Hospital	KKFTP4 (9804) KKLMP1 (9855) KKOFYP (9856)	Not available
Helse Møre og Romsdal	Not available	Not available
Western Norway RHA		
Haraldsplass	Not available	Not available
Helse Førde	Department of Medicine (30000)	Department of Medicine (30000)
Helse Bergen	Department of Thoracic Medicine (32109)	Not available
Helse Fonna	Department of Medicine (3000) Physical and Rehabilitation Medicine (5200)	Department of Medicine (3000) Physical and Rehabilitation Medicine (5200)
Helse Stavanger	General rehab. (5013) Learning and coping centre (5052)	General rehab. (5013)
South-Eastern Norway RHA		
Østfold Hospital	Department of Medicine (3000) Department of Physiotherapy (9100)	Not available
Akershus University Hospital	Dept. of Pulmonary Medicine (3200)	Not available
OUS	Dept. of Pulmonary Medicine (32004)	Not available
Lovisenberg	Not available	Not available
Diakonhjemmet	Department of Medicine (3000)	Not available
Innlandet Hospital	Granheim Lung Hospital (5110)	Granheim Lung Hospital (5110)
Vestre Viken	Department of Medicine, Barum (30002) Learning and coping centre (30063)	Not available
Vestfold Hospital	Medicine (300)	Not available
Telemark Hospital	Department of Medicine (3005)	Not available
Sørlandet Hospital	Physical and Rehab. Medicine (34000)	Not available
Sunnaas Hospital	Not available	Not available
LHL Clinics Glittre	Not available	Available

Table H.2: Private rehabilitation institutions that offered pulmonary rehabilitation to persons with COPD in 2015.

Rehabilitation institutions	Day patient treatment	Inpatient treatment
Northern Norway RHA		
LHL Clinics Skibotn	Not available	Available
Nordtun HelseRehab	Not available	Available
Valnesfjord helsesportsenter	Not available	Available
Helgeland rehabilitering	Not available	Available
Central Norway RHA		
LHL Clinics Trondheim	Available	Not available
LHL Clinics Røros	Not available	Available
Selli rehabiliteringssenter	Available	Available
Muritunet	Not available	Available
Western Norway RHA		
LHL Clinics Nærland	Available	Available
Åstveit helsesenter	Available	Available
South-Eastern Norway RHA		
Unicare Hokksund	Available	Available
Ringen rehabiliteringssenter	Available	Available

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