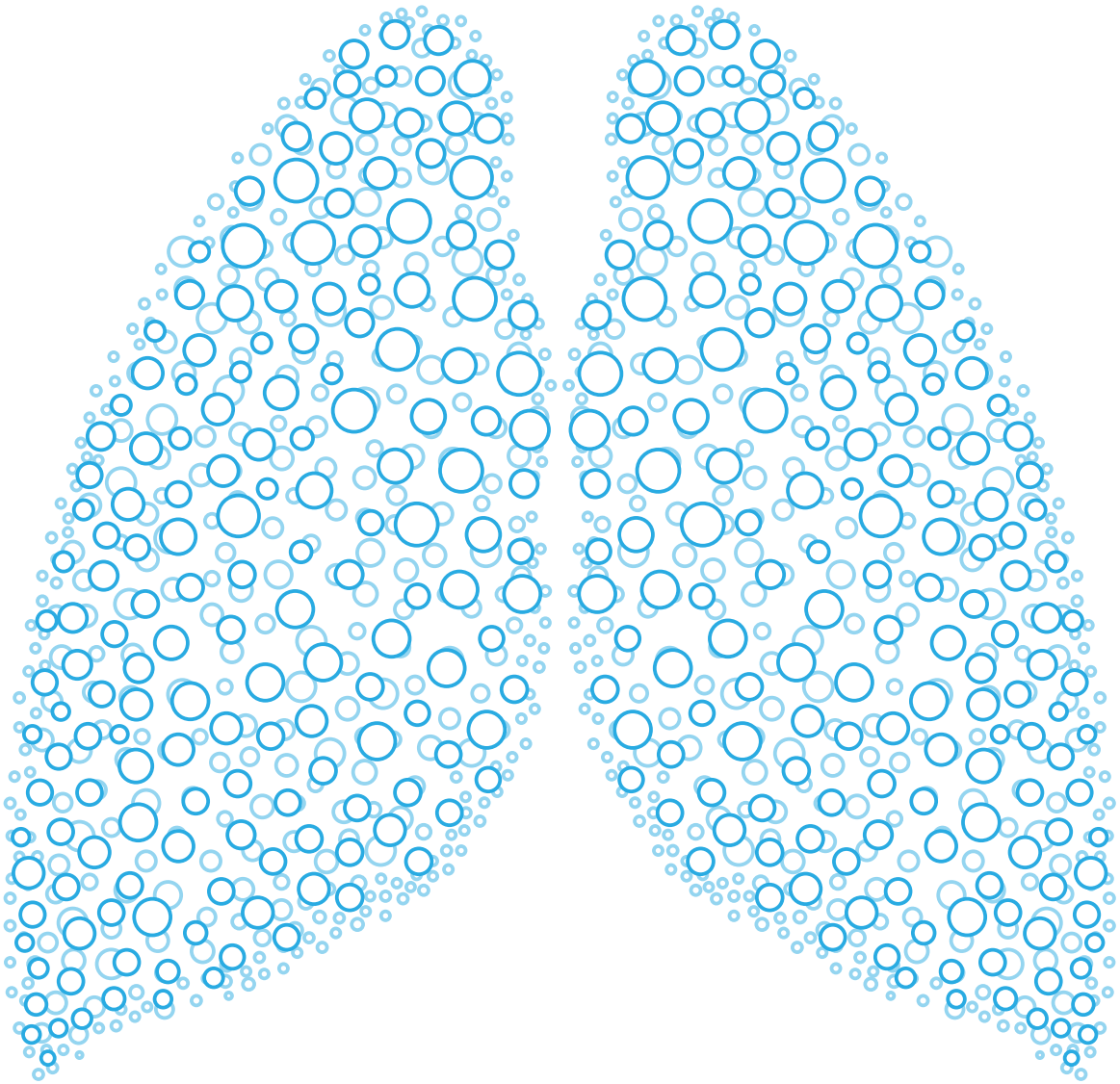
Irish Thoracic Society

# Respiratory Health of the Nation

2018



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# FOREWORD

## The lungs are essential for life and all of us at one time or another have experienced breathlessness, a common and often chronic and disabling symptom for people with respiratory disease. The Irish Thoracic Society is the national organisation representing respiratory healthcare professionals on the island of Ireland.

The society is dedicated to leading and advancing the care of people with respiratory illness. On behalf of all our members, I wish to congratulate Dr Máire O'Connor, Ms Eimir Hurley, and Professor Terry O' Connor and thank them for this vital and comprehensive work that brings into strong focus the burden and breadth of respiratory diseases in Ireland.

It is now 15 years since Drs Neil Brennan and Terry O'Connor compiled their first report on behalf of the Irish Thoracic Society that identified the complexity, scale and cost of respiratory diseases in Ireland. They entitled their report INHALE – Ireland Needs Healthier Airways and Lungs – the Evidence, and it was a major milestone for respiratory care in this country. In it they demonstrated that respiratory disease was the most commonly reported long-term illness in young adults, the most common reason to visit a GP in Ireland and that one in five deaths in Ireland was due to respiratory conditions. Changes in mortality, morbidity and management of lung diseases were subsequently tracked for their second INHALE report published in 2008.

Much good work has taken place over the last two decades and the Society acknowledges the developments in Ireland that have led to improvements in respiratory care. Genuine leadership was shown in efforts to improve the air we breathe both outdoors and in the workplace and there is in place a multi-faceted Tobacco Free Ireland strategy. Yet there is still much to do as tobacco smoking remains our leading cause of preventable death. The work of the National Programmes for cancer and cystic fibrosis has resulted in advances in care and outcomes for patients with these conditions. National Clinical Programmes for Asthma and COPD will provide models of care and many quality initiatives for patients with these common diseases. We welcome recent appointments of Advanced Nurse Practitioners that have the potential to augment services, improve lengths of stay and reduce pressure on emergency departments. Yet some of our hospitals do not yet have access to consultant respiratory specialists, the numbers of which lag well behind other EU countries, and so the care of chronic lung disease falls back on under-resourced and over-stretched primary care providers. Basic elements of quality care such as pulmonary rehabilitation continue to be severely limited for our patients compared to other countries. Thus, despite the improvements, many challenges clearly remain. While we welcome the over-arching vision for the provision of healthcare to our citizens contained in the Sláintecare Strategy, this must incorporate a responsive approach to the specific challenge of respiratory disease in order to impact on the significant burden on our population and health services highlighted in this report.

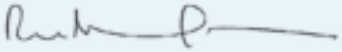
The authors of Respiratory Health of the Nation 2018 include not just an over-view of the impact of respiratory disease in Ireland but also of eleven common conditions and two key population groups - children and older people. The data herein provides us with the most accurate and comprehensive picture to date of our nation's respiratory health. Some key findings include that respiratory disease now accounts

for more hospitalisations than that for cardiovascular and non-lung cancer cases combined and that the vast majority of these are for emergency, unscheduled care. Our death rate from respiratory diseases is the fourth highest in the EU-28 and 38.2% higher than the EU average. Furthermore, in the period between 2008 and 2016 covered by this report the number of deaths from respiratory disease increased by 14.6%. This compared with a 7.5% drop in cardiovascular deaths during the same time. Indeed, as many respiratory conditions such as COPD and sleep apnoea, which is estimated to affect up to 100,000 adults in Ireland, are under-recognised, these data may not quantify the true impact.

What is clear from this report is that respiratory disease affects people at all stages of life, disproportionately affects those from lower socio-economic groups and includes conditions that may be prevented or at least detected earlier through awareness, lifestyle choices and access to co-ordinated and specialist services. These chronic respiratory diseases in addition have adverse and under-appreciated economic effects on families and communities. We need to prepare for the growing burden of lung disease on our health services due to our growing and ageing population by ensuring that adequate resources and best evidence based practice is used to care for them; we need to be vigilant for communicable and emerging infections including multi-drug resistant TB; and we need to meet the challenge of providing continuity of care for conditions such as COPD through integrated care with a properly resourced primary care community.

The authors should be commended by all for this vital report which has illuminated the toll of respiratory disease on our nation and will be critical reading for all involved in the planning and delivery of healthcare. In their conclusion they recommend six areas of action for Respiratory Health in Ireland. The European Respiratory Society has recently made a public health call to action to improve respiratory health that enunciates ten principles for Lung Health. Taken together these include a structured, co-ordinated and funded approach to tackling chronic lung diseases in which all stakeholders – policymakers, patients and carers – collaborate to lead on improvements in respiratory health.

The Irish Thoracic Society now calls for a Taskforce that would be charged with delivering an over-arching Respiratory Strategy for the nation. The principles of this would include maintenance of good lung health throughout life, the early detection and recognition of respiratory disease, the collection of data to establish the true prevalence and outcome of respiratory diseases, and an integrated and resourced model for delivery of care for our patients in the most appropriate setting.



Professor Ross Morgan
President, the Irish Thoracic Society

December 2018

# EXECUTIVE SUMMARY

**Respiratory disease includes a wide range of acute and chronic diseases that substantially contribute to the medical and economic burden on Ireland's health system. Respiratory disease led to 5,720 deaths and 14.3% of all inpatient hospitalisations in Ireland in 2016. Respiratory disease causes almost one in 5 deaths in Ireland.**

Respiratory disease places a huge burden on individuals, the Irish population and the health services. National data is not available for primary care but the burden is reflected by the fact that 20% (19.3% of males, 20.6% of females) of those with full General Medical Services (GMS) coverage for the entire year, filled at least one prescription for respiratory medications in 2016. Respiratory medication cost 11% of the GMS budget and 12% of the Drugs Payment Scheme (DPS) budget in 2016.

Over the period 2009-2016, respiratory disease accounted for the highest proportion of inpatient hospitalisations and bed-days used in public hospitals compared to other diseases. In 2016 this figure was 92,391 (14.3%) inpatient hospitalisations and 578,319 (15.8%) inpatient bed days. Comparable figures for cardiovascular disease were 8.2% and 11.3% and for non-respiratory cancers, 4.7% and 8.0%.

The majority of hospitalisations for respiratory disease were emergencies – 84.8% of the 92,391 in 2016, accounting for over half a million bed days (519,587), which equates to 18.7% of all emergency hospitalisations and 20.1% of emergency bed-days. The comparable figure for cardiovascular disease was 10.7% and 14.3%.

Many respiratory diseases are more common in lower socio-economic groups. There is a correlation between some of the most common lung diseases and social deprivation. For COPD and lung cancer, this can be explained in part by higher rates of smoking, as well as greater exposure to air pollution and adverse factors in childhood. There are geographical and socio-economic variations in mortality from respiratory disease in Ireland.

## Lung Cancer

Lung cancer accounted for 1,864 deaths (20.6% of cancer deaths) in Ireland in 2016. This was an increase of 11.8% (1,668) on the 2007 figure. However, in the same period, the age standardised mortality rate per 100,000 population reduced from 63.2 in 2007 to 56.2 in 2016. In both males and females, lung cancer is the leading cause of cancer deaths.

Over a quarter of patients (26%) presented initially as emergencies. Those resident in more deprived areas were more likely to present as emergencies. Both males and females in lower socio-economic groups had at least double the incidence of lung cancer, compared to those in higher socio-economic groups.

## Chronic Obstructive Pulmonary Disease (COPD)

The prevalence of COPD in Ireland is unknown. COPD places a significant burden of disease on people and health services in Ireland. It is second only to lung cancer as a cause of death from respiratory disease. It is responsible for more deaths than any non-respiratory cancer.

In 2016, among those with GMS eligibility, medication costs for COPD were €67.6 million. Ireland has the highest hospitalisation rate among selected

OECD countries. In 2016, the Irish age standardised hospitalisation rate for COPD was 389 per 100,000 population, with 15,979 inpatient hospitalisations using 124,847 inpatient bed days. Over 87% of COPD hospitalisations are as emergencies. The majority of hospitalisations are in the older age group.

There are regional variations in both mortality and hospitalisations with the inland/midland counties particularly affected.

## Pneumonia and Acute Lower Respiratory Infection (unspecified)

Pneumonia is the 5th most frequent cause of death in Ireland. In 2016, it caused over 1,000 deaths, compared to 1,125 in 2007. It is the third commonest cause of death from respiratory disease.

Although people with pneumonia and acute lower respiratory infections (unspecified) are largely treated in the community setting, in 2016 they accounted for 31.7% (29,293) of respiratory inpatient hospitalisations and 40.3 % (231,819) of respiratory inpatient bed days. 58.4% of these hospitalisations were among those aged 65 years and over; 98% of hospitalisations were emergencies.

## Asthma

Ireland has one of the highest rates of asthma in the world. Current estimates suggest that the prevalence of doctor-diagnosed asthma in children ("asthma ever") is 21.5% and 7-9.4% in adults. As it typically begins earlier in life than many other chronic diseases, it can impose a high lifetime burden on individuals, caregivers and the community.

Relatively speaking the numbers of patients dying each year from asthma are small (<75). The majority (>70%) of deaths occur in those aged over 70 years. In recent years, the 5 year standardised mortality rate has started to increase. For 2012-2016 it was 1.92 compared with the low of 1.67 in 2010-2014.

The number of day case hospitalisations for asthma increased from 1,336 in 2009 to 2,889 in 2016. In terms of inpatient hospitalisation, the age standardised rate in 2016 was 46 per 100,000 population. 97% of hospitalisations were emergencies. Ireland's age standardised hospitalisation rate does not differ significantly from the OECD average.

## Cystic Fibrosis

Cystic fibrosis is a chronic inherited disease of both childhood and adulthood. Ireland has one of the highest global incidences of cystic fibrosis. Seven mutations of the CFTR gene account for over 80% of cystic fibrosis cases in Ireland. The F508del mutation which causes severe or classic cystic fibrosis is a more common cause of cystic fibrosis in Ireland than in many other countries.

Newborn screening for cystic fibrosis commenced in the Republic of Ireland in July 2011. Since that time the numbers of new patients diagnosed following symptomatic presentation annually is approximately

25%. Although still a potentially lethal disease the median age of death has increased in the last decade from 23 years to 32.5 years.

There has been little change in the number of inpatient hospitalisations over recent years. In 2016, there were 1,110 of which 72% were as emergencies. The majority of hospitalisations were in the age group 16-64 years.

## Interstitial Lung Disease and Sarcoidosis

Sarcoidosis and idiopathic pulmonary fibrosis are amongst the more common of the 300-plus interstitial lung diseases. There are approximately 350 deaths each year from these conditions in Ireland. Each year there are approximately 900 day cases and almost as many inpatient hospitalisations with these diagnoses. The national prevalence or incidence is not available for these diseases. It is hoped that the national hospital based registry commenced in 2016 for idiopathic pulmonary fibrosis will provide valuable information in the future.

## Obstructive Sleep Apnoea

Obstructive sleep apnoea syndrome (OSAS) is increasingly recognised as a public health problem internationally. There is no data available nationally on its prevalence in Ireland. However, given its link with obesity, and Ireland's obesity epidemic, it can be assumed to be a potentially sizable problem in Ireland.

As a reflection of this, the number of hospitalisations almost doubled between 2007 and 2016 (1,203 to 2,241), sleep studies were among the top 20 principal procedures reported by acute hospitals in 2016, they were among the top 5 procedures for elective hospitalisations, and sleep disorders were the 4th most common principal diagnoses among elective inpatient hospitalisations in 2016.

## Pulmonary Vascular Disease

Numbers dying from pulmonary embolism in Ireland have changed little in recent years despite the increase in population. National data is not available on its incidence. The 1,426 inpatient hospitalisations in 2016 are an underestimate of its impact on health and health services. The prevalence of pulmonary hypertension, a progressive often fatal disease, is unknown in Ireland. As for other countries, it is probably under recognised in Ireland.

## Respiratory Diseases Due to External Agents

While the majority of diseases in this group are related to occupations or occupational practices which in turn impact on their incidence and prevalence, an exception to this is pneumonitis due to inhalation of solids and liquids which accounted for 96.6% (258) of deaths in this group in 2015.

In 2016, pneumonitis due to inhalation of solids and liquids accounted for 96% of inpatient hospitalisations (1,946) in this group and shows a persistent rising trend since 2009. In 2016, 76.5% of those hospitalised were aged 65 years and over. Over 99% were admitted as emergencies.

## Respiratory Infectious Diseases

Respiratory infectious diseases continue to cause considerable morbidity in Ireland. Many are notifiable and therefore incidence data is available. The best protection against influenza, the world's most important viral disease, is vaccination of vulnerable individuals. There is considerable room for improvement on vaccination uptake in Ireland. Influenza places major strains on the acute hospital system despite being mainly dealt with in the community.

While childhood vaccination programmes have positively impacted on many diseases, challenges remain in achieving the required 95% uptake in all geographical areas and population groups. In addition, protection of those vulnerable to infection due to age or chronic disease, including respiratory, by vaccination is inadequate in Ireland.

## Tuberculosis

While the number of cases of tuberculosis (TB) has fallen over the last decade, this decline has levelled off in the past two years. In 2016, 318 cases were notified and 20 people died from TB. In 2016, the highest age specific incidence rate was in those aged 25-34 years.

42.6% (136) of cases notified in 2016 lived in HSE East. The areas with the highest crude incidence were Dublin North West and Dublin North Central, which are both areas of higher social deprivation.

## Paediatric Respiratory Diseases

25% of children's consultations with General Practitioners are for respiratory problems. Acute respiratory infections, such as influenza and RSV, continue to cause major morbidity in the paediatric population. The uptake of vaccination programmes is less than the recommended 95% for many diseases nationally.

Respiratory diseases account for 31.9% of inpatient hospitalisations of 0-4 year olds and 26.7% of those aged 0-15 years. Acute infections – acute upper respiratory infection, acute bronchiolitis – account for 37% of respiratory hospitalisations in those aged 0-15 years.

Asthma and cystic fibrosis are the chronic respiratory diseases which impact most in childhood.

### Respiratory Disease Burden for Older People

In 2016, 13.5% of the Irish population were aged 65 years and over. In the same year, 43% of those hospitalised for respiratory problems were aged 65 years and over. Of the over half a million (578, 319) inpatient hospital beds used for those with respiratory problems in 2016, 64.1% were used by those aged 65 years and over. The most common respiratory diagnoses were COPD, acute lower respiratory infection (unspecified) and pneumonia accounting for 74.2% of respiratory hospitalisations in this age group and 74.6% of respiratory bed days.

In older age groups, as respiratory disease often coexists with other comorbidities, the care associated with this age group is often more complex than with younger age groups. Vaccination is a key protection from a number of acute respiratory infectious diseases, especially influenza and pneumococcal disease.

## Future Direction

**The enjoyment of the highest attainable standard of health is a fundamental human right according to WHO. The authors recommend six areas of action by which this can be achieved for Ireland – awareness and advocacy, prevention, clinical care, research, data and new and re-emerging challenges.**

# Introduction and Methodology

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## Background

This report outlines the burden of respiratory disease on the population of Ireland and its impact on health services. It focuses on data from 2016 but also reflects recent time trends. Ten years ago in 2008, the Irish Thoracic Society published the INHALE report (2nd edition) which focused on 2004 data and time trends at that period[1].

Respiratory disease covers a diverse range of acute and chronic diseases. These include a number of common conditions and a larger number of relatively rare conditions. Respiratory disease is a major cause of morbidity and mortality and is responsible for a large proportion of the overall health burden of illness, both in Ireland and globally[2].

Two of the most common respiratory diseases in terms of prevalence and mortality are chronic obstructive pulmonary disease (COPD) and lung cancer. A major risk factor for both of these is tobacco smoking. The time lag of 20–30 years between tobacco exposure and the development of disease means that both will remain major challenges for many years to come in Ireland.

Asthma has increased in prevalence in many countries including Ireland in the late 20th century. It is unclear why this has occurred but it may be related to our 'western' lifestyle and increasing urbanisation[2].

The prevalence of some other respiratory conditions is also increasing. Examples include interstitial lung disease and pulmonary vascular diseases. There is also greater realisation of the extent of the morbidity associated with obstructive sleep apnoea syndromes (OSAS) which in part may be due to better recognition, but also represents a rising prevalence as obesity becomes more common.

An increasingly recognised influence on adult respiratory health is respiratory health and disease in infancy and childhood. An example of this is the increased survival into adulthood of people with cystic fibrosis (CF) with both earlier detection through screening, and improved therapies. Another example is the improved survival rate of premature infants into childhood and adulthood which can bring its own respiratory complications. On the other hand, the increase in childhood asthma will in turn lead to an increase in adults with the disease. More generally, the impact from poor respiratory health in childhood, due to adverse social and environmental factors, on adult respiratory health is increasingly recognised and may be as important a risk factor as smoking[2].

Vaccination programmes have had beneficial impacts on many acute respiratory infectious diseases but in the absence of adequate uptake of vaccination, a number of diseases such as influenza and pertussis continue to occur. For other diseases such as respiratory syncytial virus (RSV), vaccines and vaccination programmes are awaited. Pneumonia continues to be a major source of ill health and death in Ireland as well as having a major impact on health services. Tuberculosis declined dramatically in countries like Ireland in the 20th century but with the emergence of drug resistance, it still presents challenges in the 21st century both globally and in Ireland.

As the Irish population ages, the role of co-morbidities in conjunction with respiratory disease in those affected presents an additional challenge for care and treatment.

The mission of the Irish Thoracic Society is to promote respiratory health and alleviate suffering from respiratory disease. Ten years after the publication of the 2nd INHALE report, the Irish Thoracic Society (ITS) considered it timely to adopt a new format, in line with similar reports from a number of other countries[1-5], using the International Classification of Diseases (ICD ) 10th revision, to include not just an over-view of respiratory disease in Ireland but also of eleven individual diseases and two key population groups – children and older people[1-5].

## Who this report is for?

This report provides national data on respiratory disease in the Irish population. The authors hope the report will be an invaluable resource for policy-makers, health care providers and professionals, researchers, patients and their families as well as the wider public. The data and analyses could inform the development of strategies designed to reduce the impact of respiratory disease on Ireland's health, thereby improving respiratory health and wellbeing and reducing the impact on health services.

## Data and Data sources

A number of databases were used to compile national data for this overview of respiratory disease in Ireland, major specific respiratory conditions and two age cohorts (children, older people). These included census data from the Central Statistics office (CSO), mortality data both from Vital Statistics of the CSO and Public Health Information System (PHIS). The Computerised Infectious Disease Reporting system (CIDR) was accessed for incidence of respiratory infectious diseases and the National Cancer Registry Ireland (NCRI) for incidence of lung cancer. The Primary Care Reimbursement Scheme (PCRS) was accessed for data on respiratory medication use by those eligible for General Medical Services (GMS) as was the Hospital Inpatient Enquiry (HIPE) system for data from acute publicly funded hospitals. It must be noted that all data sources have limitations.

Secondary data was obtained from relevant reports and other data sources which are referenced as appropriate.

Lack of national primary care data, medication data at disease and total population level, respiratory aids and appliances data including long term oxygen, national diagnostic data and data on other respiratory services means that this report is an underestimate of the burden of respiratory disease in Ireland.

The primary source on population size was census data (2011, 2016) from the CSO www.cso.ie/en/census.

The disease coding system used in Ireland currently both for deaths and hospitalisation is the 10th International Classification of Disease (ICD-10) convention of the World Health Organisation (WHO). It has been used for **deaths** in Ireland since 2007. Data on deaths for this report was sourced from Vital Statistics reports from the CSO (up to and including 2015). Data was sourced for the years 2007-2015. Data on deaths was also sourced from PHIS. This provides specific mortality numbers and rates by age and sex for a limited number of causes. These are the 65 causes of death reported across Europe (Eurostat 65 Causes of Death Shortlist) plus nine additional national categories, so 74 causes in total. This database extended to include provisional 2016 mortality data for these 74 causes. Throughout this report, where 2016 mortality data is provided in tables, it is noted that the data is provisional. Data in text is also provisional. The ICD 10 mortality codes available in PHIS relevant to respiratory disease and to this report are listed in the appendix. In addition to mortality data by cause, age and gender PHIS provides age standardised mortality rates, regional variations and years of potential life lost (YPLL) for the specified causes. This latter measure is of greater relevance for diseases associated with death in younger age cohorts. The specific national publications which used PHIS accessed for this report was Health In Ireland, Key Trends, 2017[9]. Otherwise PHIS database was accessed directly.

Age standardisation which takes the ages of people within a population into account helps to ensure that comparisons of the number of people dying with a condition are not unduly influenced if there are a larger number of older people in a particular population at that time.

Data for notifiable **respiratory infectious diseases** was accessed from the national Computerised Infectious Disease Reporting system (CIDR) and relevant annual reports from the Health Protection Surveillance Centre (HPSC). Many specified infectious diseases deemed of public health significance are notifiable by legislation. All medical practitioners including clinical directors of diagnostic laboratories in Ireland must notify the Medical Officer of Health (MOH) of these specified infectious diseases. The majority of these diseases/organisms are entered on a national computerised infections disease reporting system (CIDR).

As notifications only reflect those with diagnosed infectious disease, the data likely underestimate the true incidence. For example with influenza, many patients may self-manage and do not present to a medical practitioner.

Expenditure on pharmaceuticals used in the management of respiratory disease was obtained from the pharmacy claims dataset (HSE – **Primary Care Reimbursement Scheme (PCRS)**), which includes reimbursement of expenditure on the GMS and the Drugs Payments Scheme (DPS). Omitted from this are the population who do not have GMS eligibility. Hence these estimates of these costs are an underestimation of the expenditure for pharmaceuticals for respiratory disease in the population.

The pharmacy claims dataset (HSE – Primary Care Reimbursement Scheme (PCRS)), was further utilised to estimate the prevalence of respiratory medication use in the means tested GMS scheme in 2016. In that year, approximately 37% of the Irish population (1.7 million people) were covered by the GMS scheme which entitled them to medication free-of-charge with a nominal co-payment. The majority of patients aged over 70 years were also eligible for this scheme. A comparison of those with full GMS coverage for the entirety of 2016 with the 2016 census data, found that 69% of males and 75% of females over 70 years had full GMS eligibility for the entire year. Hence, rates of medication use in these older age groups are largely representative of the wider Irish population.

The age and sex specific prevalence of all respiratory medication use in 2016 were estimated by restricting the cohort to those with full eligibility for 2016, and using total numbers in the GMS population (by age and sex) that had full eligibility for the entire year as the population denominator. Patterns of medication use in this cohort including the number of different drug classes dispensed from were examined. This data is presented in Chapters (Overview, Older People, Paediatrics, COPD).

The disease coding system used in Ireland currently for hospitalisations, as for deaths, is the 10th International Classification of Disease (ICD-10). It has been used for hospitalisations in Ireland since 2006 and for deaths since 2007. Specific publications which used HIPE accessed for this report included National Healthcare Quality Reporting System Annual report (2017)[6], Activity in Acute Hospitals (2016)[7] and National Audit of Hospital Mortality[8]. Otherwise the **Hospital Inpatient Enquiry (HIPE)** database was interrogated directly.

Hospitalisations are episodes of hospital inpatient care, classified by ICD coding on discharge. They are a measure of health service utilisation and reflect local medical care practices, data coding and recording patterns as well as the epidemiology of the conditions described.

Respiratory conditions were categorised as per the British Lung Foundation's recent publication[3]. The appendix shows details of ICD 10 codes used. Analyses were conducted on all hospitals reporting to HIPE between 2009 and 2016 (including children and maternity hospitals).

The report presents data on all hospitalisation activity (inpatient and day case activity) and inpatient activity only. Inpatient care includes both elective and emergency admissions to hospital - and encompasses all activity in the Acute Medical Assessment Units (AMAU) including those admitted to the Unit and discharged home the same day. It also includes those small numbers of admissions from the Emergency Department (ED) admitted and discharged on the same day. To facilitate comparison with other published reports, including that of the Department of Health[6], the Health Service Executive[7] and the British Lung Foundation[3] , analyses were conducted and reported upon in as similar manner as was possible. The following measures from HIPE were used throughout:

**Discharges/total discharges:** The total-discharges denominator includes all discharges from the included hospitals during the time period under examination. As the majority of analyses presented here are for inpatient activity, the denominator most commonly used is the total number of inpatient discharges during that year including maternity discharges as well as those discharges that were admitted and discharged the same day (but which were not day cases). This measure provides a comprehensive measure of the proportion of total inpatient activity attributable to respiratory disease.

**Age:** In addition to the impact across all ages, data is also presented for those aged 65 years and over, those aged 16 to 64 years and those aged 0-15 years. Among the latter group those aged 0 to 4 years were also analysed in terms of inpatient hospitalisations for respiratory disease.

**Bed days used:** This count is calculated by subtracting the date of discharge from the admission date to give the number of hospital days for each episode of care, which is then summed to give a total count of bed days used in any time period (usually per year), to facilitate comparison with other conditions. The measure gives an overall estimate of the burden of a condition on hospitals. For those admitted and discharged the same day, a bed day used of one is applied throughout.

These hospitalisation statistics relate to the main reason for admission to hospital. As with mortality data, the true impact of comorbid lung diseases may be underestimated. They only include data from HIPE reporting public hospitals and the numbers reflect episodes of care and not individual patients.

The data does not include ED presentations discharged home from hospital without admission. It does not cover Outpatient Department activity or other hospital activities not requiring hospital stay.

In the interests of clarity where appropriate the specific ICD 10 code is included, for example chronic lower respiratory disease (ICD 10: J40-47), chronic obstructive pulmonary disease (COPD) (ICD 10: J40-44, 47), and pneumonia (ICD 10: J12-18), pneumonia organism unspecified (ICD 10: J18), acute lower respiratory infection (unspecified) (ICD 10: J22).

## Report Structure

The structure of this report was influenced both by that of the British Lung Foundation report Battle for Breath and the White Book of the European Respiratory Society[2,3]. In addition to an overview chapter, there is a chapter on children's respiratory health and another on older people's respiratory health. There are also 11 disease specific chapters. The structure within most chapters reflects the headings used in the UK document[3]. These are:

- Disease incidence, which is a measure of the number or rate of new cases of disease occurring in the population over a specified period such as 12 months. Incidence data for respiratory infectious diseases (notifiable) and a limited number of chronic diseases such as lung cancer and cystic fibrosis are available. Incidence data for other diseases and conditions are sparse. The absence of primary care data is a particular challenge here.
- Disease prevalence is a measure of the number of cases of existing disease in the population at a given time, or over a period such as the past 12 months. In the absence of national population registries such as the National Cancer Registry, the voluntary Cystic Fibrosis Registry, the prevalence of a disease can be difficult to measure.
- Respiratory mortality is the number of people who died from the respiratory disease in the specified time period. Where available from PHIS, rates standardised for the population structure are given to facilitate comparisons.
- Impact on health service: in the absence of data for all but public hospitalisation data, the focus in these sections is on this data. For a few chapters, data on medication was extracted.
- Gender is reflected in the above as available.
- Age is reflected in the above as available.

- International comparison was not undertaken as the focus of this report is on Irish data. However, key sources were the World Health Organisation (WHO) European Region, which extends from the Atlantic coast to Central Asia, and its data on mortality and hospital admissions which was accessed via the European Respiratory Society White Book, the British Lung Foundation document previously mentioned and other more disease specific sources referenced in relevant chapters[2,3].

Overall, the data provided here is the most accurate picture available on the respiratory health of Ireland at a national level.

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# Overview of the Burden of Respiratory Disease in Ireland

02

## Key Points

- Respiratory disease causes 1 in 5 deaths in Ireland
- Respiratory disease death rates in Ireland are 38.2% higher than the EU-28 average
- Respiratory disease accounted for 14.3% of inpatient hospitalisations and 15.8% of bed days in 2016. Comparable figures for cardiovascular disease were 8.2% and 11.3% and for non-respiratory cancers 4.7% and 8.0%
- Respiratory disease accounted for 18.7% of emergency hospitalisations in 2016. 84.8% of respiratory hospitalisations were emergency admissions
- There are geographical and socio-economic variations in mortality from respiratory disease in Ireland

## Background

Respiratory disease refers to a wide range of conditions of which there are a number of causes. These include genetic factors, early life events, nutritional factors, environmental factors, tobacco smoking and occupational exposures. Smoking is the main risk factor for two of the most important diseases - lung cancer and chronic obstructive pulmonary disease (COPD) - in terms of numbers affected and impact both on health and on health services. Pneumonia is the third biggest cause of death from respiratory disease in Ireland. Cystic fibrosis is an example of an inherited genetic disorder. In view of the impact of some risk factors on multiple body systems and the fact that many of the diseases increase with age, co-morbidities have a major impact on disease outcome.

This report focuses on the respiratory diseases which have most impact in Ireland.

Sources of routinely collected data do not extend beyond deaths and hospitalisations for many respiratory conditions. National mortality and hospitalisation statistics present an incomplete picture of the burden of respiratory disease. For many diseases, hospitalisations and deaths are only the "tip of the iceberg"[1]. Not all diseases cause death and even where they do, this is often after a long protracted period of chronic ill health. The majority of respiratory diseases are managed totally in the community. Others are managed between hospital services and community while a smaller number are managed largely by specialist respiratory hospital services.

For many of the chronic respiratory diseases there is an absence of national primary care data, national prescription data, national data on respiratory aids and appliances including home oxygen, national data on Emergency Department(ED) and Outpatient Department (OPD) attendances and data from private hospitals. These would provide a clearer picture of the burden of respiratory disease in Ireland at a population level. There are a few exceptions to this dearth of information. These include the National Cancer Registry (NCRI) and the National Cystic Fibrosis Newborn Screening Programme. In addition there are a number of voluntary patient registers including the Cystic Fibrosis Registry, the Alpha-1 Antitrypsin Deficiency Registry and the more recently established Interstitial Lung Diseases Registry, all of which provide valuable information.

Many acute respiratory diseases are of an infectious nature and are managed in the community. For those managed in the hospital setting, care is often provided by non specialist respiratory services. A number of these infections, deemed to be of public health significance, are notifiable to regional Medical officers of Health (MoH). For these diseases there is both national incidence and trend data available. Examples of these include tuberculosis, influenza, pertussis and legionella. For others, such as pneumonia and bronchiolitis, we rely on mortality and hospitalisation data, as is the case for many of the chronic diseases.

## Incidence and Prevalence

At national level, incidence and prevalence data is not available for respiratory disease as a group. For some specific respiratory diseases, there are incidence and/or prevalence data while for some others, there are estimates based on extrapolation from international studies. These are included in the relevant disease specific chapter.

## Mortality

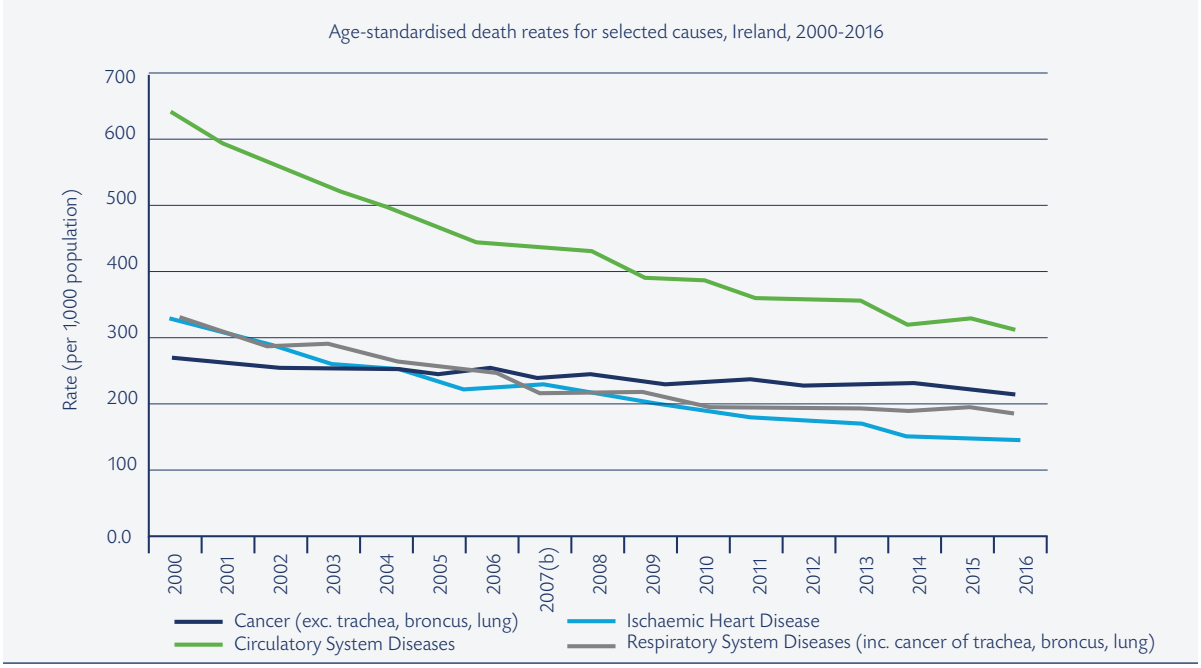
In Ireland the picture for overall all-cause mortality is one of decreasing mortality rates and rising life expectancy. The mortality rate for diseases of the cardiovascular system fell by 28.4% between 2007 and 2016. The cancer (all cancers) mortality rate decreased by 9.9% over the same period. However, there was relatively little change in terms of respiratory mortality in that period as evident in figure 2.1 below.

In 2016, the actual number of people who died from respiratory disease was 5,720 compared with 4,992 in 2007, an increase of 14.6%[2]. If lung cancer is excluded, the increase is 16.0%. Over the same decade the number of deaths from cardiovascular disease

reduced by 7.5%[2]. Respiratory disease, together with cardiovascular disease and non-respiratory cancer, are Ireland's top three causes of mortality. Respiratory disease (including cancer of the trachea, bronchus and lung) accounted for 18.8% (5,720) of all registered deaths in 2016[2]. The three major respiratory causes of death in 2016, accounting for 15.2% of all deaths, were lung cancer (6.1%, 1,864 deaths), chronic lower respiratory disease (ICD 10: J40-47) (5.6%, 1,711 deaths) and pneumonia (3.5%, 1,049 deaths). This is shown in table 2.1 overleaf.

When comparing Irish rates of principal causes of death with the EU-28 average, in 2014 the overall mortality rates in Ireland were lower than the EU-28 by 6.4% but rates of mortality from respiratory disease were higher in Ireland than the EU-28 average by 38.2%[2].

**Figure 2.1. Age-standardised death rates for selected causes, Ireland 2000-2016**




*Source: Health in Ireland, Key Trends, 2017, Department of Health, December 2017, Figure 2.6.[2] Note: b - break in series. Due to a change in classification system used to determine underlying cause of death from ICD9 to ICD10 in 2007, caution should be used in comparing rates over time. Note: data for 2016 is provisional.*

**Table 2.1. Principal causes of death: numbers and age-standardised death rate per 100,000 population 2007-2016**

| | | | | | | % Change | |
|---|---|---|---|---|---|---|---|
| | | 2007 | 2011 | 2015 | 2016 (p) | 2017-2016 | 2015-2016 |
| **All Causes** | Number | 28,117 | 28,456 | 30,127 | 30,389 | 8.1 | 0.9 |
| | Rate | 1,151.6 | 1,037.8 | 1008.9 | 983.8 | -14.6 | -2.5 |
| **Diseases of the Circulatory System** All Circulatory System Diseases | Number | 9,956 | 9,236 | 9,371 | 9,205 | -7.5 | -1.8 |
| | Rate | 436.1 | 358.7 | 330.0 | 312.2 | -28.4 | -5.4 |
| Ischaemic Heart Disease | Number | 5,375 | 4,707 | 4,492 | 4,405 | -18.0 | -1.9 |
| | Rate | 232.0 | 181.0 | 154.6 | 146.2 | -37.0 | -5.4 |
| Stroke | Number | 2,078 | 1,993 | 1,920 | 1,825 | -12.2 | -4.9 |
| | Rate | 93.0 | 78.4 | 68.7 | 63.0 | -32.3 | -8.3 |
| **Cancer** All Malignant Neoplasms | Number | 7,917 | 8,666 | 8,877 | 9,023 | 14.0 | 1.6 |
| | Rate | 304.9 | 299.6 | 277.6 | 274.6 | -9.9 | -1.1 |
| Cancer of the Trachea, Bronchus and Lung | Number | 1,668 | 1,850 | 1,828 | 1,864 | 11.8 | 2.0 |
| | Rate | 63.2 | 63.6 | 56.7 | 56.2 | -11.1 | -0.8 |
| Cancer of the Female Breast | Number | 611 | 690 | 678 | 726 | 18.8 | 7.1 |
| | Rate | 40.3 | 41.8 | 37.3 | 39.0 | -3.4 | 4.5 |
| **Diseases of the Respiratory System** All Respiratory System Diseases | Number | 3,324 | 3,438 | 3,865 | 3,856 | 16.0 | -.02 |
| | Rate | 152.3 | 138.0 | 138.9 | 132.7 | -12.9 | -4.5 |
| Chronic Lower Respiratory Diseases | Number | 1,496 | 1,504 | 1,701 | 1,711 | 14.4 | 0.6 |
| | Rate | 64.8 | 57.8 | 59.0 | 57.1 | -12.0 | -3.4 |
| Pneumonia | Number | 1,125 | 1,057 | 1,165 | 1,049 | -6.8 | -10.0 |
| | Rate | 55.5 | 45.4 | 44.3 | 38.4 | -30.8 | -13.4 |

*Source: Health in Ireland, Key Trends, 2017, Department of Health, December 2017. Table 2.4[2]. Note: data for 2016 is provisional*

## Impact on health services

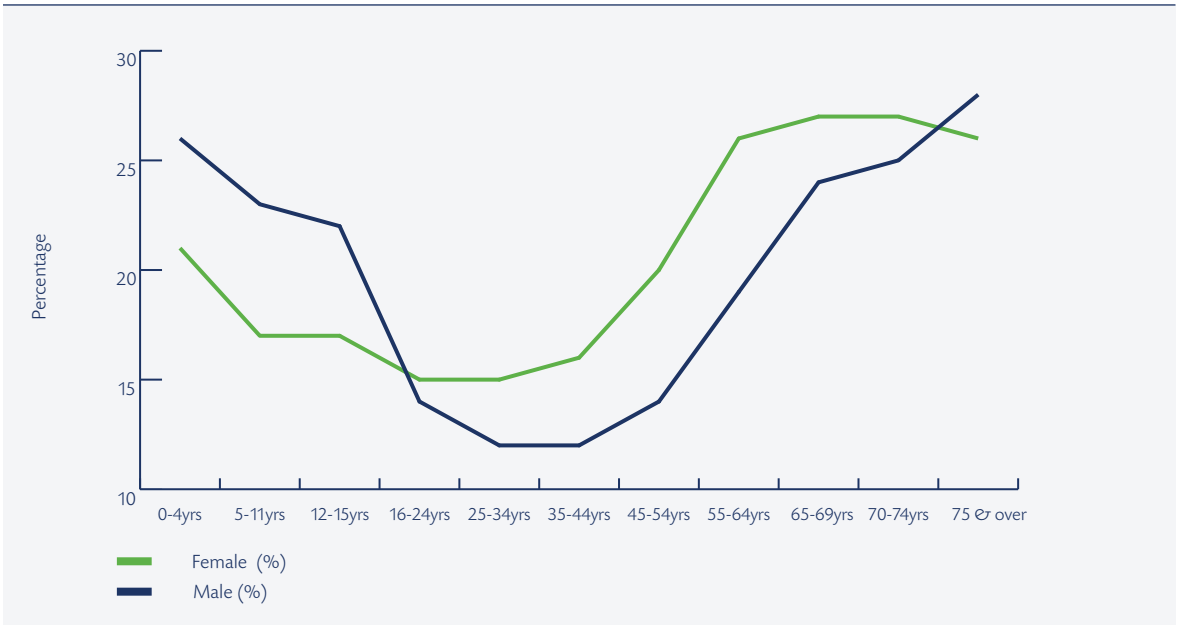
Most people with respiratory disease are cared for in the community by their GP and primary care team. Data on individual respiratory diseases is not available at national level for people with full medical cards, those with GP only cards or those who are private patients. This is also true for those who attend GPs, out of hours services and those who attend Emergency Departments. Data is not available nationally on those requiring respiratory aids and appliances including oxygen.

### *Respiratory medication use*

In Ireland in 2016, government cost for respiratory medications in the General Medical Services (GMS) population was €113.7 million (11% of the GMS budget) and 10.7 million (12% of the Drugs Payment Scheme (DPS) budget)[3]. These costs do not include additional drugs such as antibiotics or steroids or the supply of medication in hospitals. Neither do they account for the out-of-pocket costs by patients who pay privately for their medication (i.e. those not eligible for GMS or whose monthly medication costs fall below the €134 threshold for DPS). Hence these figures grossly underestimate expenditure on pharmaceuticals for the management of respiratory disease in Ireland.

Amongst those with a full GMS card for the entire calendar year 2016, (approximately 1.53 million individuals, 31% of males, 34% of females), 19.3% of males and 20.6% of females filled at least one prescription for a respiratory medication (Figure 2.2 and Table 2.2). Rates were highest in the early and later years of life. Just fewer than 30% of the population aged 0-4 years had full GMS coverage for the entirety of 2016. Of these, almost 26% of boys received a respiratory medication. This declined to a low of 12% for males in the middle age categories (25- 45 years), and rose steeply above 55 years of age to 28% in males aged over 75 years. Females showed a similar pattern, but with slightly lower rates than males until the age of 16 years, after which the rate of medication use among females remains consistently higher until very old age, when the rate was again higher amongst males[4].

**Figure 2.2. Percentage of GMS cohort that were dispensed at least one respiratory medication in 2016**




*Source: Hurley, E (2018). An analysis of medication use for respiratory disease amongst those with GMS eligibility (2015 - 2016) - a focus on Chronic Obstructive Pulmonary Disease (COPD)[4].*

**Table 2.2. Prevalence of respiratory medication use in the GMS population, 2016**

| | Population with GMS coverage | | Estimate of prevalence of respiratory medication use (%) | | | |
|---|---|---|---|---|---|---|
| | Male % | Female % | Male % | 95% CI | Female% | 95% CI |
| All ages | 31% | 34% | 19.3% | 19.2 to 19.4 | 20.6% | 20.5 to 20.7 |
| 0-4yrs | 28% | 27% | 26.4% | 26.0 to 26.8 | 21.4% | 21.0 to 21.8 |
| 5-11yrs | 35% | 35% | 22.6% | 22.3 to 22.8 | 17.2% | 17.0 to 17.5 |
| 12-15yrs | 29% | 29% | 21.7% | 21.3 to 22.1 | 17.3% | 16.9 to 17.7 |
| 16-24yrs | 24% | 26% | 14.3% | 14.1 to 14.6 | 15.2% | 14.9 to 15.5 |
| 25-34yrs | 20% | 25% | 11.6% | 11.3 to 11.8 | 14.6% | 14.3 to 14.9 |
| 35-44yrs | 23% | 27% | 11.8% | 11.6 to 12.0 | 15.5% | 15.3 to 15.8 |
| 45-54yrs | 27% | 28% | 14.3% | 14.0 to 14.5 | 20.2% | 19.9 to 20.4 |
| 55-64yrs | 31% | 32% | 19.2% | 18.8 to 19.5 | 26.1% | 25.8 to 26.4 |
| 65-69yrs | 40% | 47% | 23.5% | 23.9 to 23.9 | 26.6% | 26.2 to 27.0 |
| 70-74yrs | 60% | 67% | 25.1% | 24.7 to 25.5 | 26.6% | 26.2 to 27.0 |
| 75yrs & over | 75% | 78% | 28.0% | 27.7 to 28.3 | 26.3% | 26.0 to 26.6 |

*Source: Hurley, E (2018). An analysis of medication use for respiratory disease amongst those with GMS eligibility (2015 - 2016) - a focus on Chronic Obstructive Pulmonary Disease (COPD)[4].*

In adults aged 55 years and older, 46% of males and 51% of females held a full GMS card for the full calendar year of 2016 (Table 2.3). Of this cohort, 24% of males and 26.4% of females received at least one dispensing for a respiratory medication in 2016. In those aged 70 years and over, where GMS coverage is higher (69% females and 74% of males), the proportion receiving at least one respiratory medication in 2016 was 26.9% of eligible males and 26.4% of eligible females[4].

**Table 2.3. Prevalence of respiratory medication use in the GMS population by older age stratifications, 2016**

| Age category | Population with GMS coverage and % of Irish population | | Filled at least one Rx for a resp medication | | Estimate of prevalence of respiratory medication use (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Male (%) | Female (%) | Male | Female | Male% | 95% CI | Fem% | 95% CI |
| ≥55yrs | 250,430 (46%) | 306,648 (51%) | 60,035 | 80,868 | 24.0% | 23.8 to 24.1 | 26.4% | 26.2 to 26.5 |
| ≥65yrs | 173,505 (58%) | 224,773 (66%) | 45,272 | 59,511 | 26.1% | 25.9 to 26.3 | 26.5% | 26.3 to 26.7 |
| ≥70yrs | 131,889 (69%) | 174,516 (74%) | 35,512 | 46,132 | 26.9% | 26.7 to 27.2 | 26.4% | 26.2 to 26.7 |

*Source: Hurley, E (2018). An analysis of medication use for respiratory disease amongst those with GMS eligibility (2015 - 2016) - a focus on Chronic Obstructive Pulmonary Disease (COPD)[4].*

### *Impact on Hospitals*

Although OPD numbers can be difficult to interpret given the absence of respiratory specialists in some hospitals, variations in admission/discharge/follow-up practices and variations in community or primary care services, OPD data does reflect some of the burden on services. In 2016, 35 hospitals provided data on OPD attendances. Of these, 18 had dedicated respiratory clinics. In 2016, between general medicine clinics and respiratory clinics, there were 233,344 OPD attendances of which 19.9% were new patients. For the 18 hospitals for which there was data on respiratory clinics, there were 72,851 attendances of which 22.7% were new patients [5].

Inpatient and day case data is only available from HIPE reporting publicly funded hospitals – this data is discussed below. As noted in the methodology chapter, data on the majority of the notifiable respiratory infectious diseases was accessed from CIDR and not HIPE. Therefore the hospitalisation data below does not include most of these.

### *Trends in hospitalisations for respiratory disease, 2009-2016*

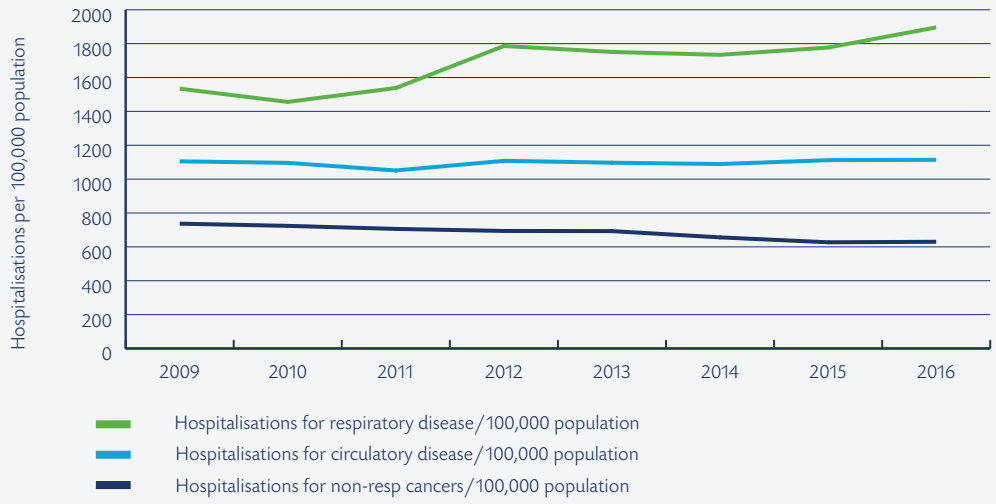
Figure 2.3 presents data on the number of inpatient hospitalisations per 100,000 population for three disease groups - respiratory hospitalisations, cardiovascular hospitalisations, and non-respiratory cancer hospitalisations - between 2009 and 2016. Figure 2.4 shows data on the proportion of inpatient hospitalisations for each of these three disease groups and bed days used. Respiratory disease accounted for the highest proportion of inpatient hospitalisations and bed days used and this relative proportion has increased steadily in recent years as shown in figure 2.4. In 2016, 14% of those hospitalised as inpatients in publicly funded HIPE reporting hospitals had a respiratory condition as the primary diagnosis accounting for just fewer than 16% of bed days used across all inpatient activity.

### *Hospitalisations (day cases and inpatients), 2016*

In 2016, respiratory disease accounted for 112,515 hospitalisations and 598,443 bed days (including day cases). This represented 6.6% of all hospitalisations and 12.7% of bed days. By comparison, hospitalisations for cardiovascular disease accounted for 4.3% of all hospitalisations and 9.2% of bed days while for non-respiratory cancers the figures were 7.4% and 8.3% respectively. These are shown in figure 2.5 and table 2.4.

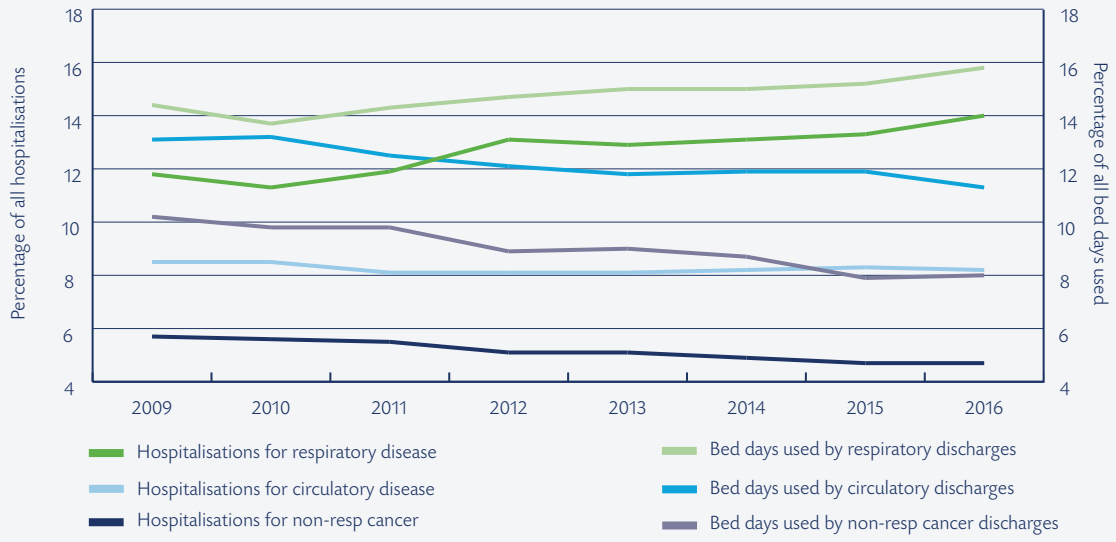
When respiratory diseases are looked at in greater detail (figure 2.6 and table 2.5), chronic obstructive pulmonary disease (COPD), acute lower respiratory infection (unspecified) and pneumonia accounted for the highest proportion of respiratory hospitalisations (15.5%, 14.8% and 11.7% respectively), while pneumonia, COPD and acute lower respiratory infection (unspecified) accounted for the greatest number of respiratory bed days used (21.5%, 21.1% and 17.3% respectively).

**Figure 2.3. Inpatient hospitalisations by disease group, per 100,000 population, 2009-2016**



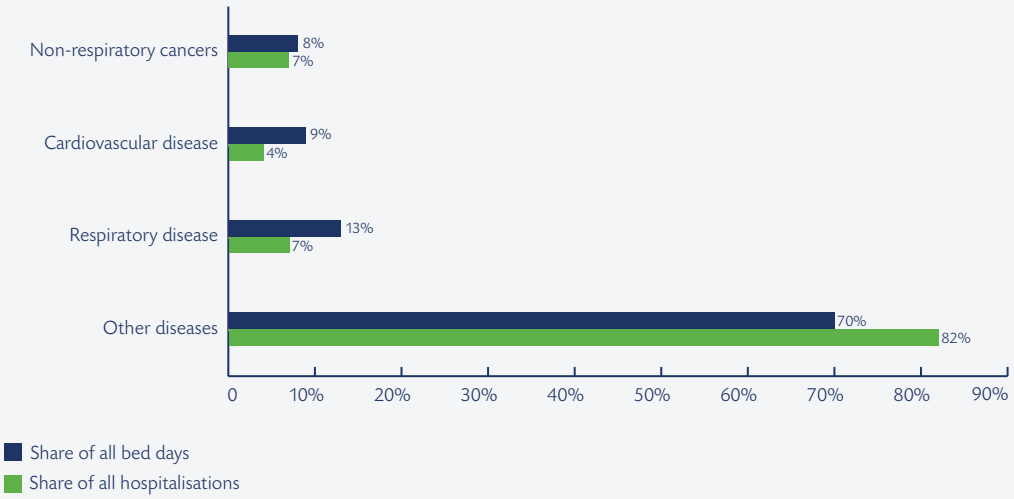

*Source: HIPE 2009-2016 - all hospitals reporting data to HIPE. Census 2011 population estimates used to standardise years 2009-2013; Census 2016 population estimates used for years 2014-2016.*

**Figure 2.4. Proportion of inpatient hospitalisations and bed days used by disease group, 2009-2016**



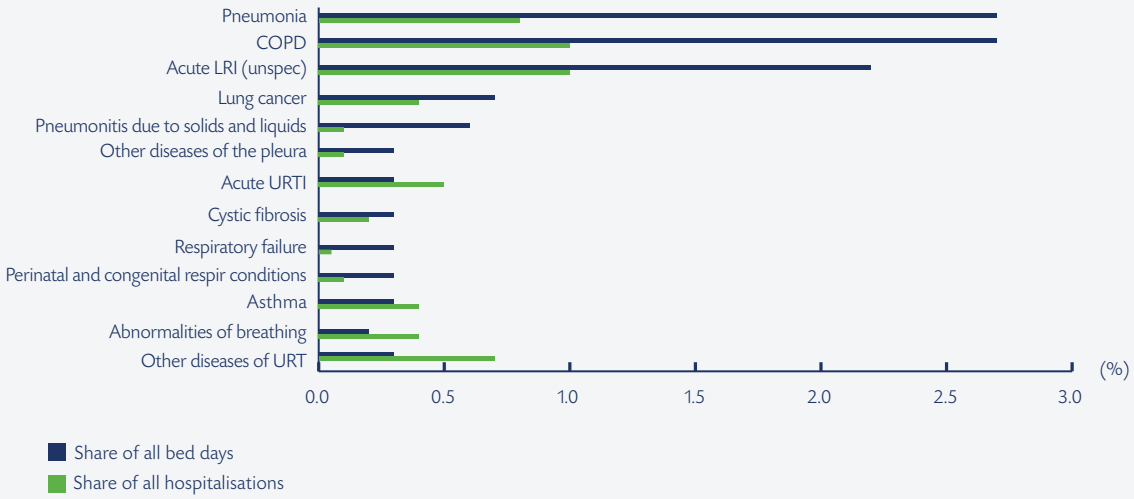

*Source: HIPE 2009-2016 - all hospitals reporting data to HIPE over the period. Note: Denominator includes all inpatient hospitalisations (elective, emergency, maternity and newborn). See Appendix for ICD-10 codes included in the creation of disease groups.*

**Figure 2.5. Percentage of all hospitalisations (including day cases) and bed days by disease group, 2016 (all ages)**




*Source: HIPE 2016 - all hospitals reporting data to HIPE*

**Figure 2.6. Percentage of all hospitalisations (including day cases) and bed days, by respiratory condition, 2016 (all ages)**



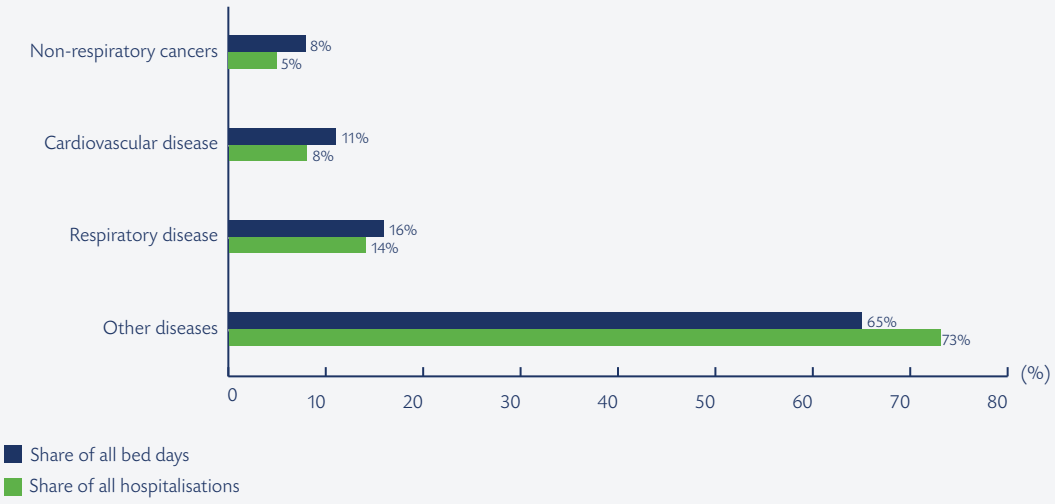

*Source: HIPE 2016 - all hospitals reporting data to HIPE*

**Table 2.4. Hospitalisations and bed days, 2016 (including day cases) (all ages)**

| | Hospitalisations | | Bed days | |
|---|---|---|---|---|
| | Number | Share of all hospitalisations | Number | Share of all bed days |
| All causes | 1,704,452 | | 4,712,040 | |
| Respiratory disease | 112,515 | 6.6% | 598,443 | 12.7% |
| Cardiovascular disease | 72,609 | 4.3% | 431,611 | 9.2% |
| Non-respiratory cancers | 126,579 | 7.4% | 388,981 | 8.3% |
| Other diseases | 1,392,749 | 81.7% | 3,293,005 | 69.9% |
| **Respiratory disease** | **Number** | **Share of resp hospitalisations** | **Number** | **Share of resp bed days** |
| COPD | 17,448 | 15.5% | 126,336 | 21.1% |
| Acute lower respiratory infection | 16,696 | 14.8% | 103,582 | 17.3% |
| Pneumonia | 13,193 | 11.7% | 128,833 | 21.5% |
| Other diseases of URT | 11,119 | 9.9% | 14,530 | 2.4% |
| Acute URTI | 8,550 | 7.6% | 15,368 | 2.6% |
| Asthma | 7,283 | 6.5% | 14,519 | 2.4% |
| Lung cancer | 6,238 | 5.5% | 34,150 | 5.7% |
| Abnormalities of breathing | 6,011 | 5.3% | 10,950 | 1.8% |
| Acute bronchiolitis | 3,516 | 3.1% | 11,951 | 2.0% |
| Cystic fibrosis | 3,245 | 2.9% | 16,216 | 2.7% |
| Perinatal and congenital resp conditions | 2,526 | 2.2% | 12,710 | 2.1% |
| Cough | 2,279 | 2.0% | 2,847 | 0.5% |
| Sleep apnoea | 2,241 | 2.0% | 2,840 | 0.5% |
| Pneumonitis due to solids and liquids | 1,952 | 1.7% | 30,327 | 5.1% |
| Other diseases of the pleura | 1,860 | 1.7% | 15,393 | 2.6% |
| Other diseases of the respiratory system | 1,578 | 1.4% | 4,005 | 0.7% |
| Pulmonary embolism | 1,452 | 1.3% | 11,359 | 1.9% |
| Influenza | 1,437 | 1.3% | 8,201 | 1.4% |
| Idiopathic pulmonary fibrosis | 981 | 0.9% | 6,776 | 1.1% |
| Sarcoidosis | 758 | 0.7% | 1,888 | 0.3% |
| Respiratory failure | 734 | 0.7% | 13,333 | 2.2% |
| Pulmonary vascular diseases (excl embolism) | 286 | 0.3% | 2,170 | 0.4% |
| Tuberculosis | 262 | 0.2% | 3,622 | 0.6% |
| Acute bronchitis | 246 | 0.2% | 549 | 0.1% |
| Suppurative and necrotic conditions of LRT | 161 | 0.1% | 2,019 | 0.3% |
| Postprocedural respiratory disorders, not elsewhere classified | 136 | 0.1% | 1,161 | 0.2% |
| Mesothelioma | 116 | 0.1% | 911 | 0.2% |
| Lung diseases due to external agents (excl pneumonitis due to solids & liquids) | 110 | 0.1% | 723 | 0.1% |
| Other respiratory diseases principally affecting the interstitium (excl J81 & J84) | 101 | 0.1% | 1,174 | 0.2% |

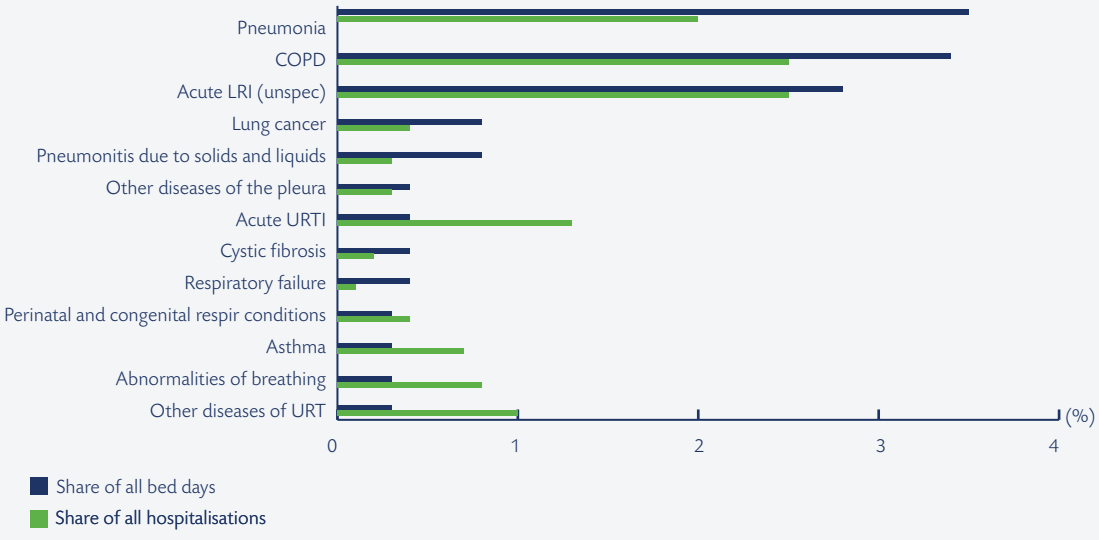
*Source: HIPE 2016 - all hospitals reporting data to HIPE.*

**Figure 2.7. Percentage of all inpatient hospitalisations and bed days by disease group, 2016 (all ages)**




*Source: HIPE 2016 - all hospitals reporting data to HIPE*

**Figure 2.8. Percentage of inpatient hospitalisations and bed days by respiratory condition, 2016 (all ages)**




*Source: HIPE 2016 - all hospitals reporting data to HIPE*

## *Hospital Inpatients 2016*

The number of inpatient hospitalisations for respiratory disease in 2016 was 92,391, which represented 14.3% all inpatient hospitalisations. These used 578,319 bed days or 15.8% of total inpatient bed days. For cardiovascular disease the corresponding figures were 8.2 % of inpatient hospitalisations and 11.3 % of bed days while for non-respiratory cancers the figures were 4.7% and 8.0 % respectively. These are shown in figure 2.7 and table 2.5.

Acute lower respiratory infection (unspecified) and COPD accounted for the highest proportion of inpatient hospitalisations for respiratory disease in 2016. COPD and pneumonia account for the largest proportion of bed days used. Acute lower respiratory infection (unspecified) accounted for 17.6% of respiratory inpatient hospitalisations, while COPD accounted for 17.3% followed by pneumonia at 14.1%. In terms of respiratory inpatient bed days used, pneumonia accounted for 22.4%, COPD 21.7% and acute lower respiratory infection (unspecified) (17.9%). This is shown in figure 2.8 and table 2.5.

**Table 2.5. Inpatient hospitalisations and bed days, 2016 (all ages)**

| | Hospitalisations | | Bed days | |
|---|---|---|---|---|
| | Number | Share of all hospitalisations | Number | Share of all bed days |
| All causes | 643,850 | | 3,651,438 | |
| Respiratory disease | 92,391 | 14.3% | 578,319 | 15.8% |
| Cardiovascular disease | 53,008 | 8.2% | 412,010 | 11.3% |
| Non-respiratory cancers | 30,099 | 4.7% | 292,501 | 8.0% |
| Other diseases | 468,352 | 72.7% | 2,368,608 | 64.9% |
| **Respiratory disease** | **Number** | **Share of resp hospitalisations** | **Number** | **Share of resp bed days** |
| Acute lower respiratory infection (unspec) | 16,245 | 17.6% | 103,131 | 17.9% |
| COPD | 15,959 | 17.3% | 124,847 | 21.7% |
| Pneumonia | 13,048 | 14.1% | 128,688 | 22.4% |
| Acute URTI | 8,288 | 9.0% | 15,106 | 2.6% |
| Other diseases of URT | 6,266 | 6.8% | 9,677 | 1.7% |
| Abnormalities of breathing | 5,184 | 5.6% | 10,123 | 1.8% |
| Asthma | 4,394 | 4.8% | 11,630 | 2.0% |
| Acute bronchiolitis | 3,476 | 3.8% | 11,911 | 2.1% |
| Lung cancer | 2,671 | 2.9% | 30,583 | 5.3% |
| Perinatal and congenital resp conds | 2,468 | 2.7% | 12,652 | 2.2% |
| Sleep apnoea | 2,167 | 2.3% | 2,766 | 0.5% |
| Pneumonitis due to solids and liquids | 1,946 | 2.1% | 30321 | 5.3% |
| Other diseases of the pleura | 1,703 | 1.8% | 15,236 | 2.6% |
| Influenza | 1,428 | 1.5% | 8,192 | 1.4% |
| Pulmonary embolism | 1,426 | 1.5% | 11,333 | 2.0% |
| Cystic fibrosis | 1,110 | 1.2% | 14,081 | 2.4% |
| Cough | 1,022 | 1.1% | 1,590 | 0.3% |
| Other diseases of the respiratory syst | 839 | 0.9% | 3,266 | 0.6% |
| Respiratory failure | 733 | 0.8% | 13,332 | 2.3% |
| Idiopathic pulmonary fibrosis | 657 | 0.7% | 6,452 | 1.1% |
| Acute bronchitis | 236 | 0.3% | 539 | 0.1% |
| Sarcoidosis | 234 | 0.3% | 1,364 | 0.2% |
| Tuberculosis | 212 | 0.2% | 3,572 | 0.6% |
| Pulmonary vascular diseases (excl emb) | 211 | 0.2% | 2,095 | 0.4% |
| Suppurative & necrotic conditions of LRT | 140 | 0.2% | 1,998 | 0.3% |
| Postprocedural respiratory disorders, not elsewhere classified | 130 | 0.1% | 1,155 | 0.2% |
| Lung diseases due to external agents (excl pneumonitis due to solids & liq) | 85 | 0.1% | 698 | 0.1% |
| Mesothelioma | 61 | 0.1% | 856 | 0.1% |
| Other respiratory diseases principally affecting the interstitium (excl J81 & J84) | 52 | 0.1% | 1,125 | 0.2% |

*Source: HIPE 2016 - all hospitals reporting data to HIPE*

The Activity in Acute Public Hospitals in Ireland report for 2016 listed three respiratory conditions among its top 10 Principal Diagnoses for inpatient hospitalisations. Following spontaneous delivery, pain in throat and chest and delivery by caesarean section came acute lower respiratory infection (unspecified) (ICD 10: J22) followed by "other chronic obstructive pulmonary disease (ICD 10: J44)" in 4th and 5th place and in 8th place came "pneumonia organism unspecified (ICD 10: J18)". In the same report, among the top 20 principal procedures blocks for inpatients, non-invasive ventilation (NIV) was at number 11 while ventilatory support was number 17, followed by sleep studies at number 18. Five of the top twenty principal procedures related to childbirth [6].

Of the elective inpatient hospitalisations in the above report, four respiratory conditions were listed among the top 20 principal diagnoses. In 3rd place were chronic diseases of tonsils/adenoids (ICD 10: J35), in 4th place were sleep disorders (ICD 10: G47), while lung cancer was 12th and abnormalities of breathing (ICD 10: R06) was 16th. Among the top principal procedures on elective inpatients, sleep studies were 4th[6].

### *Emergency Inpatient Hospitalisations 2016*

The majority of inpatient hospitalisations in 2016 were as emergencies. In 2016, of the 92,391 inpatient respiratory hospitalisations, 84.8% (78,364) were as emergencies, representing 18.7% of all emergency hospitalisations. These hospitalisations accounted for 519,587 bed days or 20.1% of all emergency inpatient bed days in 2016.

For cardiovascular disease the corresponding figures were 10.7% of all emergency inpatient hospitalisations and 14.3% of bed days used. For non-respiratory cancers the figures were 2.9% and 5.7% of emergency hospitalisations and emergency bed days. These are shown in figures 2.9 and table 2.6 below.

The respiratory conditions which necessitated emergency inpatient care are shown in greater detail in figure 2.10 and table 2.6 below. Pneumonia, COPD and acute lower respiratory infection (unspecified) accounted for 10.5% of all emergency hospitalisations and 13.3% of all bed days used by emergency admissions.

The Activity in Acute Public Hospitals in Ireland report for 2016 listed among its top three Principal Diagnoses for emergency hospitalisations two respiratory conditions i.e. after pain in throat and chest in 2nd and 3rd place came acute lower respiratory infection (unspecified)(ICD 10: J22), followed by "other chronic obstructive pulmonary disease (ICD 10: J44)". In joint 4th place came "pneumonia organism unspecified (ICD 10: J18)". Among the top 20 principal procedures blocks for emergency inpatients, at number seven was NIV while at number nine was ventilatory support[6].

## Gender

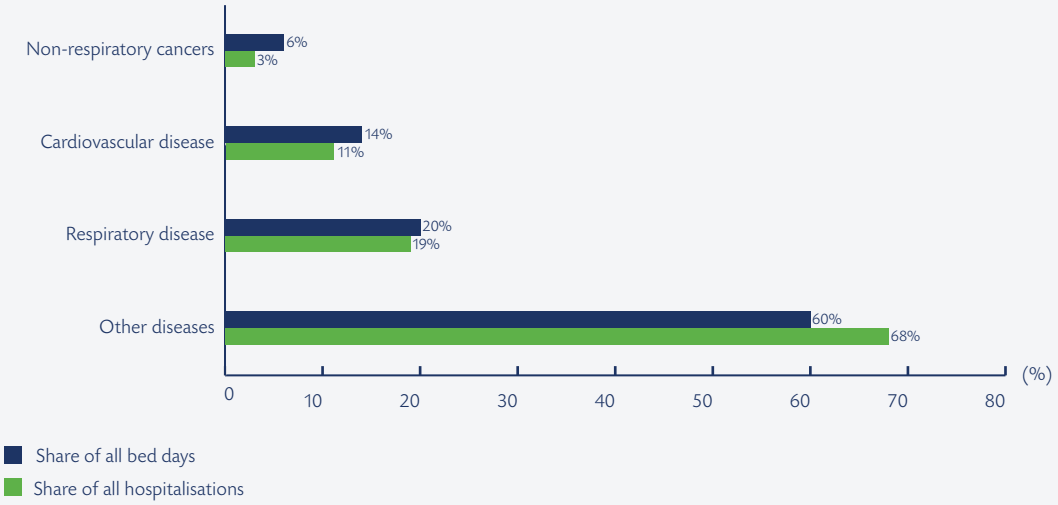
18.8% of deaths in 2016 in both males and females were due to respiratory disease. The respiratory cause of death varied by gender. In males, 6.6% of deaths were due to lung cancer, followed by chronic lower respiratory disease at 5.6% and pneumonia at 2.9%. For females the order was the same although the percentage was different ie lung cancer 5.7%, chronic lower respiratory disease 5.6% and pneumonia 4.0%.

In 2016, 5.4% of hospitalisations in females were for respiratory causes - this rose to 10.8% for inpatients only. The corresponding figures for males were 6.7% and 16.5%. In terms of bed days used, respiratory disease accounted for 13.1% of hospitalisations (16.9% inpatients) in males and 13.5 % (10.9% inpatients) in females.

## Age

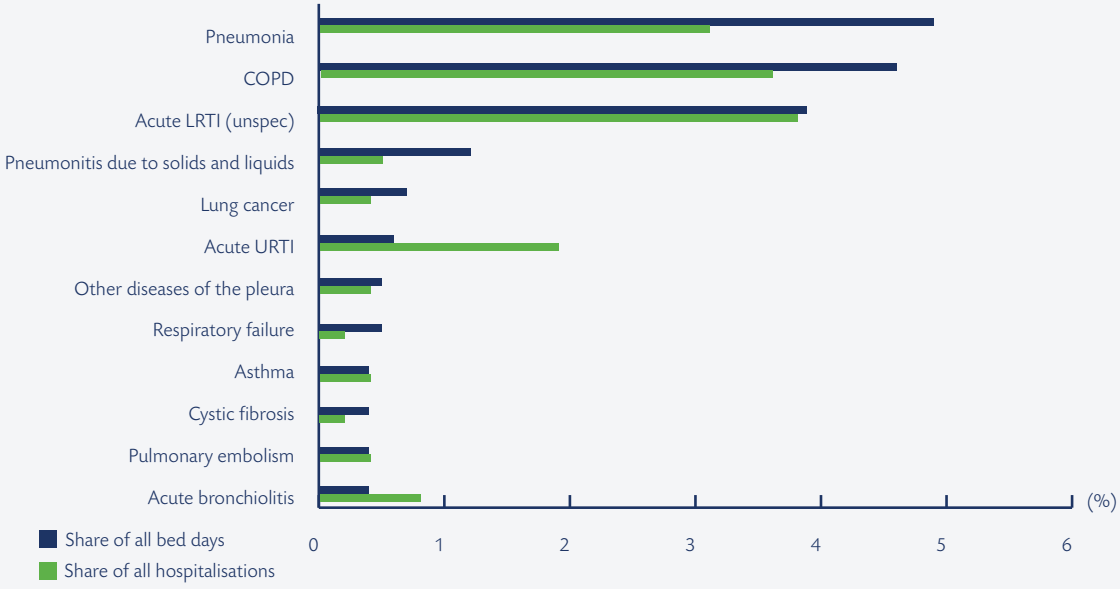
Overall mortality rates can mask variations between age groups. The majority of deaths from respiratory disease are in people aged 65 years and over. Causes of death for those aged 65 years and over differ from those in younger ages. As evident in figure 2.11, for those aged 0-64 years, in 2016 respiratory disease accounted for 12.6% of deaths compared with 20.1% for those aged 65 years and older. For those aged 0-64 years, cancer of the trachea, bronchus and lung accounted for 7.3% of all deaths followed by chronic lower respiratory disease (2.1%) and pneumonia (1.1%). For those aged 65 years and older chronic lower respiratory disease accounted for 6.1% of all deaths, followed by cancer of the trachea, bronchus and lung at 5.5% and pneumonia (3.8%)[2].

**Figure 2.9. Percentage of emergency hospitalisations and bed days by disease group, 2016 (all ages)**




*Source: HIPE 2016 - all hospitals reporting data to HIPE*

**Figure 2.10. Percentage of emergency hospitalisations and bed days by respiratory condition, 2016 (all ages)**



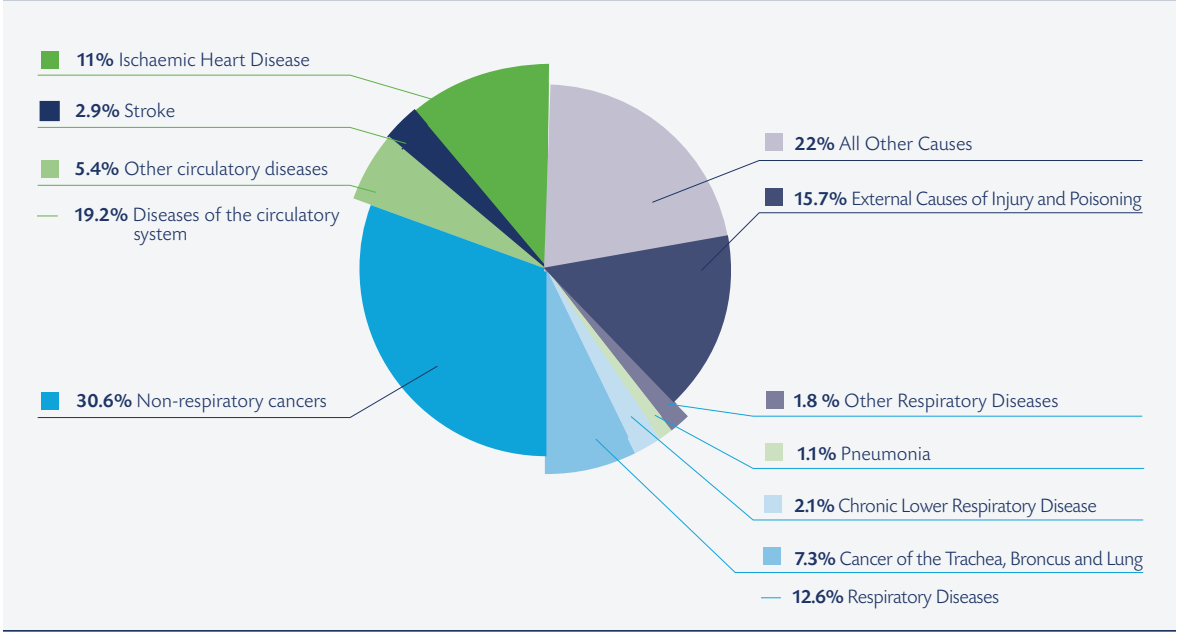

*Source: HIPE 2016 - all hospitals reporting data to HIPE*

**Table 2.6. Emergency hospitalisations and bed days, 2016 (all ages)**

| | Hospitalisations | | Bed days | |
|---|---|---|---|---|
| | Number | Share of all hospitalisations | Number | Share of all bed days |
| All causes | 418,396 | | 2,583,474 | |
| Respiratory disease | 78,364 | 18.7% | 519,587 | 20.1% |
| Cardiovascular disease | 44,932 | 10.7% | 368,635 | 14.3% |
| Non-respiratory cancers | 11,929 | 2.9% | 147,915 | 5.7% |
| Other diseases | 283,171 | 67.7% | 1,547,337 | 59.9% |
| **Respiratory disease** | **Number** | **Share of resp hospitalisations** | **Number** | **Share of resp bed days** |
| Acute lower respiratory infection (unspec) | 15,879 | 20.3% | 99,667 | 19.2% |
| COPD | 15,262 | 19.5% | 117,626 | 22.6% |
| Pneumonia | 12,821 | 16.4% | 125,654 | 24.2% |
| Acute URTI | 8,148 | 10.4% | 14,815 | 2.9% |
| Abnormalities of breathing | 4,301 | 5.5% | 8756 | 1.7% |
| Asthma | 4,252 | 5.4% | 11,119 | 2.1% |
| Acute bronchiolitis | 3,140 | 4.0% | 10,497 | 2.0% |
| Pneumonitis due to solids and liquids | 1,935 | 2.5% | 30,119 | 5.8% |
| Other diseases of URT | 1,698 | 2.2% | 4,094 | 0.8% |
| Other diseases of the pleura | 1,529 | 2.0% | 13,672 | 2.6% |
| Lung cancer | 1,507 | 1.9% | 18,716 | 3.6% |
| Pulmonary embolism | 1,391 | 1.8% | 10,983 | 2.1% |
| Influenza | 1,389 | 1.8% | 7,791 | 1.5% |
| Cough | 981 | 1.3% | 1,445 | 0.3% |
| Cystic fibrosis | 790 | 1.0% | 10,988 | 2.1% |
| Other diseases of the respiratory system | 725 | 0.9% | 2,732 | 0.5% |
| Respiratory failure | 697 | 0.9% | 12,498 | 2.4% |
| Idiopathic pulmonary fibrosis | 518 | 0.7% | 5,250 | 1.0% |
| Acute bronchitis | 233 | 0.3% | 533 | 0.1% |
| Sarcoidosis | 190 | 0.2% | 961 | 0.2% |
| Tuberculosis | 182 | 0.2% | 3,046 | 0.6% |
| Pulmonary vascular diseases (excl embolism) | 175 | 0.2% | 1,715 | 0.3% |
| Sleep apnoea | 124 | 0.2% | 357 | 0.1% |
| Suppurative and necrotic conditions of LRT | 117 | 0.1% | 1,768 | 0.3% |
| Postprocedural respiratory disorders, not elsewhere classified | 115 | 0.1% | 1,092 | 0.2% |
| Perinatal and congenital resp conditions | 101 | 0.1% | 1,378 | 0.3% |
| Lung diseases due to external agents (excl pneumonitis due to solids & liquids) | 72 | 0.1% | 595 | 0.1% |
| Other respiratory diseases principally affecting the interstitium (excl J81 & J84) | 48 | 0.1% | 1,036 | 0.2% |
| Mesothelioma | 44 | 0.1% | 684 | 0.1% |

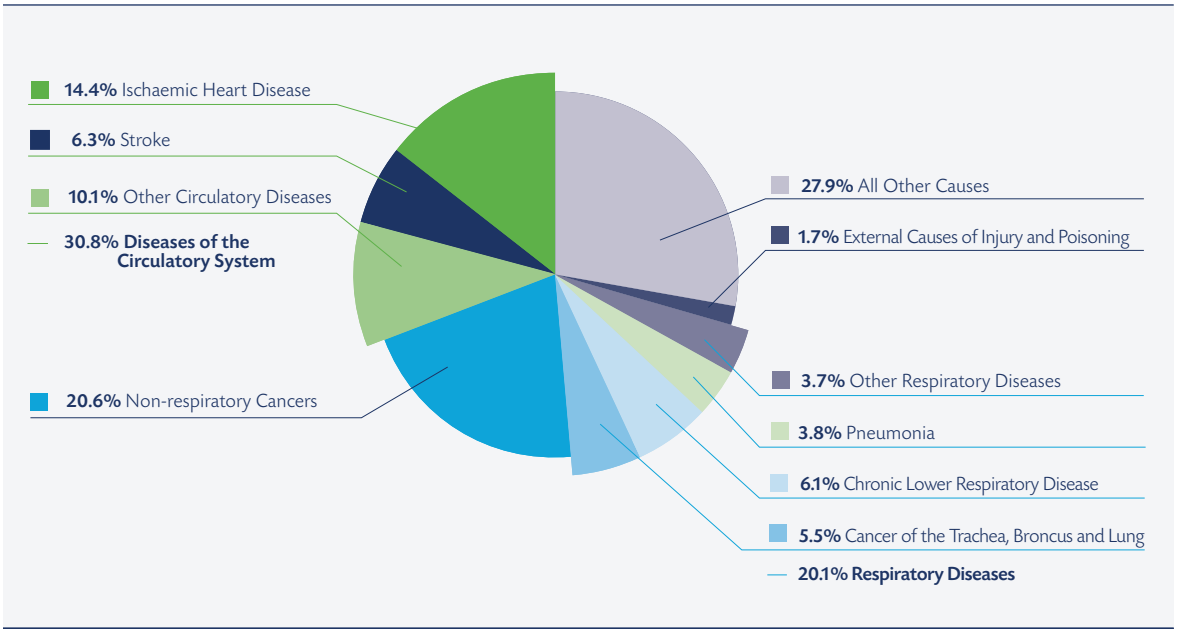
*Source: HIPE 2016 - all hospitals reporting data to HIPE*

**Figure 2.11a Deaths by principal causes, percentage distribution, 2016 ages 0-64**




*Source Health in Ireland, Key Trends, 2017, Department of Health, December 2017 Figures 2.4a[2]. Note: data for 2016 is provisional.*

**Figure 2.11b Deaths by principal causes, percentage distribution, 2016 ages 65 and over**




*Source Health in Ireland, Key Trends, 2017, Department of Health, December 2017 Figures 2.4b[2]. Note: data for 2016 is provisional.*

Figure 2.12 shows the number of hospitalisations and bed days used for respiratory conditions by three major age groups over the period 2009-2016. It reflects the value of including both variables (hospitalisations, bed days) when looking at impact on hospital services.

### *Children aged 0-15 years: 2016 (See Chapter 14)*

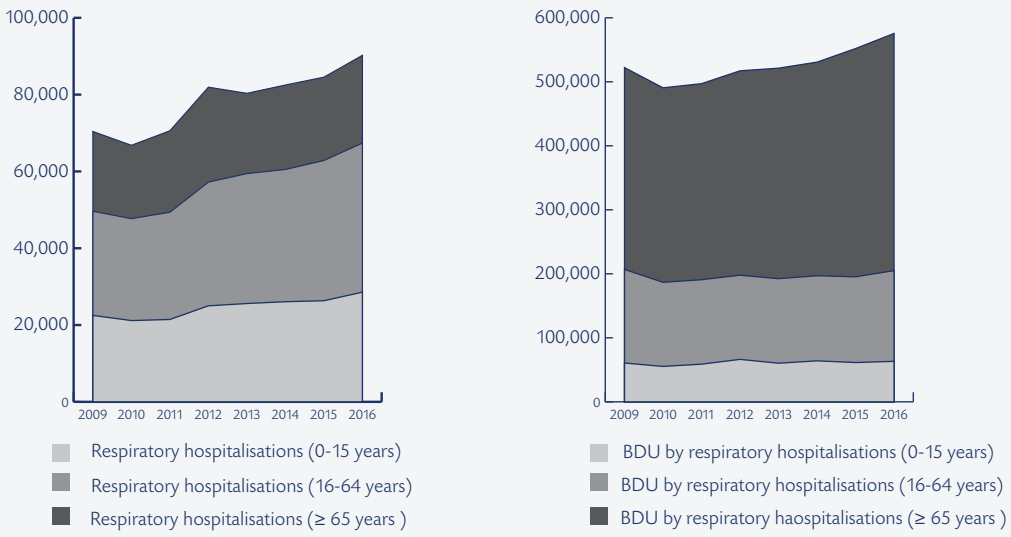
Respiratory inpatient hospitalisations accounted for 26.7% of inpatient hospitalisations and 21.7% of inpatient bed days among 0-15 year olds in 2016 (see Chapter 14). The top two respiratory causes of inpatient hospitalisations were acute upper respiratory tract infection (URTI) and acute bronchiolitis which accounted for 6.1% and 3.9% of all inpatient hospitalisations in the 0-15 year age group. In terms of inpatient bed days used, the top two respiratory conditions were perinatal and congenital respiratory conditions (4.3%) followed by acute bronchiolitis (4.0%). This is further discussed in chapter 14.

### *Adults aged 16-64 years: 2016*

In terms of number of inpatient hospitalisations and inpatient bed days as shown in figures 2.13, 2.14 and table 2.7, the picture differs significantly for those aged 16-64 years compared to the paediatric population. In 2016, respiratory disease accounted for 8.5% of inpatient hospitalisations in the 16-64 year age group (vs 5.4% for cardiovascular, 4.3% for non-respiratory cancers), and 10.2% of inpatient bed days (vs 7.9% for cardiovascular, 9.4% for non-respiratory cancers).

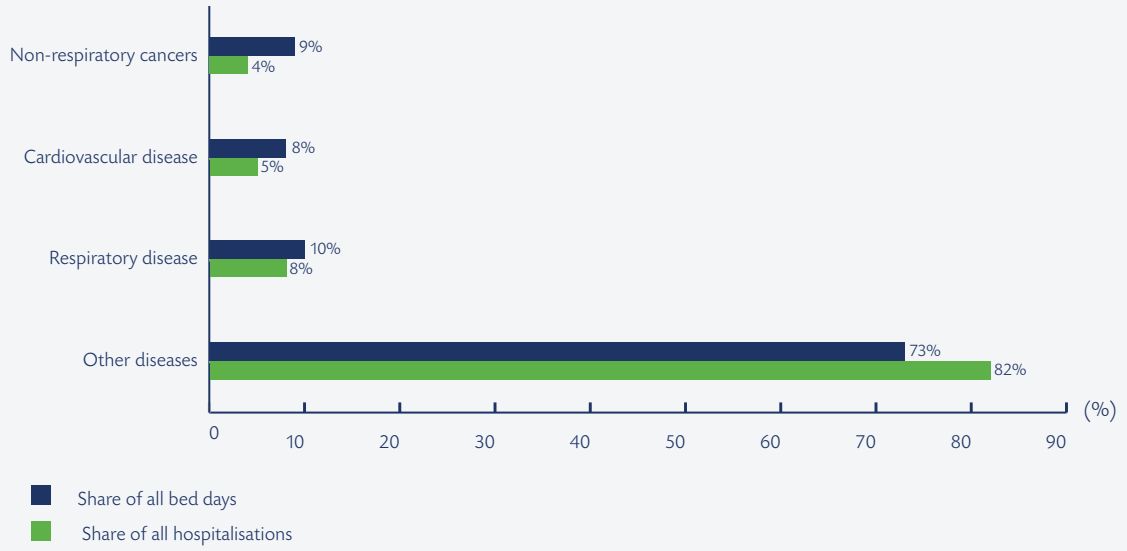
The top three respiratory causes of inpatient hospitalisations were acute lower respiratory infection (unspecified) (1.4%), COPD (1.1%) and pneumonia (1.0%) in the 16-64 year age group. In terms of bed days used the order was reversed i.e. pneumonia (1.8%), COPD (1.6%) and acute lower respiratory infection (unspecified) (1.4%).

**Figure 2.12. Inpatient hospitalisations and bed days by respiratory disease, by age category, 2009-2016**



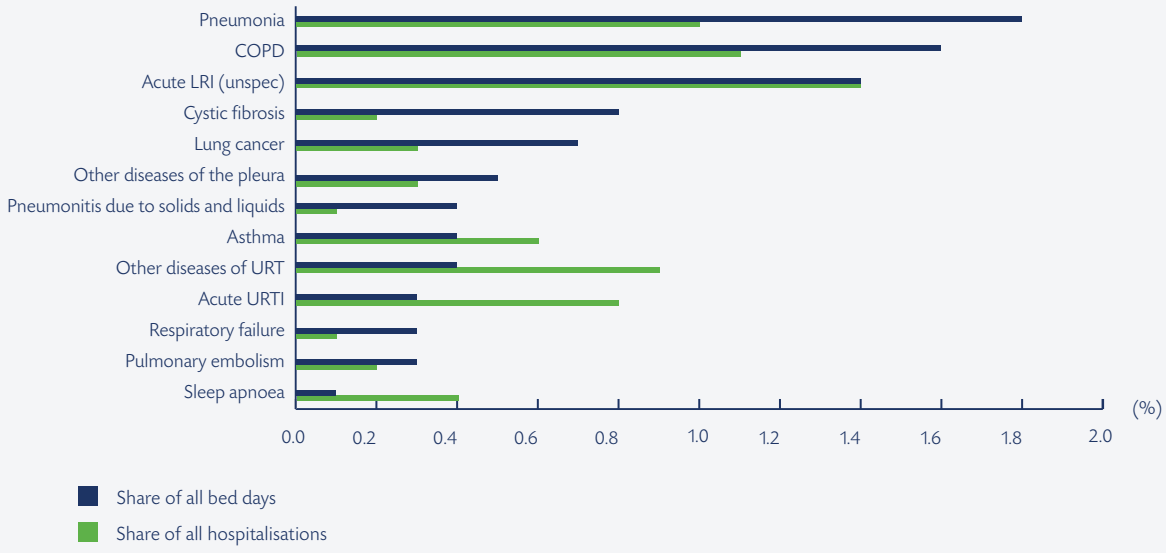

*Source: HIPE 2009-2016 - all hospitals reporting data to HIPE*

**Figure 2.13. Percentage of inpatient hospitalisations and bed days by disease group, 2016 (16-64 years)**




*Source: HIPE 2016 - all hospitals reporting data to HIPE*

**Figure 2.14. Percentage of inpatient hospitalisations and bed days by respiratory condition,2016 (16-64 years)**



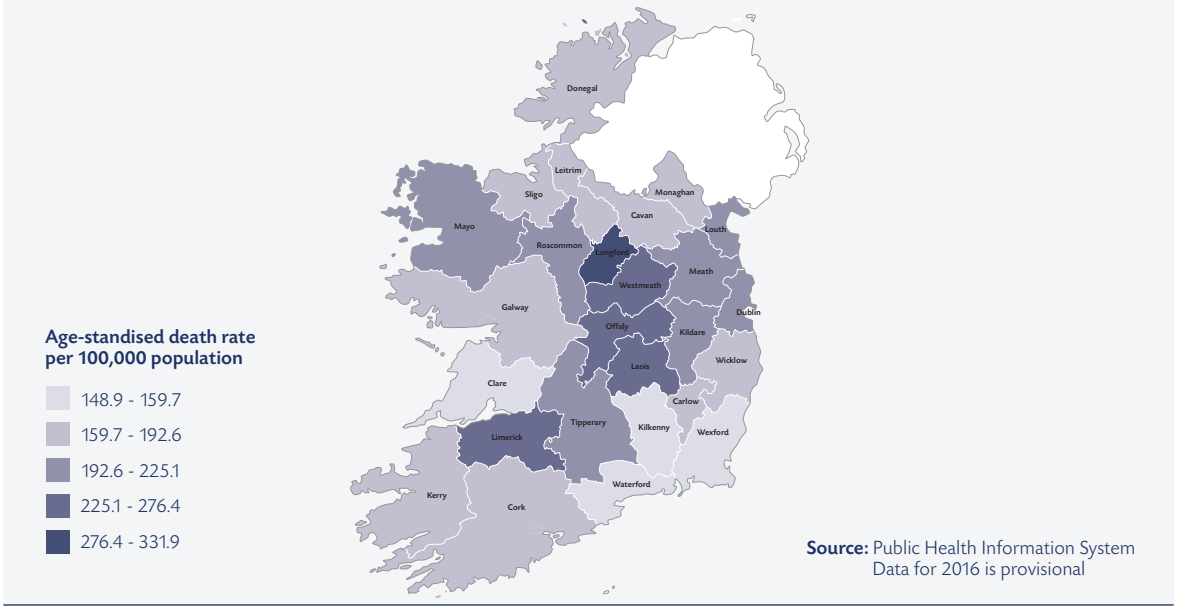

*Source: HIPE 2016 - all hospitals reporting data to HIPE*

**Table 2.7. Inpatient hospitalisations and bed days, 2016 (16-64 years inclusive)**

| | Hospitalisations | | Bed days | |
|---|---|---|---|---|
| | Number | Share of hospitalisations | Number | Share of all bed days |
| All causes | 351,219 | | 1,410,697 | |
| Respiratory disease | 29,826 | 8.5% | 143,321 | 10.2% |
| Cardiovascular disease | 18,960 | 5.4% | 110,754 | 7.9% |
| Non-respiratory cancers | 15,014 | 4.3% | 131,911 | 9.4% |
| Other diseases | 287,419 | 81.8% | 1,024,711 | 72.6% |
| **Respiratory disease** | **Number** | **Share of resp hospitalisations** | **Number** | **Share of resp bed days** |
| Acute lower respiratory infection (unspec) | 4,910 | 16.5% | 19,491 | 13.6% |
| COPD | 3,961 | 13.3% | 22,815 | 15.9% |
| Pneumonia | 3,455 | 11.6% | 25,005 | 17.4% |
| Other diseases of URT | 3,273 | 11.0% | 5,155 | 3.6% |
| Acute URTI | 2,658 | 8.9% | 4,941 | 3.4% |
| Asthma | 1,966 | 6.6% | 5,572 | 3.9% |
| Abnormalities of breathing | 1,866 | 6.3% | 3,067 | 2.1% |
| Sleep apnoea | 1,265 | 4.2% | 1,553 | 1.1% |
| Other diseases of the pleura | 896 | 3.0% | 6,430 | 4.5% |
| Lung cancer | 888 | 3.0% | 9,294 | 6.5% |
| Cystic fibrosis | 807 | 2.7% | 11,394 | 7.9% |
| Pulmonary embolism | 701 | 2.4% | 3,929 | 2.7% |
| Influenza | 653 | 2.2% | 3,635 | 2.5% |
| Cough | 484 | 1.6% | 724 | 0.5% |
| Pneumonitis due to solids and liquids | 419 | 1.4% | 5,866 | 4.1% |
| Other diseases of the respiratory system | 399 | 1.3% | 1,148 | 0.8% |
| Respiratory failure | 242 | 0.8% | 4,205 | 2.9% |
| Sarcoidosis | 203 | 0.7% | 1,096 | 0.8% |
| Idiopathic pulmonary fibrosis | 185 | 0.6% | 1,762 | 1.2% |
| Tuberculosis | 157 | 0.5% | 2,511 | 1.8% |
| Acute bronchitis | 131 | 0.4% | 198 | 0.1% |
| Suppurative and necrotic conditions of LRT | 76 | 0.3% | 1,177 | 0.8% |
| Pulmonary vascular diseases (excl embolism) | 65 | 0.2% | 738 | 0.5% |
| Postprocedural respiratory disorders, not elsewhere classified | 59 | 0.2% | 350 | 0.2% |
| Lung diseases due to external agents (excl pneumonitis due to solids & liquids) | 38 | 0.1% | 284 | 0.2% |
| Other respiratory diseases principally affecting the interstitium (excl J81 & J84) | 35 | 0.1% | 677 | 0.5% |
| Mesothelioma | 18 | 0.1% | 262 | 0.2% |
| Acute bronchiolitis | 16 | 0.1% | 42 | 0.0% |

*Source: HIPE 2016 - all hospitals reporting data to HIPE*

**Figure 2.15. 5 year age-standardised death rates from respiratory system disease, Ireland 2012-2016**




*Source: Health in Ireland, Key Trends, 2017, Department of Health, December 2017. Figure 2.5a* [2]

### *Adults aged 65 years and over (See Chapter 15)*

The number of inpatient hospitalisations in 2016 was 643,850 accounting for 3,651,436 bed days (Table 2.5). Of the inpatient hospitalisations, 32 % (204,882) were in those aged 65 years and over accounting for 53.2% (1,946, 040) of all inpatient bed days.

Respiratory disease accounted for 19% of inpatient hospitalisations in this age group (vs. 16% for cardiovascular, 7% for non-respiratory cancers), and 19% of inpatient bed days (vs. 15% for cardiovascular, 8% for non-respiratory cancers) as shown in chapter 15.

The top three respiratory causes of inpatient hospitalisations in those aged 65 years and over were COPD (5.8%), acute lower respiratory infection (unspecified) (4.4%), and pneumonia (3.9%). In terms of bed days used the order was COPD (5.2%), pneumonia (5.0%) and acute lower respiratory infection (unspecified) (4.0%). This is further discussed in chapter 15.

## Regional variation

Overall mortality rates can mask variations between regions. Within Ireland the age standardised mortality rate for respiratory disease shows regional variation as evident in figure 2.15. Age-standardised respiratory mortality at a county level is influenced by the number of deaths from the major causes of respiratory mortality i.e. lung cancer, COPD and pneumonia.

The regional impact of respiratory disease on health services is more easily understood on a condition by condition basis, and where available is discussed in the individual disease sections of this report.

## Socio-economic analysis

The links between respiratory disease and levels of social deprivation vary with the condition. There are inequalities in a range of respiratory conditions; for example, COPD and lung cancer are more common in more socially deprived communities.

Deaths from respiratory disease are a marker of socio-economic differences. This difference was quantified by the Institute of Public Health in Ireland who reported that respiratory diseases, with a difference of 200%, had the widest occupational class difference[7].

In 2016, 55.3% of all hospitalisations were amongst those with GMS eligibility[6]. For those with a respiratory diagnosis, the figure was 63.7%. Both these figures are impacted by only reflecting public HIPE reporting hospitals and age cohort eligibility for GMS.

## International Comparisons

Respiratory disease imposes an immense worldwide health burden[8]. Respiratory disease accounts for more than 10% of all disability-adjusted life-years (DALYs) globally. Respiratory disease is second only to cardiovascular diseases (including stroke) in terms of DALYs[9]. Respiratory diseases make up three of the six most common causes of death globally with COPD 3rd, lower respiratory tract infection (including pneumonia) 4th and cancer of the trachea,

bronchus and lung 6th[8]. Each year, 4 million people die prematurely from chronic respiratory disease[9]. Of equal importance is the morbidity that living with these illnesses causes[9].

An estimated 65 million people have moderate to severe chronic obstructive pulmonary disease (COPD) which, as mentioned above, is a leading cause of death worldwide[9]. Globally, 14% of children have asthma, which is the most common chronic disease of childhood[10]. Lower respiratory tract infection, as well as being globally one of the commonest causes of deaths, is a leading cause of death among children under five years old[9]. Acute lower respiratory tract infections in children pre-dispose to chronic respiratory disease later in life. Globally, the most common lethal cancer is lung cancer[9]. Influenza kills between 250,000 and 500,000 people annually[9]. In addition to the above, there are several respiratory disorders whose burden is great but less well quantified. These include sleep-disordered breathing, pulmonary hypertension, interstitial lung disease and occupational lung diseases. Antibiotic resistance and drug-resistant tuberculosis is an increasing challenge globally.

Both globally and nationally, mortality and hospital utilisation statistics present an incomplete picture of the burden of lung disease. For many diseases, especially respiratory disease, hospital admissions and deaths are only the "tip of the iceberg"[1].

In Ireland in 2016, respiratory disease accounted for 18.8% of all deaths. In the UK deaths from respiratory disease accounted for 20% of all deaths for the period 2008-2012[11]. The proportion of deaths due to respiratory disease was 12.5% annually among the 28 countries of the European Union (EU-28)[1]. Compared with the EU-28 average in 2014, the age standardised mortality rate from respiratory disease in Ireland (183.4) was higher than the EU-28 average (132.7) by 38.2% [2].

Information on hospitalisation for respiratory disease is available for most EU-28 countries and for some of the WHO Europe region non-EU28 countries. Among European countries that report, about 7% of all hospital admissions are due to respiratory disease which is comparable to Ireland. However, age-standardised admission rates for respiratory disease vary substantially within western and central Europe. The rate reported for Ireland in 2009 was 927.99 which compared with the EU-28 rate of 965.1 and a rate for WHO Europe of 938.5. The figure for the UK was 740.1[1].

By 2030, WHO estimates that four respiratory diseases (pneumonia, tuberculosis, lung cancer and COPD) will account for about one in five deaths worldwide, compared to one sixth of all deaths globally in 2008. Within the WHO European Region, the proportion is expected to remain stable at about one-tenth of all deaths, with an increase in COPD and lung cancer deaths balancing a decline in deaths from lower respiratory infections and tuberculosis[1].

Respiratory disease will remain a major burden on European and Irish societies for decades to come. Both the prevention and treatment of respiratory disease needs to be improved if their impact on longevity and quality of life of individuals, and their health impact and economic burden on society, are to be reduced in Ireland, Europe and worldwide[1].

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# Lung Cancer and Mesothelioma

03

## Key Points

- Lung cancer (trachea, bronchus and lung) accounts for 20.6% of cancer deaths in Ireland
- At time of diagnosis of lung cancer, 29% of cases are aged under 65 years and 64% are aged under 75 years
- 26% of those presenting with lung cancer for the first time present to an emergency department
- Smoking is the most important cause of lung cancer
- Rates of lung cancer among women in Ireland, unlike men, are continuing to rise

## Background

Lung cancer (trachea, bronchus and lung) accounts for 20.6% of cancer deaths in Ireland[1]. Over 85% of cases of lung cancer occur in current or ex-smokers. Smoking accounts for 90% of cases in men and 80% in women[2]. The risk increases with the quantity and duration of smoking. Exposure to environmental tobacco smoke is also associated with lung cancer risk. Although lifestyle changes have occurred in recent decades with reduced tobacco consumption, lung cancer will remain a major health problem for some years to come given the legacy effects of smoking.

Chronic obstructive pulmonary disease (COPD) is also a risk factor for lung cancer. Patients with airflow limitation are more likely to develop lung cancer than those with normal airway function, independent of smoking status. Exposure to radon, chromium, arsenic, beryllium, diesel exhaust, coal smoke, indoor emissions from other fuels and air pollution are also risk factors for lung cancer. Other factors that may predispose to it include pulmonary fibrosis, history of cancer of the head, neck or oesophagus and smokers who have previously had lymphoma or breast cancer treated with thoracic radiotherapy. Genetic susceptibility also plays a role in the development of lung cancer[2].

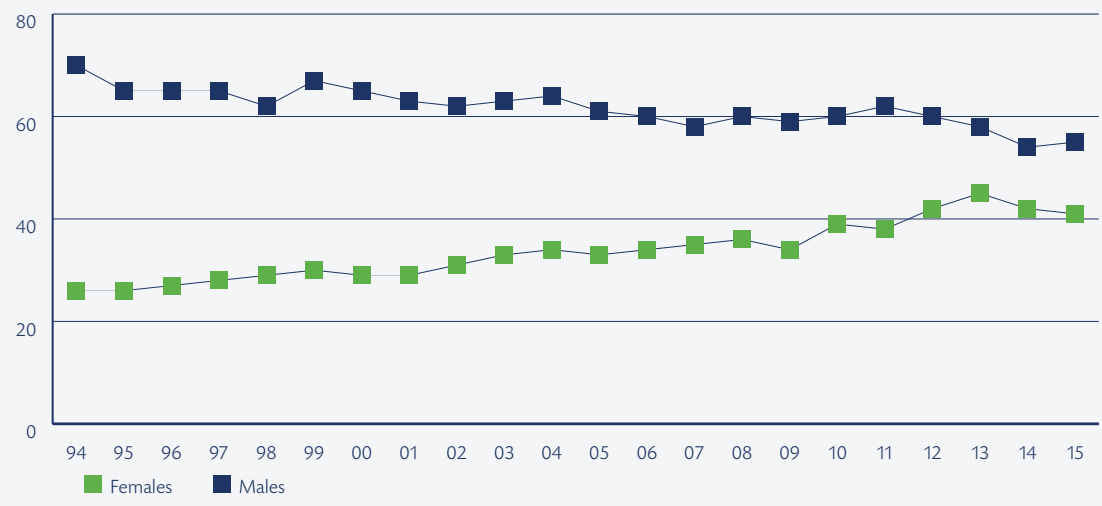
Lung cancer develops in up to 25% of those heavily exposed to asbestos. Asbestos exposure combined with cigarette smoking confers a greater than 40 times increased risk of lung cancer. Mesothelioma begins most commonly in the pleura, and is particularly associated with inhalation of asbestos dust. In Ireland, 94% of male cases and 75% of female cases are mesothelioma of the pleura[3]. In Ireland, asbestos was mostly used from the 1960s to the mid-1980s. It was banned on a phased basis from 1994 to 1998 with general prohibition on its use introduced under EU regulations in 2004[3].

In the sections which follow unless otherwise specified lung cancer refers to cancer of trachea, bronchus and lung (ICD 10: C33, C34). Mesothelioma refers to mesothelioma of any site. Of those recorded on HIPE (2016), 70% were pleural.

## Incidence and Prevalence

Lung cancer (ICD 10: C34), accounts for 11.3% of invasive cancers in Ireland[4]. In 2015, there were 2,431 new cases of which 1,104 (45.4%) were in females and 1,327 (54.6%) in males[4]. The incidence, as shown in figure 3.1, has been falling in males by 0.8% per year and increasing in women by 2.3% per year over the period 1994 to 2014[5]. In both 1995 and 2015 the number of cases of cancer of the trachea (C33) was 5 or less. The five-year age standardised survival for people with lung cancer (ICD 10: C33, C34) has increased over the period 1994-2015 from 9% to 17.9%[5].

**Figure 3.1. Trends in incidence of lung cancer (ICD 10: C34) 1994-2015**




*Source: National Cancer Registry Ireland[4]*

Mesothelioma incidence in Ireland has increased from nine cases per year in 1994 to 48 cases per year in 2015[5]. This increase is largely seen in males. The incidence is predicted to continue to increase until 2020 in view of the long latency period between exposure to asbestos and the development of mesothelioma[3].

The prevalence of a given cancer type is related to its incidence rate, median age at diagnosis and survival rates. On December 31st 2015, the most prevalent common cancers were: breast cancer (24% of all cancer survivors), prostate cancer (20%), colorectal cancer (13%) and skin melanoma (7%)[5]. Lung cancer, a common but high-fatality cancer, accounted for only 3% of all survivors[5].

## Mortality

Lung Cancer (ICD 10: C33, C34) causes the greatest number of cancer deaths in Ireland. It accounted for 20.6% of total cancer deaths in 2016[1]. With 1,864 deaths in 2016, it was second only to ischaemic heart disease as a cause of death[1]. Over the period 2007 – 2016, the number of deaths has increased from 1,668 to 1,864 although the 5 year standardised mortality ratio has decreased as shown in table 3.1.

In 2007, the move to ICD-10 coding for death certification in Ireland saw the introduction of a specific code for pleural mesothelioma. In 2007-2010, of 125 mesothelioma deaths, only 20 deaths were registered as pleural mesothelioma[3]. However on review of the death certifications for people known to have died from pleural mesothelioma (2007-2010), only 51% were coded as mesothelioma of which only 5% were coded as pleural mesothelioma[3]. In 2012 – 2014, there was an average of 38 deaths per year in Ireland attributed to mesothelioma which was an increase from 2007 – 2009, when the average was 29 deaths per year[9].

## Impact on health services

Data on those with lung cancer or mesothelioma is not available at national level in terms of attendance at GPs, out of hours services, Emergency Department attendances or hospital Outpatient Department attendances. In the period 2010-2014, 26% of people presenting with lung cancer for the first time for which method of presentation was recorded, presented as an emergency[5]. The majority at presentation were either at stage III (25.2%) or stage IV (37.2%)[4].

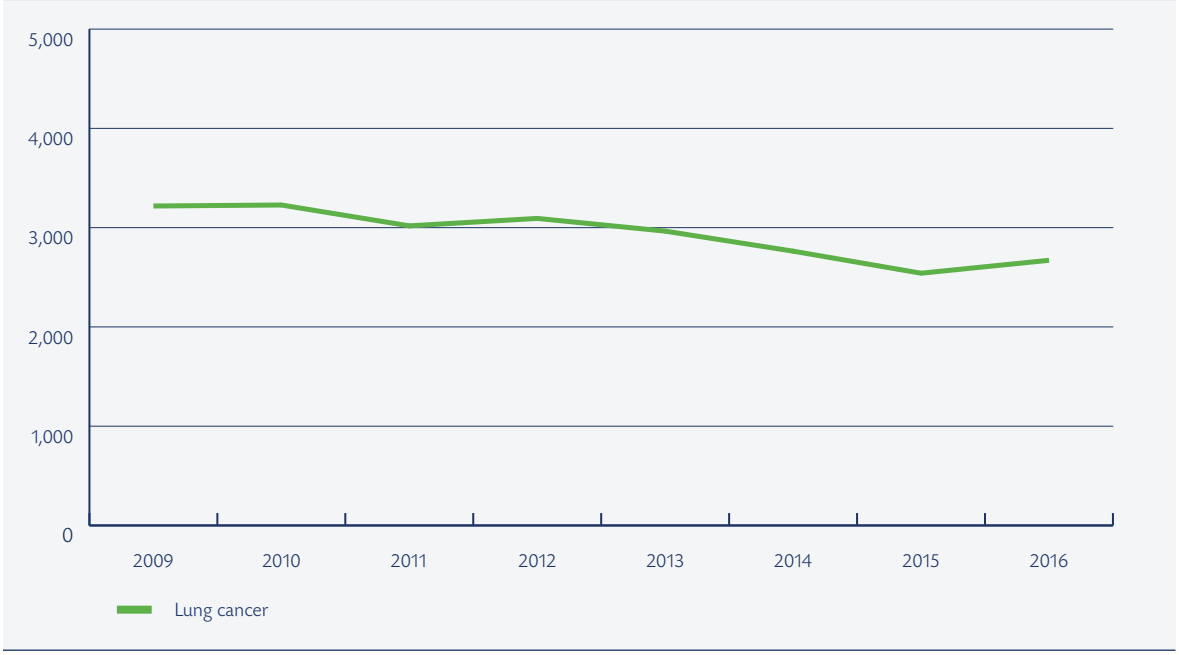
The trends in terms of inpatient hospitalisations for lung cancer in publicly funded hospitals for the period 2009-2016, is shown in figure 3.2 overleaf.

**Table 3.1. Deaths: Cancer of Lung (ICD 10 C33,C34) 2007-2016**

| Year | Total | /100,000 population | *5yrs | Standardised Mortality Rate |
|---|---|---|---|---|
| 2007 | 1668 | 38.12 | 2003-07 | 63.65 |
| 2008 | 1681 | 37.48 | 2004-08 | 62.94 |
| 2009 | 1728 | 38.08 | 2005-09 | 63.04 |
| 2010 | 1695 | 37.20 | 2006-10 | 62.34 |
| 2011 | 1850 | 40.32 | 2007-11 | 62.35 |
| 2012 | 1801 | 39.21 | 2008-12 | 61.77 |
| 2013 | 1831 | 39.68 | 2009-13 | 61.06 |
| 2014 | 1934 | 41.63 | 2010-14 | 61.38 |
| 2015 | 1828 | 38.99 | 2011-15 | 60.74 |
| **2016 | 1864 | 39.33 | 2012-16 | 59.11 |

*Source: PHIS (Public Health Information System)[8]*ICD 10 coding for deaths introduced 2007. **Provisional data for 2016.*

**Figure 3.2. Inpatient hospitalisations with a primary diagnosis of lung cancer, 2009-2016**




*Source: HIPE 2009-2016. All hospitals reporting data to HIPE.*

In 2016, lung cancer accounted for 2,671 inpatient hospitalisations (2.9% of respiratory inpatient hospitalisations, 0.4% of all inpatient hospitalisations) and 30,583 inpatient bed days (5.3% of respiratory inpatient bed days, 0.3% of all inpatient bed days). In addition there were 3,550 day cases. Of these inpatients, 56% presented as emergencies.

In 2016, there were 116 hospitalisations for mesothelioma, of whom 107 had the site specified. Of these 70% (75) had pleural mesothelioma. Of the 116, there were 61 inpatient hospitalisations (856 bed days) and 55 day case admissions. Of the inpatients, 72% presented as emergencies.

In 2016, 46.0% of inpatient hospitalisations with respiratory neoplasms were classified as major complexity and had a mean and median length of stay of 13.4 and 9 days respectively. For those inpatient hospitalisations with minor complexity, their mean and median length of stay was 6.7 and 4 days respectively[10]. Of the elective inpatient hospitalisations, the Activity in Acute Public Hospitals in Ireland report for 2016 listed lung cancer 12th of the top twenty principal diagnoses[10].

## Gender

Among males, at 11.7%, lung cancer is the 3rd commonest cause of invasive cancer, while among females, at 10.9% it is the second commonest[4]. The cumulative lifetime risk of developing it (up to age 74 years) is 1 in 24 in males and females[4].

In the period 2012-2014, lung cancer was the leading cause of cancer death in both sexes, accounting for 18.4% of cancer deaths in women and 23.5% of cancer deaths in men[5]. The cumulative lifetime risk of death from lung cancer (up to age 74 years) in males was 1 in 29, while among females it was 1 in 48[6]. The 5 years age standardised survival for those with lung cancer for the period 2010-2014 was 17.9% (21.0% for females, 15.5% for males)[4].

In the five year period, 2012-2016, 57% of deaths from lung cancer were in males and 43% in females. In the same period the standardised death rate for males was 74.8 while for females it was 47.1[8]. In 2016, 54.5% of deaths from lung cancer were in males, with 45.5% in females. The standardised mortality rate (all ages) for males was 67.36 while that for females was 47.5[8].

In the decade 2006-2015, of 387 cases of mesothelioma, 333 (86.0%) were in males[4]. Of the 38 deaths in the 3 year period 2012-2014, 35 (92%) were in males[5]. In Ireland, for those where occupational history was recorded, 49% of males had worked in construction and related trades such as electrical, metal and woodworking compared with 20% of all male cancer patients. Secondary exposure to asbestos is more likely in women who are less likely to have direct work-related exposure. 90% of females with mesothelioma were or had been married compared with 81% of females with lung cancer (where secondary exposure to tobacco is an important risk factor) and 77% of all female cancer patients[3].

**Table 3. 2. Deaths 2007-2016: Lung Cancer (ICD 10: C33,C34): Years of Potential Life lost (YPLL)**

| Year | Standardised Mortality Rate: all ages | Total | Deaths aged <70yrs (%) | YPLL < 70 yrs | YPLL/100,000 population |
|---|---|---|---|---|---|
| 2007 | 63.18 | 1,668 | 717 (43.0%) | 6,840 | 176.1 |
| 2008 | 62.16 | 1,681 | 710 (42.2%) | 7,078 | 175.4 |
| 2009 | 62.31 | 1,728 | 724 (41.9%) | 6,877 | 167.3 |
| 2010 | 59.88 | 1,695 | 702 (41.4%) | 6,685 | 160.0 |
| 2011 | 63.62 | 1,850 | 748 (40.4%) | 7,007 | 164.9 |
| 2012 | 60.61 | 1,801 | 745 (41.4%) | 6,422 | 151.8 |
| 2013 | 60.11 | 1,831 | 750 (41.0%) | 6,437 | 150.2 |
| 2014 | 61.65 | 1,934 | 799 (41.3%) | 6,974 | 161.0 |
| 2015 | 56.65 | 1,828 | 733 (40.1%) | 6,393 | 144.9 |
| *2016 | 56.20 | 1,864 | 720 (38.6%) | 6,121 | 134.9 |

*Source: Public Health Information System (PHIS)[8] *provisional data for 2016*

## Age

For the years 2011-2015, the median age group at time of diagnosis of lung cancer was 70-74 years[4]. When looked at in greater detail, 3.3% of patients were aged under 50 years of age, 25.6% aged 50-64 years, 34.9% aged 65-74 years with the remaining 36.2% aged 75 years or over[4].

The median age group for deaths from lung cancer was also 70-74 years. Over the period 2007 – 2016 the age standardised rate of deaths from lung cancer has reduced from 63.2 to 56.2 per 100,000 population as shown in table 3.2 above. Due to the increasing size of the population, the actual number of deaths has increased in that same period. The Years of Potential Life Lost (YPLL)/100,000 reduced from 176.1 to 134.9. In 2016, lung cancer accounted for 7.3% of deaths in people aged 0-64 years and 5.5% of deaths in people aged 65 years or over[1].

Approximately one third of patients are in their 60s when diagnosed with mesothelioma with another one third in their 70s[3]. Of the inpatient hospitalisations for those with mesothelioma in 2016, 29.5% were aged 16-64 years.

## Regional variation

Given the relatively small numbers, distribution of incidence by county is not shown. However, age standardised incidence by county is available from the National Cancer Regsitry[4]. For the years 1994-2015, the highest incidence for males was in Dublin (all, north, south), followed by Carlow and Louth. For females the highest incidence was also in Dublin (all, north, south) followed by Kildare and then Louth[4]. For both sexes, the lowest incidence was in Clare and Mayo[4]. Incidence is also available in absolute numbers on the NCRI Cancer Factsheet Lung[6]. The same is true for mesothelioma[3]. Compared with rural dwellers those in urban areas have a 49% higher incidence of mesothelioma, which may reflect higher proportions of manual workers in construction and related fields[3].

## Socio-economic analysis

Lung cancer incidence is usually higher in more deprived communities. This is in part due to higher rates of smoking. It is also likely to reflect greater occupational exposure to harmful dust, fibres and fumes. In the period 2010-2014, patients with lung cancer resident in the most deprived areas were more likely to present as an emergency[5]. In 2008-2011 the age-standardised incidence rate for males in the most deprived group was almost 80 per 100,000, more than double the rate (35 per 100,000) in the least deprived group. For females, the rate in the most deprived group at almost 50 per 100,000 was more than double that in the least deprived group at 22 per 100,000[11]. For 2010-2014 the absolute risk difference between the most and least deprived 20% of the population presenting as an emergency for lung cancer was +9% which was second only to pancreatic cancer (14%)[5].

## International comparisons

Lung cancer has been the most common cancer in the world for several decades accounting for 12.9% of all cancers[12]. Lung cancer is the most common cause of death from cancer worldwide. In 2015, it accounted for 1.7 million deaths[13]. In terms of years of life lost in 2015, lung cancer ranked 13th (compared with 14th in 2005)[13]. Because of its high fatality (the overall ratio of mortality to incidence is 0.87) and the relative lack of variability in survival in different world regions, the geographical patterns in mortality closely follow those in incidence[12]. In some Western countries where the tobacco epidemic reached its peak by the middle of the 20th century (e.g. the UK, Finland, and the USA), lung cancer rates have been decreasing slowly in men and plateauing in women[2]. In the 2015 Global Burden of Disease report, the age standardised mortality rate for lung cancer was 26.6 (CI: 25.9-27.4) which was a reduction of 8.1% (10.7-5.2) on the 2005 rate[13]. However, due to the increase in the global population,

the total number of deaths from lung cancer in the same time period increased by 20.1%.

Globally, lung cancer is the most common cancer in men (16.7% of cancers) with the highest estimated age-standardised incidence rates in Central and Eastern Europe (53.5 per 100,000) and Eastern Asia (50.4 per 100,000)[12]. In women, the incidence rates are generally lower with a different geographical pattern mainly reflecting different historical exposure to tobacco smoking. Thus the highest estimated rates are in North America (33.8) and Northern Europe (23.7)[12]. Worldwide, lung cancer is the fourth most common cancer in women (8.8% of all cancers) and the second most common cause of death from cancer (13.8% of total cancer deaths)[12].

In the UK, 50% of those admitted with lung cancer are as emergencies. 38% of lung cancer diagnoses in the UK are made after an emergency hospital admission[14]. The Irish figures, as mentioned earlier, were 56% (lung cancer hospitalisations which were as emergencies in 2016) and 26% (lung cancer diagnoses as a result of an emergency admission in 2010-2014). The incidence of lung cancer in the UK is 80% higher in more socially deprived groups[14]. Lung cancer accounts for 5.9% of deaths in people aged 65 years and over in the UK and 8.4% of deaths in people aged 15-64 years[14]. The Irish figures are in line with international trends. Australia has the highest mesothelioma incidence in the world at 2-3 cases per 100,000 population[15]. In the UK, 80% of cases of pleural mesothelioma occur in men[14]. Most are diagnosed in those aged over 70 years of age but 20% are diagnosed in those aged 51-60 years[14]. In Ireland, 85.5% of cases of mesothelioma occur in males (14.5% in females) with one third diagnosed in their 60s and one third in their 70s.

Lung cancer will continue as a health challenge for many years to come based both on the legacy effect of tobacco smoking, its continued use and the emergence of newer carcinogens.

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# Chronic Obstructive Pulmonary Disease (COPD) including Bronchiectasis

04

## Key Points

- COPD places a significant burden of disease on people and health services in Ireland as evidenced by mortality and hospitalisation rates
- The exact COPD prevalence in Ireland is unknown
- Ireland has a relatively high prevalence of hereditary alpha-1 antitrypsin deficiency which is a risk factor for COPD
- Bronchiectasis can be idiopathic but also occurs in those with cystic fibrosis (CF), primary ciliary dyskinesia, primary immunodeficiencies and is associated with systemic diseases, including inflammatory bowel disease and rheumatoid arthritis

## Background

Chronic obstructive pulmonary disease (COPD) is a major burden to individuals, societies and healthcare services throughout the world. Its impact is expected to rise in the decades to come, due both to continued exposure to risk factors and to an ageing population. COPD is characterised by persistent airflow limitation that is usually progressive and associated with a chronic inflammatory response in the airways and lungs to noxious particles or gases. It is a syndrome of two main phenotypes - chronic bronchitis and emphysema. Most people with COPD have varying degrees of both.

The most important and modifiable risk factor for COPD is smoking. About 40–50% of lifelong smokers develop COPD. As not all smokers develop clinically significant COPD, genetic factors may modify individual risk. The proportion of the risk of COPD attributable to smoking is estimated to be 40–60%[1]. Never-smokers comprise one-quarter of those classified with stage II+ disease (Global Initiative for Chronic Obstructive Lung Disease (GOLD))[1]. Occupational exposure accounts for 15–20% of COPD cases. In never-smokers, the fraction of COPD attributable to occupational exposure is estimated to be 30%[1].

Adverse respiratory events in childhood influence the risk of COPD as adults. Early life environmental factors including maternal smoking, frequent respiratory infections and asthma in childhood and bronchial hyper-reactivity are also risk factors for COPD in adulthood. Passive exposure to cigarette smoke contributes to impaired lung function in children. The proportion of the risk of COPD attributable to these early childhood events may be as great as that attributable to smoking[1].

In addition to childhood factors, the risk of developing COPD is inversely related to socio-economic status based on education or income.[2]

The role of outdoor air pollution in Europe as a cause of COPD is unclear. A high level of urban air pollution is harmful to individuals with COPD. The 'All Ireland study on air pollution and residential solid fuel' identified potential residential PM10 (a general term for organic air pollutants measuring less than 10 µm in diameter) hotspots in Ireland[3]. Indoor air pollution caused by the use of biomass fuel is a risk factor for the development of COPD.

The best documented genetic risk factor for COPD is hereditary alpha-1 antitrypsin deficiency. People born with this deficiency do not produce enough alpha-1 antitrypsin protein in their liver. This protein helps to protect the lungs from the harmful effects of infections and inhaled irritants, particularly tobacco smoke[4]. In Ireland, one in 25 Irish people carry the defective gene that causes alpha-1 antitrypsin deficiency. The most common mutation is the Z mutation but the S and other mutations also cause milder deficiency[5].

Bronchiectasis is a long-term condition where the airways of the lungs become abnormally widened, leading to a build-up of excess mucus that can make the lungs more vulnerable to infection and can co-exist with COPD. Bronchiectasis is associated with a range of both common and rare diseases, some of which impact on mucociliary clearance and immunity. When mucus clearance and local defence mechanisms against micro-organisms are impaired, repeated infection causes damage which further impedes the clearance of mucus. The airway dilation and consequent further impairment of mucociliary clearance combine to further increase susceptibility to repeated infection in the lungs.

Minor discrepancies in figures quoted for COPD can occur if there are different age cut offs, if bronchiectasis (ICD 10: J47) or asthma (ICD 10: J45, J46) are included or if only COPD exacerbations (ICD 10: J44.1) are included.

National Healthcare Quality Reporting System (NHQRS) hospitalisation data quoted in this chapter is based on Irish COPD returns to OECD i.e. age-sex standardised rate of hospitalisations of people aged 15 years and older with a principal diagnosis of chronic obstructive pulmonary disease (COPD) per 100,000 population i.e. ICD-10-AM/ACHI J41 (simple and mucopurulent chronic bronchitis), J42 (Unspecified chronic bronchitis), J43 (Emphysema), J44 (Other chronic obstructive pulmonary disease), J47 (Bronchiectasis) or J40 (Bronchitis) with a secondary diagnosis of J41, J43, J44 or J47[6].

Mortality data accessed from Public Health Information System (PHIS), including that referenced from Health in Ireland Key Trends 2017[7], quoted in this chapter, reflects that of Eurostat 65 causes of death shortlist named "Chronic Lower Respiratory Disease" which cover ICD 10 codes J40-47 ie asthma is included (J45,J46). In the sections Mortality and Age, deaths assigned to codes J40-47 are listed, as are the same deaths but excluding asthma (J45, J46)[7].

The Irish hospitalisation data (HIPE) in the sections Impact on health services, Gender and Age are based on the International Classification of Disease, 10th revision (ICD-10) codes J40–J44 and J47, i.e. chronic obstructive pulmonary diseases which includes bronchiectasis (J47) which is in line with codes used in ERS White Book[1].

The discussion below unless stated otherwise refers to COPD including bronchiectasis.

## Incidence and Prevalence

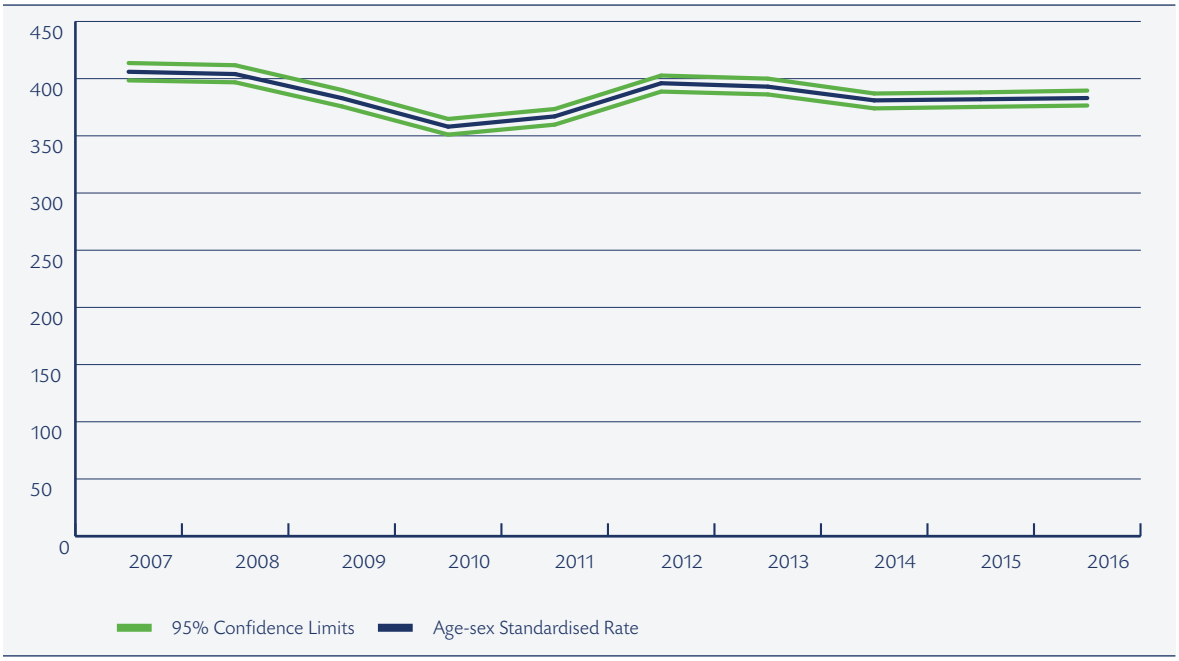
Neither COPD incidence nor prevalence data is available for Ireland at national level. Despite the burden of COPD, as evidenced by hospitalisation rates and mortality rates below, national prevalence studies using international protocols have not been conducted. Various estimates of prevalence have been made based on prevalence studies from other countries. One estimate, based on extrapolation of a study in Salzburg[8] which used the internationally recognised Burden of Obstructive Lung Disease (BOLD) methodology, is that almost 500,000 people aged 40 years and over in Ireland could have COPD, of whom over 200,000 have moderate or severe disease and only half are likely to be diagnosed. This estimate was based on the 2011 population[6]. The Salzburg study was chosen given its relatively high prevalence compared to other locations and in light of Ireland's high hospitalisation rate for COPD. An 8% prevalence of chronic bronchitis among 20-44 years olds in Ireland (45% of whom smoked) was reported in an international study in 2001[9]. In another international report in the same period Ireland was amongst five countries where the prevalence of moderate COPD in 20-44 year olds was 5% or higher[10].

Alpha-1 antitrypsin deficiency (AATD) affects over 15,000 people on the island of Ireland, with another 250,000 carriers also at risk of lung and liver disease[4]. An Irish study of a randomly selected sample of 1,100 plus a targeted population reported that in the former, 1 in 25 were heterogenous for Z allele and 1 in 10 heterogenous for S allele. Of importance was that 1 in 2,104 were ZZ homozygous, 1 in 424 were SZ heterozygous and 1 in 341 SS homozygous[5]. Of the targeted population, 27.1% had at least 1 mutation[5]. As the cohort only identified Z and S alleles, this is likely to underestimate the prevalence of AATD in Ireland.

On the National Alpha-1 voluntary Register, 56% have ZZ phenotype (56.4% males, 43.6% female) while close to another 25% have the SZ phenotype (moderate AATD)[4,12].

In the absence of population prevalence data for COPD, hospitalisation rates may be a proxy for those with more severe disease. The national age-sex standardised hospitalisation rate for COPD in 2016 was 389 per 100,000 population which compared with 406 hospitalisations per 100,000 population in 2007[6].

**Figure 4.1. Age-sex standardised hospitalisation rates for COPD per 100,000 population in Ireland, 2007 - 2016**




*Source: National Healthcare Quality Reporting System Annual Report 2017*[6]

**Table 4.1. Chronic lower respiratory disease: ICD 10 J40-47. Standardised death rate, 2007-2016**

| Year | Total J40-47 | Asthma (J45,46) excluded | /100,000 population | 5yrs | Standarised Mortality Rate |
|---|---|---|---|---|---|
| 2007 | 1,496 | 1435 | 34.19 | 2003-07 | 63.07 |
| 2008 | 1,365 | 1313 | 30.43 | 2004-08 | 60.61 |
| 2009 | 1,516 | 1463 | 33.41 | 2005-09 | 60.89 |
| 2010 | 1,334 | 1490 | 29.28 | 2006-10 | 59.24 |
| 2011 | 1,514 | 1458 | 32.78 | 2007-11 | 59.11 |
| 2012 | 1,587 | 1548 | 34.55 | 2008-12 | 58.05 |
| 2013 | 1,657 | 1609 | 35.91 | 2009-13 | 58.55 |
| 2014 | 1,551 | 1514 | 33.39 | 2010-14 | 57.73 |
| 2015 | 1,701 | 1627 | 36.29 | 2011-15 | 59.21 |
| *2016 | 1,711 | 1639 | 36.10 | 2012-16 | 58.81 |

*Source: Public Health Information System(PHIS) * Provisional data for 2016*

## Mortality

In 2016, chronic lower respiratory disease (ICD 10: J40-47) was second only to lung cancer as a cause of death from respiratory disease. The disease is responsible for more deaths than any non-respiratory cancer and is Ireland's fourth biggest killer[7].

The five year standardised mortality rates for chronic lower respiratory disease (ICD 10: J40-47) for the decade 2007 - 2016 are shown in table 4.1. All columns except the 3rd column relate to ICD 10: J40-47 but given the relatively small difference in numbers between the 2nd and 3rd column, the data largely relates to COPD.

In 2016, there were 1,711 deaths registered as chronic lower respiratory disease (ICD 10: J40-47) of which 96% (1,639) were due to COPD (ICD 10: J40-44,47)[13]. The figures for 2015 were 1,701 deaths registered as due to chronic lower respiratory disease (codes J40-47) of which 95.6% (1,627) were due to COPD. Of this latter group, 51 (3%) were due to bronchiectasis (ICD 10: J47)[14].

## Impact on health services

COPD is a disease largely managed in primary care by the patient, their GP and primary care team. Data on COPD is not available at a national level for people with full medical cards, those with GP only cards or those who are private patients. This is also true for those who attend GP out of hours services, those who attend Emergency Departments and those who attend hospital Outpatient Departments. Inpatient or day case activity is only available from HIPE reporting publicly funded hospitals. Data is not available nationally on those requiring respiratory aids and appliances including oxygen.

## Respiratory medication use

Analysis of 2013 PCRS (Primary Care Reimbursement Scheme) data for patients over the age of 40 years reported that between the General Medical Services (GMS) and the Drugs Payment Scheme (DPS), pharmacy claims for inhalers for COPD cost in excess of €90 million. Of this, approximately 55% was spent on inhalers containing a combination of inhaled corticosteroid (ICS) and long-acting beta$_2$ agonist (LABAs), corresponding to an average of approximately 68,500 prescriptions per month[15]. In 2016, expenditure on medications prescribed for COPD (R03AK - adrenergic in combination with corticosteroids or other drugs for obstructive airway disease airway, and R03BB - anticholinergics, and R03AL-adrenergics in combination with anticholinergics) accounted for approximately €67.6 million in the GMS population[16]. This figure, representing expenditure for the GMS population alone, grossly underestimates the total expenditure on pharmaceuticals for the management of COPD in Ireland.

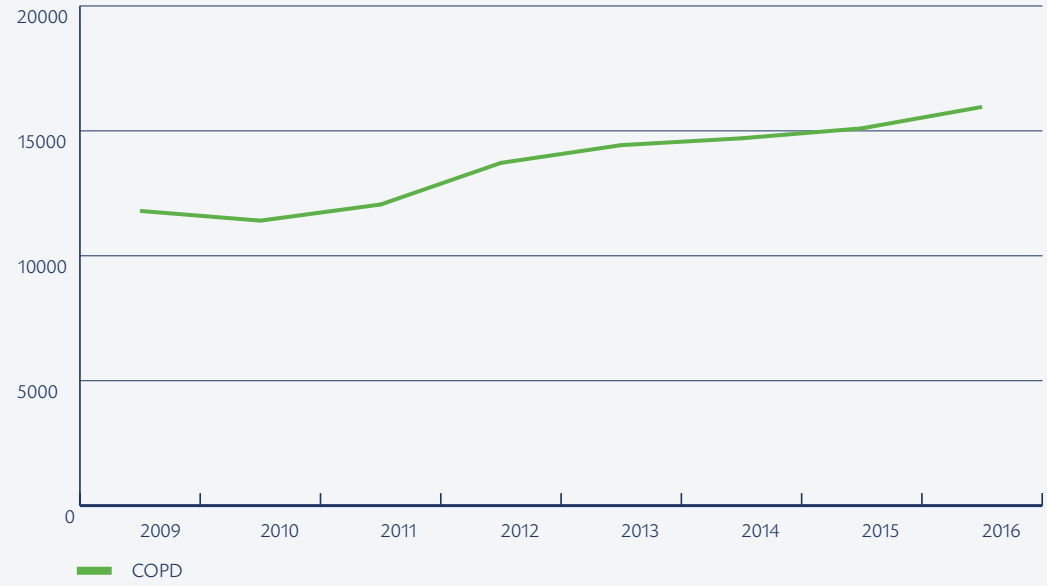
An analysis of the same dataset (PCRS-GMS) data found that of those with full GMS coverage for the entire of 2016, prevalence of medication use consistent with a diagnosis of COPD increased significantly with age, and also showed gender differences[17]. Prevalence of medication use was higher in females than males up to the age of 65 years, after which prevalence of medication use amongst males surpassed those of females, though the difference was minimal. Using a broader definition (see table 4.2 below: definition 2), prevalence of medication use consistent with a diagnosis of COPD increased from 7.5% of males aged 45-55 years, to 21.7% in those aged 75 years and over. The figures for females were 10.1% for those aged 45-55 years, and 18.9% for those aged over 75 years. Restricting the analysis to just those dispensed a long-acting muscarinic receptor antagonist (LAMA) in 2016 (definition 1), prevalence estimates in males

**Table 4.2. Prevalence of medication use to manage COPD in the GMS population**

| Age and over | Males (%) 95% CI | | | | Females (%) 95% CI | | | |
|---|---|---|---|---|---|---|---|---|
| | Definition 1 | | Definition 2 | | Definition 1 | | Definition 2 | |
| 45-55yrs | 2.6% | 2.5 to 2.7 | 7.5% | 7.3 to 7.6 | 3.3% | 3.2 to 3.4 | 10.1% | 16.1 to 16.4 |
| 55-64yrs | 6.9% | 6.7 to 7.1 | 12.9% | 12.7 to 13.1 | 8.2% | 8.0 to 8.4 | 16.4% | 17.9 to 18.2 |
| 65-69yrs | 10.0% | 9.7 to 10.3 | 17.2% | 16.8 to 17.6 | 9.2% | 8.9 to 9.5 | 17.9% | 18.4 to 18.8 |
| 70-74yrs | 11.1% | 10.9 to 11.4 | 19.0% | 18.6 to 19.3 | 9.4% | 9.2 to 9.7 | 18.6% | 18.6 to 19.0 |
| 75yrs & over | 11.3% | 11.1 to 11.6 | 21.7% | 21.4 to 21.9 | 8.0% | 7.9 to 8.2 | 18.9% | 16.1 to 16.4 |

*Source: Hurley, E (2018). An analysis of medication use for respiratory disease amongst those with GMS eligibility (2015 - 2016) - a focus on Chronic Obstructive Pulmonary Disease (COPD)[17]. Definition 1: were dispensed at least one prescription for a LAMA (with or without a LABA) *Definition 2: were dispensed at least one prescription for a LAMA (with or without a LABA), an ICS & LABA combination, OR a SAMA (with or without a SABA) in 2016.*

**Figure 4.2. Inpatient hospitalisations with a primary diagnosis of COPD, 2009-2016**




*Source: HIPE 2009-2016. All hospitals reporting data to HIPE*

increased from 2.6% in those aged 45-55 years to 11.3% in those aged 75 years and over. In females the corresponding figures were 3.3% and 8.0%.

## Impact on hospitals

In the earlier section on prevalence, inpatient hospitalisations were shown standardised for the population. The figure above reflects the increasing burden on hospital services in terms of inpatient hospitalisations for the years 2009-2016.

For bronchiectasis alone (ICD 10: J47) (primary diagnosis), the increasing impact in terms of both inpatient hospitalisations and especially day case admissions between the years 2009-2016 is evident from the table below. There is also an increasing trend for those who require inpatient hospitalisation to be admitted as emergencies.

**Table 4.3. Hospitalisations with a primary diagnosis of Bronchiectasis (J47)**

| Year | Total Hospitalisations | Inpatient Hospitalisations | Inpatient Bed Days | Day case | Emergency Hospitalisations | Emergency as % of inpatients |
|---|---|---|---|---|---|---|
| 2009 | 704 | 450 | 3,547 | 254 | 284 | 63.1% |
| 2010 | 704 | 321 | 2,922 | 383 | 228 | 71.0% |
| 2011 | 738 | 338 | 2,890 | 400 | 247 | 73.1% |
| 2012 | 952 | 464 | 3,470 | 488 | 326 | 70.3% |
| 2013 | 1,070 | 480 | 3,389 | 590 | 376 | 78.3% |
| 2014 | 1,131 | 502 | 3,448 | 629 | 402 | 80.1% |
| 2015 | 1,136 | 492 | 4,023 | 644 | 373 | 75.8% |
| 2016 | 1,132 | 499 | 3,959 | 633 | 412 | 82.6% |

*Source: HIPE 2009-2016. All hospitals reporting data to HIPE Note: these numbers are also included in figure 2*

**Table 4.4. Inpatient hospitalisations with a primary diagnosis of COPD in adult acute hospitals, 2009-2016 (adults ≥35yrs)**

| Year | Discharges COPD | % of all inpatient discharges | Rate / 100,000 population ≥35 years | Bed days used COPD | % of all inpatient bed days used | Mean & LOS (SD) | Median & LOS (IQR) |
|---|---|---|---|---|---|---|---|
| 2009 | 11,026 | 3.6% | 507 | 102,907 | 4.1% | 9.3 (13.5) | 6 (3-10) |
| 2010 | 10,615 | 3.5% | 478 | 98,718 | 4.0% | 9.3 (15.4) | 6 (3-10) |
| 2011 | 11,364 | 3.7% | 500 | 99,269 | 4.1% | 8.7 (13.2) | 6 (3-10) |
| 2012 | 13,059 | 3.9% | 567 | 105,132 | 4.3% | 8.0 (13.2) | 5 (3-9) |
| 2013 | 13,830 | 4.0% | 590 | 109,048 | 4.4% | 7.8 (13.5) | 5 (2-9) |
| 2014 | 14,140 | 3.9% | 591 | 111,349 | 4.4% | 7.8 (11.7) | 5 (2-9) |
| 2015 | 14,489 | 4.0% | 592 | 115,593 | 4.4% | 7.9 (12.1) | 5 (2-9) |
| 2016 | 15,460 | 4.1% | 614 | 119,787 | 4.5% | 7.7 (11.8) | 5 (2-9) |

*Source: Hurley, E(2018). Trends in hospitalisations for Chronic Obstructive Pulmonary Disease (COPD), 2009-2017.[18] Note: Inpatient activity in adult acute public hospitals. Denominator is all inpatient discharges in those hospitals in adults aged 35 years and older. CSO census data (2011,2016) and CSO population estimates for other years provide denominator data for rate of discharges per 100,000 population. &Inpatients with same day discharge (example those admitted and discharged from an Acute Medical Assessment Unit) are given a length of stay of 0.5 in the calculation of average length of stay (LOS), and a bed days used of one.*

COPD accounted for 17,448 (1.0%) hospitalisations and 126,336 (2.7%) bed days in 2016. Omitting day case admissions, COPD accounted for 17.3% (15,959) of respiratory inpatient hospitalisations (2.5% of inpatient hospitalisations) and 21.7% (124,847) of respiratory inpatient bed days (3.4% inpatient bed days) in 2016 in all hospitals reporting activity to HIPE.

Restricting to adult acute hospitals only, episodes of care with a primary diagnosis of COPD accounted for 4.1% of inpatient hospitalisations and 4.5% of bed days amongst adults aged 35 years and over in 2016 (table 4.4) [18]. COPD is the commonest disease-specific cause of emergency hospitalisation of adults in Ireland[6]. COPD in 2016 accounted for 15,262 (3.6%) of all emergency hospitalisations (19.5% of respiratory emergency hospitalisations) and 117,626 (4.6%) of emergency bed days (22.6% of respiratory emergency bed days) across all ages in hospitals reporting to HIPE. The Activity in Acute Public Hospitals report for 2016 reported that of those admitted with COPD as inpatients, 38.7% were classified as major complexity and had median and mean length of stay of 7 and 10.7 days respectively[19].

The crude in-hospital mortality rate for those with a principal diagnosis of COPD was 3.6 deaths per 100 admissions in 2016, a reduction from 4.6 in 2007[20]. In 2016, the in-hospital mortality SMR (99.8% Control Limits) ranged from 29 (23-190) to 169 (27-187)[20].

## Gender

In the five year period, 2012-2016, of those who died from chronic lower respiratory disease (ICD 10: J40-47) there were almost an equal number of males and females. However, the age standardised death rate for males was 74.95 while that for females was 49.80[13]. In the five years 2011-2015, of the 267 deaths due to bronchiectasis alone (ICD 10: J47), 53.6% (143) were in females [14].

In 2016, of the 1,711 deaths for chronic lower respiratory disease (ICD 10: J40-47)(96% were due to COPD (ICD 10: J40-44,47)), 50.8% were males and 49.2% females. The standardised death rate for males was 71.56 while that for females was 48.51. The percentage of bronchiectasis (ICD 10: J47) deaths which occurred in females in 2015 was 58.8%[14].

Of the hospitalisations in 2016 with COPD, 50.3% were females and 49.7% were males. Of those hospitalised in 2016 with bronchiectasis, 61.0% were females and 39.0% were males.

## Age

The majority of deaths from chronic lower respiratory disease (ICD 10: J40-47) and more specifically COPD (ICD 10: J40-44, 47) occur in those aged 70 years and over. This is shown in the table below. All columns except the 4th column relate to ICD 10: J40-47 but given the relatively small difference in numbers between the 3rd and 4th column, the data largely relates to COPD. The age standardised mortality rate (ICD 10: J40-47) in 2016 was 57.05. By way of comparison, the rates for the years 2007, 2011 and 2015 were 64.8, 57.8 and 59.0 respectively. Over this 10 year period the rate reduced by 12.0%.

In 2016, of the 204,882 hospitalisations for those aged 65 years and over, 11,948 (5.8%) were for COPD. Of the 1,946,040 inpatient bed days for the same age group, 101,842 (5.2%) were for patients with COPD. Of the 15,959 admissions and 124,847 inpatient bed days for COPD in 2016, 75% of patients were aged 65 years and over who used 81.6% of COPD inpatient bed days. For those aged 16-64 years, COPD accounted for 1.1% of all inpatient hospitalisations in 2016 and 1.6% of inpatient bed days.

The mean and median age of those hospitalised in 2016 with bronchiectasis was 62 years and 66 years respectively.

## Regional variation

It is not known whether there are regional differences in COPD prevalence as opposed to hospitalisations and mortality. There is however evidence of geographical variations in the detection of AAT deficiency[4]. Higher numbers of the MZ mutation have been detected in Cork, Dublin, Donegal and Limerick but it is unclear how much this is due to true differences and how much is due to testing[4].

There is evidence of geographic variation in factors which contribute to air quality in Ireland[3]. There are also variations both in mortality from chronic lower respiratory disease (ICD 10: J40-47) as shown in figure 4.3 below and in COPD hospitalisation rates (ICD 10: J40-44,47) as shown in figure 4.4.

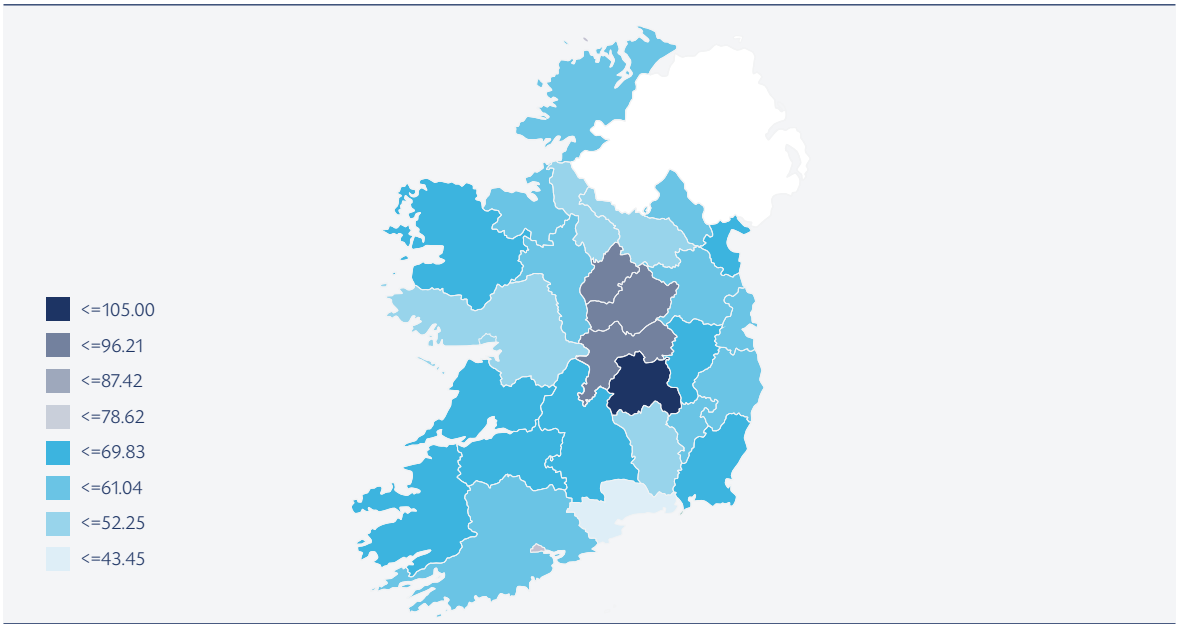
During the three year period from 2014-2016, the age-sex standardised hospitalisation rate by county of residence ranged from 254 hospitalisations per 100,000 population in Kerry to 600 hospitalisations per 100,000 population in Offaly [6].

**Table 4.5. Chronic Lower Respiratory Disease (ICD 10: J40-47) Deaths and Years of Potential Life lost (YPLL): 2007-2016**

| Year | Standarised Mortality Rate all ages J40-47 | Deaths J40-47 | Deaths J45,46 excluded | Deaths J40-47 age <70yrs (%) | YPLL up to 70 yrs J40-47 | YPLL/100,000 population J40-47 |
|---|---|---|---|---|---|---|
| 2007 | 64.79 | 1,496 | 1435 | 197 (13.2%) | 1765 | 44.7 |
| 2008 | 57.27 | 1,365 | 1313 | 192 (14.1%) | 1620 | 40.7 |
| 2009 | 62.00 | 1,516 | 1463 | 200 (13.2%) | 1549 | 38.8 |
| 2010 | 53.19 | 1,334 | 1490 | 209 (15.7%) | 1667 | 40.4 |
| 2011 | 57.81 | 1,514 | 1458 | 227 (15.0%) | 1966 | 45.5 |
| 2012 | 59.84 | 1,587 | 1548 | 236 (14.9%) | 1766 | 42.3 |
| 2013 | 61.55 | 1,657 | 1609 | 247 (14.9%) | 1931 | 45.6 |
| 2014 | 55.77 | 1551 | 1514 | 226 (14.6%) | 1740 | 40.5 |
| 2015 | 59.03 | 1701 | 1627 | 237 (13.9%) | 1965 | 47.2 |
| *2016 | 57.05 | 1711 | 1639 | 261 (15.2%) | 2186 | 47.8 |

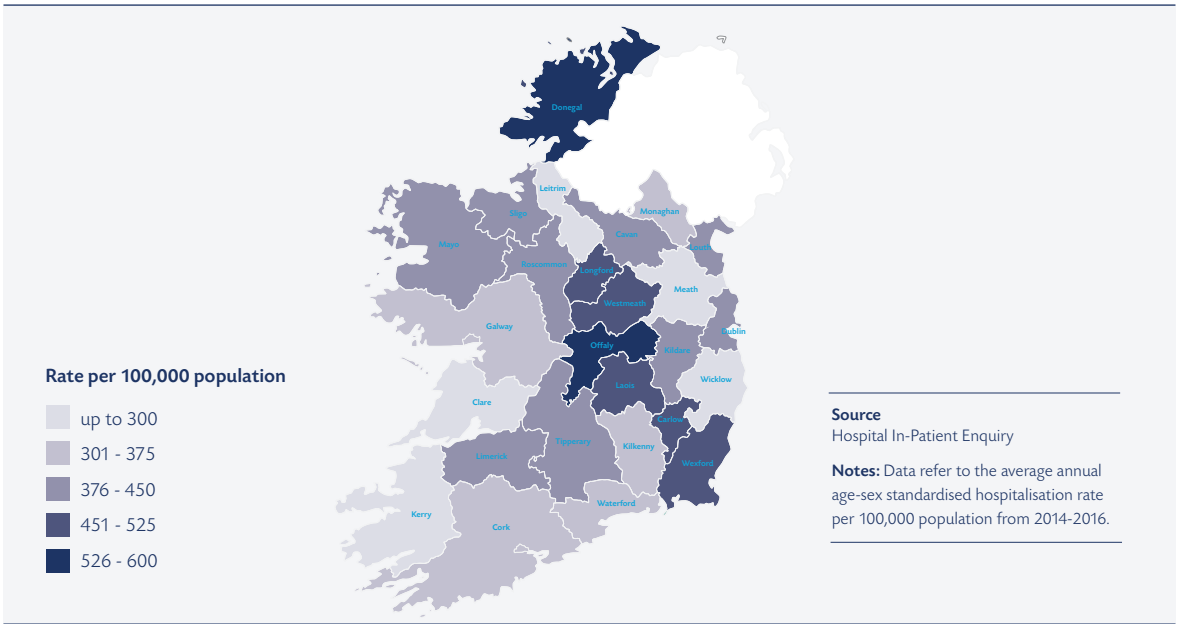
*Source: Public Health Information System (PHIS) *Provisional data for 2016*

**Figure 4.3. Standardised death rate, all ages, 2012-2016. Chronic Lower Respiratory Disease (ICD 10: J40-47)**




*Source: Public Health Information System (PHIS) (provisional data for 2016)*

**Figure 4.4 Age-sex standardised hospitalisation rates for COPD per 100,000 population in Ireland, 2014 - 2016**




*Source: National Healthcare Quality Reporting System Annual Report 2017. Figure 21*[6]

## Socio-economic analysis

In Ireland, socio-economic variation for COPD mortality is more striking than for lung cancer which suggests that factors in addition to smoking come into play for COPD[21]. Data for the period 2007-2012 showed a difference in COPD mortality in the order of 303%, in the lower socio-economic groups compared with the higher groups for males aged over 15 years. For those aged 15-64 years, the excess was even higher at 366% [14, 21].

A difference in prevalence of COPD between socio-economic groups is also to be expected. A small study on two traveller sites in 2015 (54% of participants were females), reported an obstructive pattern of lung disease among 23% of participants who were aged 18-69 years[22].

## International comparisons

COPD affects more than 200 million people in the world, 65 million of whom have moderate or severe airway disease [23]. Most studies show it is under-diagnosed by 72 to 93%[24]. Misdiagnosis is also common[25].

Ireland's prevalence of chronic bronchitis among 20-44 year olds in 2001 of 8% was in contrast to European median prevalence of 2.6%[9]. While the age group did not represent the usual age profile of COPD patients, it did indicate that COPD could be a significant problem in Ireland which was also suggested by another international survey which showed that Ireland was amongst five countries with a prevalence of moderate COPD in 20-44 year olds of 5% or higher[10].

Multicentre surveys of COPD in single countries have been coordinated in the European Community Respiratory Health Survey (ECRHS) and the Burden of Obstructive Lung Disease (BOLD) study. Most estimates of COPD prevalence from such large-scale studies are between 5% and 10% and all show an increase with age[1]. In 2008, incidence rates in the UK were 185 per 100,000[26]. It is estimated that 1 in 7 Australians aged over 40 years have COPD, of whom half are undiagnosed[27].

In terms of alpha-1 antitrypsin deficiency, throughout Europe the frequency of the Z and S mutations varies widely between countries, geographic regions, and ethnic groups[28]. The highest frequency of the S allele is found in the Iberian Peninsula with a mean gene frequency of 0.0564. The frequency of 0.0541 for the S mutation in Ireland is among the highest in Europe, and similar to the Iberian Peninsula. The frequency of the Z variant is highest in northern and western European countries, peaking in southern Scandinavia with a gene frequency of >0.02. The frequency of 0.0218 for the Z allele in the Irish population is also among the highest in Europe[29].

Prevalence of bronchiectasis in the USA ranged from 4 per 100,000 in people aged 18–34 years to 272 per 100,000 in those over 75 years of age in 2005[1]. In New Zealand, the reported prevalence is 3.7 per 100,000 population but this varies according to ethnicity[1]. In Europe, age-standardised hospitalisation rates vary from < 2 to > 6 per 100,000 population. The estimated average annual age-adjusted hospitalisation rate in a US study was 16.5 hospitalisations per 100,000 population[1]. However, as is the case in Ireland, many countries report bronchiectasis as part of COPD.

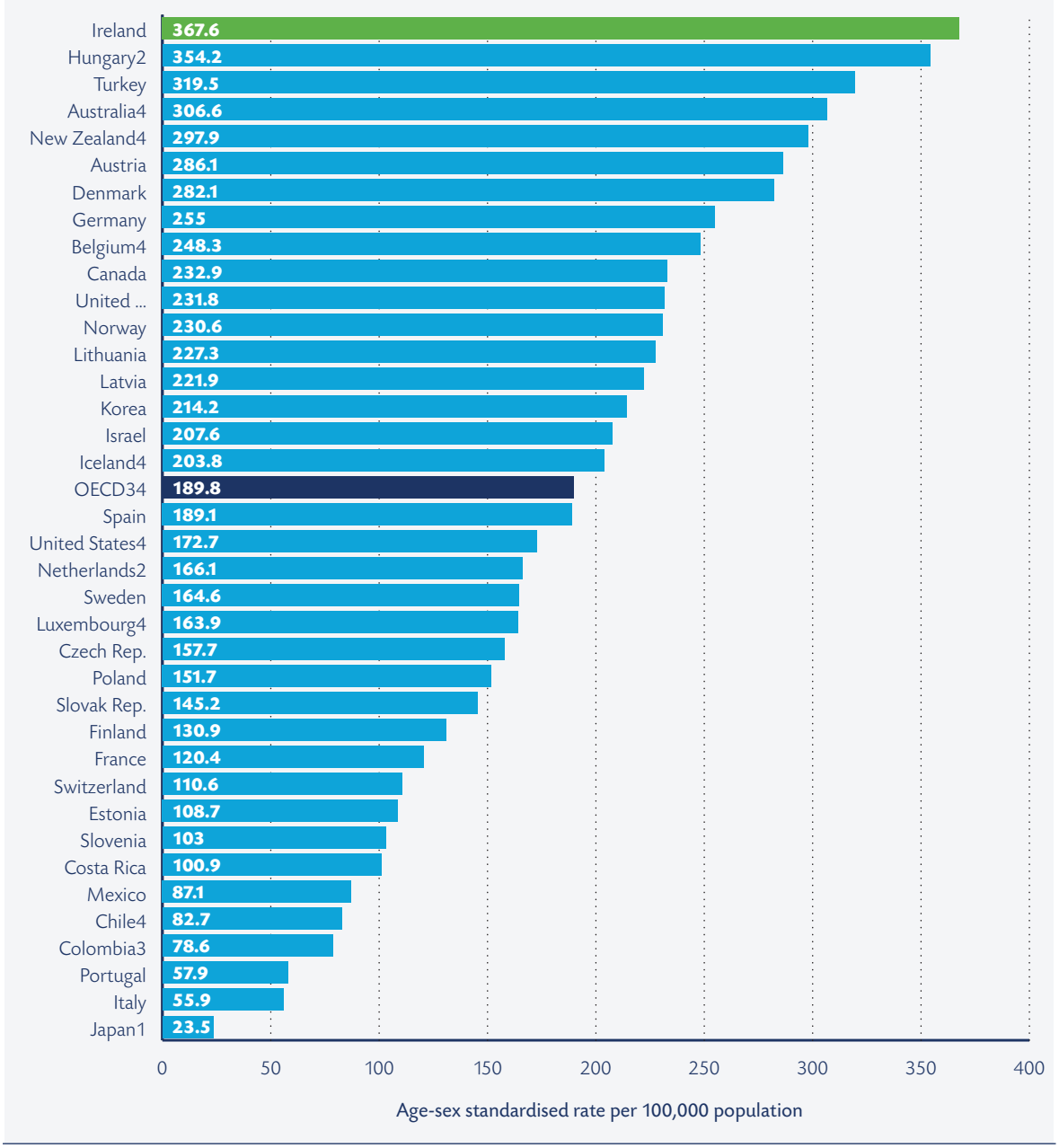
Deaths registered as due to chronic lower respiratory disease are likely to be under-estimates, as people with COPD often succumb to its co-morbidities. While the size of this under-estimation is unknown in Ireland, the literature would suggest that for more than 60% of people with COPD, a co-morbidity other than COPD may be listed as the primary cause of their death[30, 31].

Overall, the age-standardised mortality rate for COPD in the WHO European region is about 18 per 100,000 people per year but the variation between countries in 2011 within the region was more than 10-fold[1]. Ireland's age standardised COPD mortality rate of 27.87/100,000 population was the 5th highest in WHO Europe and 3rd highest in the EU.

The Global Burden of Disease study (2015) reported an age-standardised mortality rate for COPD of 51.7 (CI: 50.0-53.4) which was a reduction of 22.9% (CI: 25.4-20.0) compared with the 2005 figure of 67.0 (CI: 64.8-69.9)[32].

In 2013 (the latest year for which OECD data is currently available), the age-sex standardised hospitalisation rate for COPD in Ireland was 395 per 100,000 population, which was significantly higher than the OECD average of 201 hospitalisations per 100,000 population[6]. Ireland has the highest rate among the selected OECD countries, as shown in the figure below. This difference may be due, in part, to differences in how countries code their hospitalisation data; Ireland uses the ICD-10-AM/ACHI coding system and other countries that use this system were also above the OECD average. This caveat notwithstanding however, differences in coding alone cannot explain why hospitalisation rates in Ireland are the highest among all of the countries listed[6].

**Figure 4.5. Age-sex standardised hospitalisation rates for COPD per 100,000 population for selected OECD countries, 2013 (or nearest year)**




*Source: National Healthcare Quality Reporting System Annual Report 2017. Figure 20*[6]

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# Pneumonia and Acute Lower Respiratory Infection (Unspecified)

05

## Key Points

- Pneumonia is the 5th most frequent cause of death in Ireland
- People with pneumonia and acute lower respiratory infection (unspecified) are largely treated in the community setting
- People with pneumonia and acute lower respiratory infection (unspecified) in 2016 accounted for 31.7% of respiratory inpatient hospitalisations and 40.3 % of respiratory inpatient bed days

## Background

Acute lower respiratory infections are a leading cause of morbidity and mortality in children and adults. Pneumonia is the 5th most frequent cause of death in Ireland [1].

As acute lower respiratory infections are not uniformly defined, this can hamper an appreciation of their epidemiological importance[2]. In epidemiological data recording, acute lower respiratory infections can include acute bronchitis (ICD 10: J20), acute bronchiolitis (ICD 10: J21), acute lower respiratory infection (unspecified) (ICD 10: J22), influenza (ICD 10: J10, J11) and pneumonia (ICD 10: J12-18). This chapter, unless otherwise specified, will focus on pneumonia (ICD 10: J12-18) and acute lower respiratory infection (unspecified) (ICD 10: J22). Bronchiolitis is discussed in the Paediatric chapter and influenza in the Infectious disease chapter.

Pneumonia is a severe, acute, respiratory infection that affects the lungs[3]. Bacteria, viruses and occasionally fungi can cause pneumonia[2]. Respiratory infection due to Legionella (including Legionella pneumonia), is included in the Respiratory Infectious disease chapter. Acute bronchitis occurs in people without chronic lung disease.

## Incidence

Incidence data at a national level is not available. As these are acute events, incidence data rather than prevalence data is the data of interest.

## Mortality

Pneumonia (ICD 10: J12-18) is the 5th commonest cause of death in Ireland[1]. Over 1,000 people die each year in Ireland from pneumonia. It is the 3rd commonest cause of death from respiratory disease after lung cancer and COPD[1].

The 5 year standardised mortality rate (SMR) for pneumonia (J12-18) is shown in the table below. The rate of decline over the past few years has slowed.

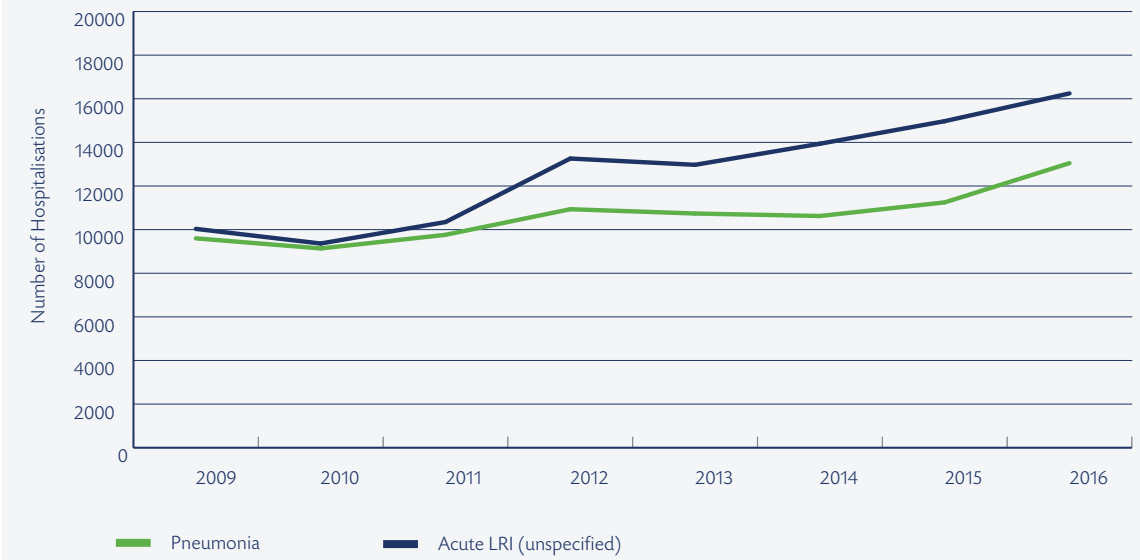
For years of potential life lost (YPLL) due to deaths from pneumonia (ICD 10: J12-18), see section on age below. In 2007, 191 deaths were recorded for acute lower respiratory infection (unspecified) (ICD 10: J22); in 2015, this number was 144[4].

**Table 5.1. Deaths from Pneumonia (ICD 10: J12-18): 2007-2016**

| Year | Total | /100,000 population | 5yrs | Standardised Mortality Rate |
|---|---|---|---|---|
| 2007 | 1125 | 25.71 | 2003-07 | 92.77 |
| 2008 | 1356 | 30.23 | 2004-08 | 81.52 |
| 2009 | 1320 | 29.09 | 2005-09 | 74.54 |
| 2010 | 1141 | 25.04 | 2006-10 | 65.06 |
| 2011 | 1057 | 23.04 | 2007-11 | 54.88 |
| 2012 | 1086 | 23.64 | 2008-12 | 52.65 |
| 2013 | 983 | 21.30 | 2009-13 | 47.68 |
| 2014 | 1003 | 21.59 | 2010-14 | 43.96 |
| 2015 | 1165 | 24.85 | 2011-15 | 43.45 |
| **2016 | 1049 | 22.13 | 2012-16 | 41.87 |

*Source: Public Health Information System (PHIS) *ICD 10 coding for deaths introduced in 2007. ** Provisional data for 2016*

**Figure 5.1. Inpatient hospitalisations with a primary diagnosis of pneumonia or acute lower respiratory infection (Acute LRI) (unspecified), 2009-2016**




*Source: HIPE 2009-2016. All hospitals reporting data to HIPE*

## Impact on health services

Data on pneumonia (ICD 10: J12-18) or acute lower respiratory infection (unspecified) (ICD 10: J22) is not available at a national level for people with full medical cards, those with GP only cards or those who are private patients. This is also true for those who attend GP out of hours services, those who attend Emergency Departments and those who attend hospital Outpatient Departments. Inpatient or day case data is only available from HIPE reporting publicly funded hospitals.

Both pneumonia (ICD 10: J12-18) and acute lower respiratory infection (unspecified) (ICD 10: J22) are largely treated in the community, hospitalisations are only the tip of the iceberg in terms of burden both on patients and on health services. The number of inpatient hospitalisations for acute bronchitis is relatively low. In 2016, there were 236 such inpatient hospitalisations using a total of 539 bed days.

In terms of publicly funded acute hospitals, figure 5.1 above, reflects the increasing burden on inpatient hospital services for both pneumonia (ICD 10: J12-18) and acute lower respiratory infection (unspecified) (ICD 10: J22) for the years 2009-2016.

For the years 2007-2016, the crude in-hospital mortality for pneumonia (ICD 10: J12-18) changed from 13.8 deaths per 100 admissions in 2007 to 11.1 deaths per 100 admissions in 2016 among the 32 included hospitals[5]. The standardised mortality rate (SMR) in 2016 (99.8% control limits), as opposed to crude mortality, ranged from 162 (39-170) to 28 (25-188)[5].

In 2016, pneumonia (ICD 10: J12-J18) accounted for 13,048 inpatient hospitalisations (14.1% of respiratory inpatient hospitalisations) while acute lower respiratory infection (unspecified) (ICD 10: J22) accounted for 16,245 (17.6%) i.e. a combined total of 29,293, which is 31.7% of all inpatient respiratory hospitalisations and 4.5% of all inpatient hospitalisations. In terms of inpatient bed days, the two conditions accounted for 40.3% of respiratory inpatient bed days or 6.3% of all inpatient bed days.

In 2016, 97.7% (15,879) of the inpatient hospitalisations for acute lower respiratory infection (unspecified) (ICD 10: J22) were admitted as emergencies. The figure for those with pneumonia (ICD 10: J12-18) was 98.3% (12,821). When combined, they accounted for 6.9% of all emergency inpatient hospitalisations and 36.7% of respiratory emergency hospitalisations.

The Activity in Acute Public Hospitals in Ireland Report for 2016 listed three respiratory conditions among its top 10 Principal Diagnoses for inpatient hospitalisations[6]. Following spontaneous delivery, pain in throat and chest and delivery by caesarean section, in 4$^{th}$ place was acute lower respiratory infection (unspecified) and in 8$^{th}$ place, pneumonia organism unspecified (ICD 10: J18)[6]. Among the top Principal Diagnoses for emergency hospitalisations, after pain in throat and chest, in 2$^{nd}$ place was acute lower respiratory infection (unspecified) while In joint 4th place was pneumonia organism unspecified (ICD 10: J18)[6].

**Table 5.2. Deaths from Pneumonia (ICD 10: J12-18): Years of Potential Life lost (YPLL): 2007-2016**

| Year | Standardised Mortality Rate: all ages | Total deaths | Deaths aged <70yrs (%) | YPLL up to 70 yrs | YPLL/100,000 population |
|---|---|---|---|---|---|
| 2007 | 55.45 | 1125 | 92 (8.2%) | 1021 | 24.9 |
| 2008 | 63.87 | 1356 | 110 (8.1%) | 1421 | 34.0 |
| 2009 | 59.75 | 1320 | 108 (8.2%) | 1529 | 35.2 |
| 2010 | 50.34 | 1141 | 110 (9.6%) | 1719 | 39.4 |
| 2011 | 45.38 | 1057 | 77 (7.3%) | 844 | 18.9 |
| 2012 | 45.80 | 1086 | 75 (6.9%) | 777 | 20.2 |
| 2013 | 40.47 | 983 | 55 (5.6%) | 861 | 20.5 |
| 2014 | 39.39 | 1003 | 79 (7.9%) | 905 | 22.2 |
| 2015 | 44.32 | 1165 | 81 (6.9%) | 1287 | 29.3 |
| *2016 | 38.40 | 1049 | 95 (9.1%) | 1237 | 28.7 |

*Source: Public Health Information System (PHIS) * Provisional data for 2016*

## Gender

More women than men die from pneumonia (ICD 10: J12-18). In 2016, of those who died from pneumonia, 43.6% were male and 56.4% were female. When age-standardised, the rate is higher in men. That for males was 45.35 and for females was 34.17 in 2016. Over the 5 year period 2012-2016, the age-standardised rate for males was 49.99 while that for females was 37.41.

For deaths due to acute lower respiratory infection (unspecified), of the 144 who died in 2015, 62% (91) were females. In 2007, the figure was 56% (107)[4].

## Age

The majority (>90%) of deaths from pneumonia (ICD 10: J12-18) occur in those aged 70 years and over (table 5.2).

Of 144 deaths from acute lower respiratory infection (unspecified) in 2015, 73% (105) were aged 85 years or over, 18.1% (26) were aged 75 -84 years and 4.9% (7) were aged 65-74 years [4].

Of the inpatient hospitalisations for pneumonia in 2016, 1,508 (11.6%) were aged 0-15 years using 8.9% of respiratory inpatient bed days (1.9% of all inpatient bed days) in that age group, 3,455 (26.5%) were aged 16-64 years using 17.4% of respiratory inpatient bed days (1.8% of all inpatient bed days) in that age group and 8,085 (62.0%) were aged 65 years or over using 26.4% of respiratory inpatient bed days (5.0% of all inpatient bed days) in that age group.

Another way of looking at these figures for 2016 is, of those aged 0-15 years hospitalised with a respiratory illness, 6.4% (1,508) had pneumonia, the figure for those aged 16-64 years was 11.6%, while for those aged 65 years or over it was 20.7%.

Of inpatient hospitalisations for acute lower respiratory infection (unspecified) in 2016, 2,325 (14.3%) were aged 0-15 years using 10.5% of respiratory inpatient bed days (6.1% of all inpatient bed days) in that age group, 4,910 (30.2%) were aged 16-64 years using 13.6% of respiratory inpatient bed days (1.4% of all inpatient bed days) in that age group and 9,010 (55.5%) were aged 65 years or over using 20.7% of respiratory inpatient bed days (4.4% of all inpatient bed days) in that age group.

As with pneumonia another way of looking at these figures is to say in 2016, of those aged 0-15 years, hospitalised with a respiratory illness, 10.2% (2,325) had acute lower respiratory infection (unspecified) (ICD 10: J22), the figure for those aged 16-64 years was 17.2% (4,910) while for those aged 65 years or over it was 23.2% (9,010).

## Regional variation

The 5 year standardised death rates for pneumonia by county of residence for the past number of 5 years periods show a wide variation in range with Longford usually at the top of the scale and Cavan at the bottom. For the period 2012-2016, the range was 25.09 (Cavan) to 98.38 (Longford). Data for acute lower respiratory infection (unspecified) on a regional basis is not available.

## Socio-economic analysis

National data is not available.

## International Comparisons

The incidence of Community-acquired pneumonia (CAP) in general practice in Europe is reported to range from 1.7–11.6 cases per 1,000 people per year in adults[2]. Although most patients are treated in the community, most available data are from hospitalised patients. Based on WHO (Europe) Morbidity data base (2011) and Eurostat (2012), the variation in age-standardised hospitalisation rates per 100,000 population for those aged ≥15 years between

European countries, ranged from 50.6 to 515.95, with Ireland at 216.61[2].

Globally, pneumonia causes 13% of childhood deaths[3]. In the Global Burden of Disease report (2015), 12.1% of deaths in children under the age of 5 years were due to lower respiratory infections[7]. This age group accounted for 26% of all deaths from lower respiratory infections[7].

The age-standardised mortality rate per 100,000 for pneumonia in adults (aged 15 years of age and over) in WHO Europe ranged from 4.50 to 38.28 as reported in 2011. Ireland was among the highest with a rate of 32.96[2]. In 2015, the Global Burden of Disease reported that the age-standardised mortality rate for lower respiratory infections was 41.6 (CI: 38.0-43.5), which was a reduction since 2005 of 19% (CI: 22.3-16.9). The figure in 2005 was 51.7 (CI: 47.9-54.1)[7]. The risk of death from pneumonia increases with age. A UK study reported case-fatality rates of 5.6% in those aged less than 65 years and 47.2% for those aged more than 85 years[2].

The age standardised hospitalisation rate for acute lower respiratory infections (but excluding pneumonia) in adults as reported by WHO Europe in 2011 ranged from 4.89 to 227.61. This latter figure was the Irish figure[2]. Malta and the UK were the 2nd and 3rd highest at 140.61 and 108.14 respectively.

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# Asthma

06

## Key Points

- Ireland has among the highest rates of asthma in the world
- Asthma typically begins earlier in life than many other chronic diseases. Consequently it can impose a high lifetime burden on individuals, caregivers and the community
- Adults with asthma include those who have had asthma since childhood, those in whom it apparently resolved but subsequently recurs and those who develop asthma as adults

## Background

Asthma is a heterogeneous group of conditions that results in recurrent episodes of reversible airway obstruction. It is a chronic inflammatory condition of the airways characterised by symptoms of wheezing, breathlessness, chest tightness and coughing, particularly at night or in the early morning.

Asthma afflicts up to 334 million people worldwide[1]. It has been increasing in prevalence for the past three decades[2]. It is the most common chronic disease in children[3]. Children with asthma may have abnormal lung growth and are at risk of developing lifelong respiratory symptoms[4].

The causes of the increase in global asthma are not well understood. Genetic predisposition, exposure to environmental allergens, indoor and outdoor air pollution, lower respiratory tract infection early in life, airway microbiome make-up, dietary factors and abnormal immunological responses may promote the development of asthma. The timing and level of exposure to such allergens, infection or irritants may be important factors in the development of asthma. Early viral infections and passive tobacco smoke exposure have been associated with its development in young children. Airborne allergens and irritants in the workplace can lead to asthma among workers if the exposure persists. Triggers such as stress, exercise, cold air and inhaling substances such as smoke, pollution or pollen can cause airways to become inflamed and narrowed[5].

Asthma affects people of all ages. Most commonly it arises in childhood and may persist into adulthood. In perhaps two-thirds of children with asthma, the disease remits in the early teenage years, only to relapse, in about a third of these cases, in adulthood. Less commonly, the disease begins for the first time in adulthood. It is estimated that 15% of all adult asthma is 'work related'[11]. Therefore adult asthma may represent persistent or relapsed childhood disease or true incident 'new' adult disease[6].

Childhood asthma results from an interaction between different environmental and genetic factors. Respiratory virus infections such as Respiratory Syncytial Virus (RSV) are major causes of acute bronchiolitis in infancy and of acute asthma attacks among older asthmatic children. From 2 years of age, rhinovirus infections are the most frequent precipitants of acute asthma. It is estimated that 85% of acute asthma attacks are precipitated by respiratory virus infections[7]. After two years of age, inhalant allergy - from both outdoor and indoor allergens - becomes increasingly important for the development of asthma.

In adults, exacerbations of asthma are often provoked by respiratory infections – usually viral in origin. In adults with allergic asthma, symptoms are provoked by exposure to the relevant allergen. Other common triggers include physical exertion (particularly in cold, dry air) and traffic pollution. Certain drugs such as βadrenergic blockers and non-steroidal anti-inflammatory agents including aspirin can provoke asthma[6].

## Incidence

At a national level the incidence of asthma is unknown.

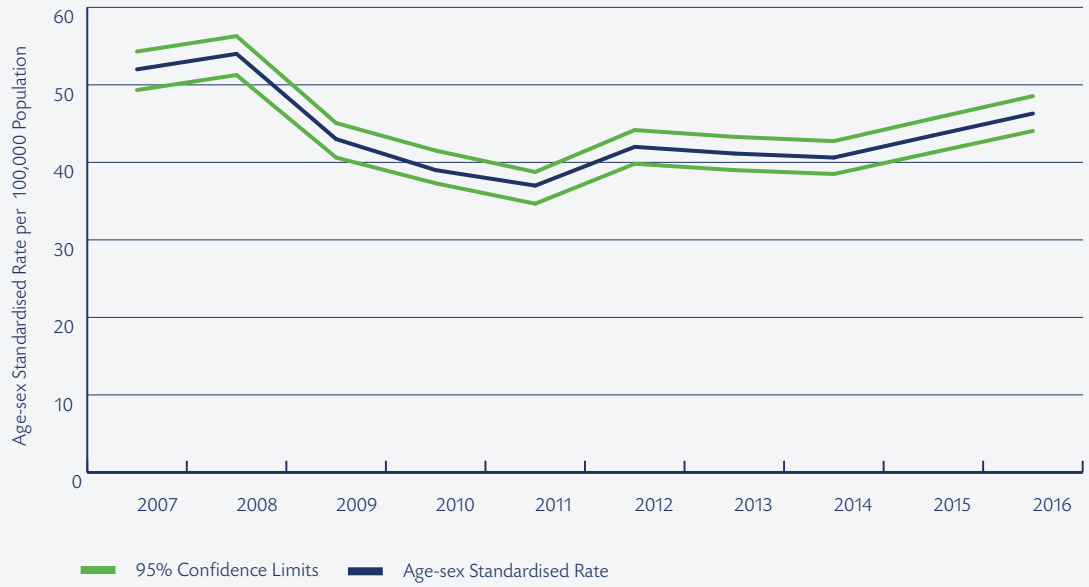
## Prevalence

Current estimates suggest that the prevalence of doctor-diagnosed asthma in Ireland is 21.5% of children ("asthma ever") and 7-9.4% of adults[8]. As part of the Longitudinal Growing up in Ireland Study in 2011, 9.5% of 3 year olds reported asthma symptoms[9]. Among those aged 15 years and older in the Healthy Ireland Survey, 8% reported that they had asthma[10].

In the absence of better population data, and as a proxy for prevalence for those with greater asthma needs, hospitalisation rates are of value. A number of people with asthma are admitted on a planned basis, either to facilitate the administration of medication or for diagnostic investigations[11].

The age-sex standardised inpatient hospitalisation rate for asthma fluctuated over the decade 2007-2016, from a high of 54 per 100,000 population in 2008 to a low of 37 per 100,000 population in 2011 (see figure 6.1 below). Over the three years (2014, 2015, 2016), the age-sex standardised rate of hospitalisation for asthma has increased year-on-year from 41 per 100,000 population in 2014 to 46 per 100,000 population in 2016[11].

**Figure 6.1. Age standardised hospitalisation rates for asthma per 100,000 population in Ireland 2007-2016**




*Source: National Healthcare Quality Reporting System Annual Report 2017. Figure 22.*[11]

**Table 6.1. Asthma RIP: 2007-2016 and 5 year Standardised Rates 2003-2016**

| Year | Total | /100,000 population | 5yrs* | Standardised Mortality Rate |
|---|---|---|---|---|
| 2007 | 61 | 1.39 | 2003-2007 | 2.54 |
| 2008 | 52 | 1.16 | 2004-2008 | 2.40 |
| 2009 | 53 | 1.17 | 2005-2009 | 2.25 |
| 2010 | 44 | 0.97 | 2006-2010 | 2.07 |
| 2011 | 56 | 1.22 | 2007-2011 | 2.06 |
| 2012 | 39 | 0.85 | 2008-2012 | 1.84 |
| 2013 | 48 | 1.04 | 2009-2013 | 1.81 |
| 2014 | 40 | 0.86 | 2010-2014 | 1.67 |
| 2015 | 74 | 1.58 | 2011-2015 | 1.86 |
| **2016 | 72 | 1.52 | 2012-2016 | 1.92 |

*Source: Public Health Information System (PHIS) *Change from ICD 9 to ICD 10 coding for deaths in 2007 ** Provisional data for 2016*

## Mortality

Table 6.1 above shows the number of deaths from asthma and the rate/100,000 population for each year of the decade 2007-2016. The five year standardised mortality rates (SMR) for the period 2003 - 2016 are also shown. At a population level the numbers are small, but at a human level these numbers are of concern as is the apparent reversion to a rising trend in recent years. For deaths in terms of years of potential lives lost (YPLL) see section on age.

## Impact on health services

Data on asthma is not available at national level for people with full medical cards, those with GP only cards or those who are private patients. This is also true for those who attend GP out of hours services, those who attend Emergency Departments and those who attend hospital Outpatient Departments for their asthma. Inpatient or day case data is only available from HIPE reporting acute publicly funded hospitals.

An analysis of 2013 Primary Care Reimbursement Scheme (PCRS) pharmacy claims data for inhalers for patients under the age of 40 years (on the assumption that the majority in this age group would have asthma rather than another respiratory diagnosis) reported that between the General Medical Services (GMS) and the Drugs Payment Scheme (DPS), pharmacy claims for inhalers amounted to an expenditure in excess of €16 million. Between these two schemes an average of 12,300 prescriptions for combination inhalers were estimated to be filled each month for patients with asthma[12]. This analysis excluded those aged under 6 years or over 40 years. In 2013, 40%

of the total population were eligible for the GMS scheme. For those not eligible for GMS, the threshold for refund under the DPS was a monthly excess of €144 in 2013. The cost for supply of newer biologics high tech asthma therapy is estimated to be about €8m annually for approximately 550 patients[13].

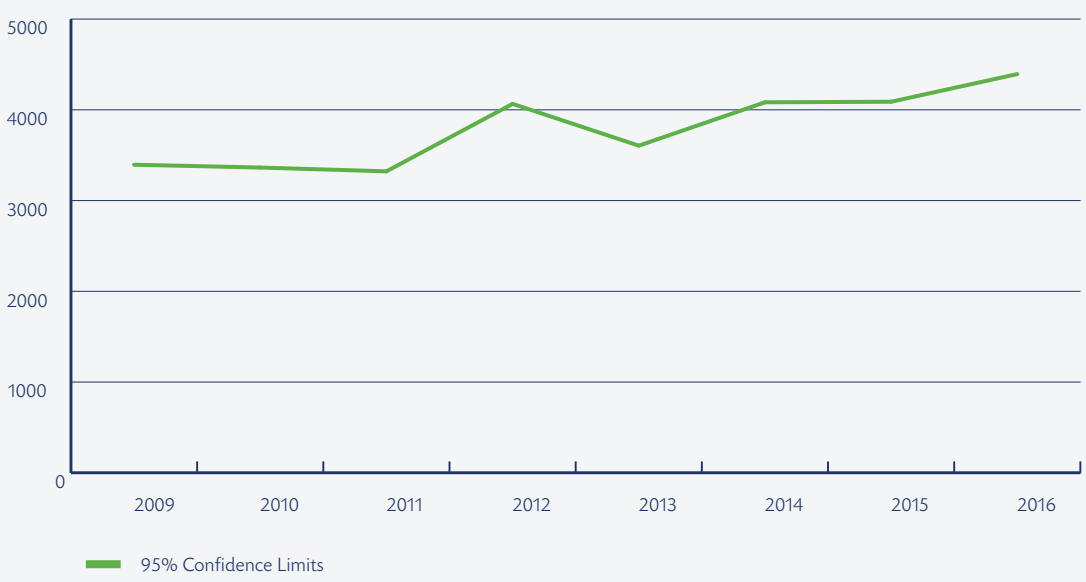
In terms of publicly funded acute hospitals, the numbers of day case hospitalisations for asthma has more than doubled in the years 2009 to 2016 from 1,336 in 2009 to 2,889 in 2016. In the section on prevalence, inpatient hospitalisations standardised for the population were shown in figure 6.1. In figure 6.2 below, the increasing burden on inpatient hospital services for the years 2009-2016 is shown.

In 2016, asthma accounted for 7,283 hospitalisations in acute publicly funded hospitals (day cases and inpatients). Of these, 4,394 (60%) were inpatients who occupied 11,630 inpatient bed days (0.3% of all inpatient bed-days, 2% of all respiratory inpatient bed days). Over 97% (4,252) of these inpatient hospitalisations were emergency admissions. Of the inpatients with asthma in 2016, 12.5% were classified as major complexity[14].

## Gender

Over the period, 2009-2016, of those aged under 15 years of age admitted as inpatients with asthma, 63.4% were males. Of those aged 65 years and over, 70.6% were females.

**Figure 6.2. Inpatient hospitalisations with a primary diagnosis of asthma, 2009-2016**



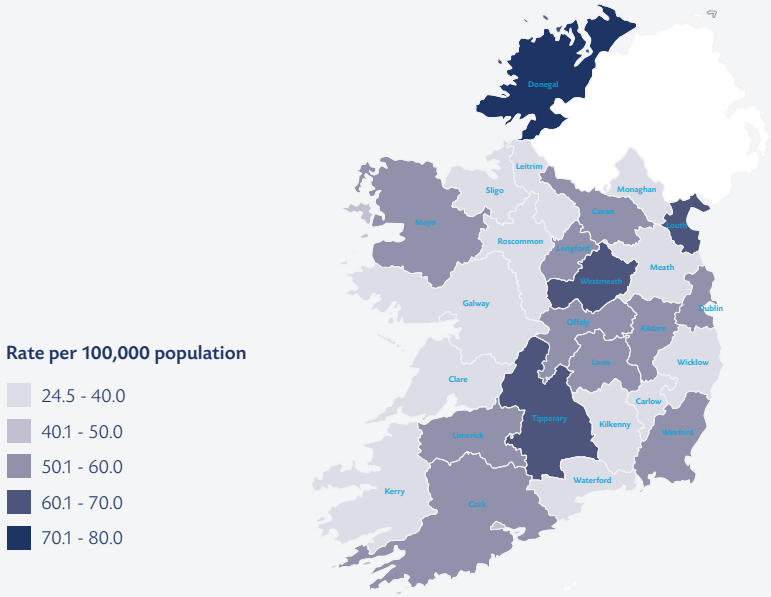

*Source: HIPE 2009-2016. All hospitals reporting data to HIPE*

**Table 6.2. Deaths from Asthma and Years of Potential Life lost (YPLL): 2007-2016**

| Year | Standardised Mortality rate: all ages | Deaths: Total | Deaths aged <70yrs (% of total) | YPLL up to 70 yrs | YPLL/100,000 population |
|---|---|---|---|---|---|
| 2007 | 2.52 | 61 | 16 (26.2%) | 354 | 7.7 |
| 2008 | 1.94 | 52 | 21 (40.4%) | 459 | 9.5 |
| 2009 | 2.13 | 53 | 12 (22.6%) | 218 | 5.0 |
| 2010 | 1.64 | 44 | 14 (31.8%) | 292 | 6.1 |
| 2011 | 2.06 | 56 | 20 (35.7%) | 433 | 8.6 |
| 2012 | 1.44 | 39 | 10 (25.6%) | 364 | 7.2 |
| 2013 | 1.85 | 48 | 12 (25.0%) | 227 | 4.7 |
| 2014 | 1.38 | 40 | 12 (30.0%) | 322 | 6.6 |
| 2015 | 2.48 | 74 | 21 (28.4%) | 624 | 15.5 |
| *2016 | 2.32 | 72 | 21 (29.2%) | 582 | 11.3 |

*Source: Public Health Information System (PHIS) * Provisional data for 2016*

**Figure 6.3. Age-sex standardised hospitalisation rates for asthma per 100,000 population by county of residence, 2014-2016**




*Source: National Healthcare Quality Reporting System Annual Report 2017.Figure 24.*[11]

## Age

Asthma is the most common chronic disease of childhood. However the majority of deaths from asthma occur in those aged 70 years and over (table 6.2). For those who die under the age of 70 years, there are significant years of potential life lost (YPLL) as shown in table 6. 2.

Of the inpatient hospitalisations for asthma in 2016, 1,885 (43%) were aged 0-15 years using 5.6% of respiratory inpatient bed days in that age group (1.2% of all inpatient bed days), 1,966 (44.7%) were aged 16-64 years using 3.9% of respiratory inpatient bed days (0.4% of all inpatient bed days) in that age group) and 543 (12.4%) were aged 65 years or over using 0.7% of respiratory inpatient bed days (0.1% of all inpatient bed) days in that age group.

## Regional variation

During the three year period from 2014-2016, the age-sex standardised hospitalisation rate by county of residence for asthma ranged from 25 hospitalisations per 100,000 population in Leitrim to 73 hospitalisations per 100,000 population in Donegal (see figure 6.3 above). The low absolute number of hospitalisations in many counties makes the rate sensitive to small changes in these numbers [11].

## International Comparisons

The prevalence of childhood asthma increased markedly in Europe in the second half of the 20th century[7]. In the UK, 8 % of the population have asthma[5].

The International Study of Asthma and Allergies in Childhood (ISAAC) survey between 2000 and 2003 reported that about 14% of the world's children were likely to have had asthmatic symptoms in the previous year[1]. In the 2002-2003 ISAAC study, for those aged 13-14 years, the prevalence of "asthma ever" in Ireland was 21.5%. The figure in the UK was 20.7% for the same age group[7]. These figures were among the highest in Europe.

Overall, 4.3% of respondents to the World Health Organisation's (WHO) World Health Survey of 18-45 year olds in 2002-2003 reported a doctor's diagnosis of asthma, 4.5% reported having either a doctor's diagnosis or that they were taking treatment for asthma, and 8.6% reported that they had experienced attacks of wheezing or symptoms (of asthma) in the preceding 12 months[1]. Ireland, with a rate of 9.41%, was at the higher end of the range in WHO Europe (range <3% - >20%) but not as high as the UK (17.84%)[6]. In Australia in 2014-2015, 10.8% of the population had asthma[15].

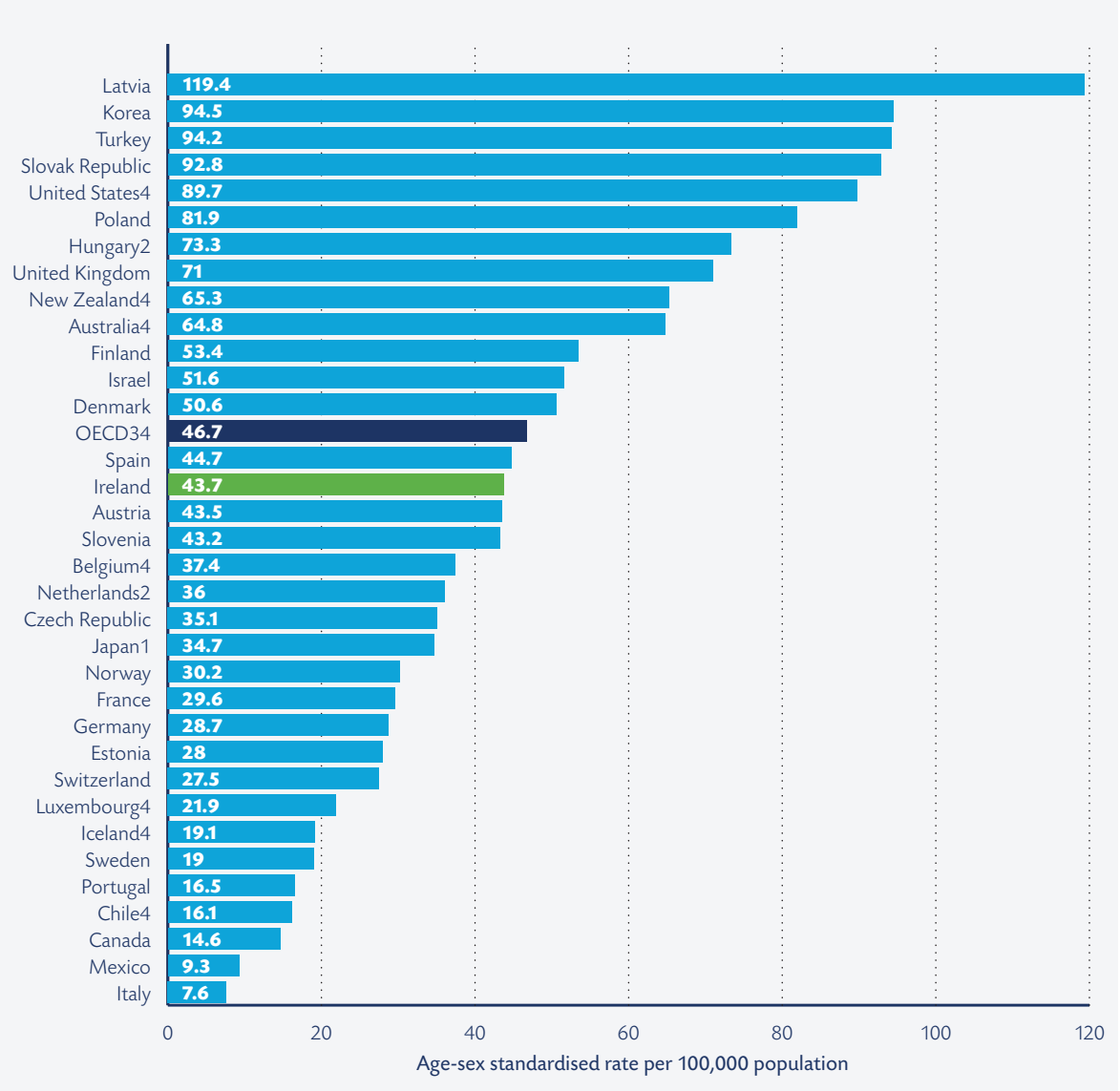
Data (2004–2010) from WHO for children aged 0–14 years shows that mortality is generally low in Europe[7]. Death from asthma in adults is uncommon in most European countries with the age standardised rate ranging from <1.0 to 9.86 (Ireland 1.45)[6]. In the UK, most asthma deaths are in those aged >65 years[5]. In 2015, the UK audit of asthma deaths reported that 90% of deaths in the UK had a preventable aspect[16].

In 2013 (the latest year for which OECD data are currently available), the age-sex standardised hospitalisation rate for asthma in Ireland at 41 per 100,000 population (see figure 6.4 below) was below the OECD average of 44 hospitalisations per 100,000

population, but the difference was not statistically significant[11].

The 2015 Global Burden of Disease study reported that in terms of years of life lost, asthma ranked 37th[17]. The burden of asthma, measured by both disability and premature death, is greatest in children approaching adolescence (ages 10-14) and the elderly (ages 75-79)[1]. The Global Asthma report estimated that asthma was the 14th most important disorder in terms of global years lived with disability. However, for people in older age groups, premature death due to asthma contributes more to the burden of disease[1].

**Figure 6.4. Age-sex standardised hospitalisation rates for asthma per 100,000 population for selected OECD countries, 2013 (or nearest year)**




*Source: National Healthcare Quality Reporting System Annual Report 2017.Figure 23.*[11]

*Note on international comparability: Differences in coding practices among countries and the definition of admissions may affect the comparability of data. Differences in disease classification systems, for example between ICD-9-CM and ICD-10-AM/ACHI may also affect data comparability. 95% confidence intervals represented by I-I.*

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# Cystic Fibrosis

07

## Key Points

- Ireland has one of the highest global incidences of cystic fibrosis
- Cystic fibrosis remains a lethal inherited disease but is also now a chronic disease of both childhood and adulthood
- Seven mutations of the CFTR gene account for over 80% of cystic fibrosis cases in Ireland
- The F508del mutation, which causes severe or classic cystic fibrosis, is a more common cause of cystic fibrosis in Ireland than in many other countries
- Newborn screening for cystic fibrosis commenced in the Republic of Ireland in July 2011

## Background

Cystic fibrosis (CF) is a life-shortening, inherited disease that affects most body systems, especially the lungs and digestive system. Most of the morbidity and mortality from CF is due to respiratory disease but complications affecting other body systems are becoming more prominent as life expectancy increases. With improved diagnosis and improved therapies, CF is changing from primarily a disease of children to a disease of children and adults.

CF is an autosomal recessive condition. There are global and regional variations in gene frequency. It is the commonest lethal inherited disease of Caucasians, but no ethnic group is exempt, although prevalence varies. One in 25 people carry a CF gene in Ireland. The genetic condition is caused by mutations of the CFTR gene which regulates salt transport. Over 2000 mutations in CFTR have been identified that cause CF. The most common CFTR mutation that causes CF worldwide is the F508del which causes severe or classic CF. In Ireland, of those living with CF, 55.6% have two copies of F508del while 36.0% have one copy of it[1]. This mutation is a more common cause of CF in Ireland than in many other countries. The G551D is the second most common mutation. Within Europe, Ireland has the highest frequency of G551D mutations[1,2].

In Ireland, seven mutations account for over 80% of CF cases[5]. The mutations are divided into different classes of severity which impact on survival. Comparisons of survival must take account of these genetic variations but within each class there is considerable individual variation[3]. This can relate to a variety of factors, including environmental factors, so predicting prognosis for an individual from their genotype is not possible. Mutation class also has implications for treatment development[3].

## Incidence and Prevalence

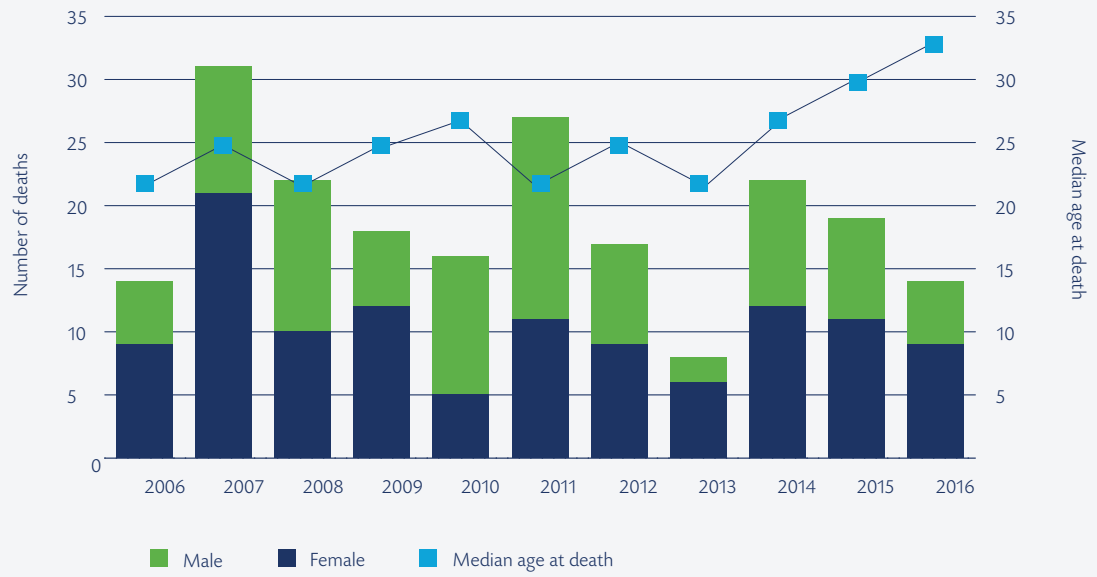
Between 2008 and 2016, on average 38 individuals were diagnosed with CF each year in Ireland (range 22-49). The median age of diagnosis was 0.33 years. Since the introduction of newborn screening in 2011, the numbers of new patients diagnosed following symptomatic presentation each year is approximately 25%[1].

In 2016, there were 1,339 people living with CF in Ireland of whom 94.5% were on the (voluntary) Cystic Fibrosis Registry of Ireland.

## Mortality

Since 2000, an average of 18 people with CF died each year (range 7-31 years)[1]. Of the 13 people who died in 2016, (9 females, 4 males) they ranged in age from 11-59 years with a median age of death of 32.5 years (this differs to median life expectancy as the former only represents the 13 deaths which occurred in 2016)[1]. Figure 7.1 below shows deaths by gender and increasing median age of death for the years 2006-2016[1]. The estimated life expectancy in Ireland for those born today with CF is 37.5 years based on the assumption of no change in the mortality rate from any future changes in CF care[1].

**Figure 7.1. Deaths associated with cystic fibrosis 2006-2016**




*Source: The Cystic Fibrosis Registry of Ireland Annual Report 2016 [1].*

**Figure 7.2. Inpatient hospitalisations with a primary diagnosis of cystic fibrosis, 2009-2016**


*Source: HIPE 2009-2016. All hospitals reporting data to HIPE.*

## Impact on health services

Neonatal screening for CF facilitates detection and intervention at an earlier age so numbers screened, numbers re-called and numbers detected should be included in consideration of impact on health services. Once diagnosed, impact on health services includes long term illness card resources, implications of co-morbidities, drug costs, provision and running costs of respiratory aids and appliances including oxygen and nebulisers, allied healthcare professional requirements in addition to GP, Emergency Department, Outpatient Department and out of hours implications.

The number of inpatient hospitalisations for CF from HIPE reporting hospitals over the years 2009-2016 is shown in figure 7.2 above. In Ireland between the years 2011-2016 there were 60 lung transplants performed for people with CF. This included 7 bilateral lung transplants[1].

There were almost six visits to out-patient settings for each person with CF in 2016[1].

In 2016, there were 1,110 inpatient hospitalisations for CF (1.2% of respiratory inpatient hospitalisations, 0.2% of all inpatient hospitalisations) which used 14,081 inpatient bed days (2.4% of respiratory inpatient bed days, 0.4% of all inpatient bed days). Of these hospitalisations, 72% were emergencies. In addition there were 2,135 day cases.

Of the inpatients in 2016, 69% were classified as CF with major complexity with a mean and median length of stay (LOS) of 13.1 and 14 days respectively. For those inpatients with CF minor complexity, the mean and median LOS was 7.8 and 6 days respectively [4].

Of those on the CF Registry in 2016, 16.1% were also on treatment for CF related Diabetes Mellitus, 11.7% for CF related liver disease, 1.0% were on CFTR modulation therapy, 5.9% on long term home oxygen (LTOT) and 5.4% on home non-invasive ventilation (NIV)[1].

## Gender

Of those on the CF Registry from 2010 – 2016, approximately 58% were males and 42% females. As stated earlier, of those who died in 2016, 69% were females[1].

## Age

With the introduction of neonatal screening in 2011, patients are increasingly diagnosed in the neonatal period. Of those on the registry in 2016, 44.6% were aged under 18 years of age, and 8.9% were aged 40 years or over[1].

Of inpatient hospitalisations in 2016, 27% were aged 0-15 years and 73% aged 16-64 years. Within the 0-15 year old age group, 14.3% (43) were aged 0-4 years.

Comparing children (age < 18 years) with adults, 6.9% versus 17.1% were on treatment for CF related liver disease, 5.2% versus 26.1% for CF related Diabetes Mellitus, 18.2% versus 14.9% on CFTR modulators, 2.0% vs 9.1% on LTOT and 2.6% versus 16.1% on NIV[1].

## Regional variation

In the South West of Ireland the G551 mutation accounts for 20% of cases compared with 15.2% nationally[5].

## Socio-economic analysis

CF impacts on the education and employment opportunities of those affected as well as on carers/parents. There are also additional ancillary costs incurred such as heating, travel, electricity, nutrition, etc.

Environmental circumstances contribute at least as much to the prognosis as CFTR gene class and modifier genes. Low socio-economic status is associated with an adverse outcome at all ages[3].

## International Comparisons

Farrell in 2008 reported a mean prevalence of CF of 0.737/10,000 in 27 EU countries which was similar to the value of 0.797 in the United States. Ireland was an outlier at 2.98[6].

In the USA, 24 CFTR mutations account for over 80% of all cases of CF. In Ireland, 7 mutations account for over 80% of CF cases. As mentioned in the Background, in Ireland, of those living with CF, 55.6% have two copies of F508del. This compares with 46.1% in the USA and 50.3% in the UK[1]. This is the mutation which causes severe or classic CF.

The European CF report of 2016 reflects data from 31 countries. Of those seen in 2016, the median age of diagnosis was 0.34 months (Ireland: 0.3 months) with a range of 0.2 months to 10 years[2].

In the UK, one third of those hospitalised for CF are children[7]. In Ireland, 27% of the inpatient hospitalisations for CF in 2016 were in those aged 0-15 years.

1% of the Irish population with CF died in 2016 which is slightly lower than that of the USA and UK (1.3% and 1.5% respectively)[1]. The median age of death in Europe in 2016 was 30 years compared with a median age of 32.5 years In Ireland[1, 2].

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# Chronic Interstitial Lung Disease and Sarcoidosis

08

## Key Points

- Sarcoidosis and idiopathic pulmonary fibrosis are amongst the most important of the 300-plus interstitial lung diseases.
- Approximately one in three cases of interstitial lung disease has a known cause
- The management of interstitial lung disease of known aetiology is, in the first place, prevention and cessation of the cause

## Background

Interstitial lung diseases (ILDs) result from damage to the alveoli (air sacs) leading to inflammation and fibrosis of the interstitium (tissue wall between the alveoli). There are more than 300 different diseases included in this category. As most ILDs are rare, accurate data on prevalence and mortality are scarce. The main symptom of ILD is progressive shortness of breath initially on exertion, and then at rest when the disease is more advanced[1].

A practical classification distinguishes ILDs of known cause from those of unknown cause. Of the major ILDs, approximately 35% have a known aetiology. These include external factors such as organic or inorganic material inhalation, drug reactions and infections. Included amongst those of unknown aetiology are sarcoidosis (ICD 10: D86) and idiopathic pulmonary fibrosis (ICD 10: J84.1)[1].

Among the 35% of major ILDs of known aetiology are pneumoconioses (see chapter 11), extrinsic allergic alveolitis (hypersensitivity pneumonitis) (see chapter 11), iatrogenic ILD caused by drugs and/or radiation and post-infectious ILD[1]. Included among the 65% of major ILDs of unknown aetiology are: sarcoidosis, idiopathic interstitial pneumonias (IIPs) ILD in connective tissue diseases (CTD) and in collagen-vascular disease[1].

Of the IIPs, the most common are: IPF with a histo-pathological pattern of usual interstitial pneumonia (~55% of IIPs), nonspecific interstitial pneumonia (~25% of IIPs), respiratory bronchiolitis ILD, occurring in smokers (~10% of IIPs), desquamative interstitial pneumonia (~5% of IIPs), cryptogenic organising pneumonia (~3% of IIPs), lymphoid interstitial pneumonia (~1% of IIPs) and acute interstitial pneumonia (~1% of IIPs)[1].

Some of these diseases, such as sarcoidosis and ILDs associated with connective tissue disease (CTD), also affect other organs and this may determine the prognosis to a greater extent than the lung dysfunction. Sarcoidosis often improves spontaneously without treatment[2]. To date, there are no curative treatments available for most ILDs. Lung transplantation offers hope for selected patients.

In this chapter, we focus on sarcoidiosis (ICD 10: D86) and "Other interstitial pulmonary diseases" (ICD 10: J84). This latter in the remainder of this chapter is called chronic interstitial lung disease. As the most common of these is idiopathic pulmonary fibrosis (ICD 10: J84.1), the latter term will be used with respect to hospitalisations.

## Incidence and Prevalence

The incidence and prevalence of chronic interstitial lung disease and idiopathic pulmonary fibrosis (IPF) in Ireland are not known. A national hospital based registry of idiopathic pulmonary fibrosis commenced in 2016. Based on international experience Ireland would expect an incidence of 400 new cases per year with a prevalence of 1,000 cases.

Ireland has the second highest prevalence of sarcoidosis in the world[4].

## Mortality

In 2015, there were 341 deaths due to chronic interstitial lung disease compared with 199 in 2007. For deaths from sarcoidosis the numbers in 2015 were 12 compared with 17 in 2007[3].

## Impact on health services

Data is not available at national level in Ireland on ILDs, nor is data available for those for whom respiratory aids and appliances, such as nebulisers and oxygen, are prescribed, either for the population as a whole or just those with general medical eligibility. Also lacking at national level is data on the impact of these diseases on GP services, Emergency Department services, and out of hours services. In terms of impact on hospital services, these conditions impact not just on inpatient hospitalisations but also on pulmonary rehabilitation services, Outpatient Departments and respiratory laboratories. National data is not available for these latter services by disease group. The impact on health services in terms of hospitalisations and bed usage is available from HIPE reporting acute publicly funded hospitals only.

In 2016, there were 324 day cases and 657 inpatient hospitalisations for idiopathic pulmonary fibrosis (0.7% of respiratory inpatient hospitalisations, 0.1% of all inpatient hospitalisations) with a usage of 6,452 inpatient hospital bed days (1.1% of respiratory inpatient bed days, 0.2 % of all inpatient bed days). Also in 2016, there were 524 day cases and 234 inpatient hospitalisations for sarcoidosis using 1,364 inpatient bed days.

Of the inpatient hospitalisations, 78.8% with idiopathic pulmonary fibrosis were admitted as an emergency. For those with sarcoidosis, the figure was 81.2%.

## Gender

In 2015, of the 341 deaths due to chronic interstitial lung disease (ICD 10: J84), 58.7% (200) were in males. In 2007, of the 199 deaths, 61.3% were in males. Of the deaths from sarcoidosis, in 2015, 58.3% (7) of the deaths from sarcoidosis were in males while in 2007 the figure was 53% (9) males[3].

Of those hospitalised in 2016 with sarcoidosis, 56% were males. Of those hospitalised with idiopathic pulmonary fibrosis in 2016, 63.5% were males.

## Age

In 2015, of the 341 deaths due to chronic Interstitial lung disease, 7.9 % (27) were aged 30-64 years, 22.6% (77) were aged 65-74 years, 45.7% (156) 75-84 years and 23.8% (81) 85 years or over[3]. Of the deaths from sarcoidosis in 2015, 7 (58.3%) were aged under 65 years of age. Of those admitted as inpatients to hospital in 2016, with idiopathic pulmonary fibrosis, 71% (465) were aged 65 years and over. Of the inpatient hospitalisations with sarcoidosis, 87% were aged 16-64 years.

## Regional variation

Robust data is not available at national level.

## Socio-economic analysis

Robust data is not available at national level.

## International Comparisons

In Europe registries of the epidemiology of different ILDs have been compiled in several countries. As many of these registries are of data reported by respiratory physicians, they have the disadvantage of not being population based. However, they do allow comparison of the relative frequencies of the different ILDs[1]. Sarcoidosis and IPF account for up to 50% of ILDs. In the UK, the annual incidence of sarcoidosis is 7 cases per 100,000 population which is consistent with the range of 5-40 per 100,000 reported by other northern European countries[2].

The UK prevalence of idiopathic pulmonary fibrosis is 50/100,000, as quoted in the UK document "Battle for Breath" which is more than double that previously reported by NICE of 15-20/100,000[2,5].

ILD, especially IPF, occurs in older subjects, while sarcoidosis occurs in young adults of both sexes and in women over 50 years of age[1]. In terms of hospitalisations, Irish figures are in line with this age trend. Internationally, IPF is more frequent in males and sarcoidosis is more frequent in women[1].

Mortality data for the majority of European countries shows differences between countries, which are partly real and partly may be due to differences in diagnostic and therapeutic strategies. The highest mortality rates in Europe (WHO) due to ILD, of 6.68 per 100,000 people, was reported in Ireland by WHO Europe in 2011, compared with the figure for the EU 28 of 2.2[1]. Among the most important ILDs, chronic ILD (ICD 10: J84) had the highest age standardised mortality rate, followed by ILD associated with connective tissue disease. The mortality rate for chronic ILD in most countries was less than 2 per 100,000, but in Ireland it was 5.49, in Malta 5.92 and the UK 4.02 compared with the average for EU 28 of 1.7. The age-standardised mortality rate for sarcoidosis as reported by WHO Europe in 2011, was 0.37 in Ireland and 0.31 in Denmark compared with EU 28 average of 0.1[1].

The WHO mortality data should be interpreted cautiously for reasons outlined above and also because for systemic diseases, such as sarcoidosis and connective tissue diseases (CTD), the WHO mortality data do not distinguish whether patients had related ILD or, if present, whether the ILD contributed to death; thus the mortality rates only partly reflect deaths due to ILD.

The 2015 report on the Global Burden of Disease reported that for ILD and pulmonary sarcoidosis, the number of total deaths between 2005 and 2015 increased globally by 51.8% to 121,800 (CI: 94,100-135,200) and the age standardised rate rose by 14.1% (CI: 4.1-20.9)in the same period[6].

The hospitalisations rate for ILDs across Europe (WHO) was highest in Austria, Denmark, Norway, Finland, Poland and Slovakia based on the WHO Hospital Morbidity Database (2011). However, no data was recorded for Ireland[1].

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# Obstructive Sleep Apnoea

09

## Key Points

- Sleep disordered breathing encompasses a range of disorders including obstructive sleep apnoea syndrome
- Obstructive sleep apnoea syndrome (OSAS) is increasingly recognised as a public health problem both in Ireland and internationally
- Obesity is a major risk factor for OSAS but a significant minority of affected individuals are non-obese

## Background

Sleep disordered breathing includes a range of conditions which result in abnormal breathing during sleep. The disordered breathing ranges from intermittent, partial obstruction of the airway without sleep disturbance (snoring) to frequent apnoeas associated with repetitive hypoxaemia and arousals leading to sleep disruption and daytime sleepiness[1].

The most common form of sleep disordered breathing is obstructive sleep apnoea (OSA). OSA leads to intermittent obstruction of the airway during sleep, leading to sleep disruption and daytime somnolescence. The condition is also known as obstructive sleep apnoea/hypopnoea syndrome (OSAHS). OSA is an independent risk factor for hypertension and is associated with an increased risk of cardiovascular disease, abnormal glucose metabolism, depression and sleepiness related accidents with their attendant morbidity and mortality[2].

In general, anything that narrows the upper airway will predispose an individual to obstructive sleep apnoea. Obesity is the single most common predisposing factor, but other risk factors for the development of OSA include upper airway abnormality, endocrine disorders including acromegaly and hypothyroidism and postmenopausal state (females)[2]. OSA is also more common in pregnancy and is also associated with increasing age, lifestyle factors and muscle relaxant medications.

Other sleep disordered breathing conditions include central sleep apnoea (CSA), in which periodic cessation of breathing occurs without obstruction of the airway and obesity hypoventilation syndrome (OHS), in which breathing is reduced during both sleep and wakefulness, with or without accompanying OSA[1]. This chapter deals with Sleep Apnoea (ICD 10: G47.3) which includes sleep apnoea (unspecified, other), central sleep apnoea, obstructive sleep apnoea syndrome (OSAS) and sleep hypoventilation syndrome.

## Prevalence

There is no national data currently available on the prevalence of sleep apnoea in the Irish population.

## Mortality

People with untreated OSA are at greater risk of life-threatening conditions such as stroke and cardiac arrest. The risk of road traffic accidents and work related accidents is also higher.

## Impact on health services

Data for those diagnosed with sleep disordered breathing disorders is not available at national level in Ireland, nor is data available for numbers for whom respiratory aids and appliances are provided to treat these conditions, either for the population as a whole or those with medical cards.

In terms of impact on hospital services, these conditions, if dealt with at hospital level, are in the main dealt with both by Outpatient Departments and respiratory laboratories. National data is not available for this latter service other than for those hospitalised.

In terms of day cases and inpatient hospitalisations, in 2007 there were 1,203 hospitalisations in HIPE reporting acute hospitals (43 day cases, 1,160 inpatients). A decade later in 2016, this had risen to 2,241 (74 day cases, 2,167 inpatients). This 2,167 inpatient hospitalisations represented 2.3% of all respiratory inpatient hospitalisations, and 2,755 inpatient bed days (0.5% of all inpatient respiratory bed days).

Of all sleep apnoea day cases reported through HIPE in 2016, 28% were classified as major complexity and 72% as minor complexity. For those treated as inpatients, 24% were classed as major complexity and 76% as minor complexity[3].

Sleep studies was ranked number 18 of the top 20 principal procedures blocks for inpatients listed in The Activity in Acute Public Hospitals in Ireland Report for 2016 accounting for 0.9% of all inpatient procedures[3]. (Of these top 20 procedures, five related to child birth). Among the top 20 principal procedures on elective inpatients, sleep studies were 4$^{th}$ while among the top 10 AR-DRGs, sleep apnoea was 9$^{th}$ [3]. Of the elective inpatient hospitalisations, sleep disorders was listed 4$^{th}$ in the top 20 principal diagnoses[3].

## Gender

Irish population prevalence data by gender is not available. In terms of data from hospitalisations the ratio of males to females in 2007 was 4:1 while in 2016 it was 2:1.

## Age

National Irish prevalence data by age group is not available. Data from hospitalisations show the median and mean age in 2016 was 48 years and 40.36 years compared with 50 years and 47 years in 2007. Of the 2,167 inpatient hospitalisations in 2016, 58.4% (1,265) were aged 16-64 years, 27.1% aged 0-15 years (47% of latter were aged under 5 years) and 14.5% aged 65 years and over.

## Socio-economic analysis

National Irish data is not available.

## International comparisons

Globally, sleep disordered breathing affects 1-6% of adults[4]. International data indicate that OSA affects between 3-7% of middle-aged males and 2-5% of women in developed countries[1]. It is thought that 10% of the population suffer from a clinically significant sleep disorder and the prevalence is expected to increase due both to ageing and obesity in western countries[5].

International incidence trends show that men are two-and-a-half to three times more likely to be diagnosed with OSA[1]. In terms of hospitalisation in Ireland, the male: female ratio in 2016 was 2:1.

In the UK, people are most often diagnosed with sleep apnoea between the ages of 40 and 70 years and the incidence rate is up to 25% higher in the most deprived quintile of society than in the least deprived quintile[6]. In the Irish data presented earlier in this chapter, the commonest age for hospitalisation was in the 16-64 year age group.

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# Pulmonary Vascular Disease

10

## Key Points

- Pulmonary embolism is a potentially serious life threatening event
- The prevalence of pulmonary hypertension, a progressive often fatal disease, is unknown in Ireland

## Background

Pulmonary Vascular Diseases include conditions such as pulmonary embolism (PE) (ICD 10: I26) and pulmonary hypertension (PH) (ICD 10: I27.0). Their effects on right heart function contribute to the burden of chronic respiratory disease and are likely both under diagnosed and under-estimated[1].

This chapter is divided into two sections. Section A deals with Pulmonary Embolism (ICD 10: I26) and Section B deals with "Other Pulmonary Heart Disease" (ICD 10: I27), "Other Diseases of Pulmonary Vessels" (ICD 10: I28) and Pulmonary Oedema (ICD 10: J81).

## Section A: Pulmonary embolism

Pulmonary embolism (PE) is a serious, common, potentially life threatening condition that results in the blockage of the pulmonary arteries by thrombotic material originating from a deep vein thrombosis (DVT), often from the legs or pelvis. PE and DVT are each clinical presentations of venous thromboembolic disease and share risk factors that can be patient related, setting related or both. These include prolonged inactivity, oral contraceptive use, pregnancy, obesity, family history of thromboembolic disease, older age, previous venous thromboembolic disease, malignancy, neurological disease that impairs mobility, prolonged immobility, trauma and orthopaedic surgery and congenital or acquired thrombophilia. Antithrombotic prophylaxis significantly reduces the risk of venous thromboembolic events in patients who are at risk.

## Incidence

As PE is an acute condition, incidence rather than prevalence is the more correct measure.

Using hospitalisations as an indicator of incidence, the condition accounted for 1,426 inpatient hospitalisations in 2016. These are inpatient hospitalisations rather than numbers of individuals and reflect data only from HIPE reporting acute public hospitals. The figures do not include occurrences of the disease after admission to hospital, for example after surgery. Therefore these figures are an under-estimate of the true incidence of PE in Ireland.

## Mortality

In 2007, there were 139 deaths due to PE recorded in Ireland. In 2015, the figure was 132. The highest number in the period 2007-2015 was in 2008 when there were 164 deaths recorded[2].

## Impact on Health services

As with many other respiratory diseases there is little data on the impact of PE on health service resources outside the acute hospital inpatient setting. Data on PE is not available at national level for people with full medical cards, those with GP only cards or those who are private patients. This is also true for those who attend GP out of hours services, those who attend Emergency Departments and those who attend hospital Outpatient Departments for the ongoing monitoring of their PE risk. Inpatient or day case data is only available from HIPE reporting acute publicly funded hospitals.

PE accounted for 1,426 inpatient hospitalisations (1.5% of all respiratory inpatient hospitalisations, 0.2% of all inpatient hospitalisations) and 11,333 inpatient bed days (2.0% of respiratory inpatient bed days, 0.3% of all inpatient bed-days) in 2016. All but 35 were emergency admissions.

In the Activity in Acute Public Hospitals 2016 report, 46.3% of patients with PE were classified as major complexity with median LOS of 7 days (mean of 10.1 days)[3]. This report included both thrombotic and non-thrombotic PE.

## Gender

Of those who died in 2015 from PE, 62.1% (82) were female and 37.9% (50) were male. The comparable figure in 2007 was 61.2% (85) females and 38.8% (54) males[2]. In 2016, of those admitted to HIPE reporting hospitals with PE, 53.5% were female.

## Age

Deaths from PE are more common in older age. Of those who died from PE in 2015, 25.8% (34) were aged 20-64 years, 24.2% (32) were aged 65-74 years, 30.3% (40) were aged 75-84 years with the remaining 19.7% (26) aged 85 years and over[2].

All of the inpatient hospitalisations in 2016 for PE were in people aged over 15 years. Of the total in 2016, 49% (701) were in those aged 16-64 years, with the remaining 51% (725) in the 65 years and over age group. In the former they accounted for 2.4% of respiratory inpatient hospitalisations (0.2% of all inpatient hospitalisations) in that age group, while in the latter the figure was 1.9% (0.4%).

## Section B: Other Pulmonary Heart Diseases, Other Diseases of Pulmonary Vessels, Pulmonary Oedema

Most of these Other Pulmonary Heart Diseases (ICD 10: I27) are pulmonary hypertension (PH) where pressure in the pulmonary artery rises above normal levels, putting a strain on the right side of the heart. There are a number of subtypes of PH. In most people, PH is secondary to another cardiac or pulmonary condition[1]. Although the prognosis of pulmonary artery hypertension (PAH) has improved it remains a progressive, often fatal disease. The term Pulmonary Hypertension (PH) will be used rather than Other Pulmonary Heart Diseases in most of the following discussion. "Other diseases of the pulmonary vessels (I28)" are rare.

### Prevalence & Incidence data

Robust data at national level is not available.

### Mortality

In 2007, there were 21 deaths due to Pulmonary Hypertension and none for Other Diseases of Pulmonary Vessels. In 2015, the figures were 53 and 0[2].

### Impact on health services

Data on Pulmonary Hypertension, Other Diseases of Pulmonary Vessels, and Pulmonary Oedema is not available at national level for people with full medical cards, those with GP only cards or those who are private patients. This is also true for those who attend GP out of hours services, those who attend Emergency Departments and those who attend hospital Outpatient Departments. Inpatient or day case data is only available from HIPE reporting publicly funded hospitals. In view of small numbers, lung transplants and drug costs for this group are not included. In 2016, there were 211 inpatient hospitalisations and 2,095 bed days recorded for these diseases. Of these 83% were emergency admissions. In addition, there were 75 day cases.

### Gender

Of those who died in 2015 from Pulmonary Hypertension, 74.5% (38) were females. The comparable figure in 2007 was 57.1% (12) females[2].

### Age

Deaths from Pulmonary Hypertension are more common in older age. Of those who died from Pulmonary Hypertension in 2015, 17.0% (9) were aged 40-64 years, 20.8 % (11) were aged 65-74 years, 34.0 % (18) were aged 75-84 years with the remaining 28.2 % (15) aged 85 years and over[2].

Of the 2016 inpatient hospitalisations for Pulmonary Hypertension, less than 5 were in the 0-15 year age group, of the remainder 30% were aged 16-64 years and 70% were aged 65 years and over.

### International comparisons: Pulmonary Vascular Disease

The European incidence estimates of PE range from 6–20 cases per 10,000 inhabitants per year with a case fatality rate from acute PE of 7-11%[1]. In the UK, 11% more women than men are hospitalised with PE[4]. In Ireland 53.5% of hospitalisations were in females. The prevalence of Pulmonary Arterial Hypertension in Europe ranged between 1.5 to 5.2 cases per 100,000 people, with a predominance in women (female: male ratio 2:1) in 2011[1]. For pulmonary vascular disease(ICD 10: I26-I28) as a group the hospital admission rate for WHO Europe in 2011 ranged from 7.0 to 79.5 with Ireland at 34.24[1]. The age standardised mortality rate for the WHO European region for pulmonary vascular diseases (ICD 10: I26 -28) reported in 2011 ranged from 1.76 (Finland) to 32.66 (Albania) with Ireland at 3.14[1].

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# Respiratory Diseases Due to External Agents

11

## Key Points

- The majority of respiratory diseases due to external agents are related to occupations or occupational practices which in turn impact on the incidence, prevalence and impact of these diseases on health services
- An exception to this is pneumonitis due to inhalation of solids and liquids which in 2016 accounted for 96% of inpatient hospitalisations in this group
- Pneumonitis due to inhalation of solids and liquids accounted for 1,946 inpatient hospitalisations in 2016 of which 99% were emergencies

## Background

Respiratory disease due to external agents incorporates the ICD 10 codes J60-70. For ease of description, these can be divided into three groups:

- Pneumoconioses (ICD 10: J60-65)(Coal-worker's pneumoconiosis, pneumoconiosis due to asbestos and other mineral fibres, due to dust containing silica, due to other inorganic dusts, unspecified pneumoconiosis, and pneumoconiosis associated with tuberculosis). The pneumoconioses are a group of lung diseases caused by inhaling dusts. Occupation causation is usually assumed. Pneumoconiosis associated with tuberculosis (ICD 10: J65) is not included in this chapter but is included in the Tuberculosis Chapter.
- Airway disease due to specific organic dust (ICD 10: J66) or hypersensitivity pneumonitis due to organic dust (ICD 10: J67): this latter includes Farmer's lung (ICD 10: J67.0) which is mainly caused by an allergic reaction to mould spores or other agricultural products[1]. Occupation causation is usually assumed for this group.
- Respiratory conditions due to inhalation of chemicals, gases, fumes and vapours (ICD 10: J68): occupation causation is usually assumed here. Other conditions in this group, but without the occupation link, are respiratory conditions due to other external agents (ICD 10: J70) and pneumonitis due to solids and liquids (ICD 10: J69). Pneumonitis due to solids and liquids (ICD 10: J69) will be presented separately in this chapter and in the chapter on older people in view of relatively large numbers.

## Incidence and Prevalence

Current data at national level is not available on either incidence or prevalence of these conditions in Ireland. In terms of Farmer's Lung, the incidence in Ireland for the years 1997-2002 was 0.58/100,000 (95% CI 0.36-0.80) compared with the period 1982 – 1996 when the national incidence rate was 1.88/100,000 (95% CI 1.27-2.49). This decline was at least in part associated with changed farming practices including the move from hay to silage production[2].

## Mortality

In 2015, there were 267 deaths from respiratory diseases due to external agents, of which 96.6% (258) were from pneumonitis due to solids and liquids. The equivalent figures in 2007 were 107 of which 88.8% (95) were from pneumonitis due to solids and liquids[3]. This was an increase of 270%.

## Impact on health services

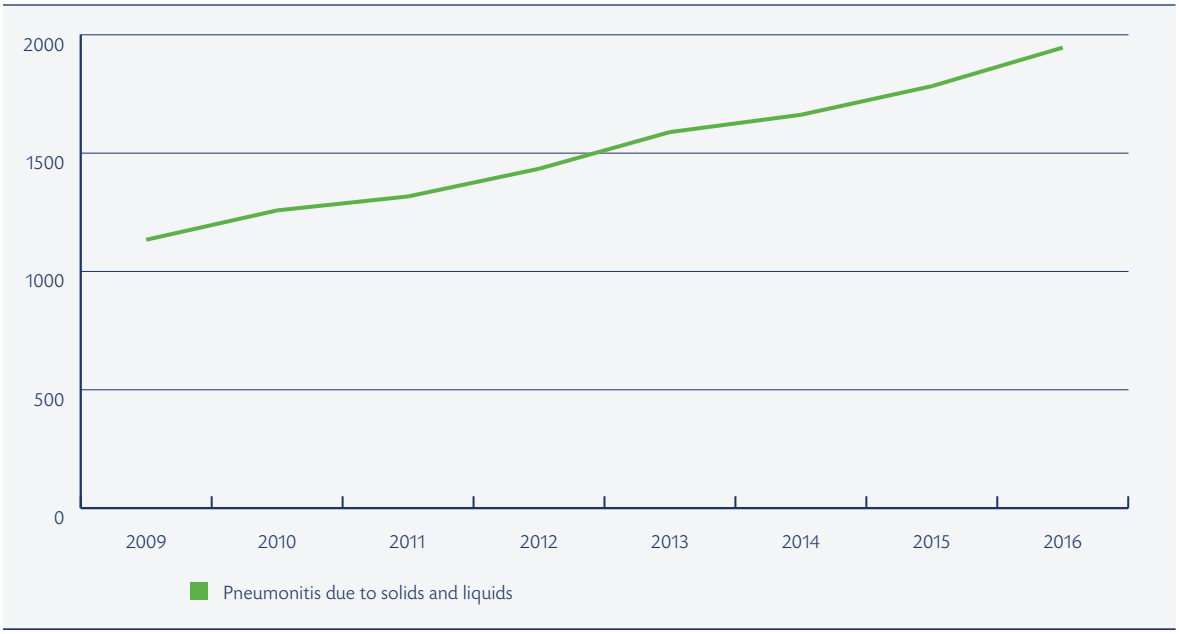
Those with respiratory diseases due to external agents require input both from primary care and specialist respiratory services including diagnostic and Outpatient Department (OPD) settings. As with many other respiratory diseases, data on these diseases is not available at national level for people with full medical cards, those with GP only cards or those who are private patients. This is also true for those who attend GPs, out of hours services, those who attend Emergency Departments and those who attend hospital OPD. Inpatient or day case data is only available from HIPE reporting publicly funded hospitals.

In the decade 2007 – 2016 the number of hospitalisations for respiratory diseases due to external agents was 14,886 of which 95.2% were for pneumonitis due to solids and liquids. The trend for inpatient hospitalisations over the years 2009-2016 for pneumonitis due to solids and liquids is shown in figure 11.1 below.

In 2016, respiratory diseases due to external agents accounted for 2,031 inpatient hospitalisations (2.2% of respiratory inpatient hospitalisations, 0.3% of all inpatient hospitalisations) and 31,019 bed days (5.4% of respiratory inpatient bed days, 0.8% of all inpatient bed days). 96% (1,946) of these inpatient hospitalisations were due to pneumonitis due to solids and liquids.

Over 99% of the latter were emergency hospitalisations as were 84.7% of the others. Table 11.1 below shows details of these hospitalisations (day cases and inpatients) in terms of the specific diagnoses by age and gender. Of the total, 1.5% (31) were day cases.

**Figure 11.1. Inpatient hospitalisations with a primary diagnosis of pneumonitis due to solids and liquids, 2009-2016**




*Source: HIPE 2009-2016. All hospitals reporting data to HIPE*

**Table 11.1: Hospitalisations, Gender, Age (Median, Mean): Respiratory diseases due to external agents 2016**

| | ICD 10 | Total | % of all J60-J70 | Male % | Female % | Average age yrs | Median age yrs |
|---|---|---|---|---|---|---|---|
| Pneumoconiosis due to asbestos and other mineral fibres | J61 | 5 | 0.24 | 100% | - | 77.2 | 78 |
| Pneumoconiosis due to dust containing silica | J62 | <5 | 0.15 | 67% | 33% | 74.3 | 73 |
| Unspecified pneumoconiosis | J64 | <5 | <0.1 | 100% | 0% | 50.0 | 50 |
| Hypersensitivity pneumonitis due to organic dust | J67 | 50 | 2.42 | 67% | 33% | 62.0 | 65 |
| Respiratory conditions due to inhalation of chemicals; gases; fumes and vapours | J68 | 16 | 0.78 | 56% | 44% | 44.2 | 46 |
| Pneumonitis due to solids and liquids | J69 | 1952 | 94.6 | 61% | 39% | 72.6 | 78 |
| Respiratory conditions due to other external agents | J70 | 35 | 1.7 | 51% | 49% | 64.3 | 68 |
| Resp disease: External agent | J60-J70 | 2063 | 100 | 1260 (61%) | 803 (39%) | 72.0 | 77 |

*Source: HIPE 2016. All hospitals reporting activity to HIPE . Note: Pneumoconiosis due to TB (ICD 10: J65) is included in TB chapter. There were no hospitalisations for J60, J63, J66 in 2016.*

## Gender

Of the deaths from pneumonitis due to solids and liquids in 2007, 58% (55) were in males. In 2015, 55.4% (143) were in males[3].

In terms of hospitalisations, for each of the specific diagnostic codes there were more males than females as shown in table 11.1 above.

## Age

Due to the small numbers of deaths in each of the individual diagnostic codes, other than for pneumonitis due to solids and liquids, it is difficult to comment. Of those dying from pneumonitis due to solids and liquids in 2007, 53.7% (51) were aged 85 years or over with another 23.2% (22) aged 75-84 years. The comparable figures in 2015 were 48.4% and 29.0%[3].

Of the inpatient hospitalisations in 2016 for pneumonitis due to solids and liquids, 76.5% (1,489) were aged 65 years and over and 2% (38) were aged 15 years and younger but both mean and median ages were under 80 years (72.59 years and 78 years respectively). For the other respiratory diseases due to external agents, 52% were aged 65 years and over, with the majority of the others aged 16-64 years.

## International Comparison

In Ireland, within this group of respiratory diseases due to external agents, other than pneumonitis due to solids and liquids, the largest group in terms of hospitalisations was hypersensitivity pneumonitis, also called Extrinsic Allergic Alveolitis (EAA). Internationally a large number of causes of EAA have been reported, such as EAA in farmers, pigeon breeders and budgerigar fanciers, and EAA due to repeated exposures to isocyanates, fungi, mollusc shells to name but a few. There are variations in the prevalence of the specific disease types between countries, due to differences in occupations and practices but also due to local seasonal climate and geographic conditions[4]. In a general population cohort study in the UK, an incidence of ~0.9 cases per 100,000 people per year was found between 1991 and 2003[4]. Farmer's lung is among the most extensively studied types of EAA. Among Swedish farmers, the incidence of EAA is ~20 cases per 100,000 people per year[4]. The Incidence of farmer's lung mentioned earlier in Ireland for the years 1997- 2002 was 0.58/100,000 (95% CI 0.36-0.80)[2].

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# Respiratory Infectious Diseases

12

## Key Points

- Respiratory Infectious diseases cause considerable morbidity in Ireland
- Childhood vaccination programmes have positively impacted on many diseases but challenges remain to achieve a 95% uptake level in all areas
- Protection of those vulnerable to infection due to age or chronic disease, including respiratory disease, by vaccination is inadequate In Ireland

## Background

Many infectious diseases of public health significance are notifiable. All medical practitioners including clinical directors of diagnostic laboratories in Ireland must notify the Medical Officer of Health (MOH) of these specified infectious diseases. These diseases can cause a variety of problems, including respiratory disease, for patients. In addition, all outbreaks of respiratory infectious diseases are notifiable, as are unusual clusters of symptoms as was the case initially with SARS and MersCoV. This chapter focuses on diseases where the impact is mainly on the respiratory system. The majority of these diseases/organisms are entered on a national computerised infections disease reporting system (CIDR). However, seven pathogens are notified directly to the European Antimicrobial Surveillance System (EARSS) and with the exception of Streptococcus pneumonia (invasive), are not recorded on CIDR.

These infectious diseases are important in their own right for all those affected but they can have added morbidity and even mortality consequences for those with underlying respiratory diseases (e.g., asthma, COPD, CF), for those who are immunosuppressed or where they occur in congregate settings such as Nursing Homes. Many are preventable or their risk reduced by vaccination and herd immunity. The structure of this chapter is different to other chapters as each of the diseases is taken as a separate entity. Additional information on aspects of some of these diseases is included in the chapter on Older People, the chapter on Paediatrics, and the chapter on Pneumonia and Lower Respiratory Infection (unspecified). Tuberculosis is discussed in chapter 13.

## Incidence and prevalence

Most respiratory infectious diseases are managed in the community setting. As with many diseases their impact on health services in terms of those who attend GPs, those who attend out of hours services, those who attend Emergency Departments and those who attend hospital Outpatient Departments (OPD) is not available at national level. Inpatient data, only available from HIPE reporting publicly funded hospitals, considerably underestimate those affected. However, the indirect consequences for some of these diseases are available eg. hospitalisation for bronchiolitis as a marker for Respiratory Syncytial Virus (RSV) infection. In addition to the impact of a disease, is the impact on health services in terms of prevention programmes such as the childhood immunisation programme, influenza and pneumococcal vaccination programmes, antenatal vaccination programmes and contact or environmental tracing.

As these diseases are notifiable, national incidence data are available for those diagnosed clinically by a medical practitioner. This is true when the illness is severe but where the disease is self-limiting and/or where the person self-cares, national data reflect trends rather than true incidence. Examples of these include influenza and RSV.

Data for each of these key notifiable infectious diseases of respiratory significance is presented below. Table 12.1 shows the numbers and population rates for the years 2007-2016 as available on CIDR. The increasing notifications of influenza are at least in part due to an increase in availability of laboratory testing.

**Table 12.1. Respiratory infectious diseases (notifiable) 2007-2016**

| Total | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| *RSV | n/a | n/a | n/a | n/a | n/a | 1972 | 1282 | 2479 | 2201 | 2690 |
| Rate/100,000 | | | | | | 43.04 | 27.98 | 52.06 | 46.22 | 56.49 |
| Legionellosis**** | 15 | 48 | 9 | 11 | 7 | 15 | 14 | 8 | 12 | 10 |
| Rate/1,000,000 | 0.35 | 1.13 | 0.20 | 0.24 | 0.15 | 0.33 | 0.31 | 0.17 | 0.25 | 0.21 |
| **Streptococcus pneumonia*** | 361 | 464 | 432 | 391 | 425 | 427 | 637 | 679 | 549 | 381 |
| Rate/100,000 | 8.51 | 10.94 | 9.43 | 8.53 | 9.28 | 9.32 | 13.90 | 14.28 | 11.53 | 8.00 |
| Haemophilus Influenza*** | 31 | 22 | 43 | 28 | 44 | 41 | 41 | 61 | 52 | 58 |
| Rate/100,000 | 0.68 | 0.48 | 0.94 | 0.61 | 0.96 | 0.89 | 0.89 | 1.33 | 1.14 | 1.27 |
| Influenza | 279 | 473 | 484 | 210 | 2077 | 743 | 1602 | 1757 | 2680 | 4764 |
| Rate/100,000 | 6.58 | 9.98 | 10.56 | 4.58 | 45.34 | 16.22 | 34.97 | 36.90 | 56.28 | 99.67 |
| Tuberculosis | 481 | 467 | 479 | 420 | 413 | 359 | 372 | 313 | 303 | 318 |
| Rate/100,000 | 10.9 | 11.01 | 10.46 | 9.17 | 8.97 | 7.81 | 8.08 | 6.57 | 6.6 | 6.68 |
| Pertussis | 77 | 104 | 78 | 114 | 229 | 458 | 173 | 73 | 117 | 213 |
| Rate/100,000 | 1.82 | 0.33 | 1.70 | 2.49 | 5.00 | 10.00 | 3.78 | 1.53 | 2.46 | 4.47 |
| Measles | 53 | 55 | 162 | 403 | 267 | 103 | 53 | 33 | 2 | 43 |
| Rate/100,000 | 1.16 | 1.20 | 3.54 | 8.80 | 5.83 | 2.25 | 1.16 | 0.72 | 0.04 | 0.94 |
| Diphtheriae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | <5 | <5 |

*Source: Computerised Infectious Disease Reporting System (CIDR) *RSV made notifiable in 2012 **EARSS pathogens not recorded on CIDR with the exception of Streptococcus pneumonia (figures since 1/7/15 refer only to confirmed cases). *** invasive disease ****Most notified cases of Legionellosis have Legionnaires' disease*

## Respiratory Outbreaks (notified)

There were 549 outbreaks affecting 6,937 people notified in 2016. These included 65 influenza outbreaks (700 cases), 12 pertussis outbreaks (31 cases), 10 RSV outbreaks (85 cases), 5 tuberculosis outbreaks (19 cases) and 26 Acute Respiratory Infection outbreaks (214 cases)[1]. In the 2016/2017 influenza season (see influenza below) there were 91 influenza outbreaks, with 1,157 people diagnosed of whom 120 (10.4%) were hospitalised and 35 (3.0%) died[1].

### *Haemophilus influenzae (invasive)*

There were 58 cases of Haemophilus influenzae (invasive) notified in 2016, giving a crude incidence rate of 1.2/100,000. The median age of those affected was 47 years with a range of 11 days to 91 years. The incidence was highest in those aged under 1 year (11.2/100,000) and aged 65 years and over (3.3/100,000). Those aged under 10 years of age and those aged 65 years and over accounted for 56.1% of cases. Of those diagnosed, 25% had pneumonia.[1] Nationally the vaccine coverage for Haemophilus influenzae type b (Hib) at both 12 months and 24 months in 2016 was 91%. Most cases reported in 2016 were non-capsular or non-typeable and preventable by the Hib vaccine.

### *Measles*

Measles virus can cause significant disability and death. Although Ireland is currently deemed to be free of endemic measles, clusters and outbreaks continue to occur in Europe which impact on Ireland. One of the most common and serious complications of measles is pneumonia, which develops in 5–10% of children[2]. It is caused either by direct invasion of the lungs by the measles virus or due to a secondary infection by other viral or bacterial pathogens[2].

In 2016, 43 cases were notified, giving a crude incidence rate of 0.9/100,000. Forty (93%) were part of an outbreak linked with mainland Europe. The median age was 8 years with a range of 3 months to 40 years. Three quarters (30) (75%) were unvaccinated, of whom 8 were aged under 1 year of age. Vaccine status was unknown in an additional 6 (15%) cases. Nationally the vaccine coverage at 24 months in 2016 for MMR1 was 92% [1].

### *Pertussis (whooping cough)*

Pertussis is an acute respiratory infection caused by the bacterium Bordetella pertussis. In 2016, 213 cases were notified giving a crude incidence rate of 4.5/100,000 population. The highest age specific incidence rate was in those aged under 1 year of age followed by those aged 1-4 years. 35% (74) were aged under 6 months. In 2016, 64 were hospitalised (30%) and there were a number of deaths[1].

Of the 213 notified cases, 37% (78) were unvaccinated. Of these, 73% (57) were aged less than 6 months, and 36% (28) were aged less than 2 months and therefore too young for vaccination so relying on maternal immunity and antenatal vaccination. Of the 74 cases aged less than 1 year of age for whom details on antenatal vaccination of the mother were available, 83% (70) of mothers were unvaccinated in the antenatal period.

Nationally in 2016 the vaccine coverage at both 12 months and 24 months was 91% and 95% respectively.

### *Streptococcus pneumoniae (invasive)*

In 2016, 381 confirmed cases of invasive Streptococcus pneumoniae were notified giving a crude incidence rate of 8.3/100,000 population. The term used is invasive pneumococcal disease (IPD) which includes meningitis, bacteraemia with/without pneumonia and invasive disease from other sterile sties. Of the 313 cases where the clinical diagnosis site was provided, 71% (222) had bacteraemia with pneumonia. For those for whom a risk factor was reported (256), 41% (59) had chronic lung disease.[1]

The median age of those affected was 64 years with a range of one month to 94 years. Almost half (49% (188)) were aged 65 years and over. The highest age specific incidence rate (ASIR) was in those aged 85 years and over (44 cases, 75.3/100,000). In children aged under 2 years the ASIR was 17.2/100,000.[1]

Outcome was reported in 323 (85%) of cases. For these, the overall case fatality was 18.8% (61) but for 13, IPD was not the cause of death. Most, but not all, deaths occurred in those aged 35 years and over.

The uptake of three doses of PCV vaccine by 24 months of age was 91% in 2016.

### *Legionellosis*

In 2016, 10 cases of Legionnaires' disease were notified giving a crude incidence rate of 2.1/1,000,000. Of the cases, 60% were males. The median age of all cases was 62 years with a range of 28 years to 82 years.[1]

### *Tuberculosis*

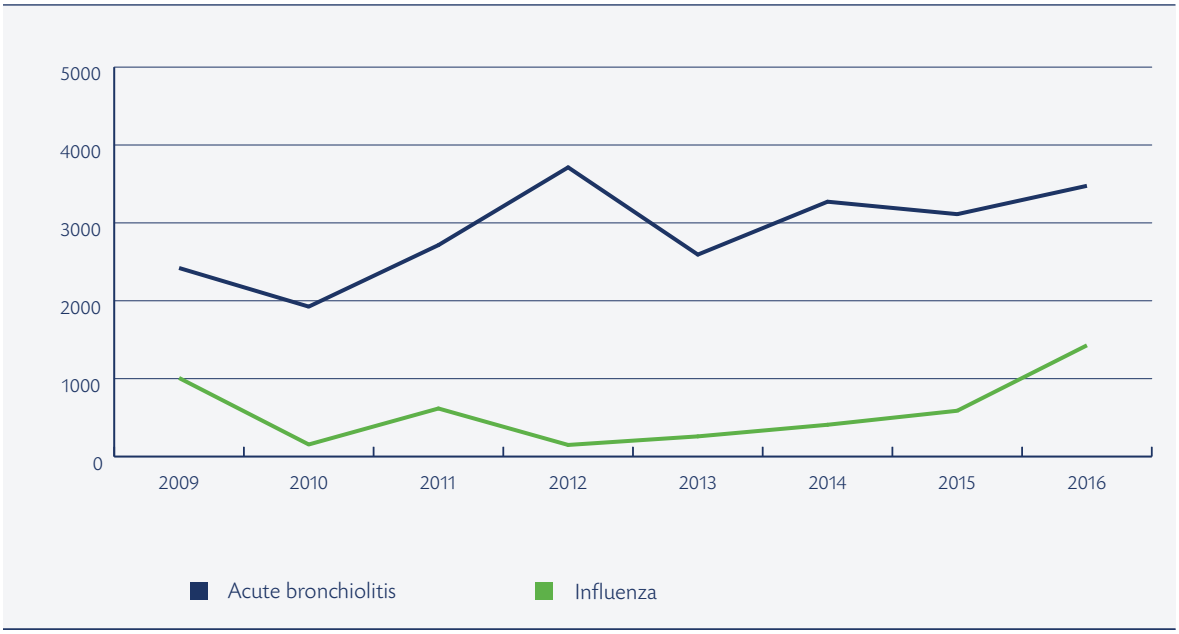
See Chapter 13

### *Influenza and Other Seasonal Respiratory Viruses*

Influenza is the world's most important viral disease[3]. Rates of serious illness and death from influenza are highest in individuals aged 65 years and older, children under 2 years of age and persons of any age who have medical conditions that predispose to increased risk of complications from influenza. More than 90% of influenza-related deaths occur in patients in the older age group[3]. The attack rates during seasonal influenza can vary considerably from year to year, but usually 5–20% of the population are affected[3].

Figure 12.1 below reflects the numbers of hospitalisations for influenza and bronchiolitis for the years 2009-2016. RSV, a notifiable disease since 2012, is one of most common causes of acute bronchiolitis hence the inclusion here of bronchiolitis as a proxy marker of the impact of RSV on hospital health services.

**Figure 12.1. Inpatient hospitalisations with a primary diagnosis of acute bronchiolitis or influenza, 2009-2016**




*Source: HIPE 2009-2016. All hospitals reporting data to HIPE*

In view of its seasonality, influenza notifications are reported not by calendar year but by influenza season which in the Northern Hemisphere runs from October to May each year. As mentioned earlier in this chapter, data on influenza and RSV reflect trends rather than true numbers and hospitalisations are over-represented.

The peak influenza-like illness rate over the season 2016/2017 was 90.4/100,000[1]. There were 3,336 influenza and 2,583 RSV notifications during the season 2016/17 (as previously noted these numbers differ from notification numbers for calendar year 2016). Of those notified with influenza in the 2016/2017 season, 95 (2.9%) died and influenza was reported as the cause of death in 68. 99% (3,299) of the notified influenza cases were laboratory confirmed[1].

Of the confirmed cases of influenza in 2016/17, 1,425 were hospitalised (43%) giving an age specific rate of 29.9/100,000 population. The highest age specific hospitalisation rate in 2016/17 was in those aged under 1 year of age (74, 118.9/100,000 population) and those aged 65 years and over (699, 109.6/100,000). For those aged 1-4 years the figure was 111 (41.2/100,000) while for 5-14 year olds it was 83 (12.3/100,000)[1].

Of the 51 people admitted to critical care units in the 2016/2017 season with influenza, 13 (25.5%) were aged under 15 years and 29 (56.9%) were aged 65 years and over. Of those admitted to critical care in 2016/2017 (median age 67 years), 33 of the adults had underlying medical conditions, of whom 54.5% (18) had an underlying chronic respiratory disease. Six of the paediatric cases had underlying health problems. Of those admitted to critical care for whom vaccination status was recorded (36), 58% (14) of the adults were not vaccinated, and 92% (11) of the children. The case fatality rate for those admitted to critical care was 39% (46% for adults, 21.4% for children)[1].

Of the notified influenza cases in the 2016/2017 season, 470 of the confirmed cases were aged 0-14 years of whom 268 (57%) were hospitalised. The median age of the latter group was 2 years. Of those hospitalised aged 0-14 years, 49% were in a risk group, with chronic respiratory disease the commonest risk. Of those confirmed cases with a reported underlying condition for whom data was complete, 88% were not vaccinated[1] .

The crude mortality rate/100,000 among the notified cases over the years 2009/2010 to 2016/2017 ranged from 0.3 to 2.0. The latter was for 2016/2017[1].

The excess mortality associated with influenza in those aged 65 years and over is estimated across Europe (FluMOMO). The data (unpublished) from Ireland using this model gives an average excess mortality associated with influenza in those aged 65 years and older of 531 (95% CI 464, 540) each influenza season. These estimates ranged from 291 to 1,156 between the 2012/2013 and 2016/2017 influenza seasons[4].

The number of acute respiratory infections/influenza outbreaks in the 2016/2017 season was 111. Of these 91 were influenza outbreaks affecting 1,157 people of whom 120 were hospitalised and 35 (3.0%) died. 87% (79) of these influenza outbreaks were associated with community hospitals/residential homes for whom the uptake of vaccination was high for residents but

was low for health care workers. For the 2014/2015 season, across nine EU/EEA members, the median uptake of influenza vaccination by those in clinical risk groups was 44.4%. For Ireland it was 28.7%. The median uptake across seventeen EU/EEA countries for health care workers was 26.9%. The figure for Ireland was 23.8%. Three countries including Ireland provided data on staff of long term care facilities. The median uptake was 27.2% but the figure for Ireland was 19.2%[5]. The uptake by residents of long term care facilities across four countries was 81.6%. The figure for Ireland was 84.3%. Twenty six countries provided data on influenza vaccine uptake by the older age group. The median was 47.6% (range 2.1%-76.3%) but for Ireland it was 59.8%[6].

In the 2015/2016 season, the uptake of influenza vaccination by those with a chronic respiratory disease attending respiratory OPD clinic at one major Irish hospital (40% of whom were aged 65 years and over) was 54%[7].

In the 2016/2017 season the uptake of influenza vaccination by hospital healthcare workers on average was 31.9%, by all health care workers in HSE funded long term care facilities it was 28.1% and by residents in long stay care facilities it was 93.5%.

As mentioned at the start of this section on influenza, it is the world's most important viral disease[3]. Vaccination remains the most important factor in its prevention. Yet, many health care workers continue to fall short in their responsibilities to protect their patients with chronic conditions, including those with chronic respiratory conditions, by neglecting to ensure that their patients are aware of and get vaccinated and also by getting vaccinated themselves so as to both reduce their risk of transmitting influenza to their patients and to increase the herd immunity around those vulnerable by virtue of age or chronic disease.

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# Tuberculosis

13

## Key Points

- 318 cases of TB were notified in Ireland in 2016
- Two thirds of those diagnosed in 2016 had a pulmonary component
- Drug resistance was reported in 13.5% of cases in 2016
- The highest age specific incidence rate was in those aged 25-34 years followed by those aged 65 years and over
- BCG vaccine has not been available in Ireland since April 2015

## Background

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis. It is an airborne infection so most commonly affects the lungs but can affect any part of the body. Of the 318 cases notified in Ireland in 2016, two thirds had a pulmonary component[1]. Some people with pulmonary TB can infect their close contacts.

Following infection, one of two clinical outcomes is possible: early development of active disease ('primary TB'), which occurs particularly in children and immunocompromised patients or latent TB infection (LTBI), which occurs in the majority of infected individuals. The lifetime risk of progressing to active TB from LTBI is 5–10% in the immunocompetent[2]. A patient with infectious TB can infect 10-15 other close contacts over the course of a year[3].

TB can affect anybody but it is strongly associated with social determinants of health, including migration, and social marginalisation such as homelessness, drug misuse and imprisonment. Medical, social and environmental conditions which impair the immune system also increase the risk of active TB. These include HIV/AIDS, diabetes mellitus, chronic renal failure, use of immunosuppressive drugs, tobacco smoking and malignancy[2].

Compliance with treatment can be challenging, especially for those from marginalised groups in society and/or those with issues with alcohol, homelessness, drug addiction, or drug resistant infections.

TB is an important clinical and public health problem worldwide. In Ireland it is a notifiable infectious disease i.e. by law it must be reported to the Medical Officer of Health (MOH). An important public health and epidemiological issue is the emergence of drug-resistant TB. This includes resistance to single drugs, multi drug resistant TB (MDR-TB) and more recently, extensive drug-resistant TB (XDR-TB)[2]. The only licensed vaccine against TB is BCG which is an attenuated strain of Mycobacterium bovis (M. bovis bacilli Calmette-Guérin)[2]. It is effective in the prevention of meningitis and disseminated disease in children. Although listed on the schedule for childhood vaccinations, it has not been available in Ireland for over three years due to manufacturing supply issues.

## Incidence

The number of cases of Tuberculosis (TB) notified over the past decade (2007-2016) to MOH in the Regional Public Health departments is shown in table 13.1.

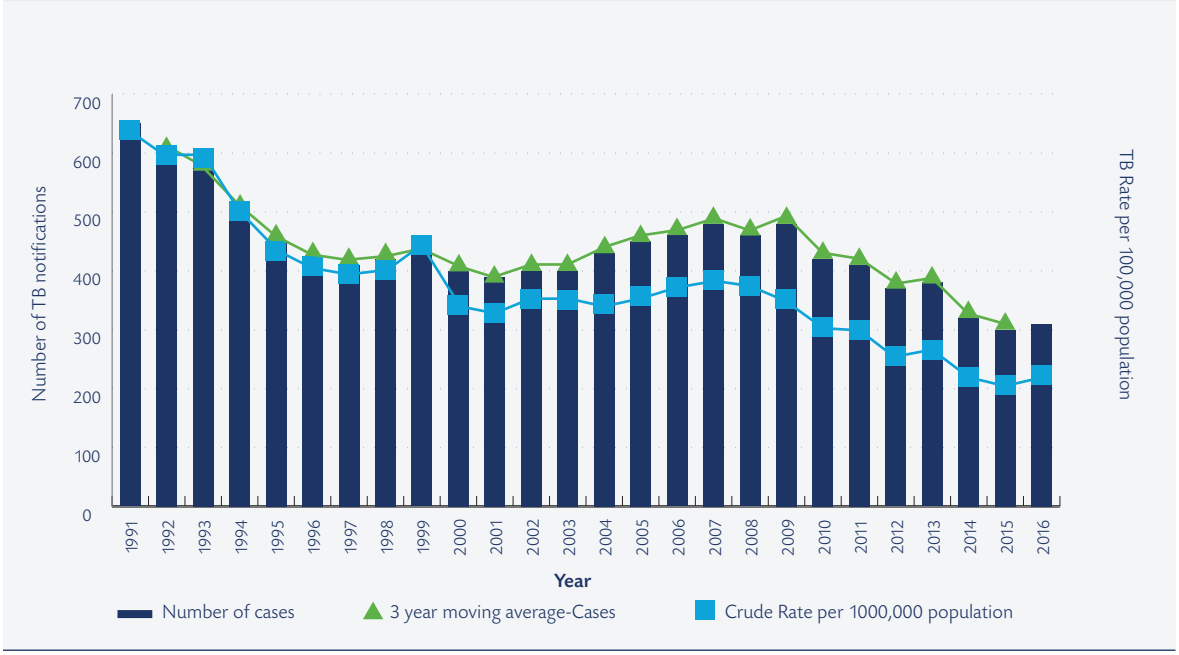
Over the 10 year period (2007-2016) there has been a downward trend in notifications but this may now be levelling as evidenced by the crude rate/100,000 population shown in table 13.1 and the three year rolling average shown in figure 13.1 below.

**Table 13.1. TB notifications Number and Rate/100,000 2007-2016**

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| Numbers | 481 | 467 | 479 | 420 | 413 | 359 | 372 | 313 | 303 | 318 |
| Rate/100,000 population | 10.9 | 11 | 10.4 | 9.2 | 9 | 7.8 | 8.1 | 6.8 | 6.6 | 6.9 |

*Source: Health Protection Surveillance Centre (HPSC)*[1,4]

**Figure 13.1. Notified cases of TB in Ireland with crude rate and 3 year moving average 1991-2016**




*Source: Tuberculosis in Ireland: latest trends in surveillance data December 2017 (www.hpsc.ie HPSC)* [5]

**Table 13.2. Summary of the Epidemiology of TB in Ireland, 2016**

| Parameter | cases | CIR | % of total cases |
|---|---|---|---|
| Number of cases | 318 | 6.9 | - |
| Cases in indigenous population | 145 | 3.9 | 45.6 |
| Cases in foreign-born persons | 160 | 20.9 | 50.3 |
| Culture positive cases | 237 | 5.2 | 74.5 |
| Pulmonary cases | 211 | 4.6 | 66.4 |
| Smear positive Pulmonary cases | 85 | 1.9 | 26.7 |
| TB meningitis cases | 0 | 0 | 0 |
| Multi/Extensive drug resistant cases | 6 | 0.13 | 1.9 |
| Deaths attributable to TB | 7 | 0.2 | 2.2 |

*Source: Adapted from table Summary of the Epidemiology of TB in Ireland, in HPSC Annual Epidemiological Report. 2017*[1]

In 2016, of the 318 cases notified, 211 (66.4%) had pulmonary involvement while 97 (30.5%) had exclusively extra-pulmonary disease. Three quarters (237, 74.5%) were culture positive. Of those with a pulmonary component at time of diagnosis, 85 (40.3%) were smear positive i.e. infectious[1]. Of the cases notified in 2016, 49.2% were foreign born[1]. In 2016, five outbreaks were reported comprising 19 active cases. In the same year there were 28 drug resistant cases including six MDR-TB or XDR-TB cases. These details are shown in table 13.2[1].

## Mortality

In 2016, twenty people of the 318 notified cases died (6.3%). TB was reported as the cause of death for seven of these, for eight, TB was not the cause while details were not available on the remainder[1,6].

## Impact on health services

Those with TB and their close contacts are managed by community, public health and hospital services. Section 38 of the 1947 Health Act allows for the detention of an infectious non-compliant patient. This Act is seldom invoked but if it is, it can have a significant impact on hospital and other health service resources. Even when not enacted, there can be a number of occasions when preliminary work to enact it is initiated.

Most people with TB are treated without hospital admission. Outpatient Department attendances are not available. In 2016, there were 262 hospitalisations for people with TB (including 50 day cases) with a use of 3,622 bed days (0.6% of respiratory bed days, 0.1% of all bed days). Almost three quarters (74%, 157) of the inpatient hospitalisations were in the 16-64 year age group.

## Gender

The male: female ratio of 1.6:1 in 2016 was consistent with that reported in previous years[1]. The highest age specific incidence rate (ASIR) among males was in those aged 65 years and over while for females it was 55-64 years[1].

## Age

The trends for the decade 2007-2016 in terms of age-specific notification rates per year are shown in figure 13.2 below[5].

In 2016, cases ranged in age from two months to 89 years with a median age of 41 years. While most cases (25.1%) were in the age group 25-34 years (ASIR 10.6), the highest age specific rate at 10.6 was in those aged 25-34 years followed by those aged 65 years and older (10.5)[1].

Cases that were Irish born had a median age of 54 years whereas those who were foreign born had a median age of 33 years[1].

## Regional variation

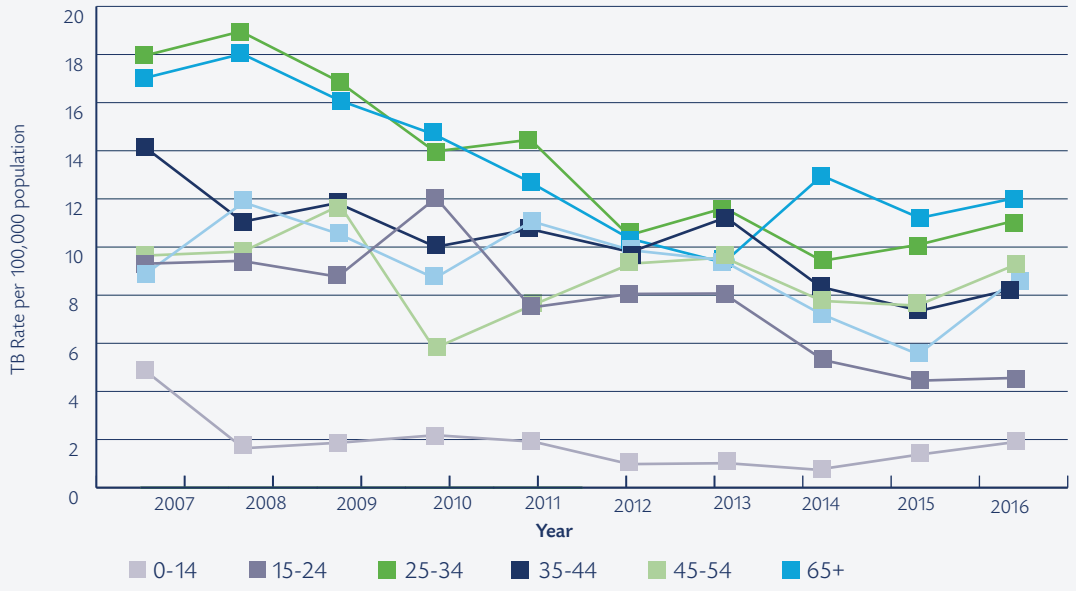
Figure 13.3 shows the notification rate by Health Service Executive (HSE) area for the years 2012-2016. In 2016, HSE East reported the highest number of cases at 136 (42.6% of total), with 36.4% of total cases being reported in Dublin[5]. HSE South with 51 cases (16.2% of total) was the region with the 2nd highest number of cases.

## Socio-economic analysis

In 2016, of the 32 Local Health Office areas (LHOs) in Ireland, the two with the highest crude incidence rate (CIR) of Tuberculosis were both in HSE East. These were Dublin North West (27 cases, CIR 13.0) and Dublin North Central (20 cases, CIR 12.9)[7]. These are both areas of relatively high deprivation.

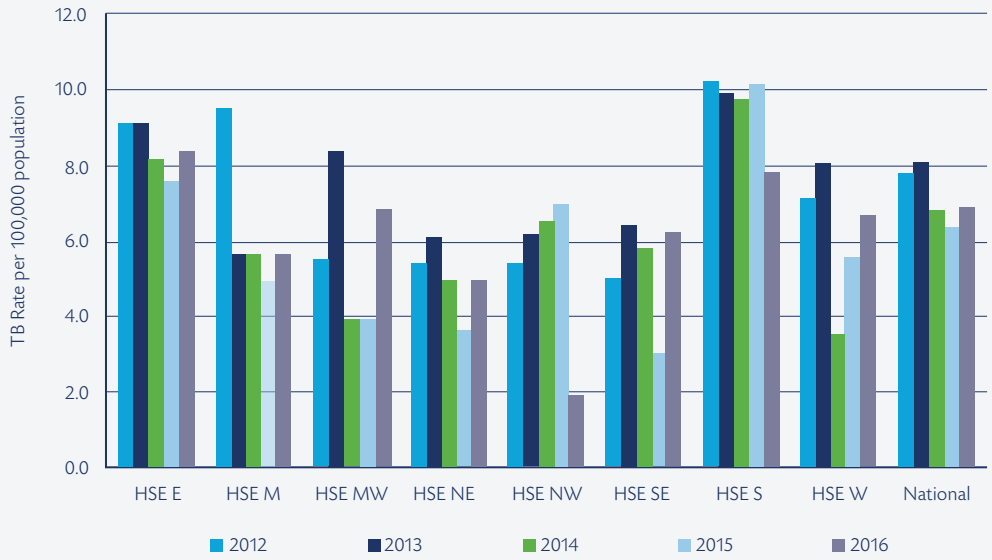
In addition to deprivation and social marginalisation, TB is strongly associated with factors such as migration. In 2016, 50.3% of those notified with TB in Ireland were foreign born[1]. Figure 13.4 below reflects the trends in risk factors for the decade 2007-2016 in Ireland[5].

**Figure 13.2. Age-specific notifications rates of TB per year: 2007-2016**



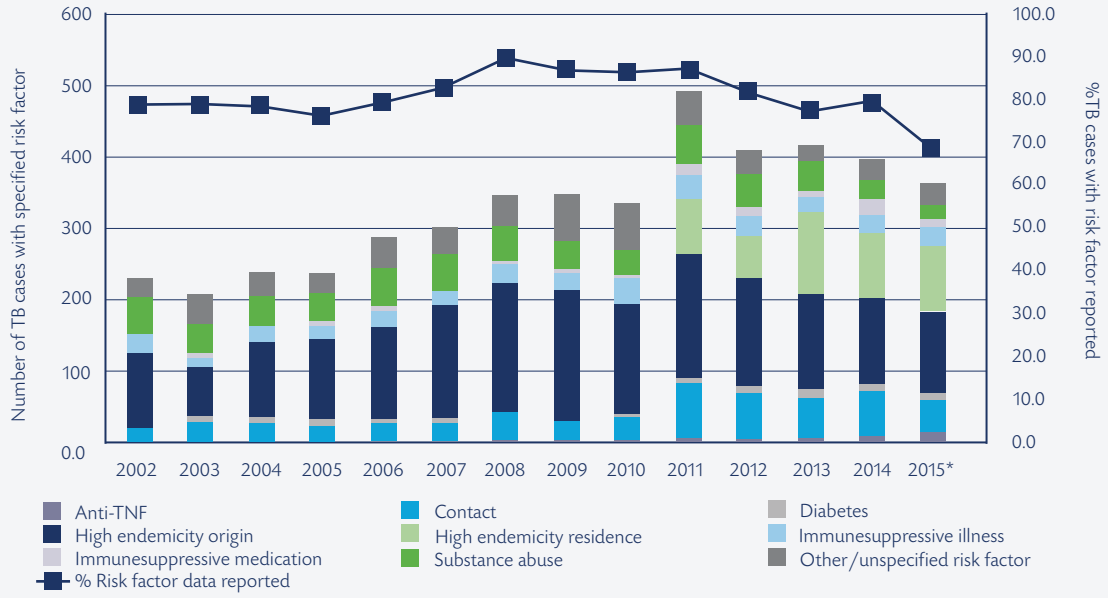

*Source: Tuberculosis in Ireland: latest trends in surveillance data December 2017 (www.hpsc.ie HPSC)* [5]

**Figure 13.3. TB Notification Rate by Health Service Executive (HSE) area and year**




*Source: Tuberculosis in Ireland: latest trends in surveillance data December 2017 (www.hpsc.ie HPSC)* [5]

**Figure 13.4. Number and Percentage of TB notifications with TB risk factor reported**




*Source: Tuberculosis in Ireland: latest trends in surveillance data December 2017 (www.hpsc.ie HPSC)* [5]

## International comparisons

It is estimated that globally there were 10.4 million new cases of TB in 2016. Of these, an estimated 4.1% of new cases and 19% of previously treated cases had MDR/Rifampicin Resistant-TB - an increase since 2015[8]. In 2016, the WHO European Region reported 290,000 cases of TB, giving an overall notification rate 32.0 cases per 100,000, with a wide variation between countries and an incremental west-to-east gradient. The lowest rate in the region occurred in Western Europe (EU countries plus Iceland and Norway), with rates lower than 10 per 100,000 reported in a number of countries, including Ireland[8].

Globally, although the TB mortality rate is falling at 3% per year, it remains a leading cause of death. In the five years 2012–2016, TB was the leading cause of death from a single infectious agent. In 2016, there were an estimated 1.3 million deaths from TB among HIV-negative people and an additional 374,000 deaths from TB among HIV-positive people[8].

The relative concentration of TB in urban areas observed in Ireland is also observed elsewhere in Europe where large cities have notification rates twice as high as rates seen in other parts of the country[9]. In 2016, there were, as in previous years, more males than females notified in Europe as well as in Ireland which may in part be due to differences in risk factors[10].

In 2016, of cases of TB reported in EU/EEA countries, 32.7% were foreign-born, but this ranged from 0.2% to 96.0% of cases[10]. The Irish figure was 50.3%.

The highest burden of MDR-TB cases in the WHO European region is in the non-EU European and central Asian countries with a rate of 36% in 2016. Over the region as a whole, the proportion of culture confirmed pulmonary cases with MDR-TB was 29.1%. The proportion reported in the EU/EEA in 2016 was 3.7% of cases with drug susceptibility testing (DST) results[10]. Extensively drug-resistant (XDR) TB was reported for 20.1% of 984 MDR TB cases tested for second line drug susceptibility[10]. In Ireland in 2016, 1.9% of cases were MDR or XDR TB.

In the EU/EEA in 2016, data on HIV co-infection was incomplete. Of all TB cases with known HIV status, 4.5% were co-infected with the virus[10]. In 2016 in Ireland, HIV status was recorded for 131 (41.2%) of cases of whom less than 5 were HIV positive.

TB in prisons is poorly reported in the EU/EEA. For the 18 EU/EEA countries reporting data in 2016, the notification rate was 163.8 per 100,000 inmates i.e. an incidence ratio of 11.1 compared to the general population in the same countries[10].

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# Paediatric Respiratory Disease

14

## Key Points

- 25% of children's consultations with General Practitioners are for respiratory issues
- Acute respiratory infections (including those which are vaccine preventable) continue to be a significant burden on Irish children and Irish health services
- Congenital and perinatal respiratory diseases in terms of death and inpatient hospitalisation are most marked in those aged under 1 year of age
- Respiratory disease accounts for 31.9% of inpatient hospitalisations of those aged 0-4 years and 26.7% of those aged 0-15 years
- Asthma and cystic fibrosis are the chronic respiratory diseases which impact most on childhood

## Background

Respiratory problems account for 25% of all visits of children to General Practitioners (GPs)[1]. The two chronic respiratory conditions which most commonly affect children in Ireland are asthma (see chapter 6) and cystic fibrosis (CF) (see chapter 7).

Many of the acute respiratory diseases which affect children are of an infectious nature. Many are managed at home in the community. As a number of respiratory infections are notifiable diseases (see chapter 12), national incidence trend data is available. Although the notification numbers for some of these are an underestimate of the true incidence, such as Respiratory Syncytial Virus (RSV) and influenza, they can be used to monitor trends. A number of the notifiable diseases are vaccine preventable and are included in childhood immunisation programmes. Disease notification numbers serve to monitor the effectiveness of these programmes. For other respiratory infections including pneumonia (see chapter 5), and bronchiolitis, the situation on data is as for many diseases i.e. a reliance on mortality data and hospitalisation data.

Of particular importance in childhood are congenital and perinatal respiratory problems and conditions often linked with prematurity.

Bronchiolitis is usually the result of viral inflammation of the bronchioles. RSV infection - a notifiable disease in Ireland since 2012 - is one of the most common causes of bronchiolitis. Bronchiolitis is one of the major causes of hospital admissions in infants under 1 year of age. Other causative viruses for bronchiolitis are human meta-pneumovirus, rhinovirus, adenovirus, para-influenza virus, enterovirus and influenza virus[1].

Perinatal respiratory conditions, some of which have long term consequences, include respiratory distress of newborn (ICD-10 P22), congenital pneumonia (ICD-10 P23), neonatal aspiration syndromes (ICD-10 P24), air leak syndrome originating in the perinatal period (ICD-10 P25), pulmonary haemorrhage originating in the perinatal period (ICD-10 P26), chronic respiratory disease originating in the perinatal period (ICD-10 P27) (which includes broncho-pulmonary dysplasia (BPD)) and other respiratory conditions originating in the perinatal period (ICD-10 P28).

Primary ciliary dyskinesia (Kartagener Syndrome) (included in ICD-10 J98, Q89.35) is an inherited disorder characterised by specific defects of cilia which results in ineffective clearance of mucous secretions and inhaled particles. The main pulmonary complication is bronchiectasis. The incidence of the disease is low[1]. The numbers hospitalised or who die in Ireland each year with this condition are small. It is not discussed further in this chapter.

Congenital malformations of the respiratory system (ICD-10 Q32-34) include abnormalities of the thorax, the lung, the blood supply and the airways. The effects of congenital disorders of the respiratory tract are particularly seen during the first year of life. The incidence is low[1].

Vaccinations are effective in preventing many childhood respiratory infections. Coverage of > 90/95% of children is usually required to achieve herd immunity. In 2016 the childhood immunisation programme in Ireland included, of relevance to the respiratory system, pertussis, measles, mumps, pneumococcus, H. influenza, meningococcus serogroup C and diphtheria. As noted in the chapter on Tuberculosis, BCG has not been available in Ireland since 2015.

In 2016 the immunisation uptakes at 12 and 24 months for both diphtheria (3 doses) and pertussis (3 doses) were 91% and 95%, for Hib (3 doses) 91% and 91%, for PCV2 at 24 months 91% and MMR (1 dose) 92% at 24 months[2]. There were regional variations in uptake. In addition to the childhood immunisation programme, influenza vaccination is recommended for children with specified chronic conditions. Both pertussis and influenza vaccination are recommended in pregnancy in part to protect the newborn child.

## Incidence

Table 12.1 in Chapter 12 shows the incidence of notifiable diseases of respiratory significance for the decade 2007-2016. Table 14.1 below shows the 2016 data as it relates to the paediatric population.

**Table 14.1. Respiratory infectious diseases (notifiable): Paediatrics Age Group: 2016**

| 2016 | Total: All ages | 0-4 yrs % of total | 5-9 yrs % of total | 10-14 yrs % of total |
|---|---|---|---|---|
| *RSV | 2690 | 2349 (87.3%) | 35 (1.3%) | 22 (0.8%) |
| **Streptococcus pneumonia (invasive) | 381 | 42 (11%) | 10 (2.6%) | <5 |
| Haemophilus Influenza (Invasive) | 58 | 11 (18.9%) | <5 | <5 |
| Influenza | 4764 | 851 (17.7%) | 461 (9.7%) | 169 (3.5%) |
| Tuberculosis | 315 | <5 | 5 (1.6%) | 8 (2.5%) |
| Pertussis | 213 | 112 (52.6%) | 18 (8.5%) | 12 (5.6%) |
| Measles | 43 | 14 (32.6%) | 8 (18.6%) | <5 |

*Source: HPSC 2016 Annual Epidemiological Report. Health Protection Surveillance Centre (HPSC). HPSC (2017)* [2] **RSV made notifiable in 2012 **EARSS pathogens not recorded on CIDR with the exception of Streptococcus pneumonia (figures since 1/7/15 refer only to confirmed cases).*

**Table 14.2. Deaths from Respiratory Perinatal and Congenital causes 2007-2015**

| | 2007-2009 | 2010-2012 | 2013-2015 |
|---|---|---|---|
| Respiratory distress of newborn (P22) | 17 | 6 | 13 |
| Congenital Pneumonia (P23) | 6 | 9 | 9 |
| Neonatal aspiration syndromes (P24) | <5 | <5 | <5 |
| Air leak syndrome originating in the perinatal period (P25) | <5 | <5 | <5 |
| Pulmonary Haemorrhage originating in the perinatal period (P26) | <5 | 7 | 7 |
| Chronic Respiratory disease originating in the perinatal period (P27) | 6 | <5 | <5 |
| Other respiratory conditions originating in the perinatal period (P28) | 16 | 24 | 6 |
| Congenital malformation of trachea and bronchus (Q32) | 5 | <5 | <5 |
| Congenital malformation of the lung (Q33) | 11 | 7 | 9 |
| Other congenital malformation of the respiratory system (Q34) | 0 | <5 | <5 |

*Source: Central Statistics Office (CSO) Vital Statistics*[3]

Of the 470 paediatric (0-14years) confirmed cases of influenza in the 2016/2017 season, 268 (57%) were hospitalised (Note: table 14.1 above refers to calendar year 2016). Over 69% (185) of the latter were aged 0-4 years with 27% (74) aged less than 1 year of age. Of the hospitalised cases, 49 % had a risk factor, which most commonly was chronic respiratory disease. The majority of those hospitalised who had an underlying risk were unvaccinated (88%)[2]. For pneumonia and acute lower respiratory infection (unspecified) see chapter 5.

## Prevalence

For the chronic respiratory diseases of childhood such as asthma and cystic fibrosis, prevalence is the measure of interest. See chapters for Asthma (chapter 6) and Cystic Fibrosis (chapter 7).

## Mortality

In Ireland the number of children who die each year from a respiratory disease is relatively small. In terms of the notifiable and vaccine preventable respiratory diseases (chapter 12) where deaths occurred in recent years in the paediatric age group, they were less than 5 in number. They are not discussed further here.

As deaths from perinatal causes (ICD-10 P22-P28) and congenital malformations of the respiratory system (ICD-10 Q32-34) were relatively few, deaths in three year periods (2007-2015) are shown in the table above. All of those with perinatal codes died under 1 year of age. All but 5 of those with congenital malformations codes who died were under 1 year of age.

In terms of deaths aged under 15 years of age from what are termed Diseases of the Respiratory system (ICD 10: J00-J99), deaths have been combined into 3 year periods for 2007-2015 plus provisional 2016 data as a single year as shown overleaf.

**Table 14.3. Deaths: Respiratory system (J00-99) Age < 15 years. 2007-2016**

| Age category | 2007-2009 | 2010-2012 | 2013-2015 | 2016* |
|---|---|---|---|---|
| 0-14 years | 14 | 13 | 18 | 9 |
| 0-4 years | 8 | 5 | 10 | 5 |
| 5-14years | 6 | 8 | 8 | <5 |

*Source: Public Health Information System (PHIS)[4] * Provisional data for 2016*

**Table 14.4. Prevalence of respiratory medication use in the GMS population, 2016, age 0-15 years**

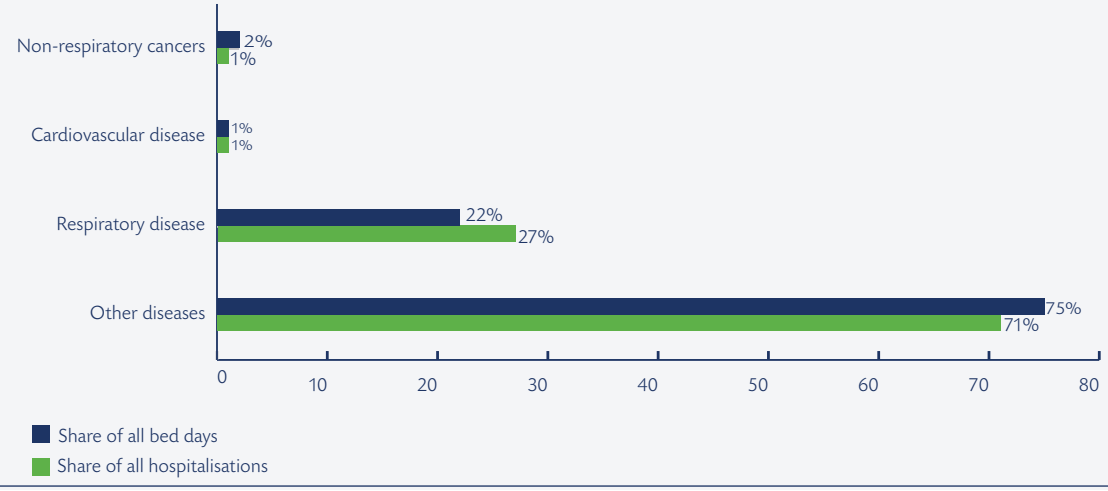
| | Population with GMS coverage | | Estimate of prevalence of respiratory medication use (%) | | | |
|---|---|---|---|---|---|---|
| | Male % | Female % | Male % | 95% CI | Female% | 95% CI |
| 0-4yrs | 28% | 27% | 26.4% | 26.0 to 26.8 | 21.4% | 21.0 to 21.8 |
| 5-11yrs | 35% | 35% | 22.6% | 22.3 to 22.8 | 17.2% | 17.0 to 17.5 |
| 12-15yrs | 29% | 29% | 21.7% | 21.3 to 22.1 | 17.3% | 16.9 to 17.7 |

*Source: Hurley, E (2018). An analysis of medication use for respiratory disease amongst those with GMS eligibility (2015 - 2016) - a focus on Chronic Obstructive Pulmonary Disease (COPD)[5].*

**Figure 14.1. Inpatient hospitalisations with a primary diagnosis of bronchiolitis, or perinatal and congenital respiratory conditions, 2009-2016**

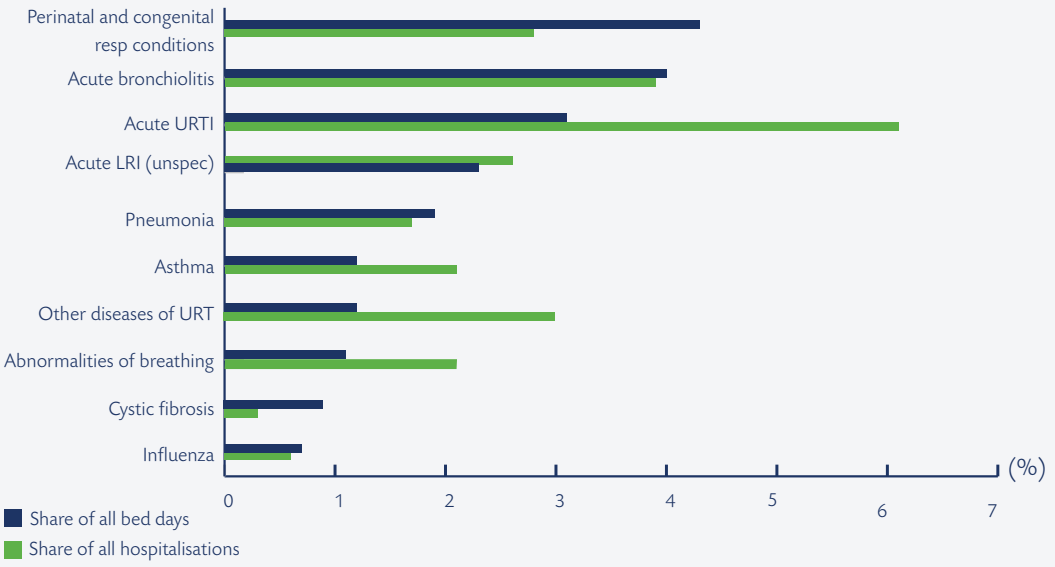

*Source: HIPE 2009-2016. All hospitals reporting data to HIPE. Note: ICD 10 codes used for "perinatal and congenital respiratory conditions" are detailed in the section on Background.*

**Figure 14.2. Percentage of inpatient hospitalisations by disease group, 2016 (0-15 years)**




*Source: HIPE 2016. All hospitals reporting data to HIPE*

**Figure 14.3. Percentage of inpatient hospitalisations by respiratory condition, 2016 (0-15 years)**




*Source: HIPE 2016. All hospitals reporting data to HIPE*

## Impact on Health Services

Data on many respiratory paediatric diseases are not available at national level for children with full medical cards, those with GP only cards or those who are private patients. This is also true for those who attend GP out of hours services, those who attend Emergency Departments and those who attend hospital Outpatient Departments for their respiratory condition. Inpatient or day case data is only available from HIPE reporting publicly funded hospitals. The majority of acute respiratory infections in children are dealt with in the community.

## Respiratory medication use

In terms of respiratory medication use, of children with a full GMS card for the entire calendar year, over one fifth of boys filled at least one prescription for a respiratory medication in 2016. For females the figure was slightly less (see table 14.4)[5].

## Impact on Hospitals

Figure 14.1 above shows trends in inpatient hospitalisations over the years 2009-2016 for both bronchiolitis and perinatal and congenital respiratory conditions. In 2016, all hospitalisations for perinatal and congenital respiratory conditions were in those aged 0-15 years and similarly, 99% of those with acute bronchiolitis. Figure 14.1 shows evidence of an increasing impact of acute bronchiolitis during this period.

Looking at the inpatient hospitalisation data for 2016 alone, 26.7% of all hospitalisations for children (0-15 years) were for respiratory disease (this excludes most acute infectious notifiable and/or vaccine preventable diseases) accounting for 21.7% of all inpatient bed days for that age group (see figure 14.2 and table 14.5). The figures for those aged just 0-4 years was 31.9% and 23.0% respectively.

The impact of specific respiratory diseases is shown in table 14.5 and figure 14.3. For discussion of specific respiratory diseases such as asthma, CF, pneumonia see relevant chapters.

In 2016, respiratory disease accounted for 32% of inpatient hospitalisations and 23% of inpatient bed days among those aged 0-4 years as shown in figure 14.4.

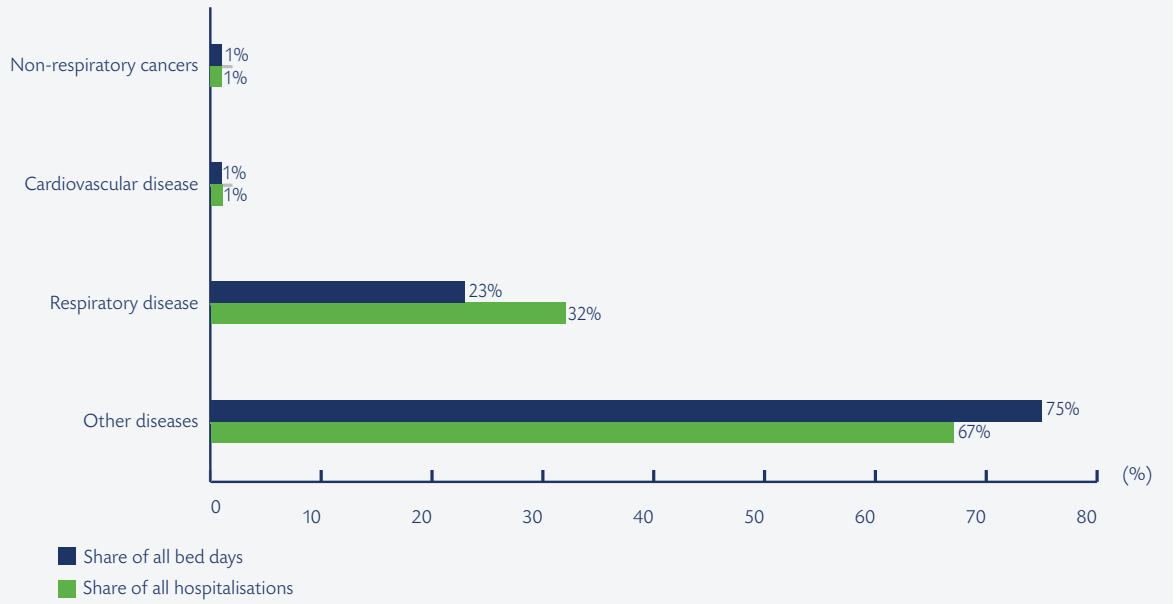
The specific respiratory conditions and their bed day usage for those aged 0-4 years are shown in figure 14.5 and table 14.6.

**Table 14.5. Inpatient hospitalisations and bed days, 2016 (0-15 years)**

| | Hospitalisations | | Bed Days | |
|---|---|---|---|---|
| | Number | Share of all hospitalisations | Number | Share of all bed days |
| All causes | 87,749 | | 294,701 | |
| Respiratory disease | 23,422 | 26.7% | 64,078 | 21.7% |
| Cardiovascular disease | 1,128 | 1.3% | 3,539 | 1.2% |
| Non-respiratory cancers | 1,218 | 1.4% | 5,768 | 2.0% |
| Other diseases | 61,981 | 70.6% | 221,316 | 75.1% |
| **Respiratory disease** | **Number** | **Share of resp hospitalisations** | **Number** | **Share of resp bed days** |
| Acute URTI | 5,324 | 22.7% | 9,018 | 14.1% |
| Acute bronchiolitis | 3,445 | 14.7% | 11,820 | 18.4% |
| Other diseases of URT | 2,659 | 11.4% | 3,404 | 5.3% |
| Perinatal and congenital resp conditions | 2,468 | 10.5% | 12,652 | 19.7% |
| Acute lower respiratory infection | 2,325 | 9.9% | 6,725 | 10.5% |
| Asthma | 1,885 | 8.0% | 3,599 | 5.6% |
| Abnormalities of breathing | 1,848 | 7.9% | 3,277 | 5.1% |
| Pneumonia | 1,508 | 6.4% | 5,717 | 8.9% |
| Sleep apnoea | 588 | 2.5% | 789 | 1.2% |
| Influenza | 496 | 2.1% | 1,953 | 3.0% |
| Cystic fibrosis | 300 | 1.3% | 2,666 | 4.2% |
| Cough | 224 | 1.0% | 356 | 0.6% |
| Other diseases of the respiratory system | 125 | 0.5% | 438 | 0.7% |
| COPD | 50 | 0.2% | 190 | 0.3% |
| Acute bronchitis | 41 | 0.2% | 111 | 0.2% |
| Pneumonitis due to solids and liquids | 38 | 0.2% | 376 | 0.6% |
| Other diseases of the pleura | 23 | 0.1% | 105 | 0.2% |
| Suppurative and necrotic conditions of LRT | 23 | 0.1% | 259 | 0.4% |
| Tuberculosis | 19 | 0.1% | 108 | 0.2% |
| Respiratory failure | 11 | 0.0% | 275 | 0.4% |
| Idiopathic pulmonary fibrosis | 7 | 0.0% | 26 | 0.0% |
| Postprocedural respiratory disorders, not elsewhere classified | 7 | 0.0% | 115 | 0.2% |
| Pulmonary vascular diseases (excl embolism) | <5 | 0.0% | 89 | 0.1% |
| Lung diseases due to external agents (excl pneumonitis due to solids & liquids) | <5 | 0.0% | 8 | 0.0% |
| Sarcoidosis | <5 | 0.0% | <5 | 0.0% |

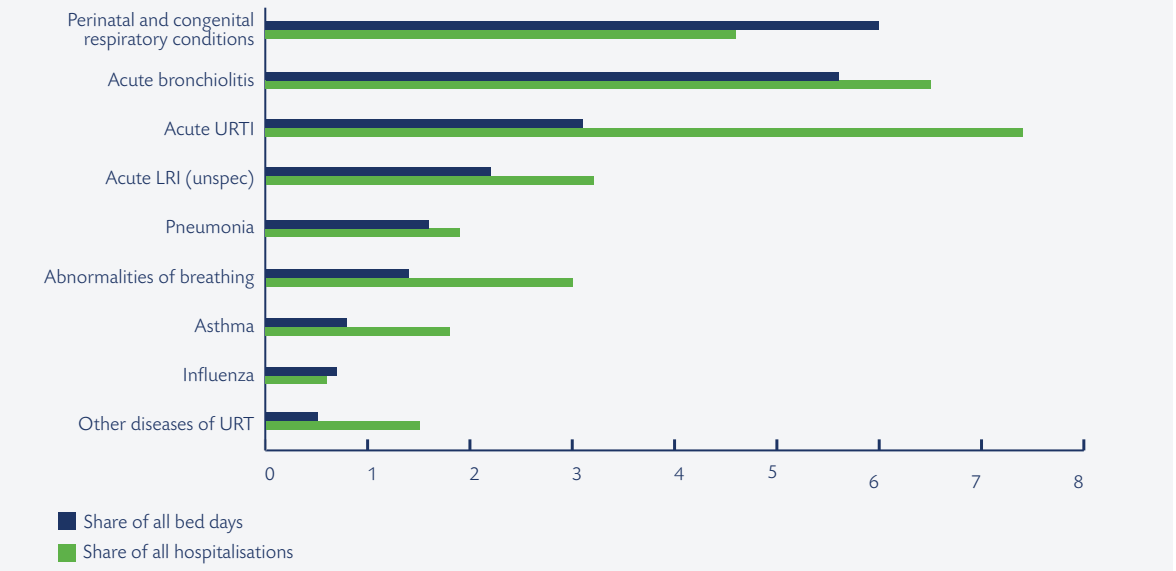
*Source: HIPE 2016. All hospitals reporting data to HIPE*

**Figure 14.4. Percentage of inpatient hospitalisations by disease group, 2016 (0-4) years**




*Source: HIPE 2016. All hospitals reporting data to HIPE*

**Figure 14.5. Percentage of inpatient hospitalisations by respiratory condition, 2016 (0-4 years)**




*Source: HIPE 2016. All hospitals reporting data to HIPE*

**Table 14.6. inpatient hospitalisations and bed days, 2016 (0-4 years inclusive)**

| | Hospitalisations | | Bed days | |
|---|---|---|---|---|
| | Number | Share of all hospitalisations | Number | Share of all bed days |
| All causes | 53,025 | | 211,091 | |
| Respiratory disease | 16,893 | 31.9% | 48,620 | 23.0% |
| Cardiovascular disease | 292 | 0.6% | 1,844 | 0.9% |
| Non-respiratory cancers | 564 | 1.1% | 2,805 | 1.3% |
| Other diseases | 35,276 | 66.5% | 157,822 | 74.8% |
| **Respiratory disease** | **Number** | **Share of resp hospitalisations** | **Number** | **Share of resp bed days** |
| Acute URTI | 3,933 | 23.3% | 6,639 | 13.7% |
| Acute bronchiolitis | 3,431 | 20.3% | 11,746 | 24.2% |
| Perinatal and congenital respiratory conditions | 2,465 | 14.6% | 12,644 | 26.0% |
| Acute lower respiratory infection (unspec) | 1,689 | 10.0% | 4,657 | 9.6% |
| Abnormalities of breathing | 1,585 | 9.4% | 2,850 | 5.9% |
| Pneumonia | 1,009 | 6.0% | 3,395 | 7.0% |
| Asthma | 929 | 5.5% | 1,644 | 3.4% |
| Other diseases of URT | 806 | 4.8% | 1,103 | 2.3% |
| Influenza | 340 | 2.0% | 1,442 | 3.0% |
| Sleep apnoea | 277 | 1.6% | 424 | 0.9% |
| Cough | 163 | 1.0% | 271 | 0.6% |
| Other diseases of the respiratory system | 82 | 0.5% | 289 | 0.6% |
| Cystic fibrosis | 43 | 0.3% | 336 | 0.7% |
| COPD | 32 | 0.2% | 73 | 0.2% |
| Acute bronchitis | 32 | 0.2% | 87 | 0.2% |
| Pneumonitis due to solids and liquids | 20 | 0.1% | 278 | 0.6% |
| Suppurative and necrotic conditions of the lower respiratory tract | 19 | 0.1% | 205 | 0.4% |
| Tuberculosis | 9 | 0.1% | 36 | 0.1% |
| Respiratory failure | 9 | 0.1% | 246 | 0.5% |
| Other diseases of the pleura | 6 | 0.0% | 34 | 0.1% |
| Idiopathic pulmonary fibrosis | 6 | 0.0% | 25 | 0.1% |
| Postprocedural respiratory disorders, not elsewhere classified | 5 | 0.0% | 110 | 0.2% |
| Pulmonary vascular diseases (other than pulmonary embolism) | <5 | 0.0% | 84 | 0.2% |
| Lung diseases due to external agents (excl pneumonitis due to solids & liquids) | <5 | 0.0% | <5 | 0.0% |

*Source: HIPE 2016. All hospitals reporting data to HIPE*

## International Comparisons

The most frequent reason for children consulting a general practitioner in the Netherlands (in 2001) was respiratory morbidity, accounting for about 25% of all consultations by children[1]. Comparable national figures are not available in Ireland but it is unlikely to be less.

International prevalence studies of bronchiolitis show that up to 50% of infants are infected by RSV by their first birthday and almost 100% by 2 years of age[1]. Bronchiolitis is one of the most common causes of admission to hospital in the first 12 months of life[1]. As evidenced earlier in this chapter, it accounted for over 20% (20.3%) of respiratory inpatient hospitalisation of 0-4 year olds in Ireland in 2016.

In 2011 the WHO European region showed a hospital admission rate for perinatal respiratory disorders in a range from 245.2 to 11,344.2 per 100 000 among those aged under 1 year of age[1]. This did not include Irish data. In the same year, the WHO European region reported a range in the mortality rate for perinatal respiratory disorders in infants under 1 year of age (rate per 100 000) of 9.65 (Sweden) to 817.61(Kyrgyzstan)[1]. The Irish rate was 20.41[1].

Global variation in Community Acquired Pneumonia (CAP) prevalence and mortality, results from factors such as malnutrition, over-crowding, low birth weight, pre-existing HIV infection, and childhood immunisation programmes [1]. In industrialised countries like Ireland, the incidence of community-acquired pneumonia (CAP) in children is about 0.05 episodes per child-year, with an extremely low risk of mortality in otherwise healthy children[1]. As evidenced in this chapter, in Ireland in 2016, pneumonia accounted for 1.9% of all inpatient hospitalisations in 0-4 year olds and 1.7% in 0-15 year olds.

Globally, pneumonia accounts for 13% of childhood deaths[6]. Mortality rates for pneumonia in children (age-standardised rate per 100 000, aged under 15 years of age) varied considerably within Europe in 2011 ranging from 0.00 to 50.131. The Irish figure at that time was 0.11[1].

In the 2015 Global Burden of Disease study, 12.1% of deaths in those aged under 5 years of age were due to lower respiratory infections[6]. In that age group, pneumococcal pneumonia and haemophilus influenza caused 65% of the deaths due to lower respiratory infections[7].

As evident from above, many childhood respiratory diseases have high morbidity and mortality in childhood. In addition, they can have effects which can persist into adulthood.

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# Respiratory Disease Burden for Older People

15

## Key Points

- In 2016, 13.5% of the Irish population were aged 65 years and over
- In 2016, 43% of those hospitalised as inpatients for respiratory disease were aged 65 years and over
- In older age groups, respiratory issues often co-exist with co-morbidities
- Chronic respiratory conditions can result from past lifestyle or environmental factors
- Vaccination is key to protection from a number of acute respiratory infectious diseases

## Background

Acute respiratory diseases such as influenza and pneumonia can have a significant impact on the health of all age groups, but in older people they can have additional significance when they occur in conjunction with existing chronic respiratory conditions such as COPD, interstitial lung disease, and asthma. For some of the acute respiratory infectious diseases, vaccination can play an important preventive role.

Part of the challenge for the health services in Ireland is that the number of people aged 65 years and over is growing by approximately 20,000 per year. In 2016, the Irish population had increased by 3.8% compared with Census 2011[1]. For those aged 65 years and over the increase was 19.1%. In 2016, those aged 65 years and over made-up 13.5% of the population[1]. Health Service use by older people differs significantly from younger healthier populations. A person aged 65 years and over consults a GP on average 7 times per year[2]. In 2016, the mean number of diagnoses for all inpatient hospital discharges was 3.9. However, for those aged 65 years and over it was 5.2[3].

Sources of information on health in older people in Ireland include those used in other chapters of this report but in addition, there is The Irish Longitudinal Study on Ageing (TILDA), a longitudinal study of community dwelling people aged 55 years and over. While the primary areas of investigation of TILDA are neuro-cardiovascular stability, locomotion and sensory function, it nevertheless provides valuable information on respiratory disease[4]. Where data is quoted from TILDA in this chapter, it relates to those aged 65 years and over.

## Incidence

As discussed in chapter 12 many of the respiratory infectious diseases are notifiable. The national trend data for these in the decade 2007-2016 are shown in chapter 12. As mentioned in that chapter, for a disease such as influenza, which many people self-manage in the community, notifications reflect trends rather than actual numbers of cases. The notifications for 2016 for those aged 65 years and over are shown in table 15.1. Both influenza vaccination and pneumococcal vaccination are recommended for all older people as well as those with underlying chronic conditions, including chronic respiratory conditions. In the 2014/2015 influenza season, the uptake of influenza vaccine by this age group was 59.8%[5]. In 2013, 36% [95%CI: 30%–42%] of those aged 65 years and older had received pneumococcal vaccination[6].In the 2016/2017 influenza season, 87% (79) of the notified influenza outbreaks occurred in community hospitals/ residential homes where most residents were in the older age group.

## Prevalence

TILDA respondents were asked whether a doctor had ever told them that they had a chronic lung condition. The self-reported prevalence of chronic lung disease was 5.3% in those aged 65-74 years (5.1% of males, 5.6% of females) and 4.9% in those aged 75 years and over (5.6% of males, 4.4% of females). In men, the prevalence of chronic lung disease increased with age, but an increase with age was not seen in women[4].

**Table 15.1. Respiratory infectious diseases (Notifiable) 2016**

| Age | Number 100% | <65 % | ≥65 yrs % |
|---|---|---|---|
| *RSV | 2690 | 95.3% | 4.7% |
| **Streptococcus pneumonia (invasive) | 381 | 50.9% | 49.1% |
| Haemophilus Influenza (Invasive) | 58 | 63.8% | 36.2% |
| Influenza | 4764 | 81.1% | 18.9% |
| Tuberculosis | 315 | 82.2% | 17.4% |
| Pertussis | 213 | 96.7% | 5.6% |
| Legionellosis*** | 10 | 60% | 40% |

*Source: HPSC 2016 Annual Epidemiological Report. Health Protection Surveillance Centre (HPSC). HPSC (2017)[7] *RSV not recorded on CIDR prior to 2012 **EARSS pathogens not recorded on CIDR with the exception of Streptococcus pneumonia (figures since 1/7/15 refer only to confirmed cases). ***Most notified cases of Legionellosis have Legionnaires' Disease*

Where national data on prevalence is available on specific respiratory diseases, this is discussed in each of the relevant chapters.

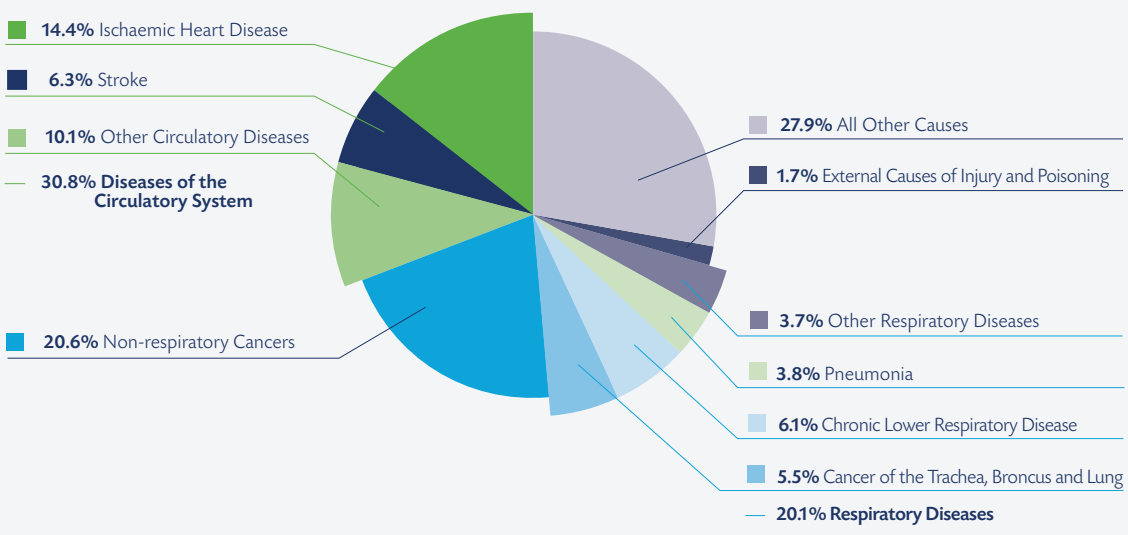
## Mortality

Overall mortality rates can mask variations between age groups, regions and other population subgroups. Causes of death for those aged 65 years and over differ from those in the younger ages. Mortality data other than in this paragraph does not include deaths from respiratory infectious diseases. The estimated excess mortality associated with influenza in those aged 65 years and older in each influenza season is 531 (95%CL: 464, 540), but in 2016/2017 it was 1,156, as mentioned in Chapter 12. That chapter provides additional information on deaths from other respiratory infectious diseases.

Mortality data for 2016 for those aged 65 years and over is shown in figure 15.1. In 2016, respiratory disease accounted for 20.1% of deaths for those aged 65 years and older. Chronic lower respiratory disease (ICD 10: J40-47) accounted for 6.1% of deaths, followed by cancer of the trachea, bronchus and lung at 5.5% and pneumonia at 3.8%

The majority of deaths from respiratory disease are in people aged 65 years and over. Over the past decade over 90% (range 92.4% - 93.4%) of all deaths from respiratory disease (J00-J99) excluding lung cancer occurred in those aged 65 years and over. For those aged 75 years and over the figure was almost 80% (range 78.8%-79.5%). This is shown in greater detail in table 15.2.

**Figure 15.1. Deaths by Principal Causes. Percentage Distribution, 2016, Ages 65 and over**




*Source Health in Ireland, Key Trends, 2017, Department of Health, December 2017 Figures 2.4b[8] Note: data for 2016 is provisional*

**Table 15.2. Age: Respiratory death, excluding Cancer of Trachea, Bronchus and Lungs**

| | Deaths All Ages | Deaths ≥ 65 years % of total | Deaths ≥ 70 years % of total | Deaths ≥ 75 years % of total |
|---|---|---|---|---|
| 2007 | 3324 | 93.0 | 88.7 | 80.4 |
| 2008 | 3522 | 93.1 | 88.3 | 79.0 |
| 2009 | 3606 | 93.1 | 88.2 | 80.0 |
| 2010 | 3280 | 92.5 | 87.1 | 78.6 |
| 2011 | 3438 | 93.1 | 87.8 | 79.3 |
| 2012 | 3497 | 93.6 | 88.0 | 79.3 |
| 2013 | 3504 | 93.4 | 88.2 | 80.1 |
| 2014 | 3492 | 93.6 | 87.9 | 79.5 |
| 2015 | 3865 | 93.3 | 88.2 | 79.4 |
| 2016* | 3856 | 92.3 | 86.2 | 76.8 |

*Source: Public Health Information System (PHIS)* [9] **Provisional data for 2016*

**Table 15.3. Prevalence of respiratory medication use in the GMS population, 2016**

| Age category | GMS population (% of entire Irish population) | | Filled at least one Rx for a resp medication | | Estimate of prevalence of respiratory medication use (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Male (%) | Female (%) | Male | Female | Male % | 95% CI | Female % | 95% CI |
| ≥65yrs | 173,505 (58%) | 224,773 (66%) | 45,272 | 59,511 | 26.1% | 25.9 to 26.3 | 26.5% | 26.3 to 26.7 |
| ≥70yrs | 131,889 (69%) | 174,516 (74%) | 35,512 | 46,132 | 26.9% | 26.7 to 27.2 | 26.4% | 26.2 to 26.7 |

*Source: Hurley, E (2018). An analysis of medication use for respiratory disease amongst those with GMS eligibility (2015 - 2016) - a focus on Chronic Obstructive Pulmonary Disease (COPD)* [11].

Looking at the major specific respiratory diseases in the decade 2007-2016, over 90% of all deaths from pneumonia occurred in those aged 70 years and older (range 90.4%-94.4%) as did over 85% of deaths from chronic lower respiratory disease (range 84.8%-86.8%) and approximately 60% of those who died from lung cancer (range 57.0%-61.4%).

As mentioned in other chapters, of those who died from pulmonary embolism (PE) in 2015, almost 75% (74.2%) were aged 65 years and over. Almost a quarter (24.2% (32)) were aged 65-74 years, 30.3% (40) were aged 75-84 years and 19.7% (26) aged 85 years and over[10]. Of those who died from Pulmonary Hypertension in 2015, 20.8 % (11) were aged 65-74 years, 34.0 % (18) were aged 75-84 years and 28.2% (15) aged 85 years and over[10].

In 2015, of those dying from pneumonitis due to solids and liquids, 48.4% were aged 85 years or over with another 29.0% aged 75-84 years[10]. In 2015, of the 341 deaths due to chronic interstitial pulmonary disease (ICD 10: J84), 22.6% (77) were aged 65-74 years, 45.7% (156) 75-84 years and 23.8% (81) 85 years or over[10]. Of the 144 deaths in 2015 due to acute lower respiratory infection (unspecified), 73% (105) were aged 85 years or over, 18.1% (26) were aged 75 years-84 years and 4.9% (7) were aged 65-74 years[10].

## Impact on Health Services

Most people with respiratory disease regardless of age are managed in primary care. Data on respiratory disease in older people is not available at national level for people with full medical cards, those with GP only cards or those who are private patients. This is also true for those who attend GPs, out of hours services, those who attend Emergency Departments and those who attend hospital Outpatient Departments for their respiratory problems. Inpatient or day case data is only available from HIPE reporting publicly funded hospitals.

## Respiratory medication use

In terms of respiratory medication use, of those aged 65 years and over who held a full GMS card in 2016 (see table 15.3), over 25% of both males and females filled at least one prescription for a respiratory medication in 2016.[11]

**Figure 15.2. Inpatient hospitalisations by respiratory disease, by age category, 2009-2016**

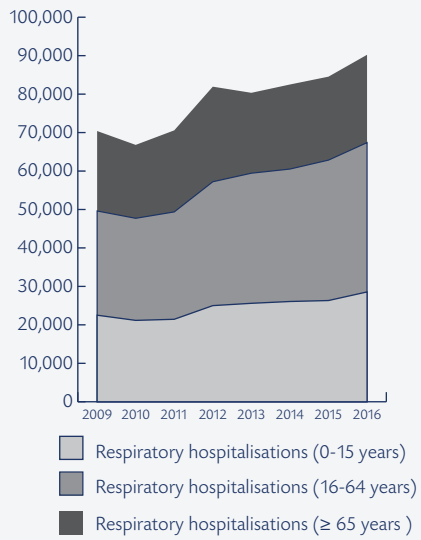
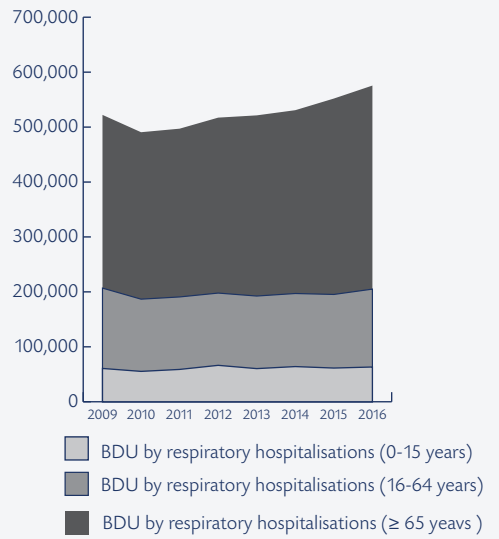



**Figure 15.3. Inpatient bed days by respiratory disease, by age category, 2009-2016**




*Source: HIPE 2009-2016. All hospitals reporting data to HIPE*

## Impact on Hospitals

The trend over the years 2009-2016 for both in inpatient hospitalisations for respiratory disease and bed-days used by age group is shown in figures 15.2 and 15.3.

In 2016, across all ages, there were 643,850 inpatient hospitalisations that accounted for 3,651,436 inpatient bed days. Of these, 32 % (204,882) were in those aged 65 years and over accounting for 53.2% (1,946, 040) of all inpatient bed days as shown in table 15.4. Of those aged 65 years and over, respiratory disease accounted for 19.1% of inpatient hospitalisations (vs. 16.1% for cardiovascular, 6.8% for non-respiratory cancers), and 19.1% of inpatient bed days (vs. 15.3% for cardiovascular, and 8.0% for non-respiratory cancers) in 2016 as shown in table 15.4 and figure 15.4.

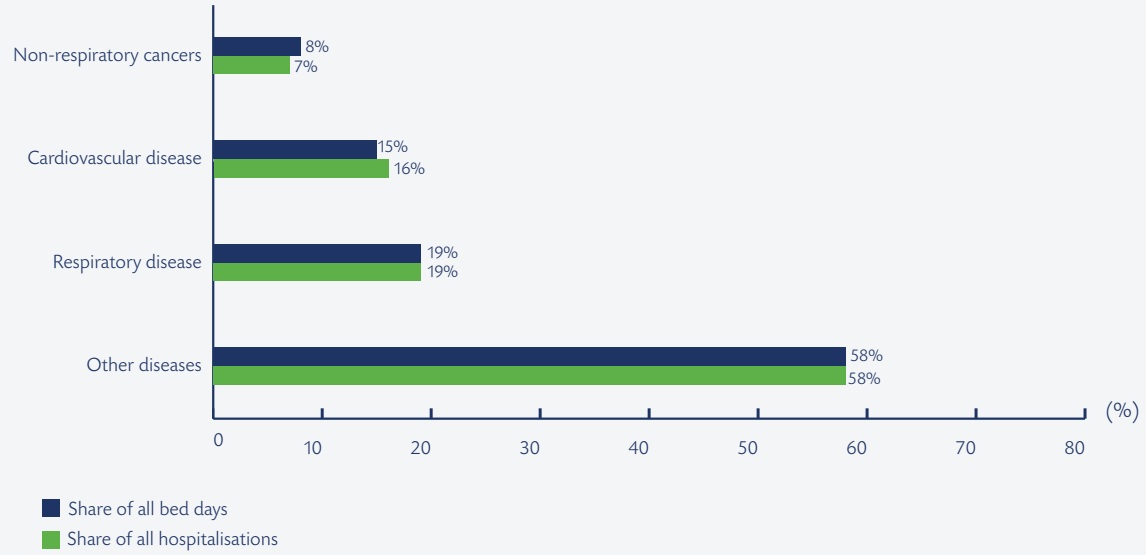
In 2016, the commonest three respiratory causes of inpatient hospitalisations in those aged 65 years and over were COPD (5.8% of all inpatient hospitalisations, 30.5% of all respiratory inpatient hospitalisations in that age group), acute lower respiratory infection (unspecified) (4.4% of all inpatient hospitalisations, 23.0% of all respiratory inpatient hospitalisations in that age group), and pneumonia (3.9% of all inpatient hospitalisations, 20.7% of all respiratory inpatient hospitalisations in that age category), as shown in figure 15.5.

In terms of inpatient bed days used, the commonest were COPD (5.2% of all inpatient bed-days, 27.5% of all respiratory inpatient bed-days), pneumonia (5.0% of all inpatient bed-days, 26.4% of all respiratory inpatient bed-days) and acute lower respiratory infection (unspecified) (4.0% of all inpatient bed-days, 20.7% of all respiratory inpatient bed-days) amongst those aged 65 years and over, as shown in figure 15.5.

Lung cancer (4.6%) and pneumonitis due to solids and liquids (3.8 %) were the fourth and fifth most common cause of respiratory inpatient hospitalisations in this age group as shown in figure 15.5.

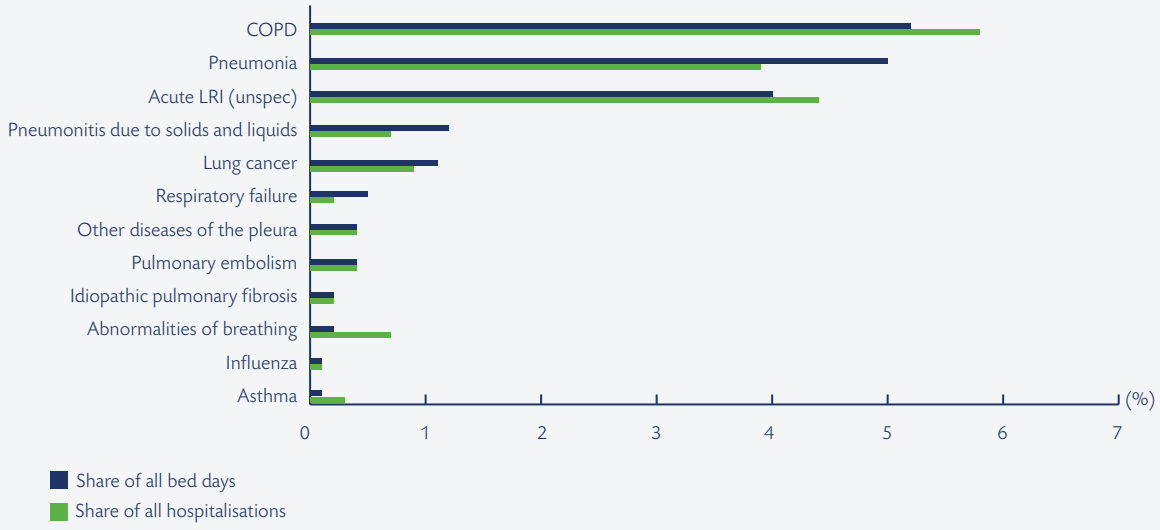
In 2016, those aged 65 years and older accounted for inpatient hospitalisations for each of the above five conditions as follows: COPD (75%); acute lower respiratory infection (unspecified) (56%); pneumonia (62%), lung cancer (67%) and pneumonitis due to solids and liquids (77%). These conditions are discussed in greater detail in their relevant chapters with data not just for 2016 but also trend date over the years 2009-2016. They show a rising trend for all conditions except lung cancer. The trend was most marked for pneumonitis due to solids and liquids.

**Figure 15.4. Percentage of inpatient hospitalisations and bed days by disease group, 2016 (age 65 years and older)**




*Source: HIPE 2016. All hospitals reporting data to HIPE*

**Figure 15.5. Percentage of inpatient hospitalisations and bed days by respiratory condition, 2016 (age 65 years and older)**




*Source HIPE 2016. All hospitals reporting data to HIPE*

**Table 15.4. Inpatient hospitalisations and bed days, 2016 (65 years and older)**

| | Hospitalisations | | Bed days | |
|---|---|---|---|---|
| | Number | Share of all hospitalisations | Number | Share of all bed days |
| All causes | 204,882 | | 1,946,040 | |
| Respiratory disease | 39,143 | 19.1% | 370,920 | 19.1% |
| Cardiovascular disease | 32,920 | 16.1% | 297,717 | 15.3% |
| Non-respiratory cancers | 13,867 | 6.8% | 154,822 | 8.0% |
| Other diseases | 118,952 | 58.1% | 1,122,581 | 57.7% |
| **Respiratory disease** | **Number** | **Share of resp hospitalisations** | **Number** | **Share of resp bed days** |
| COPD | 11,948 | 30.5% | 101,842 | 27.5% |
| Acute lower respiratory infection (unspec) | 9,010 | 23.0% | 76,915 | 20.7% |
| Pneumonia | 8,085 | 20.7% | 97,966 | 26.4% |
| Lung cancer | 1,783 | 4.6% | 21,289 | 5.7% |
| Pneumonitis due to solids and liquids | 1,489 | 3.8% | 24,079 | 6.5% |
| Abnormalities of breathing | 1,470 | 3.8% | 3,779 | 1.0% |
| Other diseases of the pleura | 784 | 2.0% | 8,701 | 2.3% |
| Pulmonary embolism | 725 | 1.9% | 7,404 | 2.0% |
| Asthma | 543 | 1.4% | 2,459 | 0.7% |
| Respiratory failure | 480 | 1.2% | 8,852 | 2.4% |
| Idiopathic pulmonary fibrosis | 465 | 1.2% | 4,664 | 1.3% |
| Other diseases of URT | 334 | 0.9% | 1,118 | 0.3% |
| Other diseases of the respiratory system | 315 | 0.8% | 1,680 | 0.5% |
| Cough | 314 | 0.8% | 510 | 0.1% |
| Sleep apnoea | 314 | 0.8% | 424 | 0.1% |
| Acute URTI | 306 | 0.8% | 1,147 | 0.3% |
| Influenza | 279 | 0.7% | 2,604 | 0.7% |
| Pulmonary vascular diseases (excl embolism) | 142 | 0.4% | 1,268 | 0.3% |
| Acute bronchitis | 64 | 0.2% | 230 | 0.1% |
| Postprocedural respiratory disorders, not elsewhere classified | 64 | 0.2% | 690 | 0.2% |
| Lung diseases due to external agents (excl pneumonitis due to solids & liquids) | 44 | 0.1% | 406 | 0.1% |
| Mesothelioma | 43 | 0.1% | 594 | 0.2% |
| Suppurative and necrotic conditions of LRT | 41 | 0.1% | 562 | 0.2% |
| Tuberculosis | 36 | 0.1% | 953 | 0.3% |
| Sarcoidosis | 30 | 0.1% | 266 | 0.1% |
| Other respiratory diseases principally affecting the interstitium (excl J81 & J84) | 17 | 0.0% | 448 | 0.1% |
| Acute bronchiolitis | 15 | 0.0% | 49 | 0.0% |
| Cystic fibrosis | <5 | 0.0% | 21 | 0.0% |

*Source: HIPE 2016. All hospitals reporting data to HIPE*

In summary, respiratory disease was the cause of 19% of inpatient hospitalisations in those aged 65 years and older hospitalised in 2016, and was the cause of an equal proportion of bed-days. Of those hospitalised for respiratory problems in 2016, 43% were aged 65 years and older. These episodes accounted for 64.4% of inpatients respiratory beds. The majority (84.8%) were admitted as emergencies, most commonly for pneumonia, COPD and acute lower respiratory infection.

## Socio-economic analysis

In the TILDA study, 5.7% of those aged 65-74 years and 5.1% of those aged 75 years and older who had no education or primary education only reported having chronic lung diseases compared with 3.2% and 3.7% respectively of those with 3rd level or higher education[4]. This gradient also held true for lowest to highest wealth quartiles with adults in the lowest wealth quartile twice as likely to report chronic lung disease compared with those in the wealthiest quartile[4]. Data on specific respiratory disease, if available, is included in relevant disease chapters.

## International Comparisons

These have been discussed where available in each of the specific chapters.

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# Future Direction

16

Respiratory disease is one of the major health challenges of the 21st century for Ireland. This report outlines the size and the burden of respiratory disease using available national data. It is an under-estimate of that size and burden.

In recent years national strategies for cancer and cardiovascular disease have led to significant improvements in outcomes. For instance, the number of people dying from cardiovascular disease between 2007 and 2016 fell by 7.5%. The number of people dying from respiratory disease over the same period increased by 14.6%. It is time that respiratory disease was put on an equitable footing. The authors hope that the data within this document will be a valuable resource for policy makers, researchers, health care providers and professionals, and the commercial health care sector, as well as patients and patient groups.

## Awareness and advocacy

Every breath is as important for life as each heartbeat. Yet, despite the overwhelming burden of respiratory disease in Ireland, there is still a general lack of understanding about the range and impact of respiratory disease.

The onset of many chronic respiratory diseases is slow and insidious unlike the often sudden onset of cardiovascular disease such as heart attacks or strokes. Persistent breathlessness and persistent cough are not normal. Greater public awareness of signs and symptoms of respiratory disease and the importance of presenting earlier to a primary care physician are crucial for improving quality of life and outcomes, and reducing impact on health services. Many patients with COPD currently remain undiagnosed. Additionally, our report highlights that over a quarter of lung cancer patients are diagnosed following an emergency hospital visit. National campaigns to raise awareness of symptoms of lung disease need to be accompanied by improved diagnostic and treatment capacity.

## Prevention

There are a range of preventable factors that cause and worsen lung disease. Some, such as smoking, air pollution, obesity and lack of exercise, are shared between cancer, lung and heart disease. Social inequality is linked to a higher proportion of deaths from respiratory disease than any other disease group. Therefore a focus on prevention and improved diagnosis and management of respiratory disease amongst marginalised and vulnerable groups should be a key consideration in the government's commitment to reducing inequality.

We commend Ireland's leadership in implementing anti-tobacco legislation, however more needs to be done, especially in view of the continuing challenge posed by the tobacco industry. Smoking remains the most common cause of the two biggest lung disease killers (COPD and lung cancer), and a factor in worsening many other conditions. Public health strategies should continue to target reductions in tobacco smoking, particularly in disadvantaged groups, while limiting the numbers of children and young adults who begin to smoke.

Air quality, both indoor and outdoor, is a major respiratory health issue. In line with WHO standards, it should be an integral part of cross government transport, industrial and energy policies.

Factors in childhood such as obesity and poor nutrition, exposure to smoke (including during pregnancy), poor social and living conditions and inadequately managed respiratory conditions, all impact on the child and their respiratory health as adults.

With respect to protection against respiratory disease, 95% coverage for childhood vaccinations in all populations should be achieved. All antenatal mothers should be offered both pertussis and influenza vaccination. All those aged over 65 years should be offered both pneumococcal and annual influenza vaccination. Patients with chronic respiratory disease (i.e. attending health services) should be offered both pneumococcal and annual influenza vaccination.

We support strengthening immunisation programmes to maximise uptake of vaccination in children, the elderly and other at risk groups, which would help to further reduce the incidence of preventable respiratory infections in Ireland.

Currently, the only population based screening programme for respiratory disease in Ireland is for cystic fibrosis. The authors of the recent NELSON trial which examined screening for lung cancer recommend that EU countries work together to develop lung cancer screening guidelines in order to help member states implement a comprehensive screening programme for high risk people. Internationally, work is ongoing to identify screening approaches to detect COPD. WHO recommendations exist for screening for alpha-1 antitrypsin deficiency.

## Clinical care

This report highlights the burden of respiratory disease on Irish hospitals. For this to be addressed, the focus needs to move to supporting patient centred care at primary care level, with a multidisciplinary approach, harnessing the expertise of the allied health professionals. Primary care physicians need access to pulmonary function tests and improved access to community outreach, pulmonary rehabilitation and timely access to specialist respiratory expertise when required. This also applies in the acute setting.

Over the past decade, progress has been made in establishing National Clinical Programmes for some respiratory diseases, developing models of care, adapting international guidelines, improving integrated care and supporting patient self care. These now need to be implemented in a structured systematic way, with set targets and actions.

New approaches to clinical care are needed in order to ensure we can provide for future needs and deliver genuine patient centred care to all sections of society including the vulnerable and marginalised.

We hope that Irish policy makers will enhance clinical care for patients with respiratory disease through the provision of adequate clinical facilities and personnel for investigating and treating those with respiratory disease.

## Research

We need research focused on people and patients to identify the barriers in terms of diagnosis, self care and access to health services. We also need research focused on quality of life outcomes as well as evaluation focused on implementation of interventions.

We urge increased support for respiratory research to develop programmes, tools and strategies to better prevent and treat respiratory diseases and to combat antibiotic resistance.

## Data: Surveillance, monitoring & evaluation

**"No data, No Problem, No Problem, No action."**

*– Michael Marmot*

From a data perspective we have highlighted the huge gaps in information that currently exist, particularly in primary care. Throughout this document attention was drawn to the lack of national data for many diseases on prevalence, primary care data, respiratory aids and appliances and data from the private sector.

Nevertheless, we have sufficient, good quality data to identify areas for action and targets. The burden on our hospitals is clearly outlined in this report, thanks to easily accessible data. However the burden on the totality of health services and, more importantly, on individuals, families, society and our economy is much greater.

Formulation of optimal policy demands accurate and up-to-date information. This is essential as a basis for improvements for prevention and care, monitoring progress and in order to estimate the magnitude of specific problems, determine the distribution of illness, portray the natural history of a disease, generate hypotheses, stimulate research, evaluate control measures, monitor changes and facilitate planning. We encourage the standardised recording of incidence, prevalence, severity and management of respiratory diseases across primary care, public and private hospital sectors to enable development of better informed national strategies.

Surveillance data on all respiratory disease, to include primary care, non inpatient care, diagnostics, therapeutic interventions, for the total population would contribute greatly to improving care of patients and saving lives.

## New and re-emerging challenges

We encourage vigilance in relation to new and emerging threats such as worsening antibiotic resistance in bacterial infections and multidrug-resistant tuberculosis.

The increase in the number of people living with non communicable diseases (NCDs), is also a challenge for the sustainability of the health system as currently configured.

## Conclusion

The enjoyment of the highest attainable standard of health is a fundamental human right according to the World Health Organisation.

The increased awareness of respiratory disease and its symptoms, along with the provision of adequate clinical facilities for investigating and treating those with respiratory disease (based on improved data) the quality of care for those with respiratory disease and comorbidities will achieve this fundamental human right for the Irish population.

# Appendix

A

## ICD-10 Codes

The 'core' disease classification of ICD-10-AM is the three character code, which is the mandatory level of coding for international reporting to the World Health Organisation (WHO) for general international comparisons. This core set of codes has been expanded to four and five character codes so that important specific disease entities can be identified, while also maintaining the ability to present data in broad groups to enable useful and understandable information to be obtained. Its structure is designed principally to facilitate epidemiological analysis.

**Table 1. Eurostat *65* Cause of Death Shortlist (+9) accessed via PHIS relevant for Respiratory Disease used in body of report**

| Description | ICD-10 Codes |
|---|---|
| All Causes of Death | A00 - Y89 |
| Neoplasms | C00 - D48 |
| Diseases of the Cardiovascular System | I00 - I99 |
| Diseases of the Respiratory System | J00 - J99 |
| Influenza | J10 - J11 |
| Pneumonia | J12 - J18 |
| Chronic Lower Respiratory Disease | J40 - J47 |
| Asthma | J45 - J46 |
| Other Diseases of the Respiratory System | Remainder of J00 - J99 |
| Cancer of the Trachea, Bronchus and Lung | C33, C34 |

**Table 2. ICD-10 codes used for hospitalisation data for respiratory conditions, adapted from the British Lung Foundation.**

| Classification of respiratory condition | ICD-10code |
|---|---|
| Abnormalities of breathing | R06 |
| Acute bronchiolitis | J21 |
| Acute bronchitis | J20 |
| Acute lower respiratory infection (unspecified) | J22 |
| Acute URTI | J00, J01, J02, J03, J04, J05, J06 |
| Asthma | J45, J46 |
| COPD | J40, J41, J42, J43, J44, J47 |
| Cough | R05 |
| Cystic fibrosis | E84, P75 |
| Idiopathic pulmonary fibrosis | J84 |
| Influenza | J09, J10, J11 |
| Lung cancer | C33, C34 |
| Lung diseases due to external agents | J60, J61, J62, J63, J64, J66, J67, J68, J70 |
| Mesothelioma | C45 |
| Other diseases of the pleura | J90, J91, J92, J93, J94 |
| Other diseases of the respiratory system | J98, J99 |
| Other diseases of URT | J30, J31, J32, J33, J34, J35, J36, J37, J38, J39 |
| Other respiratory diseases principally affecting the interstitium | J80, J82 |
| Perinatal and congenital respiratory conditions | P22, P23, P24, P25, P26, P27, P28, Q32, Q33, Q34 |
| Pneumonia | J12, J13, J14, J15, J16, J17, J18 |
| Pneumonitis due to solids and liquids | J69 |
| Postprocedural respiratory disorders, not else classified | J95 |
| Pulmonary embolism | I26 |
| Pulmonary vascular diseases (other than pul embolism) | J81, I27, I28 |
| Respiratory failure | J96 |
| Sarcoidosis | D86 |
| Sleep apnoea | G47.3 |
| Suppurative and necrotic conditions of the lower respiratory tract | J85, J86 |
| Tuberculosis | A15, A16, B90, J65 |

## Abbreviations

**AATD:** Alpha-1 Antitrypsin Deficiency

**AMAU:** Acute Medical Assessment Unit

**ASIR:** Age Specific Incidence Rate per 100,000 population

**BCG:** Bacille Calmette Guerin vaccine

**BDU:** Bed Days Used

**CF:** Cystic Fibrosis

**CI:** Confidence Interval

**CIDR:** Computerised Infectious Disease Reporting

**CIR:** Crude Incidence Rate

**COPD:** Chronic Obstructive Pulmonary Disease

**CSO:** Central Statistics Office

**CTD:** Connective Tissue Disease

**D3P3Polio3T3:** Diphtheria (3 doses), Pertussis (3 doses), Polio (3 doses), Tetanus (3 doses) vaccines

**DALY:** Disability-Adjusted Life-Year

**DPS:** Payment Scheme

**DRG:** Diagnostic Related Group (AR)

**DVT:** Deep Venous Thrombosis (DVT)

**EARSS:** European Antimicrobial Surveillance System

**ED:** Emergency Department

**ERS:** European Respiratory Society

**EU:** European Union

**GMS:** General Medical Services

**Hib3:** Haemophilus influenza type b (3 doses) vaccine

**HIPE:** Hospital Inpatient Enquiry

**HPO:** Health Purchasing Office

**HPSC:** Health Protection Surveillance Centre

**ICD:** International Classifications of Disease

**ICS:** Inhaled Corticosteroids

**ILD:** Interstitial Lung Disease

**IPD:** Invasive Pneumococcal Disease

**ITS:** Irish Thoracic Society

**LABA:** Long Acting B2 agonist

**LAMA:** Long Acting Muscarinic antagonist

**LOS:** Length of Stay

**LTOT:** Long Term Oxygen Treatment

**MersCoV:** Middle East Respiratory Syndrome due to Corona Virus

**MMR1:** Measles, Mumps and Rubella vaccine (1 dose)

**MOH:** Medical Officer of Health

**NHQRS:** National Healthcare Quality Reporting System

**NIV:** Non Invasive Ventilation

**NOCA:** National Office for Clinical Audit

**OECD:** Organisation for Economic Co-operation and Development

**OOHs:** Out Of Hours

**OPD:** Out Patients Department

**PCRS:** Primary Care Re-imbursement Scheme

**PE:** Pulmonary Embolus

**PHIS:** Public Health Information System

**QALY:** Quality Adjusted Life Year

**RSV:** Respiratory Syncytial Virus

**SABA:** Short Acting B2 agonist

**SAMA:** Short Acting Muscarinic antagonist

**SARS:** Severe Acute Respiratory Syndrome

**SMR:** Standardised Mortality Rate

**TB:** Tuberculosis

**WHO:** World Health Organisation

**YLD:** Years Lived with Disability

**YPLL:** Years of Potential Life Lost

## Glossary

**Aetiology:** The underlying origin or cause(s) of a disease or disorder.

**Age-standardised rate:** The age-standardised rate for a particular disease or condition is calculated by applying the country's age-specific rates to a standard population. Age standardisation adjusts disease rates to the level they would be if the age distribution of the population was the same either across time, across ethnic or other groups or countries. Age standardisation ensures that comparisons are comparing like with like: using non-standardised rates can make it look like disease rates are different, when in fact the difference lies in what proportion of the population are in the age-group who have the highest or lowest rates of the disease. This enables comparisons to be made between countries with different age-structures and time-periods.

**Alveoli:** Tiny sacs in the lungs at the furthest end of the airways, where exchange of oxygen and carbon dioxide between air and blood takes place.

**Apnoea:** Absence of breathing. In the context of sleep apnoea brief periods of apnoea occur during sleep, caused either by an anatomical obstruction in the upper airway or by a failure of respiratory drive.

**Cohort study:** A longitudinal study in which a population group sharing a common characteristic is followed over time to measure a particular outcome.

**Co-morbidity:** Conditions that exist alongside another condition, either independently or connectedly.

**DALY (disability-adjusted life-year):** DALYs represent "the sum of the Years of Life Lost due to premature mortality in the population and the Years Lost due to Disability for incident cases of the health condition" (WHO). DALYs are used to calculate the total disease burden on society.

**Dyspnoea:** The subjective sensation of difficulty in breathing.

**Eosinophils, eosinophilia:** A type of white blood cell involved in allergy and some cases of asthma; eosinophilia is the presence of an abnormally large number of eosinophils in the blood or body tissues (e.g. in the lungs).

**Herd immunity:** The effect whereby vaccination of a significant proportion of individuals in a population has a protective effect on even non-vaccinated individuals because they are less likely to come into contact with an infected person.

**Idiopathic:** A disease that occurs without a known cause.

**Incidence:** The incidence of a disease measures the number or rate of new cases of disease occurring in the population, over a specified period such as 12 months. Annual incidence is calculated as the number of new cases of a disease occurring in 12 months divided by the population who were disease-free at the beginning of the period.

**Longitudinal study:** A study that tracks the progress of individuals over time.

**Median:** value or quantity lying at the midpoint of a frequency distribution of observed values or quantities, such that there is an equal probability of falling above or below it.

**Obstructive disease:** A lung disease in which air flow is limited due to damage to the airways or excessive secretions; asthma and chronic obstructive pulmonary disease (COPD) are obstructive lung diseases.

**Oedema:** An abnormal accumulation of fluid in tissue.

**Particulate matter:** A mixture of solid and liquid particles present as pollution in the atmosphere, resulting from processes such as combustion or friction; they are sub-classified by size in µm, e.g. PM10, PM2.5.

**Pertussis:** Also known as whooping cough; an infectious disease caused by the bacterium Bordetella pertussis. Vaccination against the disease is available.

**Phenotypes:** Observable characteristics (physical, biochemical, etc.) produced by the interaction of genetics and environment.

**Prevalence:** The prevalence of a disease measures the number of cases of existing disease in the population at a given time, or over a period such as the past 12 months. It is calculated as the number of people with the disease divided by the total population, and is usually expressed as a percentage.

**Proteases:** Enzymes that catalyse the breakdown of proteins by hydrolysing the bonds between amino acids.

**QALY (quality-adjusted life-year):** A similar concept to DALY, but expressed in terms of quality of life gained, rather than lost to disease or disability.

**Restrictive disease:** A respiratory disease in which the lungs cannot be expanded normally, due either to disease of the lungs themselves (e.g. interstitial lung diseases) or of the chest wall (e.g. chest deformity or neuromuscular diseases).

**Surfactant:** A mixture of protein and lipid that reduces the surface tension of fluids in the lung and thereby prevents the collapse of the airways.

**Thrombosis:** Clotting of blood within a blood vessel, potentially causing tissue death.

**World Health Organisation (WHO) European Region:** extends from the Atlantic coast to Central Asia. There are two main sources of Europe-wide data on hospital admissions: the WHO-Europe Hospital Morbidity Database (HMDB) and data from the European commission statistical agency, Eurostat.

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