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

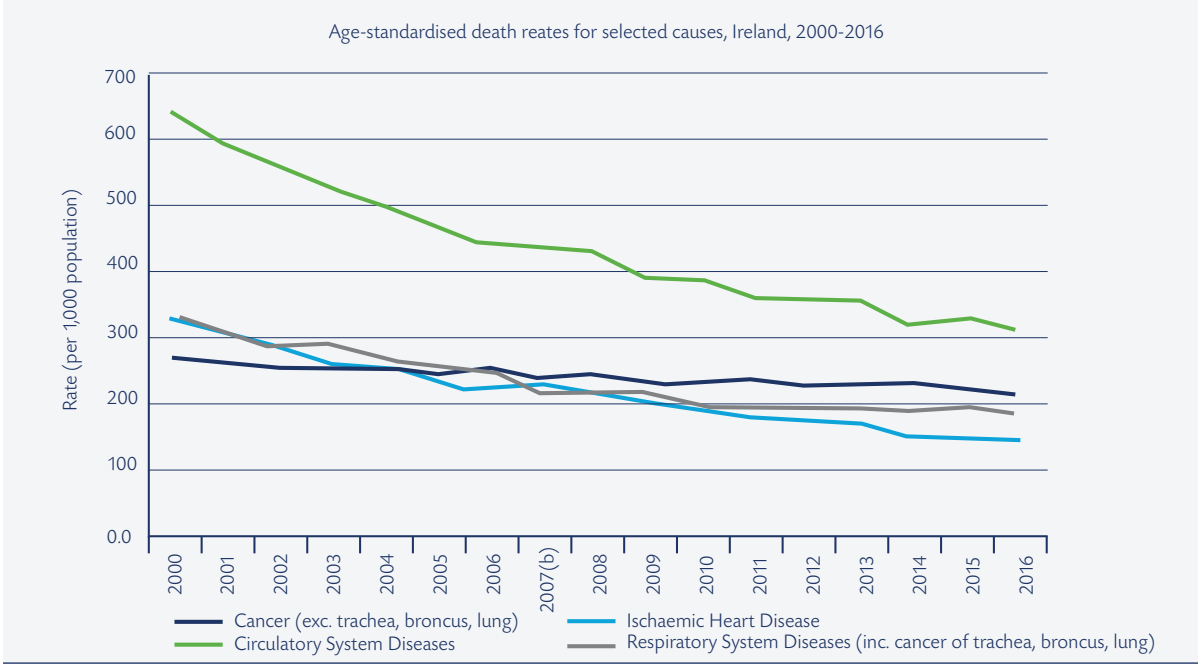
In Ireland the picture for overall all-cause mortality is one of decreasing mortality rates and rising life expectancy. The mortality rate for diseases of the cardiovascular system fell by 28.4% between 2007 and 2016. The cancer (all cancers) mortality rate decreased by 9.9% over the same period. However, 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

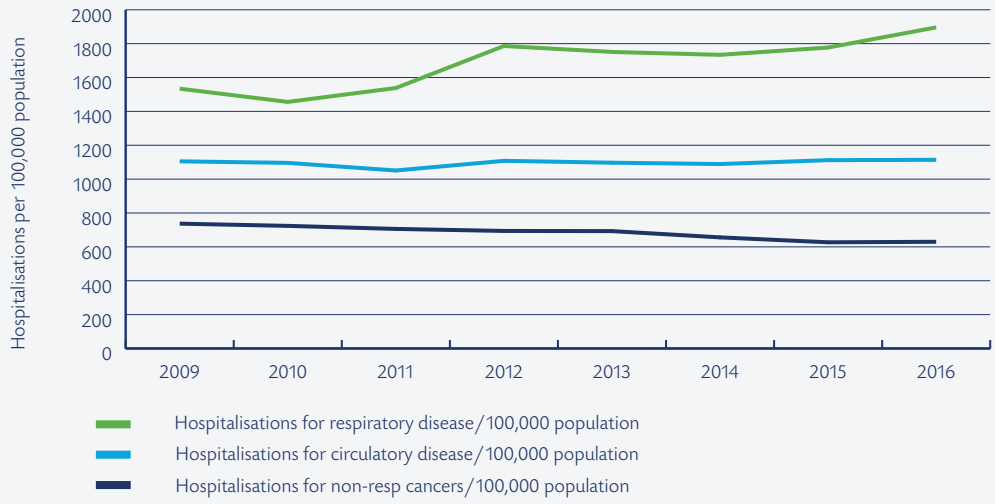
Figure 2.3 presents data on the number of inpatient hospitalisations per 100,000 population for three disease groups - respiratory hospitalisations, cardiovascular hospitalisations, and non-respiratory cancer hospitalisations - between 2009 and 2016. Figure 2.4 shows data on the proportion of inpatient 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.

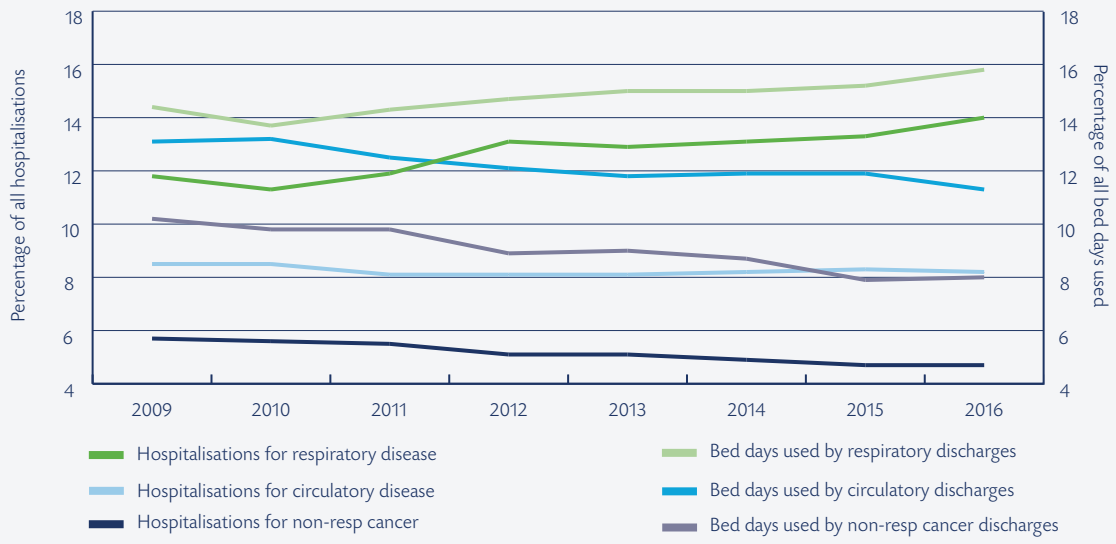
When respiratory diseases are looked at in greater detail (figure 2.6 and table 2.5), chronic obstructive pulmonary disease (COPD), acute lower respiratory infection (unspecified) and pneumonia accounted for the highest proportion of respiratory hospitalisations (15.5%, 14.8% and 11.7% respectively), 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



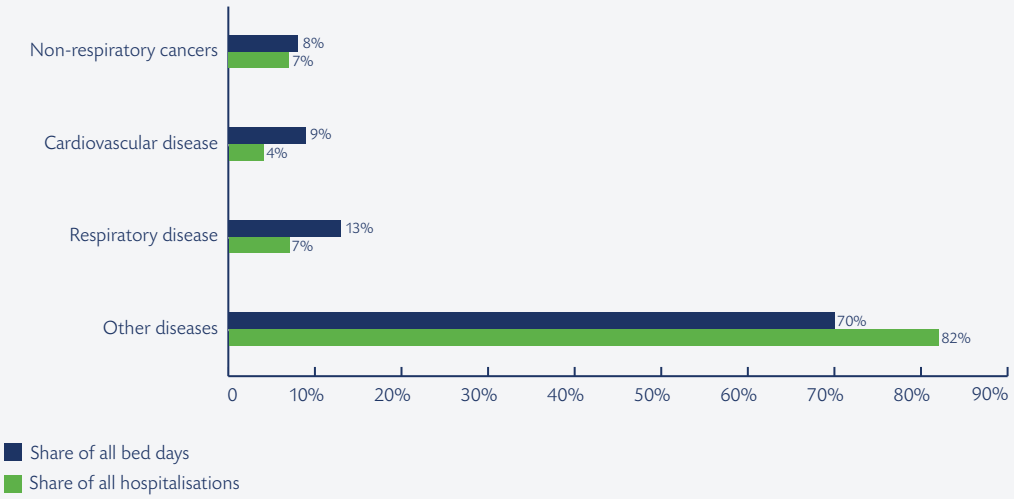
Source: HIPE 2009-2016 - all hospitals reporting data to HIPE. Census 2011 population estimates used to standardise years 2009-2013; Census 2016 population estimates used for years 2014-2016.

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



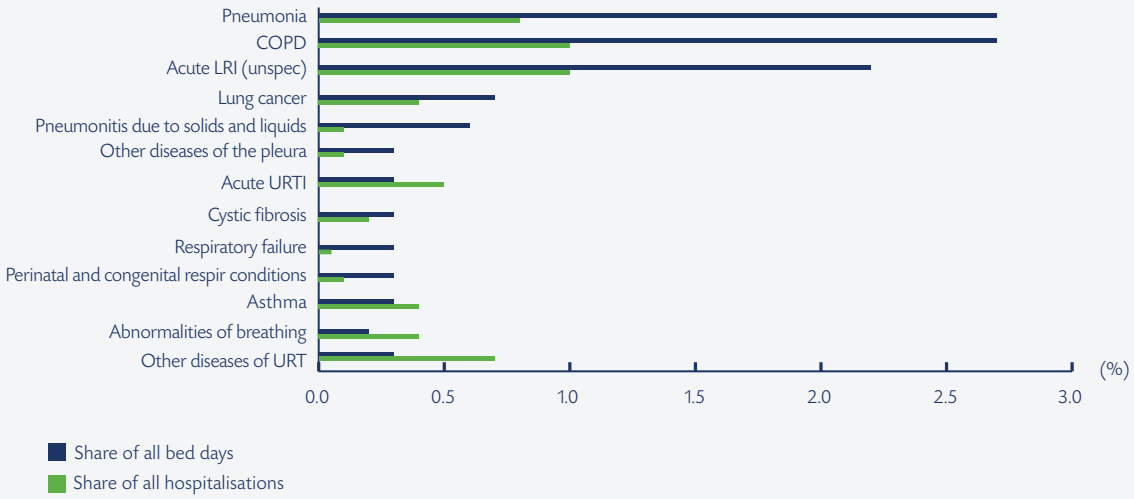
Source: HIPE 2009-2016 - all hospitals reporting data to HIPE over the period. Note: Denominator includes all inpatient hospitalisations (elective, emergency, maternity and newborn). See Appendix for ICD-10 codes included in the creation of disease groups.

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)



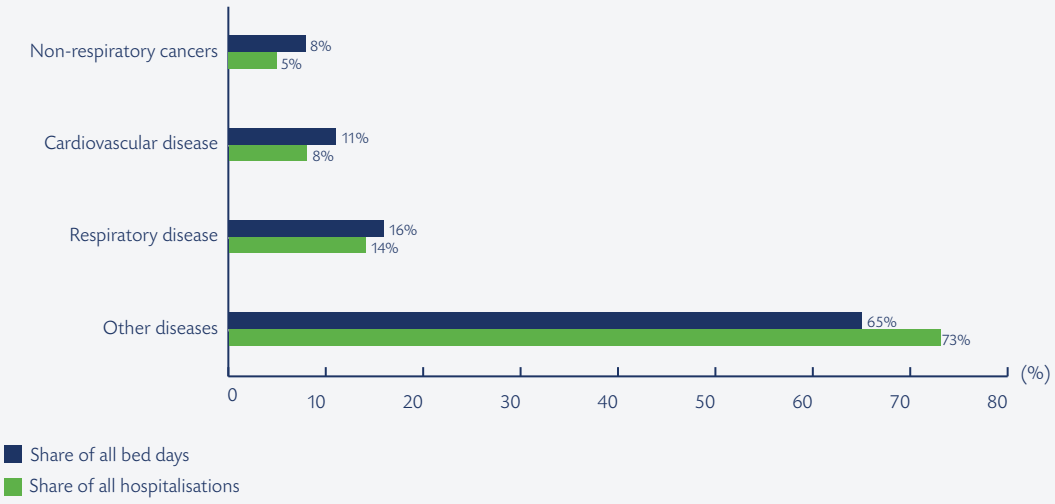
Source: HIPE 2016 - all hospitals reporting data to HIPE

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%

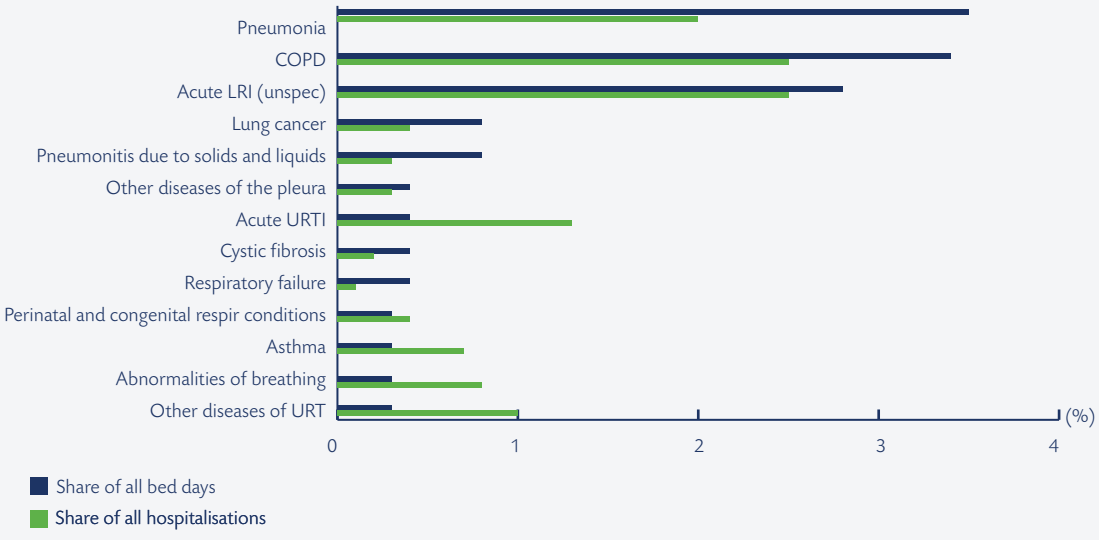
Source: HIPE 2016 - all hospitals reporting data to HIPE.

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

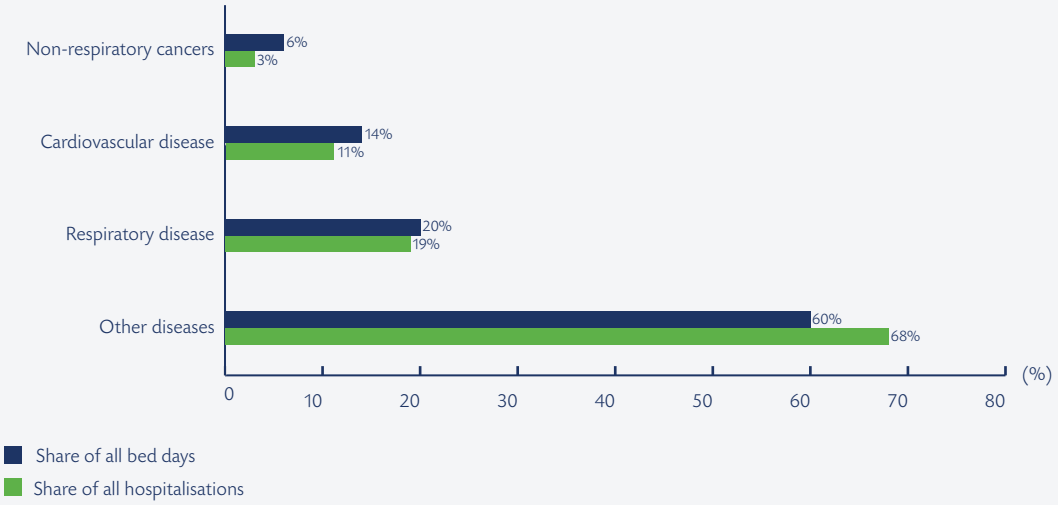
18.8% of deaths in 2016 in both males and females were due to respiratory disease. The respiratory cause of death varied by gender. In males, 6.6% of deaths were due to lung cancer, followed by chronic lower respiratory disease at 5.6% and pneumonia at 2.9%. For females the order was the same although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

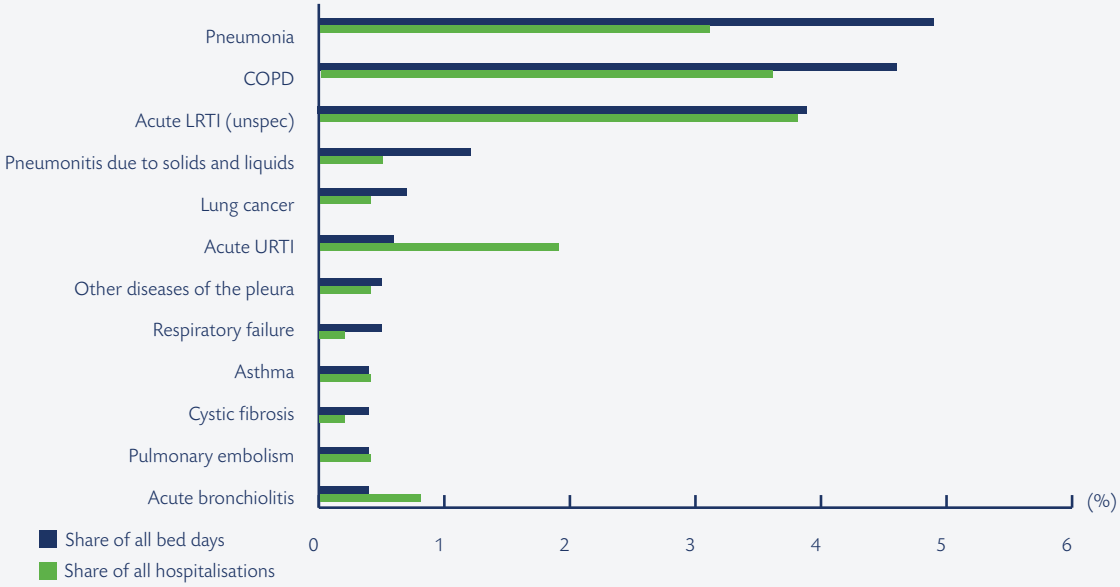
Overall mortality rates can mask variations between age groups. The majority of deaths from respiratory disease are in people aged 65 years and over. Causes of death for those aged 65 years and over differ from those in younger ages. As evident in figure 2.11, for those aged 0-64 years, in 2016 respiratory 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)



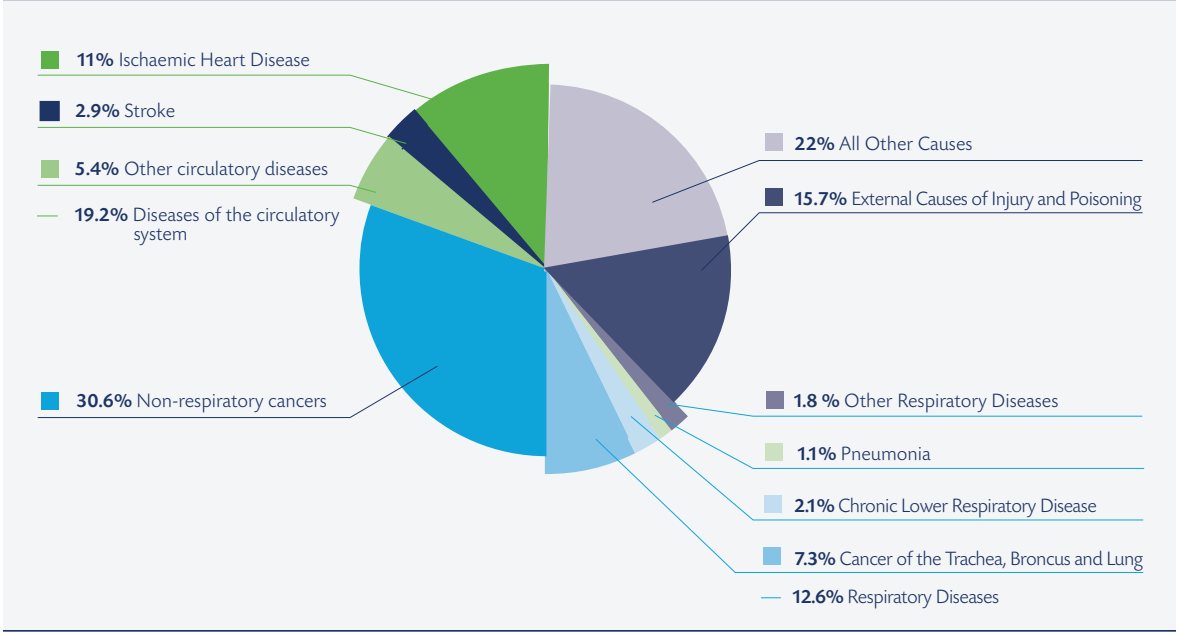
Source: HIPE 2016 - all hospitals reporting data to HIPE

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%

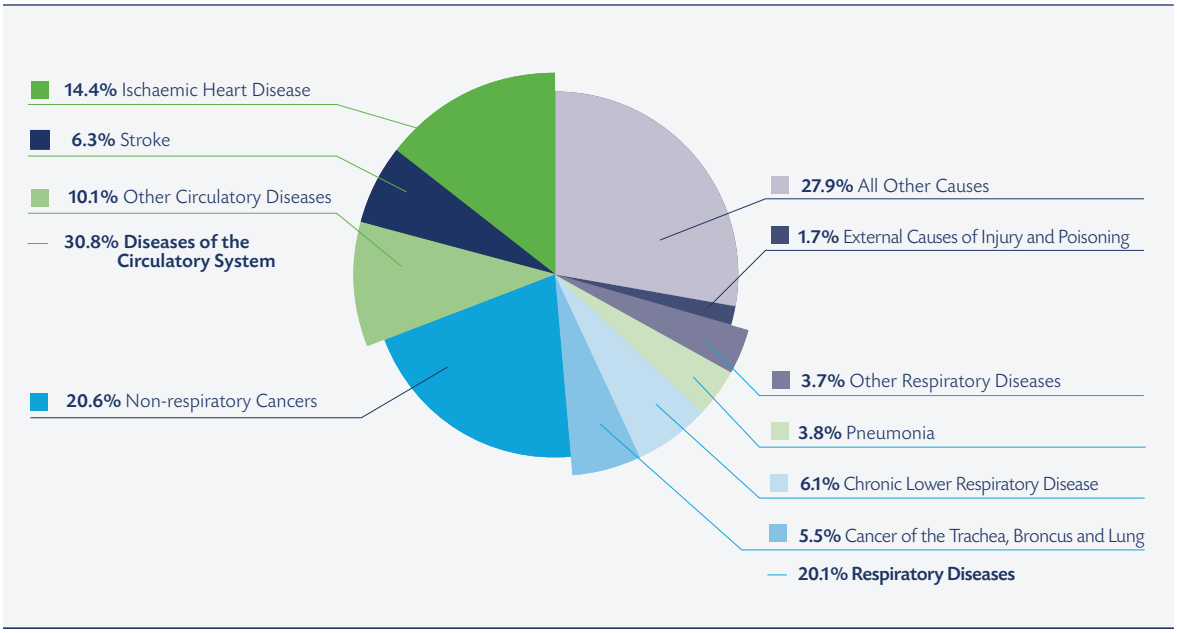
Source: HIPE 2016 - all hospitals reporting data to HIPE

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)

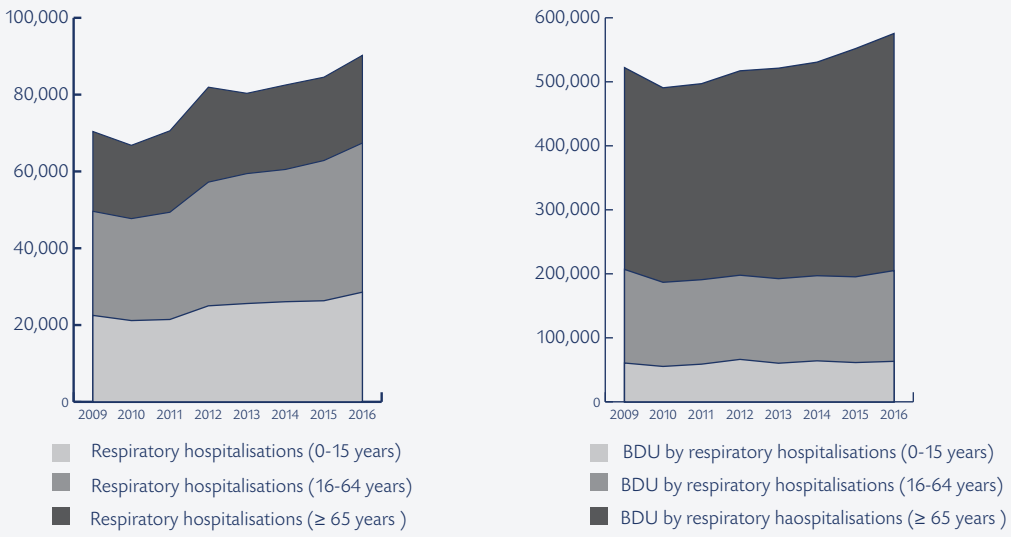
Respiratory inpatient hospitalisations accounted for 26.7% of inpatient hospitalisations and 21.7% of inpatient bed days among 0-15 year olds in 2016 (see Chapter 14). The top two respiratory causes of inpatient hospitalisations were acute upper respiratory tract infection (URTI) and acute bronchiolitis 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).

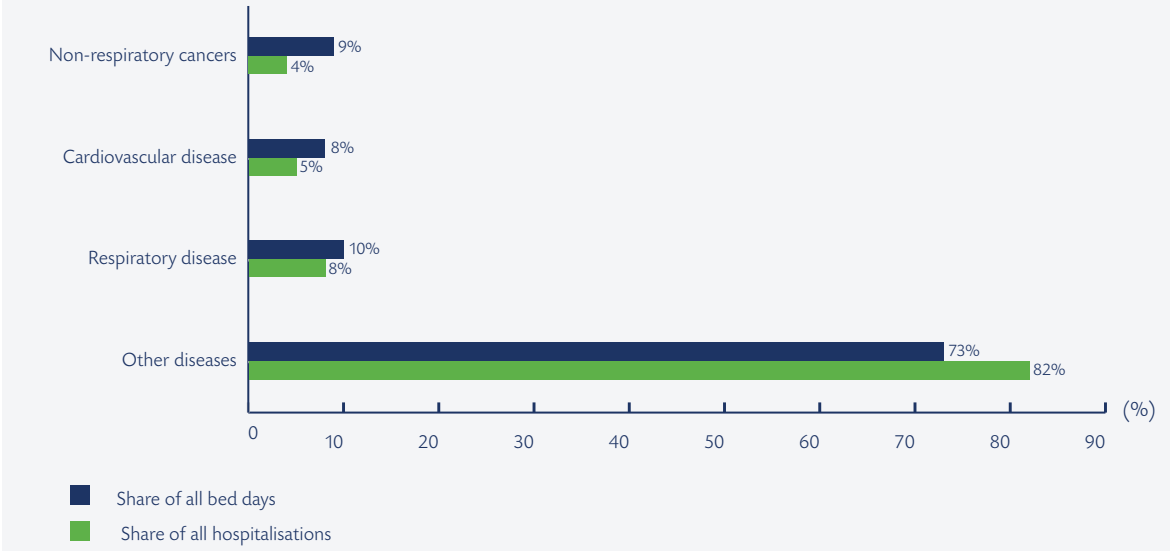
The top three respiratory causes of inpatient hospitalisations were acute lower respiratory infection (unspecified) (1.4%), COPD (1.1%) and pneumonia (1.0%) in the 16-64 year age group. In terms of bed days used the order was reversed i.e. pneumonia (1.8%), COPD (1.6%) and acute lower respiratory infection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

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



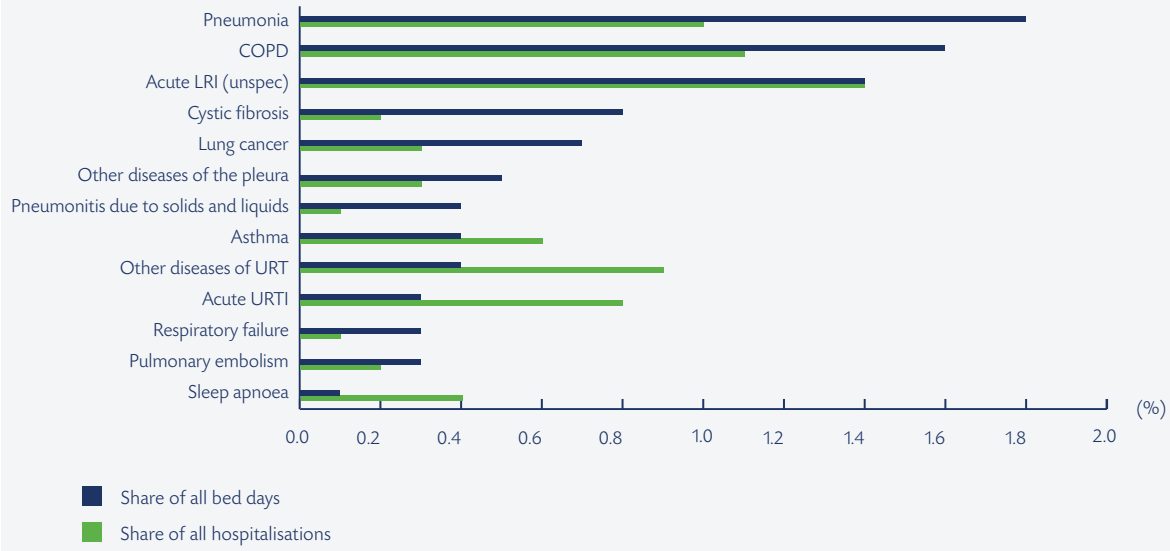
Source: HIPE 2009-2016 - all hospitals reporting data to HIPE

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)



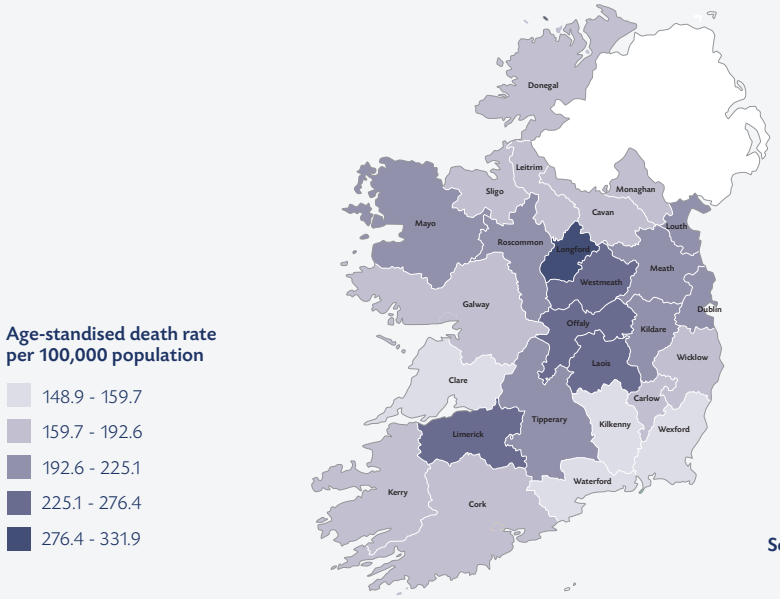
Source: HIPE 2016 - all hospitals reporting data to HIPE

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



Age-standised death rate per 100,000 population

- 148.9 - 159.7
- 159.7 - 192.6
- 192.6 - 225.1
- 225.1 - 276.4
- 276.4 - 331.9

Source: Public Health Information System
Data for 2016 is provisional

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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