

2011 Annual Report



CFRI 

The Cystic Fibrosis Registry of Ireland

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Preface

Ten years have passed since the first person with cystic fibrosis (PWCF) was enrolled onto the Cystic Fibrosis Registry of Ireland. The last five years have been particularly significant in that CFRI has seen a population coverage increase from 61.4% in 2007 to 90.9% in 2011. This high level of coverage is on a par with leading international CF patient registries.

July of 2011 saw the introduction of newborn screening for cystic fibrosis with resulting confirmed diagnosis of 16 individuals. Only 4 of the 16 diagnosed were enrolled onto CFRI during the year. This is not an issue for concern as there is a lag time between diagnosis and enrolment. What we do hope to see in future years is an improvement in the median age of diagnosis from the already good figure of 5.3 months as a direct result of the newborn screening programme.

In our 2010 Annual Report we expressed concern about our low level of funding and the additional demands that will be put on the registry for research data, patient management data and data for national quality improvement programmes. A deficit of €29,002 is stated in this Annual Report and this was addressed early in 2012 by cutting expenses and securing an additional grant from the HSE, charitable donations from industry and a pledge from the Cystic Fibrosis Association of Ireland. Without this assistance the Cystic Fibrosis Registry of Ireland would not have been able to continue in its present structure. Additional funding will provide security for our staff and the required resources to undertake our technological refurbishment programme.

The Registry is very proud of what it has achieved in the past ten years and we look forward to making significant contributions to cystic fibrosis research and quality improvement programmes in the future.

A handwritten signature in dark ink, appearing to read 'Godfrey J Fletcher', with a stylized flourish at the end.

Godfrey J Fletcher
CEO
The Cystic Fibrosis Registry of Ireland

Summary Statistics for 2011

	2009	2010	2011
Coverage of the Republic of Ireland population	89.2%	90.0%	90.9%
Live CFRI enrolees	1,027	1,044	1,073
Median age (years)	18	19	19.6
% Adults (≥18 years)	51.7%	52.7%	52.1%
% Males	57.6%	57.1%	57.0%
Number of patients with genotype information	96.9%	97.3%	96.9%
No of enrolees for whom annual assessment data was collected	865	866	856
No. of deceased CFRI enrolees	17	16	26
Median age at death (years)	25.0	28.1	23.5

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CFRI Data Collection Cystic Fibrosis Centres, 2011

County	Hospital	Consultant	Type of Centre
Cork	Cork University Hospital	Dr Barry Plant & Dr Michael Henry Dr Muireann ní Chroínín & Dr David Mullane	Adult Paediatric
Dublin	Beaumont Hospital	Prof NG McElvaney & Dr Cedric Gunaratnam	Adult
	St Vincent's University Hospital	Prof Charles Gallagher & Dr Ed McKone	Adult
	The Children's University Hospital	Dr Dubhfeasa Slattery & Dr Fiona Healy	Paediatric
	The Adelaide and Meath Hospital Dublin, Incorporating the National Children's Hospital	Dr Peter Greally & Dr Basil Elnazir	Paediatric
	Our Lady's Children's Hospital	Dr Paul McNally & Dr Sheila Javadpour	Paediatric
	Mater Misericordiae University Hospital	Prof Jim Egan	Heart/lung transplant
Galway	University College Hospital Galway	Dr Mary Herzig	Paediatric
		Dr Michael O'Mahony	Adult
Kerry	Kerry General Hospital	Dr Fergus Leahy	Paediatric
Limerick	Midwestern Regional Hospital	Dr Michael J Mahony & Dr Barry Linnane	Paediatric
		Dr Brian Casserly	Adult
Louth	Our Lady of Lourdes Hospital	Dr Amjad Altaf	Paediatric
Mayo	Mayo General Hospital	Dr Michael O'Neill	Paediatric
Sligo	Sligo General Hospital	Dr Rohininath Tummaluru	Paediatric
Waterford	Waterford Regional Hospital	Dr Animitra Das	Paediatric
		Dr Mark Rogan	Adult

CFRI Executive Council 2011

Dr E McKone	Consultant in Respiratory Medicine, St. Vincent's University Hospital, Dublin	Chairperson
Dr C Gunaratnam	Consultant in Respiratory Medicine, Beaumont Hospital, Dublin	Vice Chairperson
Prof C Gallagher	Consultant in Respiratory Medicine, St. Vincent's University Hospital, Dublin	Immediate Past Chairman, ex-officio
Dr M Rowland	UCD School of Medicine, Medical Sciences, Children's Research Centre, Crumlin, Dublin	Secretary
Mr J Coleman	CFAI	Honorary Treasurer
Mr G Fletcher	Chief Executive, CFRI	Council Member (non voting)
Dr P Greally	Consultant in Paediatric Respiratory Medicine, Adelaide and Meath National Children's Hospital, Dublin	Honorary Secretary
Prof NG McElvaney	Professor of Medicine, Royal College of Surgeons in Ireland & Consultant in Respiratory Medicine Beaumont Hospital, Dublin	Council Member
Dr P McNally	Consultant in Paediatric Respiratory Medicine, Our Lady's Children's Hospital, Dublin	Council Member
Dr B Linnane	Consultant in Paediatric Respiratory Medicine, Midwestern Regional Hospital, Limerick	Council Member
Dr B Plant	Consultant in Respiratory Medicine, Cork University Hospital, Cork	Council Member
Dr D Slattery	Consultant in Paediatric Respiratory Medicine, Children's University Hospital, Dublin	Council Member
Mr P Watt	CFAI	Council Member
Mr M Wickham	Non medic council member	Council Member

Glossary

AA	Annual Assessment
ABPA	Allergic Bronchopulmonary Aspergillosis
Adult	Aged 18 years or older (≥ 18)
BAL	Bronchoalveolar lavage
BMI	Body Mass Index
CF	Cystic Fibrosis
CFAI	Cystic Fibrosis Association of Ireland
CFRI	Cystic Fibrosis Registry of Ireland
CRA	Clinical Research Associate
CSO	Central Statistics Office of Ireland
DEXA	Dual Energy X-ray Absorptiometry
DIOS	Distal Intestinal Obstruction Syndrome
FH	Family history
FEV ₁	Forced Expiratory Volume in one second
FVC	Forced expiratory Vital Capacity
GI	Gastrointestinal symptoms
HRB	Health Research Board
H2RA	H2-receptor antagonists
IV	Intravenous
MI	Meconium ileus
MRSA	Methicillin Resistant <i>Staphylococcus aureus</i>
NBS	Newborn screening
NSAID	Non-steroidal anti-inflammatory drug
Paediatric	Aged under 18 years (< 18)
PEP mask	Positive expiratory pressure mask
PPI	Proton pump inhibitors
PWCF	Persons with cystic fibrosis
RESP	Respiratory symptoms

Hospital Abbreviations

AMNCH	The Adelaide and Meath Hospital Dublin, Incorporating the National Children's Hospital, Tallaght, Dublin 24
BMT	Beaumont Hospital, Dublin 9
Cavan GH	Cavan General Hospital, Cavan
CUH	Cork University Hospital, Wilton, Cork
CUHTS	Children's University Hospital, Temple Street, Dublin 1
Mayo GH	Mayo General Hospital, Castlebar
MWRH	Midwestern Regional Hospital, Limerick
MMUH	Mater Misericordiae University Hospital, Dublin 7
OLCH	Our Lady's Children's Hospital, Crumlin, Dublin 12
OLLH	Our Lady of Lourdes Hospital, Drogheda
Sligo GH	Sligo General Hospital, Sligo
SVUH	St Vincent's University Hospital, Dublin 4
UCHG	University College Hospital Galway
WRH	Waterford Regional Hospital, Waterford

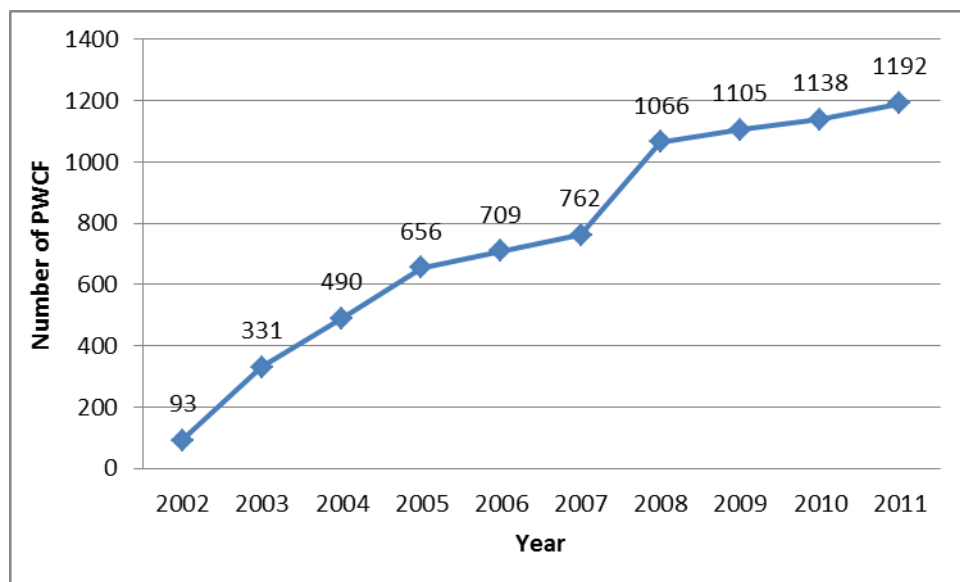
CFRI Enrolment

This is the tenth year of enrolment of persons with CF (PWCF) by the Cystic Fibrosis Registry of Ireland (CFRI). Over 1,192 PWCF in the Republic of Ireland had enrolled by the end of 2011. CFRI staff gather medical information from these individuals' hospital records on an ongoing basis (Figure 1).

During the ten years the CFRI has been in operation, the largest number of PWCF were enrolled in 2008 (n=304). This substantial increase in annual enrolment figures reflected concerted action by the CFRI, its staff and the nursing and medical personnel in the various hospitals to improve coverage of the CF population by the registry. There were 54 PWCF enrolled in 2011, compared with 33 in 2010 and 39 in 2009. As enrolment reaches saturation point, annual increases in the number of new enrollees slows.

Ninety percent (n=1073/1192) of PWCF enrolled by the CFRI over the past ten years were alive on the last day of 2011. There were slightly more males than females and adults than children enrolled on the registry by 2011; 57% were male (n=612) and 52.1% (n=559) were aged 18 years and older.

Figure 1: CFRI enrolment 2002 – 2011



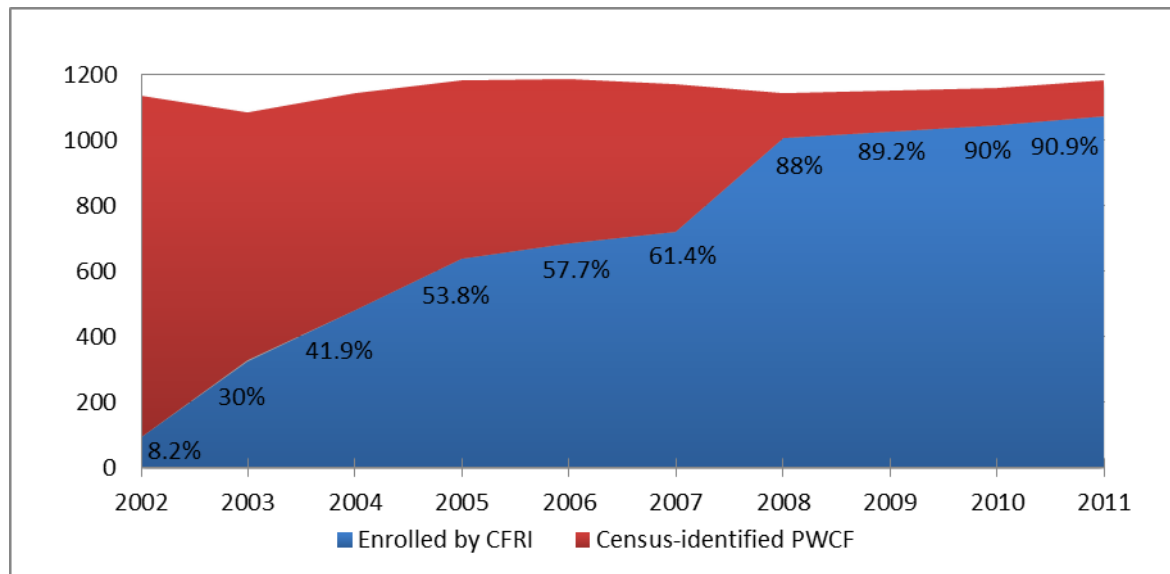
CF Centre & Clinic Census 2011

As a result of the 2011 census of CF centres and clinics in the Republic of Ireland, it was determined that there were 1,181 living PWCF. Annual census figures suggest the Irish CF population is continuing to grow, increasing in the order of approximately ten PWCF per annum (cf. 1,142 in 2008, 1,151 in 2009, and 1,160 in 2010).

As is the case each year, a proportion of PWCF had not yet been invited to consent to share their medical information with the CFRI. On the last day of 2011, the CFRI had yet to enrol 108 of the census-identified CF population of 1,181. Delays in enrolment may be due to difficulties in contacting those individuals in good health who infrequently attend clinics, emigration and new patients arriving in the country. Additionally, in certain circumstances, CFRI staff together with a CF care team may deem it appropriate to delay enrolment to allow newly diagnosed individuals and their parents' time to come to terms with a new CF diagnosis.

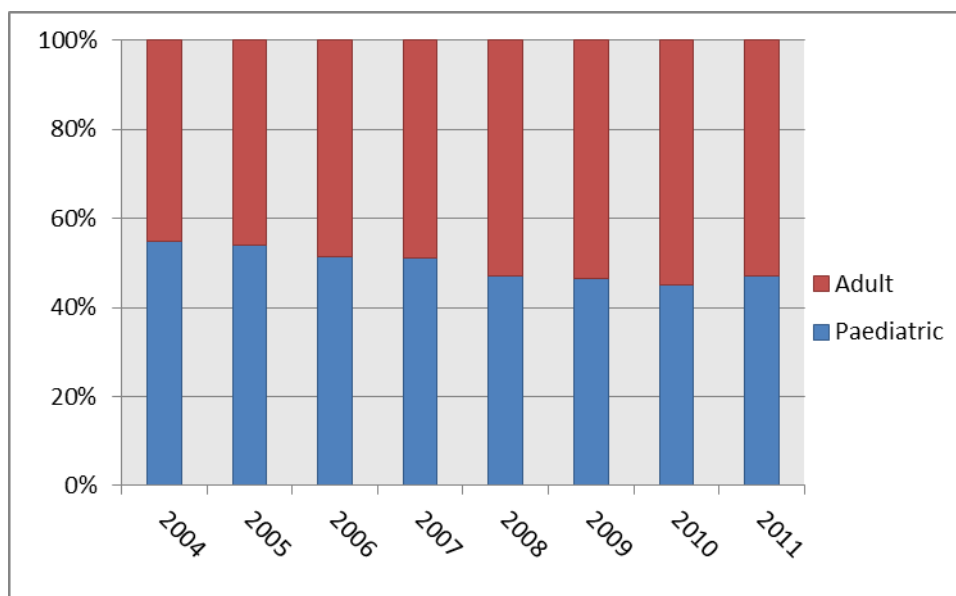
Of the 1,181 PWCF alive at the end of 2011, 1,073 had been enrolled by the CFRI, giving the CFRI a population coverage rate of 90.9% (Figure 2). This is a high level of coverage, and is on a par with leading United Kingdom and United States' CF patient registries.

Figure 2: Live CFRI enrolees and 2011 CF hospital census



Fifty-seven percent of of census-identified PWCF were male, and 52.8% were adult (i.e. aged 18 years or older). Although the proportion of adult PWCF is slightly lower than reported in 2010 (54.5%), it is similar to that reported in 2008 and 2009 (Figure 3). There is now little year-on-year change in the ratio of census estimates of paediatric to adult PWCF.

Figure 3: Ratio of adult to paediatric census-identified PWCF, 2004-2011

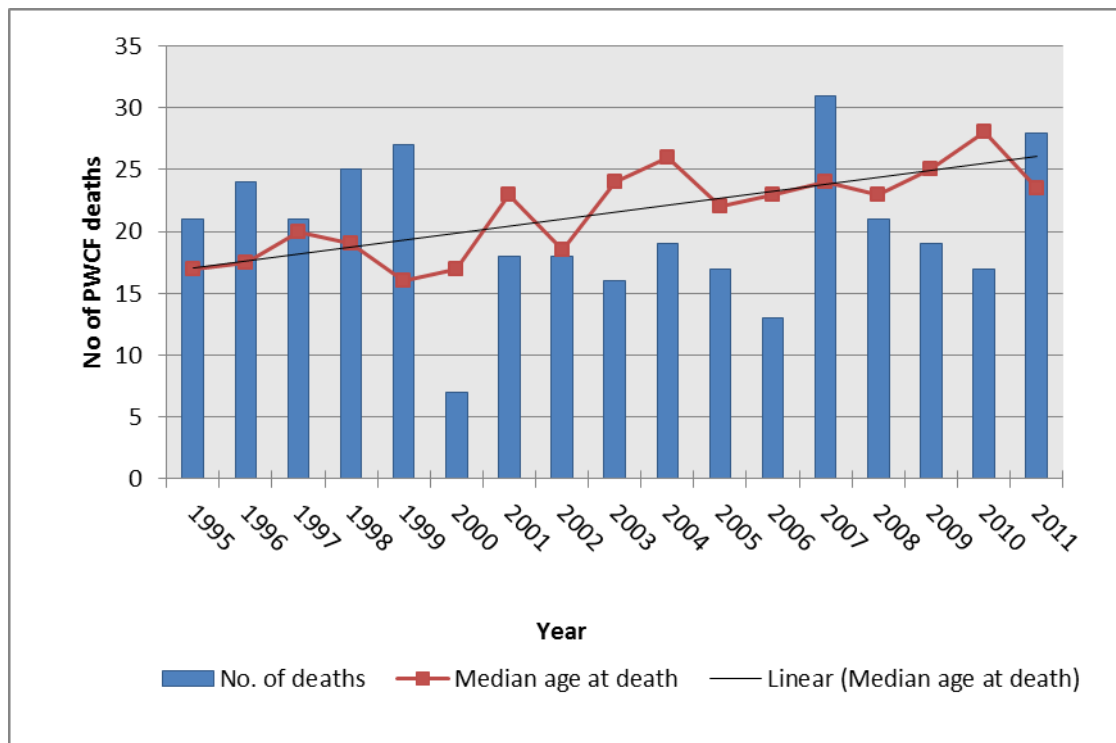


While census estimates of PWCF attending CF specialist centres and clinics are recorded and have been previously reported on here, census information is limited and cannot be used to accurately describe patients opting for shared care between two or more hospitals. As census data does not accurately reflect the frequency or reason for attendance this can lead to inaccuracies in annual PWCF counts at the hospital level.

CF Survival

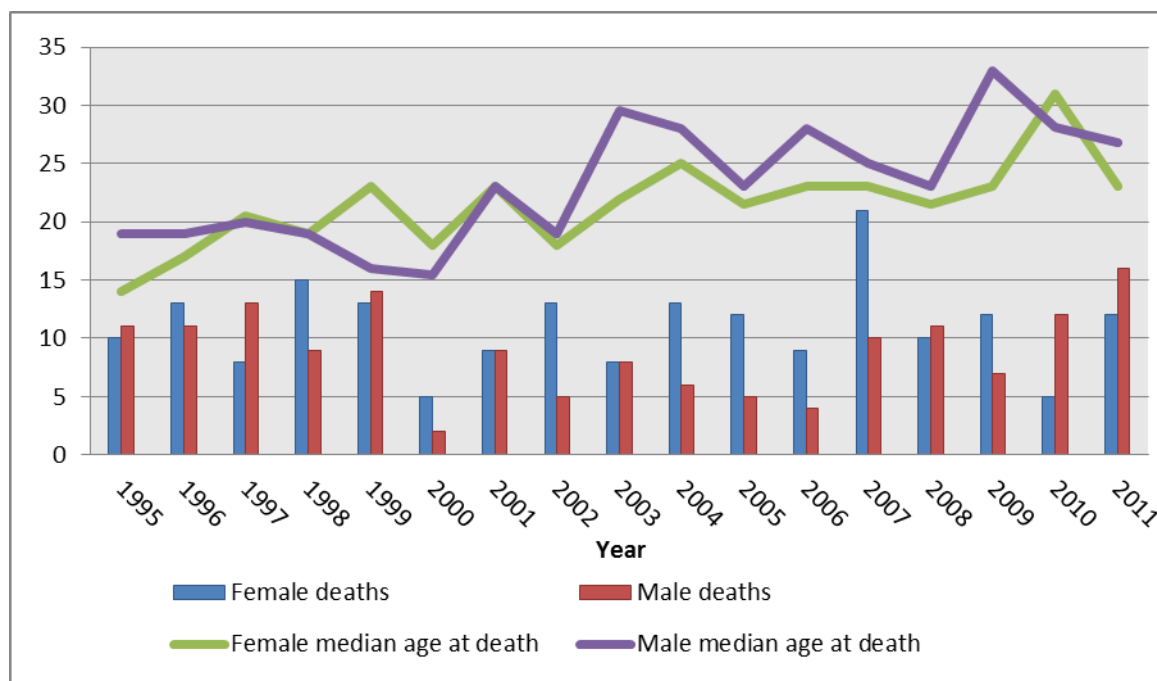
In 2011, 28 PWCF were known to have died (Figure 4); 26 had been enrolled by the CFRI prior to death and the CF Association of Ireland notified the CFRI of deaths in 2 PWCF unknown to the CFRI. Annual fluctuations in PWCF deaths are expected as the actual number of PWCF dying each year is relatively small compared to the number of living PWCF. In 2011, the number of deaths recorded was the largest in some years (cf. 17 deaths in 2010 and 19 in 2009). The last peak in PWCF deaths was observed in 2007 (n=31).

Figure 4: Total number of deaths and median age at death of PWCF, 1995-2011



The 28 PWCF who died in 2011 were aged between 13 and 54 years, with a median (average) age at death of 23.5 years. While similar median values were reported for 2005 (22 years), 2006 (23 years), 2007 (24 years) and 2008 (23 years), the 2011 value marks a decrease from the 2010 median age at death of 28.1 years. Annual fluctuations are not unexpected in a small CF population (approximately

Figure 5: Number of CF deaths and median age at death by gender, 1995-2011

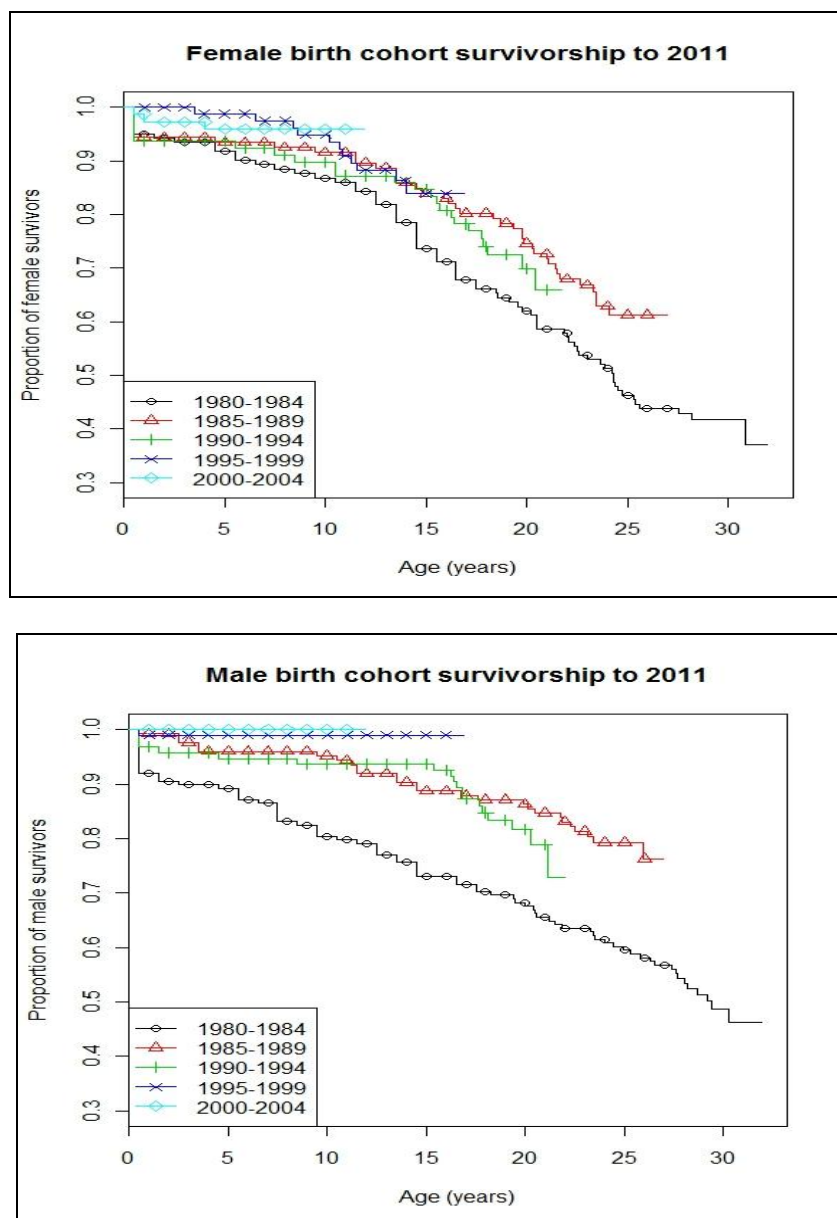


1,200 PWCF in the Republic of Ireland compared to approximately 26,000 in the United States). In 2011, the deaths of 3 PWCF under 18 years of age likely contributed to the observation of a relatively young median age at death.

For the second consecutive year, there were more deaths recorded in males ($n=16$) than in females ($n=12$) (Figure 5). However, greater numbers of deaths are usually observed in female PWCF in the Republic of Ireland than in males. The disparity in survival (which favours males) is observed by many CF registries and may be associated with poorer survival by females, for reasons that are unclear.

Previous CFRI annual reports have pointed out that 'median age at death' is not an entirely useful statistic. For example, it is widely accepted that a large majority of PWCF in the Republic of Ireland survive past the age of 23.5 years. The statistic 'median age at death' can only describe the average lifespan of deceased PWCF. To reflect the length of life of all PWCF, a different approach is required which takes into account the age of those still living.

Figure 6: Birth cohort survivorship to 2011



The estimation of 'median survival' involves following an entire CF population until half have died. Birth cohort lifetable (Kaplan-Meier) survivorship curves are calculated for this purpose. The survival of male and female PWCF (to 2011) in the Republic of Ireland who were born between 1980 and 2004 are shown in Figure 6. More than half of PWCF born 1980-1984 had died by 2011. Females and males had a median (average) survival of 24.3 years and 29.4 years respectively. The majority of PWCF born from 1985 onwards remain alive, therefore median survival cannot yet be calculated for the other birth cohorts.

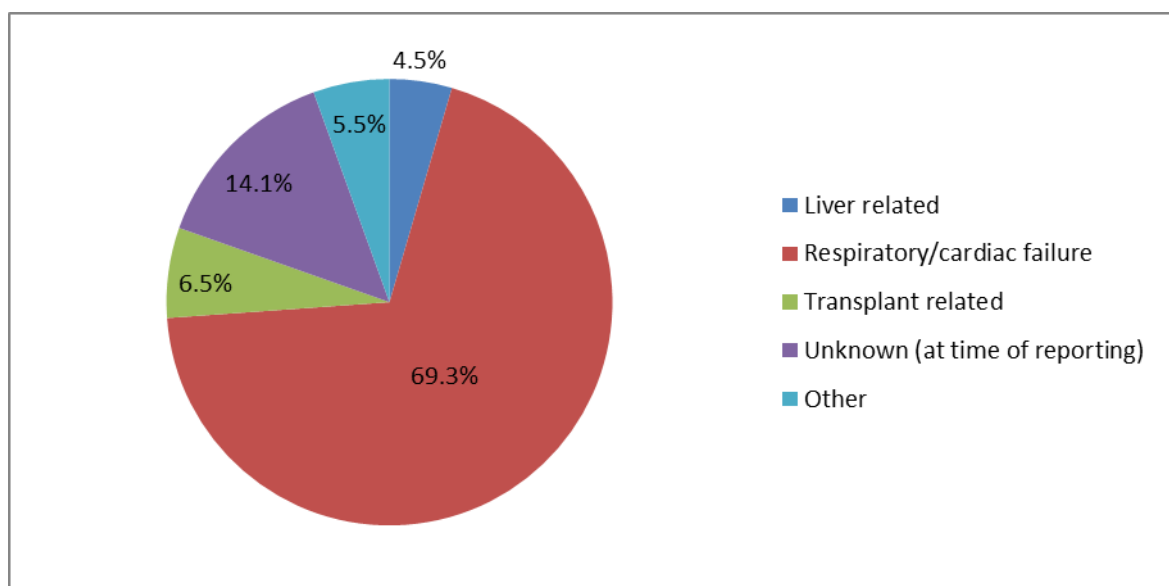
A slightly greater rate of decline was observed in survivorship curves for males born between 1985 and 1994 (Figure 6), compared to that in the 2010 annual report. This reflects the relatively large number of deaths in males in 2011 (specifically those born 1985-1994) compared to previous years. Female birth cohort survivorship curves in Figure 6 show a similar pattern to those presented in previous reports.

Cause of Death

There were 28 deaths in PWCF in 2011. The causes of death were as follows: 18 were due to respiratory/cardiac failure, 3 were transplant-related, 1 death was due to a non-CF related episode, and the remainder were due to reasons that were not disclosed to the CFRI (classified below as 'unknown').

The pie chart in Figure 7 shows the cause of death for the 199 deaths in recognised PWCF over the past ten years (2002-2011). Respiratory/ cardiac failure accounts for the largest proportion of deaths (69.3%), followed by deaths where the cause was not known (14.2%), deaths associated with transplantation (6.5%) and liver related death (4.5%). A range of other causes were attributed to deaths for 5.5% of PWCF. These included distal intestinal obstruction, metastatic carcinoma, septic shock, septicaemia and accidental death.

Figure 7: Principal cause of death, 2002-2011



Demographics of the CFRI

Detailed information gathered by the CFRI provides a profile of the CF population in the Republic of Ireland. This would not be possible using annual census data alone. According to CFRI data, there were 1,073 living PWCF in the Republic of Ireland at the end of 2011 (Table 1). These individuals ranged in age from newborn to 61 years and on the last day of 2011. The average age of enrolees was 19.6 years and 52% of enrolees were aged 18 years and older. There were 22 individuals newly diagnosed with CF in 2011 compared with 12 in the previous year. More male PWCF than females had been enrolled at the end of the ten-year period in which the CFRI has been in operation. The proportion of males aged greater than or equal to 18 years was marginally larger than that of females.

Table 1: Demographic data from the CFRI, 2011

Year	2011	%
PWCF consented	54	
Age range*	<1-61	
Mean age (yrs)*	19.6	
Median age (yrs)*	18.8	
Number diagnosed during year	22	
Number of males*	612	57.0%
Number of females*	461	43.0%
Number <18 yrs*	514	47.9%
Number ≥18 yrs*	559	52.1%
Number males ≥18 yrs¥	324	52.9%
Number females ≥18yrs¥	235	51.0%
Irish ethnicity*	1049	97.8%
Deaths during year∞	26	
CFRI enrolees alive at the end of 2011	1073	

* of the 1,073 PWCF on the registry who are alive at the end of 2011

¥ percentages are given as a proportion of the number of male and female PWCF respectively

∞ of those on the registry (i.e. excludes those who died and were not enrolled on the registry)

The age of CFRI enrolees on the last day of 2011 is summarised in Figure 8. Ninety percent were aged between 0 and 34 years. In 2010, there were 45 PWCF aged 40 years and over. That figure increased to 51 PWCF in 2011. Across the world, PWCF aged 40 years and older are the subject of research projects which seek to improve our understanding of the factors which may contribute to PWCF surviving beyond 40 years of age.

In 2011, the largest age cohort of live PWCF were CFRI enrolees aged 10-14 years (15.5%), followed by those aged 25-29 years (14.8%), 5-9 years (13.6%), 20-24 years (13.5%) and 15-19 years (13.2%). The high percentage of those aged between 10-14 gives an indication as to future demands on adult CF services.

Figure 8: Age and gender distribution by age band, 2011

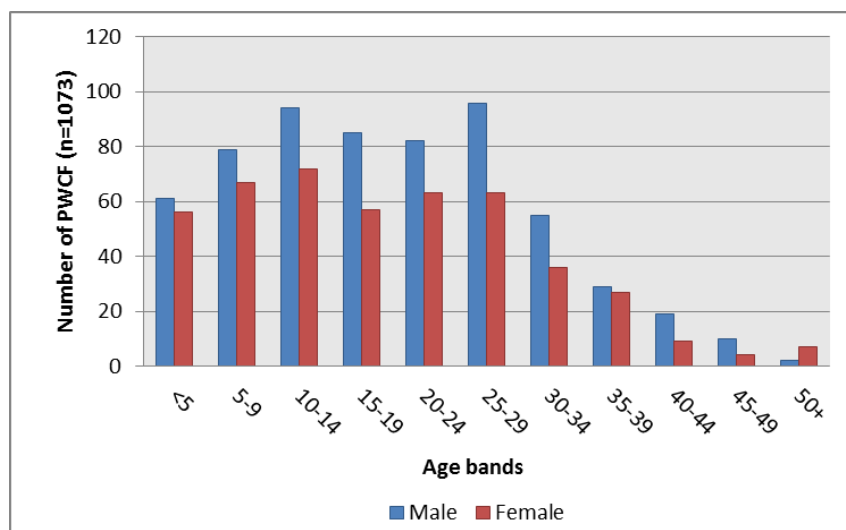


Table 2 presents the county of residence of PWCF enrolled by the end of 2011. As in previous years, Dublin is reported as the county of residence for the largest proportion of the population (27.1%). Cork is the county of residence for 13% of PWCF, 5.% reside in Limerick, 5.2% in Tipperary and 4.5% in Galway.

Table 2: PWCF by county of residence, 2011

	Number of PWCF	%
Dublin	291	27.1%
Cork	140	13.0%
Limerick	61	5.7%
Tipperary	56	5.2%
Galway	48	4.5%
Kerry	45	4.2%
Kildare	44	4.1%
Wicklow	43	4.0%
Meath	39	3.6%
Clare	36	3.4%
Mayo	31	2.9%
Cavan	22	2.1%
Louth	21	2.0%
Wexford	20	1.9%
Kilkenny	19	1.8%
Laois	19	1.8%
Westmeath	19	1.8%
Offaly	18	1.7%
Sligo	16	1.5%
Carlow	14	1.3%
Donegal	14	1.3%
Monaghan	13	1.2%
4 counties with <10 patients	21	2.0%
Total	1,073	100.0%

Siblings

In 2011, there were 1,040 families with at least one CF child or adult represented on the CFRI (Table 3). Nearly 87% had one family member enrolled with the CFRI. One hundred and forty families had two, three or four family members with CF enrolled on the CFRI. These figures likely underestimate the total number of families affected by CF. Some family members may have died before the CFRI was established or some PWCF may not yet have been invited to enrol.

Table 3: CFRI families and siblings, 2011

CFRI families	
1040	Families represented by ≥ 1 PWCF
13.5%	140 families (of 1040) had 2 or more members with CF
130	Number of families with 2 members with CF
10	Number of families with 3 or more members with CF

Diagnosis

The clinical presentation of PWCF is described here. Information was available for 96.6% of all PWCF on the CFRI (1,152/1,192). A programme of universal newborn screening for CF was introduced in the Republic of Ireland in July 2011 and Table 4 has been amended to reflect this change. In 2011, the CFRI enrolled 4 PWCF who were diagnosed as a result of the newborn screening programme. However, the actual number of individuals found to have two CFTR mutations during newborn screening in 2011 was higher (n=16) (source Prof P Mayne, National Newborn Bloodspot Screening Laboratory). This disparity reflects the delay in enrolment of newly diagnosed individuals by the CFRI, for reasons previously discussed on page 12.

Approximately 60% of PWCF presented for medical care citing either gastrointestinal symptoms only, respiratory symptoms only, or both respiratory and gastrointestinal symptoms. Gastrointestinal symptoms alone were most frequently reported (Table 4) by CFRI enrolees (22.9%) followed by respiratory symptoms (19.6%) and both respiratory and gastrointestinal symptoms (17.2%). Family history led to a diagnosis for 21.5% of enrolees (a proportion of these had additional symptoms of CF) and symptoms of meconium ileus were observed in 13.9% of PWCF (half of which were surgically treated).

Table 4: Symptoms leading to a diagnosis of CF, 2011 (n=1,192)

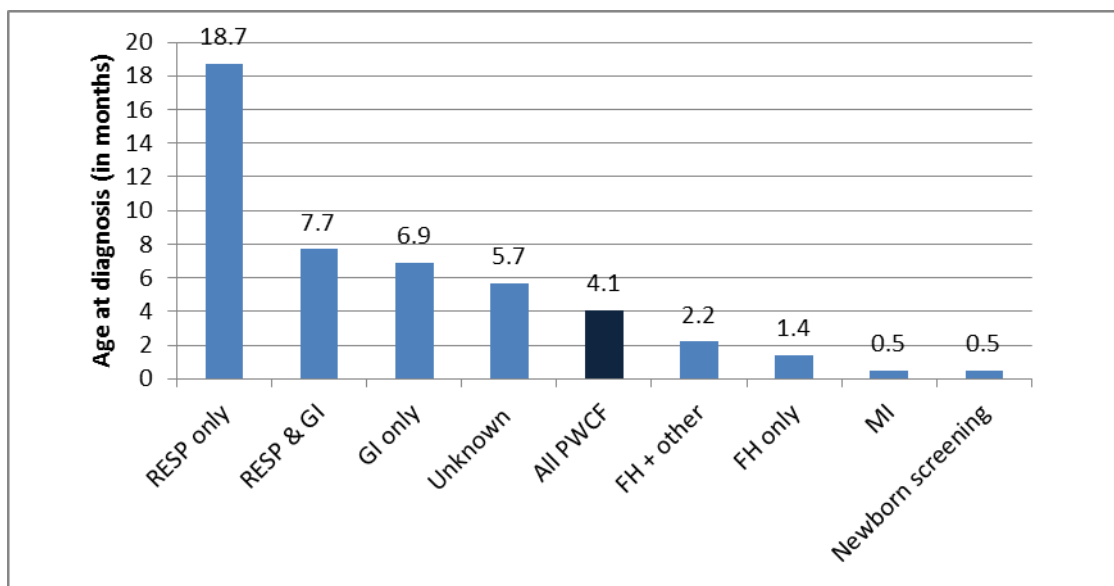
	Percent
Gastrointestinal (GI) symptoms only	22.9%
Respiratory (RESP) symptoms only	19.6%
Respiratory and gastrointestinal (RESP & GI) symptoms	17.2%
Family history (FH) only	14.8%
Meconium ileus (MI) symptoms only	13.9%
Family history with other symptoms (FH & other)	6.7%
Unknown symptoms	3.4%
Other*	1.2%
Republic of Ireland newborn CF screening programme	0.3%
Total	100%

*Other: meconium test, diagnosed through newborn screening in another country

Median age at diagnosis for PWCF diagnosed in 2010 and 2011 was 5.2 and 5.3 months respectively. In future annual reports, the median age at diagnosis for PWCF diagnosed in the reporting year will be monitored. It is expected that newborn screening will detect PWCF soon after birth, but the extent of its effect on median age at diagnosis for CFRI enrolees diagnosed in a given year cannot yet be anticipated.

Figure 10 shows that PWCF diagnosed either as a result of newborn screening or those who had symptoms of meconium ileus were youngest on average to be diagnosed (2 weeks old). The second youngest category of PWCF was those with a family history only (1.4 months) and those with a family history and other symptoms (2.2 months). PWCF with respiratory (RESP) symptoms were the oldest on average to be diagnosed (18.7 months), next to PWCF with both respiratory and gastrointestinal (RESP & GI) symptoms (7.7 months) and PWCF with gastrointestinal (GI) symptoms only (6.9 months). Median age at diagnosis for all PWCF (Figure 10) has remained unchanged at 4.1 months for many years (range: newborn to 57 years).

Figure 9: Median age at diagnosis in months by symptom category, 2011



Genotype

The most common genetic mutations reported in PWCF alive at the end of 2011 are shown in Table 5. Genotyping is mainly undertaken by the National Centre for Medical Genetics in Our Lady's Children's Hospital in Dublin. In 2011, 96.9% of living PWCF had genotyping recorded.

Ninety percent of PWCF (966/1073) had a Δ F508 heterozygous mutation. Delta F508 homozygous (56.5%) is the most commonly observed genotype, followed by Δ F508 G551D (10.9%) and Δ F508 R117H (3.7%).

Table 5: Frequencies of the most common CF mutations in living CFRI enrollees, 2011

	Number of PWCF	%
Δ F508 homozygous	606	56.5%
Δ F508 G551D	117	10.9%
Δ F508 R117H	40	3.7%
Δ F508 R560 T/K	28	2.6%
Δ F508 1717-1 G-->A	15	1.4%
Δ F508 621+1 G-->T	15	1.4%
Δ F508 G542X	15	1.4%
All other Δ F508 heterozygotes	111	10.3%
Δ F508 allele 2 unknown	19	1.5%
G551D G551D	8	0.7%
Other genotypes	50	4.7%
Not genotyped	33	3.1%
Pending	16	1.5%
Total	1073	

Hospitalisations and Complications

In 2011, annual assessment data was gathered for 856 enrollees. This is a time-consuming task, taking place at numerous CF centres and hospitals across the Republic of Ireland, with large volumes of data being extracted from hospital files and recorded on paper forms for each individual.

The numbers of PWCF annual assessments recorded annually has remained stable since 2008, at approximately 860 each year (866 in 2010, 865 in 2009). Typically, annual assessment data is gathered for nearly all paediatric patients (Table 6) and approximately two-thirds of adult PWCF. Annual assessment records were gathered for a similar proportion of paediatric PWCF in 2011 as in previous years, while slightly fewer records were collected for adults (69.4% compared to 74.9% in 2010).

Table 6: Annual assessment data collected, 2011

2011 Annual Assessments (AAs)		
	Paediatric	Adult
PWCF with 2011 AA data collected	468	388
Proportion of live PWCF with completed 2011 AAs (N=1044)	91.1%	69.4%

More hospitalisations, respiratory exacerbations and complications were reported for paediatric PWCF in 2011 than in recent years. There were approximately 120 more hospitalisations for paediatric PWCF in 2011 than in 2010, and approximately 100 more instances of respiratory exacerbation recorded (Table 7). Adults had fewer hospitalisations (81 less) and fewer respiratory exacerbations (60 less) than in the previous year, though this likely reflects the reduction in the proportion of live adult PWCF with available annual assessment data in this reporting year.

Table 7: Hospitalisations, exacerbations and complications, 2011

2011 Annual Assessments (AAs)				
	Paediatric		Adult	
	Number	Average per PWCF	Number	Average per PWCF
Number of hospitalisations	437	0.9	412	1.1
Number of respiratory exacerbations requiring IV antibiotics	423	0.7	681	1.8
Number of complications	1519	3.3	1576	4.1

Table 8 summarises the cardiac, pulmonary, gastrointestinal and other complications recorded in 2011. The most frequently occurring complication in paediatric PWCF was pancreatic insufficiency requiring pancreatic enzymes (95.5%), followed by chronic *Staphylococcus aureus* infection (62.6%), clubbing (43.4%) and gastrointestinal reflux (30.1%). Adult PWCF also reported pancreatic insufficiency requiring pancreatic enzymes (90.5%) as the most common complication, followed by chronic *Pseudomonas aeruginosa* infection (64.7%), gastrointestinal reflux (48.2%) and osteoporosis/osteopenia (43.8%).

Chronic *Staphylococcus aureus* infection (≥ 3 isolates in a year) was reported in a greater proportion of both live paediatric and adult PWCF in 2011 than in 2010; 6% more paediatric and 5% more adult PWCF tested positive in 2011 than in 2010. The number of PWCF with chronic *Pseudomonas aeruginosa* infection, *Burkholderia cepacia* and MRSA remained the same as in 2010.

Gastrointestinal reflux was reported more frequently in 2011, up by 8% for paediatric PWCF and 13% for adults since 2010. Also, a smaller proportion of adult PWCF were reported as being pancreatic insufficient requiring pancreatic enzymes in 2011 (90.5% in 2011 cf. 98.1% in 2010).

Liver disease in adults remains the same, affecting 59 PWCF in 2011. Paediatric PWCF with liver disease has increased over the past few years, however figures for 2011 remain unchanged from 2010. The frequency of reporting for insulin-dependent diabetes remains the same as in 2010, affecting approximately 1 in 4 adults. Adults with osteoporosis/osteopenia decreased by 6% from 49.8% in 2010 to 43.8% in 2011.

Table 8: Complication rates by system by age-band, 2011

2011 Annual Assessment				
	Paediatric		Adult	
No of PWCF with completed AAs	468		388	
PWCF with no complications	4		9	
Total number of complications	1519		1576	
Cardiac/Pulmonary Complications				
	Number of paediatric PWCF	% of paediatric PWCF	Number of adult PWCF	% of adult PWCF
Chronic <i>Pseudomonas</i>	118	25.2%	251	64.7%
Chronic <i>Staphylococcus</i>	293	62.6%	125	32.2%
<i>Burkholderia</i>	8	1.7%	15	3.9%
MRSA	56	12.0%	27	7.0%
Nasal polyps	15	3.2%	3	0.8%
ABPA	19	4.1%	21	5.4%
Asthma	7	1.5%	10	2.6%
All other cardiac/pulmonary complications*	2	0.4%	4	1.0%
Total card/pulm complications	518		456	
Gastrointestinal Complications				
DIOS	8	1.7%	19	4.9%
Pancreatic Insufficiency	447	95.5%	351	90.5%
Abnormal LFTs	6	1.3%	7	1.8%
Liver disease	37	7.9%	59	15.2%
GI Reflux	141	30.1%	187	48.2%
All other gastro complications**	0	0%	2	0.5%
Total gastro complications	639		619	
Miscellaneous Complications				
Diabetes requiring insulin	9	1.9%	104	26.8%
Clubbing	203	43.4%	128	33.0%
Osteopenia/osteoporosis	26	5.6%	170	43.8%
Other non-CF morbidities	108	23.1%	80	20.6%
Total misc complications	346		482	

*All other respiratory/cardiac complications: cor pulmonale, pneumothorax, haemoptysis

**All other gastrointestinal complications: haematemesis, colonic stricture, gallbladder disease

Cultures

The number of culture swabs recorded by the CFRI increased from 6,360 in 2010 to 7,903 in 2011. This represents a return to previously observed figures (7,103 in 2009). Of the 7,903 culture swabs recorded, 68% were sputum samples (Table 9). The vast majority of culture swabs in adults were from sputum samples (96.5%). For paediatric samples, half (49.7%) were taken from sputum, and just under a quarter from throat (23.2%) and cough (22.2%) swabs respectively.

Table 9: Culture types by age-band, 2011

2011 Cultures				
Sample type	Paediatric		Adult	
	Number	Average number of cultures per paediatric PWCF	Number	Average number of cultures per adult PWCF
Sputum samples	2370	5.1	3021	7.8
Throat swabs	1107	2.4	13	<0.1
Cough swabs	1059	2.3	58	0.1
BAL swabs	55	0.1	9	<0.1
Nasal swabs	111	0.2	9	<0.1

Of the 5,391 samples taken from PWCF sputum in 2011 (Table 10), *Pseudomonas aeruginosa* was the most frequently detected organism, accounting for 28.4% of all sputum specimens. The number of *P aeruginosa* cultures are presented in Table 10 according to mucoidal status. *Staphylococcus aureus* is the second most frequently detected organism (17.8%). The proportion of sputum samples positive for *Aspergillus fumigatus*, *MRSA* and *Haemophilus influenza* is the same as in 2010. There were 9 fewer samples containing *Burkholderia cepacia* in 2011 compared with 2010.

Table 10: Frequently detected organisms in sputum cultures, 2011

	Number of positive sputum cultures	% of positive sputum cultures
<i>Staphylococcus aureus</i>	961	17.8%
All <i>Candida</i> species	829	15.4%
<i>Pseudomonas aeruginosa</i> (Muroid status not reported)	637	11.8%
<i>Pseudomonas aeruginosa</i> (Muroid)	614	11.4%
Normal flora	475	8.8%
<i>Aspergillus fumigatus</i>	360	6.7%
<i>Pseudomonas aeruginosa</i> (Non-muroid)	283	5.2%
MRSA	193	3.6%
<i>Haemophilus influenza</i>	172	3.2%
<i>Stenotrophomonas maltophilia</i>	147	2.7%
Gram positive cocci	116	2.2%
Gram negative bacilli	57	1.1%
<i>Haemophilus influenza</i>	52	1.0%
<i>Burkholderia cepacia</i> complex*	49	0.9%
Other	446	8.3%
Total	5,391	

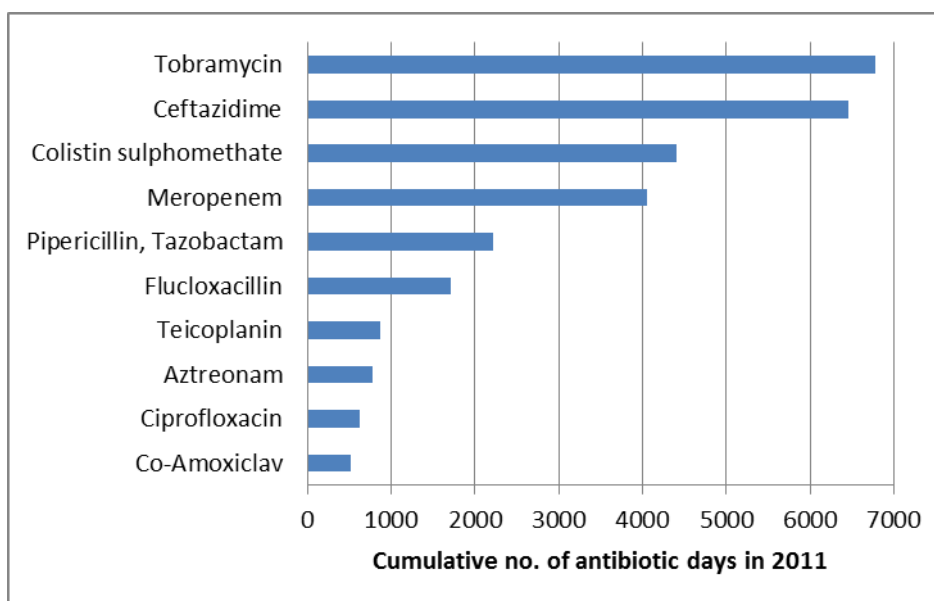
*Contains 30 *Burkholderia cepacia*, 10 *B multivorans*, and 9 *B cenocepacia* sputum cultures

Antibiotics

In 2011, the cumulative number of days PWCF took the ten most frequently prescribed IV antibiotics was approximately 28,500 days (Figure 10). In total, 33 different IV antibiotics were reported to have been prescribed for PWCF in 2011, though only ten are shown in Figure 10. The cumulative number of IV antibiotic days was similar to that reported for 2010 ($n > 29,000$), and as in 2010, tobramycin ($n = 6,773$) and ceftazidime (6,458) were the most commonly prescribed IV antibiotics.

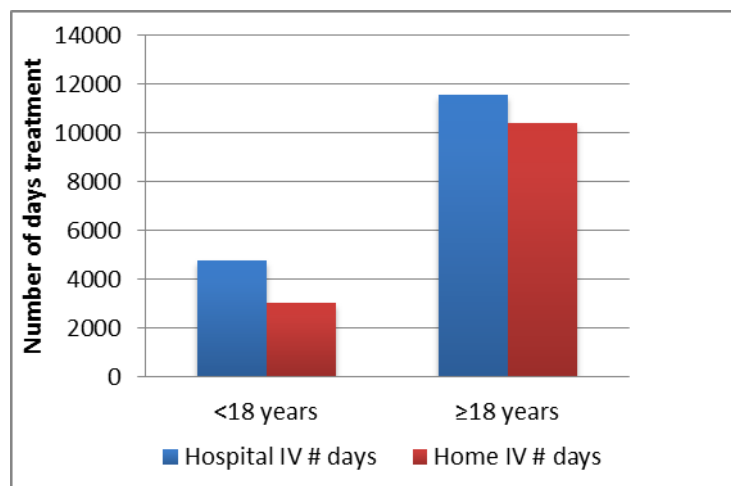
An increase in flucloxacillin IV antibiotics days (by approximately 1,000 days) observed between 2009 and 2010 was not repeated between 2010 and 2011. Instead, flucloxacillin IV antibiotics days decreased by approximately 1,200 days between 2010 and 2011. Annual fluctuations in antibiotic days are not uncommon, and trends over longer periods of time provide a better indication of changes in prescribing patterns.

Figure 10: Rank of order of IV antibiotics, 2011



The number of IV antibiotic days according to place of administration is presented in Figure 11. The administration of IV antibiotics days occurs with greater frequency in hospital, though the gap in number of days between hospital and home settings has narrowed in recent years. The number of IV antibiotic days in paediatric hospitals decreased by approximately 2,500 days in 2011 compared with 2010, while the number of days in a home environment for paediatric PWCF increased slightly. Adult PWCF had a similar number of IV antibiotic days in hospital in 2010 and 2011, but home administration increased by approximately 2,000 days.

Figure 11: Cumulative number of hospital and home IV antibiotic days, 2011



Pulmonary Function

In 2011, results from 1,889 pulmonary function tests (PFTs) were recorded by the CFRI (Table 11). At least one PFT was reported for 693 PWCF in 2011, meaning that each of those PWCF performed on average 2.7 tests in 2011. One hundred PWCF were under 5 years of age and did not perform PFTs or have reproducible results (therefore were not recorded by the CFRI). The remaining PWCF with available annual assessment data had no PFT results recorded (n=63, 7.4%). This is due to difficulties in accessing certain clinical information from medical records at some CF centres and clinics.

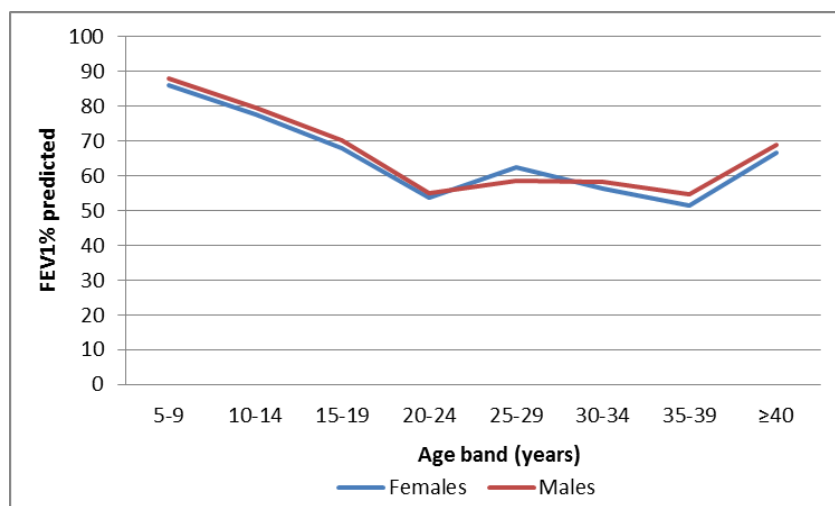
There were slightly more PFTs recorded by the CFRI in 2011 than in 2010 (n=1,754), but less than the 2,400 PFTs (approximately) reported in 2009. Overall, both mean FEV₁% predicted and FVC% predicted values were similar to those reported in 2010. PWCF aged 5 to 9 years had the best mean values. These values worsened in the older age bands, and this expected as the condition of the lungs deteriorates with age.

Table 11: Pulmonary function test summary, 2011

Age bands	Number of PFTs	Mean FEV ₁ % predicted	Mean FVC % predicted
5 - <10	275	87.1	90.1
10 - <15	311	78.7	83.8
15 - <20	293	69.4	82.6
20 - <25	365	54.4	72.1
25 - <30	305	60.4	78.6
30 - <35	172	57.5	79.1
35 - <40	82	52.5	73.9
≥40	86	67.6	90.1
Total	1889		

Looking at mean FEV₁% predicted values by age and gender (Figure 12), it is notable that males have better values in the younger age bands, up to 20-24 years. As in previous years, CFRI data has shown female mean FEV₁% predicted is better than males in the 24-29 year age group. However, in 2011 male mean FEV₁% predicted was better than that of females in the older age bands, and indeed better than 2010 male mean FEV₁% predicted values. So while in 2010 females in the 35-39 and ≥40 year age group had a better mean value than males, this was not the case in 2011. Such annual fluctuations in the older age categories can be expected due to the small numbers of PWCF in these groupings (compared to younger age bands).

Figure 12: FEV₁% predicted mean values by age band and gender, 2011



Body Mass Index

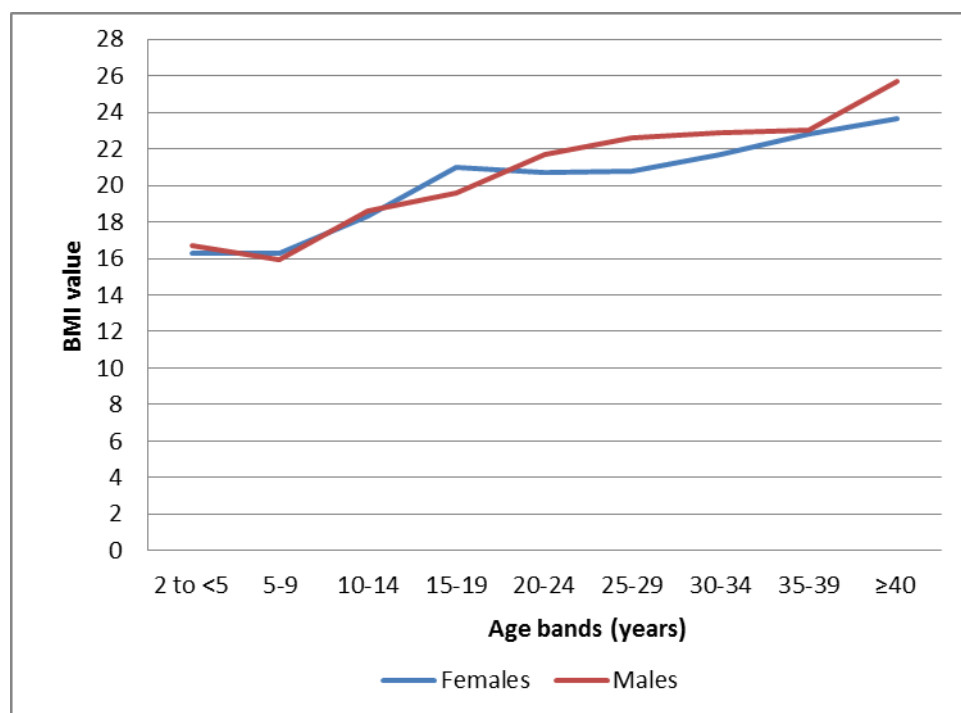
In 2011, just over 2,000 body mass index (BMI) scores were recorded by the CFRI for a total of 777 PWCF (Table 12). These 777 PWCF had on average 2.6 BMI measurements taken in 2011. The number of BMI measurements recorded in 2011 was similar to that recorded in 2010, and the mean BMI values within each age group were similar, if not marginally higher than those reported in 2010.

Table 12: BMI summary, 2011

Age bands	N	Mean BMI
2 - <5	153	16.5
5 - <10	322	16.2
10 - <15	332	18.5
15 - <20	288	20.2
20 - <25	328	21.3
25 - <30	293	21.7
30 - <35	143	22.4
35 - <40	60	22.9
≥40	79	24.5
No of PWCF	2052	

Figure 13 shows that mean BMI values are higher in older age groups for both males and females. The stagnation of female mean BMI between the ages of 15 and 29 years is a pattern that has been observed in CFRI annual reports for some years. In 2011 we observed better male mean BMI than female mean BMI in all older age groups, beginning with the 20-24 year old age band. This is unlike that reported in 2010, where higher mean BMI values varied between males and females from the 30-34 year age group onwards.

Figure 13: BMI mean values by age band and gender, 2011



Nutrition

In 2011, nearly all paediatric PWCF and over 90% of adult PWCF (Table 13) had a consultation with a dietician as part of their annual assessment, in order to optimise PWCF growth and weight. Vitamin supplements were the most common form of nutritional therapy used by both paediatric (96.8%) and adult (88.9%) PWCF. Calorie supplements were taken by nearly one in five paediatric PWCF and just over one in four adults. The figures in Table 13 are in line with those reported in previous years.

Table 13: Nutritional treatments, 2011

2011 Annual Assessment				
	Paediatric		Adult	
No of PWCF	468		388	
PWCF seen by dietician	462		354	
% PWCF seen by dietician	98.7%		91.2%	
	Number of paediatric PWCF	% of group	Number of adult PWCF	% of group
Calorie supplements	89	19.0%	102	26.3%
Vitamins	453	96.8%	345	88.9%
Minerals	36	7.7%	20	5.2%
Gastrostomy feeds	17	3.6%	36	9.3%

Supplemental feeding was reported for 34.2% of PWCF, which is slightly higher than supplemental feeding rate of 31.5% for PWCF in 2010. Oral supplemental feeding was most often adopted by PWCF. A greater proportion of adults took oral supplements in 2011 than in 2010 (27.3% cf. 20.1% respectively). Slightly more paediatric PWCF were reported as having gastrostomy tube feeding in 2011 (12.4%) than in 2010 (9.9%).

Table 14: Supplemental feeding, 2011

2011 Annual Assessment				
	Paediatric		Adult	
No of PWCF	468		388	
	Number of paediatric PWCF	% of group	Number of adult PWCF	% of group
Oral supplements	103	22.0%	106	27.3%
Nasogastric tube feeding	2	0.4%	2	0.5%
Gastrostomy tube feeding	58	12.4%	39	10.1%

Physiotherapy – Airway Clearance

A slightly greater proportion of both paediatric and adult PWCF were reviewed by a physiotherapist in 2011 than in 2010 (paediatric: 91.2%, adult: 77.8%).

The airway clearance techniques adopted by PWCF is shown in Table 15 (patients may adopt one or more). Acapella was most frequently used by paediatric PWCF in 2011 (30.1%), followed by use of the positive expiratory pressure mask (22.0%). In 2010, the positive expiratory pressure mask was most frequently reported in this age group. Active cycle breathing was also adopted more frequently by paediatric PWCF in this reporting year (12.4%).

For adult PWCF, autogenic drainage continues to be the most common physiotherapy modality. In 2011, it was used by 45.9% of adults, which is an increase on the figure reported for 2010 (35.4%). Acapella was the second most commonly used physiotherapy (11.3%), followed by the PEP mask (9.8%).

Table 15: Physiotherapy summary, 2011

2011 Annual Assessment				
	Paediatric		Adult	
No of PWCF	468		388	
PWCF seen by Physio	427		301	
% seen by Physio	91.2%		77.6%	
	Number of paediatric PWCF	% of group	Number of adult PWCF	% of group
PEP Mask	103	22.0%	38	9.8%
Acapella	141	30.1%	44	11.3%
Postural drainage	13	2.8%	1	0.3%
Percussion	52	11.1%	0	-
Active cycle breathing	58	12.4%	12	3.1%
Autogenic drainage	31	6.6%	178	45.9%
Flutter	10	2.1%	18	4.6%
Vest	10	2.1%	14	3.6%
Other*	84	17.9%	13	3.4%

*Other: positioning, Therapep, trampolining, blowing bubbles, BiPAP, running.

Long-Term Medications

Table 16 summarises long-term medications (i.e. those taken regularly over a minimum 3 month period) used in 2011. Over half of all PWCF (57.9% of paediatric and 65.2% of adult PWCF) were prescribed beta-agonists in 2011. These proportions have slowly increased since 2009. Approximately 40% of all PWCF received rhDNase. Inhaled steroids (44.6%), osteoporosis (45.1%) and H2 antagonist/proton pump inhibitor (51.3%) treatment were commonly prescribed for adult PWCF. One quarter of adult PWCF received insulin in 2011, compared with 22.1% in 2010. In 2011, nearly one in two paediatric PWCF had nebulised saline therapy, compared with 28.6% of adults.

Table 16: Long-term medication summary, 2011

2011 Annual Assessment				
	Paediatric		Adult	
No of PWCF	468		388	
	Number of paediatric PWCF	% of group	Number of adult PWCF	% of group
Beta agonist	271	57.9%	253	65.2%
Inhaled steroid	135	28.8%	173	44.6%
rhDNase	191	40.8%	174	44.8%
Urso-deoxycholic acid	85	18.2%	69	17.8%
Osteoporosis treatment	73	15.6%	175	45.1%
H2RA/PPI	138	29.5%	199	51.3%
Anti-cholinergic	10	2.1%	27	7.0%
Lactulose/movicol	48	10.3%	32	8.2%
Oral steroid	23	4.9%	31	8.0%
Insulin	8	1.7%	95	24.5%
Night-time oxygen	17	3.6%	18	4.6%
Nebulised saline	211	45.1%	111	28.6%
Aminophylline/theophylline	0	-	7	1.8%

Financial Information

The financial summary in Table 17 lists the Income and Expenses for the CFRI in 2011.

Table 17: Income & Expenses for 2011

Income & Expenses		2011
Income		€
Grant income		132,000
Sundry income		1,192
	Total income	133,192
Expenses		
Wages & salary		126,424
Employer's PRSI		8,908
Rent payable		7,159
Insurance		174
Computer network & server costs		4,308
Database costs		0
Heat & light		1,103
Repairs & maintenance		0
Printing, postage and stationery		433
Computing		0
Travelling & subsistence		6,586
Audit		968
Bank charges		228
Sundry expenses		4,000
Subscriptions		385
Depreciation on equipment		1,518
	Total expenses	(162,194)
	(Deficit)/Surplus	(29,002)

The full audited accounts were prepared Hayden Brown, Chartered Accountants, Grafton Buildings, 34 Grafton Street, Dublin 2 and copies are available upon written request to CFRI.

Acknowledgements

There are many individuals and groups that have contributed to and supported the work of the CFRI in this reporting year.

First we would like to thank the HSE for providing financial support to the CFRI since its inception in 2002.

Each PWCF and/or their guardian who kindly agreed to share medical information with this registry. By consenting in such large numbers, the information reported by the registry each year has become an important research tool.

The management committee of the CFRI have provided great support during a period of growth and development within the registry.

The Cystic Fibrosis Association of Ireland was integral in the initiation of this registry and continues to support the work that is undertaken by the registry.

Each CF centre and clinic provides immense assistance to CFRI staff in the collection of this important information. In particular, we thank the CF teams in each of the hospitals for their continuing co-operation.

The UCD School of Public Health, Physiotherapy and Population Science particularly Prof C Kelleher and her staff who have made an invaluable contribution to the CFRI research programme.

We thank the HSE's Health Intelligence Unit particularly Dr D De La Harpe and Dr H Johnson for their support and encouragement during the year.

We would also like to thank Prof Philip Mayne, Children's University Hospital confirming the numbers of infants detected in 2011 with two CFTR mutations from the start of the neonatal screening programme in July 2011.

Finally, we thank Dr Abaigeal Jackson and Larry Ungar for their hard work and dedication in preparing this report.

Published Papers and Conference Contributions, 2011

Published Papers

1. Jackson AD, Daly L, Jackson AL, Kelleher C, Marshall BC, Quinton HB, Fletcher G, Harrington M, Zhou S, McKone EF, Gallagher C, Foley L, Fitzpatrick P. 'Validation and use of a parametric model for projecting cystic fibrosis survivorship beyond observed data: a birth cohort analysis' *Thorax*, 2011, 66;p674-679.
2. Jackson AD, Daly L, Kelleher C, Marshall BC, Quinton HB, Foley L, Fitzpatrick P. 'The application of current lifetable methods to compare median survival internationally is limited' *Journal of Cystic Fibrosis*, 2011, 10(1);p62-65.

Conference Contributions

1. Jackson AD. 'A profile of CF in Ireland from the CF Patient registry (CFRI)' *Cystic Fibrosis Association of Ireland National Conference 2011*, Westport, 2011.

Posters

1. Somerville R, Jackson AD, Zhou S, Fletcher G, Fitzpatrick P. 'Increasing Survival and Chronic Disease Prevalence in Adults with Cystic Fibrosis: Challenges for the Irish Healthcare System' *Faculty of Public Health Winter Scientific Meeting*, December 2011.

“The national Cystic Fibrosis Registry of Ireland will endeavour to collect and analyse information relating to cystic fibrosis in order to improve the quality of care for all of the people with cystic fibrosis in the Republic of Ireland.”

Mission Statement of the CFRI

Cystic Fibrosis is an inherited condition that affects many body functions such as breathing, digestion, and reproduction. This lifelong condition usually becomes more severe with age and affects both males and females in equal proportions. The symptoms and severity of cystic fibrosis vary from person to person. The majority of people have both respiratory and digestive problems. There is no cure for cystic fibrosis. Life expectancy has increased steadily over the past 20 years, and today cystic fibrosis is no longer exclusive to childhood.

Better treatment strategies help to improve the length and quality of life of people with CF by controlling their symptoms. Improved treatments can be developed using patient registries. Cystic fibrosis registries gather information on all aspects of a patient's condition. They act as information storehouses for infection and treatment statistics. Detailed analysis of this information can yield significant findings about the most effective treatments for CF. It is through these analyses that better management of CF may be achieved.

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Charity Number: CHY17566



The Cystic Fibrosis Registry of Ireland