

A close-up photograph of two children's faces, focusing on their eyes and freckled skin. The child on the left has light blue eyes, while the child on the right has green eyes. Both have numerous light brown freckles across their cheeks and noses. The image is softly blurred, creating a warm and intimate feel.

**The Cystic Fibrosis Registry of Ireland**  
*Annual Report 2004*

2004

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This is the third annual report of the CF Registry of Ireland. In this report we will present some data from the registry. The first two annual reports were concerned with the planning and implementation of our registry, which is operational over the internet. Now, we have a substantial number of PWCF (Persons With Cystic Fibrosis) enrolled and we will display several parameters of this sample of the CF population of Ireland.

Beginning in January, 2004, a Clinical Research Associate, Dr Shijun Zhou, began work with the Registry. Dr Zhou has spent most of his time on data entry and will continue to do so. He also presented a paper about the registry and its functionality at the meeting of the Healthcare Informatics Society of Ireland in November, 2004.

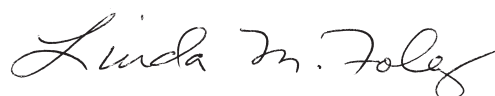
We have again conducted a census of PWCF in Ireland and this year we will present this alongside the data from the Registry. The sample of PWCF on the Registry is a close approximation to the census in that the age & sex and geographic distribution parameters are all in similar proportions to the full census.

Because we collect a large number of data fields, we have many tables and graphs that can be used to predict resource demands in coming years. As we increase the number of PWCF on the Registry, these predictions will become more accurate.

Through our initial observations of the data, we have also noted a number of unique features of the Irish CF population. In time these will be presented at European and international meetings and this information will contribute to basic knowledge of CF worldwide. Paediatric researchers in Ireland are beginning to request anonymous information from the Registry in order to carry out further vital studies. We have also already made observations which support other countries' findings. Some of these results will be submitted for publication in 2005.

I hope that the Cystic Fibrosis Registry of Ireland will continue to provide an essential service to the CF community and to those who provide services to PWCF. It is the ambition of the Registry to be confirmed as a permanent entity by the newly created Health Services Executive.

This report is dedicated to the PWCF who have given their consent for their information to be entered on the Registry. I hope that they will feel that their commitment is fulfilled and that the Registry enhances their faith. We are at the beginning of an exciting journey of discovery.



**Linda M Foley, B.Sc.**

**Director, Cystic Fibrosis Registry of Ireland**

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## Cystic Fibrosis Centres and Registry Management Committee

### Cystic Fibrosis Centres

County	Hospital	Consultant	Type of Centre
Cork	Cork University Hospital	Dr. Cathal Bredin	Adult
		Dr JB Watson	Paediatric
Dublin	Beaumont Hospital	Prof NG McElvaney	Adult
	St Vincent's University Hospital	Dr Charles Gallagher	Adult
	Children's University Hospital, Temple Street	Dr Dubhfeasa Slattery	Paediatric
	National Children's Hospital, MANCH	Dr Peter Greally	Paediatric
	Our Lady's Hospital for Sick Children	Dr Gerry Canny	Paediatric
	Mater Misericordiae Hospital	Dr Jim Egan	Post-Transplant
Galway	University College Hospital, Galway	Prof BG Loftus	Paediatric
	Merlin Park Hospital, Galway	Dr JJ Gilmartin	Adult
Kerry	Tralee General Hospital	Dr Fergus Leahy	Paediatric
Limerick	Midwestern Regional Hospital	Dr MJ Mahony	Paediatric
		Dr Eithne Mulloy/Dr TH Peirce	Adult
Louth	Our Lady of Lourdes Hospital	Dr David Vaughan	Paediatric
		Dr John Kiely	Adult
Mayo	Mayo General Hospital	Dr Michael O'Neill	Paediatric
Sligo	Sligo General Hospital	Dr Tummaluru	Paediatric
Waterford	Waterford Regional Hospital	Dr A Altaf	Paediatric

### Registry Management Committee

Professor N.G. McElvaney, MB, FRCPI, FRCPC	Professor of Medicine, Royal College of Surgeons in Ireland. Beaumont Hospital and R.C.S.I., Dublin	Chairman of the Registry Management Committee
Mrs. Linda Foley, B.Sc.	Director, CF Registry of Ireland	Registered as a Data Controller with the Data Protection Commission
Dr. Charles Gallagher, MB, FRCPI, FRCPC, FCCP.	Consultant in Respiratory Medicine, St. Vincent's University Hospital, Dublin	Committee Member
Dr. Peter Greally, MD, FRCPI, FRCPCH, DCH.	Consultant in Paediatric Respiratory Medicine, National Children's Hospital in Tallaght, Dublin	Committee Member
Dr. Gerry Canny, MD, FRCPC, FAAP, FCCP	Consultant in Paediatrics, Our Lady's Hospital for Sick Children, Dublin	Committee Member
Dr. Tummaluru	Consultant Paediatrician, Sligo General Hospital, Sligo	Committee Member
Ms. Gerardine Leen	CF Specialist Nurse, National Children's Hospital in Tallaght, Dublin	Committee Member
Ms. Anne Marie Lyons	CF Specialist Nurse, Beaumont Hospital, Dublin	Committee Member
Mr. Carl Rainey	Chairperson Cystic Fibrosis Association of Ireland	Committee Member
Mr Godfrey Fletcher	CEO, Cystic Fibrosis Association of Ireland	Committee Member
Mr. Martin Wickham	IT Director, ESAT and member of CFAI	Committee Member

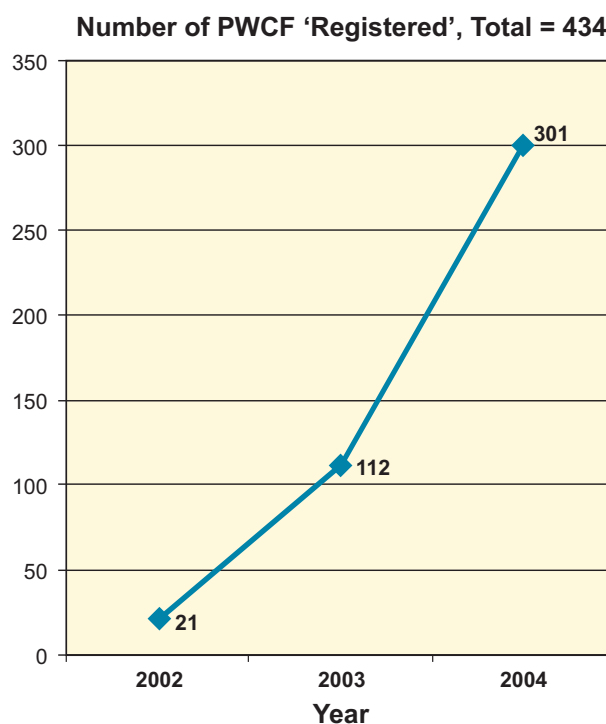
## Introduction

This Annual Report provides an overview of the functionality of the Cystic Fibrosis Registry of Ireland. It is a collection of reliable observations of the CF population of this country rather than a rigorous scientific document. At the end of 2004 we now have a sizeable data sample of PWCF. It is large enough to provide a number of worthwhile research avenues, but at this time no authoritative conclusions can be made. Many of our observations are currently receiving further attention.

On 31<sup>st</sup> December 2004 we “froze” the data that we had collected from the time that the first person was enrolled (July, 2002), and moved it to a local host. The data thus displayed in this Annual Report includes all PWCF who were registered prior to 31<sup>st</sup> December 2004.

As shown in Figure 1, one can see that the number of registered PWCF greatly increased during 2004; this was due primarily to the appointment of a Clinical Research Associate. His main activity is to visit CF Centres and collect registry data from PWCF (those who have consented) charts. In addition, several CF Specialist Nurses have been submitting data from their centres. Without the input from both of these sources, populating the database would be a slower process. This means that it would be unlikely for us to make observations on the CF population for several years.

At the end of 2004 we had 434 patients entered on the Registry. That is 38% of the 2004 census figure collected from CF Centres. Each PWCF will have an Annual Assessment completed and entered every year. Our target is the entire CF population and if we



**Figure 1: Number of PWCF Registered by Year of Entry**

have at least 1,100 (~96%) patients enrolled on the Registry, this would enhance the strength of the data in the Registry, and the power of conclusions that are made.

At present, the limiting factor for data entry is the rate at which Consent Forms are signed. These are available at CF Centres and must be signed by the PWCF (or parent) as well as the consultant. Once signed, a form will not need to be signed again until the PWCF turns 18 years of age. Then he or she can sign the Consent Form in their own right. A number of strategies designed to increase the number of consent signatures have been proposed and these will be put in place during 2005, to increase the number of PWCF on the Registry.

The initial entry process involves Registration, Diagnosis, and one Annual Assessment. (The Annual Assessment is a retrospective record of data over the previous 12 months.) The vast majority of PWCF on the Registry have all 3 items completed. However, there are a few who were entered before their first birthday; these have had only Registration and Diagnosis completed. We are presently entering second and third Annual Assessments for many PWCF. These Annual Assessments would be from PWCF who were first enrolled in 2002 and 2003. Longitudinal records for these patients are now accumulating within the Registry. This is very useful for CF caregivers: they can access comprehensive reports of their patients over time (e.g., three years in some cases).

Most of the data in this report will show comparisons of a “cross-sectional” nature (i.e., at one point in time); which means that we will generally be comparing symptoms, complications, or treatments for different age groups of PWCF at the end of 2004.

In time, as we add more Annual Assessments for each person, we will be able to look at single PWCF over a series of years. We will examine changes in their condition over time. This type of analysis is “longitudinal” in nature.

The advantage of this Registry system is that it is both “cross-sectional” and “longitudinal.” It will be possible to compare different groups of PWCF at one point in time (cross-sectional). In addition, it will be possible to view both individuals and groups of like individuals (for example those who are the same age) over time (longitudinal).

### **Further notes for understanding the data and data collection**

*The ideal situation is that all PWCF are entered on the Registry and that all of their Annual Assessments are up to date. When this is achieved we will then look at entering all new PWCF in every year (in the range of 30-40 new diagnoses per year), plus one Annual Assessment for each PWCF every year (approx. 1100). Many clinics perform approximately 3-5 Annual Assessments every week, so the data-entry monthly workload for the Registry would be in the region of 100 Annual Assessments every month,*

plus 3-4 new Registrations every month. To bring the Registry into the ideal situation now means that we must add approximately 700 more PWCF of our current population and, at the same time, continue to keep entering all of the Annual Assessments for those already enrolled (424). In other words, we currently have a backlog of approximately 1100. Until a 'steady state'/ideal situation is achieved (i.e., ~40 new PWCF + 1143 Annual Assessments every year) we will always be behind in data collection. However, once we achieve the ideal situation, we will have a full data complement at 31<sup>st</sup> December every year.

There are many 'data gaps' in the information that we have compiled to date. Some of this is due to a lack of information in the current hospital chart. For example, if the data for an adult PWCF aged 30-something is being entered for the first time, the information about their original diagnosis may be missing from their chart. The original symptoms and diagnosis will remain missing from this person's data until we can revert back to the paediatric hospital for the information. Other examples of data gaps would be if a PWCF is not able to see a dietician or physiotherapist, or if they miss other routine tests on their Annual Assessment day. Missing information creates gaps in a person's records in the database. With 1100 PWCF there are likely to be many gaps in the data. Proper data auditing procedures are needed to correct this situation.

Another important aspect is to understand the concept and practice of Annual Assessment. All CF Centres request that their PWCF attend the clinic at least once a year for extra testing. This is deemed the 'Annual Assessment'. The CF Registry records this date as the point from which one 'looks back' for twelve months and gathers all infection and treatment data for that period of time. The Annual Assessment may take place at any time during the year. This means that if an Annual Assessment date is early in a new year, much of the information recorded will actually be from the previous year. Since all cultures and antibiotic treatment recorded are associated with dates, we can accurately show in which year the activity took place; that is, these items are independent of the Annual Assessment date. So, when we produce a report of cultures for say 2003, the cultures that were actually done in 2003 will appear on the 2003 report; even though the Annual Assessment for some PWCF may have a 2004 date. This also explains why there are more 2003 data than 2004. Many PWCF were not enrolled until 2004, but much of their data is from 2003.

For most of the subsequent sections of this report we have recorded the number of Annual Assessments that were included in the particular table or chart. These numbers vary from section to section. Annual Assessments in the Registry are dated in 2002, 2003, or 2004. Because this report is designed to reveal an overall impression of the PWCF in Ireland, and it is not a research

*document, we have chosen to include all of the registered PWCF in some graphs or tables. Examples of full inclusion are represented in the information involving diagnostic symptoms, genotype, and age at diagnosis. These charts also include those PWCF who were registered but have since died in 2003 or 2004. Their data, such as genotype or sweat test results, may continue to be used to characterise the Irish CF population. In all cases, the number of Registration or Annual Assessment records is noted in the graph or table.*

*These factors all influence the appearance of the data; this is particularly so in the early years. Once we have most (if not all) PWCF enrolled and each has contributed data for a number of years, these apparent differences will diminish.*

*Thus, there are several reasons for the data set to be incomplete at this stage. Our primary objective is to improve the 'cross-sectional' nature by entering as many PWCF as possible. We can, at the same time, address some 'data gaps' when we visit the CF Centres; for example, by reviewing older charts to find genotypes or the date of diagnosis. Finally, we are continually building longitudinal data for those who are already on the Registry and this will, in time, become invaluable. So, we are working on all fronts to improve the quality of the data: continue to enrol more PWCF, add Annual Assessments for those already enrolled, and correct the data gaps that are evident.*



## Demographics & Description of the Registry and CF Population

The following data was compiled from census forms returned by CF Nurse Specialists from the CF Centres in the Republic of Ireland. This shows the current distribution of PWCF according to their attendance at CF Centres for their Annual Assessment examination. There has been an increase of 59 patients since the 2003 census. This is represented by an overall increase of 5% with the group 18 years of age and older increasing by 11% and the group younger than 18 years increasing by 1%.

The figures in the table below are the “target” figures that we aim for in populating the Registry. For the purposes of this table, we assume that a PWCF is <18 years of age if they are still attending a Paediatric CF Centre. This is not strictly true. Many are ‘in transition’ to Adult CF Centres and may, in fact, be 18 years of age or older.

**Table 1: PWCF Census compiled from CF Nurse Specialist Returns, October 2004**

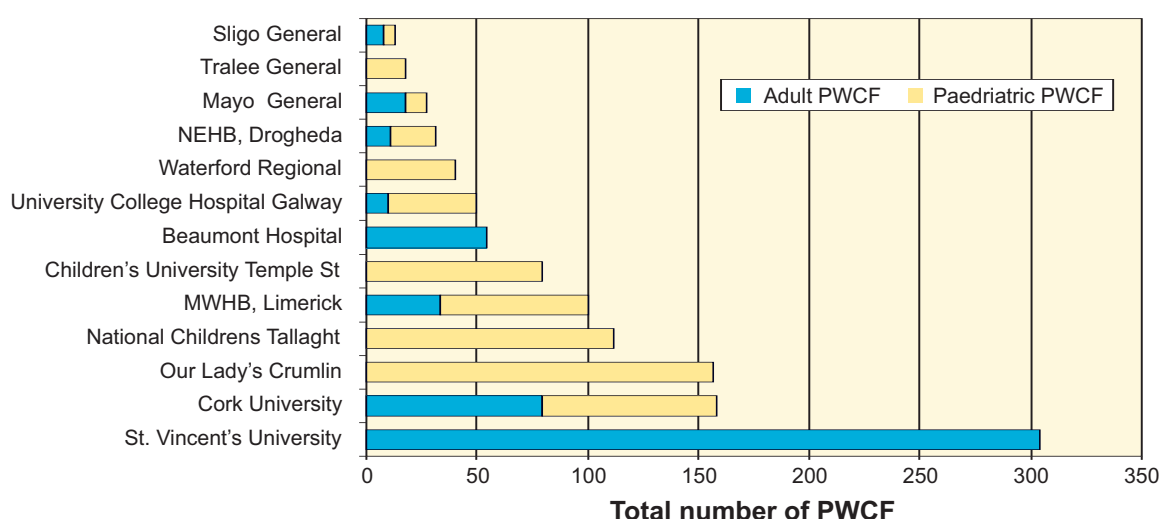
PWCF CENSUS IRELAND, 2004			
CF CENTRE	= OR > 18 YEARS OF AGE	< 18 YEARS OF AGE	TOTAL
Beaumont	54		54
St. Vincent's University	304		304
National Childrens Tallaght		112	112
Our Lady's Crumlin		157	157
Children's University Temple St		79	79
Cork University	79	79	158
Tralee General		18	18
Waterford Regional		40	40
University College Galway	10	40	50
Mayo General	18	9	27
Sligo General	8	5	13
MWHB, Limerick	33	67	100
NEHB, Drogheda	11	20	31
<b>TOTAL 2004</b>	<b>517</b>	<b>626</b>	<b>1143</b>

## CF Centres: Census vs. Enrolment on Registry

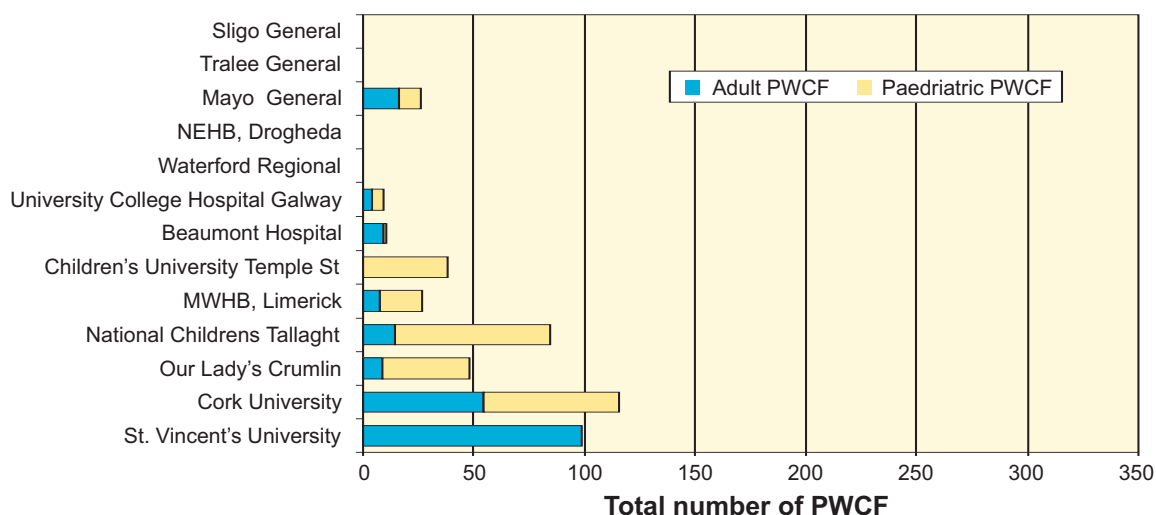
We can now compare the Census 2004 with the number of PWCF who are enrolled on the Registry as seen in the next two figures. Figure 2 shows the distribution of PWCF (both Adult and Paediatric) across the CF Centres; this data is taken from the CF Centres and reflects the information in Table 1. Figure 3 shows only those PWCF who are enrolled on the Registry.

One can compare the size of the bars in Figures 2 and 3; Figure 3 represents 38% of the total population that is shown in Figure 2. Figure 3 also shows that there are some PWCF who have reached 18 years of age, but are continuing to attend a Paediatric centre (e.g., National Children's Hospital, Tallaght and Our Lady's Hospital for Sick Children, Crumlin). These PWCF will be transferring to adult centres in 2005.

**Figure 2: Census Distribution at CF Centres, total = 1143**



**Figure 3: Registry Enrolments to end December 31, 2004, total = 434**

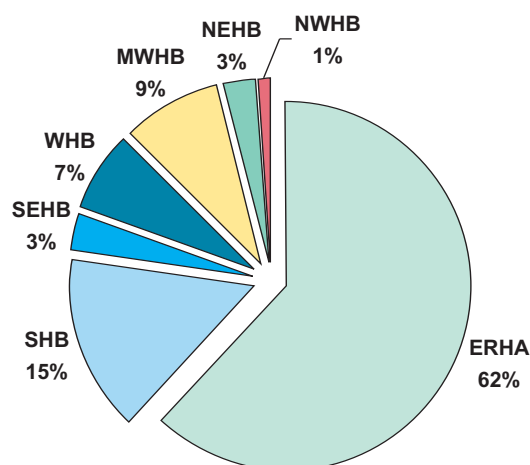


## Health Boards: Treatment Centre Attendance vs. Residence

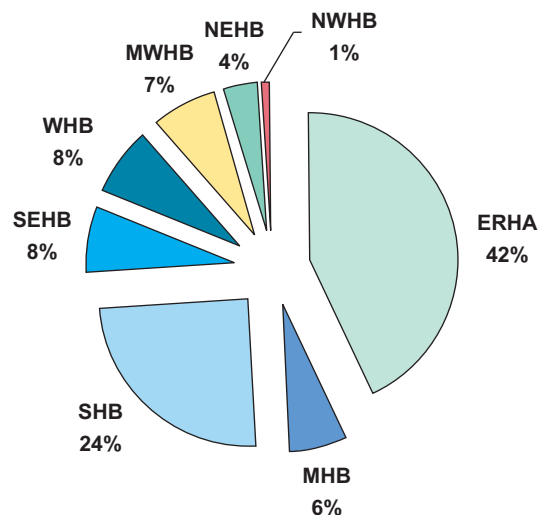
The census population and Registry enrolment can also be compared by Health Board designation. The Health Boards, as they existed in 2004, have recently been disbanded but it is useful to look at the distribution of patients before the change. In the future, this comparison will be done using the new Health Services Executive designations. The first pie chart (Figure 4) shows the distribution according to which CF Centre a patient attends (Census, 2004). Figure 5 shows the distribution of PWCF according to which Health Board they reside in.

This comparison can give some indication of how far people travel to receive treatment. Note that since there are no CF Centres in the Midland Health Board (MHB), people who live here probably travel to the ERHA for treatment. Similarly, people who live in the SEHB probably travel to either Cork (SHB) or Dublin (ERHA) for treatment. In the cases of the other health boards, it would appear that most PWCF who live in the Western, Mid-Western, North-Eastern, North-Western regions most likely attend CF Centres within those areas, because the percentages for residence and CF Centre attendance are similar in both pie charts.

**Figure 4: CF Census by CF Centre Health Board**  
*Distribution, total = 1143*



**Figure 5: Registry Enrolment; Residence by Health Board Distribution, total = 424\***

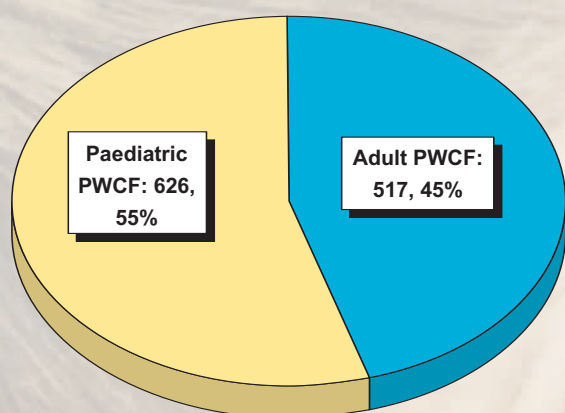


\*424 = current patients

## Age Comparison: Census vs. Registry Enrolment

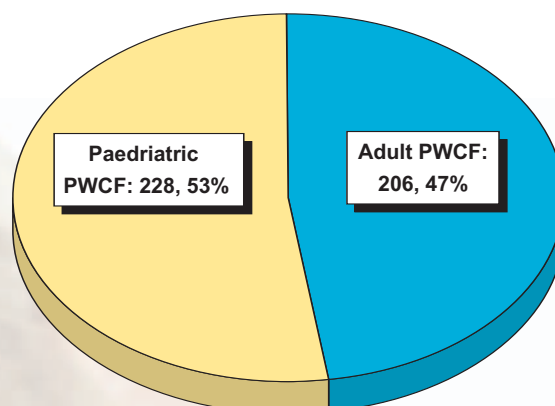
Another comparison of the PWCF Census with Registry PWCF can be made by looking at their ages during 2004. From the Census data, the ratio of Paediatric PWCF (under 18 years of age) to Adult PWCF (equal to or over 18 years of age) is shown below (Figure 6). Note that PWCF who attend Paediatric Centres are grouped in the Paediatric PWCF even though they may have turned 18 years of age.

**Figure 6: CF Census 2004: Proportion of Adult PWCF to Paediatric PWCF, total = 1143**



And, from the Registry the ratio for 2004 is very similar (see Figure 7).

**Figure 7: CF Registry 2004: Proportion of Adult PWCF to Paediatric PWCF, total = 434**



Note that Figure 7 includes all registrants, current and deceased.

Thus, we have a similar age spread and geographic spread of PWCF between those who are enrolled on the Registry and those from the Census. This means that the sample which is enrolled to date approximates the CF population as a whole. It would be unwise to draw major conclusions from our present Registry data, but “trends” may be observed and these trends can be tested as the population on the Registry increases to include all PWCF.

## CF Population Projections

Before moving on to look at the actual Registry data from 2004 in more detail, we would like to present some projections of the CF population based on Census figures from 2003-2004.

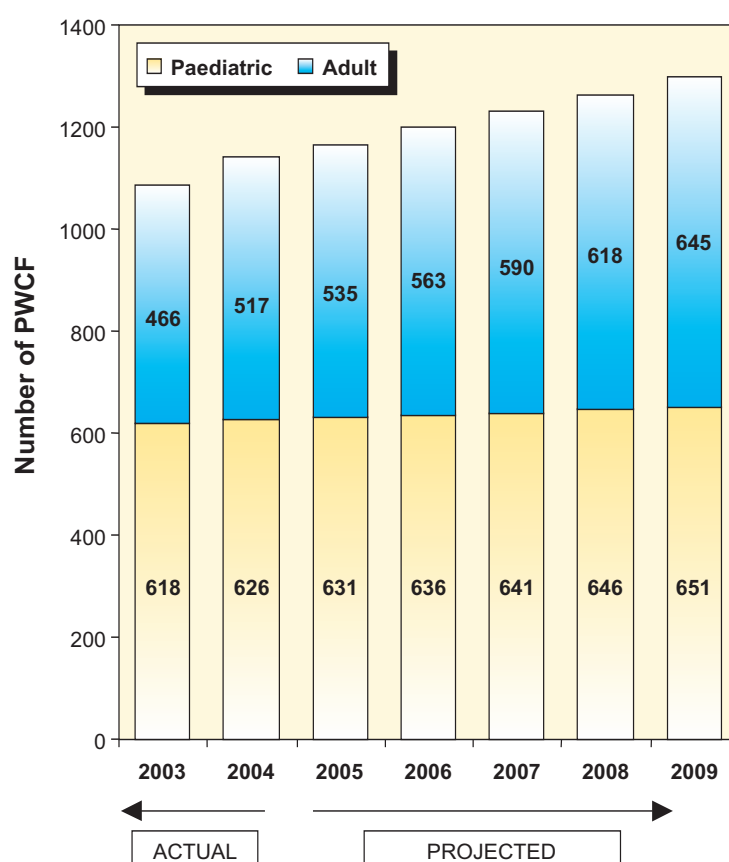
Each year approximately 35 persons are diagnosed with CF. The majority of this number will be diagnosed before they reach 18 years of age, so they will be included in the paediatric category. But, at the same time, about the same number of PWCF will migrate from the paediatric category into the adult category, by virtue of the fact that they have turned 18 years of age. Figure 8 is based on a net gain in the paediatric category of 5 each year (33 newly diagnosed, minus 28 who move into the adult

category) and a net gain in the adult category of 28.

Once we have at least 95% of the present population on the Registry and are actively enrolling PWCF as they are diagnosed, this type of projection will become much more reliable. For the present, these assumptions are very conservative and represent actual census data of PWCF from 2003 to 2004; while showing likely numbers for future years as projections.

The total PWCF population estimated in 2009 is 1296 PWCF, compared with 1084 in 2003. This would be a total increase of 20% over the seven year period. Based on these projections, the Paediatric PWCF increase from 2003 to 2009 is 5%; while the Adult PWCF increase in the same period is 38%.

**Figure 8: Projected CF Census to 2009**



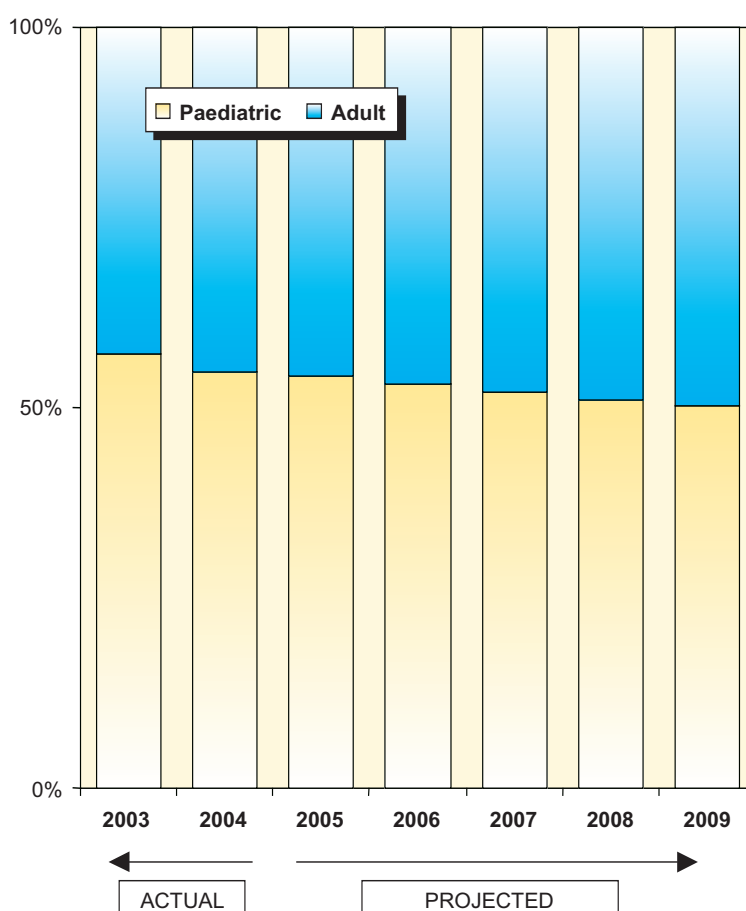
We are particularly interested in estimating the Adult PWCF population in future years. This will be helpful in planning services. Generally speaking, Adult PWCF develop more complications and require more hospitalisations as they age. This trend is demonstrated in the Hospitalisations section of the present report.

The change over time of the ratio of Adult PWCF to Paediatric PWCF is shown in Figure 9. Since the net gain (28) in the Adult category is larger than the net gain (5) in the Paediatric category, the Adult group will eventually become the dominant group in terms

of overall numbers. By 2009 we estimate that there will be equal numbers (50:50 ratio) of PWCF in each group.

This will have a significant impact on resource planning because the Adult group will require closer medical attention and management. If current resources are expanded now, especially in the Adult centres, then the impact of this growth rate will not have the consequential negative effect than if current resources remain static.

**Figure 9: Proportion of Paediatric to Adult Projection 2003-2009**



## CF Census vs. Registry Enrolees vs. Registry Consents

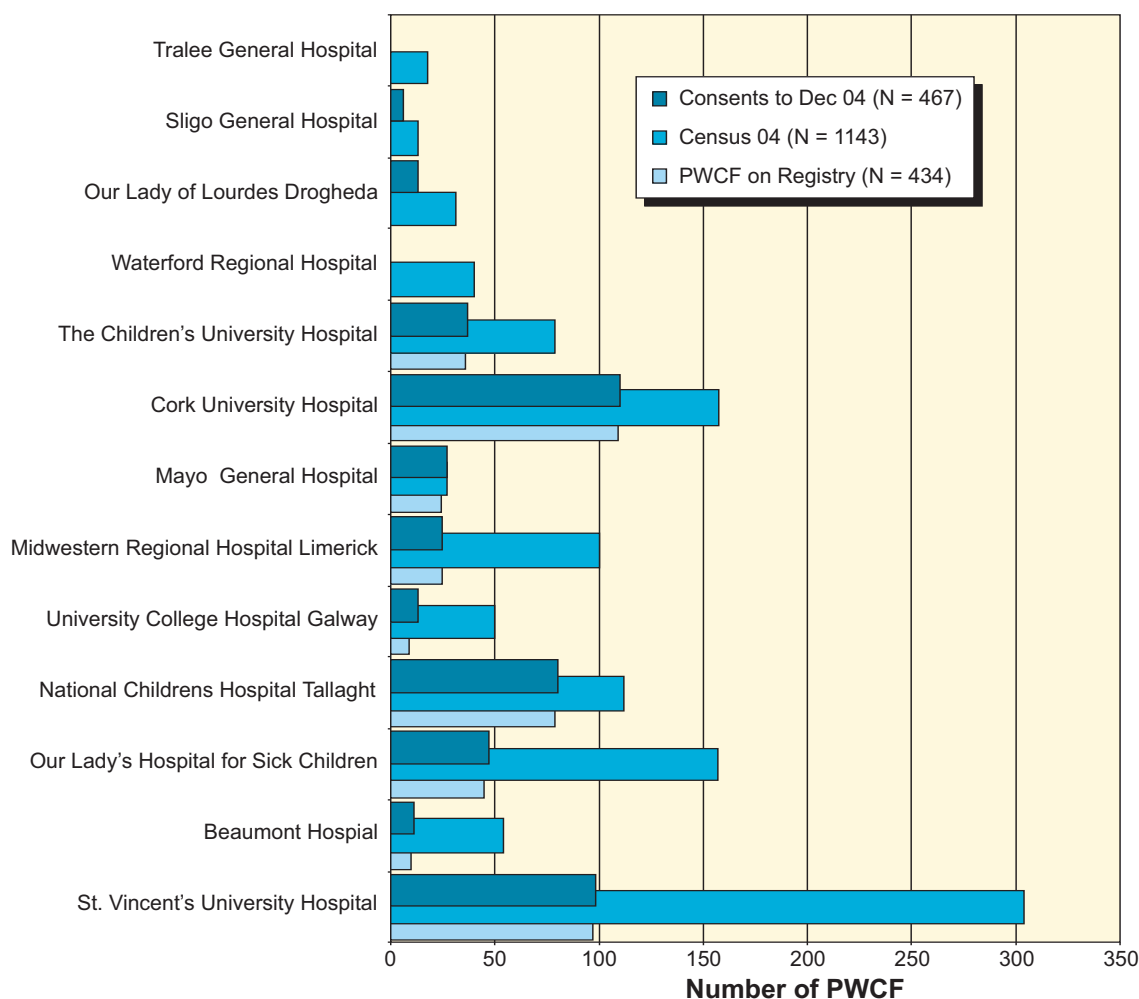
Before a PWCF can be enrolled on the Registry, they (or a parent, if the PWCF is less than 18) must sign an informed Consent Form. One way of keeping track of our objective is to compare each CF Centre's Consent Forms against their Census. We can also keep track of how many PWCF have signed Consent Forms and have already been added to the database.

Figure 10 shows each CF Centre's population alongside the number of Consents that have been

lodged with the Registry; the third bar in each category represents the number of PWCF who have been enrolled onto the Registry.

The gap between the Consent bars and Census bars represents the number of PWCF who have yet to sign a Consent Form. During 2005, time will be spent on decreasing this gap; that is, signing up as many people as possible. Once a consent form is signed we can visit the hospital and collect the relevant data from the chart.

**Figure 10: Enrolments on Registry vs. Census 04 vs. Consents Signed to end 2004**



The following table (Table 2) shows the accrual pattern onto the Registry since the first patient was entered in July, 2002. This rate of enrolment has speeded up considerably since the CRA began working for the Registry in January, 2004. If we can maintain this rate we will have a large proportion of PWCF enrolled by December, 2005. At present we are also entering second and third Annual Assessments in order to develop some longitudinal data. Of the total number of enrolees, 311 have one Annual Assessments; 92 have two Annual

Assessments; 4 have three Annual Assessments and 27 have no Annual Assessment.

The Mean age (average age) of all PWCF in the Registry is 16.6 years. The Median age (or middle value where half of the entries are above that age and the other half of entries are below that age) is 16 years. The median age of enrolees is a statistic that we will track over time and use to compare with other national CF registries.

**Table 2: General Data From Registry**

YEAR:	2002	2003	2004	TOTAL	% AGE
Number of PWCF 'Registered'	21	112	301	434	100%
Age Range				1-53	
Mean Age PWCF on Registry				16.6 years	
Median Age PWCF on Registry				16 years	
Number of Males				221	51%
Number of Females				213	49%
Number less than 18 yrs of age				243	56%
Number 18 yrs of age or older				191	44%
Number Males 18 yrs or older				94	21.7%
Number Females 18 yrs or older				97	22.4%
Deaths during year	0	6	4	10	2%
<b>Total Number PWCF alive at end of 2004</b>				<b>424</b>	<b>98%</b>

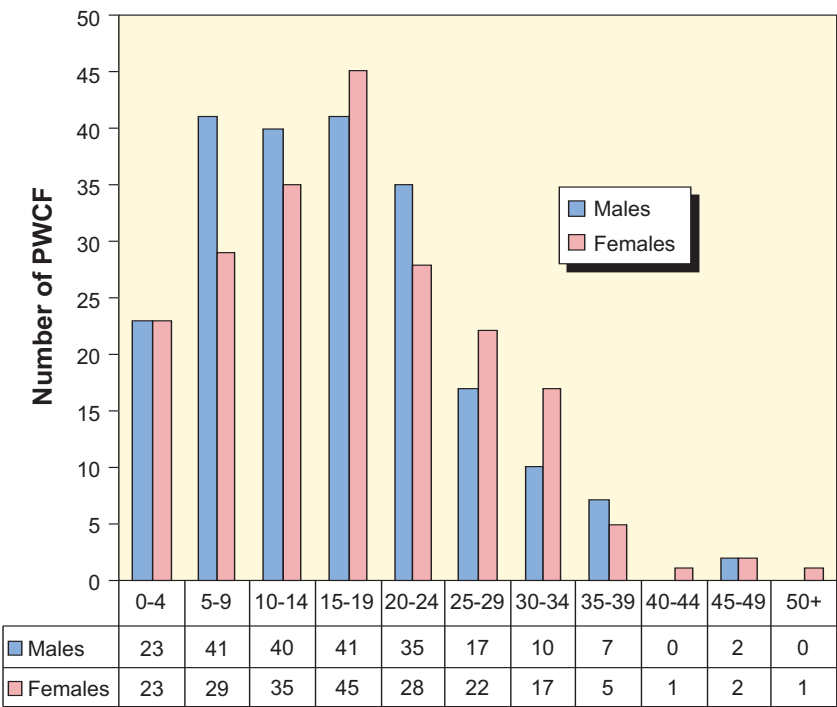
### Age and Sex Distribution

The current range of ages of PWCF on the Registry is from 1 to 53 years old. The age and sex distribution may be grouped into five year 'Age Bands' in order to compare our Registry with those of other countries. These 'Age Band' categories are used quite commonly by other registries. It is a reliable way to compare CF populations across

countries. At the end of 2004 the total number of males was 216 and the total number of females was 208 (these figures include all enrolees alive at the end of 2004).

The distribution over ages between males and females is slightly different as can be seen in Figure 11.

Figure 11: Age Band Distribution of Males and Females



## Ethnicity

We are also holding data on a person's ethnicity because this has relevance to one's genotype and the frequency of a particular genotype in Ireland.

The vast majority of PWCF on the Registry were born in Ireland of Irish parents. It is possible that future

trends may develop which will reflect a more fluid movement of population. We will be able to keep track of these trends as they will influence the incidence of CF births in this country.

**Table 3: Ethnicity of PWCF Registry Enrolees**

BIRTHPLACE	ETHNICITY	NUMBER OF PWCF	PERCENTAGE
Ireland/UK	Irish	429	98.8%
Ireland/UK	North American	1	0.2%
Ireland/UK	Mixed	1	0.2%
US/ Canada	North American	3	0.7%

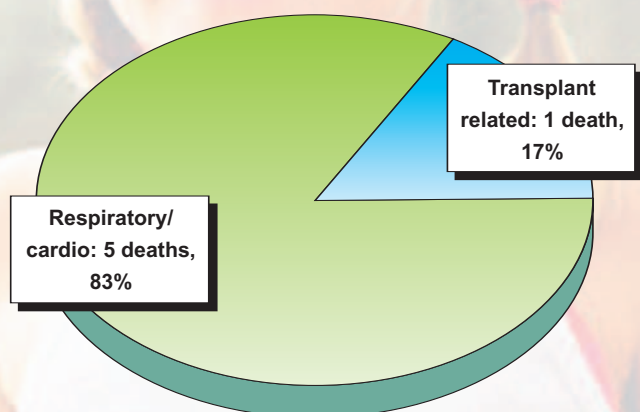
## Deaths

Figures 13 and 14 show a comparison of the number of deaths and causes of death. These are very small numbers and no conclusions can be drawn, but the dominance of 'cardio/respiratory' problems is not

unexpected. These will be tracked in future years to see if anything unusual emerges. These percentages of cause of death are in line with other CF registries worldwide.

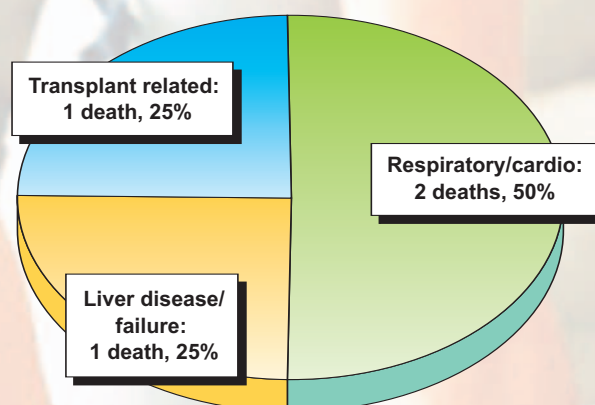
**Figure 12: Deaths 2003, Cause of Death.**

**Total deaths = 6; 5♂, 1♀**



**Figure 13: Deaths 2004, Cause of Death.**

**Total deaths = 4; 4♀**



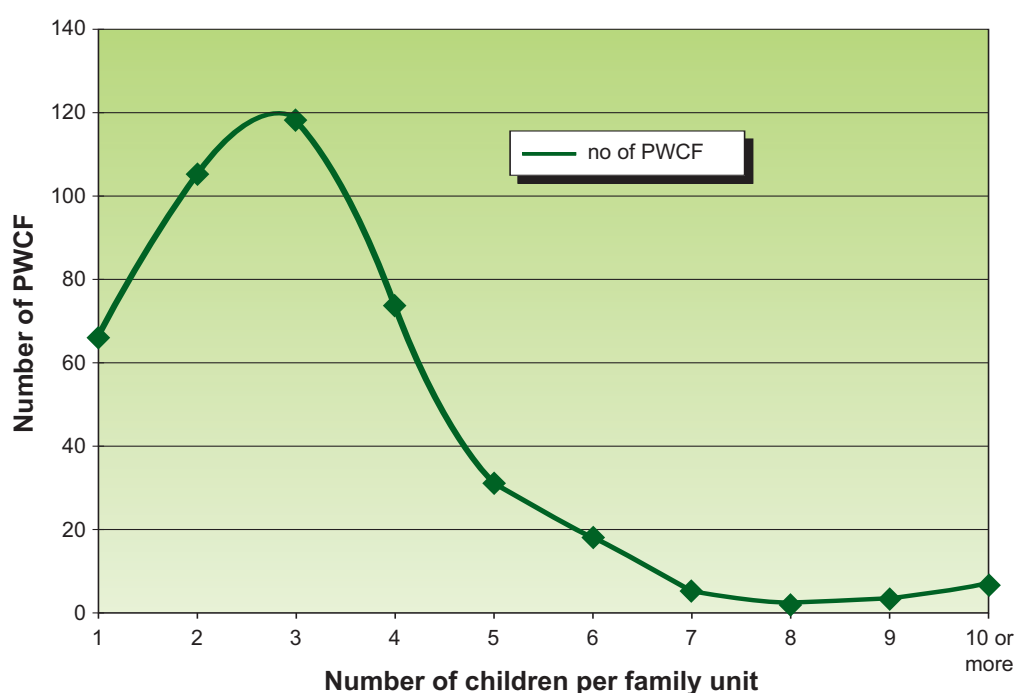
## Siblings

Ireland is rather unique in terms of family size and in terms of the number of siblings who have CF. Much of this uniqueness is undoubtedly due to socio-cultural reasons which have changed significantly over the last 20+ years. Historically, Ireland had larger families than most other countries. Since 1981 this has changed in the general population (reference: Central Statistics Office, Census 2002<sup>1</sup>). In 1981 the average number of children per family was 2.2; whereas by 2002 this number had dropped considerably to 1.6 children per family. The percentage of families with three or more children has changed also; going from 38% of family units in 1981 to 23% of family units in 2002. The drop-off of family units with four or more children has been more dramatic, going from 22% in 1981 to 8% in 2002. Thus, over a twenty year period the size of family units has decreased significantly in the general population.

In our CF Registry population we have an interesting situation that is somewhat different to the general family unit changes of the last 20 years. For instance, the average number of children per family unit in the CF sample is 3.1 which is greater than the country average in 1981 (2.2 children per family). If we look at family units described by the number of children in each unit and plot that against the number of PWCF (Figure 14) we can see that a sizable number of PWCF come from family units with 3 or more children in the family. In fact, 60% of the PWCF population comes from family units of 3 or more children. This is an interesting phenomenon which could provide some fascinating research propositions.

Undoubtedly because of the tradition of large families in Ireland, there is a significant proportion of PWCF who also have siblings with (either living or deceased) CF. Table 4 describes this situation.

**Figure 14: Family Unit Size and Number of PWCF per family unit**



**Table 4: PWCF with and without Siblings with CF**

SIBLING SUMMARY				
NUMBER OF PWCF WHO HAVE AT LEAST ONE CF SIBLING (EITHER CURRENT OR DECEASED)	NUMBER OF PWCF WITH 3 OR MORE SIBLINGS WITH CF	NUMBER OF PWCF WITH 2 SIBLINGS WITH CF	NUMBER OF PWCF WITH 1 SIBLING WITH CF	NUMBER OF PWCF WITH NO SIBLING WITH CF
208	7	48	153	226
47.9%	1.6%	11.1%	35.3%	52.1%

This is again illustrated as follows (Figure 15), showing that the number of PWCF with at least one CF sibling is almost half of the total CF population.

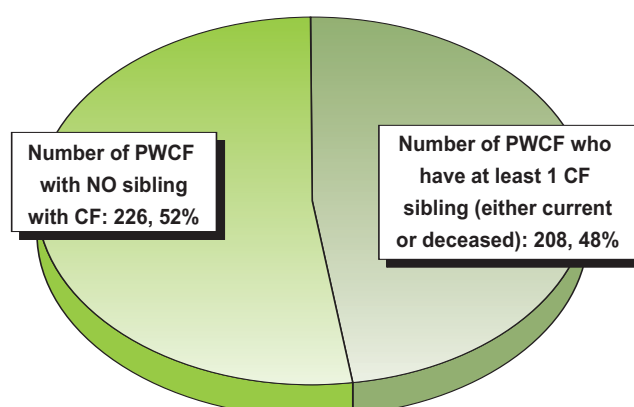
This striking phenomenon may dissipate as the social trends noted by the CSO become apparent in the CF population, but these data show that there is a sizeable, unique group that requires further study. Some of the possible research proposals could include studies of cross-infection within family units and genotype/phenotype comparisons within familial lines.

As further socio-cultural changes take place in Ireland, no doubt the size of the current sibling

phenomena may disappear so it is important to begin to study this remarkable aspect soon.

An interesting international comparison of this situation is between Ireland and Australia/ New Zealand. According to the 2002 Annual Report<sup>2</sup> from the Australasian CF Data Registry, 18.4% of Australian PWCF (total PWCF = 2394) have a sibling with CF and 26.7% of New Zealand PWCF (total PWCF = 358) have a sibling with CF. The Irish rate of siblings with CF (47.9%) is more than two and a half times that of the Australian rate and nearly twice the New Zealand rate. Studies could be designed to compare CF trends between countries and these could yield very helpful information.

**Figure 15: Proportion of PWCF with CF Sibling vs. PWCF with no CF Sibling**



Symptoms at Diagnosis

After the CFTR gene was isolated in the early 1980's researchers began to develop genetic tests for CF which could be carried out using the blood sample (i.e., the 'heel prick' test) which is routinely taken at birth. Throughout the 1990's and into the new century the technology supporting this has become very sophisticated. Alongside genetic tests, other tests are performed to confirm a diagnosis of CF.

Most CF registries now collect data on at least three types of diagnostic criteria: symptoms at diagnosis, sweat test results, and genetic test results.

We are currently using a list of 23 symptoms documented at the time of diagnosis. Figure 16 includes data from all of the PWCF who have been enrolled on the Registry (that is, both current and deceased PWCF). This type of data will be useful in compiling statistics over a long period of time. This graph is constructed with the symptoms occurring in ascending order so that the most frequently reported symptoms are at the bottom of the histogram.

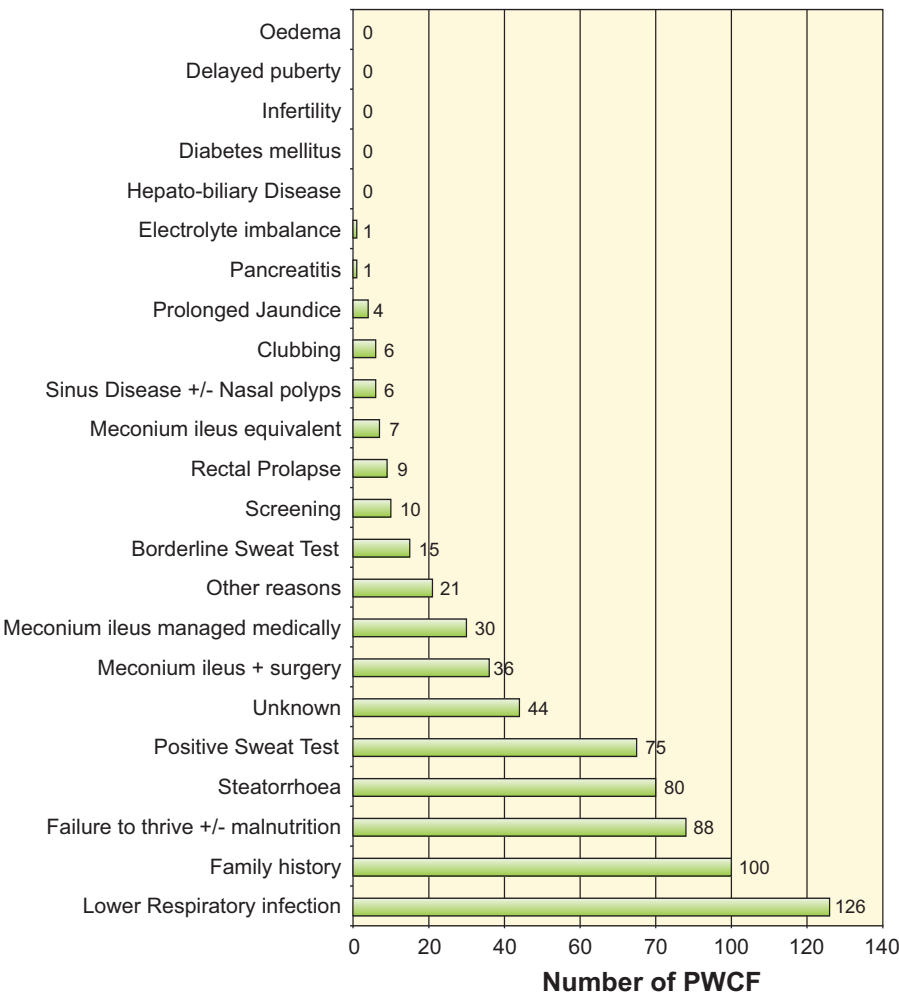
Note that the total number of presenting symptoms is larger than the total number of PWCF. This is because many will

present with 2 or more symptoms. The total that we have tabulated to date is 659 symptoms from 434 PWCF (approximately 1.5 symptoms per PWCF).

As the number of PWCF increases it will be very interesting to contrast it with symptom lists from other countries. Studies comparing cross-cultural clinical diagnoses may be initiated.

However, once newborn screening programmes begin throughout Europe, this type of symptom analysis may become redundant.

Figure 16: Symptoms at Diagnosis.  
n = 434, total number of symptoms reported: 659



**Table 5: Symptoms at Diagnosis**

	TOTALS	%AGE
Lower Respiratory infection	126	29.0%
Family history	100	23.0%
Failure to thrive +/- malnutrition	88	20.3%
Steatorrhoea	80	18.4%
Positive Sweat Test	75	17.3%
Unknown	44	10.1%
Meconium ileus + surgery	36	8.3%
Meconium ileus managed medically	30	6.9%
Other reasons	21	4.8%
Borderline Sweat Test	15	3.5%
Screening	10	2.3%
Rectal Prolapse	9	2.1%
Meconium ileus equivalent	7	1.6%
Sinus Disease +/- Nasal polyps	6	1.4%
Clubbing	6	1.4%
Prolonged Jaundice	4	0.9%
Pancreatitis	1	0.2%
Electrolyte imbalance	1	0.2%
Hepato-biliary Disease	0	
Diabetes mellitus	0	
Infertility	0	
Delayed puberty	0	
Oedema	0	
<b>Total no. of Symptoms recorded</b>	<b>659</b>	<b>152%</b>

**NB:** Since one PWCF may have more than one symptom recorded, the total number of symptoms exceeds the total number of PWCF. Also, the percentage of PWCF is calculated from 434 PWCF (rather than 659), so the total percentage exceeds 100%.

The data from Figure 16 can also be viewed in terms of percentage of PWCF who present with a particular symptom. This is represented in Table 5 which shows the relative frequency of a symptom occurring at the time of diagnosis.

This shows us that 29% of PWCF (total = 434) suffered from lower respiratory infection at diagnosis. Twenty-three per cent of PWCF recorded a family history of CF, which is not surprising in the context of the family/sibling data discussed in the previous section.

Failure to thrive also occurs with a fairly high frequency. This is extremely important and should be a warning to healthcare providers who may be able to pick up undiagnosed CF children in their early months.

If we combine the rates of meconium ileus both medically and surgically managed, the result is 15.2%. This rate is similar to other countries; examples being Australia – 13.5%; New Zealand – 12.5% (Annual Report 2002<sup>2</sup>) and Belgium – 15.6% (Annual Data Report, 2001<sup>3</sup>).

Thus, we have some interesting data for comparison with other national registries. Analysis of comparative data can reveal important information about genotypes and phenotypes. This may also have some impact on improving clinical diagnosis in the absence of newborn screening.

## Age at Diagnosis

The age of a PWCF at the time of diagnosis is significant. If it is several weeks, months, or years before a person is diagnosed, considerable adverse effects on the child's development may have become apparent. Some of these adverse effects are irreversible. Among them is a failure to thrive or outright malnutrition; both are primarily due to fat malabsorption (which is a natural consequence of pancreatic insufficiency). An early period of non-diagnosis may be responsible for continuous growth delays, affecting long-term development.

In addition, early lung infections prior to diagnosis may cause severe repercussions throughout a CF child's life. If, however, a child is diagnosed within a few weeks of life, then preventative/rehabilitative measures can be adopted. Long term problems may be delayed or avoided if diagnosis is achieved early. Thus, the 'Age at Diagnosis' is a critical factor and is easily monitored on the Registry database.

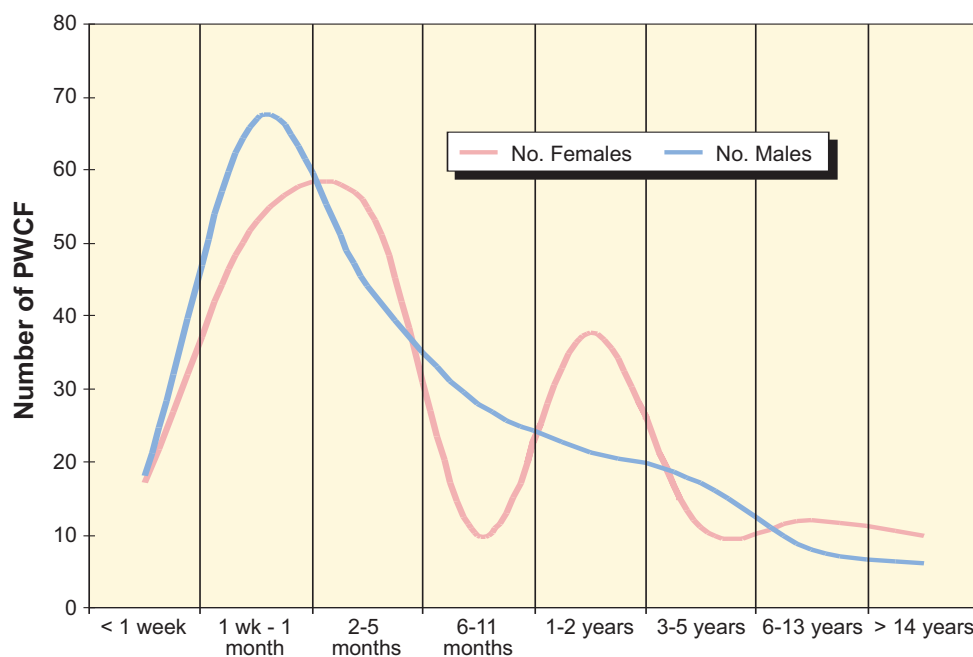
We have been periodically looking at the Age at Diagnosis of our enrollees since late 2003. Many researchers have noted a gender gap (i.e., a difference between males and females) in diagnosis and outcomes; we felt it would be interesting to look at our data to see if it supports a gender gap. So, we analysed the Age at Diagnosis and compared males with females.

Firstly, we noted a difference in the Median Age at Diagnosis in our sample. For the females (total number of females in the calculation is 204 as there are 7 females for whom this data is missing) the Median Age at diagnosis is 3 months and for the males (total number of males in the calculation is 212 as there are 11 males for whom this data is missing) the figure is 2 months. [For reference, the US Annual Data Report of

2003<sup>4</sup> reports a Median Age at diagnosis of 6 months.] If however, we calculate the Mean Age at Diagnosis, there appears to be a larger difference between males and females. For males, the Mean Age at Diagnosis is 18.7 months; and for females the Mean Age at Diagnosis is 27.6 months. These differences may, or may not be significant, but they do warrant further study.

In order to examine the range of ages at diagnosis, we assigned each age at diagnosis to an 'age band' to see if any significant picture would emerge. The age bands were chosen because they are the most likely times for an infant to come to the attention of a health professional (and possibly, diagnosis). The health system provides for routine vigilance of children at these critical times, primarily for vaccination. General practitioners and health visitors are likely to be suspicious if the child displays some of the more common symptoms during these routine, in-built visits. The age bands thus selected were: **Less than 1 week** (infants in this band are likely to be those who are born with meconium ileus or who have a family history of CF and may be investigated at birth); **1 week to 1 month** (if there are early indications of failure to thrive they are likely to be brought to the attention of a health professional in this time period); **2 months to 5 months** (a health professional will normally be seeing a child during this time period for vaccination and may note symptoms such as repetitive lower respiratory infections); **6 months to 11 months**, and **1-2 years, 3-5 years**. After that, the age bands increased to **6-13 years** and **over 14 years**. This exercise produced an interesting graph (Figure 17).

If children are relatively 'symptom free', they may be diagnosed later in life; this applies to both sexes; see Age bands **6-13 years** and **>14 years**. There are still a number of diagnoses made at these later ages in both



**Figure 17: Age at diagnosis; Females [ $n = 204$ ] vs Males [ $n = 212$ ]**

sexes. While there is a difference between males and females in the last two age bands, it is probably not significant.

However, what is extraordinary about our data are the peaks associated with female diagnosis at **2-5 months** and **1-2 years**. The first peak at 2-5 months is slightly later (and shorter) than the peak for males. Also, the female peak at 1-2 years was unexpected. We hope to study this in much greater detail in order to remove confounding factors to see if this is a valid finding, or merely due to selection bias. At first glance these differences in time delay of diagnosis between males and females appear to be a significant factor and point to a gender gap in diagnosis. This has been shown by other researchers, but no one has yet discovered the reasons for the difference.<sup>5</sup>

With the registry set up as it is, we can perform further analysis by investigating each group to look at their presenting symptoms, genotype, sweat test data, family history, year of diagnosis, and many other factors that

could influence the Age at Diagnosis. This can be done relatively quickly because we have the data already collected. If we wish to include more PWCF, then we must wait for more PWCF to be enrolled.

If the perceived gender gap is real, then there is a strong case for a Newborn Screening Programme in this country. If all children were screened at birth then the inevitable consequences of malnutrition and other serious conditions could be deferred; potentially lengthening life. Additionally, a screening programme would remove the late peaks in diagnosis for females. We do not know how significant this delay is, but one way to follow these PWCF is through the Registry Annual Assessments (i.e., longitudinally) to see how they compare with those who are diagnosed before one month. So, we can also design a long-term study that follows the cohort of females diagnosed at 1-2 years and compare their progress with other females and males of their own age who were diagnosed before 2 months.

## Genotype

Thus far, 82% of the Registry population has a genotype recorded. [Some of the enrollees may have had their genotype done, but the information may not have been readily available at the time of data entry.]

The list of alleles that is used is the list supplied by the National Genetics Laboratory in Our Lady's Hospital for Sick Children. They use a standard set of eleven alleles which should detect upwards of 93% of the CFTR mutations in the Irish population.

The results are shown in Table 6, both in numbers of alleles (top table) and in percent (bottom table) of the total number of results. If you look at the two tables, you will see that 340 PWCF, or 95.7% of the

population on the database have the  $\Delta F508$  mutation on at least one chromosome. All of the combinations are displayed. So, if you would like to find out how many PWCF have a combination of G551D/G551D, you find the G551D *column* and read down to the G551D *row* and find that 2 PWCF have that combination. There are 36 PWCF (or, 10.1%) who have the  $\Delta F508$ /G551D combination.

We are missing data on 18% of Registry enrollees and we will pursue this information during 2005.

This matrix is adapted from one used in the Australasian CF Data Registry report<sup>2</sup> and can be used for comparison purposes across countries.

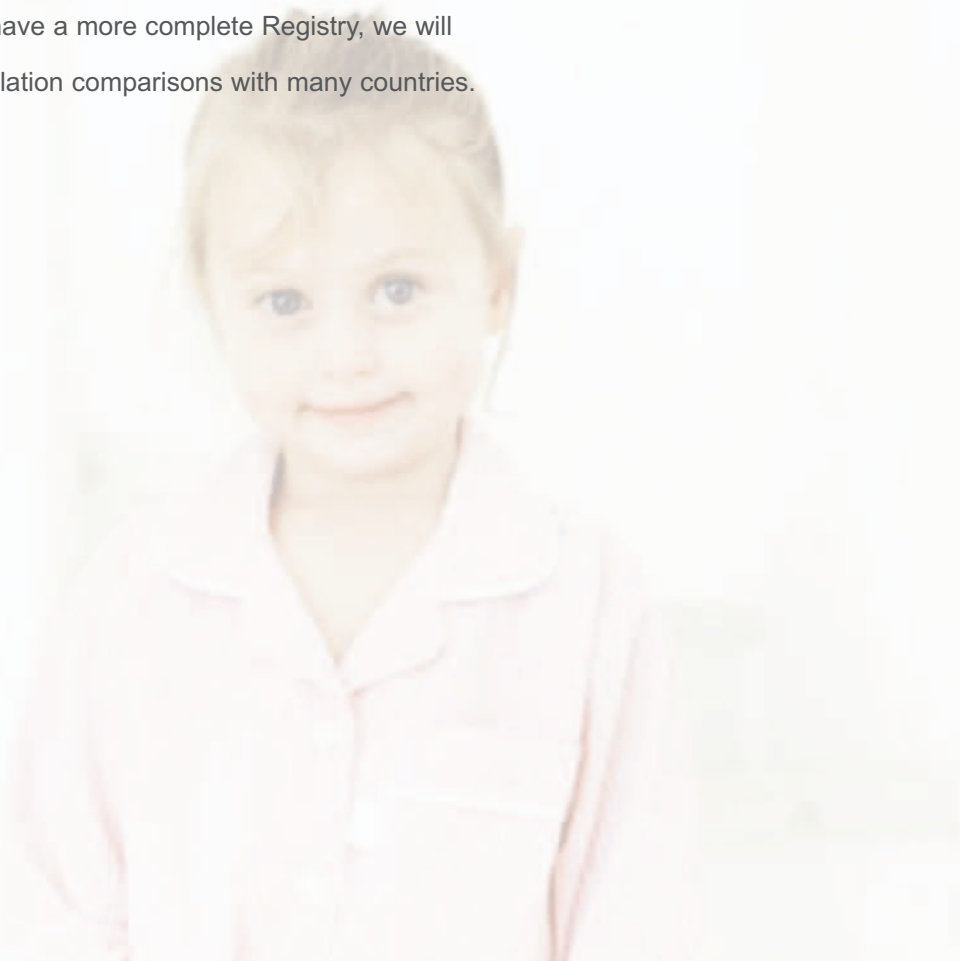
**Table 6: Genotype Irish CF Population enrolled on Registry**

NUMBER													
ALLELE 1													
ALLELE 2 ↓	$\Delta F508$	G551D	G542X	621+1, G→T	R117H	$\Delta 1507$	R560 T/K	N1303K	1717-1, G→A	R553X	R352Q	OTHER	TOTAL
$\Delta F508$	238												238
G551D	36	2					1						39
G542X	4	2											6
621+1, G→T	7												7
R117H	16					1							17
$\Delta 1507$	4												4
R560 T/K	5	1					1						7
N1303K	2												2
1717-1 G→A	5				1								6
R553X													0
R352Q	1												1
Other	6				2							3	11
Unknown													0
Mutation 2 Not Recorded	16				1								17
<b>Total</b>	<b>340</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>355</b>

**Table 6 (contd): Genotype Irish CF Population enrolled on Registry**

PERCENT													
ALLELE 1													
ALLELE 2 ↓	ΔF508	G551D	G542X	621+1, G→T	R117H	Δ1507	R560 T/K	N1303K	1717-1, G→A	R553X	R352Q	OTHER	TOTAL
ΔF508	67.0%												67.0%
G551D	10.1%	0.6%					0.3%						11.0%
G542X	1.1%	0.6%											1.7%
621+1, G→T	2.0%												2.0%
R117H	4.5%					0.3%							4.8%
Δ1507	1.1%												1.1%
R560 T/K	1.4%	0.3%					0.3%						2.0%
N1303K	0.6%												0.6%
1717-1 G→A	1.4%				0.3%								1.7%
R553X													0.0%
R352Q	0.3%												0.3%
Other	1.7%				0.6%							0.8%	3.1%
Unknown													0.0%
Mutation 2 Not Recorded	4.5%				0.3%								4.8%
<b>Total</b>	<b>95.7%</b>	<b>1.5%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>1.2%</b>	<b>0.3%</b>	<b>0.6%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.8%</b>	<b>99.0%</b>

When we have a more complete Registry, we will  
make population comparisons with many countries.



## Hospitalisations and Complications

### Hospitalisations

For this Annual Report, the most recent Annual Assessments (no matter what year they were recorded) were analysed and the data was separated into those PWCF who were 18 years and over; or, under 18 years of age at 31<sup>st</sup> December 2004. We can make comparisons of the hospitalisation rate for the two age groups.

We are basically looking for overall trends that will give an indication of hospitalisations and complications in a given year, comparing Adult and Paediatric PWCF. While the database is not

complete, we can still show that, as expected, the Adult PWCF require more hospital resources than the Paediatric population. On average, they have more than twice as many respiratory exacerbations, but only slightly more 'other exacerbations' (i.e., any other hospitalisations that are not respiratory-related). Their rate of complications is also greater at 3.28 as opposed to 1.89 per Paediatric PWCF.

Please note that all Annual Assessments are not fully completed on every Annual Assessment. That is why the number of Annual Assessments, or the number of PWCF analysed may vary from table to table.

**Table 7: Hospitalisations, Exacerbations and Complications 2002-04**

	TOTAL NUMBER OF ANNUAL ASSESSMENTS	TOTAL HOSPITALISATIONS*	TOTAL RESP EXACERBATIONS*	TOTAL OTHER EXACERBATIONS*	TOTAL COMPLICATIONS*
Total Paediatric PWCF	251	222	210	98	475
Total Adult PWCF	156	176	269	80	511
<b>Total ALL PWCF</b>	<b>407</b>	<b>398</b>	<b>479</b>	<b>178</b>	<b>986</b>

\* Data based on the most recent Annual Assessment.

PAEDIATRIC PWCF		ADULT PWCF	
Hospitalisation rate per PWCF	0.88	Hospitalisation rate per PWCF	1.13
Respiratory Exacerbations per PWCF	0.84	Respiratory Exacerbations per PWCF	1.72
Other Exacerbations per PWCF	0.39	Other Exacerbations per PWCF	0.51
Complication Rate per PWCF	1.89	Complication Rate per PWCF	3.28

## Complications

We have looked at the complications data in several different ways. Firstly, we have compared the percentage of PWCF with a complication for the two years data that we have (i.e., 2003 & 2004). We have chosen to use a percentage comparison because the PWCF numbers for both years (and in each group, adult and paediatric) are quite different.

The following table summarises the numbers of Annual Assessments tabulated for each age group, in each year. While we have the means to record 33 different complications (10 Respiratory/Cardio; 11 Gastrointestinal; and 12 Miscellaneous) there are 10 complications which account for approximately 90% of all complications recorded. It is this set which we will concentrate on in Figures 19 & 20. Data for all of the less frequent complications are presented in Table 9.

Firstly, we looked at a comparison of the complications recorded in 2003 vs. 2004. This shows that although the total numbers of Annual Assessments are quite different (269 in 2003 and 136 in 2004) there are similar percentages of PWCF in both years that describe any of the ten most frequent complications (88.6% in 2003 and 91% in 2004).

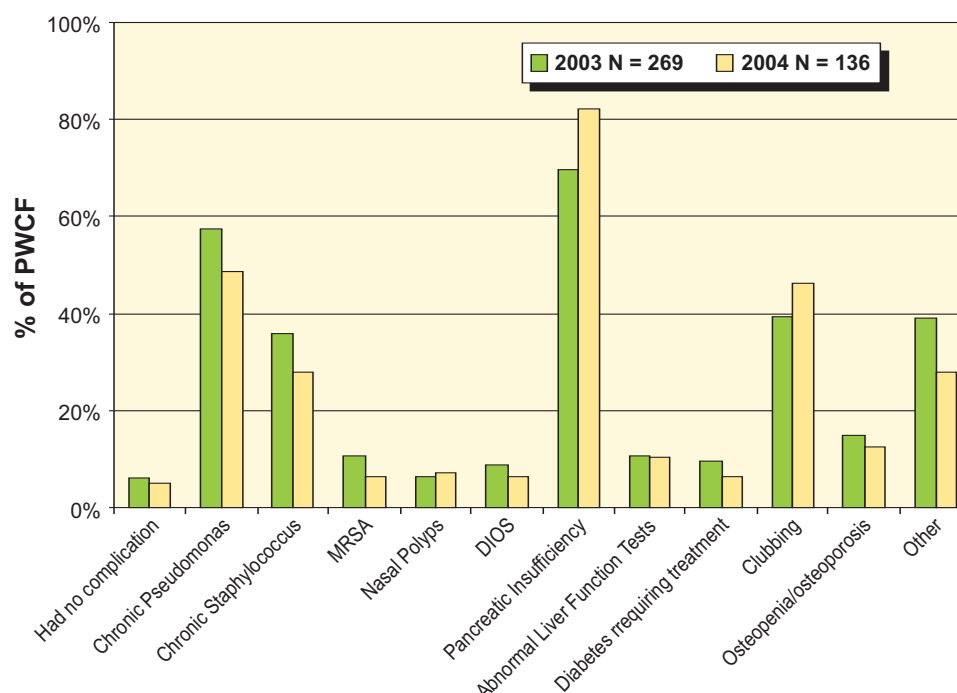
Note that the percentage of PWCF who recorded 'No complication' in both years is very similar (5.9% in 2003 and 5.1% in 2004). This 'No complication' data is presented in all Tables and Figures for reference.

It is important to compare separate age groups, and we have done so with the ten most frequently occurring complications; while combining two years of data for each group. As further data accumulates in subsequent years it may be more interesting to

**Table 8: Complications Summary 2003 & 2004**

	YEAR		TOTAL
	2003	2004	BOTH YEARS
<b>Adult PWCF</b>	102	53	<b>155</b>
<b>Paediatric PWCF</b>	167	83	<b>250</b>
<b>Total number of Annual Assessments</b>	<b>269</b>	<b>136</b>	<b>405</b>
<b>Total Number of Complications reported in year</b>	801	378	<b>1179</b>
<b>Total Number of Complications in set of 10 most frequently reported complications</b>	710	344	<b>1054</b>
<b>Percentage of total of the 10 most frequently reported complications</b>	<b>88.6%</b>	<b>91.0%</b>	<b>89.4%</b>

**Figure 18: Percentage of PWCF with Complications, 2003 vs. 2004**



**NB:** 'Diabetes requiring treatment' refers to either insulin or oral hypoglycaemic products. Also, note that *Pseudomonas* and *Staphylococcus* data are presented more fully in the Cultures section.

break up the age groups into smaller age bands.

The relatively small numbers in our sample do not yet warrant the age band exercise.

The following observations may be made when we separate the data into the two age brackets: 1) there is a slight difference in the PWCF reporting, 'No complication'; with the Adult PWCF reporting fewer at 3%; the Paediatric group at 7%; 2) the MRSA complication is similar, 12% in the Adult PWCF and 8% in the Paediatric group; 3) Chronic *Staphylococcus* infection is slightly higher in the Paediatric group; and 4) Pancreatic insufficiency is similar in both groups - over 70% in each group.

There are some more noticeable differences in many other complications, which are apparent in the

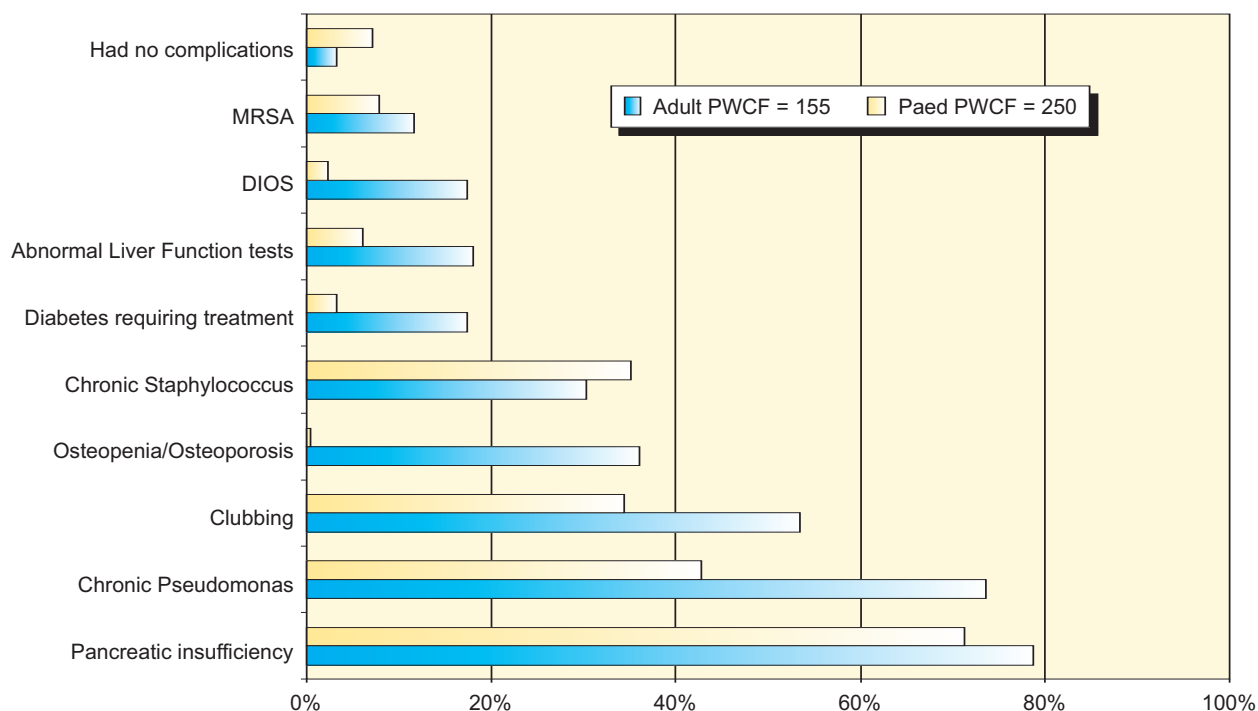
figures; notable are Chronic *Pseudomonas*, Clubbing, Osteopenia/Osteoporosis, Diabetes, Abnormal LFT's, and DIOS (Distal Intestinal Obstruction Syndrome). If we calculate the *ratio* of the Adult percentage to the Paediatric percentage, it is over 90 for the Osteopenia/Osteoporosis complication, 7.3 for DIOS, 5.4 for Diabetes and 3.0 for Abnormal LFT's. For all of the others the ratio is less than 2. This exercise is useful in order to highlight some of the complications that may emerge as PWCF grow older. This 'ratio' exercise highlights potential complications which may be anticipated. Evidence for these complications may be sought at an earlier age than previously expected. Further study of these trends is recommended to clarify the beginning of the disease process.

**Table 9: Complications of lower frequency**

LESS FREQUENTLY OCCURRING COMPLICATIONS						
	2003			2004		
Total Number of PWCF With Annual Assessment for the Year	269			136		
Total Number of Complications reported by PWCF	801			378		
Average number of Complications per PWCF	3.0			2.8		
COMPLICATION	NUMBER OF PWCF REPORTING COMPLICATION	PERCENTAGE OF PWCF WHO REPORT COMPLICATION	PERCENTAGE OF TOTAL NUMBER OF COMPLICATIONS	NUMBER OF PWCF REPORTING COMPLICATION	PERCENTAGE OF PWCF WHO REPORT COMPLICATION	PERCENTAGE OF TOTAL NUMBER OF COMPLICATIONS
Had No Complication	16	5.9%	2.0%	7	5.1%	1.9%
Burkholderia Cepacia Complex	3	1.1%	0.4%	0	0.0%	0.0%
ABPA	10	3.7%	1.2%	7	5.1%	1.9%
Massive haemoptysis	3	1.1%	0.4%	1	0.7%	0.3%
Asthma	15	5.6%	1.9%	3	2.2%	0.8%
Pneumothorax	1	0.4%	0.1%	0	0.0%	0.0%
Haematemesis	0	0.0%	0.0%	0	0.0%	0.0%
GI Reflux	13	4.8%	1.6%	3	2.2%	0.8%
Colonic Stricture	0	0.0%	0.0%	0	0.0%	0.0%
Rectal prolapse	4	1.5%	0.5%	1	0.7%	0.3%
Gallbladder disease	4	1.5%	0.5%	2	1.5%	0.5%
Pancreatitis	1	0.4%	0.1%	0	0.0%	0.0%
Liver disease other than cirrhosis	6	2.2%	0.7%	4	2.9%	1.1%
Cirrhosis with portal hypertension	5	1.9%	0.6%	3	2.2%	0.8%
Micro albuminuria	0	0.0%	0.0%	0	0.0%	0.0%
Renal failure requiring dialysis	0	0.0%	0.0%	1	0.7%	0.3%
Arthropathy	3	1.1%	0.4%	2	1.5%	0.5%
Cancer	0	0.0%	0.0%	0	0.0%	0.0%
Had IV port replaced?	11	4.1%	1.4%	3	2.2%	0.8%
Bone fracture	0	0.0%	0.0%	0	0.0%	0.0%
Hearing loss	2	0.7%	0.2%	0	0.0%	0.0%
Depression	8	3.0%	1.0%	1	0.7%	0.3%

NB: *Burkholderia cepacia* complex is further analysed in the Cultures section.

**Figure 19: Comparison of Paediatric vs. Adult PWCF Complications (2003 & 2004 combined)**



Finally, it is very important to examine the complications that occur with less frequency as they may emerge in any patient and awareness of these is important. Table 9 shows the array of the rarer complications and their relative frequencies in 2003 and 2004. The age group analysis has not been carried out with this data.

Complications data can reveal a lot of information about the individual PWCF, the CF Centre/hospital and the overall trends in a country. It can be a barometer of well-being. It can also be correlated to hospitalisations and used in pharmacological-economic studies. It will become more important in the future as the Adult group of PWCF becomes larger.

This cultures summary is based on data from both 2003 and 2004. It is presented as a description of the range of cultures that have been reported in the PWCF population who are enrolled on the Registry to date. We are only presenting data for sputum cultures in this report, but the Registry also records results from 'cough swabs', BAL[bronchoalveolar lavage], axilla, groin, nasal & throat swabs and 'other' sample types. These may be used in further detailed studies of the microbiology of Irish PWCF.

Each culture is recorded together with a date when the sample was taken. This means that it is recorded independently of the Annual Assessment date. That is, for example, if an Annual Assessment is done in March of a given year; then cultures dating back to the previous April are recorded. So, if the consultant

would like to look at all of the positive cultures in a particular year, irrespective of the year of Annual Assessment for his PWCF, he/she may call up all of the cultures for that year. These will include cultures from only one calendar year, but they may be 'gathered' from Annual Assessments that span two consecutive years.

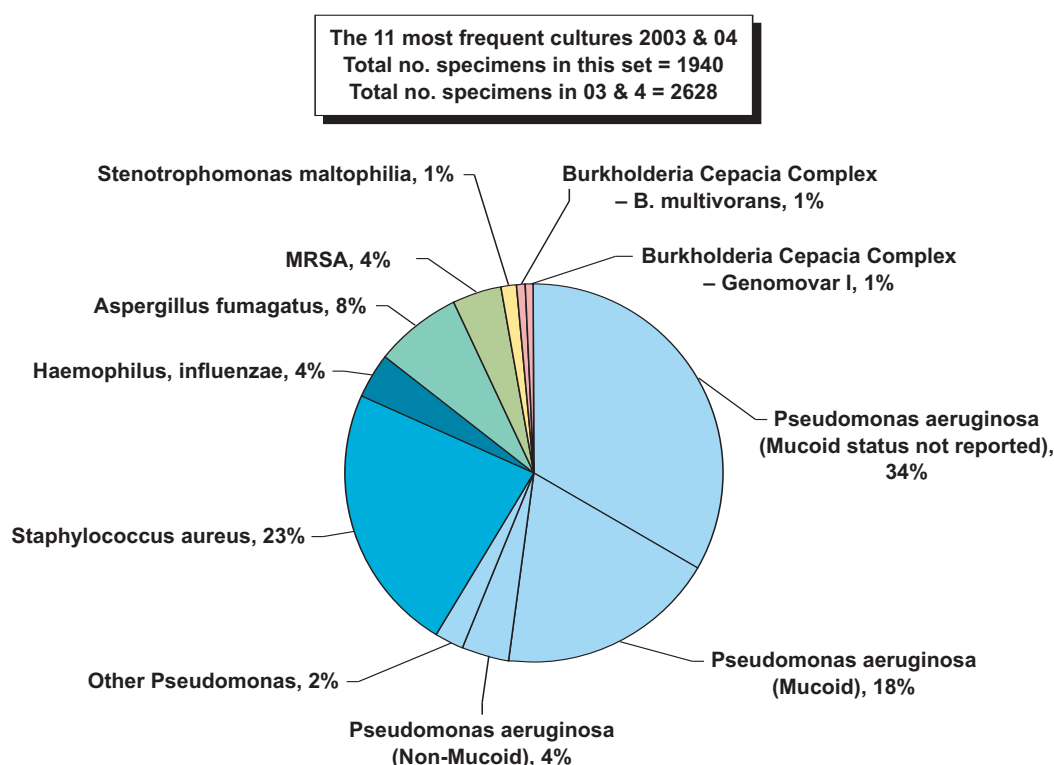
Looking at the number of specimens and their type, yields Table 10, split by year of sample.

The total number of PWCF contributing to each set is 300 for 2003; and 96 for 2004. The total number of samples taken from those PWCF is 3,016 for 2003; and 573 for 2004. The percentage of each type of sample is roughly similar for the two years: 74% sputums in 2003, vs. 69% sputums in 2004. Each

**Table 10: Culture Types, 2003 vs. 2004**

CULTURES				
2003			2004	
<b>Number of PWCF analysed:</b>			<b>96</b>	
<b>CULTURE TYPE</b>	<b>% OF SAMPLES</b>		<b>% OF SAMPLES</b>	
Cough Swab	693	23%	172	30%
Sputum Culture	2232	74%	396	69%
BAL	9		0	
Axilla Swab	1		0	
Groin Swab	4		0	
Nasal Swab	8		0	
Throat Swab	26	0.9%	3	0.5%
Other Sample Type	43	1.4%	2	0.3%
<b>Total Number Of Samples Taken:</b>			<b>573</b>	
<b>Mean number cultures per PWCF</b>			<b>6.0</b>	

**Figure 20: Most Frequent Culture Samples, 2003 and 2004 Combined**



PWCF may have more than one specimen in this set, and some could have as many as 20 cultures taken in a 12 month period.

We have a range of fifty eight different microbiologic cultures found over these two years in our Registry population. However, if we look at those cultures which contribute 1% or more of samples, then we have a total of just 12 different cultures. These 12 (including 239 samples which tested as 'Normal flora') account for 93% of all sputum samples. The remaining 46 cultures occur with a frequency of less than 1% (in the sample total of 2628 sputums).

If we remove the 'Normal flora' samples, and combine all of the minor Pseudomonas samples

together as 'Other pseudomonas', the pie chart in Figure 21 is produced.

Now, let us examine the Pseudomonas group in more detail. The Pseudomonas cultures (Pa cultures = 1138) comprise 43% of the total number of cultures (total no.= 2628). They are classified as 'Mucooid', 'Non-mucooid', 'Mucooid status not recorded', and as 'Other Pseudomonas'. We also have five additional species recorded separately: *P. stutzeri*, *P. mendocina*, *P. fluorescens*, and *P. alcaligenes*. For the purposes of Figure 21, all of these species are grouped together with those that were entered onto the database as 'Other Pseudomonas species' to give us one category for the pie chart of 'Other Pseudomonas species'.

The majority of reports (58%) do not classify the *Pseudomonas* as 'mucoid' or 'non-mucoid', rather the term 'mucoid status not reported' is used.

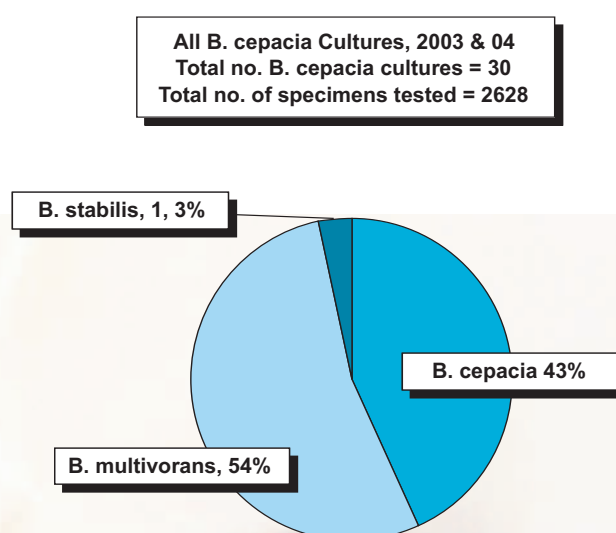
Because *Pseudomonas* is such an important microbe in CF, in future reports we will also breakdown the culture reports in terms of age groups. This is done regularly by other countries and we will be able to compare our *Pseudomonas* spectrum with other registries/countries.

Finally, it is important to examine the *Burkholderia cepacia* cultures from our sample. The only culture

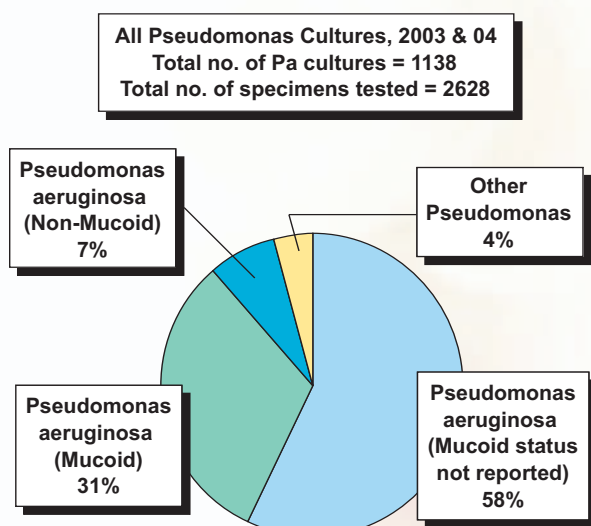
*stabilis*). The total number of *B. cepacia* cultures for 2003 and 2004 was 30; which is 1.14% of all cultures in the sample.

Thus, we now have an idea of the range of infections

**Figure 22: *Burkholderia cepacia*; Proportion of genomovars**



**Figure 21: All *Pseudomonas* Cultures**



results for *B. cepacia* in the Irish registry are from 2003 reports. There were 30 positive cultures and these came from 8 PWCF. Two of those PWCF also produced positive results for two separate genomovars. One PWCF had genomovars I (*B. cepacia*) and II (*B. multivorans*); while the other PWCF had genomovars I (*B. cepacia*) and IV (*B.*

that Irish PWCF suffer from. We also have some evidence of the proportion of the total that belong to the *P. aeruginosa* group and the *B. cepacia* group. In subsequent years we will display these results in terms their occurrence in different age groups.

Please note that the numbers of cultures for the years 2003 & 2004 will probably increase, especially the 2004 rate. This is because during the year 2005 we will be recording reports from 2004; even if the Annual Assessment is in 2005, as the data is a 12-month retrospective. This will not normalise for at least five years.

## Antibiotic Usage

During each Annual Assessment period, we collect as much antibiotic data as possible. This includes the name and dose of the antibiotic; the route (IV hospital; IV home; inhaled, oral, etc.); and the Start Date and Stop Date for each course. Most intravenous antibiotic courses have definite Start Dates and Stop Dates. Therefore, the data for IV treatment (i.e., the number of days' treatment) is as accurate as is the information from the hospital chart, although mistakes can still be made in transcribing the data into the Registry.

There are, however, problems in calculating the number of days' treatment for those antibiotics that are given either 'continuously' or 'intermittently'. This primarily affects the inhaled antibiotics, but also a number of antibiotics taken orally. For example, treatment may be noted as 'Continuous' with a Start Date that is a few years previous to the first recorded Annual Assessment for a PWCF. Other common permutations of treatment may be 28 days 'on'; followed by 28 days 'off' (or alternatively 28 days on one antibiotic, followed by 28 days on a second antibiotic, repeated continuously). We are currently developing a set of guidelines for data entry that can be assigned to these types of situations. After we have considered all the cases, we can then calculate, fairly accurately, the number of days of inhaled antibiotics for a given year. For this report we will only report on the numbers of PWCF taking inhaled or oral medications, but not on the number of days recorded.

From the data that we have, we are able to show the numbers of PWCF who have taken IV antibiotics during the entire period (2002-04) that the Registry has

recorded Annual Assessments. These data are from 434 PWCF. This group of 434 has generated 507 Annual Assessments to the end of December, 2004. The breakdown of Annual Assessments is as follows:

**Table 11: Number of Annual Assessments in Registry**

	NUMBER OF PWCF	NUMBER OF ANNUAL ASSESSMENTS
PWCF with no AA	27	
PWCF with 1 AA	311	311
PWCF with 2 AA	92	184
PWCF with 3 AA	4	12
<b>Total Enrolled</b>	<b>434</b>	
Number with at least 1 AA	407	
<b>Total no AAs</b>		<b>507</b>

There are 27 PWCF who do not have an Annual Assessment recorded as they were diagnosed less than a year before they were registered.

We counted the number of PWCF who have received at least one antibiotic in the period from 2002 to 2004. If someone received an antibiotic during any Annual Assessment period they were counted once, and not counted again. There were 396 PWCF (97.3%) who received at least one antibiotic (oral, inhaled, IV home or IV hospital) in the time period.

**Table 12: Hospital IV Treatment**

	TOTAL PWCF ON REGISTRY	NUMBER WHO HAD AT LEAST ONE AB	NUMBER OF PWCF ON IV HOSPITAL	PERCENTAGE OF TREATED PWCF	TOTAL NUMBER OF DAYS IV HOSPITAL	MEAN NUMBER OF TREATMENT DAYS/TREATED PWCF
Paed PWCF	243	218	75	34%	4693	62.6
Adult PWCF	191	178	87	49%	8290	102.5
<b>Total</b>	<b>434</b>	<b>396</b>	<b>162</b>	<b>41%</b>	<b>13613</b>	<b>84.0</b>

**NB:** One PWCF who has one antibiotic for one day = 'One Treatment Day'. Some courses of antibiotics are given concomitantly (e.g. ceftazidime + tobramycin IV are often given together over the same number of days), so the 'Number of Treatment Days' does not represent consecutive days in hospital.

## Hospital IV Consumption

The Hospital IV consumption is summarised in Table 12.

Looking first at the Paediatric PWCF group, 218 PWCF, or 90% of the total number of Paediatric PWCF had at least one antibiotic; 75 of the 218 PWCF, or 34.4% had that treatment as IV Hospital treatment. In the entire Paediatric group, 75 of 243, or 31% had IV Hospital treatment.

Doing the same exercise for the Adult group: 178, or 93% PWCF had at least one antibiotic; 87 of 178 PWCF, or 49% had that antibiotic as IV Hospital treatment. In the entire Adult group, 87 of 191, or 46% had IV Hospital treatment.

The mean number of treatment days is higher in the Adult group at 102.5 days per PWCF; as opposed to 62.5 days per PWCF in the Paediatric group. It would be expected that the Adult group would have a higher number of days, but we will gather more data before we do significance testing on these differences.

## Home IV Consumption

The same table for Home IV consumption is shown below; see Table 13.

In the Paediatric PWCF group, 39 of 218 PWCF, or 18% had Home IV antibiotic treatment; while 68 of

**Table 13: Home IV Treatment**

	TOTAL PWCF ON REGISTRY	NUMBER WHO HAD AT LEAST ONE AB	NUMBER OF PWCF ON IV HOME	PERCENTAGE OF TREATED PWCF	TOTAL NUMBER OF DAYS IV HOME	MEAN NUMBER OF TREATMENT DAYS/TREATED PWCF
Paed PWCF	243	218	39	18%	2923	74.9
Adult PWCF	191	178	68	38%	4437	65.3
<b>Total</b>	<b>434</b>	<b>396</b>	<b>107</b>	<b>27%</b>	<b>7360</b>	<b>68.8</b>

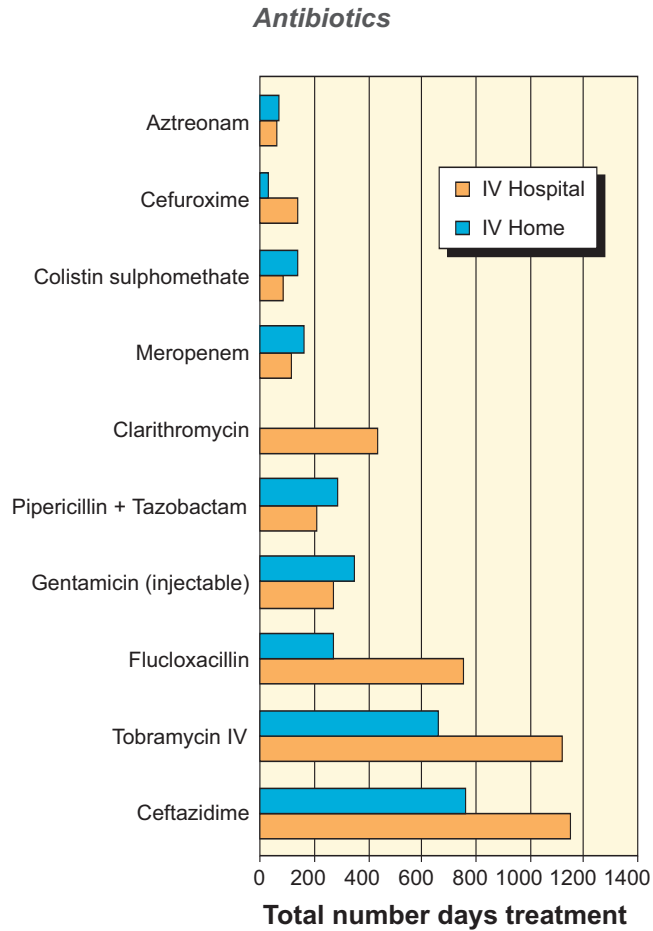
178 Adult PWCF, or 38% of the Adult group had Home IV treatment. In the entire Paediatric group, 39 of 243, or 16% had IV Home treatment, in comparison with 68 of 191, or 36% of the whole Adult group who had IV Home treatment.

Here, the mean number of days' treatment was similar for both age groups; 65.3 days for Adults versus 74.9 days for Paediatric; in fact, the Paediatric group shows a slightly higher mean number of days treatment for IV Home consumption. This is interesting, but needs further study to establish whether or not this is a significant trend.

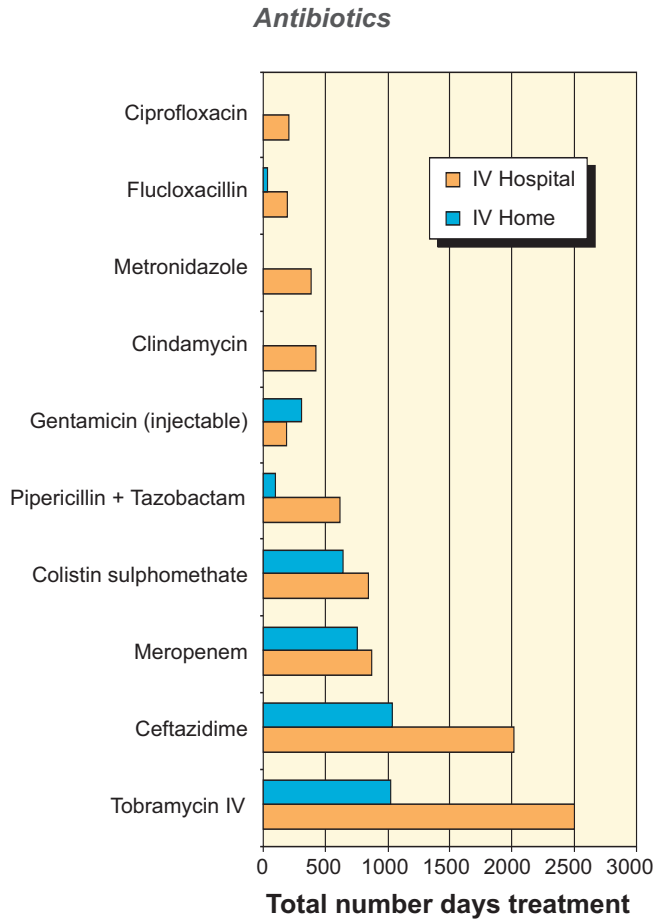
If we now concentrate on the most frequently prescribed antibiotics for IV home or IV hospital in each age group we have the following figures (Figures 23 & 24)

In both groups, ceftazidime and tobramycin IV are the most frequently prescribed, as would be expected. In the Paediatric group, these two antibiotics are followed by flucloxacillin and gentamicin. In the Adult group, however, the places of third and fourth, are supplanted by meropenem and colistin sulphomethate (IV). This comparison could possibly be used to study the differences in

**Figure 23: Paediatric PWCF - Hospital vs. Home IV Treatment, 10 most Frequently Prescribed**



**Figure 24: Adult PWCF - Hospital vs. Home IV Treatment, 10 most Frequently Prescribed**



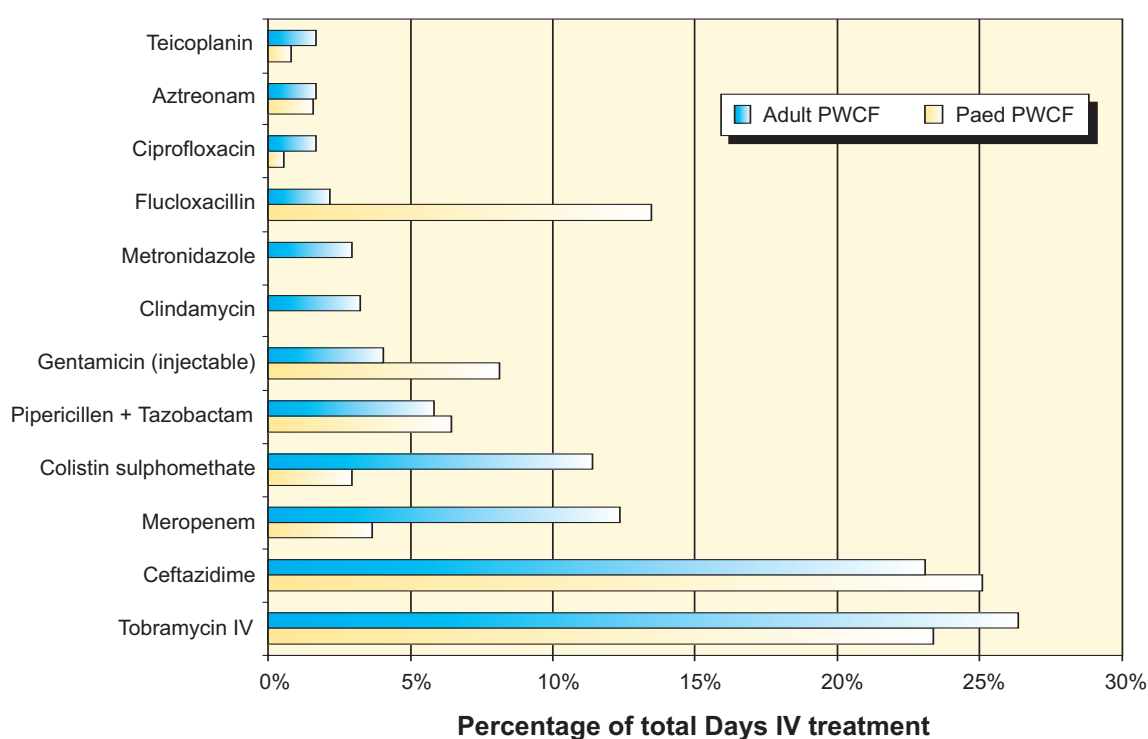
infection rates between the two groups, as well as the evolution of culture sensitivities as PWCF grow older.

Another way of looking at the IV comparison between Paediatric and Adult PWCF is to compare the relative number of days for each antibiotic prescribed. The total number of treatment days for IV treatment (both Home and Hospital) was 7625 for the Paediatric group and 13,360 for the Adult group. If the number of treatment days for each antibiotic is expressed as a percentage of the total number of days of IV treatment (both Home and Hospital) for that group, we can calculate the relative frequency of prescribing

and compare the Adult group with the Paediatric PWCF. This comparison is shown in Figure 25. The twelve most frequently prescribed antibiotics are compared.

This comparison shows that (ignoring the two most frequently prescribed antibiotics) meropenem, colistin sulphomethate IV, clindamycin, metronidazole, ciprofloxacin, and teicoplanin are all prescribed more frequently in the Adult PWCF group than in the Paediatric group. In contrast, piperacillin+tazobactam, gentamicin, and flucloxacillin are prescribed more frequently in the Paediatric group.

**Figure 25: Percentage of IV Treatment Days, Paediatric vs. Adult PWCF**



**NB:** Note that metronidazole, although an anti-fungal, is included here as it is important to the Adult group.

## Nebulised and Oral Treatment

Because of the issues highlighted above regarding the inhaled and oral medications, the number of treatment days may be inaccurate. There is a further problem regarding oral antibiotics. Since we are taking our data from the hospital chart, if an oral prescription was generated by a GP, we are unlikely to record this information. We will be attempting to correct this in the future. The numbers of PWCF taking antibiotics, either orally or by inhalation are shown in Table 14. Overall, 260 PWCF, or 66% have taken an inhaled antibiotic; and 345 PWCF, or 87% have taken an antibiotic orally.

By far the most frequently nebulised products are colistin sulphomethate and tobramycin. We have also found some interesting practices regarding inhalation therapy. For example, there are three

PWCF who have taken, or are taking on a continuous basis, flucloxacillin by inhalation. In addition, there are four PWCF who are taking gentamicin either continuously or intermittently by inhalation.

In coming years, we intend to delve into the antibiotic data much more thoroughly. Because all cultures are also recorded by date, all PWCF can be followed to establish the pattern of infection/treatment/re-infection. We will be able to examine antibiotic treatment in relation to age groups, males versus females, different combinations of treatment and many other parameters. Having all of this data on one system makes it possible to study antibiotic prescribing in much more detail than has been done in the past. It will also be the instrument for studying antibiotic costs in CF.

**Table 14: Nebulised and Oral Antibiotic Treatment**

	TOTAL PWCF ON REGISTRY	NUMBER WHO HAD AT LEAST ONE AB	NUMBER WHO TOOK NEBULISED AB	PERCENTAGE OF TREATED PWCF (NEB)	NUMBER WHO TOOK ORAL AB	PERCENTAGE OF TREATED PWCF (ORAL)
Paed PWCF	243	218	135	62%	212	97%
Adult PWCF	191	178	125	70%	133	75%
<b>Total</b>	<b>434</b>	<b>396</b>	<b>260</b>	<b>66%</b>	<b>345</b>	<b>87%</b>

The pulmonary function tests that are recorded in the Registry are 'Forced Expiratory Volume in 1 second' and 'Forced Vital Capacity'. Both of these tests are an indication of the condition of lung functioning. They are not normally carried out in children under 4/5 years old, but there are a few results recorded in the Registry for 4-year-olds.

The BMI, or Body Mass Index is a measure of the relationship between height and weight of a person. The height and weight are generally taken every time pulmonary function tests are performed, so the BMI is calculated alongside the PFT's. BMI is an important figure to track over time, as it will give some indication of nutritional health and growth.

In this section, all three of these factors have been divided into an age and sex distribution, using age bands. Here the data is summarised, but individual results of these tests are available for each PWCF.

We have the capacity to record up to six PFT's in each Annual Assessment. As more data accumulates, we will be able to combine years of test results to show longitudinal movement for each PWCF.

The table below contains the FEV<sub>1</sub>% Predicted and FVC % Predicted *averages* for each age group; divided into male and female PWCF. ['N' is the number of PWCF in each group. For example, there are 35 males and 25 females in the 5-9 year age group.] Results for those PWCF under 5 years of age are not included. Many of the PWCF had four or more PFT results entered. These data were firstly averaged for each PWCF; and then the average (i.e., Mean) for each age group was determined.

We have used all PFT and BMI results from all PWCF on the Registry, ignoring the year of Annual Assessment. This is in order to build a larger data bank in order to look for trends rather than deliver

**Table 15: Mean FEV<sub>1</sub> %- Predicted, Mean FVC % Predicted; Distribution of Males and Females in Age Bands**

PULMONARY FUNCTION TEST SUMMARY OF RESULTS, 2003 AND 2004 COMBINED							
	MALES			FEMALES			
AGE BANDS	N	MEAN FEV <sub>1</sub> %-P	MEAN FVC %-P	N	MEAN FEV <sub>1</sub> %-P	MEAN FVC %-P	TOTAL IN SET
5-9	35	84.2	88	25	78.7	77.6	
10-14	35	74	86	43	67.3	77	
15-19	39	70	81	34	68.2	79.4	
20-24	28	54.4	72	19	56.2	70.9	
25-29	12	46.7	64	19	58.1	77	
30-39	10	51.1	80	14	53.1	75	
>40	2	33.6	54	4	55.9	77	
<b>Total analysed</b>	<b>161</b>			<b>158</b>			<b>319</b>
PFTs NOT done	18			18			36
<b>Total AA's in set</b>							<b>355</b>

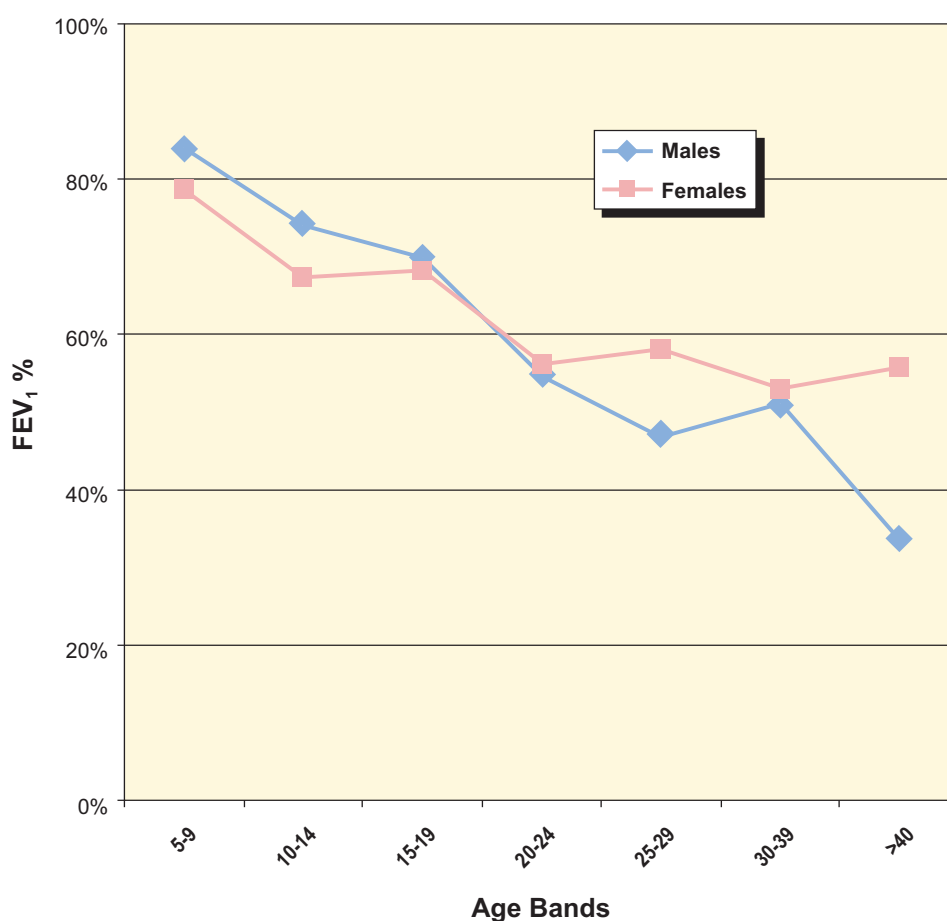
conclusions. Also, results for PWCF who died during the period were excluded. If we then chart the results in the Table 15, the image is shown in Figure 26. The FEV<sub>1</sub> comparison shows a very gradual decline in both sexes which is to be expected.

The FVC % predicted (Figure 27) for the females is quite consistent throughout the age groups; the male trend appears in decline, but the numbers in the older age groups are too small to be of any significance.

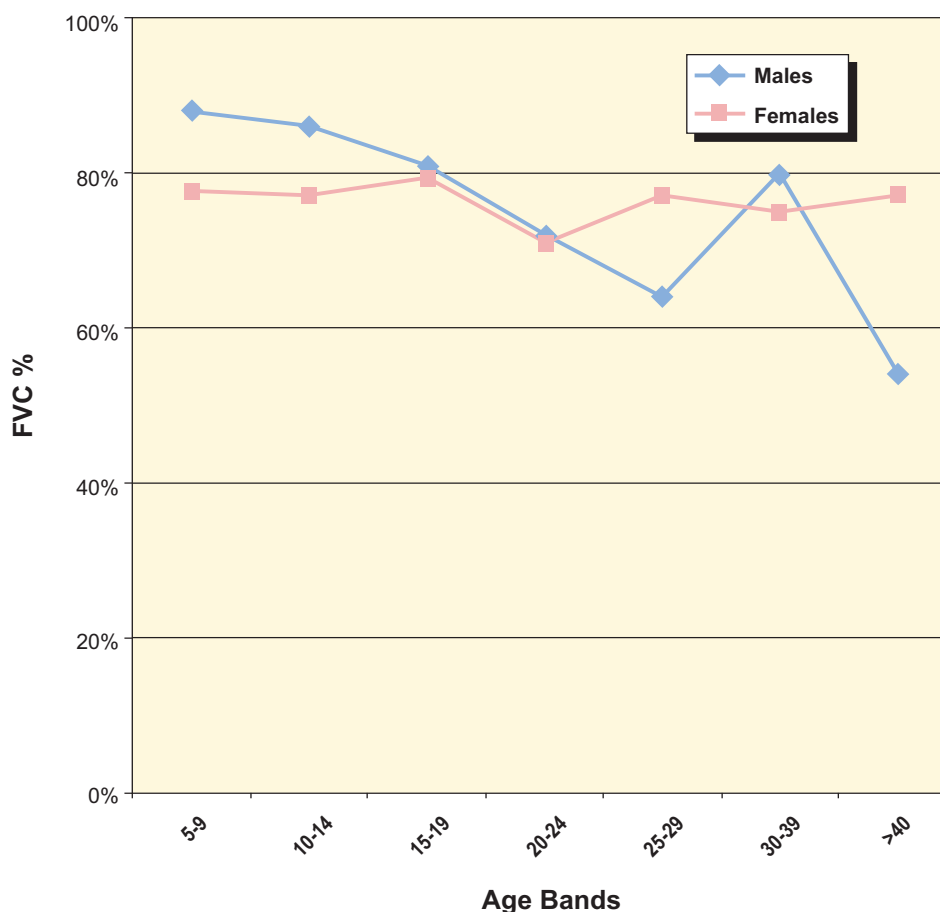
There are no conclusions that can be made from this data, but the data may support the clinical impression of the doctors, nurses, and physiotherapists who work with PWCF. Firstly, we can see that in both

PFT results shown, the males start out slightly ahead of the females in terms of lung function up to the middle teenage years. Then the two sexes are the same up to the mid-twenties. During the late 20's and after, the females tend to plateau in terms of both FEV<sub>1</sub> and FVC, while the males tend to fall away slightly. The male test results then rise to match the female test results in the 30-39 age group. It is important to note that none of these comparisons were tested for significance; and the numbers in the older age groups are so low that they do not warrant any significance testing. But, this does give us a starting point; a baseline on which to view data in the future.

**Figure 26: Mean FEV<sub>1</sub> % Predicted, Age & Sex Distribution**



**Figure 27: Mean FVC % Predicted; Age & Sex Distribution**



Finally, we compared the BMI in both sexes, over the age groups. This time we included those PWCF who were under 5 years of age, if their height and weight were recorded. However, there is some question of the validity of BMI data in young children. Table 12 shows these figures.

There are many other comparisons of height and weight that other registries measure, such as percentiles of weight and height; and Z-scores. In future, we will be assessing these and use these same comparisons in order to standardise our data with other countries. At present, our small data set does not justify this exercise.

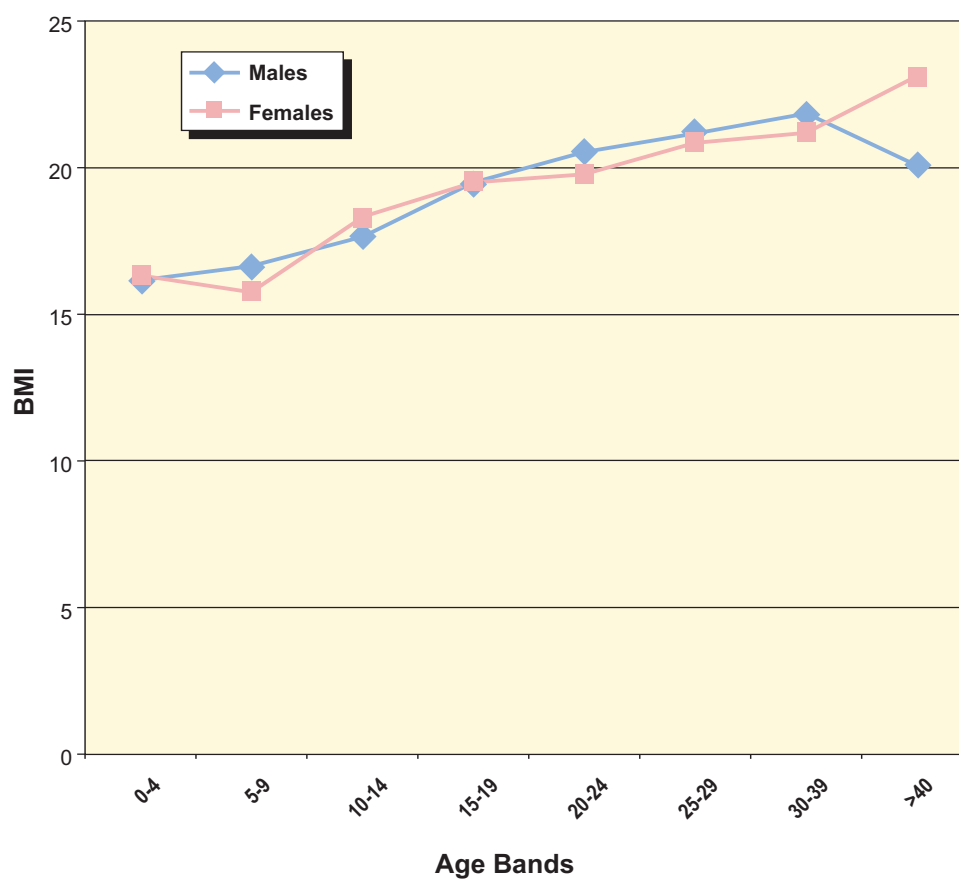
Table 16 has been graphed to produce a comparison of males and females. In Figure 28, the males and females are quite close throughout the age distribution, with the exception of the >40 age group. But, again, the numbers are too small in both sexes in the >40's to draw any conclusions.

As numbers in the older age groups increase we will be examining the data to see if there are male/female trends that warrant further study.

*Table 16: BMI in Age/Sex distribution, 2003 & 2004 combined*

AGE BANDS	N	MALES	N	FEMALES	TOTAL IN SET
0-4	13	16.1	13	16.3	26
5-9	35	16.6	25	15.8	60
10-14	34	17.6	43	18.1	77
15-19	38	19.3	33	19.5	71
20-24	25	20.6	18	19.7	43
25-29	11	21.2	19	20.9	30
30-39	8	21.8	14	21.2	22
>40	2	20.1	4	23	6
<b>Total analysed</b>	<b>166</b>		<b>169</b>		<b>335</b>
<b>BMI NOT done</b>	<b>13</b>		<b>7</b>		<b>20</b>
<b>Total AA's in set</b>	<b>179</b>		<b>176</b>		<b>355</b>

*Figure 28: Mean BMI: Age & Sex Distribution*



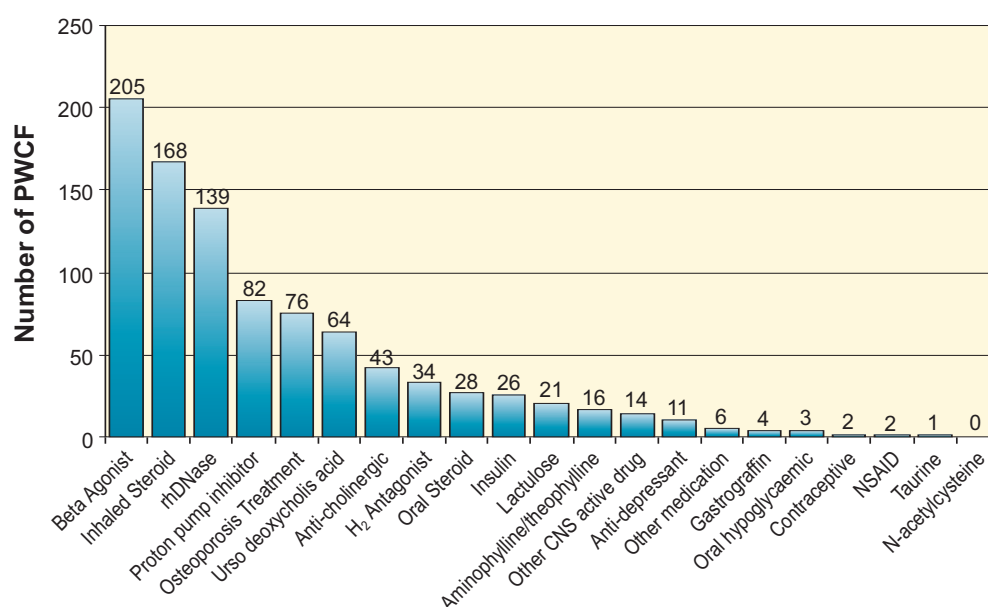
Most PWCF take many other medications apart from antibiotics. These medications are recorded as 'Yes' or 'No' in the Registry, and it is assumed that they are taken continuously. Figures 29 & 30 show 1) the range of medications taken, and a 2) a comparison of the medications taken by Adult PWCF versus Paediatric PWCF. The entire set of Annual Assessments was used in this analysis because the data was taken from the most recent Annual Assessment (all different PWCF) and because the medications are long-term. In Figure 29, the list of medications is shown in descending order from left to right with the number of PWCF taking the medication shown at the top of each bar.

The total number of medications adds up to 945, so each PWCF takes an average of 2.3 medications per day, every day. This does not include pancreatic enzymes or antibiotics, which are shown separately. Many of these long-term medications are prescribed

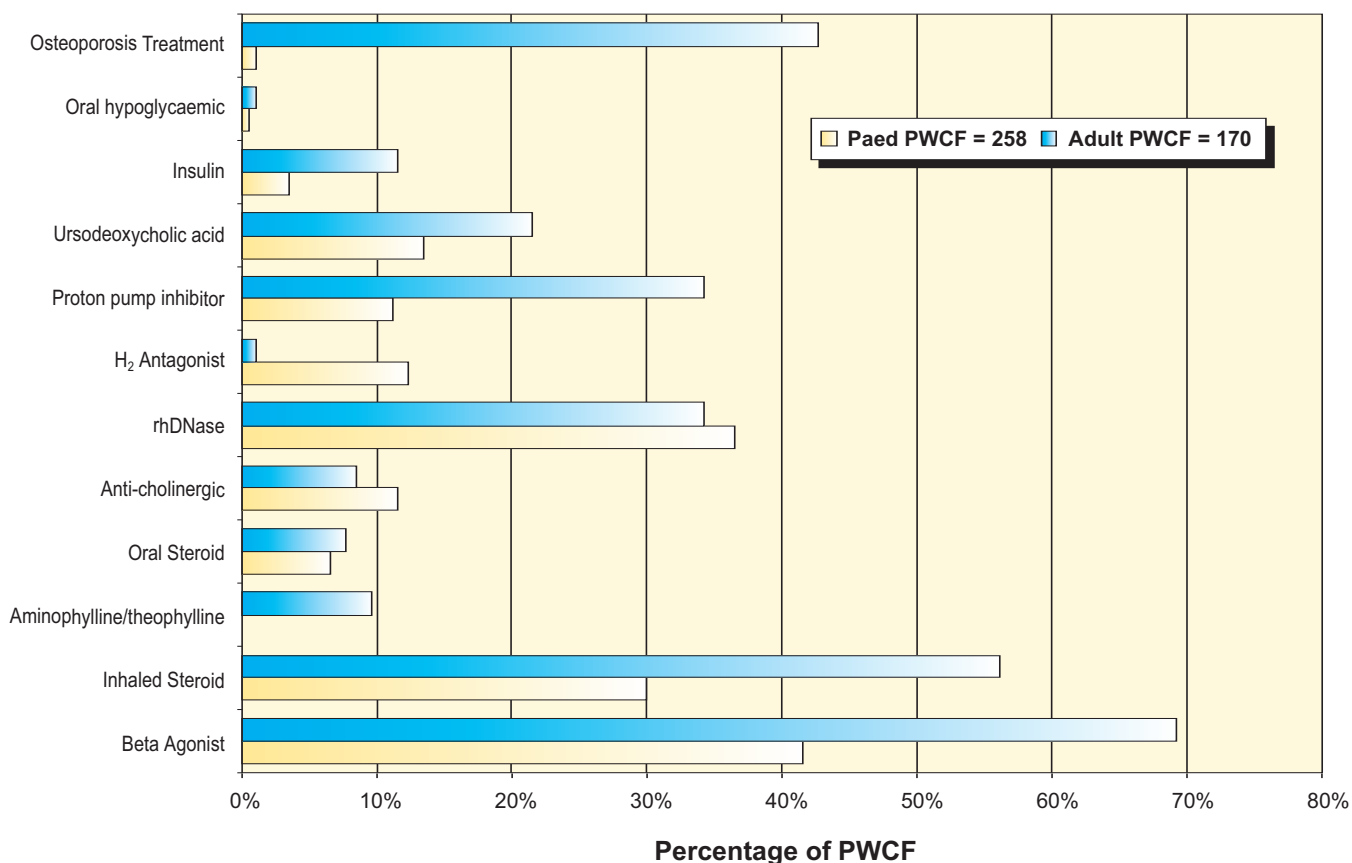
to improve lung function. We will also be tracking the medications used to treat osteoporosis and diabetes. Note that 'Other medication' includes preparations for cardiac conditions (e.g., hypertension), epilepsy and iron deficiency anaemia.

Figure 30 shows the percentage of PWCF from each age group who take a particular medication type. Only the twelve most frequently prescribed medications are shown. We can make some interesting observations between Adult and Paediatric PWCF. As PWCF grow older, there are major increases in the percentage of PWCF taking beta agonists, inhaled steroids, and aminophylline/theophylline; as would be expected in the Adult group. We also see increases in oral hypoglycemics and insulin among Adult PWCF; as well as a substantial increase in osteoporosis treatments. These trends are all expected, given the current knowledge of the Adult CF condition. It is

**Figure 29: Long Term Medications; All PWCF = 406**



**Figure 30: Most Frequent Long Term Medications; Adult vs. Paediatric PWCF, 2003 & 2004 combined**



also interesting to note a progression from H<sub>2</sub>-antagonist prescribing towards proton pump inhibitor prescribing when moving from the paediatric to the adult population.

This survey for 2004 includes all the Annual Assessments to date and provides a good baseline for future comparisons; particularly as the Adult group increases in size.

## Nutritional Summary

Nutrition is a major concern of all PWCF and their healthcare professionals. Absorption of nutritional elements from the gastrointestinal tract is affected by the condition and most PWCF have some sort of nutritional deficiencies, despite active counter-measures. General weight loss is typical and high-calorie supplements are often recommended. The inability of the g-i tract to absorb nutrients also affects vitamin and mineral levels.

Weight loss and mal-absorption are two factors affecting under-nourishment, but a third, separate factor is pancreatic insufficiency which affects a

majority of PWCF. We have collected nutritional data from 403 PWCF which is summarised in Table 17.

This data indicates that 85% of the PWCF in this sample take pancreatic enzymes every day; they are indicated at every meal. Note too, that 92% of the sample population also take vitamins daily.

If we look at this sample, but split it between the Paediatric and Adult populations some interesting things show up (Figure 31). There are different numbers in each group, so we are comparing each nutritional factor in terms of the percentage of PWCF in each group. Looking at Calorie Supplements, there are slightly fewer than 20% of the Paediatric

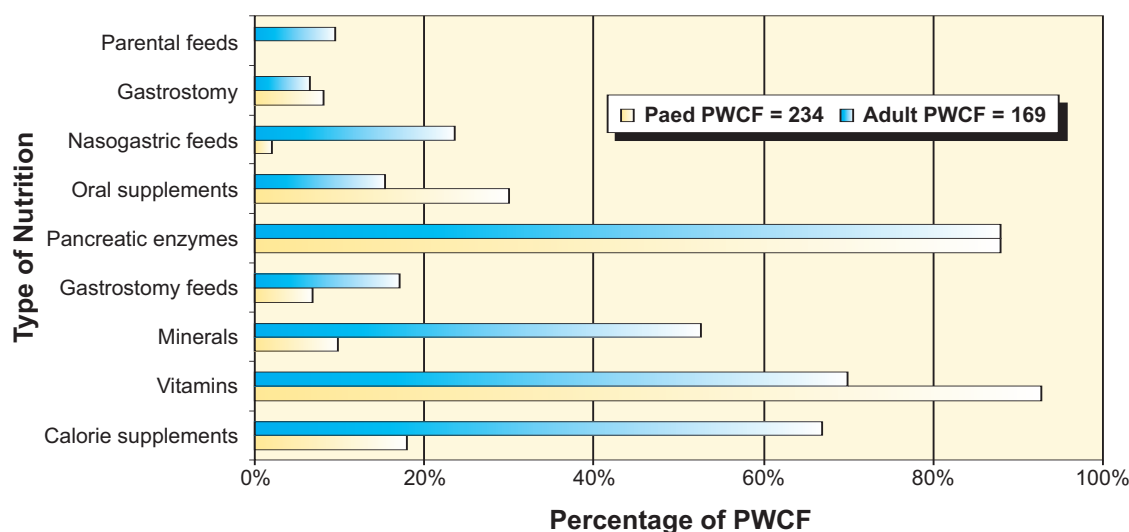
**Table 17: Nutritional Treatments in all PWCF**

**NUMBER AND PERCENTAGE OF PWCF TAKING NUTRITIONAL TREATMENTS**

	FOR ANALYSIS	CALORIE SUPPLEMENTS	VITAMINS	MINERALS	GASTROSTOMY FEEDS	PANCREATIC ENZYMES	ORAL SUPPLEMENTS	NASOGASTRIC FEEDS	GASTROSTOMY FEEDS	PARENTERAL FEEDS	OTHER SUPPLEMENT FEEDS
Totals	403	107	372	53	30	343	130	14	42	0	2
%age	100%	26.6%	92.3%	13.2%	7.4%	79.7%	32.3%	3.5%	10%	0%	0.50%

0.74% = Not seen by Dietician

**Figure 31: Nutritional Treatments Percentage Comparisons Adult vs. Paediatric**



group on them, while close to 70% of the Adult group use them. As expected, parenteral feeds, nasogastric feeds and calorie supplements are used by a higher percentage of PWCF in the Adult group.

There appears to be a greater intake of minerals in the Adult group, whereas vitamins are taken by well over 60% in each group.

One of the most significant things about this data is that over 99% of all PWCF in the sample were seen by a dietician in the year of assessment. This is a highly important review so that PWCF can maintain good nutrition. Overall, the nutritional summary supports the data shown in other tables and graphs. For example, pancreatic insufficiency seems to develop early and continues as a complication throughout life; here, we see this reinforced as over 80% of both groups take pancreatic enzymes.

### Physiotherapy Summary

Physiotherapy is a vital daily routine for every PWCF. Techniques are used primarily to improve airway clearance, but more recently exercise programmes have been introduced to help maintain a healthy lifestyle. Each PWCF should be assessed individually and a programme designed for that person. It is important for the PWCF to carry out their regime according to their individual needs and assessment.

The physiotherapy data collected by the Registry and presented here is from 339 PWCF. Not every Annual Assessment would have the physiotherapy section completed. Apart from the modalities that are recorded, we also collect data on the types of nebulisers and compressors that are used; however, only the modality data is shown in this report.

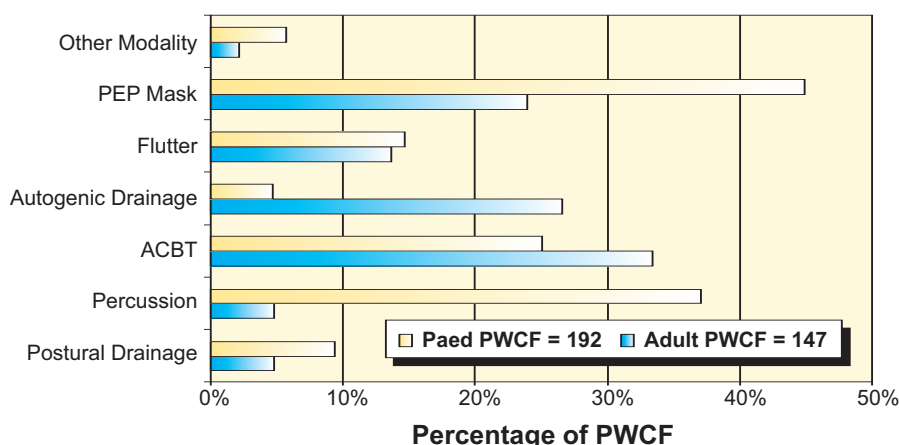
Physiotherapy information is not necessarily kept in the PWCF chart; in some hospitals the physiotherapist keeps more up to date records of appointments and this information is not always transferred to the chart. So, the figure of 20% of PWCF who have not seen a physiotherapist may not be accurate; it requires verification. If however, it is a reflection of practice, then it is probably a worrying

**Table 18: Physiotherapy Modalities Employed by PWCF**  
**NUMBER AND PERCENTAGE OF PWCF PRACTISING THE MODALITY**

	FOR ANALYSIS	POSTURAL DRAINAGE	PERCUSSION	ACBT	AUTOGENIC DRAINAGE	FLUTTER	PEP MASK	OTHER MODALITY	REGULAR EXERCISE	IRREGULAR EXERCISE
Totals	339	25	78	97	47	48	121	15	260	28
%age	100%	7%	23%	29%	14%	14%	36%	4%	77%	8%

20% = Not seen by Physiotherapist on Annual Assessment day

**Figure 32: Physiotherapy Modalities Percentage Comparisons Adult vs. Paediatric**



statistic. It is interesting to note that an equivalent figure for dieticians (i.e., PWCF not seen by dietician in assessment period) is less than 1%.

The other figures that are most likely to be inaccurate are the reporting of exercise, whether it is regular or irregular. This is information elicited from the PWCF or nurse and is reliant on memory rather than notation in the medical chart or a person's diary. And, there are quite possibly many different interpretations of "regular exercise". So we can choose to either ignore the item, or define it more specifically for the purpose of the Annual Assessment.

We record up to four physiotherapy modalities for each PWCF. There are 431 modalities attributed to 339 PWCF in this report; or 1.3 modalities per PWCF.

Another useful comparison is to look at the modalities in the two age groups, Adult and Paediatric. Figure 32 shows this comparison, excluding regular and irregular exercise.

Because the numbers in the two groups are different (Adult = 147; Paed = 192) we compare the *percentage* of each group who uses each modality.

There are some interesting comparisons to note: the PEP mask and Percussion modalities are used by a larger proportion of Paediatric PWCF; while Autogenic Drainage is used by a larger percentage of Adults. Also, ACBT is used by a slightly larger proportion of Adult PWCF.

Postural Drainage, while performed by less than 10% of either group is used by the Paediatric group more frequently than the Adult group. This may reflect the debate regarding gastro-oesophageal reflux.

The physiotherapy data that is collected should be more thoroughly analysed when more PWCF accrue onto the Registry. As PWCF grow older, their physiotherapy techniques can be correlated with their PFT's to provide useful information.

## Social Data

Social data is sometimes considered to be irrelevant in a medical context, but because cystic fibrosis has an important effect on the family and long term effects on the individual, it is worthwhile to attempt to collect relevant information at every Annual Assessment. This data can be used in calculating overall costs to the family and to society. It can also be used to assess the effectiveness of intravenous medication administered at home, versus hospital administration. For instance, a PWCF who requires two weeks of antibiotic treatment may not need to be admitted to hospital for the entire course of treatment. That person may possibly attend school or work during treatment depending upon the severity of the infection and under medical supervision. This reduces the time off from work or school and has obvious advantages.

Unfortunately, social data collection can be inconsistent. Of the 434 PWCF who have Annual

Assessments on the Registry, we have some social data for 406 (217 Paediatric; 189 Adult). Not all social data has been entered for all 406 PWCF, however.

One of the more useful sections of data is the collection of the number of days taken off work or school due to illness. This data has not been audited and often depends on PWCF, nurse, or parent recollection rather than diary notes. The following table has been generated from data collected from Annual Assessments in 2004.

Although the numbers in each group are small at present, there are some encouraging summary data. For example, the percentage of PWCF 18 years old or over who were out of school or work for *less than 2 weeks* in 2004 is 72% (work) and 67% (school). A similar proportion of those under 18 (71%) were out

**Table 19: Time off from Work or School in 2004**

	PAED PWCF	ADULT PWCF
% PWCF off Work, Full or Part time in 2004		n=45
No days off	0	28%
Less than 2 weeks	0	44%
Less than 8 weeks	0	24%
More than 8 weeks	0	12%
% PWCF off School in 2004	n=42	n=6
No days off	21%	17%
Less than 2 weeks	50%	50%
Less than 8 weeks	14%	17%
More than 8 weeks	2%	0%
Percentage of PWCF off Work <i>less than 2 wks</i> in 2004 (only 18 or over in group)	n/a	72%
Percentage of PWCF off School <i>less than 2 wks</i> in 2004 (includes all PWCF in full time education)	71%	67%

of school less than 2 weeks in 2004. This may dispel some myths about coping with CF as one grows older. Only 12% of the adult group and 2% of the Paediatric group were absent from either activity for more than 8 weeks in 2004.

We are also collecting information about physical and leisure activities in order to provide a better picture of quality of life for PWCF. The data for many of these other items is too small to be meaningful at present, but we will pursue the completion of this section of the Annual Assessment in future.

The importance of social data may not yet be recognised. It can provide useful support data for some hypotheses rather than be an end in itself. For instance, it might be used to correlate home IV administration with a better quality of life for PWCF. But it must be accurate to be useful. The completeness and accuracy of this section should improve over time.



### Closing Remarks

We have shown that our sample of those enrolled on the CF Registry (38% of the 2004 CF census) is similar in age and geographic distribution to the full CF population of Ireland. Our sample is also evenly divided between males (51%) and females (49%). If we can maintain the same rate of entry in 2005 as in 2004 we could reach nearly 700 enrollees by December, 2005. Based on the PWCF census since 2003, we predict that by 2009 approximately 50% of the total will be 18 years of age or older.

We can make the following remarks about the PWCF on the CF Registry in 2004:

- The ethnic mix is almost exclusively Irish (98.85%).
- There is a unique family composition in Ireland; 48% of those on the Registry also have a sibling with CF.
  - ◆ A family history of CF contributed to nearly one quarter of the diagnoses of CF (of those on the Registry)
  - ◆ The large sibling population may be a rich research reservoir;
- The most frequently occurring diagnostic symptoms are lower respiratory tract infection; followed by family history, failure to thrive, and the presence of steatorrhea.
- The Median Age at Diagnosis is between 2 and 3 months, in contrast to some other reports; for example, data from the USA lists a Median Age at Diagnosis of 6 months.<sup>4</sup>
  - ◆ There may be a gender gap between males and females in their Age at Diagnosis, but confirmation of this requires further study.
- The genotype profile that we have recorded is similar to other genetic studies that have been done on the Irish CF population<sup>6</sup>. Once the Registry is more complete, it can be used as a reference guide for CF genotype comparisons.
- The Hospitalisations and Complications data demonstrate that there are higher levels in each category for the older age group. Based on the most recent Annual Assessment, the hospitalisation rate for the Paediatric group was less than one hospitalisation per year, vs. 1.13 hospitalisations per year in the Adult group. The complications rate was 1.89 complications per year for the Paediatric group, vs. 3.28 complications per year for the Adult group.
- There are 10 complications that contribute to the majority of complications overall. The complications profile changes as PWCF age; those 18 years and over report higher rates of 'diabetes requiring treatment'; distal intestinal obstructive syndrome (DIOS); clubbing; abnormal liver function tests; and a higher rate of *Pseudomonas* colonisation.
  - ◆ The average number of complications per PWCF (both age groups) was similar in both years. The percentage of PWCF with 'No Complication' was similar in 2003 and 2004 at 5.9% and 5.1% respectively.
- The rate of pancreatic insufficiency is consistent

- throughout the age groups. This could be compared with the rate of pancreatic insufficiency in other national registries.
- The cultures analysis for 2003 and 2004 shows that the average number of specimens taken (including all types, e.g., sputum, cough swab, etc.) per PWCF ranged from 6 per PWCF to 10 per PWCF per year. We combined data for the two years to look at the types of cultures reported.
    - ◆ Three quarters of all culture samples are distributed among 11 microbiological species; four of the 11 are variants of *Pseudomonas*.
    - ◆ The majority (58%) of *Pseudomonas* reports do not describe the mucoid status of the sample. Thirty-one per cent of the *Pseudomonas* reports describe a mucoid specimen.
    - ◆ The only *Burkholderia cepacia* specimens came from 2003 Annual Assessments; taken from 8 PWCF. There were 3 genomovars reported: *B. cepacia* (I); *B. multivorans* (II); and *B. stabilis* (IV). Two PWCF cultured more than one genomovar.
  - Of the 407 PWCF who have an Annual Assessment recorded, 97.3% have received at least one antibiotic, either orally, intravenously, or by inhalation.
    - ◆ Overall, 87% took antibiotic medication orally, 66% took antibiotic medication by inhalation, 41% took antibiotic medication by the IV Hospital route, and 27% took their antibiotic by the IV Home route.
    - ◆ The range of IV antibiotics is somewhat different between the two age groups and is most likely explained by the prevalence of different infections in the two age groups.
  - Mean 'Forced Vital Capacity %-Predicted' and mean 'Forced Expiratory Volume (in one second) %-Predicted' were compared for both males and females using an age band distribution. Data from 2003 and 2004 was combined. Although the numbers are low, there are some trends that should be studied in the future.
  - Long term medication data was combined for 2003 and 2004. Comparisons between the Adult and Paediatric population were shown. The differences displayed were not unexpected. The medication trends in the Adult group are consistent with the complications reported by that group.
  - Data for the nutrition analysis was combined for 2003 and 2004. It is encouraging to note that over 99% of PWCF in the sample see a dietician at least once a year. Parenteral feeds, naso-gastric feeds, gastrostomy feeds, caloric supplements, and minerals are all administered to a larger proportion of Adult PWCF.
  - Physiotherapy data was combined for 2003 and 2004. The Percussion, PEP Mask, and Postural Drainage modalities are employed by a higher percentage of paediatric PWCF; while Autogenic Drainage and ACBT are utilised by a higher proportion of adult PWCF.

- Under Social Data we have only looked at records from 2004. The numbers are very small as this is one section where relevant information is not necessarily kept in the medical chart. Data recorded in this section of the Annual Assessment is more likely to depend on recall and may be less reliable. However, it is interesting to note that over two thirds of PWCF report less than two weeks away from school or work in the year.

This report is the first attempt to describe the medical status of the CF population in Ireland. We have a

sizeable sample, but in order for this to be truly descriptive and worthy of scientific analysis we would like to have at least 75% of all PWCF enrolled on the Registry. There are several interesting aspects that have emerged during this exercise, and these merit further investigation. They will be considered by the Registry Management Committee to determine priorities for study. In the meantime, the enrolment of more PWCF remains the main concern.

## Financial Details

The following financial summary of the accounts illustrates the expenditure for 2003, excluding salaries. Income is provided solely through the

Department of Health and Children. The accounts were audited by Kelly Murray Scollard, Stephens Lane, Dublin 2.

### FINANCIAL SUMMARY, 2003

<b>SYSTEM COSTS</b>	
Hosting fee, Domain maintenance, Security Certificate	€8,600
<b>DEVELOPMENT COSTS</b>	
Database Application, installation and training	€12,800
<b>SET-UP HARDWARE</b>	
LCD Projector	€2,000
<b>TRAVELLING EXPENSES</b>	€4,250
<b>ADMINISTRATION COSTS</b>	
Telephone, Heat, Electricity, Printing, Office supplies, Insurance	€7,520
<b>DATA ENTRY PROJECT</b>	€3,270
<b>ANNUAL REPORT</b>	
Design, Printing	€11,200
<b>TOTAL</b>	<b>€49,640</b>

### Acknowledgements

Each year there are many people to thank for their contributions to the Cystic Fibrosis Registry of Ireland.

This Annual Report is dedicated to all PWCF who unselfishly contribute their medical data so that all PWCF may benefit.

The Department of Health & Children has recognised the need for this Registry and continues to support it with an annual grant.

The Cystic Fibrosis Association of Ireland has continued to give its full support to the Registry and to provide much needed administrative services.

The Registry Management Committee, together with all of the dedicated doctors, nurses, physiotherapists, dieticians and other CF specialist professionals have been generous with their time and advice. All deserve special mention.

Many other national registries share their annual data reports which are continually helpful in our understanding of cystic fibrosis. Among these are Australasia, Canada, the USA, and most of our colleagues in Europe.

### References

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- <sup>3</sup> Belgisch Mucoviscidose Register-Registre Belge de la Mucoviscidose, 2001 Annual Data Report, Belgium, May 2003. (Personal communication).
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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 with the help of patient registries. Cystic fibrosis registries gather information on all aspects of a patient's condition. They act as 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 this analysis that better management of CF may be achieved.

**“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 Cystic Fibrosis Registry of Ireland*

