MONASH University

AUSTRALIAN CYSTIC FIBROSIS DATA REGISTRY

2022 ANNUAL REPORT

Data Extract Period

The data contained in this report was extracted from the ACFDR on October 12th 2023, and pertains to data that relates to patient events from January 1st to December 31st 2022. As the registry does not capture data in real time, there can be a lag between occurrence of an event and capture in the ACFDR.

Abbreviations

ACFDR	Australian Cystic Fibrosis Data Registry
BAL	Broncho Alveolar Lavage
BMI	Body Mass Index
CF	Cystic Fibrosis
CFA	Cystic Fibrosis Australia
CFRD	Cystic Fibrosis Related Diabetes
CFTR	Cystic Fibrosis Transmembrane Conductance Regulator
ETI	Elexacaftor/ tezacaftor/ivacaftor
FEV	Forced Expiratory Volume
FEV1 pp	Percent predicted Forced Expiratory Volume (litres) in 1 second
GLI	Global Lung Initiative
IV	Intravenous
MRSA	Methicillin–resistant *Staphylococcus aureus*
NTM	Nontuberculous Mycobacteria
PBS	Pharmaceutical Benefits Scheme
pwCF	People with Cystic Fibrosis

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Susannah Ahern, Ahmad Reza Pourghaderi, Marisa Caruso, Rasa Ruseckaite, John Liman, Peter Wark, Andre Schultz, Jo Armstrong, on behalf of the ACFDR. The ACFDR Registry Annual Report, 2022. Monash University, Department of Epidemiology and Preventive Medicine, December 2023, Report No 24.

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CYSTIC FIBROSIS Australia

MONASH University

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FROM THE CYSTIC FIBROSIS AUSTRALIA CEO

The Australian Cystic Fibrosis Data Registry (ACFDR) is central to the work of Cystic Fibrosis Australia as it ensures the improvement of clinical outcomes, effectively directs research, enables clinical trials, and highlights areas for advocacy. The robust data it provides is instrumental in our mission to better serve Australians living with cystic fibrosis, underscoring the indispensable nature of the ACFDR.

As of 2022, we can see that there are now 3,738 people living in Australia with cystic fibrosis, marking a notable increase from the 3,446 reported just four years ago. This surge is attributed to both longer life expectancy and increasing diagnosis including later in life and not just diagnosis in infancy. In 2022 alone, there were 90 newly diagnosed people with cystic fibrosis, reflecting a trend where the average age of those with the condition continues to rise—a promising development. I hope this positive trajectory is something that will continue to increase, especially with the availability of new therapies.

Speaking of therapeutic breakthroughs, 2022 proved to be a pivotal year for Cystic Fibrosis Australia, because after years of campaigning and advocacy work, finally access to Trikafta was secured in April, for individuals aged 12 and above with at least one F508 delta mutation. It is interesting to review the data considering this new therapy being made available in Australia and I am on the edge of my seat in anticipation of what the data will reveal in the years to come.

Significant work has taken place in 2022 to not only capture and improve the quality of data but also to support the ongoing sustainability of the registry. My thanks to our federation members and corporate supporters who have assisted in contributing to the work of the ACFDR. This is critical to ensure this vital work can continue and expand into the future as we seek to continually improve outcomes for all people with cystic fibrosis (pwCF).

I express my sincere thanks to the cystic fibrosis community and their trust and willingness to allow their health data to be included in the registry which makes the ACFDR what it is today. Further, I would like to acknowledge and appreciate the CF centres around the country, who have done a great job in supporting the ACFDR as each and every day they are at the forefront of supporting people living with CF and inputting quality data that has assisted with this report.

I would like to acknowledge the hard work of our ACFDR Steering Committee including the Chair, Deputy Chair and Members, including Consumer Representatives, for their relentless efforts in ensuring the effective oversight of the registry. Also, my sincere thanks to Monash University and everyone in the team who, as the custodians of the registry, carry out the day–to–day work on the ACFDR.

Cystic Fibrosis Australia is committed to ensuring the ongoing development and effectiveness of the data registry and this will be amplified as the needs in our community evolve and change. The intricate nature of CF underscores the imperative for meaningful data, and the ACFDR stands as an invaluable tool in propelling clinical advancements, fostering a higher quality of life, and extending life expectancy. My aspiration is that our ongoing efforts will yield more breakthroughs, innovations, and improvements in patient outcomes, ensuring that all individuals with cystic fibrosis can aspire to long, full, and healthy lives.

Jo Armstrong
Chief Executive Officer
Cystic Fibrosis Australia.

CYSTIC FIBROSIS Australia

FROM THE REGISTRY CLINICAL LEAD

The 2022 annual ACFDR report continues to provide timely and accurate data that reflects the impacts of living with CF and the outcomes experienced by Australians with CF. The 2022 report continues to deliver high quality data, captured from all CF centres and 3,738 Australians with CF. The report also continues to evolve, it presents aggregate data for the cohort, but now does a deep dive separately into the data as it relates to children and adults (those 18 years and older). For Australia 2022 was again a unique year, impacted by the COVID–19 pandemic that saw nationally the end of social restrictions and the exposure of all Australians to SARS–CoV2. Fortunately for people with CF this does not appear to have adversely impacted the health of people with CF any more than the general population. The availability of Trikafta to individuals aged 12 and above has been a watershed moment, with more than 90% of those in the same age group in Australia now eligible for a CFTR modulator.

The number of people with CF recorded on the ACFDR continues to rise, as does the proportion who are older than 18 years. This reflects the overall improvements in health outcomes, with increasing survival continuing, strong declines in the numbers receiving lung transplantation, declines in hospitalisations and also strong downward trends in colonisation with organisms such as Pseudomonas Aeruginosa and Staphylococcus Aureus. In children there continues to be increases in lung function and regular CF centre review. There are now 59% of children eligible for a CFTR modulator and these have been prescribed in more than 86% of those eligible. In adults, lung function continues to improve. There has also been a marked rise in pregnancies, from 13 in 2019 to 72 in 2022. Telehealth appointments continued to make up 54% of encounters, but there was a clear return to face to face consultations. CFTR modulators are now eligible to be prescribed in 93% of adults with CF and have been prescribed in 86%. We hope you enjoy reading the report and reflect upon important changes that are occurring in the lives of people with CF in Australia.

Professor Peter Wark
Director of Cystic Fibrosis Service
Conjoint Professor of Medicine Monash University.
Adjunct Professor University of Newcastle.
Honorary Senior Staff Specialist Respiratory and Sleep Medicine John Hunter Hospital.

FROM THE REGISTRY DEPUTY CLINICAL LEAD

The core business of the ACFDR is the accurate tracking of real–world data in Australian people with CF. This allows the identification of patterns in the delivery of care, health outcomes and disease trajectories. The ACFDR has shown that for Australians, cystic fibrosis has changed profoundly for the better over the past few years, and specifically since the introduction of CF modulator therapy. This change has been most marked since the introduction of the potent disease modulating drug combination, elexacaftor–tezacaftor –ivafactor, which became available through the PBS scheme one the 1st of April 2022. The change has been captured by the ACFDR. The 2022 reports show that as a group, people with CF have better overall health with improved lung function, fewer hospitalisations for pulmonary exacerbations, and fewer disease–related complications.

A changing landscape calls for up to date methods of reporting. Therefore, the format of the ACFDR report is different this year. The data are now presented more like other large international registries, allowing easier inter–country comparisons. In addition to the usual overview of aggregated data, children and adolescents are now described separately to adults and more variables are reported. For example, in the adults' section, a new graph shows a striking increase in pregnancies. This graph pleasingly highlights how people with CF are progressively living healthier lives but also uncovers new responsibilities. The privilege of pregnancy brings with it the need for pharmacovigilance. The CF community will have to collaborate to ensure good pharmacovigilance related to the use of disease modulating drugs during pregnancy.

The 2022 report contains a range of new tables and graphs for readers to peruse, reflect on and discover important trends. I hope you enjoy the read! A big thank you to the members of the ACFDR Steering Committee for their guidance, the team at Monash University for their expertise, the dedicated staff at CF centres around Australia for their commitment, and of course people with CF who are contributing their data to the registry.

Professor André Schultz
Deputy Clinical Lead, Australian Cystic Fibrosis Data Registry
Respiratory Physician Department of Respiratory Medicine, Child and Adolescent Health Service, Western Australia.

INTRODUCTION

The Australian Cystic Fibrosis Data Registry (ACFDR) is excited to present the Annual Report for 2022, marking another significant year in our ongoing objective to gain comprehensive insights into the health and wellbeing experiences of pwCF in Australia.

As we continue our commitment to transparent and data–driven healthcare, this year's report introduces a refreshed structure, categorising data into three distinct sections: combined data for the entire cohort; a dedicated section for the paediatric population; and another for adults with cystic fibrosis (CF). By the end of 2022, the ACFDR comprised data from a total of 3,738 individuals with CF in Australia, consisting of 2,124 adults (18+ years) and 1,614 children and adolescents (0–17 years).

Since its establishment in 1998, the ACFDR has diligently collected and analysed data for over 23 years. Our dataset from twenty–three CF centres across Australia representing both paediatric and adults with CF, adheres to international standards, enabling meaningful comparisons with CF registries worldwide. Two significant events for the CF community are captured in this report–a significant rise in COVID infections in the broader community as well as among pwCF during 2022, and the listing on the Pharmaceutical Benefits Scheme for people from age 12 years and above with CF in 2022. This report also describes trends in hospital admissions, ongoing use of telehealth, and changing patterns of microbiological infections in pwCF during this year.

The ACFDR is funded by Cystic Fibrosis Australia (CFA) and is overseen by Monash University under a shared data custodianship arrangement. The multidisciplinary Steering Committee, which includes consumer representation, plays a vital role in providing leadership and guiding the strategic direction of the ACFDR. Their expertise ensures the continued success of the registry, demonstrating their dedication to advancing CF research and care. We express our gratitude to all CF centres and individuals with CF for actively participating in the registry.

The ACFDR is pleased to continue to report evidence of increasing clinical improvement and enhanced long–term survival outcomes as the proportion of pwCF who are taking a CFTR modulator increases. A current focus of the ACFDR is to support CF centres to ensure that all pwCF who are eligible for these treatments are identified, and to continue to provide annual benchmarked reports to each CF centre to support improvement in clinical care. We invite you to explore the information and advancements revealed in the 2022 ACFDR Annual Report, a testament to the collaborative efforts that continue to improve outcomes for pwCF in Australia.

"We express our gratitude to all CF centres and individuals with CF for actively participating in the registry"

SUMMARY OF REGISTRY DATA

This section provides an overview of health outcomes and aspects of CF care in the Australian CF population*

	2019	2020	2021	2022
PEOPLE WITH CYSTIC FIBROSIS				
Total people with CF in the ACFDR	3,446	3,538	3,616	3,738
Age (median) (IQR) years	19.6	20.2	20.6	21.1 (11.4, 33.6)
Age (mean) years	22.0	22.6	23.0	23.4
Adults (≥18 years) number (%)	1,854 (53.8%)	1,965 (55.5%)	2,019 (55.8%)	2,124 (56.8%)
Adults: Males %	53.1%	52.8%	52.8%	56.8%
CF DIAGNOSIS & GENOTYPING				
Newly diagnosed people with CF	66	74	92	90
% New diagnosis <1 year	85.0%	82.4%	82.6%	78.9%
% New diagnosis ≥18 years	4.5%	10.8%	12.0%	11.1%
Genotyped–one allele (two alleles)	96.0% (88.0%)	98.4% (92.2%)	98.4% (94.8%)	99.1% (95.9%)
% F508del Homozygous	47.0%	47.0%	47.0%	46.0%
% F508del Heterozygous	42.0%	43.0%	43.0%	44.0%
CLINICAL MEASURES (LUNG FUNCTION & NUTRITION)				
Median (IQR) FEV1 pp children and adolescents 6–17 years	91.0	91.0	93.0	93.2 (83.8, 102)
Median (IQR) FEV1 pp adults 18 years and older	71.0	70.0	73.0	75.6 (56.4, 91.2)
Median (IQR) weight for length percentile <2 years	46th	51st	51st	50th (35th, 72th)
Median (IQR) BMI percentile children 2-17 years	55th	57th	58th	57th (36th, 78th)
Median (IQR) BMI adults 18 years and older	23.0	22.9	23.0	23.4 (21.0, 25.8)
RESPIRATORY MICROBIOLOGY				
P. *aeruginosa* (%)	47.8%	41.6%	38.9%	32.7%
S. *aureus* (%)	51.5%	47.1%	47.3%	43.6%
Aspergillus spp (%)	22.9%	18.8%	17.5%	13.2%
Non–tuberculous mycobacterium (%)	5.9%	6.4%	8.1%	4.2%
COMPLICATIONS				
% with CF related Diabetes <12 years	N/A	1.9%	2.2%	2.2%
% with CF related Diabetes 12–17 years	N/A	17.3%	14.2%	13.6%
% with CF related Diabetes 18–29 years	N/A	21.5%	23.8%	26.0%
% with CF related Diabetes 30+ years	N/A	30.0%	29.9%	29.6%
MULTIDISCIPLINARY CARE				
% with Physiotherapy annual review	N/A	N/A	85.7%	83.9%
% with Dietician annual review	N/A	N/A	74.7%	76.6%
% with Mental Health annual review ≥12 years	N/A	N/A	25.3%	27.1%
% with Social review	N/A	N/A	N/A	43.2%
% with Gastroenterologist annual review	N/A	N/A	N/A	24.0%
% with Endocrinologist annual review	N/A	N/A	N/A	19.5%
CFTR MODULATORS				
% taking CFTR modulator–total cohort	37.7	52.6%	55.2%	68.7%
% taking CFTR modulator–paediatric	N/A	N/A	N/A	55.6%
% taking CFTR modulator–adult	N/A	N/A	N/A	78.7%
LUNG TRANSPLANTS AND SURVIVAL				
Bilateral lung transplants	33	15	9	6
Deaths (Total CF deaths)	26	18	19	10
Median age of death (years)	32.0	30.7	36.8	44.2
Survival median (cohort, 5 years) years	54.0 (2014–2018)	53.0 (2015–2019)	56.9 (2016–2020)	58.2 (2017–2021)

*N/A appears where a calculation was not performed in previous years' annual reports.

1.
COMBINED DATA

1. COMBINED DATA

1.1 OVERVIEW

Cystic fibrosis (CF) is a recessively inherited genetic condition, a multi–system disorder associated with reduced life expectancy, mostly due to respiratory failure. This report highlights the epidemiological and clinical characteristics of children and adults with CF that are captured in the Australian Cystic Fibrosis Data Registry (ACFDR).

The ACFDR collects data from pwCF from the time of their diagnosis and throughout their life, or until they have undergone a lung transplant. Most pwCF are cared for by specialist clinicians and teams in public hospital CF Centres. These centres may be associated with paediatric health services, adult health services or both paediatric and adult health services. For the first time, the ACFDR is reporting outcomes in three sections in recognition that the experience of living with CF changes over time as do the treatments and outcomes. The three sections are:

1. Combined data for both children and adolescents and adults with CF, particularly significant trends over time
2. Data regarding the diagnosis and management of children and adolescents with CF
3. Data regarding the diagnosis and management of adults with CF.

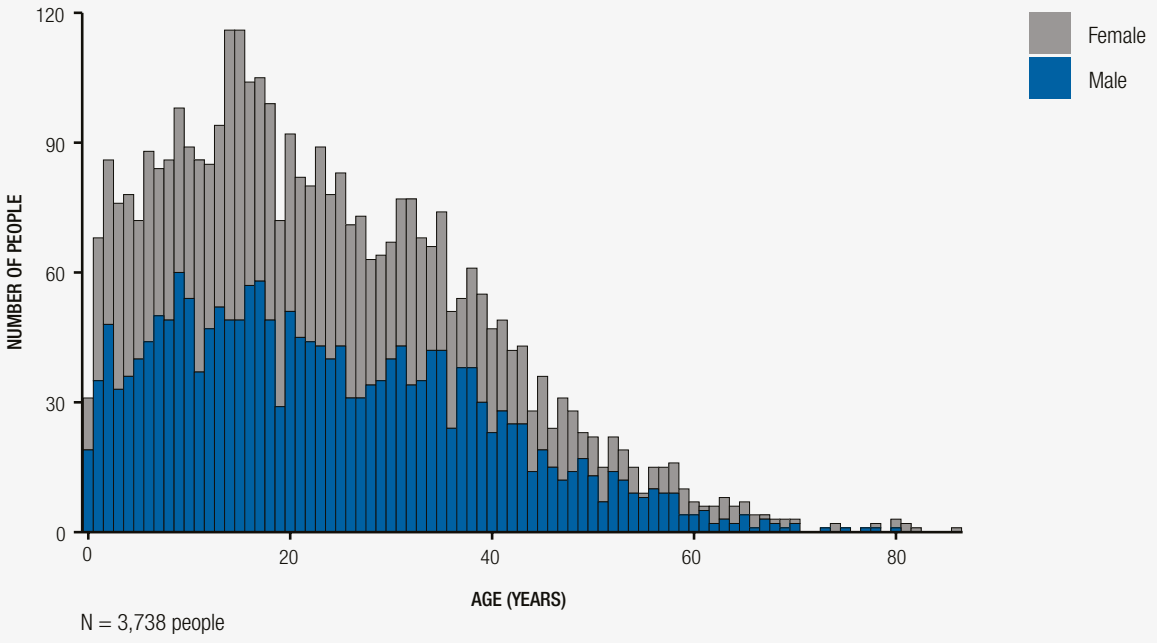
It is hoped that presenting the registry data in this way will enhance its value and meaning to clinicians, pwCF, their families and other stakeholders.

1.2 COHORT AGE AND SEX CHARACTERISTICS

As of 31st December 2022 the ACFDR held records of **3,738 pwCF.** Figure 1.1 shows the age distribution of the total ACFDR cohort at the end of 2022, with **2,124 adults** (18+ years) and **1,614 children and adolescents** (0–17 years) with CF in the registry.

In 2022, the median age for the CF population was **21.1 years,** with a mean age of 23.4 years. The median age for males at 21.5 years (21.1 years in 2021) remained higher than that for females at 20.5 years in 2022 (20.2 years in 2021).

FIGURE 1.1: ACFDR 2022: PEOPLE WITH CF IN AUSTRALIA BY AGE AND SEX



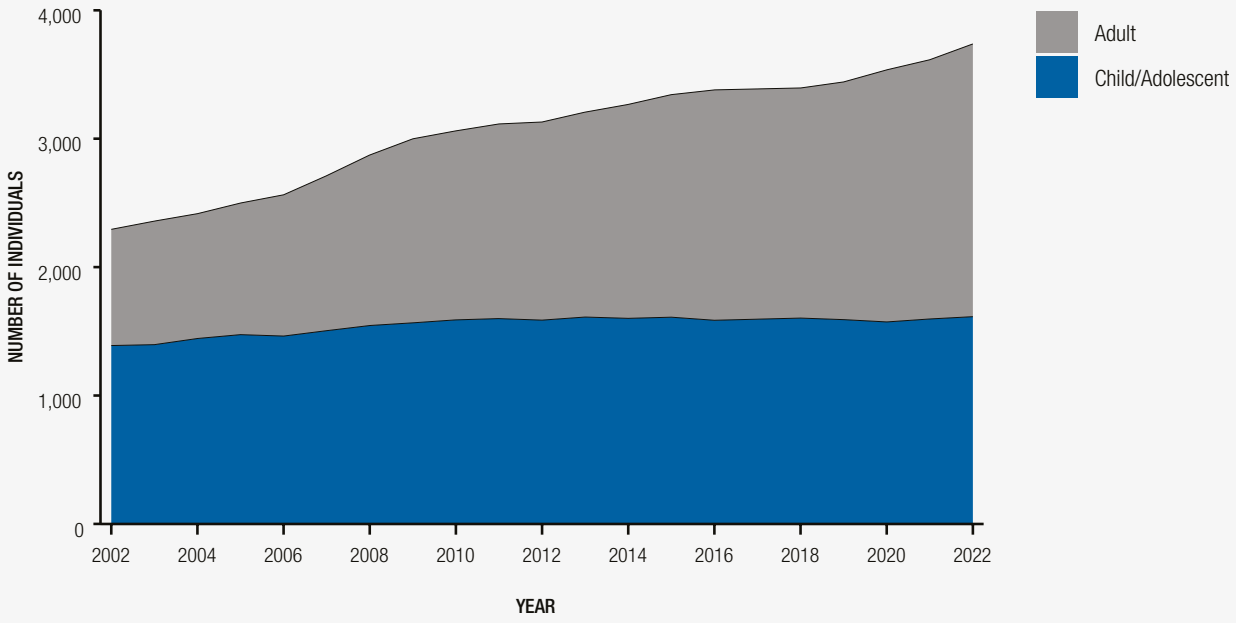
As of 31st December 2022, the proportion of males in the ACFDR was 52.9% and females were 47.1% of the ACFDR population. The distribution of population and sex for different age cohorts is shown in Table 1.1.

TABLE 1.1: ACFDR 2022: PEOPLE WITH CF BY AGE AND SEX

Age	Female	Male	Total
<2	46.5% (67)	53.5% (77)	144
2–5	50.8% (159)	49.2% (154)	313
6–11	43.6% (232)	56.4% (300)	532
12–17	50.2% (314)	49.8% (311)	625
18–29	49.2% (459)	50.8% (474)	933
30–39	44.4% (285)	55.6% (357)	642
≥40	44.3% (243)	55.7% (306)	549
Total	47.1% (1,759)	52.9% (1,979)	3738

Figure 1.2 shows the number of people in the CF registry for the last 20 years. For 2022, the proportion who were adult was 56.8%, compared to 55.8% in 2021.

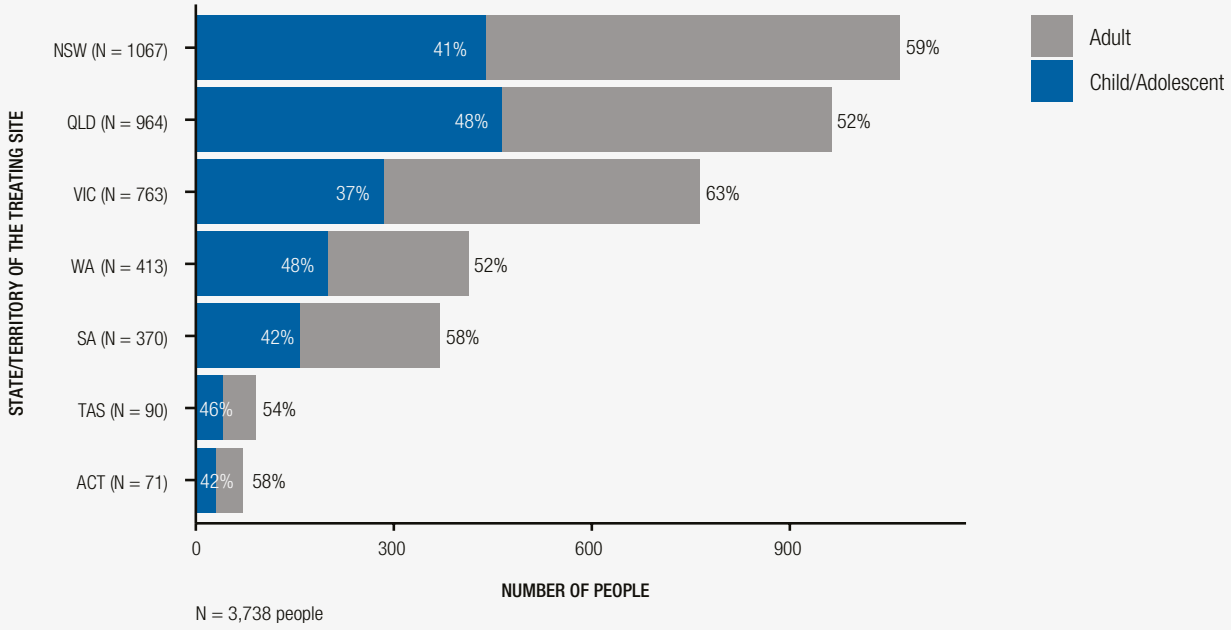
FIGURE 1.2: ACFDR 2002-2022: PAEDIATRIC VS ADULTS PROFILE OVER TIME



Note: Population size in 2017 was estimated based on the populations in years 2016 and 2018

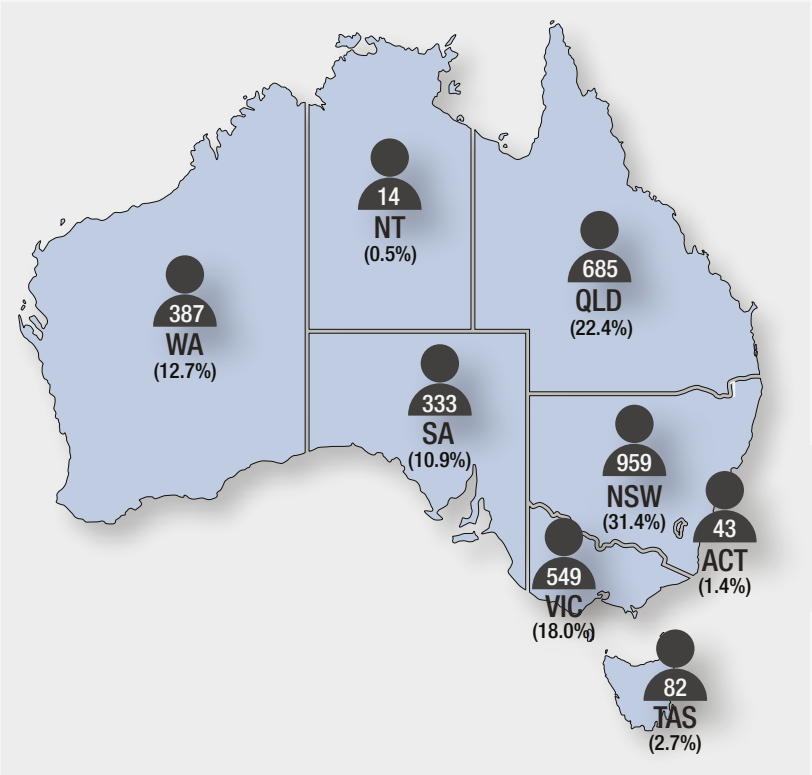
Those who received their CF care at centres in each of Australia's jurisdictions in 2022 are shown in Figure 1.3.

FIGURE 1.3: ACFDR 2022: DISTRIBUTION BY STATE AND TERRITORY



Postcode information of people in the CF registry shows that New South Wales has the highest proportion (31.4%) of pwCF, followed by Queensland (22.4%), Victoria (18.0%), Western Australia (12.7%), South Australia (10.9%), the Australian Capital Territory (1.4%) and the Northern Territory (0.5%). A total of 686 pwCF (18.4%) did not have their postcode reported.

FIGURE 1.4: ACFDR 2022: COHORT DISTRIBUTION BY PATIENT POSTCODE



1.3 DIAGNOSTIC AND GENOTYPE INFORMATION

Diagnostic Information

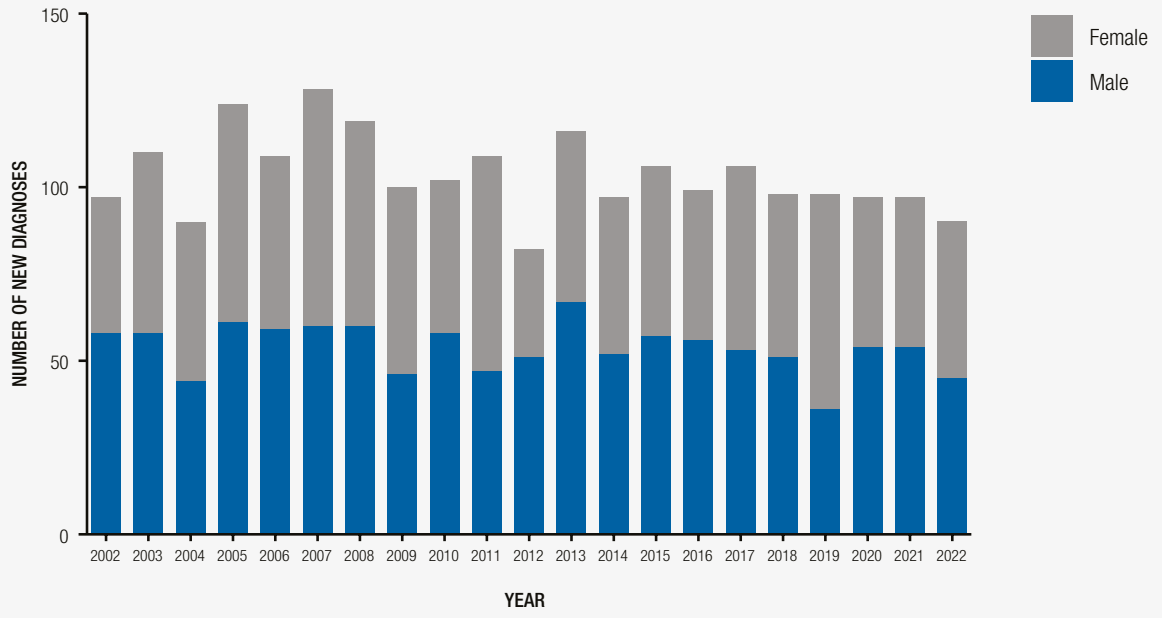
There were **90 new diagnoses of CF** notified to the registry in 2022 compared to 92 in 2021. Of these, 71 pwCF were diagnosed before one year of age, 8 people were diagnosed between 1–10 years, 1 person was diagnosed between 11–17 years, and 10 people were diagnosed over the age of 18 years. There were no new cases where the diagnosis date was unknown (Table 1.2).

TABLE 1.2: ACFDR 2022: AGE AT DIAGNOSIS FOR NEWLY DIAGNOSED

Age	Number	%
<1	71	78.9%
1–10	8	8.9%
11–17	1	1.1%
18+	10	11.1%
Total	90	100%

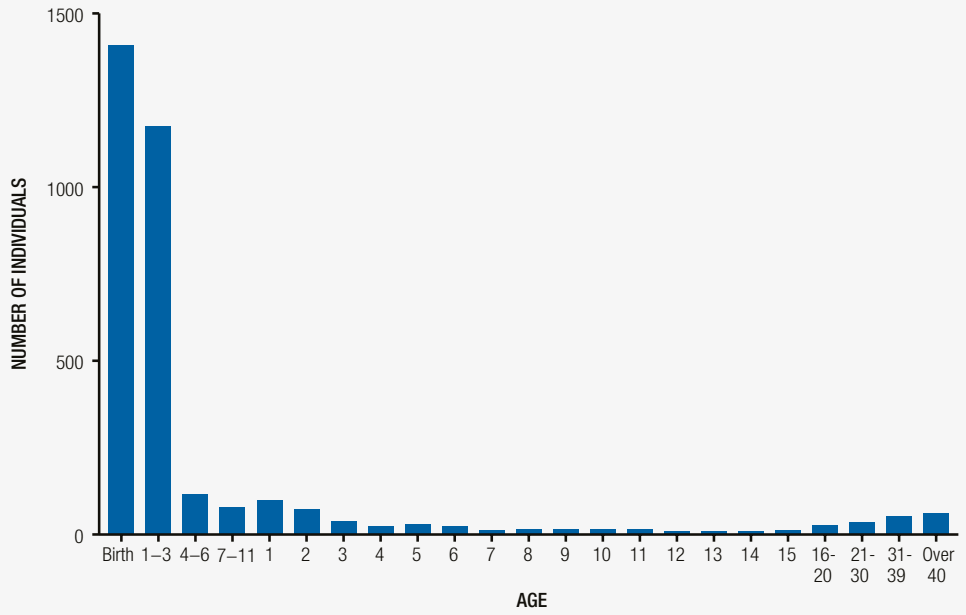
Figure 1.5 shows the number of new diagnoses of CF recorded in the registry per year for the past 20 years.

FIGURE 1.5: ACFDR 2002-2022: NUMBER OF NEW CF DIAGNOSIS



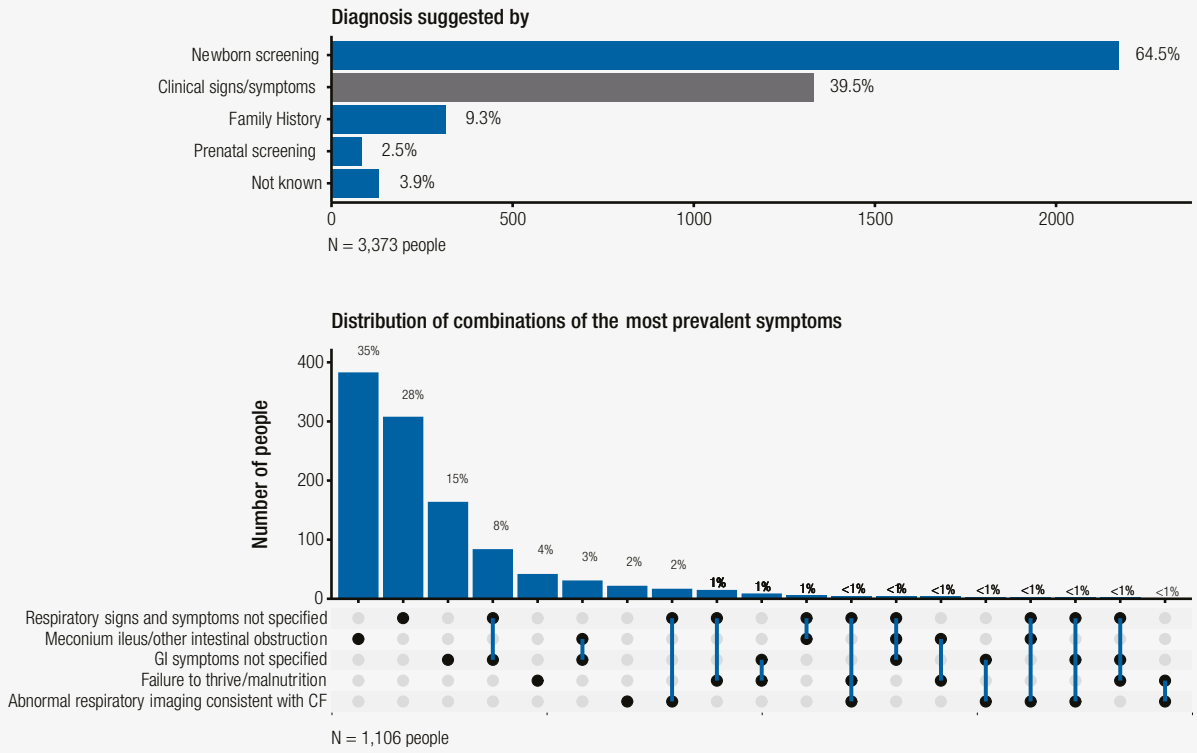
The age of diagnosis has been captured in the registry for 87.1% of the total registry cohort (Figure 1.6). 41.7% were diagnosed between birth 1 month, 34.9% diagnosed between 1–3.9 months, and a further 5.8% between 4–11.9 months. A total of 82.4% were diagnosed within the first year of life. Five percent of pwCF were diagnosed as adults, with 70.0% of adult diagnoses occurring at 30 years or older.

FIGURE 1.6: ACFDR 2022: AGE AT CF DIAGNOSIS



A diagnosis of CF was confirmed or suggested by newborn screening (64.5%), clinical signs/symptoms (39.5%), a family history 9.3% and prenatal screening (2.5%) (Figure 1.7). Of those with clinical symptoms, the most common presentations were meconium ileus/intestinal obstruction (35.0%), respiratory signs and symptoms (28.0%), and gastrointestinal symptoms (15.0%). With multiple responses available, often there is an overlap in clinical symptoms and newborn screening or family history in the registry.

FIGURE 1.7: ACFDR 2022: METHOD OF DIAGNOSIS CONFIRMED OR SUGGESTED



Over time, the proportion of new diagnoses made by newborn screening, prenatal screening, and family history has increased, while diagnoses via clinical symptoms have decreased (Table 1.3).

TABLE 1.3: ACFDR 1998–2022: METHOD OF DIAGNOSIS CONFIRMED OR SUGGESTED

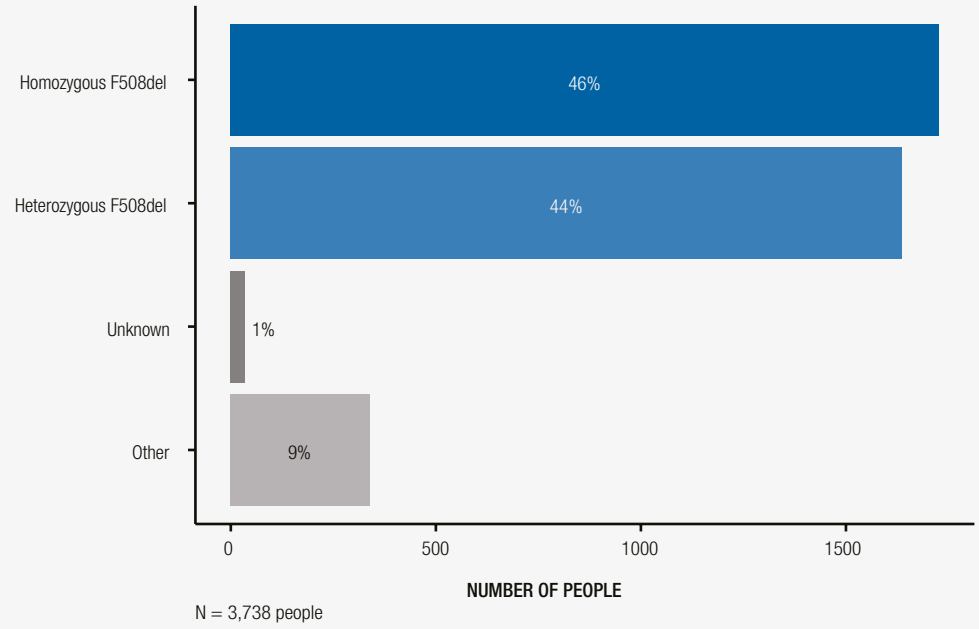
Diagnosis by	Total of cohort (%)	2022 new diagnosis (%)
Newborn screening	2175/3,373 (64.5%)	71/99 (71.7%)
Clinical signs/symptoms	1331/3,373 (39.5%)	26/99 (26.3%)
Family History	315/3,373 (9.3%)	10/99 (10.1%)
Prenatal screening	83/3,373 (2.5%)	4/99 (4.0%)
Not known	132/3,373 (3.9%)	0/99 (0.0%)

Genotype Information

The CFTR gene has two alleles, and variations may exist in both alleles that are related to the development of CF symptoms (phenotype). The most common variant is the F508del. PwCF can either be homozygous (have two F508del alleles) or heterozygous (have one F508del allele). Genotype information is important as it can determine eligibility for current specific disease–modifying treatments (CFTR modulators).

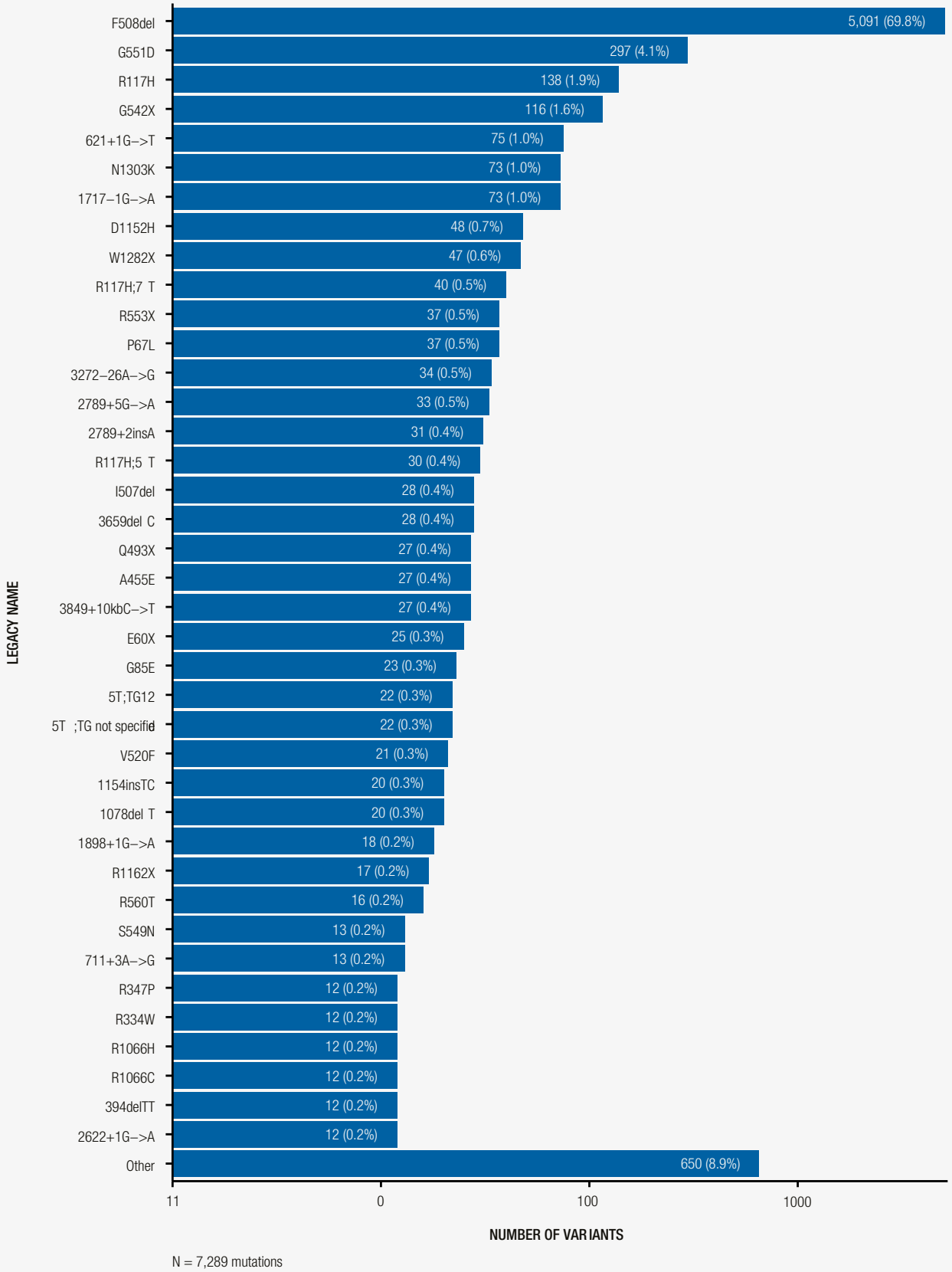
In 2022, the proportion of Australian pwCF who are **homozygous for the F508del variant is 46.0%,** and the proportion who are **heterozygous is 44.0%** and 9.0% of variants are non–F508del (Figure 1.8). One percent (35 people) in the registry are of unknown variants, 74% being adults.

FIGURE 1.8: ACFDR 2022: MOST COMMON CFTR VARIANT COMBINATIONS



The most common variant alleles other than F508del are G551D (4.1%), R117H (1.9%) and G542X (1.6%) respectively, with 8.9% being unknown (Fig 1.9).

FIGURE 1.9: ACFDR 2022: MOST COMMON INDIVIDUAL ALLELE CFTR VARIANTS IN THE ACFDR



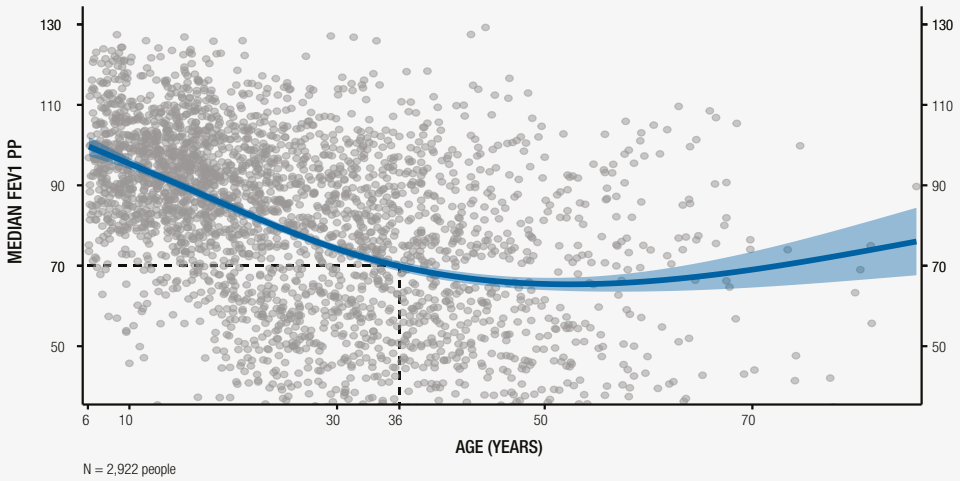
1.4 LUNG FUNCTION

For the monitoring of lung function in pwCF, the average of the highest percent predicted Forced Expiratory Volume (litres) in 1 second (FEV1 pp) is recorded in each quarter of the year. Predicted values are based on the Global Lung Initiative (GLI) formulae. Lung function measures are aligned with methods used in the United States Cystic Fibrosis Foundation's Patient Registry.

Over two–thirds of pwCF in the ACFDR have lung function information (2,922 people) for 2022 (compared to 2,421 people in 2021). Over 12.2% of participants in the registry are children younger than 6 years of age who do not routinely have lung function information recorded and a further 9.6% of registry participants did not have lung function information recorded in 2022.

Median lung function for pwCF, measured as FEV1 pp is 85.1 for the 2022 cohort. At 36 years of age, the median FEV1 pp is 70.0 (Figure 1.10).

FIGURE 1.10: ACFDR 2022: MEDIAN FEV1 % PREDICTED BY AGE

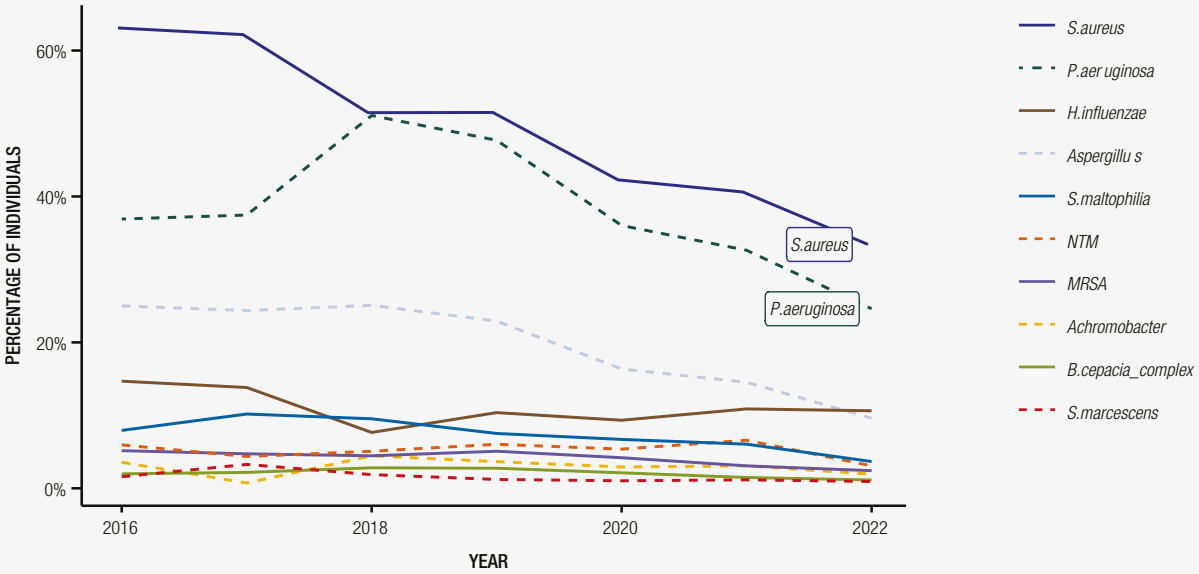


The solid trend line was estimated using a natural cubic spline with 3 degrees of freedom
Shaded area represent the 95% confidence intervals

1.5 MICROBIOLOGY

Figure 1.11 shows the prevalence of respiratory organisms that are commonly pathogenic to pwCF. There has been a recent reduction in the prevalence of *S. aureus, P. aeruginosa* and Aspergillus *spp* during this period, most particularly during the last 4 years. Further information is provided in the paediatric and adult sections of the report.

FIGURE 1.11: ACFDR 2016-2022: PREVALENCE OF RESPIRATORY MICROORGANISMS

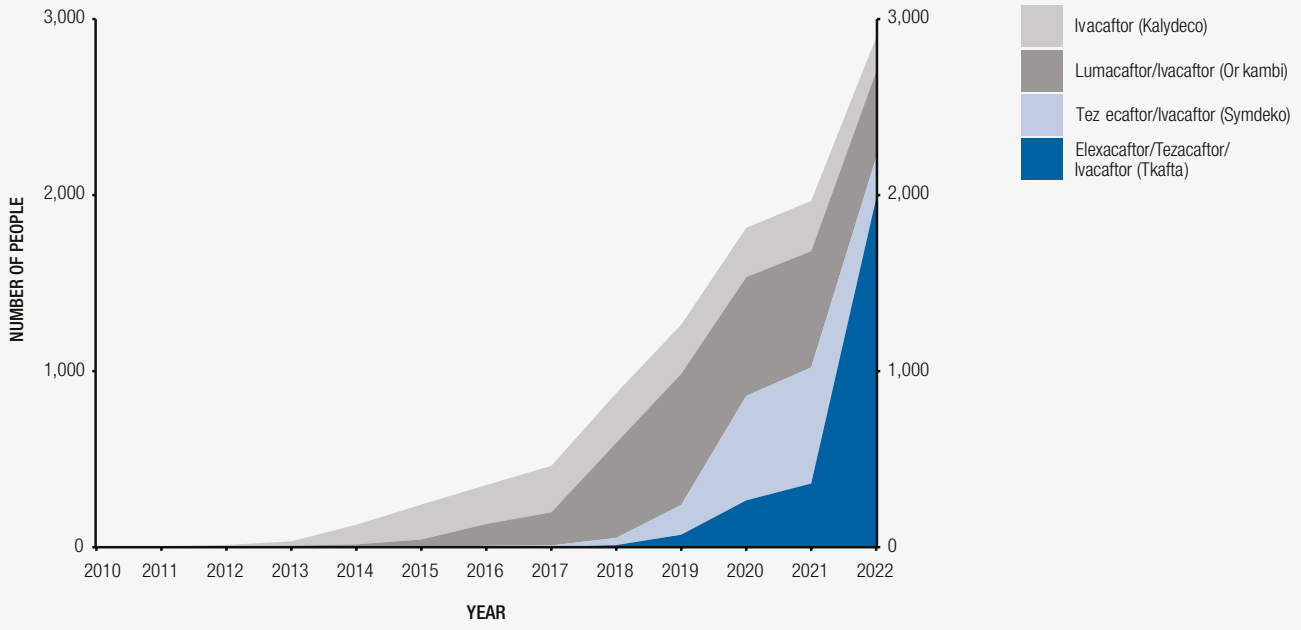


1.6 CFTR MODULATORS

Disease–modifying therapies have the potential to dramatically reduce symptoms and increase survival for an increasing number of pwCF. Different therapies target different genetic variants, and not all pwCF may be eligible to receive CFTR modulators. Additionally, CFTR modulators are high–cost medicines and are generally available initially in Australia via special access schemes before being approved for listing on the Pharmaceutical Benefits Scheme (PBS).

Figure 1.12 illustrates the total number of participants in the 2022 active cohort who, at any point from 2010 to 2022, have been prescribed various CFTR modulators. These include ivacaftor (Kalydeco®), lumacaftor/ivacaftor (Orkambi®), tezacaftor/ivacaftor with ivacaftor (Symdeko®), and elexacaftor/tezacaftor/ivacaftor (Trikafta®). It's crucial to acknowledge that this figure accounts for patients who have been prescribed any modulator during the specified period and may include individuals who have been prescribed more than one type. As such, the numbers should not be viewed as a point–in–time count of patients on a particular modulator. The graph shows a noteworthy rise of 47% in the total number of individuals who have used these modulators, increasing from 1,967 in 2021 to 2,895 in 2022. This surge is primarily due to the heightened prescription of Trikafta, which went up from 362 to 1,981. Detailed information about CFTR modulators will be further explored in the paediatric and adult sections of this report.

FIGURE 1.12: ACFDR 2010 - 2022: CFTR MODULATOR USE IN THE 2022 COHORT



1.7 TRANSPLANTATION AND SURVIVAL

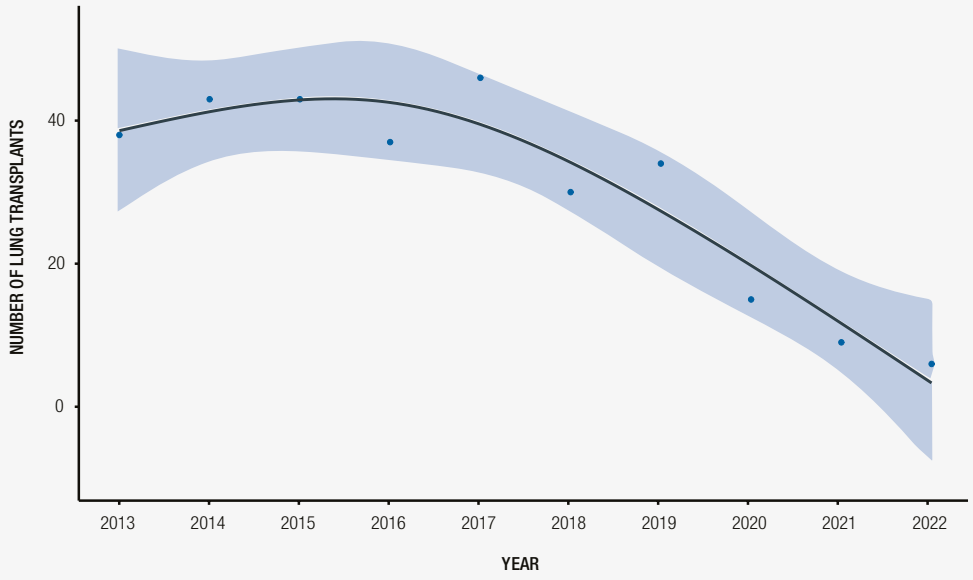
Transplantation

The most common transplantation procedure is a bilateral (double) lung transplant. As CF is a systemic disease, other organs may also be severely affected by either the underlying disease or its related complications and require transplantation, including the kidney, liver or pancreas. Occasionally multi–organ transplants are required.

In 2022, there were a total of **11 transplants for pwCF; 6 of which were bilateral lung transplants** of which 2 were performed in people younger than 30 years of age. The **5 non–lung transplants** were made up of liver and kidney transplants. There were 70 people who were evaluated for a transplant in 2022; 8 (11.4%) were waitlisted, and 9 (12.9%) were deferred from the waiting list.

The number of annual bilateral lung transplants undertaken over the last decade is shown in Figure 1.13. There has been a substantial decline in bilateral lung transplants over the last few years among pwCF in Australia, consistent with international trends.

FIGURE 1.13: ACFDR 2013 - 2022: BILATERAL LUNG TRANSPLANTS



Solid trend line w as estimated using a natural cubic spline with three degrees of freedom
haded area illustrates the 95% confidence interval

Status of People with CF in the ACFDR

The status of people in the ACFDR is updated annually by CF centres. Many pwCF who have undergone organ transplantation may not have been followed up by the ACFDR, and their deaths may not be captured in the registry. Periodically data linkage is undertaken with the national death register to validate death data. This is undertaken via probabilistic matching due to the unidentified nature of registry data.

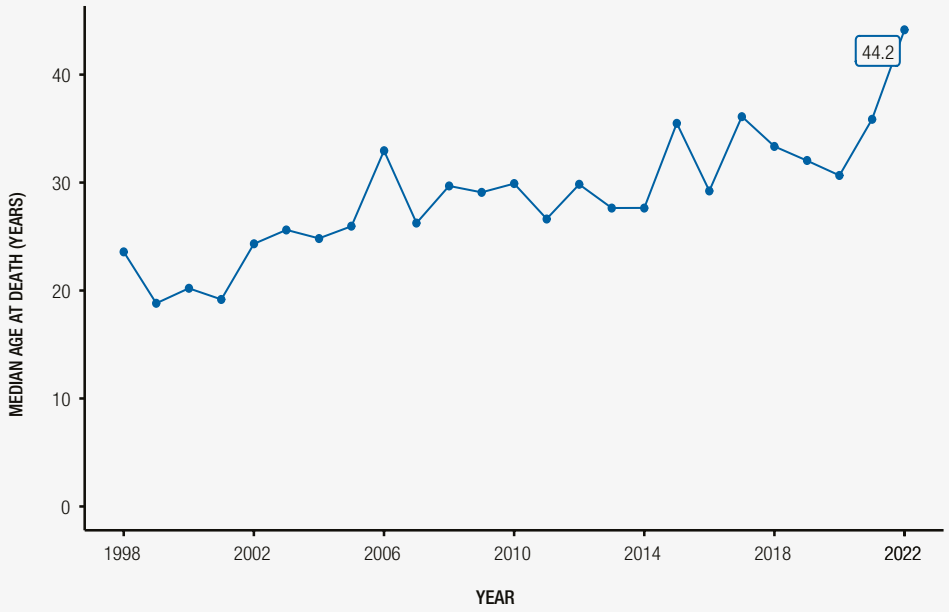
In 2022 the ACFDR recorded the deaths of 10 pwCF. Three (30.0%) of these deaths occurred in young adults (18–29 years); no deaths occurred in persons younger than 18 years. Five (50.0%) of those deaths were pwCF who received a transplant.

Of the 10 deaths in 2022, 4 were a result of post–transplant complications, 2 were related to pulmonary manifestations, 1 was from CF with intestinal manifestations, 1 was from an unspecified CF related cause and 1 had an unknown cause.

Median Age of Death

The median age of death in 2022 was 44.2 years (Figure 1.14). The median age of death continues to increase. Median age may vary from year to year given the relatively small number of deaths per annum. The median age of death is different from estimated survival, which aims to estimate the survival of a person with CF who is born within a particular year.

FIGURE 1.14: ACFDR 1998-2022: MEDIAN AGE OF DEATH



Straight dashed line represents the overall trend estimated by a linear regression model

Survival

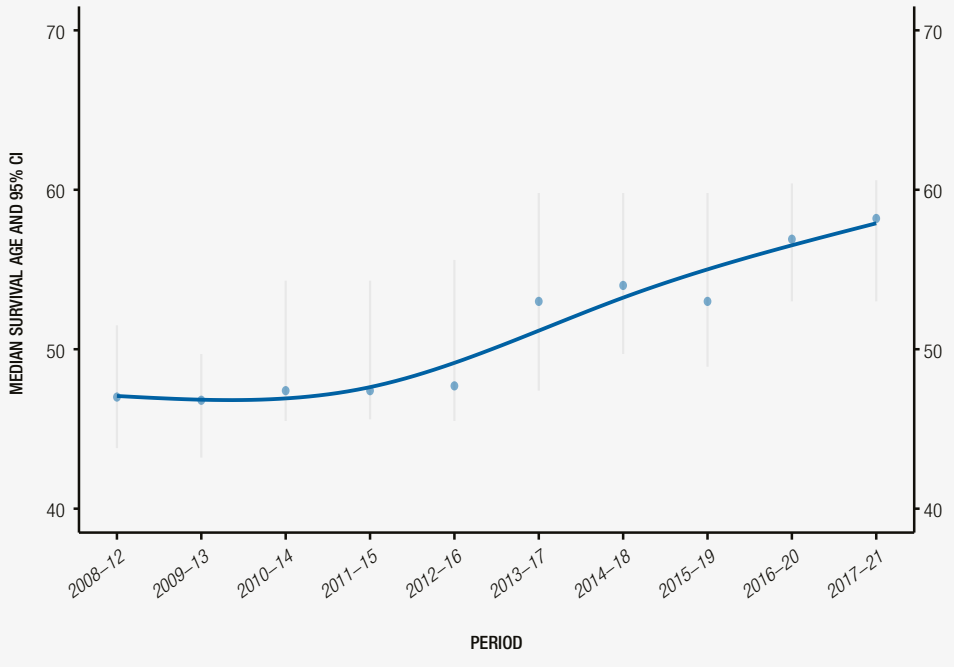
The median estimated survival for pwCF is determined based on the individuals who are alive in the ACFDR in a given year. It's important to note that these results are inclusive of some people who may have had a transplant. Internationally, CF registries have documented steady increases in median survival over recent years, attributed to advancements in treatments. This positive trend is expected to persist, with further improvements anticipated as more individuals with cystic fibrosis are managed with CFTR modulators.

TABLE 1.4: ACFDR 2008–2021: MEDIAN SURVIVAL OF PEOPLE WITH CF IN AUSTRALIA

Period	Year	Median age and 95% confidence interval	N deaths/total cohort
2008–12	2012	47.0 (43.8–51.5)	159/3,290
2009–13	2013	46.8 (43.2–49.7)	181/3,369
2010–14	2014	47.4 (45.5–54.3)	172/3,406
2011–15	2015	47.4 (45.6–54.3)	171/3,486
2012–16	2016	47.7 (45.5–55.6)	177/3,546
2013–17	2017	53.0 (47.4–59.8)	170/3,573
2014–18	2018	54.0 (49.7–59.8)	166/3,705
2015–19	2019	53.0 (48.9–59.8)	171/3,774
2016–20	2020	56.9 (53–60.4)	162/3,802
2017–21	2021	58.2 (53–60.6)	119/3,895

Table 1.4 (represented in Figure 1.15), shows that the estimated 5–year survival has increased over a 5–year period from 47.0 years for pwCF born in 2008–12, to 58.2 years for pwCF born in 2017–21. The ACFDR is reporting survival data one year in arrears to allow for late notification of recent deaths to be captured by the registry.

FIGURE 1.15: ACFDR 2008-2021: MEDIAN SURVIVAL OF PEOPLE WITH CF IN AUSTRALIA (5-YEAR COHORTS)



Each dot and line represent the estimated median survival age and 95% CI, respectively
The smooth line was estimated by fitting a natural cubic spline with 3 degrees of freedom

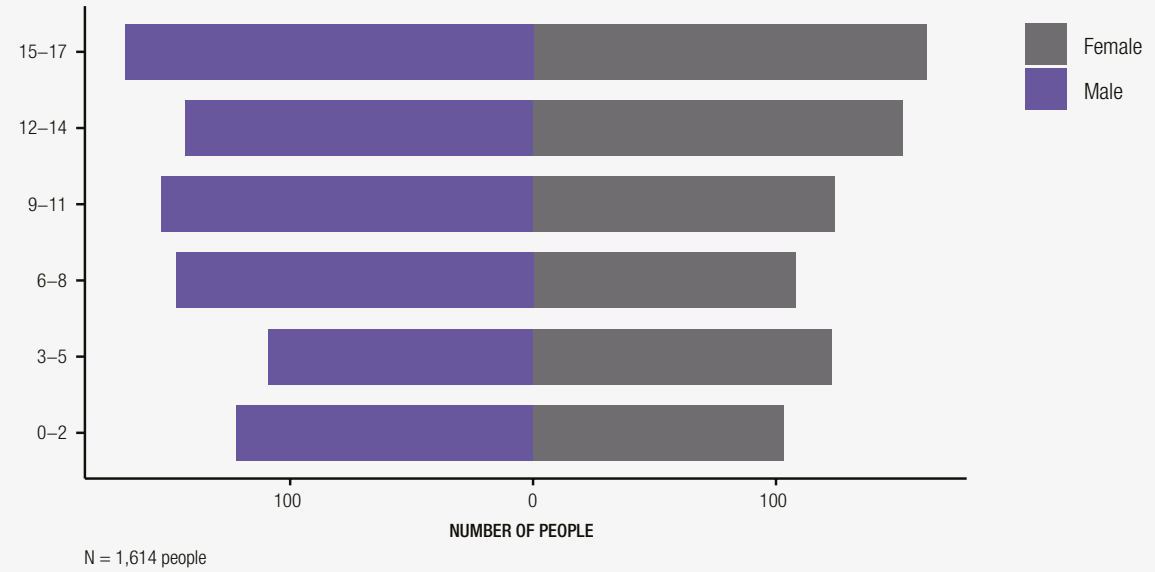
2. PAEDIATRIC DATA

2. PAEDIATRIC DATA

2.1 CHILDREN AND ADOLESCENTS WITH CYSTIC FIBROSIS

As of 31st December 2022, the ACFDR held data regarding **1,614 children and adolescents (0–17 years old) with CF,** 772 females and 842 males.

FIGURE 2.1: ACFDR PAEDIATRICS 2022: AGE AND SEX



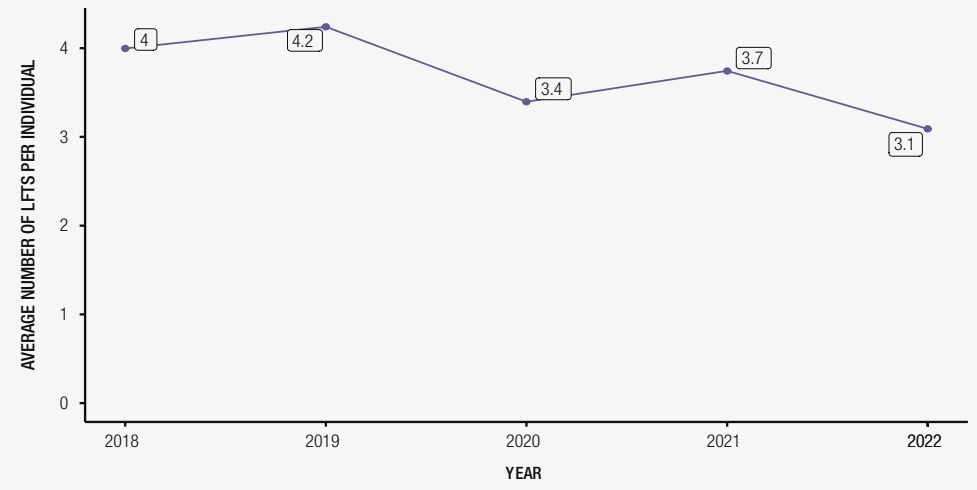
N = 1,614 people

2.2 CLINICAL MEASURES

Lung Function

Figure 2.2 illustrates the **average number of spirometry tests per child** recorded annually in the registry from 2018 to 2022. In 2018, children and adolescents averaged 4 tests each, rising slightly to 4.2 in 2019. However, the average declined to 3.4 tests per child in 2020, rebounding somewhat to 3.7 in 2021. The most recent 2022 data shows a further decrease to 3.1 average tests per child.

FIGURE 2.2: ACFDR PAEDIATRICS 2018-2022: AVERAGE NUMBER OF LUNG FUNCTION TESTS ENTERED PER INDIVIDUAL



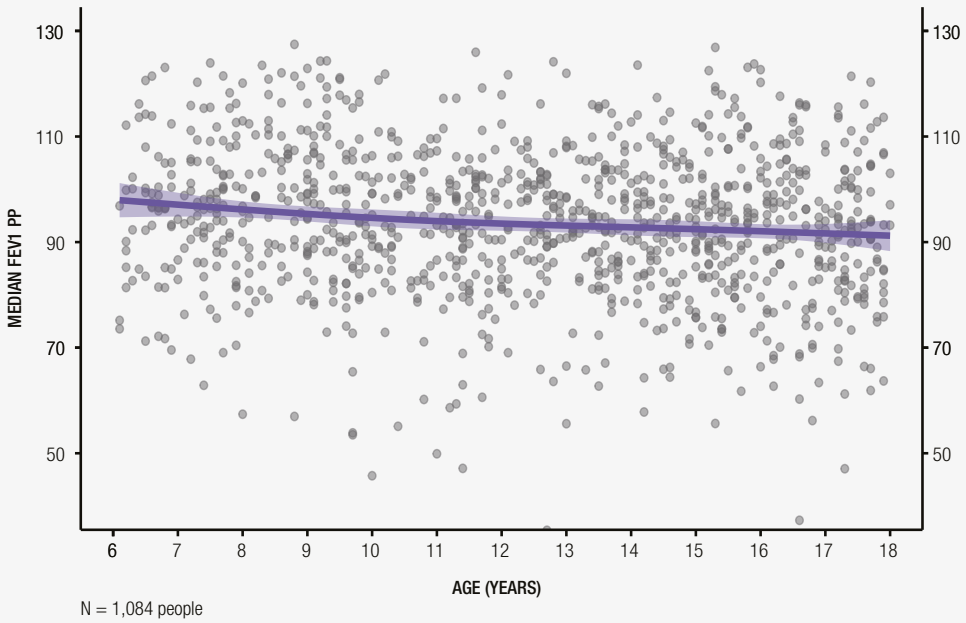
Median Lung Function

For the monitoring of lung function in pwCF, the average of the highest FEV1 pp is recorded in each quarter of the year. Predicted values are based on the Global Lung Initiative (GLI) formulae. Lung function measures are aligned with methods used in the United States Cystic Fibrosis Foundation's Patient Registry, whereby annual measures of lung function, weight, and height are reported as an average of the maximum value from each quarter where measurements have been recorded.

Over 12.0% of participants in the registry are children younger than 6 years of age who do not routinely have lung function information recorded, and a further 20.6% of registry participants did not have lung function information recorded in 2022.

Children aged 6–11 achieved a median FEV1 pp of 95.8 and adolescents aged 12–17 years 93.1 (Figure 2.3).

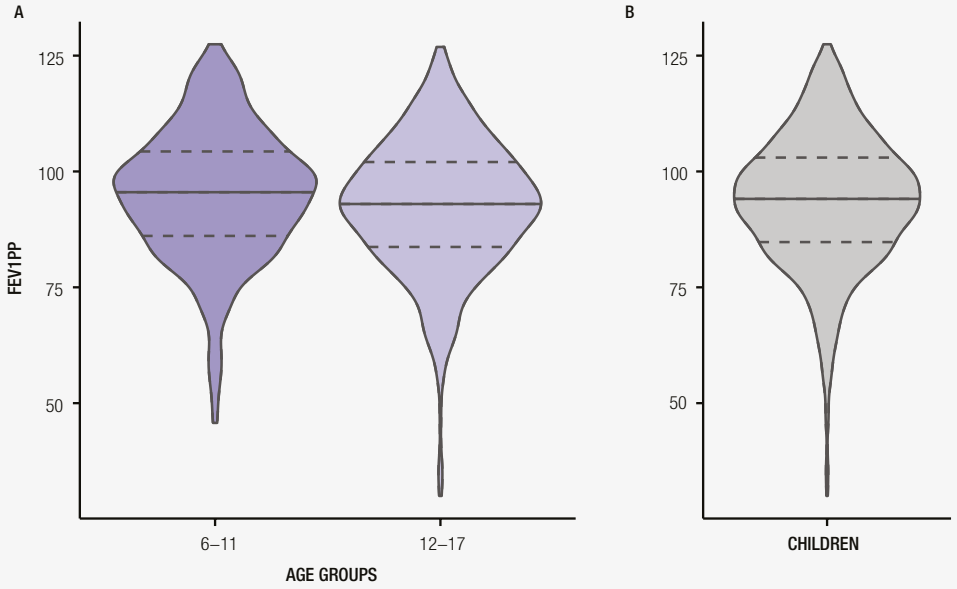
FIGURE 2.3: ACFDR PAEDIATRICS 2022: FEV1 PP BY AGE



The solid trend line was estimated using a natural cubic spline with 3 degrees of freedom
Shaded area represent the 95% confidence intervals

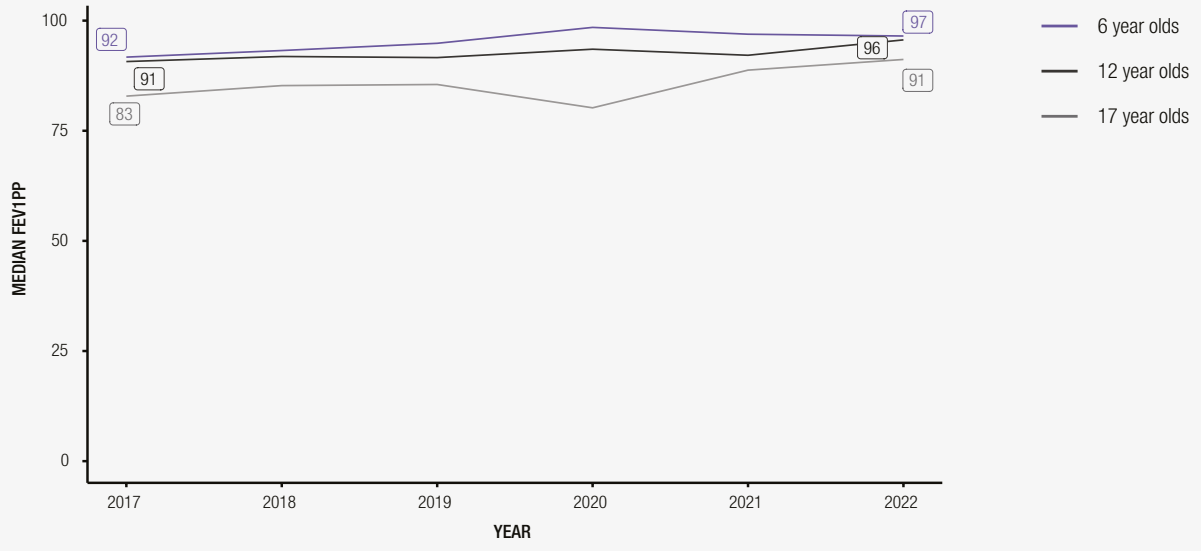
In 2022 the median FEV1 pp for 6–11 year olds was 95.8, 12–17 year olds being 93.1. With the median FEV1 pp for children and adolescent cohort overall was 94.0.

FIGURE 2.4: ACFDR PAEDIATRICS 2022: MEDIAN FEV1 PP



The median FEV1 pp has increased over time. For 6–year–olds, it has increased from 92.0 predicted in 2017 to 97.0 predicted; 12–year–olds from 91.0 to 96.0; and for 17 year olds the increase is from 83.0 to 91.0 in 2022 (Figure 2.5).

FIGURE 2.5: ACFDR PAEDIATRICS 2017-2022: MEDIAN FEV1 PP OVER TIME

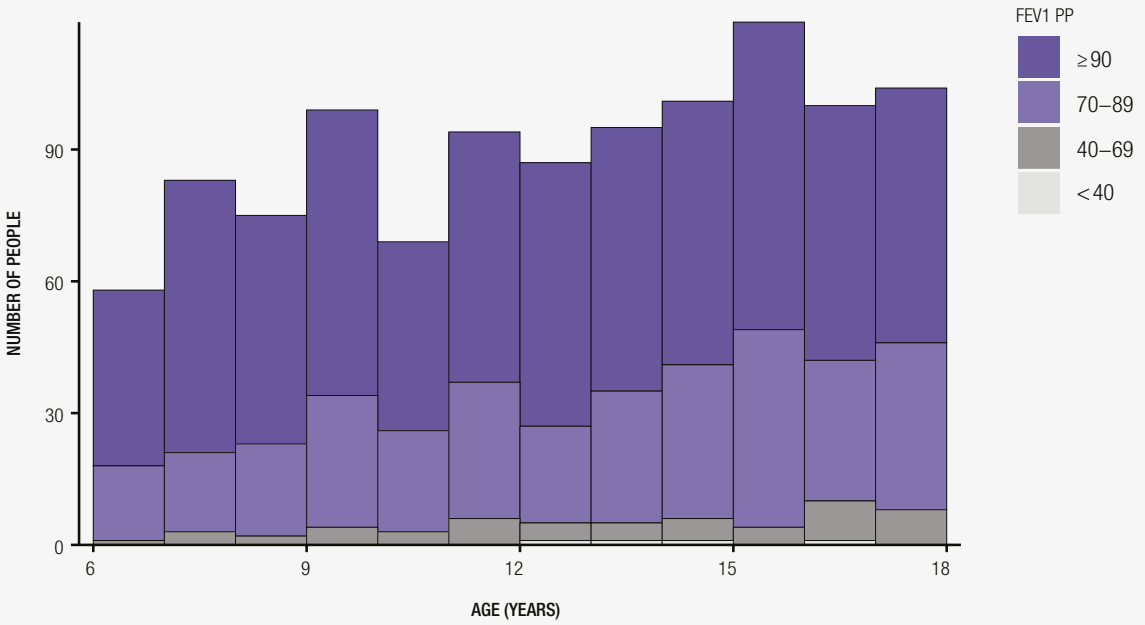


Labelled percentages illustrate median predFEV1 in 2017 and 2022
Dashed line represents all age groups

Variation in Paediatric Lung Function

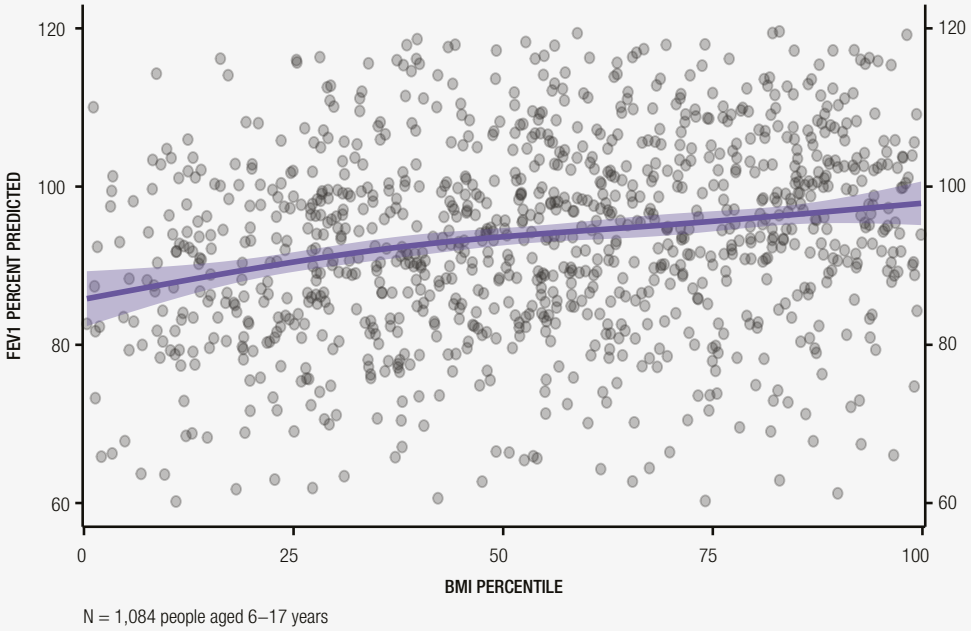
The paediatric population lung function results indicate varying levels of FEV1 pp across different age groups. In the 6–11 age range, over two thirds of children (66.9%) have an FEV1 pp of 90 or higher. Two thirds of children 6–11 years have FEV1 pp >90. However, a notable proposition of children are in the 70–89 range (29.1%), while a small proportion (4%) have moderate–severe lung function deficits. For the 12–17 age group, 60.3% have FEV1 pp ≥90, and 33.4% fall within the 70–89 range. There are smaller percentages with FEV1 pp <40 (0.70) and 40–69 (5.6%) (Figure 2.6).

FIGURE 2.6: ACFDR PAEDIATRICS 2022: LUNG FUNCTION



There is a relationship between FEV1 pp and Body Mass Index (BMI): Higher BMI, higher FEV1 pp increases (Figure 2.7).

FIGURE 2.7: ACFDR PAEDIATRICS 2022: FEV1 PP VS BMI PERCENTILE

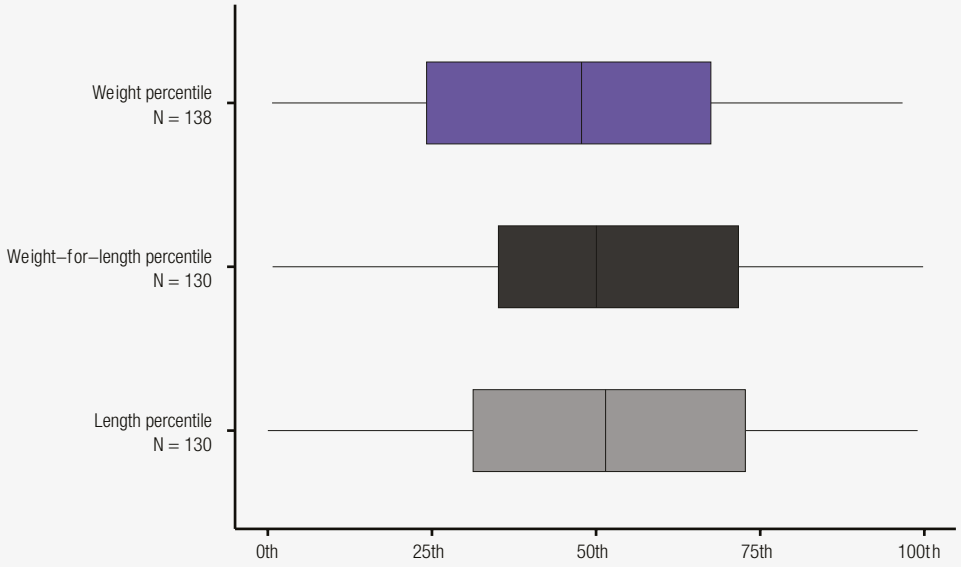


Solid line was estimated using a natural cubic spline with 3 degrees of freedom
Shaded area reprsents 95% confidence interval

Nutrition

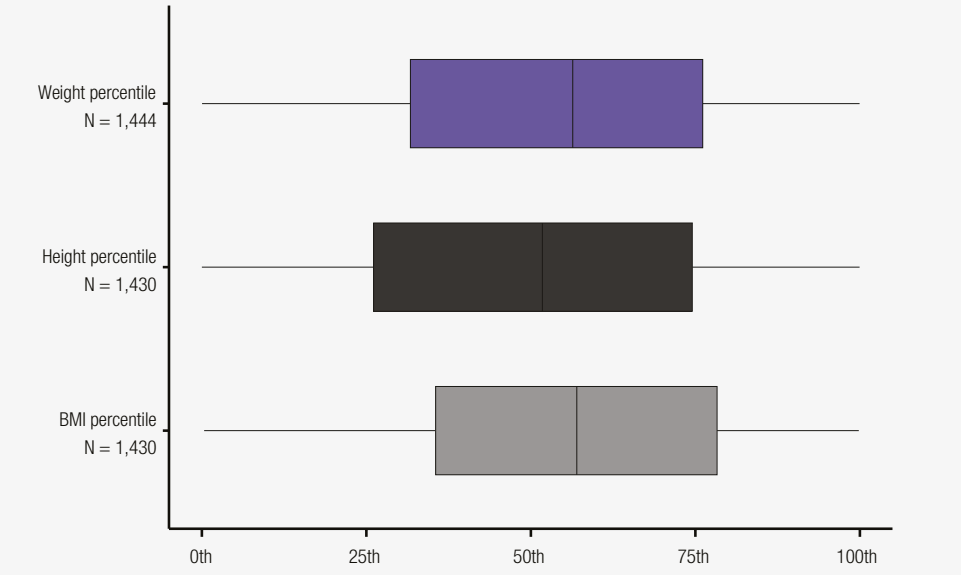
For infants (<24 months of age) the median weight percentile 47th indicating the median weight–for–length percentile 50th, and the median length percentile 51st (Figure 2.8).

FIGURE 2.8: ACFDR PAEDIATRICS 2022: <24 MONTHS PERCENTILES



For children and adolescents aged 2–17 years, the median weight 52nd percentile, median height 56th percentile, and the median BMI 57th percentile. These figures represent the best weight, best height, and best BMI, averaged over a 12–month period (Figure 2.9).

FIGURE 2.9: ACFDR PAEDIATRICS 2022: 2-17 YEARS PERCENTILES



Children 2–17 years
Height and BMI percentiles were calculated using WHO growth chart.
Weight percentiles were calculated using CDC growth chart

Nutritional status for most male and female children and adolescents with CF was in the optimal and acceptable BMI percentile ranges (Table 2.1).

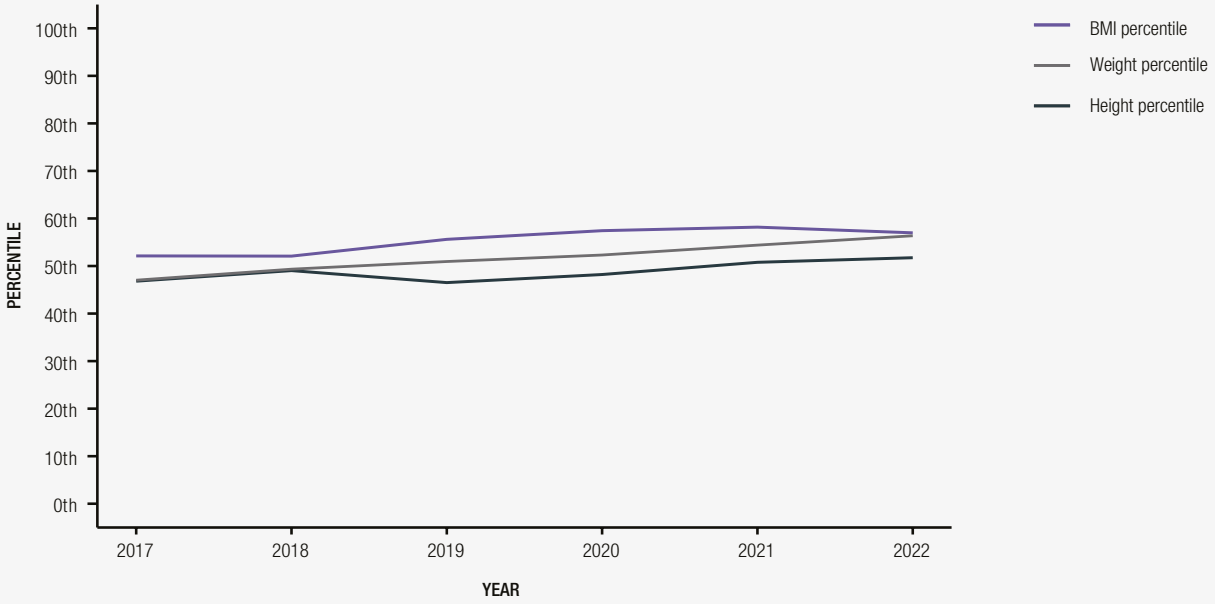
TABLE 2.1: ACFDR PAEDIATRICS 2022: <2–17 YEARS NUTRITIONAL STATUS

Nutritional status*	<2	2–5	6–11	12–17	Total
Optimal/Acceptable	88.5% (108)	67.6% (202)	66.4% (344)	71.9% (441)	70.6% (1,095)
Overweight/Obese	0.0% (0)	23.1% (69)	18.7% (97)	12.6% (77)	15.7% (243)
Suboptimal/Undernourished	11.5% (14)	9.4% (28)	14.9% (77)	15.5% (95)	13.8% (214)

*High BMI (obese range): BMI >95th percentile using CDC growth chart (children and adolescents 2–18 years).
High BMI (overweight range): BMI 85th–95th percentile using CDC growth chart (children and adolescents 2–18 years).
Optimal: weight–for–lengths >50th percentile (infants 0–1 years); BMI 50th–85th percentile using CDC growth chart (children and adolescents 2–18 years).
Acceptable: weight–for–lengths 25th–50th percentile (infants 0–1 years); BMI 25th–50th percentile (children and adolescents 2–18 years).
Suboptimal: Weight–for–length 10th–25th percentile (infants 0–1 years); BMI 10th–25th percentile (children and adolescents 2–18 years).
Undernourished: Persistent weight for length <10th percentile (infants 0–1 years); BMI <10th percentile (children and adolescents 2–18 years)

Over the last 5 years the height for children and adolescents aged 2–17 increased by 5 percentile points (from the 47th percentile to the 52th percentile), with a concomitant increase in weight of 9 percentile points (from the 47th percentile to the 56th percentile). As a result, the average BMI has also increased by 4 points from the 52nd to the 56th percentile over five years (Figure 2.10).

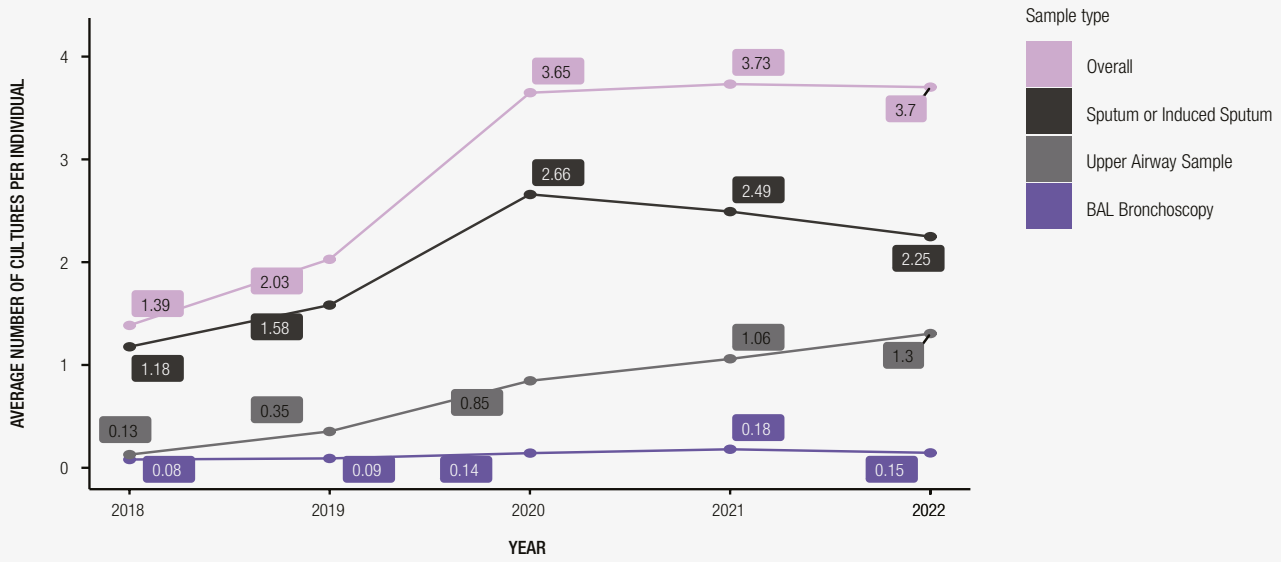
FIGURE 2.10: ACFDR PAEDIATRICS 2017-2022: 2-17 YEARS MEDIAN NUTRITIONAL PERCENTILES



Microbiology

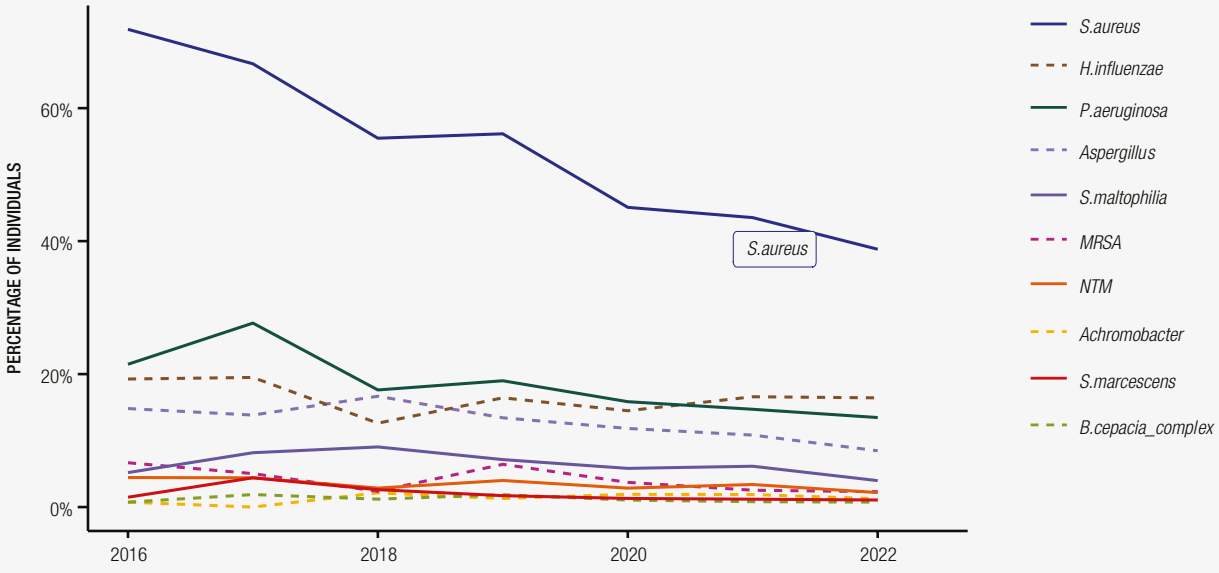
The average number of respiratory samples collected per child each year is shown in Figure 2.11. This number increased from 1.4 samples in 2018 to 2 samples in 2019. Then in 2020, there was a substantial rise to an average of 3.6 respiratory samples per child, a level sustained at 3.7 samples in both 2021 and 2022. When considering the specific sample types, Sputum or induced sputum samples accounted for a significant portion, with values increasing from 1.18 in 2018 to 2.25 in 2022. BAL Bronchoscopy samples exhibited a modest increase from 0.08 in 2018 to 0.15 in 2022. Notably, Upper Airway samples (throat swabs, cough swabs, nasopharyngeal swabs and sinus wash), also saw an upward trend, rising from 0.13 in 2018 to 1.3 in 2022.

FIGURE 2.11: ACFDR PAEDIATRICS 2018-2022: MEAN NUMBER OF RESPIRATORY SAMPLES PER INDIVIDUAL



The prevalence of some of the most common organisms has changed over the last 6 years. The prevalence of *S. aureus* was 71.9% for children with CF in 2016 and has decreased to 38.8% in 2022, and the prevalence of *Aspergillus spp* was 16.7% in 2018 and has decreased to 8.5% in 2022. The prevalence of *P. aeruginosa* has decreased from 27.7% in 2017 to 13.5% 2022. The prevalence of less common microorganisms has remained similar over this period (Figure 2.12).

FIGURE 2.12: ACFDR PAEDIATRICS 2016-2022: PREVALENCE OF RESPIRATORY MICROBIOLOGY



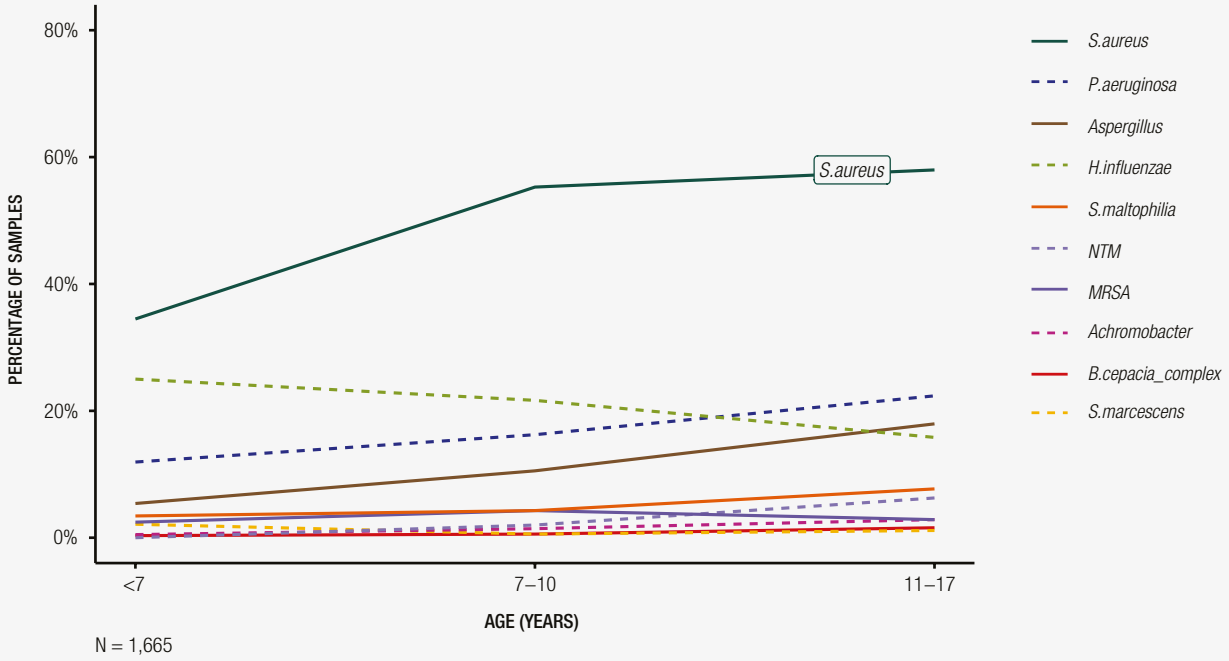
For children younger than seven years, 140 positive lower airway samples were collected by bronchoalveolar lavage (BAL) in 2022. The most common organisms identified in this age group in 2022 included S. *aureus* (26.0%), H. *influenzae* (25.0%), *Aspergillus spp* (14.0%), *P. aeruginosa* (14.0%), and *S. maltophilia* (4.0%) (Table 2.2).

Of the **1,665 positive microbiology culture samples collected in 2022,** the most common pathogen across all age groups was S. *aureus*, with the prevalence increasing with age (Table 2.2). The next most common pathogen among children and adolescents up to 11 years was *H. influenzae,* with *P. aeruginosa* being the next most common pathogen for adolescents aged 12–17 years. The prevalence of *P. aeruginosa* increases with age, being 12.0% for children <7 years, 16.0% for children and adolescents 7–11 years, and 22.0% for adolescents aged 12–17 years. *Aspergillus spp* also increases with increasing age, having a prevalence of 5.0% in children <7 years and 18.0% in adolescents 12–17 years.

TABLE 2.2: ACFDR PAEDIATRICS 2022: PREVALENCE OF RESPIRATORY MICROORGANISMS BY AGE

	BAL samples	All samples		
	<7	<7	7–11	12–17
Number in age range	540	540	351	723
Number of samples taken in 2022	140	612	351	702
Number of pwCF with samples	140	492	318	665
P.aeruginosa	20 (14.0%)	73 (12.0%)	57 (16.0%)	157 (22.0%)
H.influenzae	35 (25.0%)	153 (25.0%)	76 (22.0%)	111 (16.0%)
B.cepacia_complex	0 (0.0%)	2 (0.0%)	2 (1.0%)	11 (2.0%)
S.aureus	36 (26.0%)	211 (34.0%)	194 (55.0%)	407 (58.0%)
MRSA	3 (2.1%)	15 (2.0%)	15 (4.0%)	20 (3.0%)
Achromobacter spp	0 (0.0%)	3 (0.0%)	5 (1.0%)	20 (3.0%)
S.maltophilia	5 (4.0%)	21 (3.0%)	15 (4.0%)	54 (8.0%)
S.marcescens	1 (0.7%)	13 2 (2.0%)	2 (1.0%)	8 (1.0%)
Aspergillus spp	19 (14.0%)	33 (5.0%)	37 (11.0%)	126 (18.0%)
NTM	0 (0.0%)	0 (0.0%)	7 (2.0%)	44 (6.0%)

FIGURE 2.13: ACFDR PAEDIATRICS 2022: PREVALENCE OF RESPIRATORY MICROORGANISMS BY AGE



In 2022 nontuberculous mycobacteria (NTM) including *M. abscessus* were not detected for children under 7 years (Table 2.3 and Figure 2.13). In the 7–11 age range, the prevalence of NTM increased to 2.5%, with *M.abscessus* being 0.5%. Among adolescents aged 12–17, NTM prevalence was 6.4%, with *M. abscessus* being 3.7%.

Over the last few years there appears to have been an increase, followed by a decrease in the detection of NTM and *M. abscessus*. In adolescents aged 12–17 years the prevalence of *M. abscessus* peaked in 2019 at 5.7%, and has remained around 4.0% since then.

TABLE 2.3: ACFDR PAEDIATRICS 2016–2022: NON–TUBERCULOUS MYCOBACTERIUM (NTM) INFECTION

Age	Organism	2016	2017	2018	2019	2020	2021	2022
<7	NTM	0/6 (0.0%)	0/19 (0.0%)	0/55 (0.0%)	2/137 (1.5%)	1/322 (0.3%)	3/416 (0.7%)	0/492 (0.0%)
<7	*M.abscessus*	0/6 (0.0%)	0/19 (0.0%)	0/55 (0.0%)	0/137 (0.0%)	0/322 (0.0%)	2/416 (0.5%)	0/492 (0.0%)
7–11	NTM	0/53 (0.0%)	0/60 (0.0%)	0/151 (0.0%)	2/215 (0.9%)	10/376 (2.7%)	14/395 (3.5%)	10/408 (2.5%)
7–11	*M.abscessus*	0/53 (0.0%)	0/60 (0.0%)	0/151 (0.0%)	1/215 (0.5%)	4/376 (1.1%)	3/395 (0.8%)	2/408 (0.5%)
12–17	NTM	6/73 (8.2%)	7/76 (9.2%)	12/180 (6.7%)	24/280 (8.6%)	35/548 (6.4%)	46/569 (8.1%)	37/575 (6.4%)
12–17	*M.abscessus*	1/73 (1.4%)	2/76 (2.6%)	10/180 (5.6%)	16/280 (5.7%)	22/548 (4.0%)	21/569 (3.7%)	23/575 (4.0%)

2.3 CF MANAGEMENT

Clinic Visits

Figure 2.14 shows the total number of clinical visits for the paediatric population in the registry per year over the last 3 years. The total number of visits for children and adolescents has increased from 7,655 in 2020 to 8,120 in 2021, with a slight decrease in 2022 to 7,439.

The nature of clinical encounters has changed during this time also. During the COVID–19 pandemic, the proportion of telehealth visits (audio and visual visits conducted at home, or in a healthcare setting or audio only visits) for children and adolescents were 34.0% in 2020 and has slightly decreased to 30.0% in 2022. Children and adolescents overall have fewer telehealth visits than adults, this is discussed in the adult section of the report. The proportion of outreach visits also decreased from 7.0% in 2020 to 5.0% in 2022.

FIGURE 2.14: ACFDR PAEDIATRICS 2020-2022: TOTAL NUMBER OF ENCOUNTERS RECORDED PER YEAR

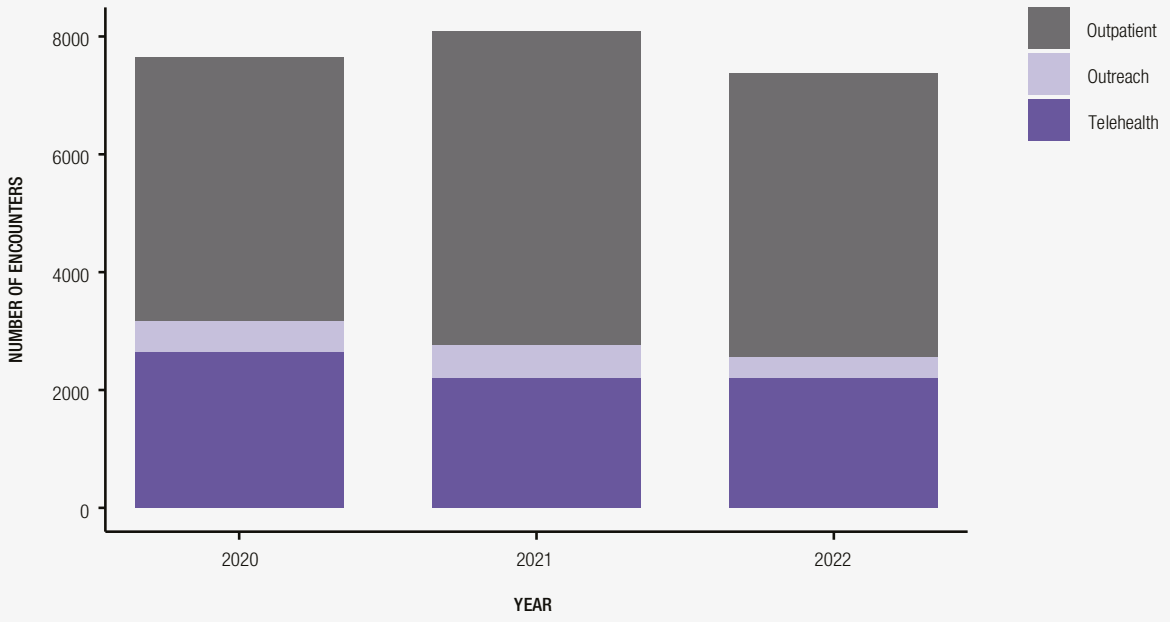
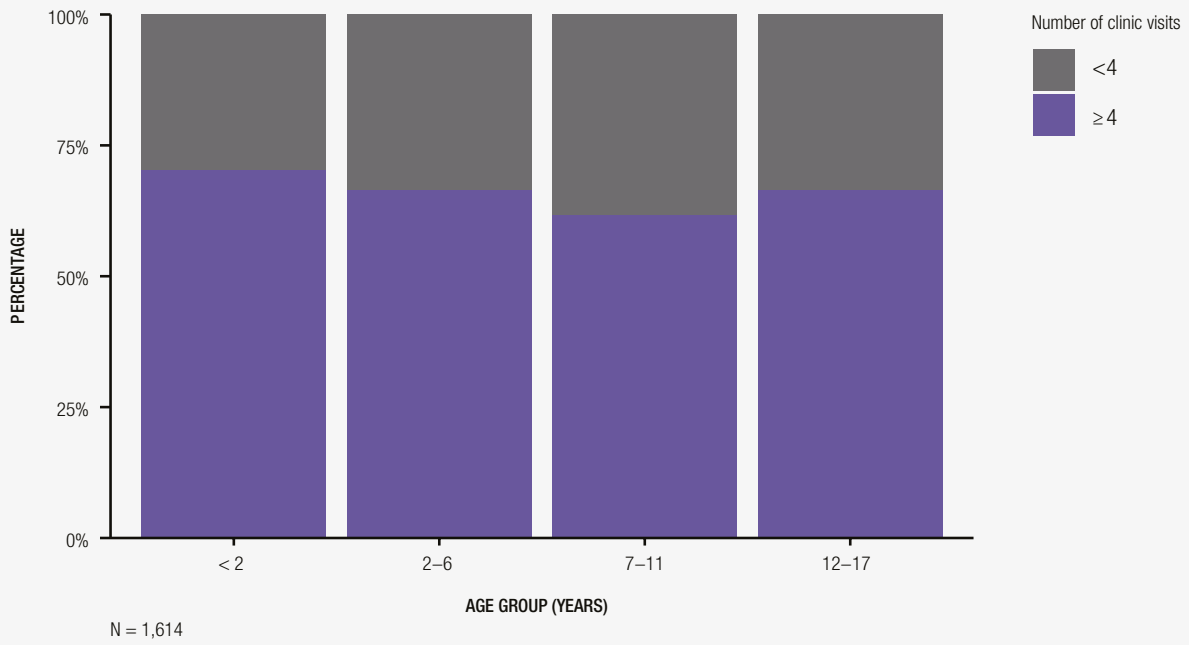


TABLE 2.4: ACFDR PAEDIATRICS 2020–2022: TOTAL NUMBER OF ENCOUNTERS RECORDED PER YEAR

Visit type	2020	2021	2022
Outpatient	4,467 (58.0%)	5,337 (66.0%)	4,805 (65.0%)
Outreach	540 (7.0%)	549 (7.0%)	370 (5.0%)
Telehealth	2,631 (34.0%)	2,203 (27.0%)	2,191 (30.0%)
Total	7,655 (100%)	8,120 (100%)	7,439 (100%)

The Australian CF Standards of Care for pwCF recommend four clinic visits per year. In 2022 the number of children with CF who had at least 4 clinic visits was 1,053 (65.2%) overall. This was highest among those <2 years old at 70.0%, followed by 2–6 and 12–17 years old at 66.0%, and the proportion who had at least 4 clinic visits was 7–11 years old at 62.0% (Figure 2.15).

FIGURE 2.15: ACFDR PAEDIATRICS 2022: PROPORTION OF PARTICIPANTS HAVING 4 OR MORE CLINICAL VISITS



The total number of children and adolescents who had at least 4 clinical visits recorded in 2022 was 1,053 compared to 1,213 in 2021 (Table 2.5).

TABLE 2.5: ACFDR PAEDIATRICS 2021–2022: AGE GROUPS WITH 4 OR MORE CLINICAL VISITS

	Number with 4+ clinic visits	
Age	**2021**	**2022**
<2	104 (76.9%)	101 (70.0%)
2–6	276 (79.0%)	263 (66.0%)
7–11	398 (69.0%)	277 (62.0%)
12–17	435 (70.0%)	415 (66.0%)
Total	**1,213 (70.0%)**	**1,053 (65.2%)**

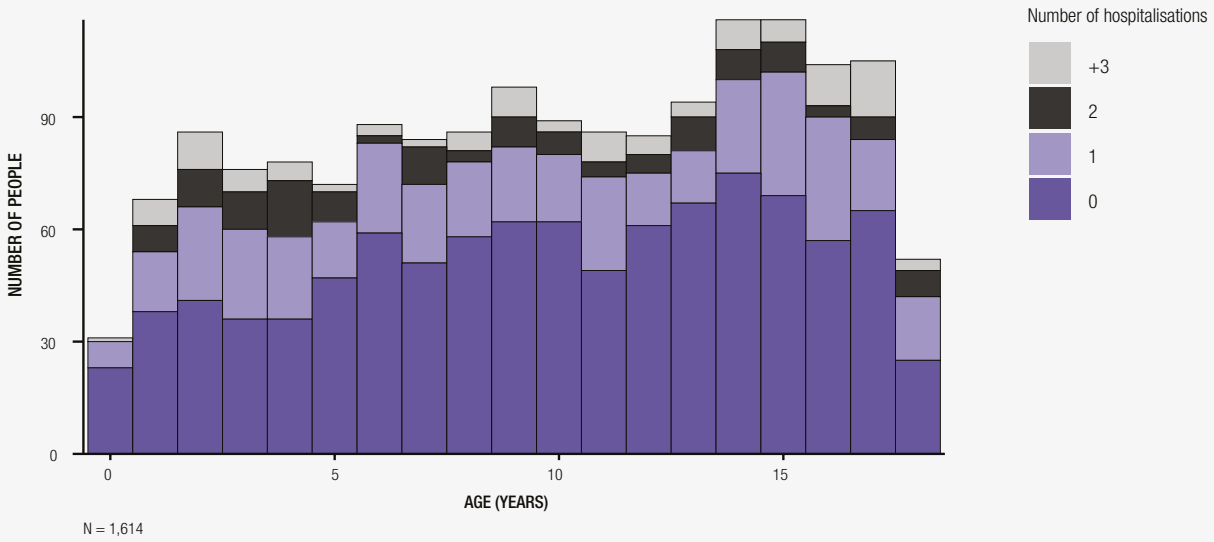
Hospitalisations

Variation in Paediatric Hospitalisations

There were a total of 1,138 hospitalisations for children and adolescents in 2022. Most (60.0%) children younger than 2 years of age did not have any hospitalisations, while 23.0% had 1 hospitalisation, 9.0% had 2 hospitalisations, and 8.0% had 3 hospitalisations. In the 2–6 age range, 56.0% had no hospitalisations, with 27.0% having 1, 11.0% having 2, and 6.0% having 3 hospitalisations. Similarly, for the 7–11 age group, the majority (65.0%) had no hospitalisations, while 23.0% had 1, 6.0% had 2, and 6.0% had 3 hospitalisations. Among adolescents aged 12–17, 61.0% had no hospitalisations, while 24.0% had 1, 7.0% had 2, and 8.0% had 3 hospitalisations (Figure 2.16).

In 2022, 307 (19.0%) children adolescents with CF were diagnosed with COVID–19, a significant increase from the 4 cases reported in 2021. Of the 307 cases, 16 (5.2%) children required hospitalisation for COVID–19 in 2022, though none were admitted to the intensive care unit (ICU).

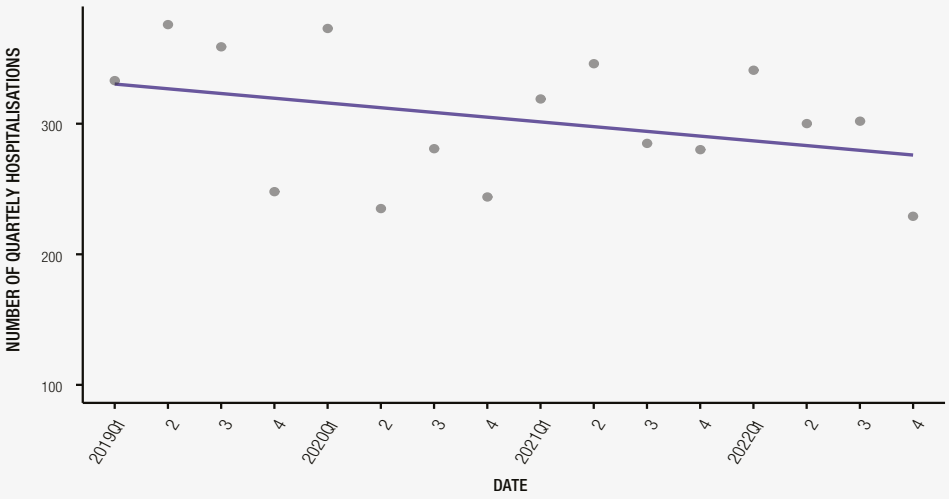
FIGURE 2.16: ACFDR PAEDIATRICS 2019-2022: HOSPITALISATIONS



Paediatric Hospitalisations over Time

Paediatric hospitalisations have reduced since 2019, with the trend line showing a decrease from an average of around 350 admissions per quarter early in 2019 to fewer than 300 admissions per quarter in late 2022.

FIGURE 2.17: ACFDR PAEDIATRICS 2019-2022: HOSPITALISATIONS PER QUARTER

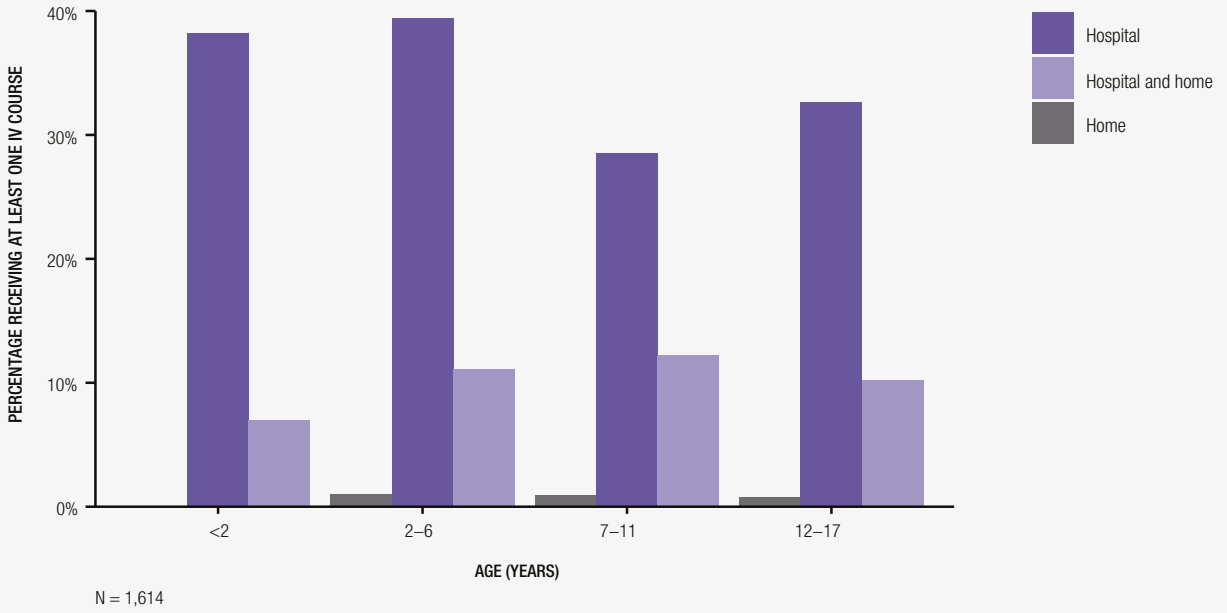


IV Antibiotic Therapy

The most common reason for hospitalisations for pwCF is to be treated with IV antibiotics for a respiratory exacerbation. In 2022, the proportion of children requiring IV antibiotic therapy in hospital was 38.0% at <2 years of age, 39.0% for those of 2–6 years of age, 33.0% for 12–17 year olds and 29.0% for 7–11 years of age.

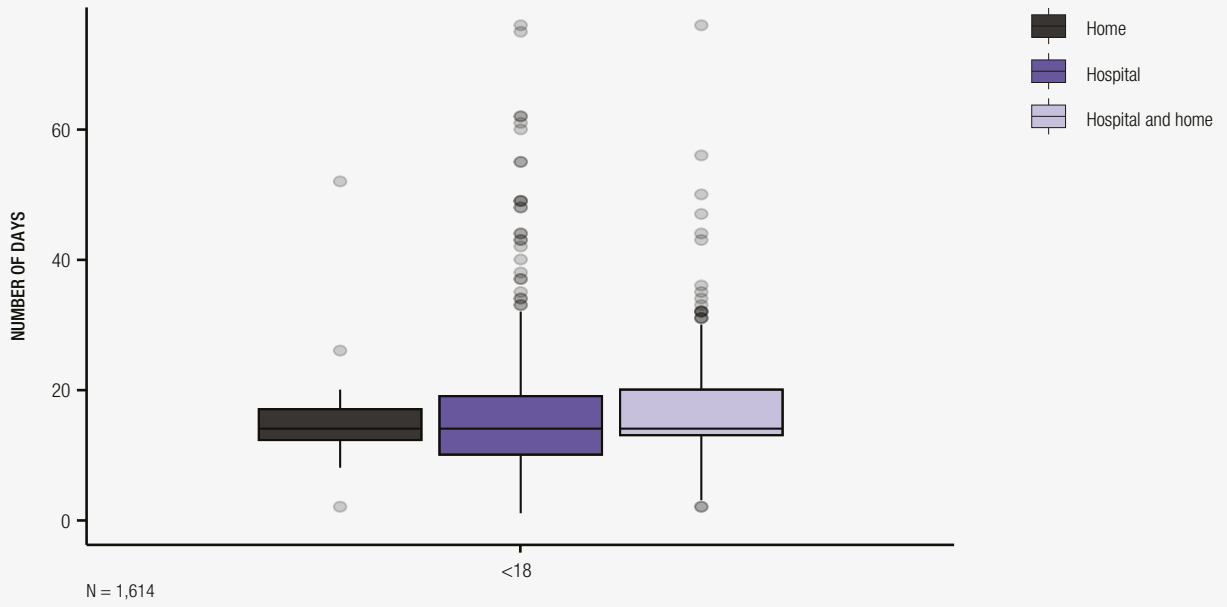
The percentage of people who had hospital and home IV antibiotic therapy (whereby pwCF are initially treated in hospital with IV antibiotics and then transition to home to continue IV treatment) is lowest at 7.0% for those <2, 11.0% for 2–6 years, peaks at 12.0% for people 7–11 years of age and 10.0% for 12–17 year olds and. The proportion of children having home IV therapy is only 1.0% for children and adolescents ages 2–17 years with no such therapy for children under 2 years. (Figure 2.18).

FIGURE 2.18: ACFDR PAEDIATRICS 2022: PARTICIPANTS RECEIVING AT LEAST ONE COURSE OF IV ANTIBIOTIC THERAPY



The median duration of IV antibiotic therapy in the hospital was 14 days, and this duration was also recorded for individuals receiving IV antibiotics via Home IV therapy. The combined hospital and home days of treatment amounted to 14 days for children and adolescents in 2022.

FIGURE 2.19: ACFDR PAEDIATRICS 2022: MEDIAN DAYS IV ANTIBIOTIC USE

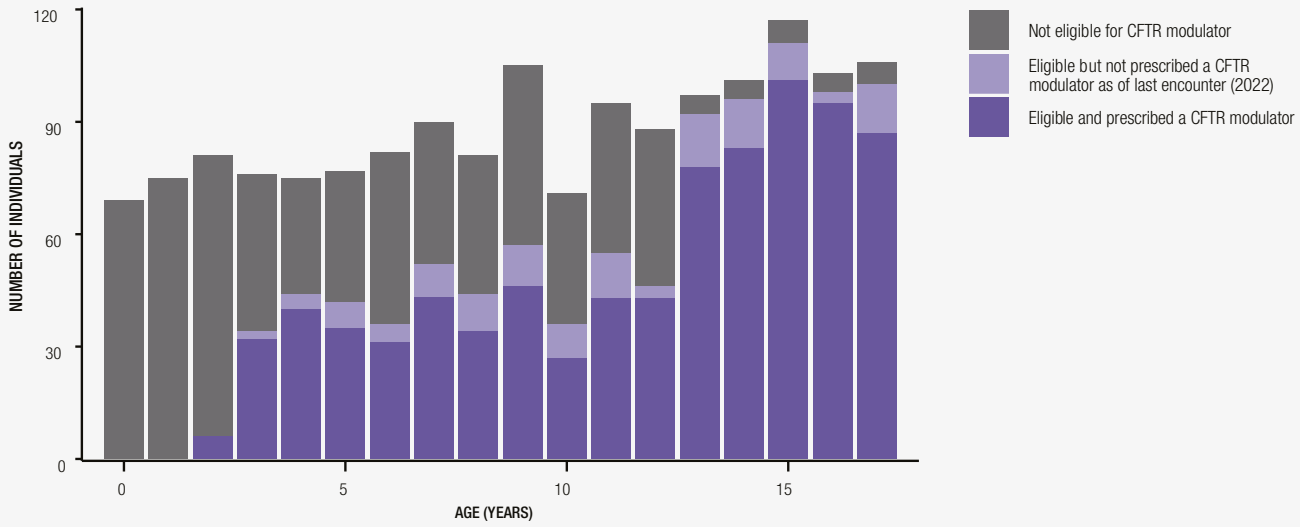


CFTR Modulators

Data were calculated from pwCF who were on a modulator as of December 31st 2022. Data presented here reflect only those pwCF who had CFTR modulator data entered into the registry, which is generally those on modulators available via the PBS.

Of the 1,614 children and adolescents in the registry, eligibility status for a CFTR modulator was known/recorded for 98.5% (1,589 people). Of these, 640 children and adolescents (40.3%) were not eligible for a modulator; 51.9% (824 children and adolescents) were eligible and prescribed a modulator; and 7.9% (125 children and adolescents) were eligible and not prescribed a modulator in 2022. Eligibility varies according to age, with 100% of children <12 months ineligible, and nearly all 12 years olds eligible for a CFTR modulator. The low eligibility percentage among 2–3 year olds, the third column, despite having Orkambi and Kalydeco for that age group, is explained by the reporting method. Eligibility was determined based on age at the start of the year to identify those eligible during that year, whereas the age groups in the data are defined by age at the end of the year (Fig 2.20).

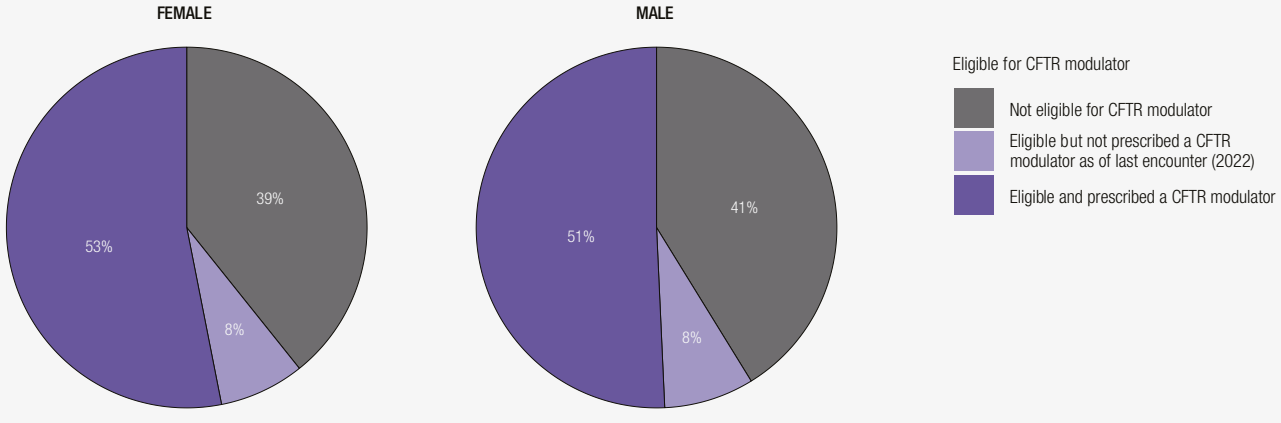
FIGURE 2.20: ACFDR PAEDIATRICS 2022: CFTR ELIGIBILITY AND PRESCRIBING BY AGE



N = 1,589 individuals with known eligibility

The figures below show eligibility and prescribing information separately for males and female children and adolescents with CF. The denominator is 1,589 children and adolescents with CF where eligibility for a modulator is recorded in the registry based on genotype. Figure 2.21 below shows that 39% of females and 41% of males were not eligible for a CFTR modulator. Of the remaining paediatric population, 53.1% of females and 50.7% of males were eligible and prescribed a modulator, with 8% of both males and females being eligible but not being prescribed a modulator.

FIGURE 2.21: ACFDR PAEDIATRICS 2022: COMBINED ELIGIBILITY AND PRESCRIBING OF CFTR MODULATORS



N = 1,589 individuals with known eligibility

Ivacaftor (KALYDECO®)

Ivacaftor is available on the PBS for people who have CF, who are aged one year and older, and who have one of the following gating (class III) gene changes in the CFTR gene: G551D, G1244E, G1349D, G178R, G551S, S1251N, S1255P, S549N, S549R.

In the tables below the numerator is those on the drug and the denominator is the eligible population (based on genotype).

TABLE 2.6: ACFDR PAEDIATRICS 2022: IVACAFTOR USE

Age (Years)	On Ivacaftor anytime	On Ivacaftor as of 31 Dec 2022	Previously on Ivacaftor and Discontinued as of 31 Dec 2022
1–5	17/23 (74.0%)	17/23 (74.0%)	0/23 (0.0%)
≥6	72/87 (83.0%)	53/87 (60.9%)	19/87 (21.8%)

TABLE 2.7: ACFDR PAEDIATRICS 2022: REASONS FOR DISCONTINUATION/SWITCH IN MODULATOR OF IVACAFTOR IN PARTICIPANTS

% (N)	Reasons for discontinuation/switch in modulator
68.4% (13)	Switch to other CFTR modulator
10.5% (2)	Other intolerance/adverse event
21.1% (4)	Other reason *

*4 Other reasons: Weight gain

Lumacaftor/Ivacaftor (ORKAMBI®)

Lumacaftor/Ivacaftor is a combination therapy available on the PBS for people who have CF, are aged two years and older, and who have two copies of the F508del gene change in the CFTR gene.

TABLE 2.8: ACFDR PAEDIATRICS 2022: LUMACAFTOR/IVACAFTOR USE

Age (Years)	On Lumacaftor/Ivacaftor anytime	On Lumacaftor/Ivacaftor as of 31 Dec 2022	Previously on Lumacaftor/Ivacaftor and discontinued as of 31 Dec 2022
2–5	124/134 (93.0%)	109/134 (81.3%)	15/134 (11.2%)
≥6	392/540 (73.0%)	240/540 (44.44%)	152/540 (28.15%)

TABLE 2.9: ACFDR PAEDIATRICS 2022: REASONS FOR DISCONTINUATION/SWITCH IN MODULATOR OF LUMACAFTOR/IVACAFTOR IN PARTICIPANTS

% (N)	Reasons for discontinuation/switch in modulator
57.5% (96)	Switch to other CFTR modulator
12.0% (20)	Liver impairment/intolerance
10.8% (18)	Other intolerance/adverse event
6.0% (10)	Pulmonary side effect/intolerance
2.4% (4)	Concomitant drug interaction
11.4% (19)	Other reason*

*19 Other reasons; Unknown (4) on trial (3), Patient discharge (3),feeding issues (2), family choice (1), increased sensory eye movements (1), not tolerating (1), sharp pain across chest/abdo (1), unable to swallow tablets (1), CF tune up (1), lung function decline (1)

Tezacaftor/Ivacaftor And Ivacaftor (SYMDEKO®)

Tezacaftor/ivacaftor is also a combination therapy available on the PBS for people who have CF, are aged 12 years and older, and who have one copy of the following changes in the CFTR gene: E56K, R117C, F508del, S977F, F1074L, 3849+10kbC→T, P67L, E193K, D579G, F1052V, D1152H, R74W, L206W, 711+3A→G, K1060T, D1270N, D110E, R352Q, E831X, A1067T, 2789+5G→A, D110H, A455E, S945L, R1070W, 3272–26A→G.

TABLE 2.10: ACFDR PAEDIATRICS 2022: TEZACAFTOR/IVACAFTOR USE

Age (Years)	On Tezacaftor/Ivacaftor anytime	On Tezacaftor/Ivacaftor as of 31 Dec 2022	Previously on Tezacaftor/Ivacaftor and discontinued as of 31 Dec 2022
12–17	110/265 (42.0%)	22/265 (8.3%)	88/265 (33.2%)

TABLE 2.11: ACFDR PAEDIATRICS 2022: REASONS FOR DISCONTINUATION/SWITCH IN MODULATOR OF TEZACAFTOR/IVACAFTOR IN PARTICIPANTS

% (N)	Reasons for discontinuation/switch in modulator
81.8% (72)	Switch to other CFTR modulator
4.5% (4)	Liver impairment/intolerance
2.3% (2)	Other intolerance/adverse event
2.3% (2)	Concomitant drug interaction
1.1% (1)	Pulmonary side effect/intolerance
8.0% (7)	Other reason *

*7 Other reasons; Drug trial (3) and non–adherence (3), development cataract (1)

Elexacaftor/Tezacaftor/Ivacaftor (TRIKAFTA®)

Elexacaftor/ tezacaftor/ivacaftor (ETI) is a triple combination therapy available on the PBS in April 2022 for people who have CF aged 12+ years and older, with at least one copy of the F508del gene change in the CFTR gene.

TABLE 2.12: ACFDR PAEDIATRICS 2022: ELEXACAFTOR/TEZACAFTOR/IVACAFTOR USE

Age (Years)	On ETI anytime	On ETI as of 31 Dec 2022	Previously on ETI and discontinued as of 31 Dec 2022
12–17	471/561 (84.0%)	466/561 (83.1%)	5/561 (0.9%)

Table 2.13 describes **reasons for discontinuation as well as change in dosage** of elexacaftor/tezacaftor/ivacaftor.

TABLE 2.13: ACFDR PAEDIATRICS 2022: REASONS FOR DISCONTINUATION/CHANGE OF ELEXACAFTOR/TEZACAFTOR/ IVACAFTOR IN PARTICIPANTS

% (N)	Reasons for discontinuation/change
43.3% (13)	Liver impairment/intolerance
16.7% (5)	Other intolerance/adverse event
13.3% (4)	Concomitant drug interaction
3.3% (1)	Pulmonary side effect/intolerance
3.3% (1)	Switch to other CFTR modulator
20.0% (6)	Other reason

*6 Other reasons: Increase dose (3), high bilirubin (1),itch (1), Influencing behaviour/mental health in negative way (1)

2.4 COMPLICATIONS AND THERAPIES

CF Pulmonary Disease

In 2022, the rate of haemoptysis was 0.6% for children <12 years, and 3% for adolescents aged 12–17. The incidence of pneumothorax was 0.1% for children <12 years, and 0.3% for adolescents aged 12–17 years.

CF Pulmonary Therapies – Maintenance Antibiotics

The use of maintenance antibiotic therapy for children and adolescents is depicted in Fig 2.22. Inhaled antibiotics are more frequently used in older age categories, with percentages increasing from 14.9% in children under 6 to 21.8% in adolescents aged 12–17. Use of regular oral antibiotics decreases with increasing age, from 45.7% in the under 6 group to 31.8% in the 12–17 age range, while macrolide use increases with age, from 9.4% for those under 6 years to 17.6% for those 12–17 years (Figure 2.22 and Table 2.14).

FIGURE 2.22: ACFDR PAEDIATRICS 2022: MAINTENANCE ANTIBIOTIC THERAPY

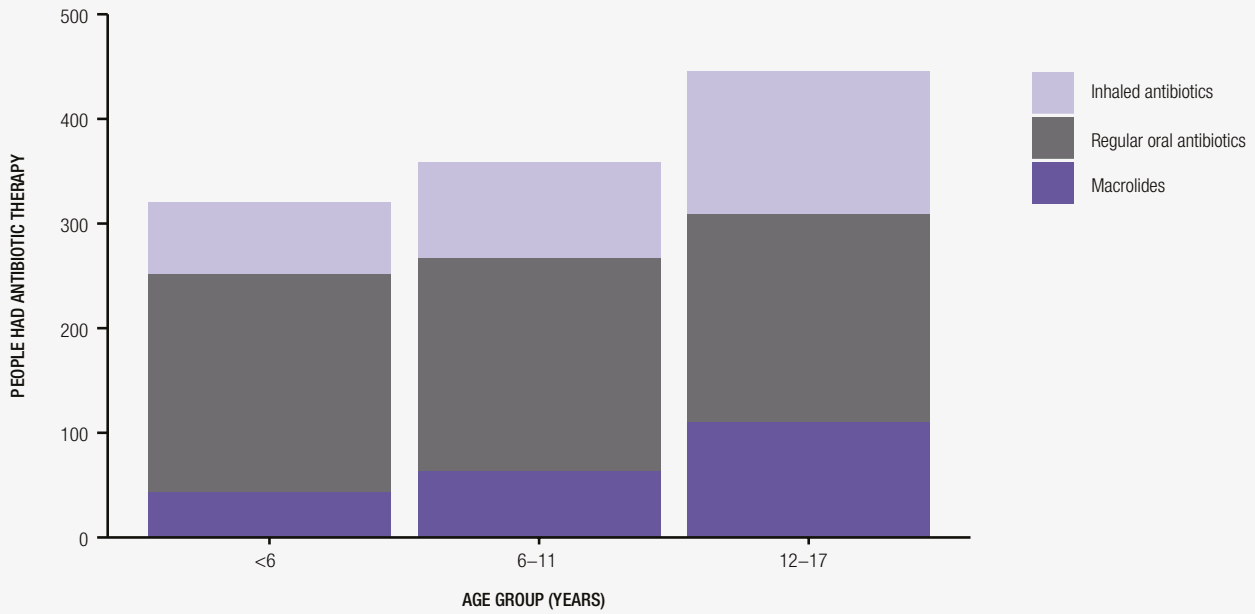


TABLE 2.14: ACFDR PAEDIATRICS 2022: MAINTENANCE ANTIBIOTIC THERAPY

	<6 (N=457)	6–11 (N=532)	12–17 (N=625)
Inhaled antibiotics	68 (14.9%)	91 (17.1%)	136 (21.8%)
Regular oral antibiotics	209 (45.7%)	204 (38.3%)	199 (31.8%)
Macrolides	43 (9.4%)	63 (11.8%)	110 (17.6%)

CF Lung Therapies—Non-Antibiotic Management

The most used adjuvant lung therapies among children and adolescents are dornase alpha, hypertonic saline and bronchodilators, with use increasing with age (Table 2.15). Inhaled corticosteroid use also increases with age, as does inhaled mannitol use. Oral corticosteroids are less commonly used, by approximately 3–5% of children and adolescents across the age groups.

TABLE 2.15: ACFDR PAEDIATRICS 2022: OTHER LUNG THERAPIES

	<6 (N=457)	6–11 (N=532)	12–17(N=626)
Dornase alpha	144 (31.5%)	389 (73.1%)	483 (77.3%)
Hypertonic saline	117 (25.6%)	244 (45.9%)	281 (45.0%)
Inhaled mannitol	1 (0.2%)	5 (0.9%)	81 (13.0%)
Bronchodilators	97 (21.2%)	211 (39.7%)	315 (50.4%)
Inhaled corticosteroids	27 (5.9%)	99 (18.6%)	159 (25.4%)
Oral corticosteroids	15 (3.3%)	27 (5.1%)	29 (4.6%)
Long term oxygen therapy	1 (0.2%)	0 (0.0%)	3 (0.5%)
Non–invasive ventilation	4 (0.9%)	3 (0.6%)	4 (0.6%)

CF Endocrine Disease

The incidence of impaired glucose tolerance reported in 2022 was very low for young children, with 1.7% of children less than 12 reporting impaired glucose tolerance, and 2.2% reporting diabetes. For adolescents 12–17 years, the prevalence of these increased to 10.7% and 13.6% respectively. Approximately 90% of children with diabetes were treated with insulin. Most of the insulin use by children and adolescents was long term (chronic) use (Table 2.16).

TABLE 2.16: ACFDR PAEDIATRICS 2022: DIABETIC STATUS

Diabetic status	<12 (N=989)	12–17 (N=625)
Normal, (no diabetes or impaired glucose tolerance)	555 (56.1%)	311 (49.8%)
Impaired glucose tolerance	17 (1.7%)	67 (10.7%)
Diabetes	22 (2.2%)	85 (13.6%)
Not known	395 (39.9%)	162 (25.9%)

Diabetes Treatment Type	<12 (N=22)	12–17 (N=85)
Insulin	19 (86.4%)	79 (92.9%)
Diet/lifestyle management only	1 (4.5%)	1 (1.2%)
No treatment for diabetes	2 (9.1%)	5 (5.9%)

Insulin Use	<12 (N=20)	12–17 (N=75)
Intermittent insulin use	0 (0.0%)	4 (5.3%)
Chronic insulin use	20 (100.0%)	67 (89.3%)
Insulin use, duration unknown	0 (0.0%)	4 (5.3%)

CF Gastrointestinal Disease

The most common gastrointestinal complication among children was gastroesophageal reflux, at 9.3% of <12 year olds, and 13.6% of 12–17 year olds. Liver disease was uncommon among children and adolescents, with the most common issue being non–cirrhotic liver disease at 10.5% of 12–17 year olds.

TABLE 2.17: ACFDR PAEDIATRICS 2022: GASTROINTESTINAL COMPLICATIONS

	<12	12–17
Gastroesophageal reflux	92/989 (9.3%)	85/625 (13.6%)
Liver disease, non–cirrhosis (includes viral hepatitis, fatty liver)	54/944 (5.7%)	60/571 (10.5%)
Liver disease, cirrhosis (image confirmed)	8/898 (0.9%)	26/537 (4.8%)
Liver disease, cirrhosis with portal hypertension	7/897 (0.8%)	12/523 (2.3%)

Pancreatitis was unusual among children with ≤1% of children/teenagers having acute or recurrent pancreatitis. Pancreatic insufficiency affected most children, being reported in 75.3% of children <12 years, and 81.9% of adolescents 12–17 years.

TABLE 2.18: ACFDR PAEDIATRICS 2022: PANCREATITIS

Pancreatitis	<12 (N=975)	12–17 (N=621)
No history of pancreatitis	972 (99.7%)	612 (98.6%)
Acute (first pancreatitis event this current year)	1 (0.1%)	2 (0.3%)
Recurrent pancreatitis (history of more than one event of pancreatitis)	2 (0.2%)	7 (1.1%)

Pancreatic status	<12 (N=989)	12–17 (N=625)
Insufficient	745 (75.3%)	512 (81.9%)

Bone Density

Bone mineral density scans are not routinely undertaken on children younger than 10 years of age unless clinically indicated. For adolescents older than 10 years who had their bone density status reported to the ACFDR in 2022, 39.6% had osteopenia, 3.8% had osteoporosis, with 1.3% reporting a fracture (Table 2.19).

TABLE 2.19: ACFDR PAEDIATRICS 2022: BONE DENSITY

Bone mineral density	10–17 (N=106)
Normal	60/106 (56.6%)
Osteopenia	42/106 (39.6%)
Osteoporosis	4/106 (3.8%)

Bone mineral density	10–17 (N=780)
Fracture	24/780 (3.1%)

Nutritional Supplementation

In 2022, Table 2.20 reveals the usage of pancreatic enzymes and nutritional supplements across age groups. For those under 12, 74.9% used pancreatic enzymes, 73.9% took fat–soluble vitamin supplements, and 67.5% used salt replacement therapy. Among 12 to17–year–olds, 79.8% used pancreatic enzymes, 77.6% took vitamin supplements, and 69.4% used salt replacement therapy.

TABLE 2.20: ACFDR PAEDIATRICS 2022: <12–17 NUTRITIONAL SUPPLEMENTS

	<12 (N=989)	12–17 (N=625)
Pancreatic enzymes	741 (74.9%)	499 (79.8%)
Vitamin supplements (Fat soluble vitamins A, D, E and K)	731 (73.9%)	485 (77.6%)
Salt replacement therapy	668 (67.5%)	434 (69.4%)

Use of nutritional support among children and adolescents in 2022 was low. Of those under 12, 10.5% used oral nutritional supplements, 3.8% had a gastrostomy tube, and 1.4% used a nasogastric tube. For the 12–17 age group 9.8% received oral nutritional supplements, 7.5% had a gastrostomy tube, and very few used nasogastric tubes or parenteral nutrition.

TABLE 2.21: ACFDR PAEDIATRICS 2022: <12–17 NUTRITIONAL SUPPORT

	<12 (N=989)	12–17 (N=625)
Oral	104 (10.5%)	61 (9.8%)
Gastrostomy tube	38 (3.8%)	47 (7.5%)
Nasogastric tube	14 (1.4%)	2 (0.3%)
Jejunostomy tube	0 (0.0%)	0 (0.0%)
Parenteral nutrition	3 (0.3%)	0 (0.0%)

Multidisciplinary Care

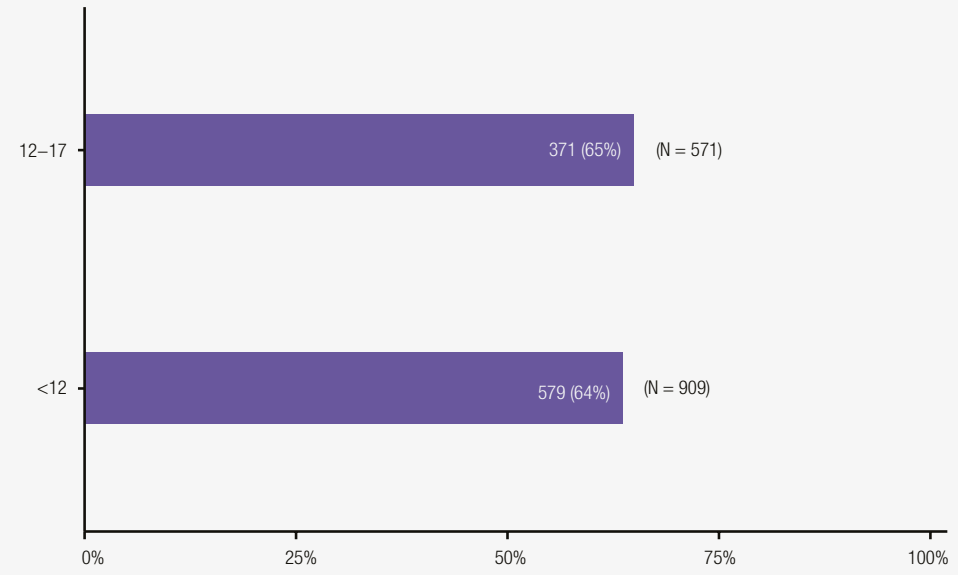
The data from the ACFDR paediatric cohort in 2022 indicates high engagement in multidisciplinary care appointments among children and adolescents, with physiotherapy and dietitian reviews being widely attended, with 93.5% and 95.5% participation, respectively (Table 2.22).

TABLE 2.22: ACFDR PAEDIATRICS 2022: MULTIDISCIPLINARY CARE APPOINTMENTS

Preventive care	<12 (N=989)	12–17 (N=625)
Physiotherapy review	923 (93.5%)	592 (95.5%)
Dietitian review	846 (85.5%)	524 (83.8%)
Social work review	472 (47.9%)	286 (45.8%)
Mental health review	NA	186 (34.4%)
Gastroenterologist review	254 (25.8%)	171 (27.4%)
Endocrine review	38 (3.9%)	104 (16.6%)

Influenza immunization is recommended for individuals with CF age six months and older on an annual basis. Immunization coverage for children and adolescents in 2022 was 950 (64.0%). Specifically, 65.0% of adolescents aged 12–17 and 64.0% of adults aged <12 reported being vaccinated against influenza in 2022 (Figure 2.23).

FIGURE 2.23: ACFDR PAEDIATRICS 2022: INFLUENZA VACCINATIONS



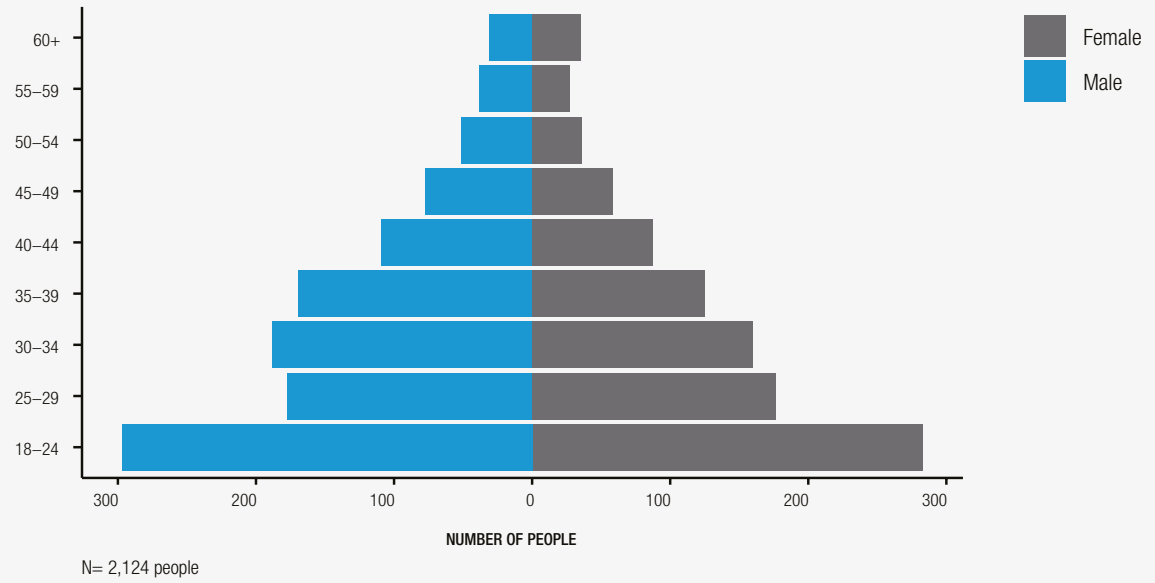
3.
ADULT DATA

3. ADULT DATA

3.1 ADULTS WITH CYSTIC FIBROSIS

As of 31st December 2022, the ACFDR had data regarding **2,124 adults with CF,** of which 987 were female and 1,137 male. This chapter discusses the management and clinical outcomes of adult patients in the registry (Figure 3.1).

FIGURE 3.1: ACFDR ADULTS 2022: AGE AND SEX

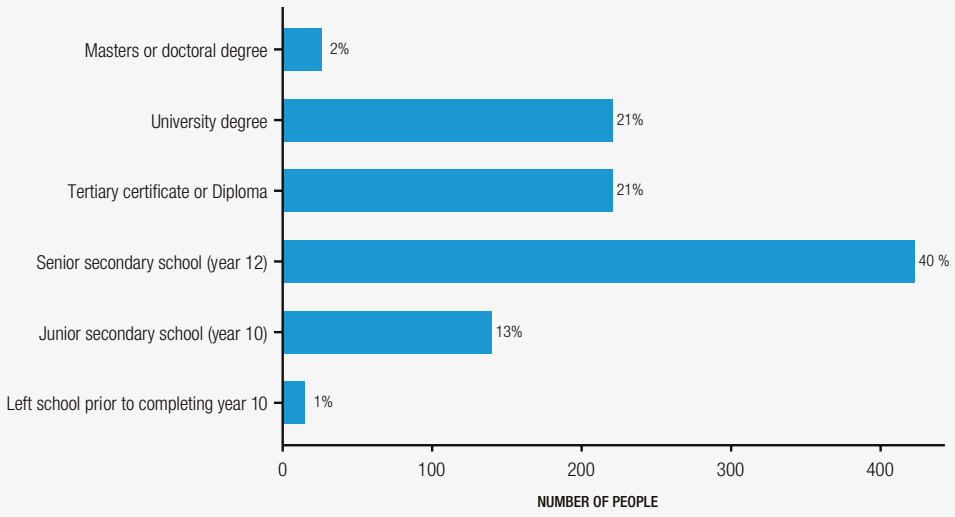


N= 2,124 people

Socioeconomic Characteristics

Out of the 1,046 (49.2%) adults with CF for whom education information was available in the ACFDR in 2022 (49.0%), 21.0% completed a tertiary certificate or diploma, while 23.0% attained a University education, similar to the previous year. Figure 3.2 and Table 3.1 shows the comparison to the available Australian Bureau Statistics (ABS) data.

FIGURE 3.2: ACFDR ADULTS 2022: HIGHEST EDUCATIONAL ATTAINMENT



N = 1,046 people aged ≥18 years

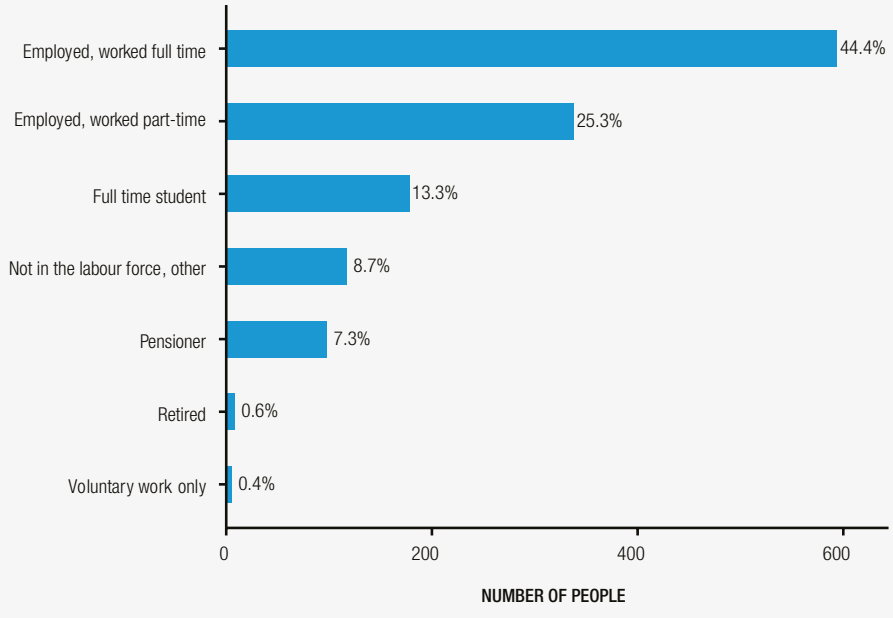
TABLE 3.1: ACFDR ADULTS 2022: HIGHEST EDUCATIONAL ATTAINMENT

Highest educational attainment	% ACFDR (N=1,046*)	ABS Data May 2023 for 15–74 year olds
Masters or doctoral degree	26 (2.5%)	8.1%
University degree	221 (21.1%)	20.3%
Tertiary certificate or diploma	221 (21.1%)	30.4%
Senior secondary school (year12)	423 (40.4%)	18.1%
Junior secondary school (year 10)	140 (13.4%)	9.8%
Left school prior to completing year 10	15 (1.4%)	6.0%

*Note: 49.2% of data was record for adults for highest educational attainment in 2022

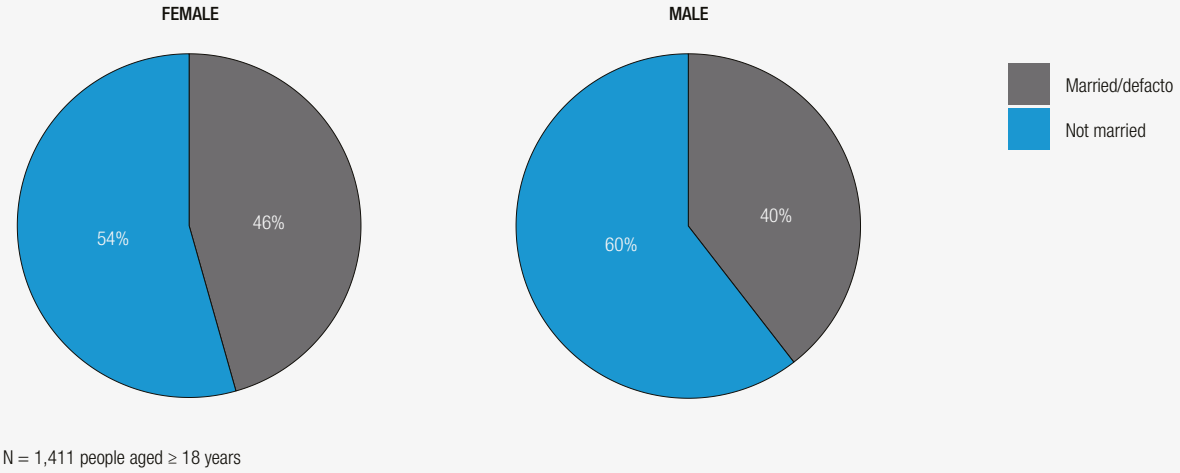
Within the ACFDR dataset, information on employment status is available for 1,338 adults (63.0%) with CF. Among them, 44.4% were engaged in full–time employment, 25.3% in part–time employment, and an additional 13.3% were enrolled in full–time study. The proportion employed or in full time study has increased slightly compared with the previous year.
A subset of 8.7% of individuals with CF were either not in the labour force or actively seeking employment, and another 7.9% were either retired or received a pension (Figure 3.3).

FIGURE 3.3: ACFDR ADULTS 2022: EMPLOYMENT STATUS



Information regarding marital status was available for two–thirds of adults in the registry (66.0%). Of these, 46.0% of women and 40.0% of men were either married or in a de facto relationship (Figure 3.4), similar to the previous year.

FIGURE 3.4: ACFDR ADULTS 2022: MARITAL STATUS



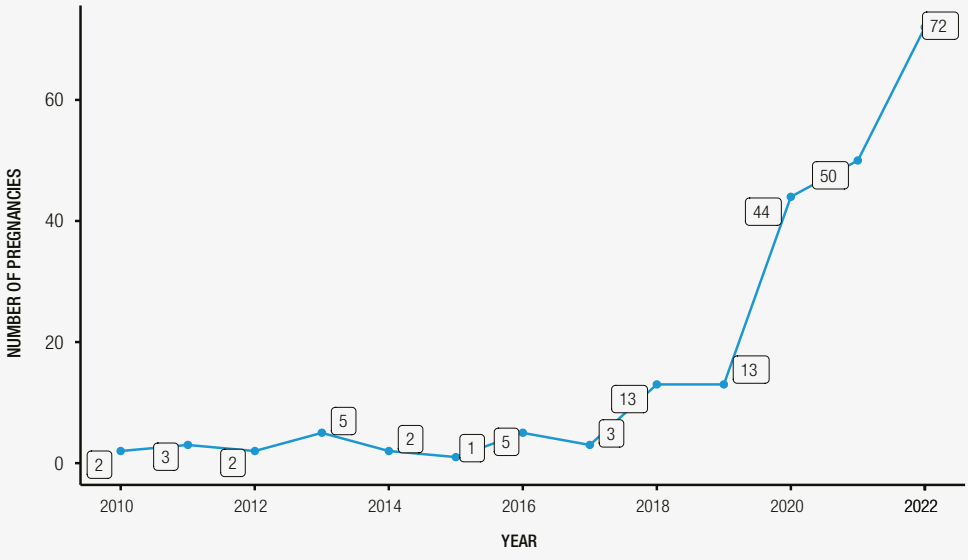
N = 1,411 people aged ≥ 18 years

In 2022, 72 pregnancies recorded in the ACFDR, which is an increase from only 2 recorded births in 2010 (Figure 3.5). There were 37 (51.7%) live births and 31(43.1%) people still pregnant as of the 31st December 2022 (Table 3.2).

TABLE 3.2: ACFDR ADULTS 2022: PREGNANCY STATUS

Status	≥18 (N=72)
Currently pregnant	31 (43.1%)
Live birth	37 (51.4%)
Other (Miscarriage, stillbirth or Termination/Unknown outcome)	4 (5.5%)

FIGURE 3.5: ACFDR ADULTS 2022: PREGNANCY



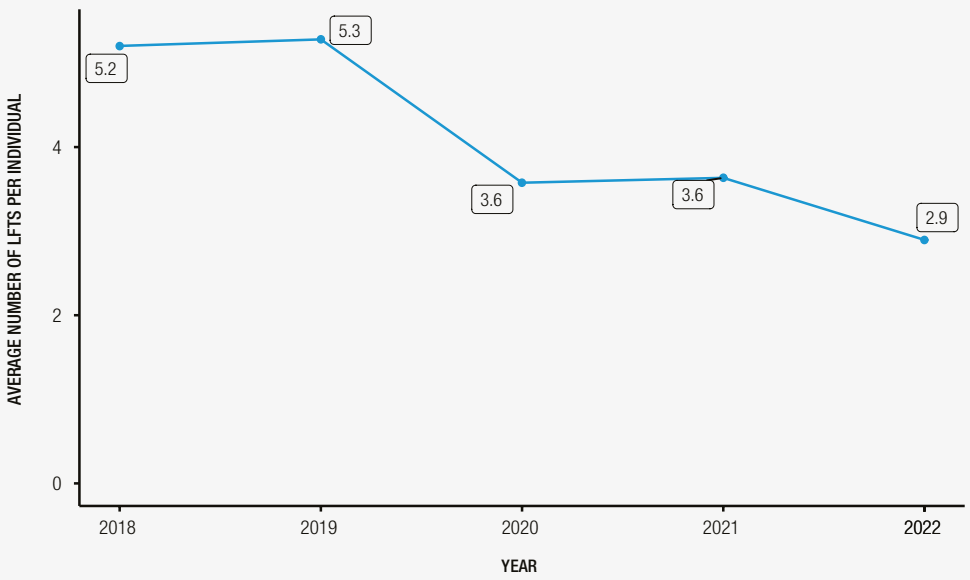
Based on the annual general update and sign off data

3.2 CLINICAL MEASURES

Lung Function

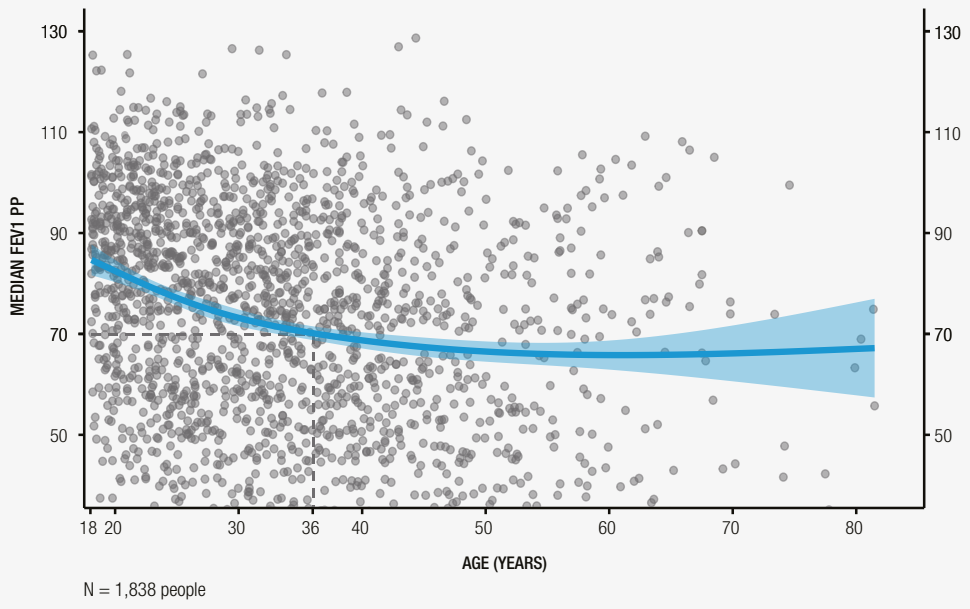
Figure 3.6 depicts the **annual average number of lung function tests per adult** recorded in the registry from 2018 to 2022. In 2018, adults averaged 5.2 tests each, with a slight increase to 5.3 in 2019. However, the average declined to 3.6 tests per adult in 2020, maintaining the same level in 2021. The latest data from 2022 indicates a further decrease to an average of 2.9 tests per adult.

FIGURE 3.6: ACFDR ADULTS 2018-2022: AVERAGE NUMBER LUNG FUNCTION TESTS ENTERED PER INDIVIDUAL



There were 1,838 (86.5%) adults in 2022 who had their lung function measures recorded. The adult lung function results reveal a progressive decline in median FEV1 pp with increasing age (Fig 3.7 below). The median age at which an FEV1 pp of 70.0 is recorded is 36 years.

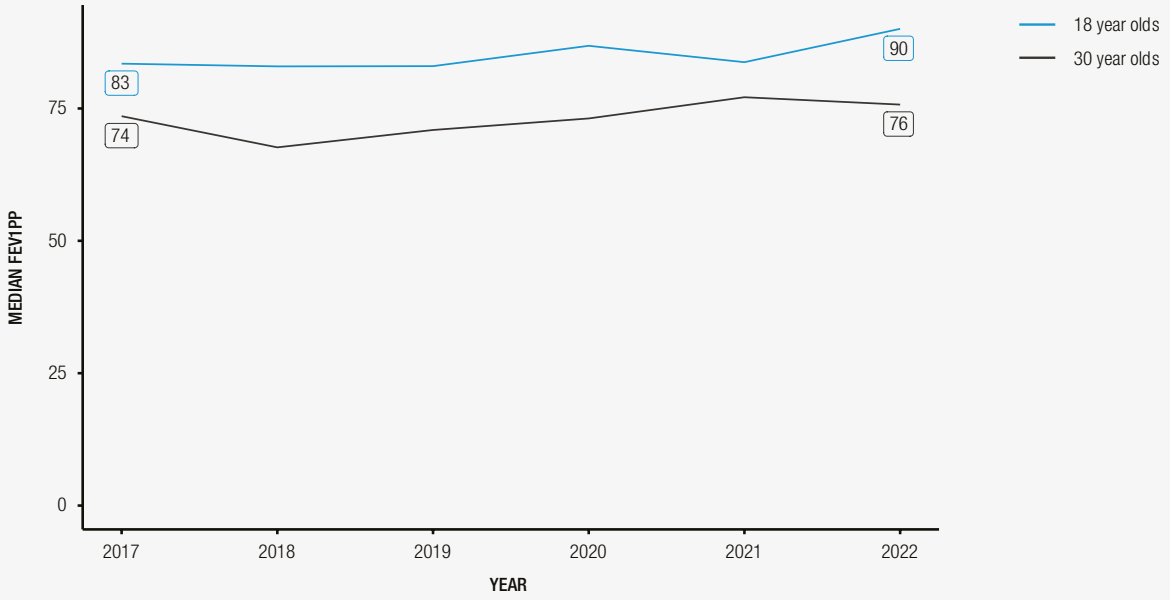
FIGURE 3.7: ACFDR ADULTS 2022: FEV1 PP BY AGE



The solid trend line was estimated using a natural cubic spline with 3 degrees of freedom
Shaded area represent the 95% confidence intervals

The median FEV1 pp has increased over time. For 18–year–olds, it has increased from 83.0 in 2017 to 90.0 and for 30 year olds the increase is from 74.0 to 76.0 in 2022 (Figure 3.8).

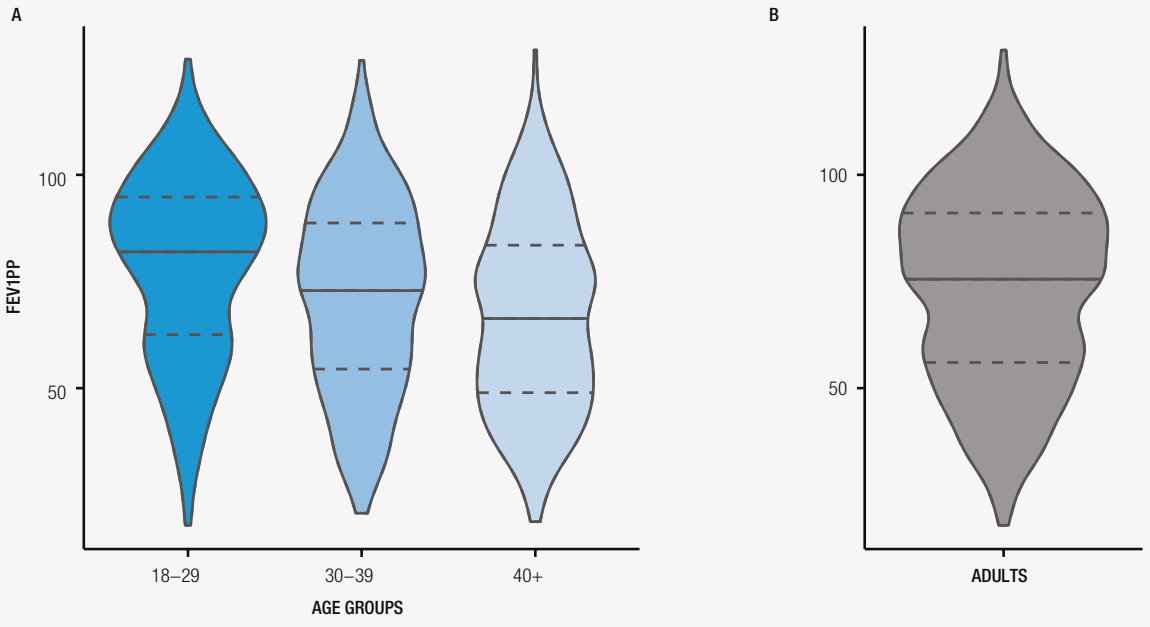
FIGURE 3.8: ACFDR ADULTS 2017-2022: MEDIAN FEV1 PP OVER TIME



Labelled percentages illustrate median predFEV1 in 2017 and 2022

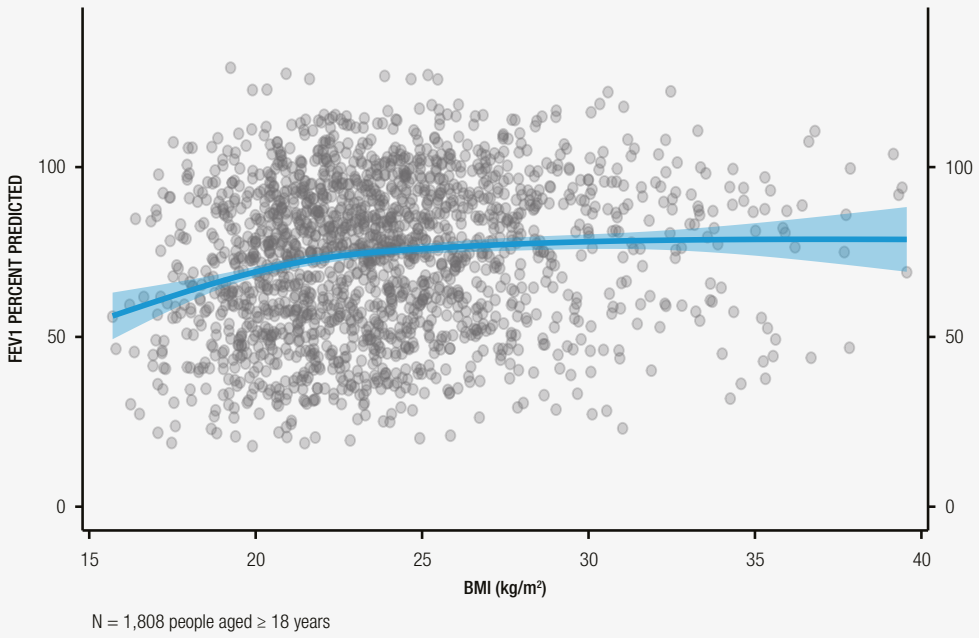
In 2022, the median FEV1 pp for adults overall was 76.0, with the median FEV1 pp for 18–29 year olds being 82.9, 30–39 year olds being 73.6, and 40+ year olds being 65.6 (Figure 3.9)

FIGURE 3.9: ACFDR ADULTS2022: MEDIAN FEV1 PP



For pwCF ages 18–40 years, FEV1 pp increases with increasing BMI, although, at BMIs into the high 20s, this appears to variably affect FEV1 pp. People with CF over 40 years are not included due to fewer numbers, making the data difficult to interpret due to increased variability (Figure 3.10).

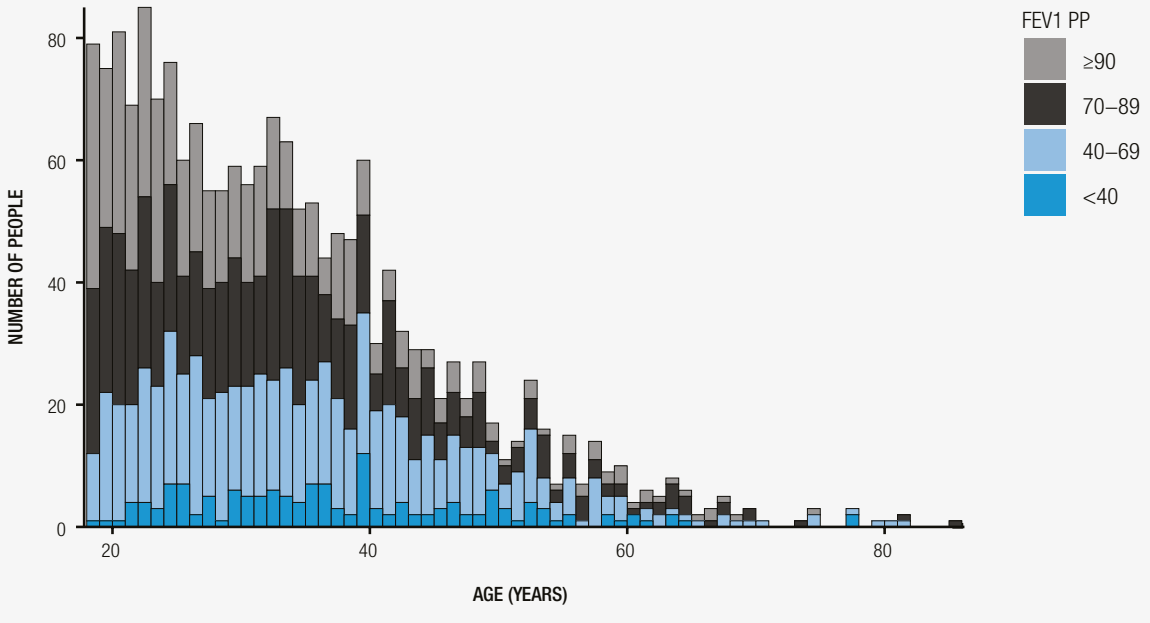
FIGURE 3.10: ACFDR ADULTS 2022: FEV1 PP VS BMI PERCENTILE



Solid line was calculated using a natural cubic spline with 3 degrees of freedom
Shaded area represents 95% confidence interval

In the 18–29 age range, 35.3% show lung function (FEV1 pp ≥90), yet 5.1% face potential respiratory challenges with FEV1 pp <40. In the 30–39 group. For those aged 40 and above, a higher proportion falls into the 40–69 and 70–89 FEV1 pp range. Notably, even in the 40+ age group, 17.2% maintain lung function (FEV1 pp ≥90), highlighting a subgroup with preserved respiratory health. Figure 3.11 shows how lung function declines over time, with a higher proportion of younger adults having minimally impaired lung function (≤90) or mildly impaired lung function (70–89) compared with older adults.

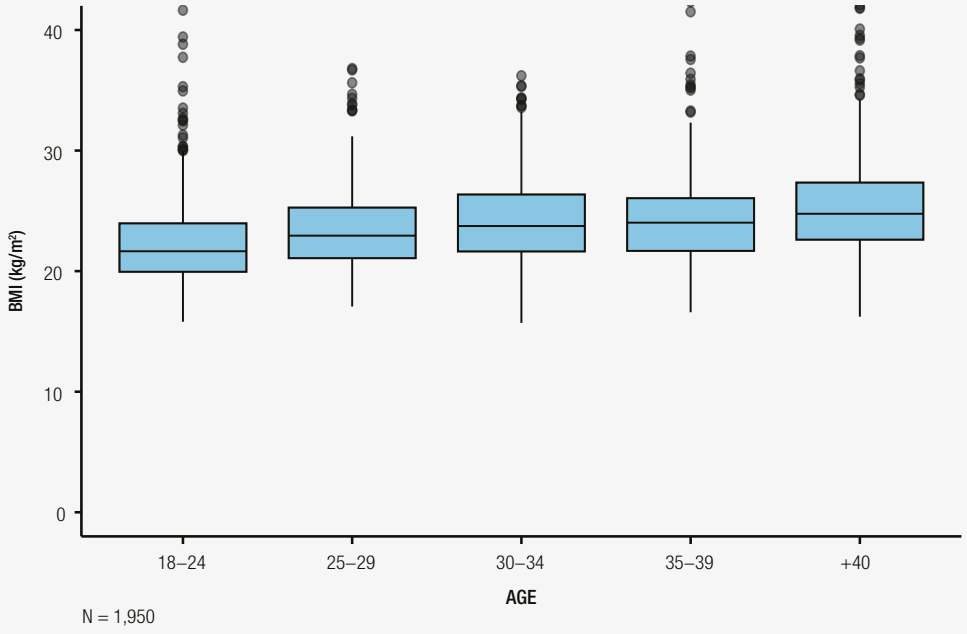
FIGURE 3.11: ACFDR ADULTS 2022: LUNG FUNCTION VARIABILITY



Nutrition

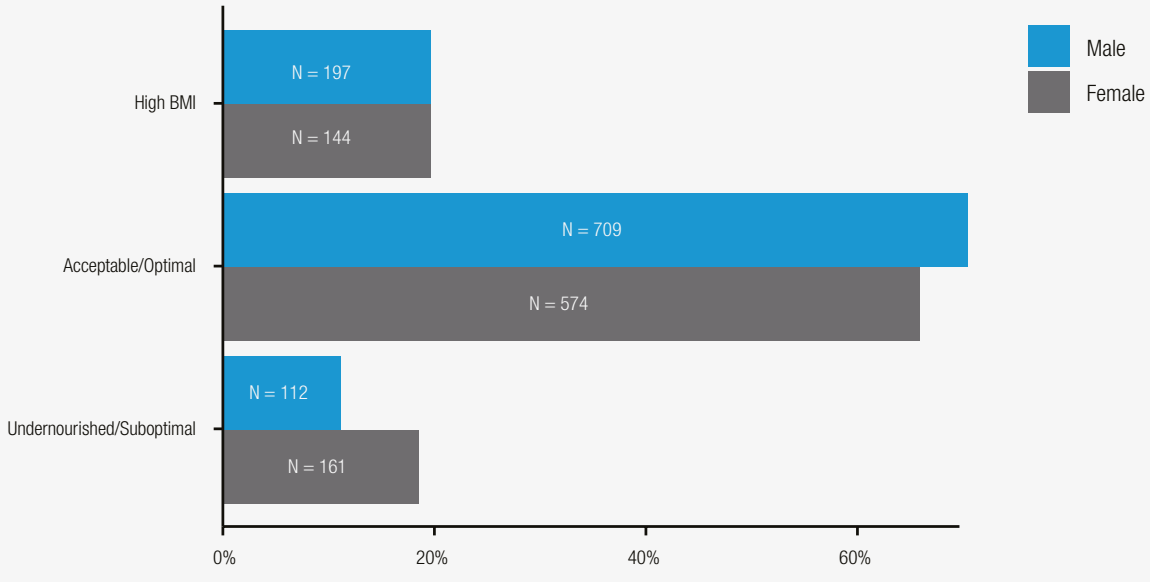
The adult BMI data for different age ranges in 2022 indicates a generally increasing trend in median BMI with age. In the 18–24 age group, the median BMI is 21.6. As age progresses, there is a gradual rise in median BMI, with values of 22.9 for the 25–29 age range, 23.7 for 30–34, and 24 for 35–39. The highest median BMI is observed in the 40 and above age category, with a value of 24.8 (Figure 3.12).

FIGURE 3.12: ACFDR ADULTS 2022: BMI



Adults with CF predominantly have a BMI in the optimal/acceptable range (70.0% of males and 65.0% of females). Approximately 19.0% of males have a BMI in the high range, and 18.0% of females have a BMI in the suboptimal range (Figure 3.13).

FIGURE 3.13: ACFDR ADULTS2022: BMI BY SEX

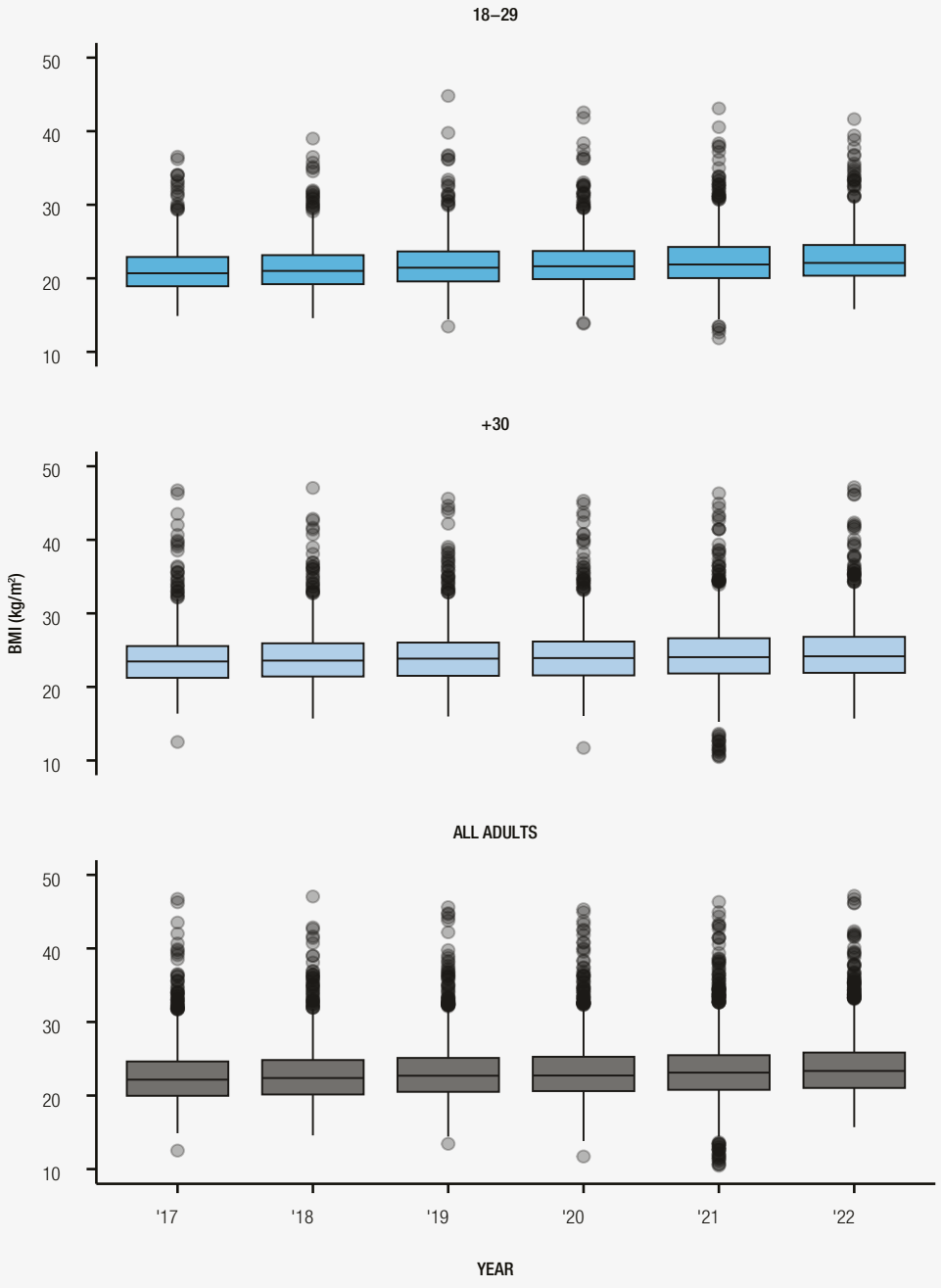


High BMI: BMI >27 kg/m2
Optimal: Female BMI 22–27 kg/m2, Male BMI 23–27 kg/m2
Acceptable: Female BMI 20–22 kg/m2, Male BMI 20–23 kg/m2
Suboptimal: BMI <20 kg/m2
Undernourished: BMI <18.5 kg/m2

The BMI data for adult CF population, reveals a consistent upward trajectory over the years. In the 18–29 age group, the median BMI has risen steadily from 20.7 in 2017 to 22.1 in 2022, indicating a notable increase in body mass among younger adults with CF. A similar pattern is observed in the 30 year age group, where the median BMI has increased from 23.5 in 2017 to 24.2 in 2022.

When considering all adults with CF, the overall median BMI has shown a continuous increase from 22.2 in 2017 to 23.4 in 2022. This collective trend across different age groups points to a general upward shift in body mass for adult CF patients over the specified years (Figure 3.14).

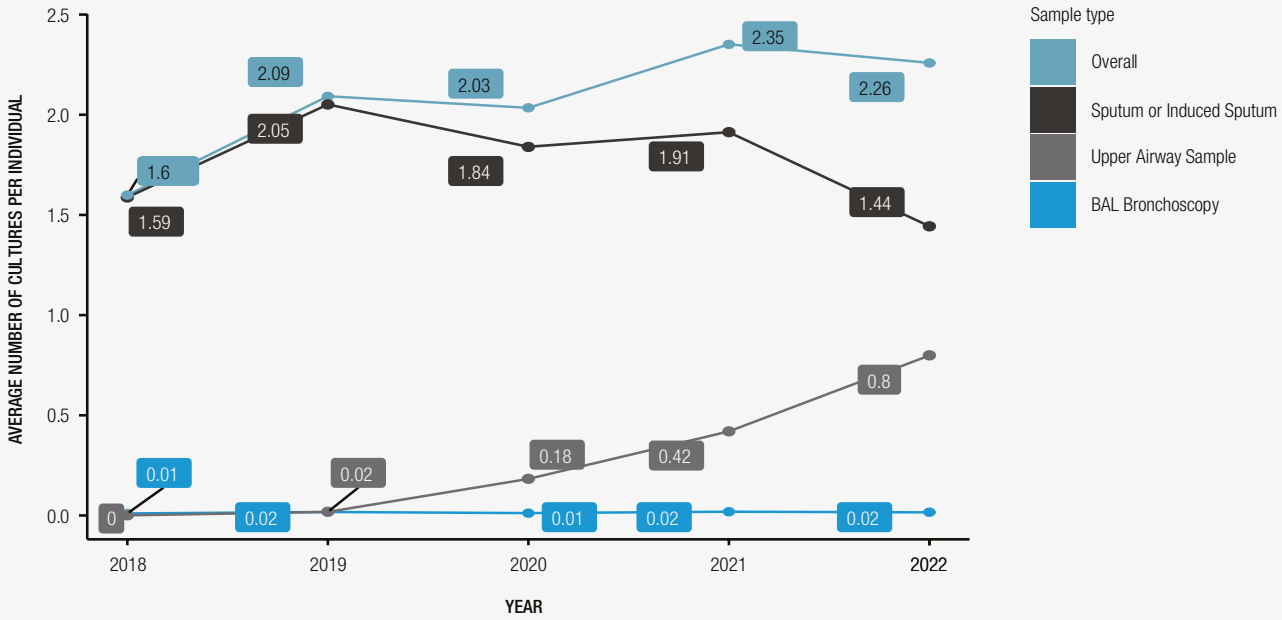
FIGURE 3.14: ACFDR ADULTS 2022: MEDIAN BMI



Microbiology

The average number of respiratory samples collected per adult each year is depicted in Figure 3.15. This figure shows an increase of overall samples from 1.6 in 2018 to 2.1 samples in 2019. In 2020, there was a notable decrease to an average of 2 respiratory samples per adult, followed by a modest rise to 2.3 samples in 2021 and a slight decrease to 2.2 samples in 2022. Delving into specific sample types, Sputum or induced sputum samples displayed variations, starting at 1.59 in 2018 and fluctuating to end at 1.44 samples in 2022. BAL Bronchoscopy samples exhibited minimal changes, ranging from 0.01 in 2018 to 0.02 in 2022. Interestingly, Upper Airway samples showed an increasing trend, starting from 0 in 2018 to 0.8 in 2022.

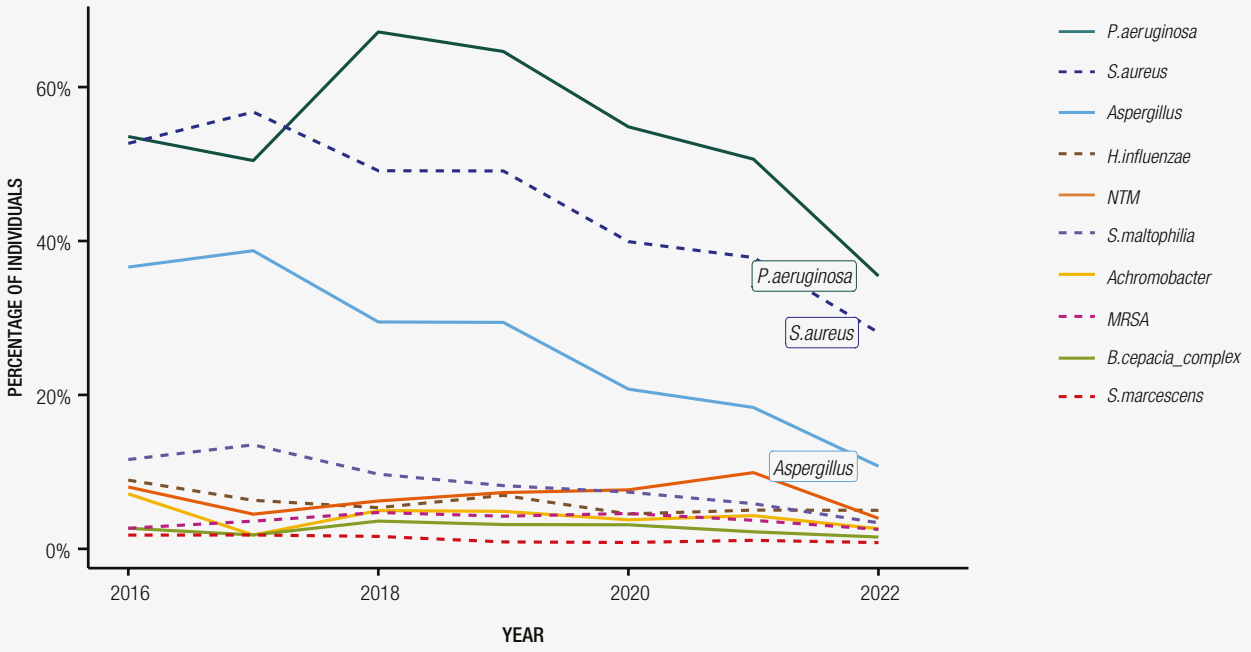
FIGURE 3.15: ACFDR ADULTS 2018-2022: AVERAGE NUMBER OF RESPIRATORY SAMPLES PER INDIVIDUAL



Straight dashed line represents the overall trend estimated by a linear regression model

The prevalence of some of the most common organisms has changed over the last 6 years. The prevalence of S. *aureus* was 52.7% for adults with CF in 2016 and has decreased to 28.1% in 2022, and the prevalence of Aspergillus *spp* was 38.7% in 2017 and has decreased to 10.7% in 2022. The prevalence of P. *aeruginosa* has decreased from a high of 67.2% in 2018 to 35.5% 2022. The prevalence of less common microorganisms has remained fairly similar over this period (Figure 3.16).

FIGURE 3.16: ACFDR ADULTS 2016-2022: PREVALENCE OF RESPIRATORY MICROBIOLOGY



Microbiology results for adults from 1,625 samples collected in 2022, reveal varying prevalence of specific microorganisms across age groups. P *aeruginosa* is notably common, with rates ranging from 39.0% in the 18–24 age group to 58.0% in the 35–44 age group. S *aureus* also shows prevalence decreases with age, ranging from 38.0% in the 25–34 age range to 56.0% in the 18–24 category. Aspergillus *spp* is notably present, ranging from 11.0% to 20.0% across age groups (Figure 3.17 and Table 3.3).

FIGURE 3.17: ACFDR ADULTS 2022: PREVALENCE OF RESPIRATORY MICROORGANISMS BY AGE

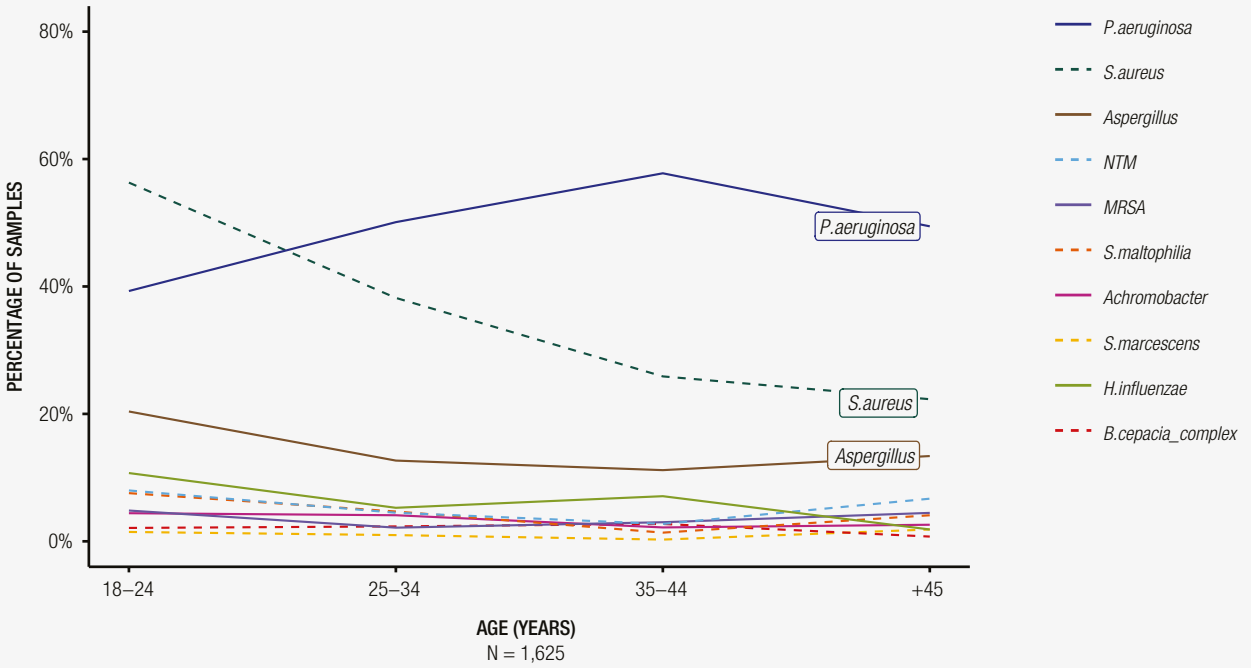


TABLE 3.3: ACFDR ADULTS 2022: PREVALENCE OF RESPIRATORY MICROORGANISMS BY AGE

All samples				
	18–24	25–34	35–44	45
Number in age range	580	701	490	353
Number of samples taken in 2022	476	513	367	269
Number of pwCF with samples	467	510	358	262
P. *aeruginosa*	187/476 (39.0%)	257/513 (50.0%)	212/367 (58.0%)	133/269 (49.0%)
H. *influenzae*	51/476 (11.0%)	27/513 (5.0%)	26/367 (7.0%)	5/269 (2.0%)
B. *cepacia_complex*	10/476 (2.0%)	12/513 (2.0%)	10/367 (3.0%)	2/269 (1.0%)
S. *aureus*	268/476 (56.0%)	196/513 (38.0%)	95/367 (26.0%)	60/269 (22.0%)
MRSA	23/476 (5.0%)	11/513 (2.0%)	11/367 (3.0%)	12/269 (4.0%)
Achromobacter *spp*	21/476 (4.0%)	21/513 (4.0%)	8/367 (2.0%)	7/269 (3.0%)
S. *maltophilia*	36/476 (8.0%)	24/513 (5.0%)	5/367 (1.0%)	11/269 (4.0%)
S. *marcescens*	7/476 (1.0%)	5/513 (1.0%)	1/367 (0.0%)	5/269 (2.0%)
Aspergillus *spp*	97/476 (20.0%)	65/513 (13.0%)	41/367 (11.0%)	36/269 (13.0%)
NTM	38/476 (8.0%)	23/513 (4.0%)	10/367 (3.0%)	18/269 (7.0%)

In the 18–30 age group, NTM infection rates have shown a fluctuating pattern, ranging from 8.5% in 2016 to 7.5% in 2022. *M. abscessus* infection rates, on the other hand, varied from 1.4% in 2016 to 3.3% in 2022. Among individuals aged 30, NTM infection rates ranged from 7.5% in 2016 to 3.7% in 2022, while *M. abscessus* infection rates fluctuated from 2.5% in 2016 to 0.8% in 2022.

TABLE 3.4: ACFDR ADULTS 2016–2022: NON–TUBERCULOUS MYCOBACTERIUM (NTM) INFECTION

Age	Organism	2016	2017	2018	2019	2020	2021	2022
18–30	NTM	6/71 (8.5%)	3/76 (3.9%)	27/374 (7.2%)	48/496 (9.7%)	86/693(12.4%)	105/709(14.8%)	55/731(7.5%)
18–30	M. *abscessus*	1/71(1.4%)	3/76 (3.9%)	13/374 (3.5%)	21/496 (4.2%)	38/693 (5.5%)	33/709 (4.7%)	24/731(3.3%)
30	NTM	3/40 (7.5%)	2/33 (6.1%)	23/422 (5.5%)	32/570 (5.6%)	44/770 (5.7%)	74/784 (9.4%)	32/866 (3.7%)
30	M. *abscessus*	1/40 (2.5%)	2/33 (6.1%)	8/422 (1.9%)	9/570 (1.6%)	14/770 (1.8%)	13/784 (1.7%)	7/866 (0.8%)

3.3 CF MANAGEMENT

Clinical Visits

There has been a significant increase in the number of clinical visits per year for adults with CF since 2020, when 9,713 clinic visits were recorded in the ACFDR. While the number of outpatient visits has continued to be around 5,000 per year, since 2020 there has been the addition of a similar number of telehealth services.

Adults with CF have utilised telehealth services much more as a result of the COVID–19 pandemic. In 2020 51.0% of services were delivered by telehealth, this reduced to 44.0% in 2021 and increased again in 2022, where 54.0% of adult specialist CF services were delivered by telehealth (Figure 3.18 and Table 3.5).

FIGURE 3.18: ACFDR ADULTS 2020-2022: TOTAL NUMBER OF ENCOUNTERS RECORDED PER YEAR

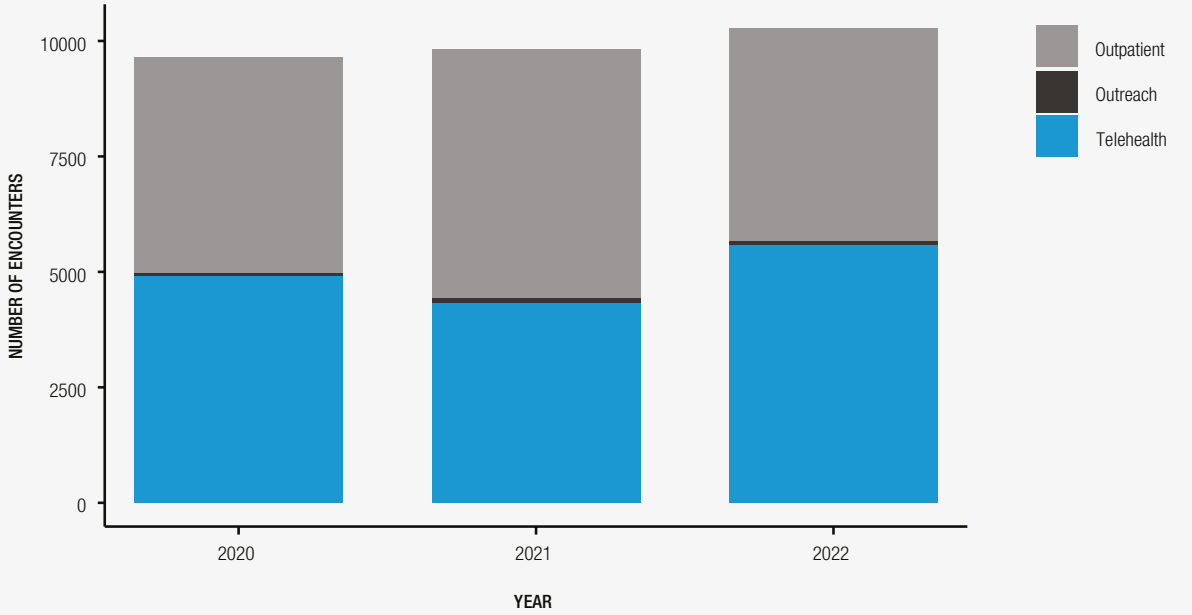


TABLE 3.5: ACFDR ADULTS 2020–2022: TOTAL NUMBER OF ENCOUNTERS RECORDED

Visit type	2020	2021	2022
Outpatient	4,676 (48.0%)	5,404 (55.0%)	4,620 (45.0%)
Outreach	66 (1.0%)	90 (1.0%)	86 (1.0%)
Telehealth	4,907 (51.0%)	4,328 (44.0%)	5,574 (54.0%)
Total	**9,713 (100.0%)**	**9,981 (100.0%)**	**10,340 (100.0%)**

The Australian CF Standards of Care for pwCF recommend four clinic visits per year. In 2022 the number of adults with CF who had at least 4 clinic visits was 1,303 (64.5%) overall, compared to 1,217 (60.3%) in 2021. This was highest among those 30+ years old at 62.0%, followed by 18–29 at 61.0% (Figure 3.19 and Table 3.6).

FIGURE 3.19: ACFDR ADULTS 2022: 4 OR MORE CLINICAL VISITS

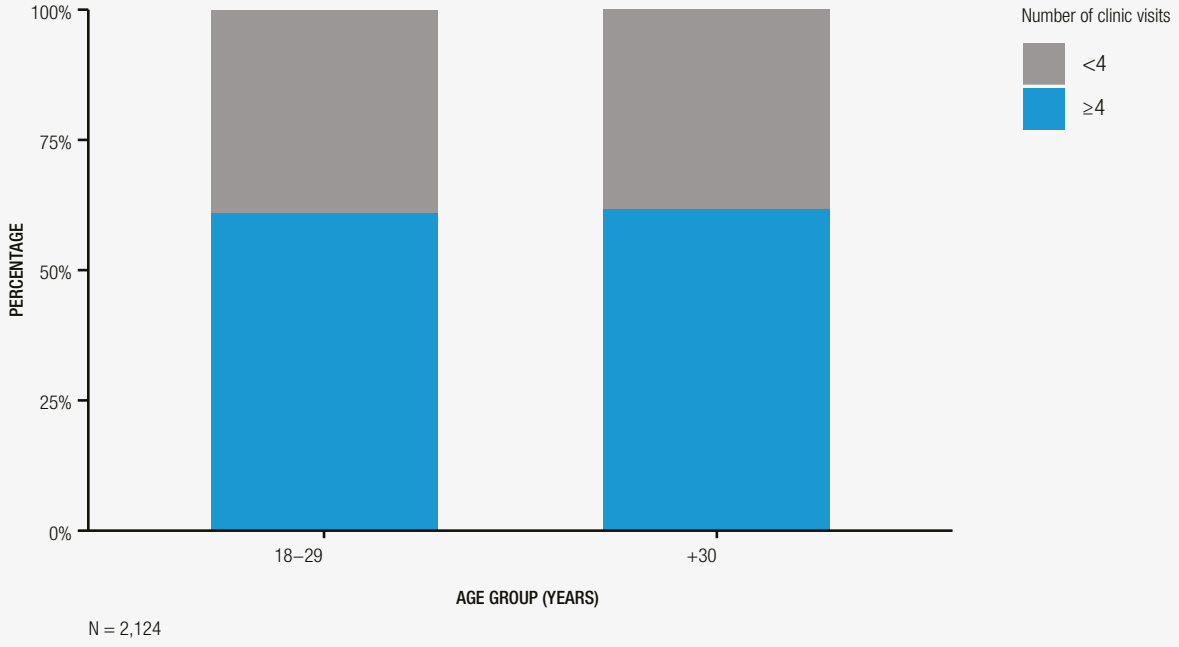


TABLE 3.6: ACFDR ADULTS 2021–2022: AGE GROUPS WITH 4 OR MORE CLINICAL VISITS

	Number with 4+ visits	
Age	**2021**	**2022**
18–29	607 (67.0%)	568 (61.0%)
30+	669 (63.0%)	735 (62.0%)
Total	**1,217 (60.3%)**	**1,303 (64.5%)**

Hospitalisations

There were a total of 1,254 hospitalisations for the adult cohort in 2022. For individuals aged 18–29, the majority (63.0%) did not experience any hospitalisations, while 23.0% had 1 hospitalisation, 8.0% had 2 hospitalisations, and 6.0% had 3 or more hospitalisations. Similarly, for those aged 30+ years, the majority (68.0%) had no hospitalisations, with 21.0% having 1, 6.0% having 2, and 5.0% having 3 hospitalisations (Figure 3.20 and Table 3.7).

In 2022, 590 (14.5%) adults with cystic fibrosis (27.8% of the total) were diagnosed with COVID–19, a significant increase from the 19 cases in 2021. Of those 590 diagnosed in 2022, 37 (6.3%) required hospitalisation, with 2 needing intensive care.

FIGURE 3.20: ACFDR ADULTS 2022: HOSPITALISATIONS

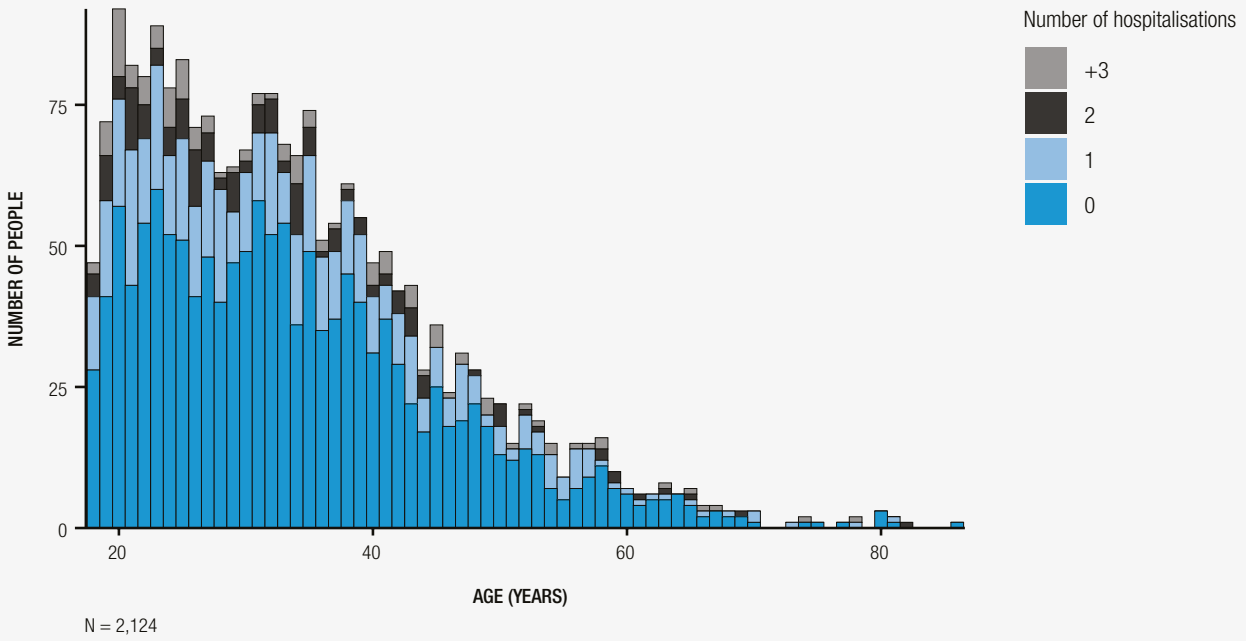


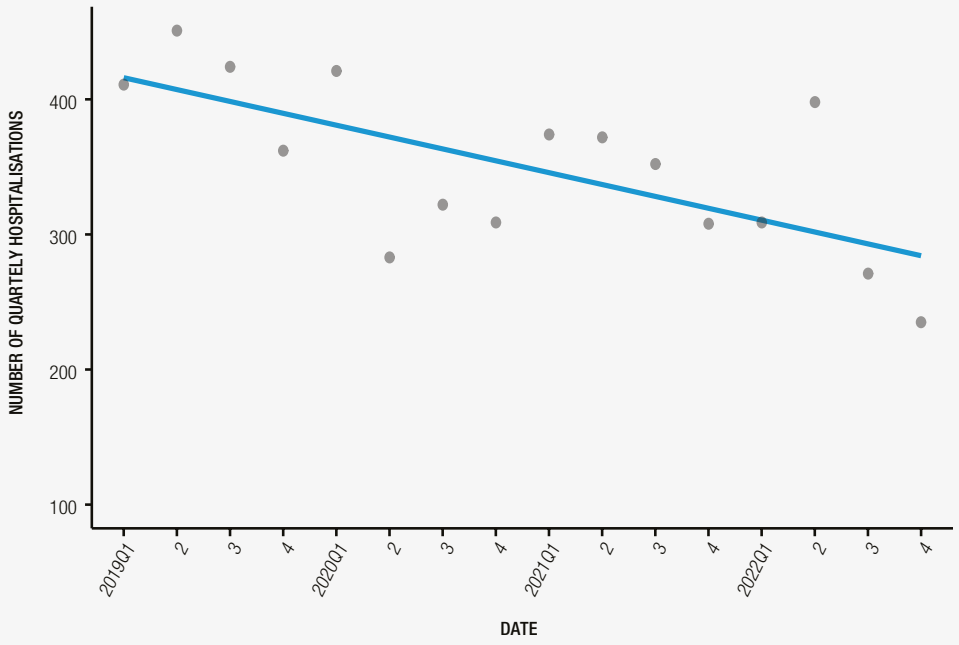
TABLE 3.7: ACFDR ADULTS 2022: HOSPITALISATIONS BY AGE

Age	Hospitalisations	N (%)
18–29	+3	58 (6.0%)
	2	74 (8.0%)
	1	213 (23.0%)
	0	588 (63.0%)

Age	Hospitalisations	N (%)
30+	+3	56 (5.0%)
	2	70 (6.0%)
	1	252 (21.0%)
	0	813 (68.0%)

Adult hospitalisations per quarter decreased from 2019 to 2022. The trend line shows a decrease from approximately 400 admission per quarter at the start of 2019, to fewer than 300 admissions per year by the end of 2022.

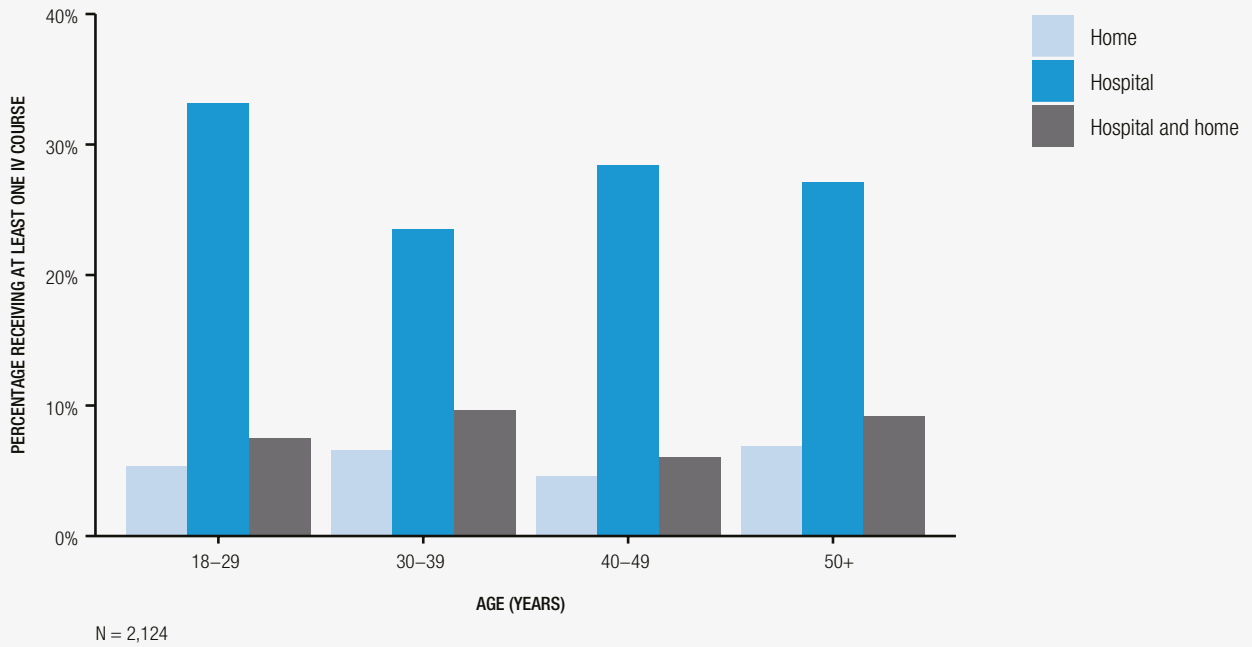
FIGURE 3.21: ACFDR ADULTS 2019-2022: HOSPITALISATIONS PER QUARTER



IV Antibiotic Therapy

Adults who received at least one course of IV antibiotic therapy show varied approaches across age groups. In the 18–29 category, 33.0% received hospital–based treatment, 5.0% at home, and 8.0% through a combination of hospital and home therapy. Similarly, in the 30–39 age group, hospital–based therapy was prevalent at 24.0%, home therapy at 7.0%, and a combination at 10.0%. The 40–49 and 50+ age groups exhibited similar patterns, with hospital–based treatments at 28.0% and 27.0%, respectively.

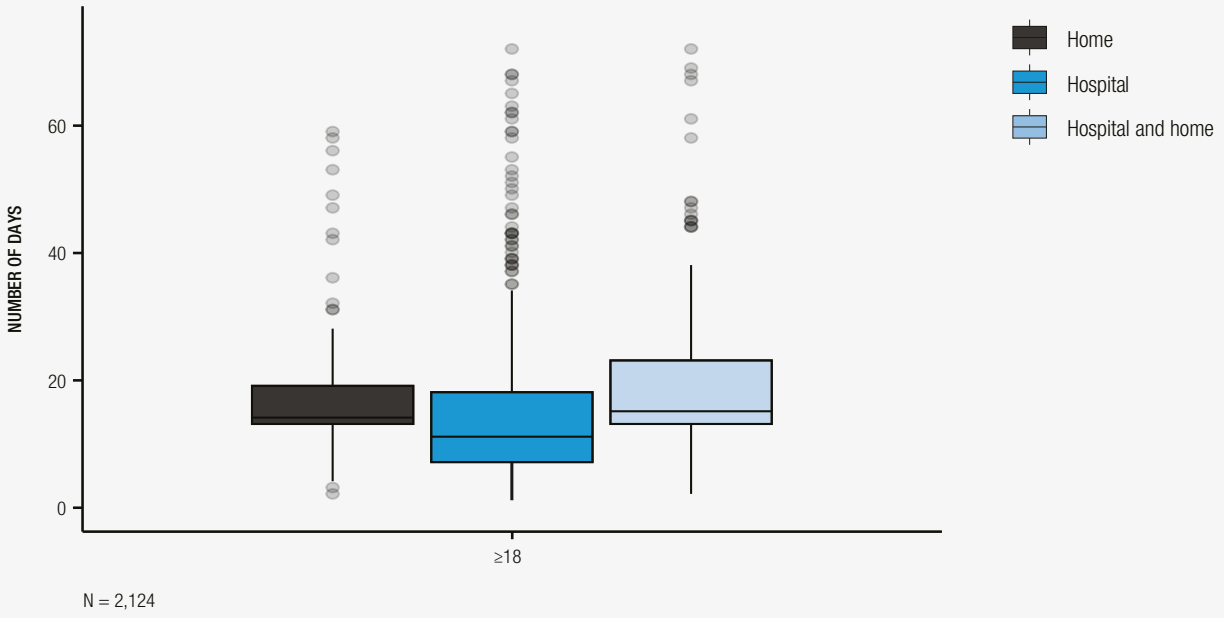
FIGURE 3.22: ACFDR ADULTS 2022: RECEIVING AT LEAST ONE COURSE OF IV ANTIBIOTIC THERAPY



For adults in hospital, the median duration of IV antibiotic therapy was 10 days, and the median duration for home IV therapy was 12 days. In 2022, the combined hospital and home days for adults totalled 13 days.

Figure 3.23 shows the median duration of IV antibiotic therapy for adults with CF.

FIGURE 3.23: ACFDR ADULTS 2022: MEDIAN DAYS IV ANTIBIOTIC USE



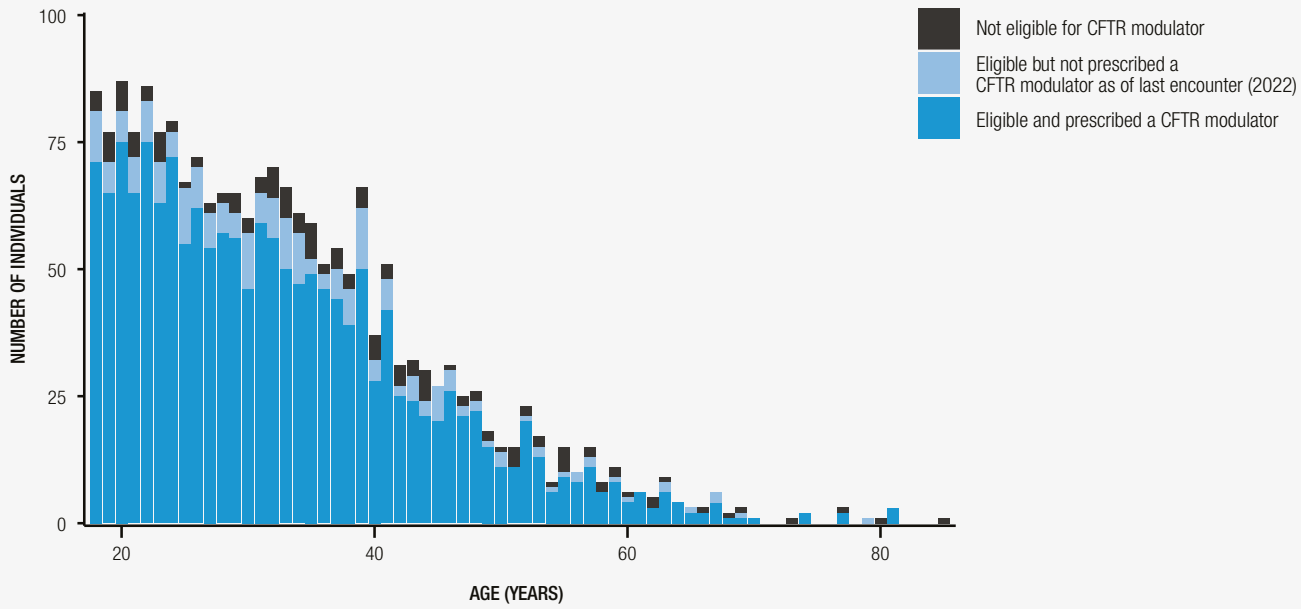
CFTR Modulators

Disease–modifying therapies reduce pulmonary exacerbations, improve quality of life and improve nutritional parameters for an increasing number of pwCF. Different therapies target different genetic variants, and not all pwCF may be eligible to receive CFTR modulators. Additionally, CFTR modulators are high cost medicines and are generally available initially in Australia via special access schemes before being approved for listing on the Pharmaceutical Benefits Scheme (PBS).

Data were calculated from pwCF who were on a modulator as of December 31st 2022. Data presented here reflect only those pwCF who had CFTR modulator data entered into the registry, which is generally those on modulators available via the Pharmaceutical Benefits Scheme (PBS). Fig 3.24 below shows that the majority of adults were eligible for a modulator at the end of 2022.

Of the 2,124 adults in the registry in 2022, 96.4% (2,009 people) had their eligibility for CFTR modulators known/reported. Seven point two percent of adults were not deemed eligible for CFTR modulators in 2022. 81.8% of eligible adults (1,644) were prescribed CFTR modulators in 2022, with 11.0% (220) of adults being eligible and not prescribed modulators.

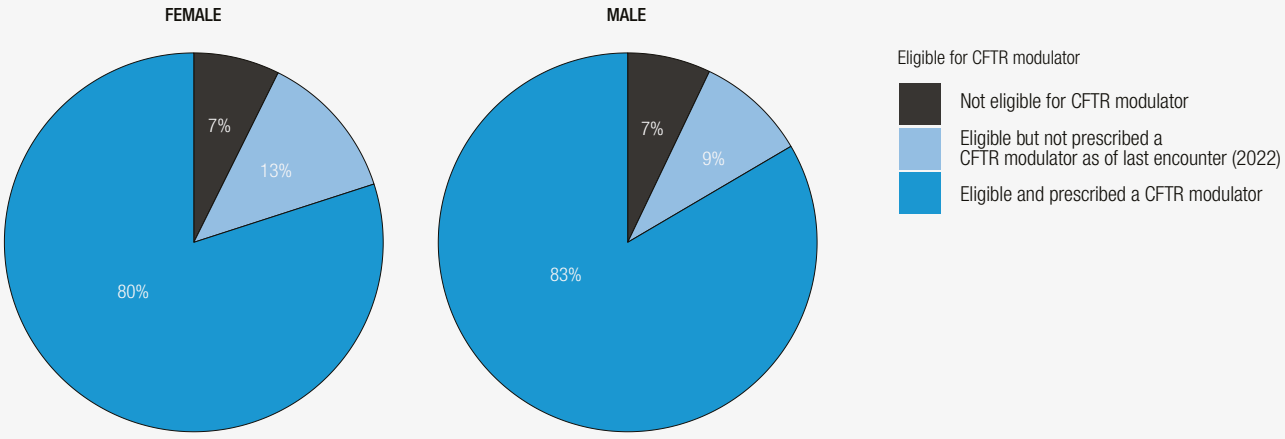
FIGURE 3.24: ACFDR ADULTS 2022: CFTR POPULATION



N = 2,009 individuals with known eligibility

Of the adults with known eligibility for a modulator (based on the recorded genotype), 7% of both males and females were not eligible, 80% of females and 83% of males were prescribed a CFTR modulator, and 13% of females and 9% of males were not prescribed a modulator (Figure 3.25).

FIGURE 3.25: ACFDR ADULTS 2022: COMBINED ELIGIBILITY AND PRESCRIPTION OF CFTR MODULATORS



N = 2,009 individuals with known eligibility

Ivacaftor (KALYDECO®)

Ivacaftor is available on the Pharmaceutical Benefits Scheme (PBS) for people who have CF, who are aged one year and older, and who have one of the following gating (class III) gene changes in the CFTR gene: G551D, G1244E, G1349D, G178R, G551S, S1251N, S1255P, S549N, S549R.

In the tables below the numerator is those on the drug and the denominator is the eligible population (based on genotype).

TABLE 3.8: ACFDR ADULTS 2022: IVACAFTOR USE

Age (Years)	On Ivacaftor anytime	On Ivacaftor as of 31 Dec 2022	Previously on Ivacaftor and discontinued as of 31 Dec 2022
≥18	154 /221 (70%)	71/221 (32.1%)	83/221 (37.6%)

TABLE 3.9: ACFDR ADULTS 2022: REASONS FOR DISCONTINUATION/SWITCH IN MODULATOR OF IVACAFTOR PARTICIPANTS

% (N)	Reasons for discontinuation/switch in modulator
81.9% (68)	Switch to other CFTR modulator
2.4% (2)	Liver impairment/intolerance
1.2% (1)	Other intolerance/adverse event
1.2% (1)	Concomitant drug interaction
13.3% (11)	Other reason *

*11 Other reasons; On trial (5), unknown (3) transplant (2), mental health(1).

Lumacaftor/Ivacaftor (ORKAMBI®)

Lumacaftor/Ivacaftor is a combination therapy available on the PBS for people who have CF, are aged two years and older, and who have two copies of the F508del gene change in the CFTR gene.

TABLE 3.10: ACFDR ADULTS 2022: LUMACAFTOR/IVACAFTOR USE

Age (Years)	On Lumacaftor/Ivacaftor anytime	On Lumacaftor/Ivacaftor as of 31 Dec 2022	Previously on Lumacaftor/Ivacaftor and discontinued as of 31 Dec 2022
≥18	635 /984 (65.0%)	129/984 (13.0%)	506/984 (51.0%)

TABLE 3.11: ACFDR ADULTS 2022: REASONS FOR DISCONTINUATION//SWITCH IN MODULATOR OF LUMACAFTOR/IVACAFTOR PARTICIPANTS

% (N)	Reasons for discontinuation/switch in modulator
72.9% (369)	Switch to other CFTR modulator
11.3% (57)	Pulmonary side effect/intolerance
7.3% (37)	Other intolerance/adverse event
0.6% (3)	Liver impairment/intolerance
0.4% (2)	Pregnancy
0.2% (1)	Concomitant drug interaction
7.3% (37)	Other reason *

*37 Other reasons; Commencement of trial drug (10), unknown (10), transplantation (3), patient self ceased (3), ran out of drug (2), pregnancy planning(2), patient felt no benefit (2), social issues and pulmonary (1), unable to swallow tablet(1), family choice (1), increased anxiety (1), lost medication(1).

Tezacaftor/Ivacaftor and Ivacaftor (SYMDEKO®)

Tezacaftor/Ivacaftor is also a combination therapy available on the PBS for people who have CF, are aged 12 years and older, and who have one copy of the following changes in the CFTR gene: E56K, R117C, F508del, S977F, F1074L, 3849+10kbC→T, P67L, E193K, D579G, F1052V, D1152H, R74W, L206W, 711+3A→G, K1060T, D1270N, D110E, R352Q, E831X, A1067T, 2789+5G→A, D110H, A455E, S945L, R1070W, 3272–26A→G.

TABLE 3.12: ACFDR ADULTS 2022: TEZACAFTOR/IVACAFTOR USE

Age (Years)	On Tezacaftor/Ivacaftor and Ivacaftor anytime	On Tezacaftor/Ivacaftor and Ivacaftor as of 31 Dec 2022	Previously on Tezacaftor/Ivacaftor and Ivacaftor and discontinued as of 31 Dec 2022
≥18	702 /1,111 (63.0%)	184/1,111 (16.6%)	518/1,111 (46.6%)

TABLE 3.13: ACFDR ADULTS 2022: REASONS FOR DISCONTINUATION/SWITCH IN MODULATOR OF TEZACAFTOR/IVACAFTOR PARTICIPANTS

% (N)	Reasons for discontinuation/switch in modulator
84.7% (439)	Switch to other CFTR modulator
5.2% (27)	Other intolerance/adverse event
2.1% (11)	Pulmonary side effect/intolerance
0.8% (4)	Liver impairment/intolerance
0.6% (3)	Pregnancy
6.6% (34)	Other reason*

*34 Other reasons; Pregnancy planning (6), self ceased (5), clinical trial (4) no benefit (4), non–compliant (4), weight gain (3), transplant (2), overseas (1), social issues (1), headaches (1), unknown (1), mental health(1), intolerance (1).

Elexacaftor/Tezacaftor/Ivacaftor (TRIKAFTA®)

Elexacaftor/ tezacaftor/ivacaftor (ETI) is a triple combination therapy available on the PBS on the 1st April 2022 for people who have CF aged 12 years and older, with at least one copy of the F508del gene change in the CFTR gene.

TABLE 3.14: ACFDR ADULTS 2022: ELEXACAFTOR/TEZACAFTOR/IVACAFTOR USE

Age (Years)	On ETI anytime	On ETI as of 31 Dec 2022	Previously on ETI and discontinued as of 31 Dec 2022
≥18	1,536 /1,892 (81.0%)	1,520/1,892 (80.3%)	16/1,892 (0.9%)

Table 3.15 shows **reasons for discontinuation as well as change in dosage** of Trikafta.

TABLE 3.15: ACFDR ADULTS 2022: REASONS FOR DISCONTINUATION/CHANGE OF ELEXACAFTOR/TEZACAFTOR/ IVACAFTOR PARTICIPANTS

% (N)	Reasons for discontinuation/change
40.6% (71)	Other intolerance/adverse event
21.7% (38)	Liver impairment/intolerance
5.1% (9)	Pregnancy
1.1% (2)	Concomitant drug interaction
1.1% (2)	Switch to other CFTR modulator
30.3% (53)	Other reason

*2 Other reasons; Change in dose (11), unknown reason (7), transplant (4), rash (4), clinical Trial (4), self cessation (4), mental health (2), participants choice (2), ceased trial (2), no benefit (2), cholecystectomy (1), DIOS (1), hospital drug committee funding ceased (1), mouth ulcers (1), use of parconazole (1), extreme lethargy (1), increase in weight (1), insomnia (1), anxiety (1), no benefit (1), pregnancy planning (1).

3.4 COMPLICATIONS AND THERAPIES

CF Pulmonary Disease

In 2022, the rate of haemoptysis was 8.9% for adults 18–29 years (compared to 12.8% in 2021), and 8.2% for those aged 30+ (compared to 8.5% in 2021). Rates of haemoptysis requiring embolisation remained consistent across 2021–2, with 0.5% of haemoptysis presentations of 18–29 year olds and 0.4% of 30+ year olds requiring embolization for both years. A pneumothorax occurred in 0.3% of 18–29 year olds and 0.6% of 30+ year olds in 2022.

CF Pulmonary Therapies–Maintenance Antibiotics

A mainstay of medical treatment for CF lung disease is preventive and therapeutic antibiotic therapy that may be oral or inhaled. Among individuals aged 18–29, 31.3% were prescribed inhaled antibiotics, 24.2% were on regular oral antibiotics, and 31.7% were using macrolides (Figure 3.26). In the 30+ age group, 36.9% were on inhaled antibiotics, 24.9% on regular oral antibiotics, and 52.8% were utilizing macrolides.

For both adult age groups, the use of inhaled antibiotics decreased from 2021–2022 while the use of oral antibiotics increased during this period. For younger adults, the use of macrolides decreased from 2021 (39.0%) to 2022 (31.7%) while macrolide use in older adults decreased (52.8%) in 2022 compared with 56.8% in 2021.

FIGURE 3.26: ACFDR ADULTS 2022: MAINTENANCE ANTIBIOTIC THERAPY

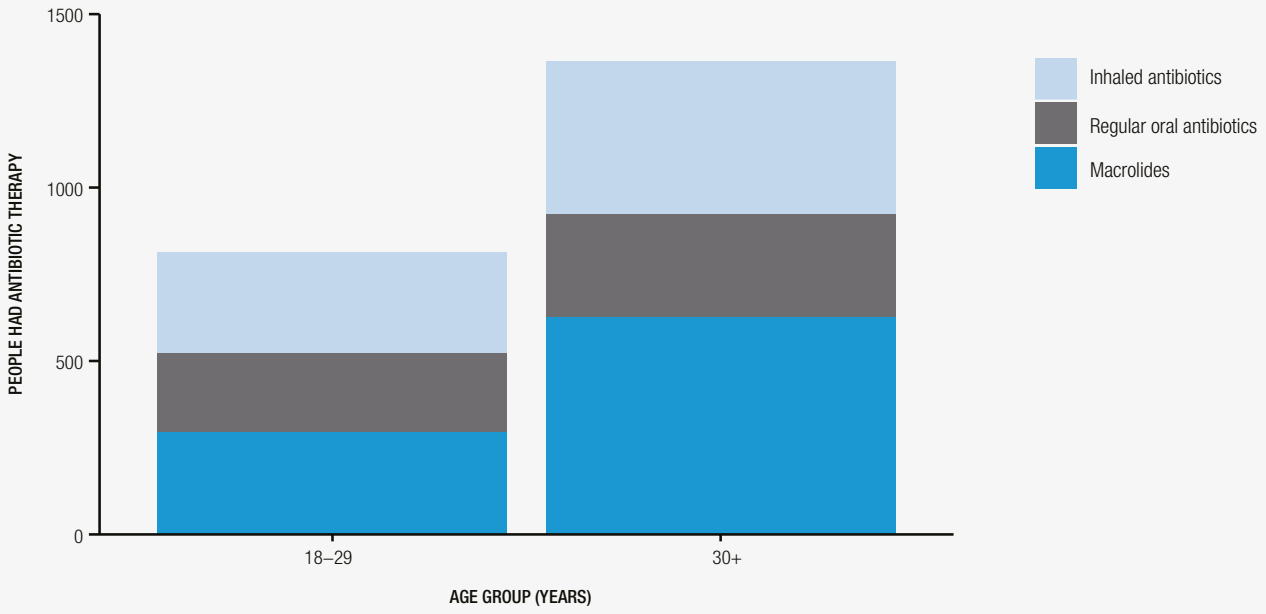


TABLE 3.16: ACFDR ADULTS 2022: MAINTENANCE ANTIBIOTIC THERAPY

	18–29 (N=933)	30+ (N=1,190)
Inhaled antibiotics	292/933 (31.3%)	439/1,190 (36.9%)
Regular oral antibiotics	226/933 (24.2%)	296/1,190 (24.9%)
Macrolides	296/933 (31.7%)	628/1,190 (52.8%)

CF Lung Therapies—Non-Antibiotic Management

In 2022, among adults aged 18–29 years, a majority used bronchodilators (59.7%), dornase alpha (59.7%) and inhaled corticosteroids (51.5%), with nearly 50.0% (49.4%) using hypertonic saline (Table 3.17). Less commonly used were inhaled mannitol (6.3%), oral corticosteroids (4.3%), non–invasive ventilation (1.7%) and long term oxygen therapy (1.0%).

In 2022, among older adults aged 30+ years there was higher use of bronchodilators (61.3%), inhaled corticosteroids (51.5%), and oral corticosteroids (10.6%). A significant proportion also used dornase alpha (48.0%) and hypertonic saline (42.8%), while use of inhaled mannitol was uncommon compared to younger adults (2.6%). Approximately two and a half percent of adults over 30 years required non–invasive ventilation or long term oxygen therapy.

Compared to 2021, fewer 18–29 year olds in 2022 used a majority of these adjuvant therapies. There was a slight increase in use of inhaled mannitol and oral corticosteroids, with long-term oxygen therapy use remaining stable. Similarly, for older adults 30+, there was reduced use of all of these therapies with the exception of slightly increased use of oral corticosteroids and long term oxygen use.

TABLE 3.17: ACFDR ADULTS 2022: NON–ANTIBIOTIC MANAGEMENT

	18–29 (N=933)	30+ (N=1,190)
Bronchodilators	557 (59.7%)	729 (61.3%)
Inhaled corticosteroids	394 (42.2%)	613 (51.5%)
Dornase alpha	557 (59.7%)	571 (48.0%)
Hypertonic saline	461 (49.4%)	509(42.8%)
Inhaled mannitol	59 (6.3%)	31 (2.6%)
Oral corticosteroids	40 (4.3%)	126 (10.6%)
Non–invasive ventilation	16 (1.7%)	30 (2.5%)
Long term oxygen therapy	9 (1.0%)	28 (2.4%)

CF Endocrine Disease

Among individuals aged 18–29, approximately 17% did not have information recorded in the registry regarding their diabetes status (Table 3.18). Forty–five percent of 18–29 year olds and 41% of 30+ year olds did not have impaired glucose tolerance. The proportion of those with diabetes increased from 26.0% of 18–29 year olds to 29.6% of those aged 30 years or more. The proportion of those with impaired glucose tolerance increased from 11.8% of 18–29 year olds to 13.5% of those who were 30+ years.

TABLE 3.18: ACFDR ADULTS 2022: DIABETIC STATUS

Diabetic status	18–29 (N=933)	30+ (N=1,190)
Normal, (no diabetes or impaired glucose tolerance)	415 (44.5%)	484 (40.7%)
Impaired glucose tolerance	110 (11.8%)	161 (13.5%)
Diabetes	243 (26.0%)	352 (29.6%)
Not known	165 (17.7%)	193 (16.2%)

Of those with diabetes, the vast majority are treated with insulin: 84.6% of 18–29 year olds and 80.1% of those 30 years or older. Approximately 8% of 18–29 year olds and 13.0% of those 30+ years of age use diet/lifestyle management only, and 4% of those 30+ use oral hypoglycemics only (Table 3.19).

TABLE 3.19: ACFDR ADULTS 2022: CF RELATED DIABETES (CFRD) TREATMENT

Diabetes treatment type	18–29 (N=243)	30+ (N=352)
Insulin	204 (84.6%)	278 (80.1%)
Oral Hypoglycemics	3 (1.2%)	14 (4.0%)
Insulin and oral hypoglycemics	5 (2.1%)	5 (1.4%)
Diet/lifestyle management only	19 (7.9%)	45 (13.0%)
No treatment for diabetes	10 (4.1%)	5 (1.4%)

Of those that use insulin, the vast majority (92.5%) of 18–29 year olds and 96.8% of 30+ year olds use chronic insulin administration. Just over 5% of 18–29 year olds use insulin intermittently (Table 3.20).

TABLE 3.20: ACFDR ADULTS 2022: INSULIN USE

Insulin use	18–29 (N=187)	30+ (N=280)
Intermittent insulin use	10 (5.3%)	6 (2.1%)
Chronic insulin use	173 (92.5%)	271 (96.8%)
Insulin use, duration unknown	4 (2.1%)	3 (1.1%)

CF Gastrointestinal Disease

Gastrointestinal complications for people with CF include those relating to the pancreas, stomach and liver. In 2022, among adults aged 18–29, 32.0% experienced gastroesophageal reflux, which increased to 43.9% for those aged 30 and above. These proportions are lower than in 2021.

The most common liver disease for pwCF is acute liver disease which affects 9.1% of 18–29 year olds and 8.3% of 30+ year olds in 2022. Chronic liver disease was a complication for 7.4% of 18–29 year olds and 6.4% of 30+ year olds (Table 3.21). These proportions are similar for 2021.

TABLE 3.21: ACFDR ADULTS 2022: GASTROINTESTINAL COMPLICATIONS

	18–29	30+
Gastroesophageal reflux	298/932 (32.0%)	522/1,190 (43.9%)
Liver disease, non–cirrhosis (includes viral hepatitis, fatty liver)	78/860 (9.1%)	92/1,110 (8.3%)
Liver disease, cirrhosis (image confirmed)	30/812 (3.7%)	41/1,059 (3.9%)
Liver disease, cirrhosis with portal hypertension	30/812 (3.7%)	26/1,044 (2.5%)

A majority of adult participants in the registry have pancreatic insufficiency. In 2022, 83.8% of individuals aged 18–29, and 73.3% of those aged 30 years or older, had pancreatic insufficiency. The vast majority do not have a history of acute or chronic pancreatitis (Table 3.22).

TABLE 3.22: ACFDR ADULTS 2022: PANCREATITIS

Pancreatic status	18-29 (N=933)	30+ (N=1,190)
Insufficient	782 (83.8%)	872 (73.3%)

Pancreatitis	18–29 (N=861)	30+ (N=1,061)
Acute (first pancreatitis event this current year); pancreatitis not specified	3 (0.3%)	3 (0.3%)
No history of pancreatitis	838 (97.3%)	1,014 (95.6%)
Recurrent pancreatitis (history of more than one event of pancreatitis)	20 (2.3%)	44 (4.1%)

Bone Density

In the 18–29 age range, 55.3% exhibit normal bone mineral density, 35.4% show osteopenia, and 9.3% have osteoporosis. For adults aged 30 and above, 35.5% have normal bone density, 47.9% display osteopenia, and 16.7% exhibit osteoporosis. With 1.5% of individuals aged 18–29 and 1.3% of those aged 30 and above reporting fractures in 2022 (Table 3.23).

TABLE 3.23: ACFDR ADULTS 2022: BONE DENSITY

Bone mineral density	18-29 (N=161)	30+ (N=234)
Normal	89 (55.3%)	83 (35.5%)
Osteopenia	57 (35.4%)	112 (47.9%)
Osteoporosis	15 (9.3%)	39 (16.7%)

Bone mineral density	18-29 (N=894)	30+ (N=1,144)
Fracture	13 (1.5%)	15 (1.3%)

Cancer

Of the ACFDR's adult cohort, 18–29 year olds had 1 recorded case of cancer while those aged 30 and above had 21 newly diagnosed cases.

The cancers included: 2 cases of breast cancer; 1 bone sarcoma, 1 colorectal cancer, and thyroid cancer; gastric cancer (1), metastatic cholangiocarcinoma in the liver (1), and liver with lymphadenopathy (1); one case of lung cancer; melanoma (2), basal cell carcinoma (2), atypical fibroxanthoma of the scalp (1), pre–squamous cell carcinoma on the chest (1), and unspecified skin cancer (1); one case each of prostate and cervical cancer; acute myeloid leukemia and early stage Hodgkin's lymphoma in the mediastinum. There were also 2 cases of unknown primary cancer.

Nutritional Supplementation

Pancreatic enzymes have been a mainstay of treatment for pancreatic insufficiency for people with CF. In 2022, 80.8% of those aged 18–29 and 73.4% of those aged 30 years or older used pancreatic enzymes. A majority also used Vitamin supplements, with fewer using salt replacement therapy. Use of nutritional supplements was more common in the 18–29 year age group of adults, and use has reduced for both age groups since 2021.

Few people in this age group required nutritional support. The most common was use of oral supplements for nearly 8.0% of 18–29 year olds and 4.0% of over 30 year olds. Over 3.0% of 18–29 year olds had a gastrostomy tube for feeding at some point in 2022, otherwise supported feeding was rarely used.

TABLE 3.24: ACFDR ADULTS 2022: NUTRITIONAL SUPPORT

	18–29 (N=933)	30+ (N=1,190)
Pancreatic enzymes	754 (80.8%)	874 (73.4%)
Vitamin supplements (Fat soluble vitamins A, D, E and K)	647 (69.3%)	750 (63.0%)
Salt replacement therapy	336 (36.0%)	275 (23.1%)

Nutritional support	(N=933)	(N=1,190)
Oral	73 (7.8%)	48 (4.0%)
Gastrostomy tube	31 (3.3%)	6 (0.5%)
Nasogastric tube	4 (0.4%)	1 (0.1%)
Jejunostomy tube	2 (0.2%)	0 (0.0%)
Parenteral nutrition	1 (0.1%)	0 (0.0%)

Multidisciplinary Care

In 2022, the ACFDR Steering endorsed additional multidisciplinary care information in the registry annual data set for the first time, including an annual review by social work, mental health practitioners and gastroenterologists.

The table reveals notable variations in multidisciplinary care appointments among adults in the ACFDR in 2022. While physiotherapy and dietitian reviews are more prevalent, with 80.7% and 74.4% respectively, in the 18–29 age group, social work and mental health reviews show lower activity.

TABLE 3.25: ACFDR ADULTS 2022: MULTIDISCIPLINARY CARE APPOINTMENTS

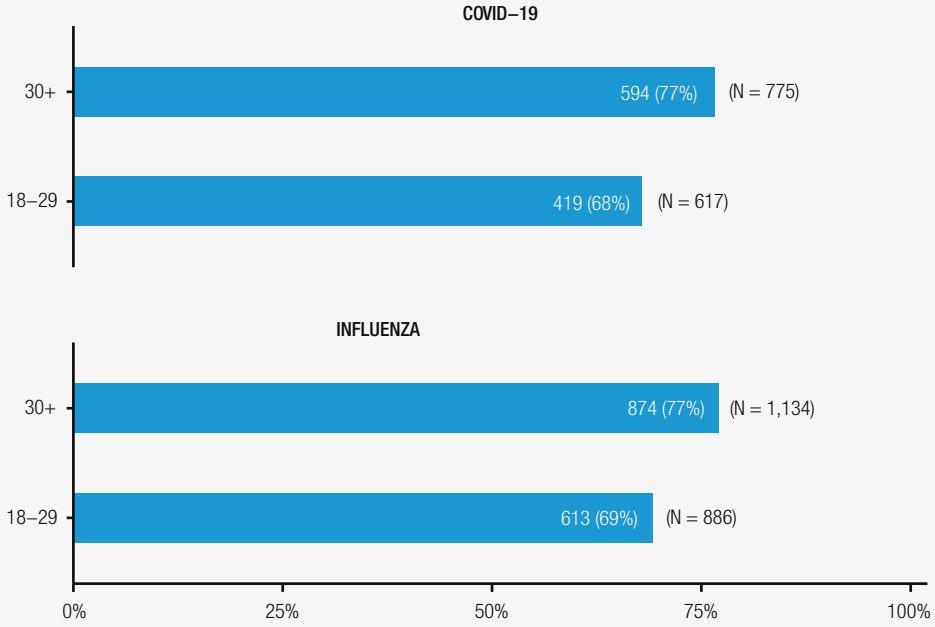
Preventive care	18–29 (N=933)	30+ (N=1,191)
Physiotherapy review	749 (80.7%)	858 (72.3%)
Dietitian review	694 (74.4%)	798 (67.1%)
Social work review	425 (45.8%)	426 (35.9%)
Endocrine review	236 (25.4%)	348 (29.3%)
Mental health review	225 (27.2%)	239 (23.2%)
Gastroenterologist review	176 (19.0%)	294 (24.8%)

Vaccination

Of the 2,020 adults with recorded influenza vaccination data, 74.0% (1,487 individuals) reported receiving an influenza vaccination in 2022. Specifically, 69.0% of adults aged 18–29 and 77.0% of adults aged 30 and above, reported being vaccinated against influenza.

There were 65.5% adults who recorded information on COVID–19 vaccination is 2022, similarly 68.0% of adults aged 18–29 and 77.0% of adults aged 30 and above, reported receiving COVID–19 vaccination in 2022 (Figure 3.27).

FIGURE 3.27: ACFDR ADULTS 2022: VACCINATIONS



4. 2022 ACADEMIC OUTPUTS

Publications

Carr SB, McClenaghan E, Elbert A, Faro A, Cosgriff R, Abdrakhmanov O, Brownlee K, Burgel PR, Byrnes CA, Cheng SY, Colombo C, Corvol H, Daneau G, Goss CH, Gulmans V, Gutierrez H, Harutyunyan S, Helmick M, Jung A, Kashirskaya N, McKone E, Melo J, Middleton PG, Mondejar–Lopez P, de Monestrol I, Nährlich L, Padoan R, Parker M, Pastor–Vivero MD, Rizvi S, Ruseckaite R, Salvatore M, da Silva–Filho LVRF, Versmessen N, Zampoli M, Marshall BC, Stephenson AL; CF Registry Global Collaboration. Factors associated with clinical progression to severe COVID–19 in people with cystic fibrosis: A global observational study. J Cyst Fibros. 2022 Jul;21(4):e221–e231. doi: 10.1016/j.jcf.2022.06.006. Epub 2022 Jun 13. PMID: 35753987; PMCID: PMC9189103.

Coriati A, Ma X, Sykes J, Stanojevic S, Ruseckaite R, Lemonnier L, Dehillotte C, Tate J, Byrnes CA, Bell SC, Burgel PR, Stephenson AL. Beyond borders: cystic fibrosis survival between Australia, Canada, France and New Zealand. Thorax. 2023 Mar;78(3):242–248. doi: 10.1136/thorax–2022–219086. Epub 2022 Sep 15. PMID: 36109163.

Ruseckaite R, Salimi F, Earnest A, Bell SC, Douglas T, Frayman K, Keatley L, King S, Kotsimbos T, Middleton PG, Morey S, Mulrennan S, Schultz A, Wainwright C, Ward N, Wark P, Ahern S. Survival of people with cystic fibrosis in Australia. Sci Rep. 2022 Nov 17;12(1):19748. doi: 10.1038/s41598–022–24374–4. PMID: 36396972; PMCID: PMC9672093.

Conference Presentations

The 14th Australasian Cystic Fibrosis Digital Medical Conference

NACFC 2022, Philadelphia, 2022: Longitudinal Assessment of Health–related Quality of Life and Clinical Outcomes in Children and Adolescents with Cystic Fibrosis in Australia. Rapid Fire Poster Talk. Ruseckaite R., Saxby N, Ahern S.

5. DATA ACCESS REQUESTS

The ACFDR encourages the secondary use of its data for research and related purposes. 12 data access requests were received and approved for the ACFDR in 2022.

Date	Name	Organisation	Request type	Request
4–Jan	Maxine Orre	Vertex Pharmaceuticals	Non–research	Long–term Real–world Impact of Ivacaftor on Clinical Outcomes in Patients with Cystic Fibrosis
7–Feb	Bennett Shum	School of Medical Sciences, University of NSW	Research	Spectrum of CFTR variants in Australia
22–Mar	Kathy Hou	Vertex Pharmaceuticals	Non–research	A real–world study in Cystic Fibrosis in collaboration with Vertex Pharmaceuticals
9–May	Maxine Orre	Vertex Pharmaceuticals	Non–research	CF patient population by age and mutation; clinical parameters for subgroups
9–Jun	Maxine Orre	Vertex Pharmaceuticals	Non–research	Long–term Real–world Impact of Ivacaftor on Clinical Outcomes in Patients with Cystic Fibrosis–(2021 data)
30–Jun	Darsy Darssan	The University of Queensland	Research	Environmental exposures and cystic fibrosis
28–Jul	Maxine Orre	Vertex Pharmaceuticals	Non–research	CF patient population by age and mutation; clinical parameters for subgroups (2020–2021)
15–Aug	Scott Bell	QIMR Berghofer Medical Research Institute	Research	The emerging problem of nontuberculous mycobacteria infection in pwCF
18–Aug	Maxine Orre	Vertex Pharmaceuticals	Non–research	CF patient population by age and mutation; clinical parameters for subgroups in <5 years
26–Aug	Maxine Orre	Vertex Pharmaceuticals	Non–research	ACFDR data comparison for TSANZ abstract
5–Oct	Astrid Gardiner	Royal Prince Alfred Hospital, University of Sydney	Research	NIV and Respiratory Failure in cystic fibrosis
8–Nov	Claire Wainwright	Queensland Children's Hospital	Non–research	Outcomes for QCH cystic fibrosis service for cystic fibrosis service planning purposes 2022

How can I request data from the ACFDR?

Data access requests are subject to approval by the registry's Steering Committee and relevant ethics committees, and Monash University's conditions of use. Interested researchers/individuals are advised to contact Monash University for details and to arrange consideration of their research proposal. In accordance with the ACFDR data access policy, a fee may be charged to recover costs for data extraction and/or analysis.

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REGISTRY STEERING COMMITTEE MEMBERSHIP 2022

Steering Committee Members	Role/Specialisation	Institution/Association
Professor Susannah Ahern	Coordinating Investigator/Academic Lead	Monash University, VIC
Professor Peter Wark	Clinical Lead ACFDR/CF Adult Physician	The Alfred Hospital, VIC
Dr Andre Schultz	CF Paediatric Physician	Perth Children's Hospital, WA
Dr Rasa Ruseckaite	Deputy Monash Academic Lead ACFDR	Monash University, VIC
Ms Jo Armstrong	CEO Cystic Fibrosis Australia	Cystic Fibrosis Australia
A/Professor Tom Kotsimbos	CF Adult Physician	Alfred Health, VIC
Dr Siobhain Mulrennan	CF Adult Physician	Sir Charles Gairdner Hospital, WA
Dr Tonia Douglas	CF Paediatric Physician	Queensland Children's Hospital, QLD
Dr Katherine Frayman	CF Paediatric Physician	Royal Children's Hospital, VIC
Dr Nathan Ward	Physiotherapist	Royal Adelaide Hospital, SA
Sue Morey OAM	Nurse Practitioner	Sir Charles Gairdner Hospital, WA
Dr Pia Sappl	Consumer Representative	NSW
Chloe Arthur	Consumer Representative	QLD
Honor Rose	Consumer Representative	VIC
Caz Boyd	Consumer Representative	WA (Joined in 2023)

LIST OF PARTICIPATING SITES

Site	
Centenary Hospital for Women & Children (CHW)	Paediatric
Gold Coast University Hospital (GCH)	Adult
Gosford Hospital (GOS)	Paediatric and Adult
John Hunter Children's Hospital (JHC)	Paediatric
John Hunter Hospital (JHH)	Adult
Launceston General Hospital (LGH)	Paediatric
Mater Hospital (MAH)	Adult
Monash Medical Centre (MMC)	Paediatric and Adult
North West Regional Hospital (BUR)	Paediatric
Perth Children's Hospital (PCH)	Paediatric
Queensland Children's Hospital (QCH)	Paediatric
Royal Adelaide Hospital (RAH)	Adult
Royal Children's Hospital (RCH)	Paediatric
Royal Hobart Hospital (RHH)	Paediatric & Adult
Royal Prince Alfred Hospital (RPA)	Adult
Sir Charles Gairdner Hospital (SCG)	Adult
Sydney Children's Hospital (SCH)	Paediatric
The Alfred Hospital (ALF)	Adult
The Canberra Hospital (CHA)	Adult
The Children's Hospital, Westmead (CHW)	Paediatric
The Prince Charles Hospital (PCH)	Adult
Westmead Hospital (WMH)	Adult
Women's and Children's Hospital (WCH)	Paediatric

ACFDR COORDINATING CENTRE, MONASH UNIVERSITY

The ACFDR coordinating team encourages contact regarding all registry related activities and operations, including access to data through the email account below

Email: med–acfdregistry@monash.edu
Registry Academic Lead: Prof Susannah Ahern
Deputy Monash Academic Lead: Dr Rasa Ruseckaite
Principal Data Science Lead: Dr Ahmad Reza Pourghaderi
Registry Coordinator: Marisa Caruso
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ACCESS TO REGISTRY DATA

Requests for information from the ACFDR are welcome
Application should be made to the ACFDR Coordinating Centre, Monash University.
Email: med–acfdregistry@monash.edu

ELECTRONIC DATA CAPTURE

Study data was collected and managed using REDCap electronic data capture tool hosted and managed by Helix (Monash University).[1,2] REDCap (Research Electronic Data Capture) is a secure, web–based software platform designed to support data capture for research studies, providing 1) an intuitive interface for validated data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for data integration and interoperability with external sources.

1. PA Harris, R Taylor, R Thielke, J Payne, N Gonzalez, JG. Conde, Research electronic data capture (REDCap)–A metadata–driven methodology and workflow process for providing translational research informatics support, J Biomed Inform. 2009 Apr;42(2):377–81.

2. PA Harris, R Taylor, BL Minor, V Elliott, M Fernandez, L O'Neal, L McLeod, G Delacqua, F Delacqua, J Kirby, SN Duda, REDCap Consortium, The REDCap consortium: Building an international community of software partners, J Biomed Inform. 2019 May 9 [doi: 10.1016/j.jbi.2019.103208]

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