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The implementation of standards of care in Europe: State of the art

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Abstract

The care and condition of people with cystic fibrosis (CF) in 34 European countries is reported using data obtained from publications, registries and professionals providing CF patient care. Care and outcomes differ markedly between countries. Although the 2005 European standards of patient care publication was widely known, in many countries there were no specialized CF centres. In only a minority of countries was funding considered adequate and in some countries costs covered by patients compromised care. Only 15 countries had a national CF patient registry. Neonatal screening was routine in only 10 countries, but this included 59% of European infants. The initiatives of EuroCareCF Workpackage 1 to form networks for professionals working with CF patients are described. Suggestions for the future include at least one adequately staffed CF Centre in each country, improved funding, neonatal screening, national patient registries and the formation of national CF parent and patient organisations.

Keywords: Cystic fibrosis; Care; Demographics

1. Introduction

Advances in patient care have led to dramatic improvements in prospects for cystic fibrosis (CF) patients; in many countries most individuals are now expected to reach adulthood. However, the burden of care remains high. Management requires a close collaboration between specialists from different fields to maximise longevity and quality of life (QoL). The primary objective of Workpackage 1 (WP1) of the EuroCareCF project was to optimise patient care and CF teamwork, ensuring parity and equity of access to services across all countries in the European Union (EU). The purpose of this paper is to describe the extent to which these objectives have been achieved.

2. Influence of standard of care on health and survival

It has become apparent that the progressive deterioration of respiratory function described in the older CF literature is not inevitable. If respiratory infection is identified early and repeatedly eradicated by appropriate antibiotic treatment, chronic infection with both *Staphylococcus aureus* and *Pseudomonas aeruginosa* can be prevented or certainly delayed for many years [1–3]. Also the early malnutrition and later growth problems can be avoided or minimised when enzyme supplements and nutritional intervention are started soon after birth [4]. To achieve this for all infants with CF, neonatal screening followed by early diagnosis, close monitoring and effective treatment is mandatory – the last is essential to achieve benefit from early diagnosis [5].

3. Central role of CF centre care

There is general agreement that advice on treatment and management is best provided by a multidisciplinary team at a CF centre [6–9]. The CF team also has the responsibility to undertake clinical audit and research in a condition, such as CF, where treatment is continually changing, improving

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and becoming increasingly more effective. In practice, this is best accomplished by a team at a CF centre where many people with CF are treated. Indeed, all significant advances in treatment have occurred at CF centres where there are sufficient patients and staff to recognise and investigate problems. It is also important that the results of care are assessed over the long term. Pulmonary damage, either sustained before diagnosis or caused by suboptimal treatment after diagnosis, can be contained with intensive modern treatment for a few years [10,11]. However, this damage will eventually result in a more rapid decline in pulmonary function during adolescence or early adult life.

The main principles of treatment are now readily available to those treating people with CF. However, it appears to be the fine details of management, which may differ between CF centres that account for some of the significant differences in the welfare of patients. For example, most studies that correlate treatment received with clinical condition indicate that more frequent monitoring of a CF patient's clinical status, including measurements of lung function and respiratory cultures leads to more frequent treatment, especially with intravenous antibiotics, which in turn maintains good health [12].

4. Publications, guidelines and standards

The past 20 years have seen a great increase in all types of published information relating to CF. Medline citations increased from 7,622 in the decade between 1986 and 1995 to 11,396 between 1996 and 2005; already there are a further 5,194 since 2006. Moreover, between 1966 and 1997 there was a 30-fold increase in CF clinical trials of which over a third were only reported at meetings [13]. Between 1998 and 2002, another 261 CF clinical trials took place [14].

In an attempt to ensure that patients receive the most appropriate and acceptable treatment, various patients' and professional organisations, with the help of expert committees, have produced their own standards for general care as well as more detailed guidelines for specific aspects of treatment [8,9,15]. These publications provide guidance for those with less experience and ensure that members of CF patient teams give consistent advice to patients and carers. In addition, these publications indicate to providers the facilities and level of funding required. In 2005, the main concepts of the standards of care for people with CF were reviewed in the European Cystic Fibrosis Society's "Standards of care for patients with cystic fibrosis: A European consensus" [9].

5. Standards of care for people with cystic fibrosis: a European consensus

In March 2004, a 2-day European Cystic Fibrosis Society (ECFS) consensus meeting was held in Artimino, Italy on Standards of Care for People with Cystic Fibrosis. The 34 members of the consensus group were from 17 European countries and North America. The role of a CF centre was discussed as well as the staff required. The routines for CF patient care were agreed including outpatients, inpatients, annual reviews, details of various aspects of care, including the recently diagnosed patient, the patient diagnosed in adult life and atypical patients. The importance and role of other specialists in CF patient care were detailed. The document finished with 35 practical questions, the answers to which were agreed by the consensus group. The conclusions of the consensus meeting were published in the Journal of Cystic Fibrosis in 2005 [9].

Thus, the ECFS consensus group achieved their aim of defining standards for the routine evaluation, monitoring and treatment of people with CF. If adopted by all European CF centres, these consensus guidelines would provide a quality assurance instrument and a basis for the audit of CF care.

There have also been European consensus groups to consider antibiotic therapy [16,17], nutrition [18], immunisation [19], the management of pregnancy [20], mutation analysis [21] and neonatal screening [5,22].

6. Standards of care in Europe as represented by an early survey in 2005/6

The European standards of care for people with CF was published in 2005 [9] and provided criteria for defining a CF centre and the roles of the individual professional members of the CF patient care team. Since 2000, there had been earlier European consensus publications (see above Section 5). In 2005/6, a survey was undertaken which asked questions on general care and infection management; the results of this survey were published in 2009 [23,24]. The questionnaire was sent to a heterogeneous group of professionals who were all members of the ECFS; they were identified from the Society's mailing list. There was a disappointing response to the survey with only 177 of 544 (33%) completed questionnaires returned. Analysis of those returned revealed "a high degree of implementation of the European Consensus Guidelines" and identified "areas of improvement to include shared care, access to care and funding inequalities" [23]. With regard to the control and treatment of infection, the authors concluded that the European Consensus Guidelines were widely adhered to. Areas for improvement included "initiating therapy for exacerbations early, separating infected patients and optimizing the duration of antibiotic therapy" [24]. We agree with the authors that, in view of the poor response to the survey, the results might overestimate the extent of adherence to guidelines and standards of care – clinics familiar with the guidelines and following the standards being more likely to respond. Of note, there was a striking difference in the rate of response from countries in Eastern and Western Europe with the UK, France, Germany and Italy providing approximately half of all the responses; only 12% were from Eastern Europe.

7. Collection of documents on standards of care by WP1 of EuroCareCF (2007–2009)

One of the initiatives of EuroCareCF WP1 was the collection of information regarding CF patients especially documents produced in various European countries indicating

the extent to which ECFS standards of care had already been implemented. Analysis of the collected documents would provide information about the present status of CF patient care in Europe. It was also anticipated that the existence of standard documents relating to CF patient care would provide some indication of the experiences of the multi-disciplinary CF teams in Europe and the quality of patient care they provided.

It was decided to contact colleagues in various European countries either by e-mail or directly during ECFS conferences. The collection of the documents proved to be a very demanding task and required more time and effort than anticipated.

Nevertheless, information from a total of 34 European countries was collected The number of people with CF resident in each of these countries was derived from national registries (available in 15 countries), from estimations by local CF physicians or paediatricians or from previous publications [44]. Overall, there were a total of 39,897 people with CF who were treated in 32 European countries (Table 1). The countries having their own national documents relating to CF care are reported in Table 2.

A first analysis of the collected information relating to the standard documents and other data from the various European countries has been summarised (for further information, see Tables 1 and 2).

Fifteen countries were aware of and used the ECFS Standards of Care document even though they did not have a national document of their own. However, 6 countries did not consider that their practice followed ECFS standards for a variety of reasons, including staffing and facilities or small patient numbers. In 11 countries, the extent of use of the ECFS Standards of Care document was not determined.

We endorse the production of national consensus guidelines to develop and consolidate a national approach. Hopefully, the more advanced CF centres and clinics would favourably influence the standard of care in those clinics with less experience and facilities. A national approach would also be more likely to result in adequate national government funding for CF care. It is this model of development we would endorse to ensure equity of care because it involves and motivates health professionals to actively implement the Care Standards.

8. Differences in the Standard of Care between European countries is still very wide

There are many examples of suboptimal provision of facilities and care for people with CF for which there are a number of reasons. For many years, it has been known that outcomes between countries differ significantly [25]. In North America, there were even significant differences between patient outcomes at accredited CF Centres [26,27]. These differences are still obvious in many regions and appear to be due to the type and intensity of care that CF patients receive [12,28,29]. In recent years, differences in patient outcomes in various CF centres have received a considerable amount of attention particularly in the United States [30,31].

CF professionals in virtually all European countries stated that the ECFS document on standards of care for CF patients [9] was well known and being implemented in many countries. However, our survey revealed that in at least 10 European countries the fundamental concept of a "Specialized CF Centre" based on the integrated action of a multidisciplinary team is either non-existent or far from being applied. The following examples from various clinics illustrate the problems:

- *"Importance (of physiotherapists) is underrated by the doctors. No trained nutritionists in any centre – teams do not exist"*
- *"In some centres there is only the doctor. Specialized physiotherapists and dietitians are missing. Dietitians only in some centres*
- *"No CF team"*
- *"No CF centres"*
- *"Some physiotherapy, few dietitians. Doctors give advice"*
- *"Essentially only pediatricians"*

The lack of a CF centre team is almost certainly one of the major factors adversely affecting the care of many people with CF. As discussed above, centre care delivered by a team of professionals, who spend much of their time treating people with CF, is probably the most important single factor that has improved the care and outlook of people with CF over the years [6–8,32–36].

An almost unanimous view of those providing CF patient care is that funding made available for CF services was inadequate to provide the standard of care and facilities recommended in the ECFS document on standards of care for CF patients [9]. In only 2 of 21 countries where an opinion on the adequacy of funding for CF staff was obtained, were funding levels regarded as adequate (Netherlands and France). In the remaining 19 countries, funding was regarded as inadequate or not specifically intended for CF staff.

As previously reported by Elborn et al. [23], the predominant funding provider of CF centres and clinics is the national healthcare system of the country. However, the proportion of care cost covered by CF patients may at times compromise their treatment. This more frequently is the case for adults with CF. In 13 European countries, treatment was free; in 10 countries, some payment was required for certain medicines (e.g. vitamins and dietary supplements) and in 4 countries, the treatment of children was free, but adults were required to contribute to the cost of their treatment. However, in most countries the parents' or patients' contribution to the cost of their treatment was relatively modest when set against the total cost of treatment. Nonetheless, in certain instances it might have been one of the factors contributing to why CF patients received suboptimal care or were denied more expensive and effective treatments [24].

9. The importance of CF patient registries

A CF registry or database is essential if national figures are required for monitoring patients' treatment and outcomes. For many years, it has been appreciated that patient registries

Table 1
Demographics of the European CF population

Country	Population ×1000	People with CF	Prevalence per 10,000	Incidence	Median age (years)	Percentage of patients >18 years >16 years	Median age of death (years) (Median survival)	Percentage of expected if survival normal
Austria	8,210	680	0.828	1:3,500	14.8	42.86		29
Belgium	10,414	1,057	1.015	1:2,850	17.4	49.3	30.2	29
						51.9		
Bulgaria	7,204	192	0.266	1:3,250		33	20	9
Cyprus	797	26	0.338	1:7,914				26
Czech Republic	10,212	570	0.558	1:2,833	14.7	38.3	24.6	16
Denmark	5,501	450	0.819	1:4,700	18.9	52.28		39
Estonia	1,299	40	0.308	1:7,500				23
Finland	5,250	64	0.127	1:25,000				31
France	62,151	4,533	0.729	1:4,348	15	41.3	23.5	32
Germany	82,330	6,835	0.829	1:3,300	19.1	50.4	23.7	27
						43.4	(37.4)	
Greece	10,737	555	0.517	1:3,500				18
Hungary	9,906	580	0.586	1:4,000			20	23
Ireland	4,203	1,182	2.81	1:5,353	17	49	24	38
Italy	58,126	5,064	0.871	1:4,238	16.5		22.3	37
Latvia	2,232	30	0.134	1:3,300		26		4
Lithuania	3,555	47	0.276	1:6,000				8
Luxembourg	492	40	0.813					
Malta	405	23	0.467					
Netherlands	16,716	1,275	0.763	1:4,750	17.1		33	36
Poland	38,483	1,000	0.26	1:5,000	17		18.7	6
Portugal	10,708	285	0.266	1:6,000				16
Romania	22,215	238	0.107	1:2,056			20	2
Slovakia	5,463	416	0.761	1:1,800				11
Slovenia	2,006	66	0.329	1:3,000				10
Spain	40,281	2,750	0.679	1:3,750				21
Sweden	9,060	620	0.684	1:5,600	18.8	56		38
United Kingdom	61,113	8,513	1.393	1:2,381	18		27	33
						56.2	(38.8)	
Croatia	4,489	108	0.241	1:3,300		17.2		8
Macedonia	2,067	110	0.532	1:3,980			9.5	20
Turkey	76,806	600	0.078	1:3,000				2
Iceland	307	7	0.228	1:8,344				19
Norway	4,661	274	1.030	1:8,642	21.3		27.8	51
						63.5		
Russia	140,041	2,200	0.64	1:10,080				16
Israel	7,234	510	0.774		17.04	43		

Sources of data are listed at the end of the main text.
Data for Bulgaria and Finland taken from Farrell [44].
Median age of survival was available for a minority of countries and is bracketed below the median age of death.

are essential to determine both outcomes and the appropriate funding required to provide an adequate service [12]. Fortunately, recent data are increasingly available for a number of European countries that have their own national CF registries [37–42].

Of 32 European countries where recent information was available, only 15 had a national CF registry; in 17 countries there was no current registry. Seventeen countries had submitted some patient data to the European CF Patient Registry in 2007, but from 4 countries the data were from only one CF centre and in some instances patient numbers fell below those estimated by local clinicians. Sixteen countries did not submit any data to the European CF Patient Registry in 2007 (Dr HV Olesen, personal communication). Undoubtedly, the lack of reliable pan-European data on CF is a major handicap to the monitoring of changes in patient treatment and care.

For many countries, there are no basic national data for prevalence of the condition, for median survival and median age of death of people with CF. So, the success of the European CF Patient Registry is of central importance, indeed essential, for the improvement of CF patient care [43]. Unfortunately, the collection of national patient data on this scale is time-consuming, expensive and difficult to achieve in clinics where staff are overworked and may fail to appreciate the ultimate benefits to their patients of time spent in this way.

10. Many European countries do not have outcome data on their patients

The present study was not designed (nor are the data of adequate accuracy) to compare the survival or median age of death in various European countries. However, the data

Table 2
Treatment of European CF population

Country	Neonatal screening	Number of CF centres	Centres with >50 patients	National guidelines available?	Follow ECFS standards?	Adequate staffing?	Funding of CF care?	Cost to families and patients?	National CF Registry?	Data to ECFS Registry?
Austria	YES	4	4	YES	YES	NO	GOV	NIL	YES	YES
Belgium	NO	7	7	NO	YES	NO	GOV	NIL	YES	YES
Bulgaria	NO	4	1			NO	GOV	SOME	YES	YES
Cyprus	NO	0	0	NO					NO	YES
Czech Republic	YES	4		YES	NO	NO	GOV	SOME	YES	YES
Denmark	NO	2	2	YES	YES	NO	GOV	NIL	YES	YES
Estonia		2	0	NO					NO	NO
Finland	NO	0	0	NO	NO				NO	NO
France	YES	49	49	YES	YES	YES	GOV	SOME	YES	NO
Germany	NO	93	36	YES	YES	NO	INS	NIL	YES	YES
Greece	NO	8	4	YES			GOV	NIL	NO	YES
Hungary	NO	12	4	YES	YES	NO	GOV	NIL	YES	YES
Ireland	YES	13		NO			GOV	NIL	YES	YES
Italy	YES	28	24	NO	YES	NO	GOV	NIL	YES	YES
Latvia	NO	1	0	NO	YES	NO	GOV	ADULTS/SOME	NO	NO
Lithuania	NO	0	0	NO	NO			NIL	NO	NO
Luxembourg	NO	0	0	NO			GOV	SOME	NO	NO
Malta	NO	1	0	Brompton	YES	YES	GOV	NIL	NO	NO
Netherlands	NO	7	7	YES	YES	YES	INS+GOV	SOME	YES	YES
Poland	YES	10	4	YES	NO	NO	GOV	SOME	NO	NO
Portugal	NO	5	3	NO	YES	NO	GOV	NIL	NO	YES
Romania	NO	6	2	NO		NO	GOV	ADULTS/SOME	YES	YES
Slovakia	YES	6	4	YES	NO	NO	INS	SOME	NO	NO
Slovenia		0	0	NO					NO	YES
Spain	YES	27	20	NO	YES		GOV	NIL	NO	NO
Sweden	NO	4	4	YES	YES	NO	GOV	SOME Max. €180 p.a.	YES	YES
United Kingdom	YES	48	38	YES	YES	NO	GOV	ADULTS/SOME	YES	YES
Croatia	NO	5	1	YES	NO	NO	HOSPITAL	SOME	YES	YES
Macedonia	NO	1	1		NO	NO	INS+GOV	SOME	NO	NO
Turkey	NO	7				NO	GOV/UNIV	ADULTS/SOME	NO	NO
Iceland	NO	1	0	NO	NO		GOV	NIL	NO	NO
Norway	NO	2	2	YES	YES	NO	GOV	SOME Max €250 p.a.	NO	NO
Russia	YES	42		YES			GOV			YES
Israel	NO	7	6	NO	YES		GOV	SOME	YES	YES

Abbreviations: Brompton, Royal Brompton Hospital, London; GOV, government; INS, insurance; UNIV, university. See text for further information.

reported by individual clinicians closely involved in CF care suggest that there is significant variation in both facilities and outcomes in different European countries. The median age of patients, the percentage of patients who are 16 years and over and the median age of death would all be expected to increase as CF patient care in a country improves. Recent data demonstrate obvious differences between countries particularly between those in Western and Eastern Europe confirming an urgent need for improvements in CF patient care in several areas of Europe [43].

Those countries with well established CF centres and large patient populations had median patient ages of between 15 and 19 years. The median age of death all over Europe varied from 9.5 to 27 years and the percentage of patients over 16 to 18 years from approximately 17 to 56% (Table 1). Unfortunately, there was so little information on median survival that the figures can only be taken as a very approximate indicator of the situation. Nevertheless, there appears to be an association between large patient numbers and the presence of CF centres and a greater proportion of older patients and an increased median survival.

The marked variation in reported incidence of CF (range 1:1,800 in Slovakia to 1:25,000 in Finland) probably, not only reflects the frequency of CF mutations in the population, but also problems in the detection of the disease in many countries where there is no neonatal CF screening [44]. Where neonatal screening has been introduced, the incidence is likely to be more accurate. This is suggested by the relation between the reported incidence rate of CF and the existence of a neonatal screening program: most of the 9 countries with a relatively infrequent incidence rate of CF of 1:5,000 or above had no neonatal screening program in recent years. In some countries where there is no neonatal screening, the likely incidence of CF has also been estimated from studies examining the carrier rate of CF mutations in the population [45]. The knowledge of the presence of a single mutation in a person with symptoms suggestive of CF can also lead to over diagnosis [46].

11. The relationship of prevalence to incidence

As a relatively crude indicator of the standard of CF care, and thus survival, in a particular country, the relationship between the estimated incidence at birth, the number of people with CF surviving and the total population may give some broad indication of their fate. One assumes that the incidence at birth would remain the same throughout life if the disease was completely controlled and all survived as did the unaffected population. The percentage below this expected incidence (total population divided by incidence) would give some indication of the chances of survival. We have calculated this for countries where adequate data are available. It appears that a larger proportion of the infants with CF survive in countries where the care facilities appear to be more adequate – for example in some countries nearly 40% of the expected number survive, whereas in other countries, less than 10% survive (Table 1).

12. Neonatal screening for CF

Early diagnosis is an important issue that has been considered as part of the activities of EuroCareCF Workpackage 3. Our survey revealed that although national neonatal CF screening is performed in only 10 of 34 countries, some 59% of the European population is screened. In 2 of these 10 countries only certain regions undertake neonatal screening. Although the evidence of the benefits of neonatal screening, with early diagnosis and treatment, are now well documented, it is important to emphasize that to achieve these benefits, early diagnosis must be followed by a high standard of CF care. If this care is not available, it is unlikely that neonatal screening will have a significant favourable effect on either the health or survival of affected children [47].

It is interesting that some of the countries with major CF centres and recognised excellent outcomes such as Denmark, Netherlands, Belgium, Sweden and Israel have not yet introduced national neonatal CF screening. Nonetheless, evidence of early chest involvement is accumulating [48] and while good care will minimise the short and medium effects of early pulmonary damage [10], in the absence of neonatal screening some infants will not be diagnosed until extensive irreparable damage to the lungs has occurred. It is likely that this early damage will be irreversible and progressive and will eventually compromise long term health and survival. It is increasingly obvious that neonatal CF screening, diagnosis and intensive treatment will be required to achieve the best results. This will be essential when treatments for the basic defect become available.

13. Difficulties with providing CF care in some European countries

There are a number of examples where there is great difficulty in delivering a standard of care which in any way approaches that recommended by the ECFS. In Latvia, for example, up until the 1970s, the mean duration of survival did not exceed 1–2 years. CF specialists from Sweden made a major contribution to improvements in the survival of Latvian CF patients, by providing the latest ideas about CF patient management and a great deal of advice and practical experience from the Stockholm CF Centre. Inhalators and medicine were brought as humanitarian aid. The median age of survival is presently 22 years in Latvia.

A consistent problem in Eastern European countries is the lack of CF centres as defined by the European consensus [9], with an associated lack of a multidisciplinary CF care team. There are in addition frequent problems in obtaining medicines and other treatment devices free of charge for patients. There are few transplantation programs, and patients are referred to other countries for transplantation (mostly to Vienna, Austria).

14. Actions carried out by EuroCareCF WP1 to improve the situation

Another task of EuroCareCF WP1 was to establish networks for each clinical care speciality:

- The network of physicians was established initially with the help of the ECFS of which most paediatricians and physicians working in the CF field across Europe are members. Thus, ECFS membership lists were invaluable in establishing contacts with CF doctors to set up EuroCareCF activities and allowed us to develop the physicians' network including countries of Eastern Europe (376 physicians and paediatricians from over 30 countries joined the network).
- Information on the network for physiotherapists was obtained from the membership list of IPG-CF (International Physiotherapy Group for Cystic Fibrosis; www.cfww.org/ipg-cf/). This professional group is organized as follows: there are 5 people on the board and approximately 60 contact persons from European countries (about 2 per country).
- A network for CF nurses has been in existence for a number of years, with 204 nurses coming from European countries.
- The psychologists/psychiatrists network has 37 European members, but just 4 are from Eastern European countries. Also social workers have been included, as a subgroup, in this network.
- The dieticians/nutritionists network has 35 members from Europe, including both dieticians and physicians.
- Currently an international network for pharmacists does not exist.

The existence of a network of National CF Associations (CF Europe) has had the effect of improving communication with those involved in CF patient care.

Finally, training grants were provided by WP1 of EuroCareCF to send a professional involved in the care of CF patients to a specific institution or to attend a specialized course to receive further training. Alternatively, training grants were used to bring an experienced CF team member to a specific CF centre to give specialist training to a group of trainees.

15. Future perspective and actions

There are few conditions where outcome is so dependent on treatment and where treatment is so complex, time consuming, changing and improving all the time. There are obvious and significant differences between the standard of care delivered and outcomes for people with CF in various European countries; obviously expectations differ in various countries. Some of the means to be considered to achieve a more uniform standard of good CF patient care are as follows:

- One or more teams of CF professionals in each country should be identified that would form a nucleus of expertise to demonstrate and spread the principles of good practice. These would be sited in one or more of the large cities where there is the possibility of attracting a substantial number of patients. A nucleus of dedicated staff with a significant proportion of their time devoted to CF care and a clinic of ideally more than 50 patients are essentials to develop a high standard of CF care and improve services – in fact, to develop a CF centre, for without such a development it is unlikely care will improve.
- Special consideration should be given to small clinics which, of necessity, will always have few patients (e.g. Malta, Cyprus, and Iceland). Some form of shared care with regular visits by CF specialist from a major centre, as now occurs between Malta and the Royal Brompton Hospital in London, as well as for Latvia and the Stockholm CF Centre, would be a reasonable compromise.
- Sufficient funding to support the CF staff and facilities at a CF centre must be achieved. Although the physical facilities in the hospital and outpatients are important, it is the staff and their time, knowledge and sufficient patients, which are essential to improve the service. Some specific actions were taken to urge politicians and administrators allocating money and resources to establish CF teams according to the ECFS document on standards of care for CF patients [9]. For example, during the V4-CF Conference (Kraków, Poland, 20–22 November 2008) detailed discussions were held about the priorities for allocation of funding, staff resources, facilities and devices. During a public ceremony, the document listing the agreed priorities was signed by physicians, local representatives of CF Patient Organizations, the President of CF Europe and the leader of WP1 on behalf of EuroCareCF. This document was then presented to policy makers in each of the Visegrad Group of countries (Czech Republic, Hungary, Poland and Slovakia) and its progress then followed-up by local patient organizations. In addition, during their visit to the CF Centre at Košice, Slovakia, the CF care team from Göteborg, Sweden took part in a meeting with local hospital authorities to discuss how to implement a proper CF Team dealing with the shortage of resources, but also relying on the experience of other countries. It is not possible to force any country or even any hospital to undertake actions without being sensitive to their circumstances. Only effective lobbying of hospital administrators and government policy makers will lead to success. This means understanding that making available resources at the beginning leads to the saving of resources later in terms of survival and quality of life of patients, their families and society as a whole.
- Obviously supporting services such as microbiology, biochemistry, clinical physiology and medical physics are very important, but will only develop if there is demand for their services (i.e. if there are sufficient patients).
- Early diagnosis is important and neonatal screening should be introduced at the same time as CF centres are established. Screening if not followed by good care is of little benefit.
- Although our survey did not examine the treatments available to patients, it is likely that the cost of the particularly expensive treatments will prove to be a continuing problem in some countries. However, if treatment of chest infection is early and vigorous and combined with the early introduction of physiotherapy and mucolytic treatment, chronic infection may be prevented for many years. As a result, the need for more expensive treatments is considerably reduced [40].
- It is essential that CF centres have a patient registry and that they submit their patient data to both national and European CF Registries. Only then will their progress be monitored, outcomes compared and the need for changes identified. The collection of data is time consuming and the immediate rewards for staff involved are often not obvious.
- Training visits are of major importance and should be encouraged. Visits by professionals from developing centres to established centres are preferable to established teams from major centres visiting smaller developing clinics – a practice which may seriously affect the work at the major centre, in the case of smaller teams where there is just one member for each speciality. If the staff from the developing clinic visit an established centre, they can see not only the team in action, attend CF clinics, ward rounds and team meetings, but also meet all other professionals involved in the care of CF patients, including microbiologists, biochemists and radiologists.
- Readily available publications such as the ECFS consensus documents are obviously appreciated and familiar to many professionals treating people with CF. It must be stressed that the basic principles of good CF care remain much the same apart from the greater precautions to avoid cross infection in recent years.
- CF parent and patient associations are essential and should be encouraged. In collaboration with CF professionals, these associations have a major role in improving care. In many countries with reasonably developed CF services, they have been responsible for many major advances in care and can act as a pressure group on the health authorities and Government. The UK CF Trust is a good example of such an organisation that has been responsible for or initiated many of the advances in CF care in the UK. A national CF organisation, working with professionals who provide care, acts as a permanent force to improve treatment and facilities.

16. Conclusions

It is crucial not to waste all the enthusiasm and work undertaken by EuroCareCF participants and as a consequence of the training grants financed by EuroCareCF. However, future programmes have to take into account the great amount of work that remains outstanding. It is encouraging that there are many people with a very high level of commitment to improving the care of people with CF. It is also important that scientific interests are encouraged. Members of EuroCareCF WP1 are available for facilitating contacts between all the members of the CF community and colleagues in different countries of which names and e-mail addresses have been collected for the specialist networks developed by WP1. This is a source for contacts and mutual exchanges. Changing social, economic and health management issues is by no means easy, but it may become possible with the leadership and co-ordinated efforts of the many skilled and experienced colleagues in our continent.

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Conflict of interest

Both authors state that there is no conflict of interest.

References

[1] Valerius NH, Koch C, Hoiby N. Prevention of chronic *Pseudomonas aeruginosa* infection in cystic fibrosis by early treatment. Lancet 1991;338:725–6.

[2] Frederikson B, Lanng S, Koch C, Høiby N. Improved survival in

the Danish center-treated cystic fibrosis patients: results of aggressive treatment. Pediatr Pulmonol 1996;21:153–8.
[3] Lebecque P, Leal T, Zylberberg K, Reychler G, Bossuyt X, Godding V. Towards zero prevalence of chronic *Pseudomonas aeruginosa* infection in children with cystic fibrosis. J Cyst Fibros 2006;5:237–44.
[4] Farrell PM, Kosorok MR, Rock MJ, et al. Early diagnosis of cystic fibrosis through neonatal screening prevents severe malnutrition and improves long-term growth. Pediatrics 2001;107:1–13.
[5] Castellani C, Southern KW, Brownlee K, et al. European best practice guidelines for cystic fibrosis neonatal screening. J Cyst Fibros 2009;8:153–73.
[6] Cystic Fibrosis Foundation. Clinical Practice Guidelines for Cystic Fibrosis. Bethesda, MD: Cystic Fibrosis Foundation; 1997
[7] Mahadeva R, Webb K, Westerbeek RC, Carroll NR, Dodd ME, Bilton D. Clinical outcome in relation to care in centres specialising in cystic fibrosis: cross sectional study. BMJ 1998;316:1771–5.
[8] Standards for the clinical care of children and adults with cystic fibrosis in the UK. Cystic Fibrosis Trust Clinical Standards and Accreditation Group. London: Cystic Fibrosis Trust; 2001.
[9] Kerem E, Conway S, Elborn S, Heijerman H for the Consensus Committee. Standards of care for patients with cystic fibrosis: A European consensus. J Cyst Fibros 2005;4:7–26
[10] Sims EJ, Clark A, McCormick J, Mehta G, Connett G, Mehta A. Cystic fibrosis diagnosed after 2 months of age leads to worse outcomes and requires more therapy. Pediatrics 2007;119:19–28.
[11] Sims EJ, McCormick J, Mehta G, Mehta A. Newborn screening for cystic fibrosis is associated with reduced treatment intensity. J Pediatr 2005;147:306–11.
[12] Padman R, McColley SA, Miller DP, et al. Investigators and coordinators of the epidemiologic study of cystic fibrosis. Infant care patterns at epidemiologic study of cystic fibrosis sites that achieve superior childhood lung function. Pediatrics 2007;119:531–7.
[13] Cheng K, Smyth RL, Motley J, O'Hea U, Ashby D. Randomized controlled trials in cystic fibrosis (1966–1997) categorized by time, design, and intervention. Pediatr Pulmonol 2000;29:1–7.
[14] Briggs TA, Bryant M, Smyth RL. Controlled clinical trials in cystic fibrosis – are we doing better? J Cyst Fibros 2006;5:3–8.
[15] Cystic Fibrosis Foundation Guidelines for Patient Services, Evaluation, and Monitoring in Cystic Fibrosis Centers. Cystic Fibrosis Foundation Center Committee and Guidelines Cystic Fibrosis Foundation Subcommittee. Am J Dis Child 1990;144:1311–2.
[16] Döring G, Conway SP, Heijerman HG, et al. Antibiotic therapy against *Pseudomonas aeruginosa* in cystic fibrosis: a European consensus. Eur Respir J 2000;16:749–67.
[17] Döring G, Høiby N for the Consensus Study Group. Early intervention and prevention of lung disease in cystic fibrosis: a European consensus. J Cyst Fibros 2004;3:67–91.
[18] Sinaasappel M, Stern M, Littlewood J, et al. Nutrition in patients with cystic fibrosis: a European Consensus. J Cyst Fibros 2002;1:51–75.
[19] Malfroot A, Adam G, Ciofu O, et al. Immunisation in the current management of cystic fibrosis patients. J Cyst Fibros 2005;4:77–87.
[20] Edenborough FP, Borgo C, Knoop C, et al. Guidelines for the management of pregnancy in women with cystic fibrosis. J Cyst Fibros 2008;7(Suppl 1):S1–32.
[21] Castellani C, Cuppens H, Macek Jr M, Consensus on the use and interpretation of cystic fibrosis mutation analysis in clinical practice. J Cyst Fibros 2008;7:179–96.
[22] Mayell SJ, Munck A, Craig JV, et al. A European consensus for the evaluation and management of infants with an equivocal diagnosis following newborn screening for cystic fibrosis. On behalf of the European Cystic Fibrosis Society Neonatal Screening Working Group. J Cyst Fibros 2009;8:71–8.
[23] Elborn JS, Hodson M, Bertram C. Implementation of European standards of care for cystic fibrosis – provision of care. J Cyst Fibros 2009;8:348–55.
[24] Elborn JS, Hodson ME, Bertram C. Implementation of standards of care for cystic fibrosis – control and treatment of infection. J Cyst Fibros 2009;8:211–7.
[25] Phelan P, Hey E. Cystic fibrosis mortality in England and Wales and Victoria Australia. Arch Dis Child 1984;59:71–3.
[26] Wood RE, Piazza F. Survival in cystic fibrosis: correlation with treatment in three cystic fibrosis centers. 10th International Cystic Fibrosis Congress, Sydney. Excerpta Medica Asia Pacific Services 1988;74:89.
[27] Corey M, McLaughlin FJ, Williams M, Levison H. A comparison of survival growth and pulmonary function in patients with cystic fibrosis in Boston and Toronto. J Clin Epidemiol 1988;41:588–91.
[28] UK Cystic Fibrosis Trust CF Patient Registry. 2008. (http://www.cftrust.org.uk)
[29] US Cystic Fibrosis Foundation Patient Registry. 2008 (http://www.cff.org)
[30] Quinton H. Using data to identify opportunities for change and to monitor progress. Pediatr Pulmonol Suppl 2004;27:124–5.
[31] Quinton HB. O'Connor GT. Current issues in quality improvement in cystic fibrosis. Clin Chest Med 2007;28:459–72.
[32] Warwick WJ, Manson S. Life table studies of mortality. In: Rossi E, Stoll E (eds.). Cystic Fibrosis Part I. Physiology and pathophysiology of serum secretion clinical investigation and therapy. Proc 4th Int Conf on CF. Geigy Symposium Berne/Grundewald 1966 (Modern Problems in Pediatrics Vol 10). Karger: Basle and New York; p. 353.
[33] Nielsen OH, Schoitz O. Cystic fibrosis in Denmark in the period 1945–1981. Evaluation of centralized treatment. Acta Paediatr Scand Suppl 1982;301:107–19.
[34] Vasquez Cordero C, Idigoras Ayastuy G, Galardi Andonegui MS, et al. Survival rates of children with cystic fibrosis. Anales Espanoles de Pediatria 1990;32:407–12.
[35] Merelle ME, Schouten JP, Gerritsen J, Dankert-Roelse JE. Influence of neonatal screening and centralized treatment on long-term clinical outcome and survival in CF patients. Eur Resp J 2001;18:306–15.
[36] Lebecque P, Leonard A, De Boeck K, et al. Early referral to cystic fibrosis specialist centre impacts on respiratory outcome. J Cyst Fibros 2009;8:26–30.
[37] Stern M, Wiedemann B, Wenzlaff P. German Cystic Fibrosis Quality Assessment Group. From registry to quality management: the German Cystic Fibrosis Quality Assessment project 1995–2006. Eur Respir J 2008;31:29–35.
[38] Bilton D, MacNeill SJ, Cullinan P, Larsen A. Cystic fibrosis in the UK: A review of the 2007 data. Pediatr Pulmonol Suppl 2009;32:378.
[39] Mei-Zahay M, Yahav Y, Kerem E, et al. The Israeli cystic fibrosis database – genetic and clinical characteristics. Pediatr Pulmonol Suppl 2009;32:378.
[40] Lindblad A, Hjelte L, Mared L, et al. Differences in treatment and outcome between the USA and Sweden. Pediatr Pulmonol Suppl 2009;32:376.
[41] Gunn E, Osmond J, Baker M, Larsen A, Bilton D. A costing and severity banding exercise in patients with cystic fibrosis in the UK for 2007 and 2008. Pediatr Pulmonol Suppl 2009;32:394.
[42] Buzzetti R, Salvatore D, Baldo E, et al. An overview of international literature from cystic fibrosis registries: 1. Mortality and survival studies in cystic fibrosis. J Cyst Fibros 2009;8:229–37.
[43] McCormick J, Mehta G, Olesen HV, Viviani L, Macek M, Mehta A: European Registry Working Group. Comparative demographics of the European cystic fibrosis population: a cross sectional database analysis. Lancet 2010;375:1007–13.
[44] Farrell PM. The prevalence of cystic fibrosis in the European Union. J Cyst Fibros 2008;7:450–3.
[45] Bobadilla JL, Macek M, Fine JP, Farrell PM. Cystic fibrosis: A worldwide analysis of CFTR mutations – Correlation with incidence data and application to screening. Hum Mutat 2002;19:575–606.
[46] Kahre D. Personal communication, 2010.
[47] Chatfield S, Owen G, Ryley HC, et al. Neonatal screening for cystic fibrosis in Wales and the West Midlands: clinical assessment after five years of screening. Arch Dis Child 1991;66:29–33.
[48] Sly PD, Brennan S, Gangell C, et al. Lung disease at diagnosis in infants with cystic fibrosis detected by newborn screening. Am J Resp Crit Care 2009;180:146–52.