

Compliance with treatment in adult patients with cystic fibrosis

S P Conway, M N Pond, T Hamnett, A Watson

Abstract

Background – Patients with chronic disease comply with about 50% of their treatment. The complex and time consuming daily drug regimens needed in the care of adult patients with cystic fibrosis encourage non-compliance with prescribed treatments. Understanding the reasons for, and the extent of, non-compliance is essential for a realistic appraisal of the patient's condition and sensible planning of future treatment programmes.

Methods – Patients were invited to complete a questionnaire which asked about their compliance with daily treatment. The data were used to calculate a compliance score, the percentage of prescribed treatment taken, and to examine patient attitudes to each individual prescription. An assessment score derived from consultant, cystic fibrosis research fellow, specialist nurse, and physiotherapist ratings of patient compliance was compared with the compliance score. Both scores were correlated with patient characteristics and disease severity, and the compliance score was also correlated with the patient's knowledge of cystic fibrosis.

Results – More than half the patients claimed to take more than 80% of their treatments. Compliance with individual treatments varied according to their perceived unpleasantness and degree of infringement on daily activities. The most common reason given for omitting treatment was forgetfulness. Professional carers were poor judges of patient compliance. There was no correlation between compliance and patients' socio-demographic characteristics or their knowledge about cystic fibrosis.

Conclusions – Non-compliance is universal and should be recognised as normal behaviour. There are no reliable criteria for predicting any patient's level of compliance. Treatment protocols should be planned around individual patient's requirements, modifying treatment ideals where necessary according to the exigency and pattern of that patient's lifestyle.

(Thorax 1996;51:29-33)

Keywords: adult cystic fibrosis, compliance.

overestimate his patients' adherence to therapeutic regimens.¹ There is general agreement that only one third of patients adequately comply, one third partially comply, and one third fail to comply, so that overall compliance rates are about 50%.^{1,2} In chronic illness, coping mechanisms of denial and minimisation and attempts to assume "normality" and reduce anxiety can divert patients from optimal treatment.^{3,4} In order to change patients' behaviour we must recognise that a degree of non-compliance is normal,⁵ attempt to quantify it, and understand the likely factors that produce such behaviour in the individual patient. For patients receiving multiple treatments we must examine compliance with each individual treatment. This study was undertaken in an attempt to assess the degree of, and understand the nature of, compliance in a large adult population with cystic fibrosis.

Methods

Patients were asked to complete a questionnaire on daily compliance with 12 different commonly prescribed treatments; oral and nebulised antibiotics, vitamin supplements (A, D, and E), inhaled and oral corticosteroids, inhaled bronchodilators, insulin, glibenclamide, dietary supplements, pancreatic enzyme supplements, and physiotherapy. Patients prescribed any of the above on a daily basis indicated whether they adhered to the treatment regimen "every day or almost every day" (good compliance), "about 3-5 days a week" (moderate compliance), "less than 3 days a week" or "never" (poor compliance). For pancreatic enzyme supplements the questions were similarly phrased to show compliance with enzyme prescriptions for meals and snacks. Respondents were asked to indicate if any of the following reasons for non-adherence to prescribed treatments applied:

- (1) I'm not sure why I should be taking it;
- (2) I don't feel it makes any difference;
- (3) I tend to forget;
- (4) it takes a lot of effort/time to take it;
- (5) it makes me feel worse;
- (6) it tastes awful/makes the room smell (nebulised antibiotics only);
- (7) it's embarrassing (pancreatic enzyme supplements and physiotherapy only);
- (8) no time in the morning/too tired at night/ I do exercise instead (physiotherapy only); or
- (9) any other reasons.

Respondents could give more than one reason for non-compliance with any treatment. The

Regional Adult Cystic Fibrosis Unit,
Seacroft Hospital,
York Road,
Leeds LS14 6UH, UK
S P Conway
M N Pond
T Hamnett
A Watson

Correspondence to:
Dr S P Conway.

Received 3 May 1995
Returned to authors
11 July 1995
Revised version received
8 September 1995
Accepted for publication
12 September 1995

Compliance with appropriate and effective treatment programmes for cystic fibrosis will improve a patient's quality of life and prolong survival. The physician is, however, likely to

questionnaire was explained individually to each patient. Respondents were given the option to complete the questionnaire anonymously.

Basic data were collected on each patient to provide a patient profile:

- (1) age and sex;
- (2) employment status;
- (3) social class;
- (4) time as an inpatient during the preceding year;
- (5) number of inpatient treatments during the preceding year;
- (6) average % weight/height and forced expiratory volume in one second (FEV₁) during the preceding year;
- (7) Chrispin-Norman score,⁶ Shwachman-Kulczycki score⁷ (numerical scores, the former an assessment of the chest radiograph and the latter an overall clinical assessment, with higher and lower scores representing increasing disease severity, respectively);
- (8) disease severity scored on a visual analogue scale by both respondent and doctor (SPC). The difference between the patient's and the doctor's score was analysed by the Wilcoxon signed rank test.

Data from (5) to (8) were used to calculate an overall disease severity score. A compliance score estimating the percentage of prescribed treatment taken was calculated from the questionnaire answers. The consultant, registrar, physiotherapist, and specialist nurse were each asked to estimate and rate in quartiles com-

pliance for all patients without reference to the data. Correlations between these quartiles and those for the compliance score were measured by Goodman and Kruskal's gamma. Spearman rank correlation was used to assess any association between the assessment score, based on the average of the four carers' assessments, and the compliance score. Agreement between the physiotherapist's prediction of patient compliance and patients' reported compliance with physiotherapy was assessed by dividing predictions and responses into two categories. Good compliance was represented by physiotherapist allocation of patients to the highest two quartiles and patients reporting adherence to the physiotherapy regimen on at least five days a week.

The compliance score and the assessment score were correlated with patient characteristics and disease severity using the Wilcoxon-Mann-Whitney U test for sex, the Kruskal-Wallis one way analysis of variance for employment and social class, and by testing significance of the Spearman rank correlation coefficient for the other variables. Any association between questionnaire derived compliance scores, where respondents gave their name, and respondents' knowledge about cystic fibrosis determined from a multiple choice questionnaire, was assessed by testing the significance of the Spearman rank correlation coefficient.

Results

Eighty (88%) of 91 patients responded to the questionnaire. Seventy six (95%) gave their names, of whom 40 were women. The median patient age was 22 years (range 14-40). The median number of prescriptions per patient was seven (range 2-11).

Patient self rating of disease severity on a visual analogue scale of 0-10 was shifted to the left (less severe) when compared with physician (SPC) rating ($p=0.001$). Compliance with therapy varied with the different treatments assessed (table 1).

Some reasons given for non-compliance were specific to certain therapies - for example, "embarrassment" (pancreatic enzymes and physiotherapy), "do exercise instead" (physiotherapy), and "it tastes awful" (nebulised antibiotics and inhaled steroids). Other reasons were applicable to all 12 prescriptions (table 2). The most common reason given for omitting treatment was "I tend to forget", which accounted for 66% of missed vitamin supplements, 64% of missed oral antibiotics, 55% of missed pancreatic enzyme supplements, 50% of missed inhaled corticosteroids, and 29% of missed dietary supplements. The degree of effort and time needed for adherence to prescriptions for nebulised antibiotics, dietary supplements and inhaled bronchodilators accounted for 60%, 41%, and 41% of missed doses, respectively. Respondents gave more than twice as many reasons for not doing physiotherapy as for any other treatment studied. The major reasons for omitting physiotherapy were the time and commitment it

Table 1 Compliance in different areas of treatment

	No. of prescriptions	Compliance: number (%)		
		Good	Moderate	Poor
Insulin/glibenclamide	13	13 (100)		
Pancreatic enzymes*	78	66 (85)	10 (12)	
Vitamin E supplements	76	64 (84)	11 (15)	1 (1)
Oral antibiotics	71	59 (83)	10 (14)	2 (3)
Oral corticosteroids	10	8 (80)	2 (20)	
Inhaled steroids	18	14 (78)	4 (22)	
Inhaled bronchodilators	51	35 (69)	10 (20)	6 (11)
Nebulised antibiotics*	48	31 (65)	13 (27)	3 (8)
Dietary supplements*	48	24 (50)	17 (35)	6 (15)
Physiotherapy*	80	33 (41)	18 (23)	27 (34)
Pancreatic enzymes* with snacks	78	30 (38)	28 (36)	14 (20)

* Between one and six respondents did not answer these questions.

Table 2 Reasons for omitting therapy

	No. of times given as reason for non-compliance by patients	% of total reasons given
I tend to forget	141	34.5
A lot of effort to take/takes too long	128	31.4
I don't think they make any difference	53	12.9
I do exercise instead (physiotherapy only)	30	7.4
It's embarrassing (pancreatic enzymes and physiotherapy only)	18	4.4
They make me feel worse	12	4.4
They taste awful (nebulised antibiotics and inhaled corticosteroids)	5	1.2
I'm not sure why I should be taking them	3	0.7
Other reason*	18	4.4
Total	408	100.0

* Take just when I feel I need (inhaled bronchodilators) (n=7).
 Too "full" (dietary supplements) (n=4).
 Too expensive (dietary supplements) (n=2).
 Too difficult to swallow (vitamin E tablets) (n=1).
 Take only when worse (nebulised antibiotics) (n=1).
 Omit when too drunk to draw up into syringe (insulin) (n=1).
 Resent doing (physiotherapy) (n=1).
 Don't like admitting sick role (physiotherapy) (n=1).

Table 3 Correlations between different carers' assessments of patient compliance, and between carers' assessment and patients' compliance score

	Registrar	Physiotherapist	Nurse	Score
Consultant	0.57	0.72	0.58	0.09
Registrar		0.63	0.55	0.22
Physiotherapist			0.62	0.37
Specialist nurse				0.26

Table 4 Relationship of patients' characteristics to questionnaire compliance score and carers' assessment score (significance = higher compliance)

	Compliance score	Carers' score
Age	p<0.05 (younger)	NS
Sex	NS	NS
Employed	NS	p<0.05 ¹
Social class	NS	p<0.001 (higher)
Number of admissions	NS	NS
Number of outpatient visits	NS ²	NS
% weight/height	NS	NS
% predicted FEV ₁	NS	NS
Severity score	NS	NS

¹ Employment categories in descending order of median compliance score were: student/housewife, part-time, full-time, unemployed.

² Using only the five most commonly prescribed treatments, patients with more outpatient visits had higher compliance scores (p<0.05).

demands (44%), a preference for exercise instead (27%), and a perception that it makes no difference (13%). Nineteen patients only did chest physiotherapy "when my chest is bad".

Two patients had very low compliance scores of 10% and 28%. The scores in the remainder were: 50–59% (three patients), 60–69% (four patients), 70–79% (13 patients), 80–89% (27 patients), 90–99% (23 patients), and 100% (eight patients). Correlations between carers' assessments of patients' compliance, rated in quartiles, and between these assessments and the quartiles for the questionnaire derived compliance scores, are shown in table 3. The Spearman rank correlation coefficient between the assessment score, based on the average of the four carers' assessments and the questionnaire score was 0.31. Analysis of the physiotherapist's prediction of patient compliance and reported compliance with physiotherapy showed agreement in 67% of cases.

The influence of patient characteristics on both the compliance score and the assessment score are shown in table 4. When considering the five most commonly prescribed treatments, patients with more outpatient visits showed greater compliance (p<0.05). The significance of the relationship seems to depend on a few very frequent attenders with good compliance and a few very poor compliers with relatively few attendances. Taking 85% compliance with the five treatments as a cut-off point (dividing the patients into equal halves), the more compliant subjects had more outpatient visits (p=0.01). Correlation between respondents' knowledge of cystic fibrosis determined by a multiple choice questionnaire and the compliance questionnaire score was not significant.

Discussion

Patient compliance, "the extent to which a person's behaviour (in terms of taking medication, following diets, or executing lifestyle changes) coincides with medical or health advice",⁸ is complex, inconsistent,^{9,10} and poorly understood. The degree of compliance across all medical prescriptions lies between 30% and 70%, with approximately half of patients with chronic disease showing non-compliance.^{8,11} Because of the chronicity of cystic fibrosis and the necessity for multiple daily medications (the median number of daily prescriptions per patient in this study was seven), patients are likely to have a high degree of non-compliance.^{12–14} Moreover, the demands of cystic fibrosis have to be balanced with those of work, family, and other relationships. This becomes more difficult in adolescence and adult life, compliance tending to decrease with increasing age.^{9,15,16}

Young adults with cystic fibrosis are generally well adjusted at school, work, and home^{17–21} but may experience depression and anxiety when ill, and deny both present symptoms and eventual outcome when well.^{18,19,22,23} Denial is found in all chronic illness groups,²⁴ and tends to increase with age to facilitate emotional adjustment to adult life.¹⁹ Our own adult respondents saw themselves as less severely ill than did their doctor, a common misperception of personal health status.^{20,23,25} Coping mechanisms involving denial and minimisation will tend to subvert optimal treatment regimens by encouraging a rejection of clinical advice. These are responses that must be taken into account when planning overall treatment.

Self-assessment may overestimate compliance by up to 20%²⁶ but agrees well with more objective assessments when done in a non-judgemental and non-threatening way.^{20,27,28} Overall compliance in this study was good with over half the respondents claiming to take more than 80% of their treatments. Others report similar results.^{16,20,29} The greater compliance found in cystic fibrosis compared with other chronic diseases probably reflects patient focus on the short term benefits of treatment and the immediacy of unpleasant symptoms consequent on non-compliance.²⁵ The much greater compliance shown by our own respondents with diabetic medication and pancreatic enzyme supplements with meals, as compared with that with nebulised antibiotics, dietary supplements, physiotherapy, and enzyme supplements with snacks, probably reflects this outlook.

The natural tendency to forget was the most common reason given for omitting treatment (34% of responses). The second most common reason for non-compliance was the commitment in effort and time demanded by the treatment regimen (31% of responses). The least difficult programmes and those requiring the least alteration to lifestyle will tend to be favoured.^{9,13} Physiotherapy, dietary supplements, and nebulised therapies are low priorities for most patients as they require the most planning and interfere the most with daily life.^{9,25,29} The third most common reason given

for omitting therapy was a perception that the treatment did not make any difference (13% of responses) – for example, 19 patients only did chest physiotherapy during a respiratory exacerbation, and seven only took inhaled bronchodilators when symptomatic. Given the above plethora of influences governing patient action it is not surprising that compliance varies with each of the treatments evaluated.^{9 25}

The dislike of, and non-compliance with, physiotherapy is universal, with most studies, as ours, reporting approximately only half of patients with good compliance.^{25 29} The 80 respondents gave 111 reasons for not doing physiotherapy, 49 relating to the time and effort needed, and 30 citing a preference for exercise, an activity with good peer group acceptability.

On only three occasions was "I'm not sure why I should be taking the treatment" given as the reason for non-compliance. Physicians and allied professionals caring for adults with cystic fibrosis can testify to the high degree of patient knowledge about their medication. There was no significant correlation between patients' compliance and their knowledge about cystic fibrosis in general. We would argue that education alone^{5 10 29 30} will not be enough to improve compliance.³¹

The assessment scores of patient compliance showed good concordance but little or no correlation with the patient's questionnaire compliance score. This agrees with most,^{1 14} but not all,^{16 25} previous studies. Doctors, physiotherapists, and nurses must be aware of the likelihood that they will overestimate compliance and may only become aware of this when medical complications show, and further irreversible lung damage has occurred. Cystic fibrosis carers may be better at assessing patient compliance within their own specialised area. The physiotherapist's assessment showed better agreement with patients' compliance with physiotherapy than with patients' compliance with treatment in general.

The subjective views of the four carers may also reflect personal value judgements, with students, the employed, and the higher social classes being seen as most compliant. The questionnaire score showed no effect on compliance of any sociodemographic factor, or of any marker of disease severity, a result consistent with previous work.^{9 10 25 30} This underlines the unreliability of predicting individual patient compliance.

How might we improve patient compliance? Physiotherapy is our most prescribed therapy yet had the second lowest compliance rate. Patients struggling to adhere to a particular physiotherapy regimen might find alternative methods less onerous. Full use should be made of educational aids such as models of the bronchial tree and lungs (Adam Rouilly, manufacturers) to underline the rationale of physical treatment. Patients with generally poor compliance might benefit from small group interactive sessions, gaining from peer support and the knowledge that others have similar difficulties. Time management skills might help those who cannot fit their therapies into their routine lives. With adequate resources, greater

support could be given in the home by the cystic fibrosis specialist nurse and community physiotherapist. Self-monitoring by respiratory function tests, recording of weight, and sputum volume, should be encouraged both as a feedback to patients of the efficacy of their self-treatment, and as an indicator as to when to increase the intensity of their treatment.

It is axiomatic that an attempt to assess patient adherence to treatment regimens should be made at each contact between doctor and patient, with encouragement within a secure and friendly relationship^{10 13 27} to discuss all aspects of the disease as patients grow into adolescence.²² Emphasis on the need for compliance must be accompanied by information that gives hope. We must convince patients that their actions in taking treatment make a difference, recognise that there is no single treatment regimen for all patients, simplify treatment as much as possible, provide close monitoring, extensive follow up and adequate supervision, and always try to be non-judgemental, accepting that non-compliance is the norm.⁵

The data showed a significant association between the frequency of outpatient attendance and compliance when the five most commonly prescribed therapies were considered. Statistics cannot demonstrate cause and effect. More compliant patients may attend outpatients more regularly, or patients may be more compliant as a result of more frequent outpatient attendance. Yet we hypothesise that the significantly greater compliance shown by patients who attended outpatients more frequently reflects a positive outcome from more doctor-patient contacts during which time the above principles are espoused. This may in turn be partly responsible for the improved clinical status seen in patients with more frequent hospital contacts.³²

- 1 Sackett DL, Snow JC. The magnitude of compliance and non-compliance. In: Haynes RB, Taylor DW, Sackett DL, eds. *Compliance in health care*. Baltimore, Maryland: The John Hopkins University Press, 1979:11–22.
- 2 Wright EC. Non-compliance – or how many aunts has Matilda? *Lancet* 1993;342:909–13.
- 3 Lazarus RS. The costs and benefits of denial. In: Breznitz S, ed. *Denial of stress*. New York: International Universities Press, 1983:1–30.
- 4 Suls J, Fletcher B. The relative efficacy of avoidant and non-avoidant coping strategies: a meta-analysis. *Health Psychol* 1985;4:249–88.
- 5 Lask B. Non-adherence to treatment in cystic fibrosis. *J R Soc Med* 1994;21 (Suppl):25–7.
- 6 Chrispin AR, Norman AP. The systematic evaluation of the chest radiograph in cystic fibrosis. *Pediatr Radiol* 1974;2: 101–5.
- 7 Shwachman H, Kulczycki LL. Long-term study of one hundred and five patients with cystic fibrosis. *Am J Dis Child* 1958;96:6–15.
- 8 Haynes RB. Introduction. In: Haynes RB, Taylor DW, Sackett DL, eds. *Compliance in health care*. Baltimore, Maryland: The John Hopkins University Press, 1979:1–7.
- 9 Gudas LJ, Koochur GP, Wypij D. Perceptions of medical compliance in children and adolescents with cystic fibrosis. *J Dev Behav Pediatr* 1991;12:236–42.
- 10 Jay S, Litt IF, Durant RH. Compliance with therapeutic regimens. *J Adolesc Health Care* 1974;5:124–36.
- 11 Epstein LH, Cluss PA. Behavioural medicine perspective on adherence to long term medical regimens. *J Consult Clin Psychol* 1982;50:950–71.
- 12 Haynes RB. Determinants of compliance: The disease and the mechanics of treatment. In: Haynes RB, Taylor DW, Sackett DL, eds. *Compliance in health care*. Baltimore, Maryland: The John Hopkins University Press, 1979: 49–62.
- 13 Francis V, Korsch BM, Morris MJ. Gaps in doctor-patient communication. *N Engl J Med* 1969;280:535–40.
- 14 Rapoff MA, Christophersen ER. Compliance of paediatric patients with medical regimens: a review and evaluation.

- In: Stuart RB, ed. *Adherence, compliance and generalisation in behavioural medicine*. New York: Brunner/Mazel, 1982: 79-124.
- 15 Czajkowski DR, Koocher GP. Medical compliance and coping with cystic fibrosis. *J Child Psychol Psychiatry* 1987; 28:311-9.
 - 16 Meyers A, Dolan TF, Mueller D. Compliance and self medication in cystic fibrosis. *Am J Child* 1975;129:1011-3.
 - 17 Blair C, Cull A, Freeman CP. Psychosocial functioning in young adults with cystic fibrosis and their families. *Thorax* 1994;49:798-802.
 - 18 Bywater EM. Adolescents with cystic fibrosis: psychosocial adjustment. *Arch Dis Child* 1981;56:538-43.
 - 19 Cowen L, Corey M, Simmons R, Keenan N, Robertson J, Levison H. Growing older with cystic fibrosis: Psychologic adjustment of patients more than 16 years old. *Psychosom Med* 1984;46:363-76.
 - 20 Shepherd SL, Hovell MF, Harwood IR, et al. Comparative study of psychosocial assets of adults with cystic fibrosis and their healthy peers. *Chest* 1990;97:1310-6.
 - 21 Moise JR, Drotar D, Doershuk CF, Stern RC. Correlates of psycho-social adjustment among young adults with cystic fibrosis. *J Dev Behav Pediatr* 1987;8:141-8.
 - 22 Boyle IR, diSant'Agnese PA, Sack S, Millican F, Kulczycki LL. Emotional adjustment of adolescents and young adults with cystic fibrosis. *J Pediatr* 1976;88:318-26.
 - 23 Strauss GD, Wellisch DK. Psychosocial adjustment in older cystic fibrosis patients. *J Chron Dis* 1981;34:141-6.
 - 24 Zeltzer L, Kellerman J, Ellenberg LJ, Rigler D. Psychological effects of illness in adolescents II. Impact of illness in adolescents - crucial issues and coping styles. *J Pediatr* 1980;97:132-8.
 - 25 Abbott J, Dodd M, Bilton D, Webb AK. Treatment compliance in adults with cystic fibrosis. *Thorax* 1994;49: 115-20.
 - 26 Haynes RB. Strategies for enhancing patient compliance. *Drug Therapy* 1982;January:33-40.
 - 27 Litt IF. Know thyself - adolescent self assessment of compliance behaviour. *Pediatrics* 1985;75:693-6.
 - 28 Jay S, DuRant RH, Litt IF, Linder CW, Shoffitt T. Comparison of the use of riboflavin: self report and serum norethindrone as indicators of adolescent compliance with oral contraceptives. *Am J Dis Child* 1984;138:70-3.
 - 29 Passero MA, Remor B, Salomon J. Patient reported compliance with cystic fibrosis therapy. *Clin Pediatr* 1981;20: 264-8.
 - 30 Hulka BS, Cassel J, Kupper L, Burdett EJA. Communication, compliance and concordance between physicians and patients with prescribed medications. *Am J Publ Health* 1976;66:847-53.
 - 31 Litt IF, Cluskey WR. Compliance with medical regimens during adolescence. *Pediatr Clin North Am* 1980;27:3-15.
 - 32 Wood RE, Piazza F. Survival in cystic fibrosis: correlation with treatment in three cystic fibrosis centres. *10th International Cystic Fibrosis Congress, Sydney. Excerpta Medica Asia Pacific Congress Series* 74, 1988:79.