



Health related quality of life in cystic fibrosis: To work or not to work?

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Abstract

Background: The present study investigated whether patients with CF who are studying or working report a better HRQoL in comparison to non-working/studying patients.

Methods: 57 adult CF patients completed the Cystic Fibrosis Questionnaire—Revised, a CF-specific measure of HRQoL. Medical condition was quantified in terms of FEV1 % predicted, BMI, Pseudomonas aer. status, pancreatic status (PS), having an indwelling catheter device (PAC), CF Related Diabetes Mellitus and nutritional status.

Results: Mean age was 26.7 years (SD 8.1), mean FEV1 % predicted was 65.09 (SD 22.18), mean BMI was 21.23 (SD 3.45). FEV1 % predicted was related to HRQoL domains Physical Functioning and General Health ($r=0.27$ and 0.38 respectively, $p<0.05$). A higher BMI was associated with better scores on Eating Disturbances (= fewer problems; $r=0.44$, $p<0.01$) and a better perception of Weight ($r=0.43$, $p<0.01$) and Body Image ($r=0.28$, $p<0.05$). Analysis of variance showed that specific domains of HRQoL were related to diabetes (Weight), taking caloric supplements (Body Image and Weight) and/or PAC (Physical Functioning, Treatment Burden, Role, Weight). Twenty-four patients worked/studied, these patients had a higher FEV1, and fewer had Pseudomonas aer. or a PAC or took high caloric supplements, compared to non-working/studying patients. After controlling for medical parameters, patients who were working/studying scored higher than non-working/studying patients on Physical Functioning, Role Functioning and Social Functioning.

Conclusions: CF patients' HRQoL is related to medical status. The non-working/studying CF patients in this sample had greater disease severity and reported a lower quality of life than their working/studying peers, even after controlling for relevant medical parameters. The decision to stop work/study for CF patients is difficult and affects patients' personal, social and financial well-being.

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1. Introduction

1.1. Cystic fibrosis

With advances in the treatment and care of patients with cystic fibrosis, the life expectancy for this population has risen markedly to approximately 35–40 years of age [1]. With this improved life expectancy, more patients are able to attend school, obtain diplomas and work in either full- or part-time positions and as patients live longer they are more interested in pursuing adult, age-appropriate activities.

1.2. HRQoL and CF

Over the past 15 years, Health-related Quality of Life (HRQoL) research has gained substantial interest in psychological and medical research of cystic fibrosis (CF). HRQoL is a multidimensional construct that encompasses physical, psychological, social and functional domains of daily life and measures the impact of health and illness on these areas of functioning.

Several researchers have measured HRQoL in patients with CF in relation to psychosocial, demographic and/or clinical factors [2–6] and CF-specific measures of HRQoL in different languages have been developed [7–9]. HRQoL measures have been used in clinical trials [10,11]. Recent reviews have reported on HRQoL as an outcome measure in clinical trials in adults [12] and children [13], in association with antibiotic

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therapies [14] and after lung transplantation [15]. The literature reveals various factors that are associated with domains of HRQoL, including coping, medical parameters and compliance. An important overall result is that medical parameters, used as indicators of disease severity (e.g. lung function, body mass index, exercise performance) are only modestly related to HRQoL scores [4,6].

1.3. Work and CF

With patients living longer the issue of work (or school) has become important in CF HRQoL research. Two studies specifically looked at traditional clinical parameters and HRQoL in relation to patients' work status. For example, Burker et al. found that FEV₁ % predicted did not differentiate between patients who were or were not working [16] and they reported that patients who were working had significantly lower depression scores and a higher educational level than those who were not working. In line with this, Hogg et al. [17] reported a strong relationship between hours worked and patients' perception of disability and quality of life ('mastery of disease'). The data from these studies suggested that whether a patient with CF is working or not is not solely related to their medical situation. In clinical practice we observe that patients who are employed find it hard to reduce their working hours or stop working even though they are advised to do so in order to stabilize their medical situation. Some patients will continue working down to a lung function of 25–30 FEV₁ % predicted. Patients say 'I feel in control of my life when I work' or 'I need to work to feel appreciated.' Working may increase perceptions of HRQoL despite the fact that most do realize this places them at increased risk of deteriorating health.

With regard to HRQoL, medical status and work/study status three hypotheses have been constructed based on the literature and clinical observation. Hypothesis 1 states that health status will be positively related to higher scores on HRQoL, using FEV₁ % predicted, Body Mass Index, *Pseudomonas aeruginosa* status, pancreatic status, having an indwelling catheter device, CF Related Diabetes Mellitus (CFRDM) and nutritional status as indicators of clinical status. Hypothesis 2 states that patients who work/study will have less severe disease than those who do not work or study. Hypothesis 3 states that after controlling for medical parameters, patients in a work/study situation will rate their HRQoL higher than those who are not in a work/study situation.

2. Method

2.1. Study design and subjects

This cross-sectional study recruited patients consecutively attending the outpatient clinic at the Adult CF Centre at the University Hospital Leuven between September 2006 and September 2007. As the measure is part of the annual review, ethics approval is not required. Patients whose lung disease was stable were asked to complete a quality of life questionnaire during an outpatient clinic visit as part of their annual review.

Table 1
Characteristics of the study group.

Male	29
Female	28
Mean age (SD)	26.79 (8.15)
Lung function FEV ₁ (mean, SD)	65.09 (22.18)
BMI (mean, SD)	21.23 (3.45)
Work/study	No=13 Yes=24
High caloric supplements	No=44 Yes=13
PAC ^a	No=37 Yes=20
Pancreatic status ^b	PS=9 PI=48
Diabetes (CFRDM) ^c	No=47 Yes=10
Psa ^d	Group 1=13 Group 2=20 Group 3=24

^a PAC = presence or absence of central venous implantable device.

^b Pancreatic status: PI = pancreas insufficient; PS = pancreas sufficient.

^c Treated with insulin therapy.

^d *Pseudomonas aeruginosa* (PA) colonization status: group 1 = negative for PA, group 2 = positive non-multiresistant and group 3 = positive multiresistant.

Patients who had been transplanted were not included. Fifty seven patients (67% of the adult CF population) completed the questionnaires. Table 1 shows patients characteristics. None of the patients declined to complete the questionnaires, but patients experiencing a CF exacerbation or complication (e.g. acute severe hemoptysis, pneumothorax, DIOS, PAC related infection), or those admitted for treatment with IV antibiotics, were excluded from the study.

2.2. Measures

2.2.1. Medical variables

Objective assessment of disease status (medical status) included spirometry (forced expiratory volume in 1 second; FEV₁ % predicted) and body mass index (BMI). In addition, the following variables were included: the presence or absence of central venous implantable device (portacath or PAC), diabetic status (presence or absence of Cystic Fibrosis Related Diabetes Mellitus treated with insulin therapy (CFRDM)), exocrine pancreatic status (PI = pancreas insufficient; PS = pancreas sufficient), *Pseudomonas aeruginosa* (PA) colonization status (group 1 = negative for PA, group 2 = positive non-multiresistant and group 3 = positive multiresistant) and nutritional status (taking high caloric supplements or not). These medical data were obtained from the patients' medical record on the date the questionnaire was completed.

2.2.2. HRQoL

HRQoL was measured using a Dutch translation of the CFQ-R Teen/Adult version of the CFQ-R [18]. It consists of 44 items across 12 scales (Table 2). The CFQ-R Teen/Adult version has good reliability, with Cronbach alpha's ranging from 0.67 to 0.94. Response choices generally included ratings of frequency and difficulty on a 4-point scale (1 = always to 4 = never; 1 = a

Table 2
CFQ—teen/adult scales.

HRQoL dimensions	Items, no.	Sample items
Physical functioning	8	Walking as fast as others
Role	2	How often were you absent from school/work during the last 2 weeks because of your illness or treatments?
Vitality	4	You felt tired
Emotional functioning	5	You felt worried
Social	5	I get together with my friends a lot
Body image	3	I think I am too thin
Eating disturbances	3	I have to force myself to eat
Treatment burden	2	Compared to 3 months ago, how much time do you currently spend on your treatment?
Health perceptions	3	I feel healthy
Weight	1	Have you had trouble gaining weight
Respiratory symptoms	6	Have you had trouble breathing
Digestive symptoms	2	Have you had abdominal pain

lot of difficulty to 4 = no difficulty) or true/false responses (1 = very true to 4 = very false). Scores were standardized on a 0- to 100-point scale, with higher scores representing better quality of life.

2.2.3. Work/study status

Work/study status was recorded from the Cystic Fibrosis Quality of Life scale, teen/adult-version (CFQ-14+) and categorized into 'yes = working or attending study full- or part-time' or 'no = not working or attending study full- or part-time.' Employment and school status were combined and referred to as 'work.'

2.3. Statistical analyses

Statistical methods used were as follows:

Pearson correlations were conducted to assess the association between lung function, BMI and HRQoL scores. Fisher's Exact Test was used to test the associations between medical parameters and work/study status. Analyses of variance were used to assess differences between groups as defined by medical status (e.g. Pancreatic status) on domain scores of HRQoL. Where needed, Bonferroni corrections were used to adjust for multiple comparisons. Multivariate analyses of variance including covariates were used to assess the relationship between work/study status and domains of HRQoL. Clinical parameters were used as covariates.

3. Results

3.1. HRQoL and medical status

Hypothesis 1 stated that less severe disease would be associated with higher scores on the CFQ-R. Correlations showed that lung function was only related to Physical Functioning and Health Perceptions. Lower FEV1 % predicted scores were associated with lower scores on Physical Functioning and a worse perception of General Health ($r=0.27$ and 0.38 respectively, $p<0.05$). With regard to BMI, the hypothesis was confirmed for the domains Eating Disturbances and Weight. Higher BMI was associated with higher scores on Eating Disturbances (indicating fewer problems with eating) ($r=0.44$,

$p<0.01$) and better perceptions of Weight ($r=0.43$, $p<0.01$) and Body Image ($r=0.28$, $p<0.05$).

Analysis of variance were conducted to assess differences in mean CFQ-R Teen/Adult domain scores depending on PA status, pancreatic status, PAC, CFRDM status and nutritional status, after controlling for FEV1 % predicted and BMI. Bonferroni corrections were used to adjust for multiple comparisons. The hypothesis that health status is related to higher HRQoL scores was confirmed for the Weight scale in relation to CFRDM. Patients with CFRDM reported lower (indicating more problems) scores on the Weight scale than patients without CFRDM (mean scores 43.65 vs. 69.88, $F=8.62$, $p=0.005$). Body Image and Weight were also related to nutrition status. Patients not taking high caloric supplements scored higher on the Body Image scale compared to patients who did take high caloric supplements (76.60 vs. 47.72, $F=10.34$, $p=0.002$). Similarly, patients taking high caloric supplements scored lower on the Weight scale compared to patients not taking supplements (43.48 vs. 70.04, $F=8.28$, $p=0.006$).

Having a PAC was associated with scores on the domains of Physical Functioning, Treatment Burden, Role and Weight. Patients with a PAC scored lower than patients without a PAC on Physical Functioning (59.84 vs. 78.03, $F=5.65$, $p=.02$), indicating that patients feel less able to participate physical activities. They also reported a higher Treatment Burden (42.24 vs. 57.21, $p=0.15$), perceived more difficulties in their Role Functioning (60.35 vs. 74.96, $p=0.04$) and had lower scores on the Weight scale (41.79 vs. 71.74, $p=0.001$).

3.2. Work and medical status

Hypothesis 2 stated that patients who work would have less severe disease than patients who were not working.

The results showed that patients who were working had a significantly higher FEV1 % predicted (mean 70 vs. 57, $t=-2.61$, $p=0.03$) than non-working patients. Tests of associations between the nominal medical variables showed that *all* non-working patients ($n=23$) had PA in their sputum (they were in the PA positive non-multiresistant or PA positive multiresistant group). This is significantly different from the group of working patients where 13 were situated in the PA negative

group and 21 in the PA positive non-multiresistant or PA positive multiresistant status (Fisher's exact=0.44, $p=.003$). Thus, although working patients were present in all three PA groups, patients who were not working all had PA.

Non-working patients also had a PAC more often (Fisher's exact=-0.59, $p=.001$) and took more caloric supplements (Fisher's exact=-0.32, $p=.01$) than patients who were working.

3.3. Work and HRQoL

Hypothesis 3 stated that, after controlling for FEV₁ % predicted, BMI and other medical parameters, patients in a work situation rate their HRQoL higher than those not in a working situation.

Multivariate models were constructed to assess the relationship between work and domains of the CFQ-R, with medical parameters as covariates. Table 3 shows results of the analysis of variance of mean scores of the CFQ-R Teen/Adult domains by work. For each domain, a model was constructed to assess main effects of factors and covariates. In each model FEV₁ % predicted and BMI were included, in conjunction with specific parameters specified before.

After controlling for medical variables, working patients reported higher, but not significantly higher, than non-working patients on the domains Vitality, Emotional Functioning, Body Image, Eating Disturbances, Treatment Burden, Health Perception, Weight, Respiratory Symptoms and Digestive Symptoms. For three domains the difference between working and non-working patients was statistically significant. Working patients reported their Physical Functioning (walking, running etc) as better than non-working patients and this effect remained after controlling for FEV₁ % predicted, BMI and having a PAC. Patients who worked had a better Role Perception, after taking into account FEV₁ % predicted, BMI, PAC or taking high caloric supplements. Finally, patients who worked reported a better Social Functioning than patient who did not work, after controlling for FEV₁ % predicted or BMI.

4. Discussion

One of the main aims of adulthood is to achieve independence. This typically involves attending school, working and increasing financial independence. Not being able to work has a major impact on a person's life, regardless of whether one has a chronic illness, such as CF. This study has investigated the association between HRQoL, medical status and work status.

4.1. HRQoL and medical status

The first hypothesis that was tested stated that better HRQoL would be related to less severe disease. For several domains of the CFQ-R Teen/Adult this was confirmed. The results are similar to those reported by others [5,18–20], with higher FEV₁ % predicted relating to scores on Physical Functioning and Health Perceptions. Higher BMI scores were related to higher

Table 3

Analysis of variance of mean CFQ14+ domain scores by work/study, including covariates (with Bonferroni adjustment for multiple comparisons).

CFQ-14+ domain	Non-working patients mean (SD)	Working patients mean (SD)	F	Covariates in the model
Physical functioning	59.87 (5.29)	86.32 (4.14)	12.41, $p=.001$	FEV ₁ BMI PAC
Role	57.38 (4.79)	82.03 (3.75)	13.16, $p=.001$	FEV ₁ BMI PAC Caloric supplements
Vitality	53.82 (5.15)	66.71 (4.03)	3.11, $p=.08$	FEV ₁ BMI
Emotional functioning	63.07 (5.25)	73.72 (4.11)	2.04, $p=.16$	FEV ₁ BMI Caloric supplements
Social	58.56 (4.32)	73.47 (3.38)	5.92, $p=.02$	FEV ₁ BMI
Body image	69.38 (5.68)	84.21 (4.45)	3.38, $p=.07$	FEV ₁ BMI Caloric supplements
Eating disturbances	79.83 (5.38)	90.76 (4.21)	2.05, $p=.16$	FEV ₁ BMI Caloric supplements
Treatment burden	51.12 (4.53)	59.68 (3.54)	1.77, $p=.19$	FEV ₁ BMI PAC
Health perceptions	44.66 (6.59)	56.01 (5.15)	1.47, $p=.23$	FEV ₁ BMI PAC Caloric supplements
Weight	75.91 (5.90)	78.12 (4.62)	0.15, $p=.70$	FEV ₁ BMI PAC Diabetes Caloric supplements
Respiratory symptoms	66.14 (4.75)	76.19 (3.72)	2.22, $p=.14$	FEV ₁ BMI
Digestive symptoms	77.13 (5.01)	82.94 (3.92)	0.67, $p=.41$	FEV ₁ BMI

scores on the Eating Disturbances, Body Image and Weight scales. Diabetes (CFRDM) status was related to more problems on the Weight scale, which makes sense since the occurrence of CFRDM in a patient with CF makes it difficult to maintain weight and to balance food to maintain normal glucose levels. No relationship was found between CFRDM status and Treatment Burden, which was unexpected since most patients describe diabetes and its treatment as 'a significant extra burden.' The diabetes literature reports significant correlations between psychological variables and HRQoL when comparing diabetes patients with non-diabetics [21]. The present findings may be explained by the fact that diabetes is conceived as an illness on its own, with a very specific treatment plan and

complications. When patients complete a CF-specific questionnaire like the CFQ-R Teen/Adult, they may be referring to their CF and not their diabetes. In addition, the CFQ-R does not have questions specific to CFRDM related problems. Over the past 10 years CFRDM has become more common in CF and CF-specific HRQoL questionnaires should include questions about this theme. Apart from Gee et al. [4] no studies have reported on CFRDM in relation to HRQoL, however several investigators have reported that CFRDM is related to decreased life expectancy and mortality, most notably in female patients, as well as decreased pulmonary function and body weight reduction [22,23]. The number of diabetes patients in this sample was small and further study of the relationship between CFRDM and HRQoL is warranted.

Taking high caloric supplements was related to patients reporting more problems with Weight and Body Image. When a patient is advised to take high caloric supplements this is not only a sign of worsening health, but also an indication that the patient is not able to control weight by eating as s/he was used to, which may explain the found associations. Having a PAC was associated with lower perceptions of Physical Functioning, higher Treatment Burden and lower perceptions of Role and Weight. Similar results have been described by Gee et al. [4]. Most patients with a PAC need regular intravenous antibiotics and having a PAC requires special attention with 6–8 weekly visits to a specialist CF nurse. These issues may explain higher scores on Treatment Burden for patients with a PAC. The association between the impact a PAC has on patients' Physical Functioning, Treatment Burden and Role Functioning may also explain why having a PAC placed is a difficult decision for some patients. It is not only a confirmation of deteriorating health, but also of the need for more treatment.

Pseudomonas aeruginosa (PA) status was not related to any of the CFQ-R Teen/Adult domains in the analysis. Goldbeck et al. [24] found in a longitudinal study, that *new* colonization with PA was a significant factor in explaining quality of life. New PA colonization often changes the treatment schedule and one could expect this to be reflected in patients' experience of treatment burden. Patients in the present sample were colonized with PA for a considerable period of time and the extra treatments related to PA may not be experienced currently as an extra burden, because 'they are used to it.' This consideration also applies to pancreatic status for which no differences were found in HRQoL. This topic needs more study, and longitudinal studies which address the impact of PA or PI over time. For example, perception of 'treatment burden' may change depending on the treatment schedule, which is likely to increase over time with deterioration of disease. However, treatment burden may also change because patients 'get used to it.'

4.2. Work and medical variables

The hypothesis that patients who are working (or studying) have less severe disease was confirmed. Non-working patients more often had a PAC and/or PA and also took more high caloric supplements in comparison to working patients. Contrary to findings of Burker et al. [16], who found no

differences in lung function between working and non-working patients, the non-working patients in the present sample had a significantly lower lung function. These results were anticipated because patients with CF who are colonized with PA need regular treatment, daily aerosols with anti-pseudomonas antibiotics and regular intravenous treatment. With this increased need for treatment, patients are advised to have a PAC to ease the administration of intravenous antibiotics. In addition, the recurrence of infections is often related to loss of weight for which they have to take high caloric supplements.

4.3. HRQoL and work status

The third hypothesis proposed that working patients would report a higher QoL than non-working patients. After controlling for the effects of medical variables, three domains were significantly related to work status. Patients who work reported a better physical functioning, role perception and social functioning in comparison to their non-working peers. In other words, working patients felt better physically and scored higher on questions relating to their ability 'to walk distances like other people their age, walking up the stairs, carrying heavy things, etc.' Importantly, they reported higher on these HRQoL items despite their lung function. This is noteworthy as patient-reported Physical Functioning (using the CFQoL) has been shown to be an independent predictor of survival after taking into account key clinical variables [25]. In addition, working patients had a more positive view of their role functioning and reported a better social functioning, again controlling for their medical status. Like the results of Hogg et al. [17] the present results showed that working is importantly related to specific domains of quality of life. Working seems to improve patients' psychosocial well-being in spite of their medical status. This finding is worth taking into account when advice is given about reducing work or school load as working may protect patients from psychological problems.

Unexpected was the finding that work status was not related to Treatment Burden. It is possible that both groups perceived treatment burden differently. Non-working patients had worse disease status than working patients and *needed* to do more treatment. Treatment burden for working patients may be related to having 'less time available for treatment.' The Treatment Burden scale of the CFQ-R Teen/Adult may not be specific enough to identify underlying differences and this needs further investigation.

4.4. Limitations

A limitation of this study is the relatively small, cross-sectional sample. Also, for patients with CF work status depends on many factors, both medical and psychosocial. Financial issues have not been examined, but may play a vital role. Thirdly, some of the expected associations between domains of HRQoL measured by the CFQ-R Teen/Adult were not found. For example, no differences were found on treatment burden in relation to CFRDM status or work status, which we expected based on comments made by patients. It is possible

that the CFQ-R Teen/Adult needs updating to make sure it taps potential new issues that are related to HRQoL in adult patients with CF.

4.5. Conclusion

The results point to an important clinical concern, namely that advising patients to stop working is a key issue for both the patient and the CF team. Differences in perception of the HRQoL domains physical functioning, role and social functioning between working and non-working patients may explain why in clinic we observe that the advice to reduce working hours or to stop working is often met with strong opposition and emotions. Patients and CF teams need to have open discussions about this dilemma. Prospective studies need to look at whether the demands of a working life speed up the process of deterioration and how patients weigh out their decision between quality of life and medical condition.

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