Cost of illness and illness perceptions in patients with fibromyalgia

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ABSTRACT

Objective. *The disease impact and economic burden of fibromyalgia (FM) are high for patients and society at large. Knowing potential determinants of economic costs may help in reducing this burden. Cognitive appraisals (perceptions) of the illness could affect costs. The present study estimated costs of illness in FM and examined the association between these costs and illness perceptions.*

Methods. *Questionnaire data of FM severity (FIQ), illness perceptions (IPQ-R-FM), productivity losses (SF-HLQ) and health care use were collected in a cohort of patients with FM. Costs were calculated and dichotomised (median split). Univariate and hierarchic logistic regression models examined the unique association of each illness perception with 1) health care costs and 2) costs of productivity losses. Covariates were FM severity, comorbidity and other illness perceptions.*

Results. *280 patients participated: 95% female, mean age 42 (SD=12) years. Annualised costs of FM per patient were €2944 for health care, and €5731 for productivity losses. In multivariate analyses, a higher disease impact (FIQ) and two of seven illness perceptions (IPQ-R-FM) were associated with high health care costs: 1) high scores on 'cyclical timeline' reflecting a fluctuating, unpredictable course and 2) low scores on 'emotional representations', thus not perceiving a connection between fibromyalgia and emotions. None of the variables was associated with productivity losses.*

Conclusion. *Our study indicates that perceiving a fluctuating course and low emotional representation, which perhaps reflects somatic fixation, are associated with health care costs in FM. Future studies should examine whether targeting these illness perceptions results in reduction of costs.*

Introduction

Fibromyalgia (FM) is a chronic, musculoskeletal pain disorder of unknown aetiology that occurs mostly in women and has a prevalence range from 2% to 4% in the general population (1, 2). FM is characterised by widespread pain and the occurrence of a wide range of symptoms including fatigue, sleep disturbance, functional disability, stiffness, cognitive impairment, anxiety and depressive symptoms (1). People with FM often experience a significant burden of illness, such as decreased functioning in daily life, work productivity and health-related quality of life (3, 4). There is no cure for FM. Although interventions such as physical exercise training and cognitive-behavioural therapy may help in dealing with FM and medications may be helpful for some patients to alleviate symptoms (5, 6), the long-term challenge for patients is to self-manage FM and its consequences.

Nevertheless, direct (health care) costs for assessment and treatment and indirect costs (*e.g.* costs of work absence and productivity losses) in FM remain substantial throughout the course of the disease (7-13). Besides factors such as disease severity and the presence of comorbid conditions (10, 14-16), illness perceptions may influence patients' health care use and costs. Illness perceptions are cognitive appraisals of the illness regarding, for instance, the cause, timeline, consequences, and perceived control over the illness (17).

While appropriate health care will lead to a reduction of the disease burden and an increase of quality of life and work participation, a significant portion of health care costs in FM likely reflects overuse or inappropriate use of care such as unnecessary referrals, redundant diagnostic procedures and ineffective treatments. Redundant health care consultations in FM could be due to physicians' difficulty with diagnosing

FM and suboptimal physician-patient communication (18), the absence of a defining cure for FM (6), and patients' dissatisfaction with the professional not being able to prescribe effective treatment (19). Illness perceptions can influence health care costs through its effects on these factors (*e.g.* disease burden and physician-patient communication) and other factors (*e.g.* the patient's treatment choices).

According to Leventhal's 'Common Sense' Model (20), illness perceptions guide patient reactions to symptoms of illness, patient's ways to cope with the illness, and patient's appraisal of the efficacy of this coping behaviour. This will have consequences for health care use. For instance, perceiving that FM has severe consequences on life and is chronic in nature could lead to high direct costs when patients seek health care to alleviate these consequences. Besides, this could lead to high indirect costs, as these perceptions interfere with work participation and daily productivity. Furthermore, if patients feel less able to cope with the illness or appraise that their self-management efforts are not effective, they may rely more on health care resources and professionals.

Evidence for the potential contribution of illness perceptions to costs, through increased health care use or through work absence, has been established in cross-sectional research. Perceiving the illness as emotionally distressing and chronic, experiencing low personal control, and perceiving severe consequences of the illness, have been found to be associated with increased health care use and work absence (21-28). A longitudinal study in patients with somatoform disorders (29), showed that negative emotional representations and perceiving their illness as chronic, were associated with higher health care costs and an increase of costs during 2-year follow-up. Moreover, in patients with functional somatic syndromes, changes in illness perceptions during cognitive behavioural therapy were associated with improved health outcomes (30). This suggests that it is possible to target illness perceptions with positive consequences for health and health care costs.

Thus, previous studies suggest that patients' dysfunctional illness perceptions are associated with direct and probably also indirect costs, but in FM this relationship has not been studied before. Therefore, more insight in the contribution of illness perceptions to costs is clearly warranted for reducing the high economic burden of FM. As research shows that disease severity in FM is related to illness perceptions (31, 32) as well as health care costs (9, 10), testing this model of illness perceptions and costs implies correcting for the disease severity in FM.

The aim of the present study in patients with FM was to describe the direct costs and indirect costs and to examine the association of illness perceptions with direct and indirect costs. We hypothesised that patients with high (in)direct costs have more dysfunctional illness perceptions, compared to patients with low (in)direct costs, even when adjusting for disease severity.

Patients and methods
Study design
Health care use, direct and indirect costs and illness perceptions were examined in a cohort of patients with FM, newly referred to the Sint Maartenskliniek rheumatology outpatients clinic, location Nijmegen and Woerden, the Netherlands, between December 2011 and May 2013. For this study, the baseline data of the prospective longitudinal cohort study were used.

The primary outcomes of this study were direct and indirect costs. Costs were examined from a societal perspective comprising direct costs, *i.e.* costs of health care use, and patients' transportation and time costs to health care providers, and indirect costs, *i.e.* costs of productivity losses resulting from absenteeism, presenteeism and reduced productivity in unpaid work.

Patients
Patients were included in the cohort after being classified as having fibromyalgia by certified rheumatologists. Furthermore, patients were 18 years or older at time of diagnosis, were able to read and write Dutch language, and gave informed consent. The Institu-

tional Review Board of the University Medical Centre, Nijmegen, approved the study (protocol number: 2011/271).

Measurements
Sociodemographic and clinical data were gathered, including gender, age, education level, employment status, and comorbidity. Comorbidity was measured by a list of 20 common comorbidities. These were pulmonary diseases, sinusitis, cardiac diseases, high blood pressure, cardiovascular accident, stomach ulcer, chronic bowel dysfunction, diabetes mellitus, thyroid dysfunction, epilepsy, vertigo, migraine, severe skin disease, malignant disease, depression, personality disorder, anxiety disorder, attention deficit disorder, bipolar disorder and eating disorder. Respondents indicated having one or more of the 20 comorbid conditions; additional comorbidities could be listed.

Illness perceptions
The measure of illness perceptions of FM was based on the revised Illness Perception Questionnaire (IPQ-R-FM), a valid and reliable instrument for measuring illness perceptions in patients with FM (33), derived from Leventhal's 'Common Sense' Model (20). The following seven dimensions were included: acute/chronic timeline (perceptions of duration of the illness), cyclical timeline (perceptions of a fluctuating or unpredictable course of the illness over time), consequences (expected effects and outcome of the illness), personal control (belief in personal control over the illness), treatment control (belief in cure through treatment), illness coherence (beliefs about understanding the illness) and emotional representation (perception of negative emotions generated by the illness). Items were scored on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). In this study the Cronbach's alpha ranged from .77 to .87 across the seven dimensions.

Severity of FM
The Fibromyalgia Impact Questionnaire (FIQ) is an instrument for assessing health status in FM (34). The questionnaire consists of 10 items. The first

item contains 11 questions on activities of daily living, the second item is the number of days felt good during the past week, the third item asks for the number of days off work due to FM during the past week. Items 4 to 10 assess ability to work, pain, fatigue, morning tiredness, stiffness, anxiety and depressive symptoms. In this study the Cronbach's alpha was .80 for the 10 items.

Health care use
Retrospective data of health care consultation, medication use, diagnostic procedures and admission to and treatment in health care institutions were gathered, using self-reported registration forms with a 6 months recall format.
Health care consultation included: consultations with general practitioner (GP), doctor's assistant, occupational health physician, medical specialists, health professionals (*e.g.* physical therapists, occupational therapists, psychologists) and complementary practitioners.

Absenteeism and presenteeism, productivity losses in unpaid work
The Short Form- Health and Labour Questionnaire (SF-HLQ) is a validated instrument to assess productivity losses related to health problems in individuals with paid or unpaid work (35). It was used to measure productivity losses related to health problems in individuals with paid work, measuring both absenteeism and presenteeism (productivity losses due to reduced efficiency) at work, with a 2 weeks recall format. If absenteeism exceeded the period of 2 weeks, respondents were asked to state the date they reported being sick. Absenteeism was measured by two items related to short-term and long-term absence, presenteeism was measured by two items related to the presence of productivity losses (not at all, slightly, very much) and the amount of productivity losses (number of hours).
Furthermore, the SF-HLQ was used to assess productivity losses in unpaid work. These productivity losses were measured by one item related to the substitution of unpaid household work (no or yes). If this item was scored "yes" the substitution of unpaid work

needed to be specified for whom took over household work. This could be an informal (*e.g.* family member or other person receiving no pay), formal (*e.g.* employee of home care institution) and/or private household care giver (*e.g.* person receiving payment from patient). Furthermore, the amount of household work (number of hours) needed to be specified.

Statistical methods
Estimation of direct (health care) costs
Health care costs of consultations with health care providers, diagnostic procedures, admission to health care institution (number of overnight stays) and institutionalised treatment programs were calculated by multiplying standard cost prices with the frequency of the health care use (36, 37). For complementary practitioners public Dutch cost price levels were used, since no standard cost price was available. As consultation time across health care providers varied, costs were calculated based on cost prices per consultation instead of cost prices per hour (Appendix 1).
Medication costs were calculated by multiplying the frequency of medication use with the lowest cost prices for each type of medication, using an online tool with Dutch cost prices of prescription and over-the-counter (OTC) medication (38). For prescription medication, the dispensing fee for the pharmacist was added to the costs. In case dosage and/or frequency of medication use was missing, the defined daily dose (DDD) (39) was used to calculate costs. Costs of patients' transportation and time to health care consultations were calculated by multiplying standard cost prices for time (equated to standard cost price of informal care) and for means of transportation (car, public transportation and taxi) with the frequency of consultations (36) .
All cost prices of direct costs are expressed in euros adjusted for the year 2012, using the consumer price index (CPI) (36). Total direct health care costs were extrapolated to 1 year costs.

Estimation of indirect costs
In the estimation of productivity losses due to work absenteeism, the fric-

tion cost method was used (36). The friction period (23 weeks) is the time needed by the employer to replace the sick employee. If the number of absent days exceeds the friction period, only the costs of absence during friction are calculated.
Costs of presenteeism, were estimated according to the "HLQ" method (35). This method uses direct estimates of production losses caused by time losses due to health problems on work days.
The general price index was used to calculate both productivity losses due to absenteeism and presenteeism (36, 40), by multiplying hours of productivity losses with cost prices per hour per working individual, specified for gender and age.
Furthermore, productivity losses in unpaid work were estimated. These productivity losses were calculated by multiplying standard cost prices for informal, formal and private household care with the frequency of the hours that had been worked by unpaid and/or paid help (36).
All cost prices of indirect costs are expressed in euros adjusted for the year 2012, using the consumer price index (CPI) (36). Total indirect costs were extrapolated to 1 year costs.

Analyses
Descriptive statistics (mean, SD, ranges) were computed for sociodemographic variables, disease-related patient characteristics, health care use and costs of FM patients. Except for missing data of presenteeism (<9%), missing data of all study variables was <5%, therefore no imputation of missing data was performed.
The distributions of both direct and indirect costs data (dependent variables) were severely skewed. As transformation of these data did not result in normal distributions, direct and indirect cost data were dichotomised by median split. This yielded groups with low and high direct and indirect costs.
Prior to conducting the hierarchic logistic regression analyses, relevant assumptions were tested. First, bivariate correlations between independent study variables were computed. Correlations ranged from .00 to .48, indi-

Table I. Characteristics of study sample (n=280).

	n	(%)	M	SD
Female	267	(95)		
Age; in years			42.6	11.8
Education level				
Low	122	(44)		
Middle	95	(34)		
High	55	(20)		
Paid employment	143	(51)		
Work absence	51	(36)		
Comorbidity*	218	(78)		
Most frequent comorbid conditions				
Migraine	72	(26)		
Depression	63	(23)		
Chronic bowel dysfunction	52	(19)		
Pulmonary diseases	52	(19)		
Sinusitis	52	(19)		
Severity of fibromyalgia^ (0-100)			59.1	15.5
Illness perceptions**				
Acute/chronic timeline (6-30)			23.7	4.3
Cyclical timeline (4-20)			14.7	3.3
Consequences (6-30)			19.9	4.3
Personal control (6-30)			20.3	3.7
Treatment control (5-25)			17.0	2.9
Illness coherence (5-25)			15.0	4.1
Emotional representation (6-30)			15.8	4.7

*Comorbidity is defined as having at least one comorbid condition.
^Severity of fibromyalgia was measured with the Fibromyalgia Impact Questionnaire (FIQ).
**Illness perceptions were measured with the revised Illness Perception Questionnaire (IPQ-R-FM), the theoretical range is indicated per dimension. High scores on acute/chronic timeline, cyclical time-line, consequences and emotional representation represent dysfunctional perceptions of the illness, whereas high scores on personal control, treatment control and illness coherence represent functional perceptions of the illness.

cating no collinearity between study variables. Second, univariate correlations between the illness perceptions and dependent variables were computed. Third, no extreme univariate outliers in study variables were identified, based on visual inspection of the data. Fourth, as a rule of thumb 10 to 15 cases per predictor variable in logistic regression analyses will suffice for a robust regression model, therefore a sample size of >180 was deemed adequate given nine independent variables to be included in the hierarchic logistic regression analyses.

In order to examine the association between illness perceptions and costs, two separate hierarchic logistic regression models were built; one for direct and one for indirect costs. The two hierarchic logistic regression models both comprised two steps. In step 1 the most important determinants for costs in FM identified in the literature (*i.e.* severity of FM and comorbidity) entered the analysis as potential covariates. In step 2 all illness perception dimensions (acute/chronic timeline, cyclical timeline, consequences, personal control, treatment control, illness coherence and emotional representation) were added in the analysis. A *p*-value <.05 was considered to be statistically significant. Statistical analyses were performed using Stata 10.

Results
Sample
Characteristics of the study sample are displayed in Table I. A total of 452 patients with FM were eligible for inclusion, 311 gave informed consent (68.8%), and subsequently 280 patients returned the baseline questionnaire (90.0%). Most frequent dropout reasons were lack of energy or concentration, and lack of time; several patients did not specify a reason.

Direct costs
Annualised direct costs (mean, SD, range) of FM per patient are presented in Table II. Total mean costs were €2944 (median €1866) per patient per year.

Consultation with health care providers accounted for almost 50% of the total direct costs; the highest costs were for consulting health professionals such as physiotherapists, followed by medical specialists and general practitioners. Furthermore, costs of time (travelling to health care provider and time spent at health care consults) accounted for over 25% of the total direct costs. Admission to health care institutions and medication use both accounted for almost 10% of total direct costs.

Indirect costs
Annualised indirect costs (mean, SD, range) of FM per patient are presented in Table II, the total mean costs were €5731 (median €1273). Costs of productivity losses in paid work were for the total group of patients on average €4440, but for the subgroup of patients with paid work (n=143) on average €8901.
Costs of absenteeism (mean €3057) were the largest portion of total indirect costs, followed by costs of presenteeism, and costs of unpaid household help.

Total costs
Total mean costs of patients were €8675 per patient per year (median €4360), with about two-thirds consisting of indirect costs and one-third of direct costs of FM.

Association between illness perceptions and direct costs
Univariate associations between the illness perceptions and direct costs are displayed in Table III. The IPQ-R-FM-dimension cyclical timeline (*i.e.* illness fluctuations) in fibromyalgia was associated with high direct costs (*p*=.01). The mean score of 15.2 (SD 3.2) on the IPQ-R-FM-dimension cyclical timeline for the high direct cost group was 1.1 higher than for the low direct cost group (14.1, SD 3.3). Proportionally dividing the IPQ-R-FM-dimension cyclical timeline into five categories, illustrates the relation between the perception of higher fluctuation of the illness over time and high costs (Fig. 1). The majority of the patients experienced moderate or large illness fluctuations. More important,

Table II. Annual direct and indirect costs of fibromyalgia, per patient, in Euros, Dutch price level 2012

	M	SD	Range
Direct health care costs			
General practitioner	148	153	0-1485
Doctor's assistant	112	120	0-535
Occupational health physician	126	229	0-1209
Medical specialist	327	345	0-2297
Health professional*	524	843	0-6130
Complementary practitioner	128	346	0-2969
Diagnostic procedures	98	184	0-1294
Admission health care institution	239	1614	0-21887
Institutionalised treatment program	99	629	0-6658
Medication (total)^ ±	240	348	0-2715
Paracetamol (Acetaminophen)	23	36	0-175
NSAIDs	29	61	0-361
Opioids	21	83	0-795
Antidepressants	26	67	0-688
Anti-epileptics	20	140	0-1259
Benzodiazepines	4	12	0-72
Sedative/hypnotics	2	18	0-238
Miscellaneous#	115	247	0-1970
Direct non-health care costs			
Transport to health care provider	138	276	0-1924
Time of transport & consultation	790	1159	0-12235
*Total direct costs^*			
Total direct health care & non-health care costs	2944	3514	0-35585
Costs of productivity losses in unpaid work			
Informal (unpaid) household help	1226	2297	0-15910
Formal (paid) household care	103	622	0-4888
Private (paid) household care	90	415	0-3818
Costs of productivity losses in paid work			
Absenteeism	3057	8459	0-45617
Presenteeism	1383	3506	0-31288
Total indirect costs^	5731	9603	0-48637

*Health professional included: physical therapist, manual therapist, exercise therapist, occupational therapist, psychologist, social worker, (psychosomatic) nurse, podiatrist, and dietitian.

^Total direct and indirect costs are calculated for n=280. Due to missing values in the different cost categories, costs were only calculated for available data in every cost category, therefore numbers do not add up exactly to total direct costs.

± The most commonly prescribed medications in each category were Paracetamol (*e.g.* paracetamol or paracetamol with additives), NSAIDs (*e.g.* diclofenac, ibuprofen, naproxen), Opioids (*e.g.* tramadol, oxycodone), Antidepressants (*e.g.* amitriptyline, paroxetine, duloxetine), Anti-epileptics (*e.g.* pregabalin, gabapentin), Benzodiazepines (*e.g.* oxazepam, temazepam) and Sedative/hypnotics (*e.g.* zopiclone, zolpidem).

#The largest five groups of miscellaneous medication are, in order of number of users, proton pump inhibitors (n=75, most commonly prescribed was omeprazole), selective beta 2-sympathomimetic drugs (n=31, most commonly prescribed was salbutamol), corticosteroids (n=30, most commonly prescribed was fluticasone), antihistaminic drugs (n=24, most commonly prescribed was levocetirizine), and diuretics (n=18, most commonly prescribed was chloortalidon).

the figure shows the linear association between illness fluctuation and costs: 76% of the high cost group experienced moderate or large illness fluctuations compared to 61% patients in the low cost group. No other univariate associations between illness perceptions and direct costs were found; perceiving severe consequences of fibromyalgia showed a trend towards association with direct costs (*p*=.06).

Hierarchic logistic regression modelling of the association between illness perceptions and high versus low direct costs, adjusted for potential covariates and other illness perceptions, is presented in Table IV. A higher score on severity of FM (*p*=.01), a higher score on IPQ-R-FM-dimension cyclical timeline (*p*=.01) and a lower score on IPQ-R-FM-dimension emotional representation (*p*=.01) were associ-

ated with high direct health care costs. Comorbidity was not associated with health care costs (*p*=.18). The total model explained 8% of the variance.

Association between illness perceptions and indirect costs
Univariate associations between the illness perceptions and indirect costs are displayed in Table III. No illness perceptions were associated with indirect costs. The severity of fibromyalgia was also not associated with indirect costs. In hierarchic logistic regression modelling of the association between illness perceptions and high versus low indirect costs, adjusted for potential covariates and other illness perceptions, none of the independent variables were significantly associated with indirect costs (*i.e.* work absenteeism and presenteeism, and productivity losses in unpaid work) (results not shown).

Discussion
This is the first cost of illness study that examined the cross-sectional relationship between illness perceptions and direct and indirect costs in fibromyalgia. Two illness perceptions were associated with direct health care costs when adjusting for the severity of fibromyalgia, comorbidity, and other illness perceptions: perceiving higher variability of fibromyalgia over time, and not perceiving a connection between fibromyalgia and emotions. No relationship was found between illness perceptions and indirect costs (*i.e.* work absenteeism and presenteeism, and productivity losses in unpaid work).

Our finding that perceiving a higher fluctuating course of fibromyalgia is associated with more health care costs, is in line with previous research in osteoarthritis and somatoform disorders investigating health care use (22, 24). This is a robust finding as the association was still observed after taking account of severity of illness, comorbidity, and other illness perceptions. Perhaps actual or perceived fluctuations lead to more health costs, because it incites uncertainty and concerns about their illness (41, 42). Illness uncertainty is related to poor adjustment to illness (43) and problematic cop-

Table III. Univariate logistic regression modelling of the association between illness perceptions and direct and indirect costs.

	Direct costs			Indirect costs		
	Odds ratio	95% CI	p	Odds ratio	(95% C.I.)	p
Acute/chronic timeline	1.00	[0.94, 1.05]	.96	1.00	[0.94, 1.05]	.87
Cyclical timeline	1.11	[1.03, 1.20]	.01	1.01	[0.94, 1.08]	.85
Consequences	1.06	[1.00, 1.12]	.06	1.04	[0.99, 1.10]	.15
Personal control	0.96	[0.90, 1.03]	.27	1.03	[0.97, 1.10]	.30
Treatment control	1.01	[0.93, 1.09]	.85	1.07	[0.99, 1.16]	.11
Illness coherence	1.00	[0.95, 1.06]	.92	0.98	[0.93, 1.04]	.53
Emotional representation	0.97	[0.92, 1.02]	.25	1.00	[0.95, 1.05]	.85

Note. CI: confidence interval.

Table IV. Hierarchic logistic regression modelling predicting direct costs.

| Variable	Odds ratio	95% CI	p-value	Pseudo R^2
Step 1				.03
Severity of FM	1.03	[1.01, 1.05]	.01	
Comorbidity (yes/ no)	1.54	[0.82, 2.91]	.18	
Step 2				.08
Acute/chronic timeline	0.99	[0.93, 1.06]	.35	
Cyclical timeline	1.13	[1.04, 1.23]	.01	
Consequences	1.06	[0.98, 1.14]	.14	
Personal control	0.92	[0.84, 1.01]	.08	
Treatment control	1.07	[0.96, 1.20]	.24	
Illness coherence	1.02	[0.96, 1.10]	.53	
Emotional representation	0.92	[0.86, 0.98]	.01	

Note. CI: confidence interval.
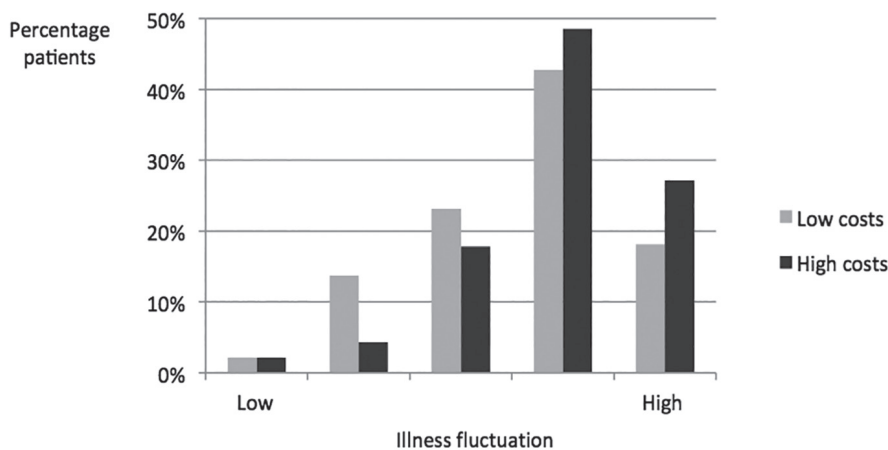
Fig. 1. Percentage of patients with low and high direct costs scoring low to high on the cyclical timeline domain (ranging 4-20) of the illness perception questionnaire (IPQ-R-FM).
Scores of the IPQ-R-FM-dimension cyclical timeline were divided into five categories: (4-7.2), (7.2-10.4), (10.4-13.6), (13.6-16.8), and (16.8-20). A score lower than 7.2 reflects low fluctuation of fibromyalgia over time and a score higher than 16.8 reflects high fluctuation of fibromyalgia over time.

ing with the illness, such as the use of passive and avoidant coping strategies (44, 45). Cognitive behavioural interventions aimed at these problematic coping strategies, may help in dealing with fluctuations (46). In primary care, cognitive reassurance, changing patients' beliefs through education, has been indicated to reduce concerns of patients with non-specific pain about the illness, decrease their symptoms and reduce health care use (47).

An at first sight unexpected finding of our study, compared to previous studies (22, 24, 29), was that attributing less negative emotions to the illness was associated with more health care costs. This association was only found after correction for somatic burden (severity of fibromyalgia and comorbidities). Previous research suggests that some patients may be fixated on the somatic substrate of fibromyalgia (42) or are even alexithymic, *i.e.* unable to describe and recognise their emotions (48). Alexithymia is prevalent in fibromyalgia and it is associated with more symptoms (49). Our observation of an association between low emotional representation and health care costs after correction for somatic burden, might reflect that health care use is especially high in patients who are unable to acknowledge the emotional significance of their symptoms, which may go with somatic fixation.

Unexpectedly, we found no relationship between illness perceptions and indirect costs (costs of work absenteeism, presenteeism and productivity losses in unpaid work), in contrast to studies examining illness perceptions and absenteeism in myocardial infarction, chronic diseases, and the general population (23, 50, 51). However, our cross-sectional finding does not rule out that reshaping dysfunctional illness perceptions can lead to decreased symptoms of fibromyalgia (52), and a reduction of indirect costs (9). To test this hypothesis, longitudinal intervention studies are needed.

The mean annual direct and indirect costs of patients recently diagnosed with fibromyalgia in this study were €8675 per patient. This finding is in line with a previous observation of €7814 annual costs in 2002 (7). In international studies total annual fibromyalgia costs per patient, converted to euro's, ranged from €4806 to €34325 (9-12, 14, 53, 54). Compared to other countries, the costs of fibromyalgia in our study were on the lower side of this range, which could, for instance, be due to differences in health care legislation, social welfare regulations, prosperity, or cultural differences such as role patterns in the family. Use of different cost categories and conservative methods for calculating costs of absenteeism (friction-cost method) and presenteeism ("HLQ" method) (35, 36)

could also have led to relatively low cost estimates in our study.

Strengths of this study are the large sample size and costs being estimated in accordance with current Dutch guidelines for economic evaluations (36). A first limitation of the study is that we used a patient-reported questionnaire to estimate health care use and costs. Recall bias may have led to an underestimation of health care use and potentially also work absence, leading to lower direct and indirect costs (55). Therefore, validating patient-reported -health care consumption data against data from medical or administrative records is recommended (56). Second, it is not sure that all health care use is exclusively due to the fibromyalgia diagnosis. Third, the use of a single self-reported questionnaire (FIQ) to measure disease severity prevents generalisation of disease severity beyond subjective experiences of the patient or to other aspects of well-being and functioning. Fourth, we chose to include the FIQ to reflect severity of fibromyalgia and the disturbance to quality of life. Although the FIQ is correlated with generic quality of life instruments such as the short form-36 (SF-36) (57), comparison with studies using other measures than the FIQ is hampered.

Future studies should examine whether targeting illness perceptions results in reduction of costs. Overall, our current study indicates that most illness perceptions are not related to costs in fibromyalgia, but that health care costs are relatively high in patients with fibromyalgia who do perceive a fluctuating course of their illness and who do not connect negative emotions to their illness.

Acknowledgements

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Appendix 1. Cost prices per category and their source.

Cost category	Cost price, per unit (€)	Source of estimate
Direct costs		
General practitioner	28 per consult, 43 per consult at home	Hakkaart - van Roijen *et al*. 2010
Doctor's assistant	14 per consult	Hakkaart - van Roijen *et al*. 2010
Occupational health physician	57 per consult	Hakkaart - van Roijen *et al*. 2010
Medical specialist	96,50 per consult	Hakkaart - van Roijen *et al*. 2010
Health care professional	36,05* per consult	Hakkaart - van Roijen *et al*. 2010
Complementary practitioner	74,23 per consult	Estimated market price
Diagnostic procedures	25,30* per test	Hakkaart - van Roijen *et al*. 2010, and consensus-based clinicians Sin Maartens-kliniek
Admission health care institution	390,85* per day	Hakkaart - van Roijen *et al*. 2010
Institutionalised treatment program	202,50* per treatment session	Hakkaart - van Roijen *et al*. 2010
Medication	Different cost price per medication type.	Online medication costs: https://www.medicijnkosten.nl/ DDD information: https://kennisbank.knmp.nl/article/Informatorium_Medicamentorum-_-intro.html
Transport to health care provider	0,20 per km for car and public transportation, 2,00 per km for taxi (additional 3,50 per ride)	Hakkaart - van Roijen *et al*. 2010
Time of transport & consultation	0,2083 per minute	Consensus-based, derived from cost price informal care.
Indirect costs		
Formal household care	24 per hour	Hakkaart - van Roijen *et al*. 2010
Private (paid) household care	12,50 per hour	Hakkaart - van Roijen *et al*. 2010
Unpaid household help	12,50 per hour	Hakkaart - van Roijen *et al*. 2010
Absenteeism	8,76 – 22,06 per hour, according to gender and age	Hakkaart - van Roijen *et al*. 2010
Presenteeism	8,76 – 22,06 per hour, according to gender and age	Hakkaart - van Roijen *et al*. 2010

*Prices are average prices of the cost category.
Consumer price index (CPI) was used to adjust above mentioned cost prices to the year 2012,
General CPI:
http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=71905NED&D1=a&D2=a&HD=081218-1319&HDR=T&STB=G1
Work CPI (used for absenteeism and presenteeism):
http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=81280NED&D1=0&D2=0&D3=5,7-9,11&VW=T