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Abstract

The items of the Five Minute Speech Sample, an instrument to elicit relatives' expressed emotion, were investigated in a follow-up study of 120 parents of adolescents with recent-onset schizophrenia. A composite scale was constructed using Mokken scale analysis. From the 9 available items, 6 formed a unidimensional and cumulative scale. This scale was applicable for the total parent group, as well as for fathers and mothers separately. A second scale of 2 items did not meet the criteria for the Mokken model completely and was applicable for the parent group as a whole, but not for fathers and mothers as separate groups. The configuration of the subscales as found with the Mokken scale analysis was comparable with the results of principal component analysis. A quantitative measure may detect smaller differences in expressed emotion than the dichotomous index and expands the possibilities for statistical tests. © 1997 Elsevier Science Ireland Ltd.

Keywords: Composite scale; Five minute speech sample; Mokken scale analysis; Principal component analysis; Simultaneous principal component analysis

1. Introduction

Expressed emotion (EE), as an indicator for family stress, has been studied in relation to the course of psychiatric illness since the late 1960s (Brown and Birley, 1968). Since then, several studies have demonstrated a relationship between high EE, characterized by a critical and hostile attitude and emotional overinvolvement (EOI) of relatives, and a poorer outcome in schizophrenic patients. A considerable number of studies failed to replicate this effect. A recent review of EE studies (Kavanagh, 1992) shows that the effect of high EE on psychotic relapse or exacerbation was replicated in 16 out of 23 studies.

The construct of EE has been criticized (Hooley, 1985; Kanter et al., 1987). Hatfield et al. (1987) argued that the concept of EE is only

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vaguely defined, and that its meaning must be inferred from the assessments from which it is derived. Also, the validity of the construct is based mainly on its predictive value (Koenigsberg and Handley, 1986; Bebbington and Kuipers, 1994). This leaves the possibility that high EE reflects the relative's reaction to the severity of the illness of the patient. High EE may be confused with the relation's concern for the patient during the acute phase of the illness and is not necessarily a cause for a poorer course of the illness (Valone et al., 1983).

The operationalization of EE has been criticized as well. The rating of EE is derived from the Camberwell Family Interview (CFI; Vaughn and Leff, 1976), a semi-structured interview which generally takes 1.5–2 h to administer and 3–4 h to rate. The audiotaped interview is scored on several aspects by trained raters. A high EE involves: 6 or more critical remarks, a score of 4 on the 6-point scale (0–5) of EOI and a score of 1 or higher on the scale of hostility, ranging from 0 to 3. The other aspects, warmth and positive remarks, are not included in the index.

It has been noted that the cut-offs for these subscales were varied in order to improve the predictive value regarding psychotic relapse (Kanter et al., 1987; Gottschalk and Keatinge, 1993; Bebbington and Kuipers, 1994). This may affect the construct validity of the index. Furthermore no evidence has been found that the three subscales, criticism, EOI and hostility, constitute one index (Miklowitz et al., 1983; Hogarty et al., 1986). The highest EE score of two relatives is taken as the family profile score, resulting in a dichotomous family index, which might be too rigorous. For instance, one critical remark more or less, eitherfrom a father or a mother, can characterize the family as high EE (Hatfield et al., 1987). This very global index does not cover the complex nature of family atmosphere (Kuipers, 1992; Gottschalk and Keatinge, 1993). Moreover, the dichotomous index may not detect minor changes — for instance, when EE is studied longitudinally.

Magaña et al. (1986) introduced an alternative method to elicit relative'sEE: the Five Minute Speech Sample protocol (FMSS), developed by Gottschalk and Gleser (1969). Relatives are asked to talk about their feelings toward the patient for about 5 min. The audiotaped monologue is scored on 9 aspects. Eight of these are used to construct the index of EE. It consists of the categories criticism and EOI. A parent is rated as highly critical when the following scores are rated: Negative Initial Statement, a negative rating on Quality of Relationship or one or more Critical Remarks. High EOI contains: Emotional Display, Overprotective/Self-sacrificing Behavior or any two of the following: Excessive Detail, expression of feelings about the patient (Statement of Attitude) and exaggerated praise (5 or more Positive Remarks). This index showed a high agreement with the CFI-EE in several replicated studies (Magaña et al., 1986), although 30% of the low EE families were rated as high according to the CFI. The results of the Magaña et al. study were replicated cross-nationally (Leeb et al., 1991; Stark and Buchkremer, 1992). This method still yields a dichotomous index (high or low EE) and, moreover, the highest score of two relatives, if assessed, is taken as the family index.

Kazarian (1992) described alternative operationalizations of EE, scored on interval scales. Two of these scales showed concurrent validity with the CFI index of EE, or one or more subcategories, and had predictive value regarding psychotic relapse: Patient Rejection Scale (Kreisman et al., 1979) and Level of Expressed Emotion Scale (Cole and Kazarian, 1988). The subscales care and criticism of the Influential Relationships Questionnaire (Baker et al., 1984) discriminated between relapsed and non-relapsed patients with schizophrenia. Although the internal consistency of the two subscales was good, the correlation with CFI ratings was weak. The subscales criticism and EOI of the Questionnaire Assessment of Expressed Emotion (Docherty et al., 1990) showed correspondence with the CFI categories, but the predictive value still has to be established. The subscales conflict and expressiveness of the Family Environment Scale (Moos and Moos, 1981) showed no direct association with the CFI categories criticism and EOI. However, the two subscales discriminated between frequent and less frequent readmitted patientswith schizophrenia

(Schnur et al., 1986). The Perceived Criticism Scale (Hooley and Teasdale, 1989) is a 10-point scale that showed concurrent validity with the CFI. The relationship with psychotic relapse for this operationalization of relatives' criticism has not been studied. The anxiety and hostility scales of Gottschalk et al. (1988), based on 5 min speech samples, are interval scales. However, dichotomized categories were used to test for concurrent and predictive validity.

The (sub)scales as mentioned by Kazarian (1992) are not widely used and the construct and predictive validity are established only for small groups of patients, $N = 46$ (Cole and Kazarian, 1988) and $N = 66$ (Kreisman et al., 1988). The categories criticism and EOI by Magaña et al. (1986) are constructed using FMSS items on an a priori basis. Although the predictive value and the concurrent validity of the two EE subcategories have been examined in several studies (Hahlweg et al., 1989; Tompson et al., 1995), little attention has been paid to the internal consistency of the EE subcategories. Parker et al. (1989) studied the factorial qualities of EE categories according to the CFI in combination with categories from other instruments and found support for the dimensions warmth and overprotection.

In the present study an attempt was made to accommodate the criticisms about the dichotomous nature of the EE index by constructing a composite scale from the FMSS variables. According to Gottschalk and Keatinge (1993), a continuous measure for EE might better account for heterogeneity within families than a dichotomous index, and expands the possibilities for statistical tests. For instance, longitudinal statistical methods are not available for categorical variables. In the second place, by examining the scalability of the FMSS items without any a priori assumption about the existence of the three subscales, we wanted to explore whether there is justification to treat EE as a global index, or whether the subscales criticism, EOI and hostility must be considered as separate constructs. Third, we wanted to examine the internal consistency of the EE index or the eventual subscales, since scale construction requires intercorrelation measures.

2. Methods

2.1. Subjects

In this follow-up study, contact was made with parents and patients who participated, after informed consent, in a 15-month intervention program in the adolescents' clinic of the Psychiatric Department of the University of Amsterdam.

The criteria for inclusion were: (1) a diagnosis of schizophrenia or schizophrenia-like disorder according to DSM-III-R criteria (APA, 1987); (2) being in need of continuous antipsychotic medication; (3) an age between 15 and 26 years and (4) living, or in close contact with, parents or other relatives. Patients with primary alcohol or drug dependence, or with brief drug-related psychoses, were excluded.

Of the 97 admitted patients, 9 patients dropped out of the intervention study. Of the remaining 88 patients, 75 families could be contacted for the follow-up study in 1992. Reasons for drop-out were: refusal 6, not traceable 3, emigration 1, suicide 2, and natural death 1.

Of the 75 families the FMSS could be assessed in 30 instances from one parent (7 fathers and 23 mothers) and in 45 instances from both parents. The follow-up assessments on average took place 34 months after discharge (range 17-55 months).

2.2. The intervention program

The intervention program consisted of a 3-month in-patient phase and an out-patient phase of 12 months.

During the in-patient phase an important issue was the maximization of medication compliance. In this phase one or two psycho-educational meetings with parents were held, in which parents were also instructed to create low stress levels for their child.

The out-patient phase consisted of a day hospital program of 3 months, followed by a 9-month community care program. At the out-patient phase individual contacts occurred biweekly during the first 5 months and monthly during the remaining 7 months. Patients were taught about

their illness, prodromal signs and risk factors of relapse. They also received medication management training, learned problem-solving techniques and were supported in seeking employment, education and financial support.

Half of the patients and their families received an additional family treatment, based on the behavioral family management approach of Falloon et al. (1984). The frequency of the sessions was identical to those in the standard intervention. Families were randomly assigned to the intervention conditions. The intervention program and the two conditions are described in more detail elsewhere (Linszen et al., 1996).

2.3. Assessments

During the Five Minute Speech Sample (FMSS; Gottschalk and Gleser, 1969; Magaña et al., 1986), relatives were asked to talk about the patient (What kind of person is he/she?; How do you get along together?) for 5 min. The audiotaped monologue was scored on 9 categories: Criticisms, Quality of Initial Statement, Quality of Relationship, Dissatisfaction, Overprotective/Self-sacrificing Behavior, Emotional Display, Excessive Detail, Statements of Attitude and Positive Remarks. Although Magaña et al. suggested dropping Dissatisfaction from the coding system, due to the lack of association with criticism and EOI categories, we decided to keep it for analysis, since we wanted to analyze the items independently.

Three of the items are frequency counts: Critical Remarks, Statements of Attitude and Positive Remarks. Three items are dichotomous (no/yes): Dissatisfaction, Emotional Display and Excessive Detail. Three items have three answer categories: Initial Statement and Quality of Relationship (positive/neutral/negative) and Overprotective/Self-sacrificing (no/borderline/yes).

The FMSSs from the parents at follow-up were administered by a research assistant, who also scored the audiotaped monologues. She was trained by one of the authors (PD), who has been receiving continuous training at the University of California, Los Angeles since 1986. The agreement of the research assistant with standard tape ratings of the Los Angeles group was 90%.

During the intake phase of the intervention study, parents were interviewed with regard to social and psychiatric history of their child (Psychiatric Symptoms and History Schedule, 1984). In addition data with regard to prognosis (Strauss and Carpenter, 1974, 1977) and premorbid functioning (Goldstein, in: Kokes et al., 1977) were obtained.

Comparison between participating patients ($N = 75$) and non-participants ($N = 22$) of the follow-up study showed no significant differences in characteristics of demography and medication. For factors of clinical importance almost no significant differences were found. Participants more often had previous hospitalizations than non-participants (47% vs. 23%; $\chi^2 = 4.02$; df = 1; $P = 0.04$). Also the time between the last psychotic episode and admission tended to be shorter for non-participants than for participants (longer than 1 year: 14% vs. 35%; $\chi^2 = 3.59$; df = 1; $P = 0.06$). The two groups showed no significant differences in premorbid functioning, prognosis and severity of illness as indicated by positive and negative symptoms, assessed by the Brief Psychiatric Rating Scale (Breier et al., 1991) during the last two months of the in-patient phase (data not shown).

2.4. Data analysis

Two strategies were applied to detect the underlying or latent structure of the FMSS items.

First, Mokken scale analyses (Mokken, 1971) were carried out to discover to what extent items, or a subset of items, constitute a unidimensional scale. Mokken developed a non-parametric model for the measurement of latent traits and attitudes. The basic assumption for this model is that the items must form a double monotonous set (Molenaar et al., 1994). To meet this assumption, four criteria must be satisfied. (1) Unidimensionality: the items must form a single construct. (2) Local stochastic independence of the item scores, which means that the answers on the items must be stochastically independent for every respondent with a given value on the latent scale. (3) The probability of a positive response must be a monotonously non-decreasing function of the latent scale value (cumulative items). If these three

criteria are met, the items form a monotonously homogenous set. The fourth criterion concerns double monotony. (4) The item response functions must not intersect, which implies that items with a higher 'difficulty', or probability of negative responses, actually have a lower or equal probability of positive responses.

The Mokken program can be used in several ways, depending on the purpose of the study: to construct a (sub)scale from a pool of items stepwise, or to test an existing scale. Loevinger's coefficient H is used as the criterion of scalability. The value of this coefficient must be between 0.0 and 1.0 (negative values indicate violation of the assumption of non-decreasingness). Each item is also tested for its scalability (H_g) with respect to the other items.

The utility of this approach has been demonstrated in four studies with different aims and populations. Kempen and Suurmeijer (1991) used this method to develop a scale for physical limitations for elderly people. Suurmeijer et al. (1994) found the underlying dimension of disability in a scale for restriction of activity for elderly or chronically ill people. Jess and Bech (1994) distinguished the general dimension of neuroticism among items from the Minnesota Multiphasic Personality Inventory. Gerritsen and Van der Ende (1994) developed a Care-Giving Burden Scale for informal caregivers of psychogeriatric patients.

To carry out Mokken scale analysis, all variables must be in the same format.Originally the Mokken model was restricted to dichotomous items. Recently the program was extended to polytomous items (Molenaar et al., 1994). In our study the FMSS items were scored in different formats. Therefore the scores were dichotomized. The levels of the dichotomous variables were based on the distribution as found in our response group. Only four parents, for instance, scored negatively on Quality of Relationship. Therefore neutral and negative values were combined into one level, which must be interpreted as 'less positive'. For the same reason the categories 'borderline' and 'present' of the variable Overprotective/Self-sacrificing were combined. For the variables Critical Remarks, Statements of Attitude and Positive Remarks, one or more re-

marks were combined into one level (only one parent had more than one, i.e. 11, critical remarks). Moreover, the variable Positive Remarks was reflected, resulting in 'one or more remarks' as a positive attitude toward the patient and 'no positive remarks' as a less positive attitude.

Principal component analysis was used as a parallel analysis method to check for comparable results. This method is more directed to the construction of different components and less to unidimensionality. Simultaneous Component Analysis (SCA; Millsap and Meredith, 1988; Kiers, 1990) was used to test for differences in the component resolutions for fathers and mothers.

For principal component analysis all variables must be in the same format as well, although this can be circumvented by applying Z-scores. To make the results comparable with those from Mokken scale analysis, the dichotomized scores were taken.

3. Results

First, we tested whether there were associations between the FMSS scores of fathers and mothers. In Table 1 the results are shown for the 45 cases in which both parents were interviewed.

The statistics for Kendall's τ (for categorical variables) and Spearman's rank correlation (for interval variables) show that there was no association between fathers and mothers for any of the variables. Only for Positive Remarks a positive trend was found.

Since none of the correlations were significant, we decided that the FMSS scores from fathers and mothers could be analyzed independently. Therefore the following analyses are based on 120 FMSS interviews: 52 fathers (7 of patients with one, and 45 of patients with two parents interviewed) and 68 mothers (23 of patients with one, and 45 of patients with two parents interviewed).

A search procedure of Mokken scale analysis on the 9 items of the parental FMSS was carried out (Table 2).

Five items were selected, while the items Emotional Display, Statements of Attitude and Over-

Table 1
Associations between FMSS scores of fathers and mothers ($N = 45$)

	Fathers		Mothers		Statistic[1]	P[2]
	N	%	N	%		
Initial statement[3]						
positive	9	20	18	40	0.05	
neutral	36	80	27	60		
Quality of relationship						
positive	16	36	22	49	−0.05	
neutral	27	60	22	49		
negative	2	4	1	2		
Critical remarks[4]						
0	41	91	41	91	0.18	
1 or more	4	9	4	9		
Dissatisfaction						
no	42	93	40	89	0.19	
yes	3	7	5	11		
Emotional display						
no	45	100	43	96	*	
yes	0	0	2	4		
Statements of attitude						
0	41	91	39	87	0.10	0.51
1	4	9	5	11		
2	0	0	1	2		
Overprotective/Self-sacrificing						
no	42	93	40	89	−0.09	
borderline	1	2	2	4		
yes	2	4	3	7		
Excessive detail						
no	41	91	40	89	0.14	
yes	4	9	5	11		
Positive remarks						
0	25	56	29	64	0.25	0.10
1	11	24	5	11		
2	6	13	7	16		
3	1	2	2	4		
4	2	4	2	4		

[1] For categorical variables the statistic is Kendall's τ. For interval variables the statistic is ρ (Spearman's rank correlation).
[2] For Kendall's Tau, P can only be calculated by approximation (based on the asymptotic standard error). The statistics show however, that none of the associations deviate sufficiently from zero.
[3] No negative initial statements were scored.
[4] For all but one parents 0 or 1 Critical Remarks was scored; therefore this variable was dichotomized.
* Only two parents showed Emotional Display; therefore the statistic could not be calculated.

protective/Self-sacrificing were rejected due to negative H_{gh} values with respect to one or more of the selected scales. This indicated that these items were not independent across subjects. Critical Remarks was excluded because the scalability (H_g) was not significantly above the lower limit ($H = 0.30$). The scalability coefficient (H) for the selected scale was 0.48, which implied an intermediate magnitude of the scale.

The FMSS items were reanalysed for fathers and mothers separately, because of the possibility that dependency across subjects for the three rejected items is caused by the fact that in 45 instances fathers and mothers from one family

Table 2
Results of Mokken scale analysis on the FMSS scores; $\alpha = 0.05$; lowerbound $H = 0.30$

	Search All parents ($N = 120$)		
	Proportion	H_g	Z^1
Initial statement	0.73	0.57	6.88
Quality of relationship	0.59	0.54	7.20
Dissatisfaction	0.09	0.45	3.24
Excessive detail	0.08	0.44	3.07
Positive remarks	0.63	0.35	4.71
Rejected			
Overprotective/Self-sacrificing	0.07	0.00	0.04
Statements of attitude	0.10	−0.20	−2.06
Emotional display	0.02	−0.38	−1.71
Excluded			
Critical remarks	0.08	0.31	3.07
Number of selected items		5	
Scale coefficient H		0.48	8.25
Reliability (ρ)		0.68	

$^1\alpha$ was set on 0.05; the critical Z for the adjusted α (0.0011) is 3.07.

were interviewed. This resulted in the selection of different sets of items. For fathers only Dissatisfaction and Excessive Detail passed the selection criteria. For mothers Critical Remarks, Dissatisfaction, Quality of Relationship and Initial Statement were selected. However, the construction of different scales for the two groups of parents is not desirable, because this would hamper the eventual construction of a family profile score. Moreover, for mothers all items of the separate searches, except Critical Remarks, were also selected in the initial analysis (Table 2).

Because Critical Remarks nearly met the criteria in the initial analysis, the search procedure was repeated with a higher significance level ($\alpha = 0.06$ instead of the default $\alpha = 0.05$), at the risk of selecting a somewhat weaker scale. In this search (Table 3) Critical Remarks was now selected as well, because the Z value (3.07) was slightly above the lower limit ($Z = 3.01$).

The coefficient of scalability for the scale ($H = 0.44$) was lower than in the first search but still fell within the range for a medium strong scale

($H = 0.40$–0.50). The checks for single and double monotony showed no violations of the model assumptions. The reliability ($\rho = 0.67$) was reasonable. It may be concluded that the scale, although not very strong, consists of 6 cumulative items which form a unidimensional scale.

The higher significance level in the second search led to the selection of two more items, Emotional Display and Overprotective/Self-sacrificing, in a second scale, again of intermediate magnitude ($H = 0.46$). This scale could not be tested for double monotony completely, because not all checks are possible for a two-item scale. However, the check for non-intersection of the item response functions showed that these functions intersect ($H_a^T > 10$), indicating that the item set is not doubly monotonous. The checks for single monotony (assumptions 1–3) indicated that the scale was monotonously increasing. Conclusions about the reliability ($\rho = 0.38$) were difficult, owing to the lack of double monotony.

The scalability of the two scales was analyzed for fathers and mothers separately in a test run

Table 3
Results of Mokken scale analysis on the FMSS scores; $\alpha = 0.06$; lowerbound $H = 0.30$

	Search			Test					
	All parents ($N = 120$)			Fathers ($N = 52$)			Mothers ($N = 68$)		
	Proportion	H_g	Z	Proportion	H_g	Z	Proportion	H_g	Z
Scale 1			[1]						
Initial statement	0.73	0.58	6.90	0.81	0.41	2.68	0.65	0.65	6.49
Quality of relationship	0.59	0.56	7.42	0.69	0.38	3.55	0.52	0.68	6.60
Positive remarks	0.63	0.37	5.00	0.62	0.30	2.72	0.63	0.42	4.32
Dissatisfaction	0.09	0.36	3.51	0.06	0.31	2.18	0.12	0.40	3.03
Excessive detail	0.08	0.31	3.07	0.08	0.45	3.02	0.07	0.20	1.51
Critical remarks	0.08	0.31	3.07	0.08	0.09	0.60	0.07	0.47	3.47
Number of selected items		6							
Scale coefficient H		0.44	8.77		0.33	4.35		0.51	7.76
Reliability (ρ)		0.67			0.58			0.71	
Scale 2			[2]						
Emotional display	0.02	0.46	2.29	0.00[3]	—	—	0.03	0.45	2.07
Overprotective/Self-sacrificing	0.07	0.46	2.29	0.06	—	—	0.09	0.45	2.07
Number of selected items		2							
Scale coefficient H		0.46	2.29		—	—		0.45	2.07
Reliability (ρ)		0.38			—			0.42	
Excluded									
Statements of attitude	0.10	0.09	0.93	0.08	—	—	0.12	—	—

[1] The critical Z for the adjusted α (0.0013) is 3.01.
[2] The critical Z for the adjusted α (0.015) is 2.17.
[3] No father showed Emotional Display.

(Table 3). The results showed that the coefficient of scalability of the first scale was lower for fathers ($H = 0.33$) than for mothers ($H = 0.51$), and lower than for the total response group. This was caused specifically by the low scalability of Critical Remarks ($H_g = 0.09$). The other five coefficients of scalability were lower than for the total group, except for Excessive Detail, but were still above the lower bound. For mothers all item coefficients, except for Excessive Detail, were higher than for the total response group, resulting in a stronger scale ($H = 0.51$). The criteria for double monotony were met for both parent groups. Therefore the reliability ($\rho = 0.58$ and $\rho = 0.71$) can be interpreted as reasonable.

The second scale could not be constructed for fathers, because the frequencies of the two items were too low. Only three fathers scored on Overprotective/Self-sacrificing and no father showed Emotional Display. For mothers, one of the checks for double monotony which could be performed for the two items indicated that the two item response functions intersect. The scale proved not to be doubly monotonous, which implies that the reliability cannot be ascertained.

Principal component analysis provided four components with an eigenvalue greater than 1.0. The explained variance was 63%. The results of Varimax rotation (Table 4) showed that Quality of Relationship loaded on Factor 1 and on Factor 2. Also Dissatisfaction, Critical Remarks and Statements of Attitude appeared to load on two factors. Oblique rotation did not separate the variables any better. Also, the removal of four cases with relatively high scores on one or more of the components did not result in any improvement.

The FMSS scores of fathers and mothers did

Table 4
Results of principal component analysis (Varimax rotation) of the FMSS scores from fathers and mothers ($N = 120$)

	Factor loadings[1]			
	Factor 1	Factor 2	Factor 3	Factor 4
Positive remarks	0.76			
Initial statement	0.74			
Quality of relationship	0.72	0.34		
Excessive detail		0.76		
Dissatisfaction		0.70		0.31
Emotional display			0.77	
Overprotective/Self-sacrificing			0.71	
Critical remarks	0.32			0.66
Statements of attitude			0.32	0.65
Eigenvalue	1.91	1.35	1.28	1.10
Cronbach's α	0.66	0.38	0.28	0.02

[1]Loadings smaller than 0.30 are left out.

not correlate. It is possible that fathers and mothers show different component structures. Simultaneous component analysis (Kiers, 1990) can find a component solution which optimally explains the variance for two or more populations simultaneously. The results of the Simultaneous Component Analysis (SCA) could be compared with those of Principal Component Analyses (PCA) for the separate data sets. An approximately equal amount of explained variance for both methods indicates that the same component structure is applicable for the different data sets.

The difference in explained variance for the two methods with Varimax rotation (Table 5) was

Table 5
Comparison between simultaneous and separate principal component analysis of the FMSS scores from fathers and mothers

	% of variance explained	
	Simultaneous component analysis (SCA)	Separate component analysis (PCA)
Fathers ($N = 52$)	65.49	68.62
Mothers ($N = 68$)	65.51	67.71
Total variance explained	65.50	68.14

about 2.5%. For fathers the difference was somewhat higher (65.49% for SCA and 68.62% for PCA); for mothers, somewhat lower (65.51% vs. 67.71%). The low difference in explained variance between the two groups of parents indicated that it is not necessary to construct different component solutions for fathers and mothers.

4. Discussion

Given the results of the Mokken scale analyses, it may be concluded that, based on the nine FMSS items, it is certainly possible to construct a unidimensional scale for EE. This scale, consisting of six items, has the cumulative qualities, is of intermediate magnitude and has a reliability that is satisfactory. This scale is appropriate for the two subgroups of parents, as well as for the combined parent group. For mothers the scale is generally stronger than for fathers, which is caused specifically by the low scalability of the item Critical Remarks in the group of fathers.

This scale has a wider range than the two categories of the original EE index, and provides the possibility to detect finer nuances and minor changes in the family atmosphere. As Hatfield et al. (1987) argue, human characteristics, like EE, can seldom be divided into dichotomous categories. They usually occur on a continuum, with

different people showing different amounts of the characteristic. Also, when a family intervention is aimed at the reduction of EE (cf. Leff et al., 1982; Hogarty et al., 1986; Tarrier et al., 1988), smaller reductions than the change from high to low EE may be detected. A meta-analysis by De Jesus Mari and Streiner (1994) for instance, showed that the difference in EE level before and after intervention is only marginally significant across all reviewed studies. Furthermore, longitudinal methods of analyses on EE are possible using a quantitative scale (Gottschalk and Keatinge, 1993). Finally, a quantitative scale may be used to construct a more elaborate family profile score. Traditionally a family is scored as high EE when one or two of the parents show high EE. Valone et al. (1983) divided families in dual low, mixed and dual high EE. This is possible only when for all patients two parents are interviewed. The quantitative scale for EE makes it possible to calculate the mean score of two parents for instance. Whether this is the best possible operationalization of the family index, when the predictive value of EE is studied, still remains to be investigated.

The items Emotional Display and Overprotective/Self-sacrificing form a secondscale of intermediate magnitude. The reliability of this scale is uncertain, because the assumptions of the Mokken model are not completely met for this scale. In addition this scale is not appropriate for the two subgroups of parents. This is due to the fact that fathers express themselves differently from mothers.

When the results of the Mokken scale analysis are compared with those of the principal component analysis, some striking similarities become apparent. The first two factors of the principal component analysis converge in the first scale of the Mokken scale analysis, together with Critical Remarks. This latter item loaded 0.32 on the first factor and formed the fourth factor in the principal component analysis, together with Statements of Attitude. In the Mokken model Statements of Attitude is a stand-alone item, which is not selected. Factor 3 of the principal component analysis, Emotional Display and Overprotective/Self-sacrificing, form the second scale of the Mokken

scale analysis. The internal consistency (Cronbach's α) for the four-item component is satisfactory. The internal consistency for the other components is low, due to the low number of items. Therefore the Mokken model is preferred, as the reliability is satisfactory. This model guarantees a truly cumulative scale.

The scale consists of five items: Initial Statement, Quality of Relationship, Dissatisfaction, Excessive Detail and Positive Remarks. It deserves consideration to add Critical Remarks to the scale at the cost of a somewhat lower magnitude of the scale. Principal component analysis supports this idea, because Critical Remarks loads on the first component, which, together with the second, is comparable with the first scale of the Mokken scale analysis.

The 6-item scale is also applicable for fathers and mothers as separate groups, although it is stronger for mothers than for fathers due to the low scalability of Critical Remarks for fathers. The assumptions of the Mokken model are not violated in the subgroups, however. Moreover, because the results of simultaneous principal component analysis indicate that the same component structure is applicable for the two groups of parents, we recommend that different item configurations not be constructed for fathers and mothers. This allows analyses of complementarity of the scores for EE between fathers and mothers and the eventual development of a family profile score.

The second scale of the Mokken scale analysis, consisting of the items Emotional Display and Overprotective/Self-sacrificing, has the cumulative characteristics, but the assumption of double monotony is almost certainly violated. However, because the reliability is in the low range, it is not appropriate to apply this scale to fathers and mothers separately, because the assumptions of the Mokken model are definitely violated in this case.

A possible drawback may be that the Mokken scale analyses were carried out on dichotomized items. This was done because the FMSS items have different answer categories. For Mokken scale analysis the answer categories must be in the same format. For principal component analysis this problem can be circumvented by analyzing

the correlation matrix. As a post-hoc analysis we carried out principal component analysis on the correlation matrix ρ (Kendall's τ), since all original answer categories are ordered. Critical Remarks was dichotomized: only one parent had more than one critical remark. This analysis yielded the same component solution as when the dichotomized items were used. The explained variance was the same: 63%. Therefore, in view of the similar results of two methods of principal component analysis, it may be concluded that collapsing the answer categories does not influence the results dramatically.

Comparing the two scales with the EE components as distinguished by Magaña et al. (1986) reveals that the first Mokken scale contains items regarding criticism (Initial Statement, Quality of Relationship and Critical Remarks) but also items regarding the EOI component. Exaggerated Praise (5 or more positive remarks), in combination with Excessive Detail or Statements of Attitude, was contained in the EOI component of Magaña et al. We found that the absence of positive remarks waspositively related to the other items of the first scale. When the unaltered answer categories were analyzed with the principal component analysis, a negative relationship of Positive Remarks with Initial Statement and Quality of Relationship in the first factor was found. The latter items were regarded as belonging to the component of criticism by Magaña et al. (1986). It may therefore be concluded that the number of positive remarks is negatively related to criticisms. Excessive Detail was positively related to the other items of the first scale and to Dissatisfaction in the second factor according to the two different methods of principal component analysis. The first scale of the Mokken analyses therefore concerns criticisms and dissatisfaction. Of the five items regarding EOI, two were distinguished from the other FMSS items in the Mokken scale analysis as well as in the two different principal component analyses. It may be concluded that the second scale can be characterized as EOI.

A further limitation of our study is the fact that in our parent group low frequencies of negative attitudes towards the patient were found for 6 of the 9 FMSS items. This is particularly the case

with items belonging to the EOI scale. According to the Magaña et al. (1986) criteria, only 17% of the families could be rated as high EE. This proportion is very low compared with other FMSS studies (Magaña et al., 1986; Leeb et al., 1991). This low proportion could reflect the lack of chronicity of our patient group as compared to the other studies. However, the Mokken scale method is a non-parametric approach, and no limitations with regard to distributions are specified. Re-analysis of earlier FMSS material, preferably with relatives with larger proportions of high EE, would contribute to the establishment of reliability of the scales. We strongly recommend the assessment of FMSS and CFI at the same time in future research. Comparison between the standard and quantitative measures of EE would make it possible to assess the validity of the quantitative scales.

As recommended by Magaña et al. (1986), hostility was not scored, because of its overlap with criticism (Vaughn and Leff, 1976). In our intervention study (Linszen et al., in press) 10 (27%) of the 47 parents who were scored on Hostility had no Critical Remarks. Therefore attention should be paid to the role of this variable in future research.

Furthermore, the concurrent validity of this measure for parental EE should be assessed. Valone et al. (1983) found that high EE parents also expressed high levels of mild and harsh criticisms (Affective Style) in direct interaction with their offspring. Goldstein (1985) established the relation between schizophrenia and EE, Affective Style and Communication Deviance.

Also the predictive value regarding psychotic relapse of this quantitative measure for EE should be investigated in combination with the classical dichotomous index.

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References

American Psychiatric Association (1987) *Diagnostic and Statistical Manual of Mental Disorders*, 3rd ed., revised. American Psychiatric Press, Washington DC.

Baker, B., Helmes, E. and Kazarian, S.S. (1984) Past and present perceived attitudes of schizophrenics in relation to rehospitalization. *Br J Psychiatry* 144, 263–269.

Bebbington, P. and Kuipers, L. (1994) The clinical utility of expressed emotion in schizophrenia. *Acta Psychiatr Scand* 89 (Suppl 382), 46–53.

Breier, A., Schreiber, J.L., Dyer, J. and Pickar, D. (1991) National Institute of Mental Health longitudinal study of chronic schizophrenia: prognosis and predictors of outcome. *Arch Gen Psychiatry* 48, 239–246.

Brown, G.W. and Birley, J.L.T. (1968) Crises and life changes and the onset of schizophrenia. *J Health Soc Behav* 9, 203–214.

Cole, J.D. and Kazarian, S.S. (1988) The level of expressed emotion scale: a new measure of expressed emotion. *J Clin Psychol* 44, 392–397.

De Jesus Mari, J. and Streiner, D.L. (1994) An overview of family interventions and relapse on schizophrenia: meta-analysis of research findings. *Psychol Med* 24, 565–578.

Docherty, N.M., Serper, M.R. and Harvey, P.D. (1990) Development and preliminary validation of a questionnaire assessment of expressed emotion. *Psychol Rep* 67, 279–287.

Falloon, I.R.H., Boyd, J.L. and McGill, C.W. (1984) *Family Care of Schizophrenia*. The Guilford Press, New York.

Gerritsen, J.C. and Van der Ende, P.C. (1994) The development of a care-giving burden scale. *Age Ageing* 23, 483–491.

Goldstein, M.J. (1985) Family factors that antedate the onset of schizophrenia and related disorders: the results of a fifteen year prospective longitudinal study. *Acta Psychiatr Scand* 71 (Suppl 319), 7–18.

Gottschalk, L.A., Falloon, I.R.H., Marder, S.R., Lebell, M.B., Gift, T.E. and Wynne, L.C. (1988) The prediction of relapse of schizophrenic patients using emotional data obtained from their relatives. *Psychiatry Res* 25, 261–276.

Gottschalk, L.A. and Gleser, G.C. (1969) *The Measurement of Psychological States through the Content Analysis of Verbal Behavior*. University of California Press, Berkeley, CA.

Gottschalk, L.A. and Keatinge, C. (1993) Influence of patient caregivers on course of patient illness: 'Expressed emotion' and alternative measures. *J Clin Psychol* 49, 898–912.

Hahlweg, K., Goldstein, M.J., Nuechterlein, K.H., Magaña, A.B., Mintz, J., Doane, J.A., Miklowitz, D.J. and Snyder, K.S. (1989) Expressed emotion and patient-relative interaction in families of recent onset schizophrenics. *J Consult Clin Psychol* 57, 11–18.

Hatfield, A.B., Spaniol, L. and Zipple, A.M. (1987) Expressed emotion: a family perspective. *Schizophr Bull* 13, 221–226.

Hogarty, G.E., Anderson, C.M., Reiss, D.J., Kornblith, S.J., Greenwald, D.P., Javna, C.D. and Madonia, M.J. (1986) Family psychoeducation, social skills training and maintenance chemotherapy in the aftercare treatment of schizophrenia. I. One-year effects of a controlled study on relapse and expressed emotion. *Arch Gen Psychiatry* 43, 633–642.

Hooley, J.M. (1985) Expressed emotion: a review of the critical literature. *Clin Psychol Rev* 5, 119–139.

Hooley, J.M. and Teasdale, J.D. (1989) Predictors of relapse in unipolar depressives: expressed emotion, marital distress, and perceived criticism. *J Abnorm Psychol* 98, 229–235.

Jess, P. and Bech, P. (1994) The validity of Eysenck's neuroticism dimension within the Minnesota Multiphasic Personality Inventory in patients with duodenal ulcer. *Psychother Psychosom* 62, 168–175.

Kanter, J., Lamb, H.R. and Loeper, C. (1987) Expressed emotion in families: a critical review. *Hosp Community Psychiatry* 38, 374–380.

Kavanagh, D.J. (1992) Recent developments in expressed emotion and schizophrenia. *Br J Psychiatry* 169, 601–620.

Kazarian, S.S. (1992) The measurement of expressed emotion: a review. *Can J Psychiatry* 37, 51–56.

Kempen, G.I.J.M. and Suurmeijer, Th.P.B.M. (1991) Factors influencing professional home care utilization among the elderly. *Soc Sci Med* 32, 77–81.

Kiers, H.A.L. (1990) *SCA, a Program for Simultaneous Components Analysis of Variables Measured in Two or More Populations*. IEC ProGamma, Groningen, The Netherlands.

Koenigsberg, H.W. and Handley, R. (1986) Expressed emotion: from predictive index to clinical construct. *Am J Psychiatry* 143, 1361–1373.

Kokes, R.F., Strauss, J.S. and Klorman, R. (1977) Part II, Measuring premorbid adjustment: the instruments and their development. *Schizophr Bull* 3, 186–214.

Kreisman, D., Blumenthal, R., Borenstein, M., Woerner, M., Kane, J., Rifkin, A. and Reardon, G. (1988) Family attitudes and patient social adjustment in a longitudinal study of out-patient schizophrenics receiving low-dose neuroleptics: the family's view. *Psychiatry* 51, 3–13.

Kreisman, D.E., Simmens, S.J. and Joy, V.D. (1979) Rejecting the patient: preliminary validation of a self-report scale. *Schizophr Bull* 5, 220–222.

Kuipers, L. (1992) Expressed emotion in 1991. *Soc Psychiatry Psychiatr Epidemiol* 27, 1–3.

Leeb, B., Hahlweg, K., Goldstein, M.J., Feinstein, E., Mueller, U., Dose, M. and Magaña-Amato, A. (1991) Cross-national reliability, concurrent validity, and stability of a brief method for assessing expressed emotion. *Psychiatry Res* 39, 25–31.

Leff, J., Kuipers, L., Berkowitz, R., Eberlein-Vries, R. and Sturgeon, D. (1982) A controlled trial of social intervention in the families of schizophrenic patients. *Br J Psychiatry* 141, 121–134.

Linszen, D.H., Dingemans, P.M.A.J., Nugter, M.A., Van der Does, A.J.W., Scholte, W.F. and Lenior, M.E. Patient attributes and expressed emotion (EE) as risk factors for psychotic relapse. *Schizophr Bull* (in press).

Linszen, D., Dingemans, P., Van der Does, J.W., Nugter, A., Scholte, P., Lenior, R. and Goldstein, M.J. (1996) Treat-

ment, expressed emotion and relapse in recent onset schizophrenic disorders. *Psychol Med* 26, 333–342.

Magaña, A.B., Goldstein, M.J., Karno, M., Miklowitz, D.J., Jenkins, J. and Falloon, I.R.H. (1986) A brief method for assessing expressed emotion in relatives of psychiatric patients. *Psychiatry Res* 17, 203–212.

Miklowitz, D.J., Goldstein, M.J. and Falloon, I.R.H. (1983) Premorbid and symptomatic characteristics of schizophrenics from families with high and low levels of expressed emotion. *J Abnorm Psychol* 92, 359–367.

Millsap, R.E. and Meredith, W. (1988) Component analysis in cross-sectional and longitudinal data. *Psychometrica* 53, 123–134.

Mokken, R.J. (1971) *A Theory and Procedure of Scale Analysis.* Mouton, The Hague, The Netherlands.

Molenaar, I.W., Debets, P., Sijtsma, K. and Hemker, B.T. (1994) *MSP, a Program for Mokken Scale Analysis for Polytomous Items.* IEC ProGamma, Groningen, The Netherlands.

Moos, R.H. and Moos, B.S. (1981) *Family Environment Scale: Manual.* Consulting Psychologists Press Inc., Palo Alto, CA.

Parker, G., Hayward, L. and Johnston, P. (1989) Factorial validity of the EE scales. *Psychol Med* 19, 435–446.

Psychiatric Symptoms and History Schedule (1984) PSHS Revision 6/26/1984. University of California, Los Angeles (unpublished manuscript).

Schnur, D.B., Friedman, S., Dorman, M., Redford, H.R. and Kesselman, M. (1986) Assessing the family environment of schizophrenic patients with multiplehospital admissions. *Hosp Community Psychiatry* 37, 249–252.

Stark, F.M. and Buchkremer, G. (1992) Das Fünfminuteninterview. Eine Kurzfassung zur Erfassung der Expressed Emotion Status [The five-minute speech sample. A brief method for assessing expressed emotion]. *Der Nervenarzt* 63, 42–45.

Strauss, J.S. and Carpenter, W.T. Jr. (1974) The prediction of outcome in schizophrenia: II. Relationships between predictor and outcome variables. *Arch Gen Psychiatry* 31, 37–42.

Strauss, J.S. and Carpenter, W.T. (1977) Prediction of outcome in schizophrenia: III. Five year outcome and its predictors. *Arch Gen Psychiatry* 34, 159–163.

Suurmeijer, T.P.B.M., Doeglas, D.M., Moum, T., Briancon, S., Krol, B., Sanderman, R., Guillemin, F., Bjelle, A. and Van den Heuvel, W.J.A. (1994) The Groningen activity restriction scale for measuring disability: its utility in international comparisons. *Am J Public Health* 84, 1270–1273.

Tarrier, N., Barrowclough, C., Vaughn, C., Bamrah, J.S., Porceddu, K., Watts, S. and Freeman, H. (1988) The community management of schizophrenia: a controlled trial of a behavioral intervention with families to reduce relapse. *Br Med J* 153, 532–542.

Tompson, M.C., Goldstein, M.J., Lebell, M.B., Mintz, L.I., Marder, S.R. and Mintz, J. (1995) Schizophrenic patients' perceptions of their relatives' attitudes. *Psychiatry Res* 57, 155–167.

Valone, K., Norton, J.P., Goldstein, M.J. and Doane, J.A. (1983) Parental expressed emotion and affective style in an adolescent sample at risk for schizophrenia spectrum disorders. *J Abnorm Psychol* 92, 399–407.

Vaughn, C.E. and Leff, J.P. (1976a) The influence of family and social factors on the course of psychiatric illness: a comparison of schizophrenic and depressed neurotic patients. *Br J Psychiatry* 129, 125–137.

Vaughn, C.E. and Leff, J.P. (1976b) The measurement of expressed emotion in the families of psychiatric patients. *Br J Soc Clin Psychol* 15, 157–165.