



Differential correlates of criticism versus emotional overinvolvement towards patients with schizophrenia living in halfway houses or with their families

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Abstract

Purpose This study systematically searched for differential correlates of criticism vs. emotional overinvolvement (EOI) towards patients with schizophrenia in families and halfway houses, which have only incidentally been reported in previous research. Identified patterns were compared across settings.

Methods We included 40 inpatients with schizophrenia living in halfway houses and 40 outpatients living with their families and recorded the expressed emotion (EE) of 22 psychiatric nurses or 56 parents, respectively, through Five Minutes Speech Samples. Each nurse rated 1–12 inpatients and each inpatient was rated by 2–5 nurses. Each outpatient was rated by one or both parents. As EE ratings had a multilevel structure, weighted Spearman correlations of criticism and EOI with various patient- and caregiver-related characteristics were calculated and compared with Meng’s z-test.

Results Criticism was weakly negatively correlated with EOI in nurses but negligibly in parents. Distinct patterns of significant differential correlates arose across settings. Outpatients’ aggressive behavior and parents’ related burden were mainly associated with higher criticism. Inpatients’ symptoms (agitation/aggression, negative and other psychotic symptoms) and nurses’ burnout (Depersonalization) were mainly associated with lower EOI. Inpatients’ perceived criticism and outpatients’ previous suicide attempts were equally associated with higher criticism and lower EOI (mirror correlations). Finally, various inpatient attributes (older age, chronicity, unemployment and smoking) triggered higher EOI only. Inpatients’ age, psychopathology (esp. agitation/aggression and negative symptoms) and perceived criticism survived adjustment for multiple comparisons.

Conclusion Our findings suggest setting-specific pathogenetic pathways of criticism and EOI and might help customize psychoeducational interventions to staff and families.

Keywords Criticism · Differential correlates · Emotional overinvolvement · Expressed emotion · Halfway houses · Schizophrenia

Panagiotis Ferentinos and Stamatina Douki have contributed equally to this work and share first authorship.

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Introduction

The family environment is recognized as a major modifiable predictor of the course of schizophrenia along with stressful life events, reduced compliance to treatment, substance misuse and poor premorbid adjustment [1–3]. The family environment is associated with the emergence of relapses through “expressed emotion” (EE) [4], a construct introduced in the 1950s to describe affective attitudes and behaviors determining the quality of intrafamilial emotional communication. It includes five dimensions [5] as traditionally recorded with the gold standard tool, Camberwell Family Interview (CFI) [1]: three negative dimensions, which have

drawn much greater attention and are used in scoring EE, i.e., criticism (critical, resenting or disapproving comments about the patient's behavior), hostility (extreme form of criticism and rejection, often highly correlated with criticism), and emotional overinvolvement (EOI, evidenced by exaggerated emotional responses, over-intrusive, over-protective or self-sacrificing behavior, and over-identification with the patient), as well as two positive dimensions, i.e., warmth (empathy, concern and interest for the patient, usually negatively correlated with criticism and positively correlated with EOI) and positive remarks (praising, appreciating or approving comments), which do not count in scoring EE but are increasingly attracting attention in more recent studies. Apart from the time-consuming CFI, EE is assessed with the far briefer Five Minutes Speech Sample, measuring only criticism and EOI, i.e., the two key EE components, and several self-report questionnaires for caregivers [6, 7], such as the Patient Rejection Scale [8], the Family Attitude Scale [9] and the Family Questionnaire [10]. Meta-analyses of various prospective studies documented the negative impact of high EE, particularly criticism and to a far lesser extent EOI, on clinical outcomes in family settings [11, 12] while high warmth, particularly in the absence of EOI, acts protectively [13].

During the last three decades, research on EE in schizophrenia has extended to the staff (usually mental health nurses) of psychosocial rehabilitation services. Among them, supported housing facilities in the community, a cornerstone of deinstitutionalization, are comparable to the patient's family environment. However, as staff may emotionally invest less in patients than family relatives, high EE in staff-patient studies almost always arises from criticism rather than EOI, which seems less relevant in these settings [14]. Tools to assess staff EE are generally the same as in families but setting-specific tools, such as the Nurse Attitude Scale [15], are increasingly used. Staff EE or its components have also been associated with patient outcomes though weakly, inconsistently and in much fewer prospective studies [16–19].

Given the importance of EE for clinical outcomes, various studies have investigated patient- and caregiver-related characteristics associated with EE in family and staff-patient settings [14, 20]. Although studies rarely report correlations of criticism with EOI, it has been suggested that they are relatively independent in family relatives and often have different correlates [21]. Specifically focusing on differential correlates of criticism vs. EOI may highlight specific pathways giving rise to each EE dimension. For example, patients' perceived criticism is often recognized as a differential predictor of criticism but not EOI in family relatives [22, 23] but also in staff [24, 25]. However, differential correlates of criticism vs. EOI have not been systematically investigated in both families and

staff. The only study that explicitly had this specific aim included patients with first episode psychosis and identified duration of untreated psychosis and family relatives' distress as differential correlates of criticism vs. EOI [21]. Various other studies only incidentally reported contrasting patterns of correlations of criticism and EOI with patients' demographics (gender [26], age [27], employment [27, 28]), clinical characteristics (disease duration [29], previous hospitalizations or psychotic episodes [28, 30, 31], history of aggressive behavior [32]), current psychopathology or aggressive behavior [33–36], and PC [22, 23, 25] or caregivers' demographics (parents' gender and employment [30, 36], nurses' age, education and work experience [29, 37]), causal attributions/ illness perceptions [24, 38–40], distress [32], coping strategies [32, 35], duration of contact with patients [33] and personality factors [29]. However, studies above have not documented that differences in correlations of various features with criticism and EOI were statistically significant as this was not their aim. Furthermore, several features have scarcely been investigated as differential correlates, such as parents' psychiatric history (given that parents with affective disorders display higher criticism [41]) and patients' history of suicide attempts or smoking status, while others need further research. For example, caregiver burden, as a global score, was positively associated with both criticism and EOI [21, 42, 43] but its domain-specific dimensions have not been studied with regard to criticism and EOI; emotional burnout was positively associated with criticism and negatively with positive remarks (i.e., not EOI) as assessed with the NAS [15, 44] but this finding needs to be replicated with other EE tools measuring criticism and EOI.

Finally, it is unknown whether patterns of differential correlates are similar among families and hostels. EE correlates can only indirectly be compared between the two settings since studies including patients in both settings are unfortunately absent. However, indirect comparisons can suffer from many biases. EE and other measures used, scoring algorithms and procedures followed as well as EE predictors investigated can be different. Comparing patterns across settings might uncover setting-specific pathogenetic pathways of criticism and EOI and help customize psychoeducational interventions to staff and families.

This study included patients with schizophrenia living in halfway houses or with their families and recorded the EE of the caring staff or parents, respectively, towards the patients. It aimed to systematically investigate differential correlates of criticism vs. EOI in each setting among various patient- and caregiver-related characteristics, including most of those with some previous supporting evidence, outlined above, as well as few understudied ones, and directly compare identified patterns across settings. We hypothesized that

these features would display significantly different correlations with criticism and EOI and that patterns of significant differential correlates would be similar across settings.

Materials and methods

Participants

A convenient sample of 80 patients of both sexes with a DSM-5-based diagnosis of schizophrenia, aged 18–65 years, was recruited during a two-year period; 40 inpatients lived in four transitional halfway houses (psychiatric hostels) for at least 3 months and 40 patients lived with their families and were followed-up in two general hospital outpatient clinics. All patients had to be on antipsychotic medication, free of relapse and in no need for psychiatric hospitalization during the last 3 months. Exclusion criteria for inpatients' admission into the hostels were intellectual disability, history of alcoholism or drug use in the last 6 months and current severe medical conditions (e.g., neurological degenerative diseases, brain lesions); these were also applied in recruiting both inpatients and outpatients. Patients' clinicodemographic characteristics were recorded.

In addition, twenty-two nurses working in the four halfway houses and caring for the 40 inpatients and 56 parents of the 40 outpatients also participated in the study as raters of their EE towards patients. An additional exclusion criterion for raters was lifetime diagnosis of psychotic disorder.

Both patients and raters were ensured about the anonymity and confidentiality of all data requested and provided written informed consent before participation in the study. The research protocol followed the principles of the Helsinki Declaration and was approved by the Research Ethics Committees of all mental health facilities involved.

Measurements

Patients of both groups went through the following evaluations:

- *Brief Psychiatric Rating Scale (BPRS)* BPRS originally included 16 interviewer-rated items assessing the intensity of symptoms of schizophrenia [45]. The most commonly used 18-item version (with the addition of excitement and disorientation in 1966) has a five-factor structure, including Thinking disorder, Withdrawal, Anxiety/Depression, Hostility/Suspicion, and Activity factors [46]. The Greek version had a Cronbach's $\alpha=0.80$ for the total scale [47].
- *Perceived Criticism (PC)* The PC instrument was introduced to measure perceived criticism in a sample of depressed patients and their spouses [48] but has since

been used with several other populations, including patients with schizophrenia [49, 50]. It consists of only one self-rated question on a 10-point Likert scale: "How critical do you feel hostel nurses/your parents have been of you overall in the last month?".

Staff nurses caring for inpatients in psychiatric hostels underwent the following assessment:

- *Maslach Burnout Inventory (MBI)* The scale of professional burnout was designed by Maslach and Jackson in 1981 and amended in 1996 [51, 52]. It consists of 22 self-evaluation items scored 0–6 and explores the feelings and attitudes of professionals in their work. The scale consists of three subscales measuring Emotional Exhaustion (9 items), Depersonalization (5 items) and Personal Achievements (8 items); higher scores in the first two subscales and lower ones in the third suggest higher burnout. The Greek version of the MBI had satisfactory psychometric properties in a sample of nurses [53].

The parents of outpatients living with their families were evaluated as follows:

- *Family Burden Scale (FBS)* The FBS was designed by Madianos and Economou in 1993 and in 2004 it was amended to its final form [54], which displayed satisfactory validity and reliability (Cronbach's $\alpha=0.85$). It is a structured interview for the relatives of patients with schizophrenia and explores the burden of the mental illness on them in the last 6 months. The scale consists of 4 subscales with 23 questions in total rated 0–2: Financial Burden (5 items), Impact on Daily Activities and Social Life (8 items), Aggressive Behavior (4 items) and Impact on Health (6 items). The first three subscales indicate the objective burden, while the fourth indicates the subjective burden. The total score ranges from 0 to 46.

Finally, both staff nurses and outpatients' parents participated in the following procedures:

- *Five Minutes Speech Sample (FMSS)* The FMSS [55] is a tool for measuring EE. In relation to CFI, the standard assessment tool of EE, the FMSS is easier to use, needs far less time to administer, and requires shorter training of the interviewer. It can also be used even when the investigator does not know the patient very well. Each rater/caregiver is asked to talk continuously for 5 min about each patient (in his/her absence) and the interview is audiotaped. All recorded 5 min interviews are then scored according to specific rules based on the assessment of: (a) the initial statement (content, voice tone), (b)

the quality of the patient-rater relationship, (c) the number of negative or positive comments and d) the display or report of specific behaviors during the interview (see Supplementary Methods for details on scoring). Every 5 min speech sample is eventually characterized as high, borderline or low on criticism and EOI; combined classifications also arise (e.g., ‘high critical’, ‘high EOI’, ‘high critical + EOI’). Although FMSS is considered less sensitive than the CFI in detecting high-EE individuals [6], its validity in predicting relapse of schizophrenia has been established [56]. FMSS interviews were scored by a trained author (S.D.) and acceptable inter-rater agreement with another trained author (P.F.) was recorded in 20 interviews (criticism: 95% agreement on 6 low- and 13 high-criticism ratings, kappa = 0.89; EOI: 95% agreement on 7 low- and 12 high-EOI ratings, kappa = 0.89).

Statistical analysis

The distribution of all variables was explored with descriptive statistics. Normality was checked with the Shapiro–Wilk test and graphically with histograms and QQ-plots. Reliability (internal consistency) of the returned questionnaires was evaluated with Cronbach’s alpha. Differences in characteristics of participants (i.e., patients and nurses or parents) and EE outcomes between the two groups were evaluated with chi-square, Fisher’s exact, t-test or Mann–Whitney tests, as appropriate. As frequencies of low FMSS-Criticism/EOI categories were very small, they were collapsed with borderline FMSS-Criticism/EOI categories in downstream analyses.

EE ratings derived from FMSS interviews were a multi-level dataset of observations. In particular, each inpatient received ratings from various nurses and each nurse rated several inpatients (‘crossed levels’) while parents’ ratings were nested within outpatients (Fig. 1). Pairwise Spearman correlations between criticism (high and borderline/low FMSS-Criticism) and EOI (high and borderline/low

FMSS-EOI) were calculated in each patient group and in the total sample. Correlations were calculated as either unweighted or weighted, using ‘wCorr’ and ‘weights’ (‘wtd.cor’ function) R packages and either of two sampling weights, $1/N_{pat}$ (N_{pat} = number of ratings made for each patient) or $1/N_{rat}$ (N_{rat} = number of ratings each rater made), so as to take into account the hierarchical/ multilevel structure of EE ratings. Weights were based on the inverse of the probability of each patient’s or each rater’s ratings to be included in the total sample of ratings; respective probabilities were proportional to N_{pat} or N_{rat} . Furthermore, we calculated weighted Spearman correlations of criticism and EOI with caregiver-related features (weighted by $1/N_{rat}$) and patient-related features (weighted by $1/N_{pat}$) in each patient group. Therefore, for example, patients rated by more nurses (i.e., with higher N_{pat}) were downweighted when their BPRS was correlated with their FMSS-Criticism ratings while nurses rating more patients (i.e., with higher N_{rat}) were downweighted when their MBI was correlated with their FMSS-EOI ratings.

To identify differential correlates of criticism vs. EOI, the weighted correlations of each feature with FMSS-Criticism and FMSS-EOI in each group were compared with Meng’s z-test [57], an improved version of William’s and Steiger’s tests, using ‘cocor’ R package. This is appropriate for comparing correlation coefficients which are correlated (i.e., in the same sample) and overlapping (i.e., sharing a variable), e.g., comparing correlations A-B vs. A-C, where A is a rater or patient feature, B is FMSS-Criticism and C is FMSS-EOI. Meng’s test produces a z-score which depends on correlations A-B, A-C and B-C and its absolute value increases with sample size.

Statistical analysis was conducted in STATA MP v17 and R 4.1.2. Given the exploratory nature of the study, the level of statistical significance was set to $p < 0.05$ (two-tailed). However, the most robust findings were identified by adjusting for multiple comparisons (24 in hostels and 26 in families) using a strict corrected $p < 0.001$ (two-tailed).

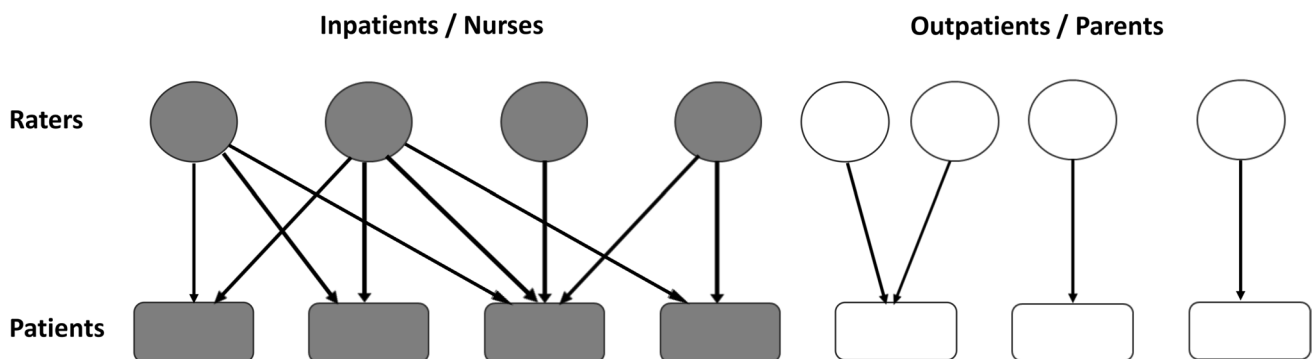


Fig. 1 Multilevel structure of expressed emotion ratings made by raters (circles) for patients (rectangles) in the two settings (grey, inpatients/nurses; white, outpatients / parents)

Results

Sample descriptives, univariate comparisons and correlations

Patients (inpatients-outpatients)

Age and disease duration did not significantly deviate from normality while previous hospitalizations were not

normally distributed. Inpatients were older and less well educated than outpatients and had a longer disease duration as well as more hospitalizations (Table 1).

All patient questionnaires had adequate reliability (Cronbach's $\alpha > 0.7$) (Suppl. Table 1). PC was approximately normally distributed while BPRS total and subscales were positively skewed. Outpatients had significantly higher scores in BPRS Withdrawal, BPRS Total and PC than inpatients (Table 1). However, both patient groups were overall remitted [58], since BPRS Total scores around 30 approximately

Table 1 Description of patient sample (40 inpatients, 40 outpatients) and basic demographics for raters (22 nurses, 56 parents)

	Inpatients (N = 40)	Outpatients (N = 40)	p-value
Gender (Male)	27 (67.5%)	22 (55.0%)	0.251 ^a
Age (years)	48.6 ± 9.3	40.1 ± 7.8	< 0.001 ^c
Family status			1.000 ^b
Single	34 (85.0%)	33 (82.5%)	
Married	1 (2.5%)	2 (5.0%)	
Divorced/widowed	5 (12.5%)	5 (12.5%)	
Education			0.002^a
Primary/high school	33 (82.5%)	20 (50.0%)	
University or higher	7 (17.5%)	20 (50.0%)	
Employment			0.762 ^b
Employed	7 (17.5%)	10 (25.0%)	
Unemployed	30 (75.0%)	27 (67.5%)	
Retired	3 (7.5%)	3 (7.5%)	
Smoking	28 (70.0%)	24 (60.0%)	0.348 ^a
History of violent behavior	14 (35.0%)	10 (25.0%)	0.329 ^a
History of suicide attempts	3 (7.5%)	3 (7.5%)	1.000 ^b
Duration of disease (years)	18.2 ± 10.9	13.4 ± 7.2	0.025^c
No of hospitalizations	2 (2–4)	2 (1–3)	0.012^d
BPRS Thinking disorder	5 (4–7.5)	6.5 (5–9.5)	0.190 ^d
BPRS Withdrawal	6 (4–8)	8.5 (6–11.5)	0.015^d
BPRS Anxiety/Depression	7.5 (6–9.5)	9 (6.5–12)	0.162 ^d
BPRS Hostility/Suspicion	4 (3–5.5)	4 (3–6.5)	0.964 ^d
BPRS Activity	3 (3–4)	3 (3–4.5)	0.345 ^d
BPRS Total	28 (22.5–37)	33.5 (28.5–40.5)	0.027^d
Perceived Criticism	3.7 ± 2.4	5.80 ± 2.66	< 0.001 ^c
	Nurses (N = 22)	Parents (N = 56)	
Gender (Male)	6 (27.3%)	24 (42.9%)	0.203 ^a
Age (years)	40.0 ± 7.2	68.0 ± 8.6	< 0.001 ^c
Education			0.001 ^b
Primary school	0 (0.0%)	20 (35.7%)	
High school	8 (36.4%)	19 (33.9%)	
University or higher	14 (63.6%)	17 (30.4%)	

Bold $p < 0.05$

N(%) or median(IQR) or mean ± SD are presented

BPRS Brief Psychiatric Rating Scale

^aChi-square

^bFisher's exact

^ct-test

^dMann-Whitney

correspond to a score of 3 ('mildly ill') on the Clinical Global Impression- Severity scale [59].

Raters (nurses—parents)

Demographics for nurses and parents are presented in Table 1 and in further detail in Suppl. Table 2. Nurses were significantly younger than parents and had a higher level of education. Seven (12.5%) parents had a lifetime psychiatric history of depression. All raters' questionnaires (MBI, FBS) had adequate reliability (Suppl. Table 1). Overall, nurses scored moderate on MBI Personal Achievements and low on other MBI subscales [51] while parents scored low on FBS total, with 12 (21.4%) scoring > 24 [54].

EE ratings

Each of the 22 nurses was involved in 1–12 EE ratings (FMSS interviews); each of the 40 inpatients was rated by 2–5 nurses. A total of 155 ratings were performed by nurses on inpatients. All 56 parents rated their offspring; each of the 40 outpatients was rated by one or both parents (Fig. 1).

There were no significant differences among groups in FMSS-Criticism and FMSS-EOI (Table 2). However, a marginally significant difference in the distribution of combined EE categories (mainly driven by the 'borderline critical' category) but not binary EE categories (high vs. low EE) was detected among groups.

As shown in Table 3, FMSS-Criticism was significantly weakly negatively correlated with FMSS-EOI in nurses but negligibly in parents. Weighted correlations followed the same pattern.

Differential correlates of criticism vs. EOI outcomes in each setting

Significant differential correlates of criticism vs. EOI were identified in each setting with Meng's test (Table 4A, B). In hostels, nurses' MBI Depersonalization and inpatients' BPRS Thinking disorder, Withdrawal, Hostility/Suspicion, Activity and Total were weakly to moderately negatively associated with EOI, with much weaker positive associations with criticism; BPRS Activity had the strongest positive association with criticism. PC had a weak negative association with EOI and a weak positive association with criticism of similar size (mirror correlations). Inpatients' age, unemployed status, smoking and disease duration were weakly to moderately positively associated with EOI, with much weaker negative associations with criticism; inpatients'

Table 2 Comparison of Expressed Emotion (EE) outcomes between nurses/inpatients and parents/outpatients

Five Minutes Speech Sample (FMSS) outcomes	Nurses ^a	Parents ^b	p-value
Criticism			0.310 [†]
High	84 (54.2%)	33 (58.9%)	
Borderline	65 (41.9%)	23 (41.1%)	
Low	6 (3.9%)	0 (0.0%)	
Emotional Overinvolvement (EOI)			0.940 ^{††}
High	72 (46.5%)	27 (48.2%)	
Borderline	65 (41.9%)	22 (39.3%)	
Low	18 (11.6%)	7 (12.5%)	
EE categories (n = 7)			0.049[§]
High critical	54 (34.8%)	17 (30.4%)	
High EOI	42 (27.1%)	11 (19.6%)	
High critical + EOI	30 (19.4%)	16 (28.6%)	
Borderline critical	1 (0.6%)	4 (7.1%)	
Borderline EOI	0 (0.0%)	0 (0.0%)	
Borderline critical + EOI	28 (18.1%)	8 (14.3%)	
Low critical + EOI	0 (0.0%)	0 (0.0%)	
EE Categories (n = 2)			0.659
High EE	126 (81.3%)	44 (78.6%)	
Low EE	29 (18.7%)	12 (21.4%)	

Bold p < 0.05

N(%) are presented. Chi-square or Fisher's exact tests were used as appropriate

^aData come from 155 nurses' ratings (FMSS interviews); each of the 22 nurses was involved in 1–12 ratings; each of the 40 inpatients was rated by 2–5 nurses

^bAll 56 parents were involved in an FMSS interview for their offspring; each of the 40 outpatients was rated by one or both parents

[†]p = 0.541 for high vs. borderline/low FMSS-Criticism

^{††}p = 0.821 for high vs. borderline/low FMSS-EOI

[§]p = 0.405 for four FMSS categories (high critical, high EOI, high critical + EOI, borderline/low critical + EOI)

female gender (at trend level) had a weak positive association with EOI and a weak negative association with criticism of similar size (mirror correlations).

In families, parents' FBS Aggressive Behavior and outpatients' history of aggressive/violent behavior (at trend level) were weakly to moderately positively associated with criticism, with much weaker negative associations with EOI; previous suicide attempts had a weak positive association with criticism and a weak negative association with EOI of similar size (mirror correlations).

After adjusting for multiple comparisons (50 tests in both groups), the only significant (p < 0.001) differential correlates of criticism vs. EOI were identified in hostels and included patients' age, BPRS Withdrawal, Activity, Total and PC.

Table 3 Correlations of FMSS-Criticism with FMSS-EOI

	FMSS-Criticism (high vs. borderline/low)		
	Unweighted	Weighted by 1/Npat	Weighted by 1/Nrat
FMSS-EOI (high vs. borderline/low)	– 0.170, 0.013	– 0.142, 0.039	– 0.062, 0.372
	– 0.234, 0.003	– 0.238, 0.003	– 0.244, 0.002
	0.007, 0.960	– 0.052, 0.705	0.006, 0.962

Bold, $p < 0.05$

Unweighted and weighted Spearman correlations are presented (rho, p-value). Weighted correlations have been calculated using two weights (1/Npat, 1/Nrat): Npat = number of ratings made for each patient; Nrat = number of ratings each rater made

Upper line = total sample (N = 211 ratings), middle line = inpatients rated by nurses (N = 155 ratings), lower line = outpatients rated by their parents (N = 56 ratings)

FMSS Five Minutes Speech Sample

Comparison of patterns across settings: sensitivity analysis

The patterns of significant differential correlates were not directly comparable across settings as Meng's z-score is sample size dependent and the number of ratings performed in the two settings was quite different (155 vs. 56). Therefore, as a sensitivity analysis, we recalculated Meng's tests in hostels assuming that they were based on 56 rather than 155 ratings and keeping all other parameters unchanged (Table 4A, last column). Differential correlates now identified as significant ($p < 0.05$) were 5/24 in hostels compared to 2/26 in families. The two proportions were not significantly different (Fisher's exact, $p = 0.24$).

Discussion

This study adds to a large literature on EE and its correlates in families of patients with schizophrenia as well as a smaller, more recent literature in staff-patient settings. It is novel in simultaneously recording with FMSS interviews and directly comparing EE across parents and professional caregivers. We systematically searched in each setting for differential correlates of criticism vs. EOI among various patient- and caregiver-related features, including most of those with previous supporting evidence and few understudied ones, and compared identified patterns across settings.

The EE rate in parents (Table 2) is at the upper end of meta-analytical reports but criticism and EOI rates are less than 1 S.D. higher than the means of previous studies in families [12, 60]. On the other hand, the EE rate in nurses was unexpectedly high, since rates are typically lower than 40% in staff-patient studies, with negligible rates of EOI [14]. Rates of criticism were, expectedly, larger than EOI in both settings. Cultural variation [61], especially regarding the EOI construct [62], individual characteristics of families

and hostels and author's scoring style might provide explanation for these inflated EE rates.

In our study, criticism and EOI were found uncorrelated in parents but weakly negatively correlated in nurses (Table 3). FMSS-EOI is known to capture part of CFI's warmth dimension (concern and interest for patients) through positive comments [5, 6], suggesting that high criticism in nurses was associated with disengagement from patients. In fact, this explains why nurse ratings were more often either 'high critical' or 'high EOI' and less often 'high critical + EOI' than parent ratings (Table 2). Therefore, differential correlates of criticism vs. EOI were expected to be more relevant for hostels. A much richer pattern of significant differential correlates was indeed identified in inpatients, but this is partly explained by many more ratings performed in this group, lending higher power in Meng's test. After adjusting for the different number of ratings between groups in a sensitivity analysis, inpatients still displayed more differential correlates but not to a significant extent.

Previous supporting evidence for differential correlates of criticism vs. EOI is incidentally reported and inconsistent in both families and staff-patient settings. In nurse-inpatient settings, patients' overall psychopathology (particularly, negative symptoms/poor social functioning and behavioral disturbance/aggressive-agitated behavior) [24, 29, 33, 34, 37] and patients' PC [24, 25] were positively associated with criticism and/or negatively with EOI, in line with our findings. We also identified positive associations of inpatients' age and disease duration with EOI only; in previous studies, age was positively associated with criticism and EOI [29] and disease duration with criticism only [29]. Furthermore, inpatients' unemployed status and smoking were associated with higher EOI only, while female gender (at trend level) had mirror correlations with criticism and EOI; these findings were not previously reported. Regarding nurse characteristics, in our study MBI Depersonalization was negatively associated with EOI only, a finding not previously reported; MBI Depersonalization and Emotional Exhaustion were

Table 4 Differential correlates of criticism vs. EOI in inpatients (A) and outpatients (B)

(A) Inpatients (155 ratings)	FMSS—criticism	FMSS—EOI	Meng's test (z)	p-value	p-value scaled to 56 ratings
Nurse features^a					
Female gender	0.210**	0.255**	− 0.368	0.713	0.828
Age	0.211**	0.247**	− 0.294	0.769	0.862
Family status (married vs. single)	0.074	0.094	− 0.157	0.875	0.926
Education (higher vs. secondary)	− 0.089	− 0.185*	0.762	0.446	0.653
Work experience (> 11 years vs. lower)	0.028	− 0.002	0.235	0.815	0.890
MBI Emotional exhaustion	0.056	− 0.062	0.923	0.356	0.586
MBI Personal achievements	− 0.002	0.095	− 0.760	0.447	0.654
MBI Depersonalization	0.060	− 0.215**	2.167	0.030*	0.201
Patient features^b					
Female gender	− 0.135	0.110	− 1.924	0.054	0.256
Age	− 0.138	0.365**	− 4.031	0.0001**	0.017*
Education (university or higher vs. lower)	− 0.135	0.071	− 1.618	0.106	0.339
Unemployed (vs. employed/retired)	− 0.099	0.213**	− 2.460	0.014*	0.146
Smoking	− 0.076	0.238**	− 2.483	0.013*	0.143
Disease duration	− 0.079	0.216**	− 2.328	0.020*	0.169
No of previous hospitalizations	− 0.045	0.072	− 0.917	0.359	0.588
History of violent behaviour	− 0.005	− 0.036	0.243	0.808	0.886
History of suicide attempts	0.025	− 0.072	0.761	0.447	0.653
BPRS Thinking disorder	0.016	− 0.327**	2.758	0.006**	0.103
BPRS Withdrawal	0.113	− 0.421**	4.334	< 0.0001**	0.010*
BPRS Anxiety/Depression	0.067	− 0.127	1.523	0.128	0.368
BPRS Hostility/Suspicion	0.082	− 0.180*	2.062	0.039*	0.223
BPRS Activity	0.166*	− 0.326**	3.916	0.0001**	0.021*
BPRS Total	0.142	− 0.439**	4.724	< 0.0001**	0.005**
Perceived Criticism	0.257**	− 0.231**	3.861	0.0001**	0.023*
(B) Outpatients (56 ratings)					
	FMSS—criticism	FMSS—EOI	Meng's test (z)	p-value	
Parent features^a					
Female gender	− 0.063	0.258	− 1.674	0.094	
Age	0.139	0.152	− 0.068	0.946	
Education (higher vs. primary/secondary)	0.078	0.062	0.083	0.934	
Currently employed	− 0.074	0.015	− 0.460	0.646	
Psychiatric history	− 0.014	0.068	− 0.424	0.672	
FBS Financial burden	0.059	0.117	− 0.301	0.763	
FBS Impact on activities/social life	0.246	0.052	1.020	0.308	
FBS Aggressive behavior	0.366**	− 0.069	2.300	0.022*	
FBS Impact on health	0.094	− 0.122	1.117	0.264	
FBS Total	0.253	0.001	1.320	0.187	
Patient features^b					
Female gender	0.078	0.201	− 0.627	0.531	
Age	− 0.057	0.119	− 0.885	0.376	
Education (university or higher vs. lower)	0.155	0.300*	− 0.759	0.448	
Unemployed (vs. employed/retired)	0.069	− 0.053	0.613	0.540	
Smoking	0.000	− 0.051	0.256	0.798	
Disease duration	0.001	0.035	− 0.171	0.864	
No of previous hospitalizations	0.057	− 0.027	0.422	0.673	
History of violent behaviour	0.268*	− 0.115	1.940	0.052	

Table 4 (continued)

(B) Outpatients (56 ratings)	FMSS—criticism	FMSS—EOI	Meng's test (z)	p-value
History of suicide attempts	0.221	– 0.190	2.073	0.038*
BPRS Thinking disorder	0.062	– 0.020	0.412	0.681
BPRS Withdrawal	0.089	0.035	0.272	0.786
BPRS Anxiety/Depression	– 0.055	– 0.009	– 0.231	0.817
BPRS Hostility/Suspicion	0.018	– 0.141	0.801	0.423
BPRS Activity	0.091	– 0.052	0.718	0.473
BPRS Total	0.048	– 0.023	0.357	0.722
Perceived Criticism	0.163	– 0.046	1.053	0.292

Bold, significant after adjusting for multiple comparisons ($p < 0.001$ two-tailed)

Weighted Spearman correlations of each feature with FMSS—Criticism and FMSS—EOI are presented

BPRS Brief Psychiatric Rating Scale, FBS Family Burden Scale, MBI Maslach Burnout Inventory

^aWeighted by $1/N_{rat}$ (N_{rat} = number of ratings each rater made)

^bWeighted by $1/N_{pat}$ (N_{pat} = number of ratings made for each patient)

* $p < 0.05$

** $p < 0.01$

previously associated with higher criticism, as recorded with the NAS, and fewer positive remarks (i.e., not EOI) while personal achievements followed the reverse pattern of associations [44]. In our study, nurses' female gender and age were positively associated with both criticism and EOI (i.e., without differential effects) while higher education mainly with lower EOI; earlier studies reported associations of nurses' older age, lower education and longer work experience with higher criticism only [29, 37] but many others found no significant EE associations with staff demographics [16, 17, 33].

On the other hand, in families, outpatients' psychopathology and PC did not have significant differential effects on criticism vs. EOI in our study; yet, history of patients' aggressive behavior (at trend level) and parents' related burden were positively associated with criticism only. Previous studies recorded positive associations of patients' current or past aggression with criticism only [32, 35] and negative ones with EOI [36], positive associations of patients' depression/ anxiety with both criticism and EOI [28, 36], but most studies reported no EE associations with patients' current psychotic symptoms [21, 40, 49]. Previous suicide attempts were equally associated (i.e., had mirror correlations) with higher criticism and lower EOI in our study, a finding not previously reported; an earlier study reported non-significant associations in the same direction [63]. Previous evidence on other characteristics not identified as differential correlates in our study included positive associations of patients' PC with criticism only [22, 23] or both criticism and EOI [43], and positive associations of previous hospitalizations or psychotic episodes with criticism only [28, 31, 36] or EOI only [30]. Patients' age was positively or negatively associated with criticism and negatively with EOI [27, 42], male

patients received higher criticism only [26], while patients' unemployment was associated with higher criticism only [28] or higher EOI only [27]. Regarding parents' characteristics, global burden was most often positively associated with both criticism and EOI in earlier studies [21, 42, 43], while female [27, 30, 35, 36] and unemployed [30] parents scored higher on EOI only.

Therefore, families and hostels had quite distinct patterns of differential correlates of criticism vs. EOI. The interpretation of our findings may help formulate hypotheses about specific pathogenetic pathways of criticism and EOI in the two settings. First, patients' aggressive/ agitated behavior (current or past) was associated with higher criticism in both groups. However, this association was stronger in families, probably because outpatients were younger and had more severe symptoms than inpatients while their parents were older and less well educated than nurses. Higher criticism may suggest modifiable causal attributions of schizophrenia to personal, internal and controllable factors [24, 38–40]. Second, in hostels patients' symptoms (agitation/ aggression, negative and other psychotic symptoms) were mainly associated with lower EOI, i.e., disengagement from patients. EOI is lower in hostels as staff usually emotionally invest less in patients than family relatives [14]. Third, the impact of patients' symptoms on caregivers followed the same pattern, i.e., parents' aggression-related burden was mainly associated with higher criticism while nurses' burnout (Depersonalization) with lower EOI. Fourth, two mirror correlations were identified. Patients' PC in hostels and previous suicide attempts in families were equally associated with both higher criticism and lower EOI, i.e., a maximal and multi-faceted EE response. In both settings, the direction of causality between criticism/EOI and patients' behaviors/

attitudes cannot be deduced, and circular causation is highly probable. Finally, various inpatient attributes (i.e., older age, chronicity, unemployment and smoking) triggered higher EOI only, reflecting nurse's concern for certain patient categories. Overall, inpatients' age, psychopathology (esp. agitation/ aggression and negative symptoms) and PC were our most robust differential correlates. To the best of our knowledge, our findings regarding nurses' MBI Depersonalization, inpatients' age, unemployment, smoking and disease duration, parents' FBS Aggression and outpatients' previous suicide attempts were not previously reported.

The aforementioned hypotheses might help customize the objectives and therapeutic components of psychoeducational interventions to families [64, 65] or professional caregivers [66, 67], aspiring to enhance their caregiving capacity. Psychoeducation of families should aim to increase knowledge about schizophrenia or associated behaviors (aggression, suicidality), modify their causal attributions, increase competency to face emergencies and help endorse more adaptive coping strategies to alleviate burden or avoid disengagement [68]. Psychoeducation to staff should aim to improve understanding of patients' aggression, criticism or negative symptoms, encourage tolerance and a non-critical attitude, inspire therapeutic dynamism and optimism, motivate interventions targeting patients' health-related problems (e.g., smoking, inactivity, aging) or psychosocial status (e.g., vocational or social skills training) in order to avoid burnout and disengagement [69].

Strengths and limitations

Most previous EE studies used patient-caregiver dyads after arbitrarily selecting one 'primary' caregiver for each patient in order to simplify statistical analyses, yet unavoidably introducing bias. Instead, we have allowed each patient to be rated by 2–5 nurses or 1–2 parents while each nurse rated 1–12 patients; therefore, another strength of this study was our recruitment scheme ('one patient by many raters, one rater for many patients'), which provides more valid and less biased EE ratings.

Limitations of our study include: (a) a relatively small sample size for both groups; (b) much fewer EE ratings in outpatients (56 vs. 155 in inpatients); therefore, the outpatient group had less power to detect significant associations and differential correlates; however, our sensitivity analysis adjusted for the different number of EE ratings between groups, making results comparable among them; (c) additional patient (duration of untreated psychosis) or caregiver (distress, causal attributions/ illness perceptions, coping strategies, personality profile) characteristics with previous supporting evidence as differential correlates might have also been investigated. Finally, duration of contact with patients (e.g., time since inpatients' admission to hostels),

previously associated with both EE components [29, 33], is a potential confounder not controlled in our study.

Conclusion

In this study, we systematically searched in families and psychiatric hostels for differential correlates of criticism vs. EOI towards outpatients or inpatients, respectively, with schizophrenia. We found that some patient symptoms and their impact on caregivers were mainly associated with distinct EE dimensions in each setting (outpatients' aggression and parents' related burden with higher criticism; inpatients' aggression, psychotic symptoms and nurses' burnout with lower EOI) while inpatients' perceived criticism and outpatients' previous suicide attempts were equally associated with higher criticism and lower EOI. Certain patient attributes (older age, chronicity, unemployment and smoking) mainly triggered higher EOI in hostels. Our findings suggest setting-specific pathogenetic pathways of criticism and EOI and might inform psychoeducational interventions to staff and families. Future studies are warranted to investigate a wider array of features.

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Author contributions PF conceptualized and designed the study. Data collection was performed by SD and DD. Statistical analyses were performed by PF and EK. Overall study supervision was performed by PF and AD. The first draft of the manuscript was written by PF and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Data availability The study dataset is available upon reasonable request.

Declarations

Conflicts of interests The authors declare that they have no conflict of interest.

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