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The Beavers, McMaster and Circumplex Clinical Rating Scales:

A study of their sensitivity, specificity and discriminant validity.

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ABSTRACT

To assess the sensitivity and specificity of clinical rating scales from the Beavers, McMaster and Circumplex models of family functioning videotapes of 60 families engaging in a standardized family task interview were rated using the three rating scales. The 60 families included 20 containing a child with an emotional disorder, 20 containing a child with a mixed disorder of emotions and conduct; and 20 in which none of the children presented with clinically significant difficulties. The three rating scales accurately classified 85-90% of normal controls; 70-90% of cases containing a child with a mixed disorder of emotions and conduct; and 55-65% of families containing a child with an emotional disorder. On the rating scales, the Beavers and McMaster models showed particularly high levels of sensitivity in detecting clinical cases, whereas the Circumplex rating scale was particularly good at classifying non-clinical cases accurately.

Clinical rating scales, grounded in well articulated models of family functioning may bridge the gap between family research and therapy. Useful family assessment instruments may serve many functions including the identification of family strengths, facilitating the matching of treatment strategies to family requirements, and evaluating family changes arising from treatment. However, in order to be capable of fulfilling these complex functions, a fundamental requirement of family rating scales is that they be able to discriminate between families who require therapy and those that do not. That is they must be sufficiently sensitive to family difficulties to be useful in identifying families requiring family therapy. They must also have good specificity and be able to accurately classify non-problematic families as such.

The aim of the present study was to compare the discriminative validity (or the sensitivity and specificity) of three of the most prominent theoretically based clinical rating scales for family functioning. These scales are the Beavers Clinical Rating Scale which is derived from the Beavers Family Systems Model (Beavers & Hampson, 1993); the McMaster Clinical Rating Scale which is grounded in the McMaster Model of Family Functioning (Epstein, Bishop et al, 1993); and the Circumplex Clinical Rating Scale which developed from the Circumplex Model of Family Functioning (Olson, 1993). Diagrams of the three models are given in Figure 1.

Insert Figure 1 about here

For all three models, clinical rating scales and self-report instruments have been developed. While numerous comparative studies of the validity of self-report scales have been conducted (e.g. Beavers & Hampson 1990; Beavers, Hampson & Hulgus, 1985; Green, Kolevzon & Vosler, 1985; Hampson, Beavers & Hulgus, 1988; Hampson, Hulgus & Beavers, 1991; Miller, Epstein et al, 1985; Rodick, Henggler & Hanson, 1986) only one has addressed the central concerns of this paper and compared the discriminative validity of clinical rating scales (Fristad, 1989). Fristad (1989) in a comparison of the McMaster and Circumplex clinical rating scales found that the McMaster Clinical Rating Scale was more sensitive in

detecting clinical cases than the Circumplex instrument. The study had a number of limitations including the use of a small (n=41) heterogeneous group of families and the absence of a control group.

In the present study the sensitivity of the Beavers, McMaster and Circumplex rating scales in detecting families with problems was assessed for a group of families in which a child presented with emotional problems only and a group of families in which a child presented with both emotional and conduct problems. The specificity of the three rating scales in classifying non-problematic families as such was evaluated with a group of families in which none of the children had clinically significant difficulties.

METHOD

Participants

Three groups of 20 families participated in this study: (1) clinical families containing an index child with an emotional disorder; (2) clinical families containing an index child with a mixed disorder of emotions and conduct; and (3) normal controls. Clinical families were recruited from Eastern Health Board Child and Family Mental Health outpatient centres in Dublin and normal controls were recruited from the community. Cut-off scores of index children on the Child Behaviour Checklist (CBCL, described below in the section on instruments) were used to assign families to emotional disorder, mixed conduct and emotional disorder and control groups. Children who returned T scores greater than 63 on the internalizing scale of the Child Behaviour Checklist, but below 63 on the externalizing scale were classified as having emotional disorders. Those who scored above 63 on both the internalizing and externalizing scales were classified as having mixed disorders of emotions and conduct. Control group children had scores below 63 on both the internalizing and externalizing scales. Profiles of children from the three groups on the internalizing, externalizing and total behaviour problems scales of the Child Behaviour checklist are given in Table 1. From this table it is clear that, as expected there were significant differences, as assessed by one way ANOVAs on the 3 main scales of the Child Behaviour Checklist. The mean scores for children in the emotional disorder group were higher than those in the control group on the total behaviour problem

scale and the internalizing behaviour problem scale. Mean scores for the emotional disorder group differed from the mixed disorder group on the externalizing behaviour problem scale only. In the mixed disorder group, mean scores on all 3 main scales of the CBCL were higher than those of the control group.

Insert Table 1 about here

Demographic characteristics of the three groups and parental status on the General health Questionnaire 28 (GHQ, described below under instruments) are also given in Table 1. The groups were demographically similar in many respects. However, children in the control group were younger than those in the other two groups. Also, families of children with mixed disorders of emotions and conduct contained more children than families from the other two groups. The three groups were not significantly different with respect to level of parental psychopathology.

Instruments

Beavers Clinical Rating Scale (Beavers & Hampson, 1990). This observational rating scale yields scores on competence and style subscales and permits families to be classified as clinical or non-clinical, depending upon their status with respect to cut-off scores on the competence and style dimensions. The competence subscale permits an overall rating to be made along with ratings in the following specific competence domains: I. Structure of the family (overt power, parental coalitions, closeness); II. Mythology; III. Goal directed negotiation; IV. Autonomy (clarity of expression, responsibility; permeability); and V. Family affect (range of feelings; mood and tone; unresolvable conflict; empathy). Specific competence dimensions are rated from 1 (healthy) to 5 (dysfunctional), while the global competence scale is rated from 1 (optimal functioning) to 10 (severely dysfunctional). The family style dimension ranges from centrifugal to centripetal, with members of centrifugal families looking outside the family for their needs to be met and members of centripetal

families looking exclusively within the family for their needs to be met. The style subscale permits an overall rating to be made along with ratings on the following dimensions: dependency needs; adult conflict; proximity between family members; attitudes to outsiders, professed closeness; assertive and aggressive qualities; balance of positive and negative feelings; and internal scapegoating. Ratings are made from 1 (centripetal) to 5 (centrifugal) and summed across domains. Interrater and internal consistency reliabilities for the competence and style subscales have been found to range from 0.7-0.9 and factor analyses have confirmed the unidimensional nature of each of the two constructs (Hampson and Beavers, 1996b; Beavers & Hampson, 1990)

McMaster Clinical Rating Scale (Miller, Kabacoff, Epstein, Bishop, Keitner, Baldwin, & Spuy, 1994). This instrument yields scores for overall family functioning and for problem solving, communication, roles, affective responsiveness, affective expression and behaviour control. Families may be classified as clinical or non-clinical, depending upon their status with respect to cut-off scores on the overall scale and subscales of the McMaster clinical rating scale. The McMaster clinical rating scale manual provides definitions for each dimension, descriptions of family characteristics at three levels of functioning - severely disturbed, non-clinical, and superior - and a set of principles for rating each dimension. Scores range from 1 (severely disturbed) to 7 (superior). Inter-rater reliabilities (kappa coefficients) range from .57 to .91 and test-retest reliabilites over a three month period range from .81 to .87. The scales are not designed to be orthogonal and correlation's among the scales range from .05 to .90. The General Functioning scale correlates substantially with all subscales.

Circumplex Clinical Rating Scale (Olson & Killorin, 1985; Olson, 1990). This instrument yields scores for cohesion, adaptability and communication. Extremely low or high scores on the cohesion and adaptability scales are indicative of problematic functioning and families may be classified on the basis of cut-off scores on these two dimensions as clinical or non-clinical. Family cohesion scores are based on combined ratings of emotional bonding, family involvement, martial relationship, parent-child relationship, internal boundaries (time, space,

decision making) and external boundaries (friends, interests, activities). Family adaptability scores are based on combined ratings of leadership (control), discipline, negotiation, roles, and rules. Communication scale scores are based on ratings of listener skills (empathy, attentive listening), speaker's skills (speaking for self, speaking for others), self-disclosure, clarity, continuity/tracking, respect and regard. For the cohesion scale, four clearly defined anchor points represent the four levels of cohesion (disengaged, separated, connected, enmeshed). For adaptability, four clearly defined anchor points represent the four levels of adaptability (rigid, structured, flexible, chaotic). Families may score high or low within each level on each of these two scales resulting in each instance in an 8-point rating scale. For the communication scale, there are six levels which can be collapsed into three categories (poor, good, very good). Inter-rater and internal consistency reliability coefficients for cohesion adaptability and communication range from .8 to .9. Factor analytic studies have confirmed the orthogonality of the adaptability and cohesion scales, the two main dimensions of the circumplex model.

The Child Behaviour Checklist (CBCL, Achenbach, 1991). This is a 113 item inventory completed by parents. Items describe problem behaviours that children in the 4-18 year age bracket may exhibit. A three point response format is used for each item. For this study, T-scores for the total problem behaviour scale and both internalizing and externalizing behaviour problem scales were derived from parental responses to the checklist and included in statistical analyses. Cases obtaining T-scores above 63 on the total problem scale of the CBCL qualify for a DSM diagnosis in about 79% of cases (Kasius, Ferdinand, van den Berg & Verhulst, 1997). T-scores above 63 on the internalizing scale typically are associated with diagnoses of emotional disorders such as anxiety or mood disorders. T-scores above 63 on the externalizing scale are most commonly occur in children with conduct disorders. Children who show elevations on both the internalizing and externalizing scales typically have comorbid emotional and conduct disorders or mixed disorders of emotions and conduct.

General Health Questionnaire (GHQ-28, Goldberg, 1978; Goldberg & Williams, 1991). For both mothers and fathers, psychological adjustment was evaluated using the 28 item version of the GHQ which yields an overall score and subscale scores for somatic symptoms, anxiety, social dysfunction and depression. In this paper reference is made to the total score only. For each item, four-point response formats were used and the 0,0,1,1 scoring method was employed to obtain total and subscale scores. Internal consistency reliability coefficients range from .8 to .9 and the test-retest reliability coefficients range from .5 to .9 after a 6 month delay. In detecting cases with psychiatric diagnoses, the sensitivity of the GHQ ranges from 44 per cent to 100 per cent and the specificity range from 74 per cent to 93 percent.

Demographic data sheet. This sheet was used to obtain information on family role (e.g., father, mother, brother sister), age, gender, marital status, family composition, family type and occupational status.

Procedure

After giving informed consent, families completed a 1 hour Family Task Interview, based on the interview developed by Kinston & Loader (1984). The Family Task Interview consisted of eight tasks: two action-oriented tasks (building a tower with blocks; sorting cards into groups) and six discussion tasks (planning something to do together as a family; spending £100 as a family; making up a story about one family member going to hospital; parent(s) choosing a proverb and explaining what it means to the children; describing the likes and dislikes of everyone in the family; discussing how you found the interview). The tasks were designed in order to elicit clinically relevant information and to generate family interaction related to the dimensions on the three models clinical rating scales. After a short break all family members over 12 years completed a packet of self-report questionnaires. The parents packet included the CBCL, the GHQ-28 and the demographic data sheet.

Interrater Agreement

Videotapes of family interviews were rated by three trained raters. All raters used all three rating scales. Training included two 4 hour sessions in which detailed instruction and practice occurred. In addition raters read relevant literature on the three models and the clinical rating scales. After every few families 'rater drift' was checked to insure that raters were using the three coding systems reliably. Inter-rater reliability was calculated for 10 of the 60 videotapes. These were rated by a pair of blind raters who used all three rating scales. Scores on each scale were classified as falling within the clinical or non-clinical range and Kappa coefficients were computed using these categorical data. The Kappa coefficient indicates the proportion of agreement between two raters after chance agreement has been removed from consideration (Cohen, 1960). Kappa coefficients for the main scales of the three models ranged from .75-1.0, indicating that in this study all three scales showed a high level of interrater reliability.

RESULTS

For each instrument, using recommended cut-off scores on each constituent dimension and for the overall rating scale, cases were classified as clinical or non-clinical, and the significance of differences in the distribution of clinical and non-clinical cases within each of the three groups was assessed using Chi Square tests. This procedure was adopted in preference to the use of parametric statistics such as ANOVA because our primary interest was in sensitivity and specificity rates rather than differences between means and also because two of the instruments (the Circumplex and Beavers clinical rating scales) contained curvilinear dimensions and this precluded the valid use of parametric statistics.

Insert Table 2 about here

From Table 2 it may be seen that for overall ratings on all three clinical rating scales the distribution of cases classified as clinical and non-clinical across the three groups was statistically significant. There was also a consistent pattern across all three rating scales with

the greatest number of cases classified as falling within the clinical range occurring in the mixed disorder group and the fewest number of such cases occurring in the control group. The distribution of cases within the emotional disorder group fell between these two extremes. For the Beavers model, 80% of the mixed disorder group, 65% of the emotional disorder group and 10% of the control group were classified as falling within the clinical range. For the McMaster model, 90% of the mixed disorder group, 60% of the emotional disorder group and 15% of the control group were classified as falling within the clinical range. For the Circumplex model, the numbers of cases classified as falling within the clinical range were 70% for the mixed disorder group; 55% for the emotional disorder group; and 10% for the control group.

From Table 2 it may also be seen that for all three clinical rating scales, the distribution of cases classified as clinical and non-clinical across the three groups was statistically significant on some, but not all dimensions. For the Beaver's clinical rating scale, the groups differed significantly on the competence dimension but not the style dimension. More cases were classified as falling within the clinical range in the mixed disorder and emotional group compared with the control group. More mixed disorder cases were classified as falling within the clinical range compared with cases in the emotional disorder group on the competence scale although the difference was only 15%.

For the McMaster clinical rating scale, the three groups differed on all 6 subscales. More cases were classified as falling within the clinical range in the mixed disorder and emotional group compared with the control group. Also, more mixed disorder cases were classified as falling within the clinical range compared with cases in the emotional disorder group on all subscales of the McMaster clinical rating scale. For all of the subscales except emotional responsiveness this difference was 30% or greater.

For the Circumplex clinical rating scale, significant differences occurred on the cohesion and adaptability subscales but not the communication subscale. For cohesion and adaptability, more cases were classified as falling within the clinical range in the mixed disorder and emotional group compared with the control group. More mixed disorder cases were classified as falling within the clinical range compared with cases in the emotional

disorder group on the cohesion dimension but the opposite pattern occurred for family adaptability. In each instance the intergroup difference did not exceed 15%.

DISCUSSION

Overall, there were remarkable similarities between the ways in which the three rating scales classified and described families from the three groups. In all instances over 85% of non-clinical cases were classified as such. More mixed disorder cases than emotional disorder cases were classified as falling within the clinical range and more emotional disorder cases were classified as falling within the clinical range than controls. For all three rating scales, this same pattern or distribution of cases falling above and below clinical cut-off scores occurred on 50% or more of rating scales' constituent subscales.

Areas of strength and weakness were identified for each rating scale. The Beavers clinical rating scale was the best of the three scales in detecting families containing children with emotional disorders (65% V 60% for the McMaster clinical rating scale and 55% for the Circumplex clinical rating scale). It shared with the circumplex clinical rating scale a high specificity and correctly classified 90% of non-clinical cases as such (compared with 85% for the McMaster clinical rating scale). In terms of shortcomings, the style subscale added little in the way of descriptive or discriminative power to the competence scale, but clearly the competence scale is a remarkably robust unidimensional indicator of level of family functioning.

The McMaster clinical rating scale was the best of the three scales in detecting families containing children with mixed disorders of emotion and conduct (90% V 80% for the Beavers clinical rating scale and 70% for the Circumplex clinical rating scale). All of the subscales differentiated between mixed disorder cases and emotional disorder cases and between emotional disorder cases and controls, insofar as more mixed disorder cases than emotional disorder cases were classified as falling within the clinical range and more emotional disorder cases were classified as falling within the clinical range than controls. The only minor shortcoming of the McMaster scale was its slightly poorer specificity in correctly

classifying normal controls as such (85% V 90% for the Beavers and Circumplex clinical rating scales).

The Circumplex clinical rating scale shared with the Beavers clinical rating scale a high specificity and correctly classified 90% of non-clinical cases as such (compared with 85% for the McMaster clinical rating scale). Its main weakness was its slightly poorer sensitivity in classifying emotional or mixed disorder cases.

Considerable confidence may be placed in the results of this study because of the range of cases involved, the reliability of ratings and the high levels of statistical significance which occurred in the chi square tests. To our knowledge, this is the first study of its kind to compare the sensitivity of the three models of family assessment across two different clinical groups.

From a clinical perspective, the results of this study suggest that any one of the three scales might valuable be included in a routine family assessment or intake protocol. However, it is clear that the greatest detail on specific family strengths would be afforded by the Mc Master scale.

With respect to future research, there is a clear need for further studies like that reported here but including different families presenting with differing types of problems such as adult depression or substance use problems, chronic disability in a family member or post-divorce adjustment problems. There is also a need to for treatment outcome studies in which the association between families status on dimensions of rating scales at intake and treatment processes and outcome are investigated. For example, Beavers and his colleagues have shown that cases which more closely approximate the healthy family profile on their clinical rating scale respond better to family therapy (Hampson & Beavers, 1996a). Also families who obtain healthy and dysfunctional profiles on the Beavers clinical rating scale respond optimally to different therapeutic approaches (Hampson & Beavers, 1996b). Relatively healthy families have been shown to respond best to a collaborative open therapeutic style, such as that advocated by the narrative and social constructionist tradition. In contrast, severely dysfunctional families have been found to respond poorly to this approach. Rather they have been found to benefit more from a directive therapeutic

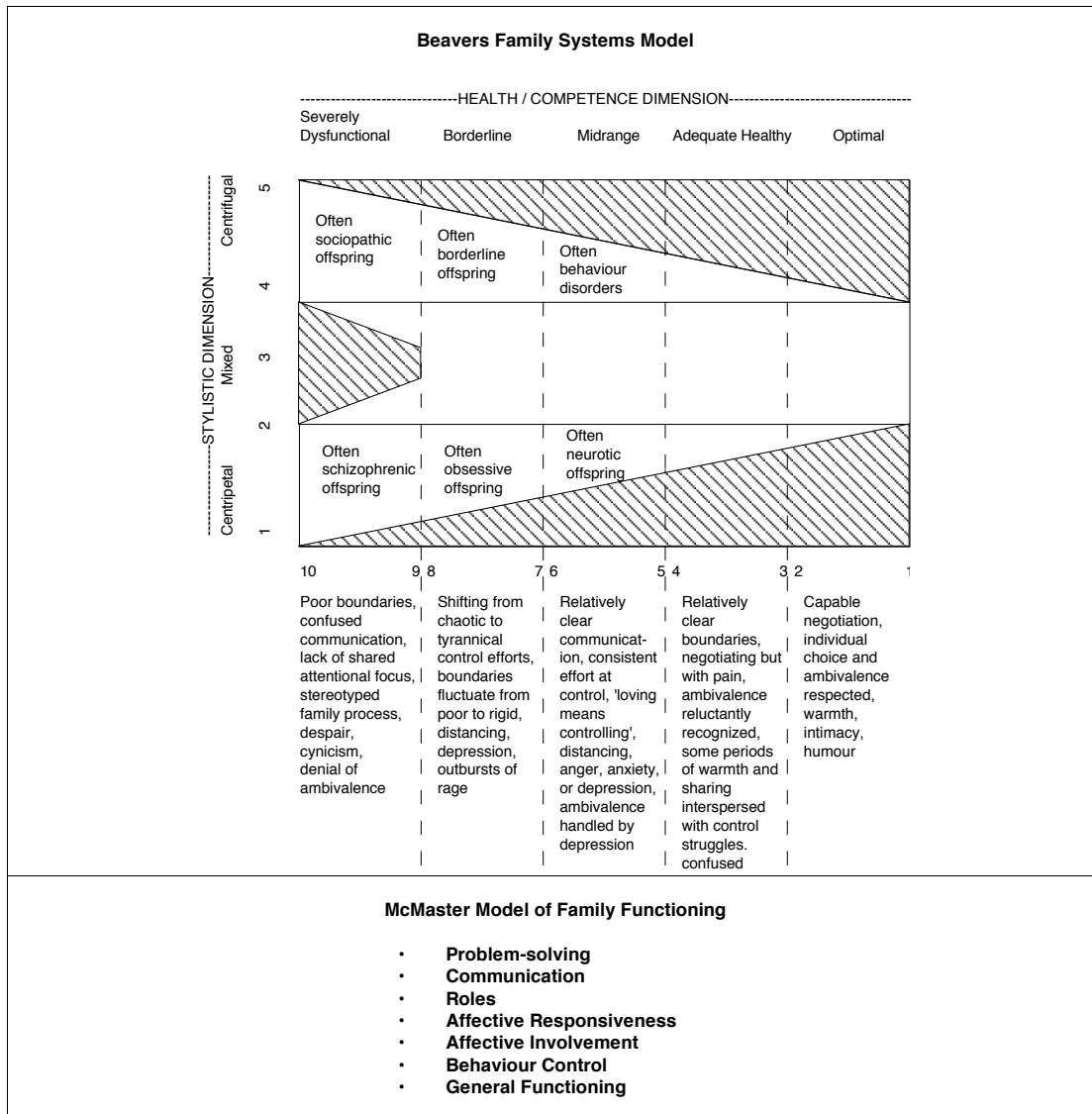
approach, where the therapist is less open about hypotheses and interventions, a style adopted within the strategic family therapy tradition.

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Figure 1. Beavers, McMaster and Circumplex Family Assessment Models



Circumplex Model of Marital and Family Systems

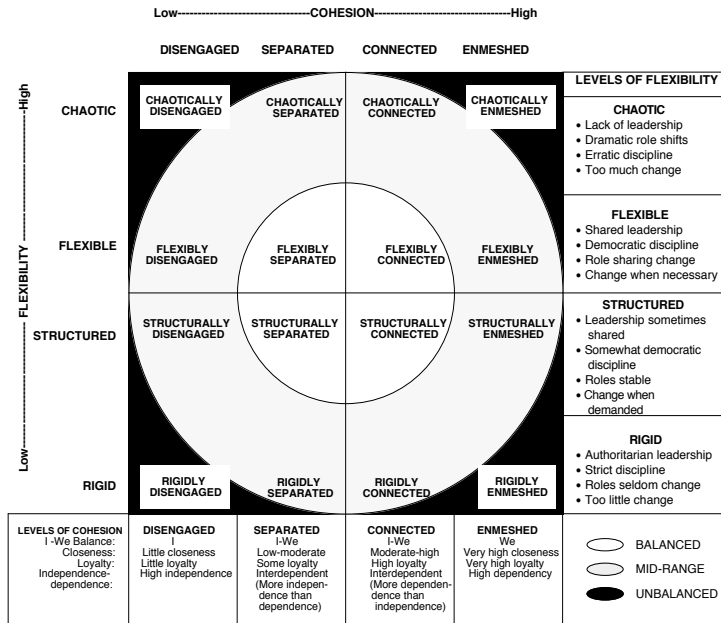


Table 1. Demographic characteristics and psychological adjustment of family members in the three groups

System	Variable	Group			χ^2 or F	p	
		Control	Emotional Disorder	Mixed Disorder			
Index child	N	20	20	20			
	Gender	Male	75%	50%	75%	3.75	NS
		Female	25%	50%	25%		
	Age	Mean	9.1 ^a	11.0 ^b	10.9 ^b	3.71	.03
		SD	2.51	2.71	2.19		
	CBCL total	Mean	50.65 ^a	63.0	71.32 ^c	47.86	.001
		SD	8.31	5.43	5.78		
CBCL externalizing	Mean	49.40 ^a	53.00 ^b	70.89 ^c	36.12	.001	
	SD	9.19	8.20	7.20			
CBCL internalizing	Mean	52.15 ^a	67.40 ^b	67.21 ^b	29.33	.001	
	SD	6.75	7.35	7.49			
Father	N	7	7	8			
	Age	Mean	39.86	41.0	40.33	0.11	NS
		SD	6.85	6.58	6.51		
GHQ-28 total	Mean	0.43	5.14	2.50	1.78	NS	
	SD	0.79	6.52	4.78			
Mother	N	19	19	19			
	Mother	Mean	36.76	38.00	39.24	0.83	NS
		SD	5.38	4.72	6.37		
GHQ-28 total	Mean	3.00	6.74	6.79	3.03	NS	
	SD	4.44	5.08	6.60			
Family	N	20	20	20			
	Family Type	Intact	70%	45%	80%	16.20	NS
		Co-habit	0%	5%	0%		
		Separated	20%	45%	10%		
		Widowed	5%	5%	0%		
		Divorced	5%	0%	0%		
		Reconstituted	0%	0%	10%		
	SES	1 (10%)*	0%	0%	0%	9.50	NS
		2 (14%)	5%	5%	5%		
		3 (18%)	15%	10%	5%		
4 (23%)		15%	40%	25%			
5 (15%)		25%	5%	10%			
6 (10%)		20%	20%	45%			
Number of Children	Mean	2.65 ^a	2.85 ^a	4.15 ^b	4.62	.01	
	SD	1.09	1.53	2.25			

Note: In each row means with different superscripts differ from each other at p<.05, with a<b.

CBCL=Child Behaviour Checklist. GHQ=General Health Questionnaire-28.

*Percentages of the national population falling into each of 6 social class groups based on the 1986 Irish census (CSO, 1989) are given in this column but not included in the calculation of the Chi square.

For all chi square analyses df=2. For ANOVAs df = 2, 57.

Table 2. Percentage of families classified as falling within the clinical range on three rating scales and results of chi square tests

Rating Scale	Dimension	Group			χ^2	p
		Control (n = 20)	Emotional Disorder (n = 20)	Mixed Disorder (n = 20)		
Beaver's	Overall rating	10%	65%	80%	21.76	.0001
	Family competence	10%	65%	80%	21.76	.0001
	Family style	5%	25%	35%	5.50	NS
McMaster	Overall rating	15%	60%	90%	23.03	.00001
	Problem solving	20%	60%	90%	20.09	.0001
	Communication	10%	55%	85%	22.80	.00001
	Roles	15%	50%	90%	22.56	.00001
	Affective responsiveness	15%	70%	85%	22.13	.0001
	Affective involvement	10%	55%	85%	22.80	.00001
	Behaviour control	10%	50%	90%	25.60	.00001
Circumplex	Overall rating	10%	55%	70%	15.76	.001
	Family cohesion	5%	40%	30%	6.93	.05
	Family adaptability	10%	45%	70%	14.95	.001
	Family communication	0%	10%	20%	4.44	NS

Note: The overall rating for the Beavers scale was calculated by using the combined competence and style dimensions. The overall rating for the McMaster scale was based on the overall family functioning dimension. The overall rating for the Circumplex scale was calculated by using the combined cohesion and adaptability dimensions. For all chi square analyses df=2.