The influence of maternal psychopathology on ratings of child psychiatric symptoms: An SEM analysis on cross-informant agreement

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Abstract

The distorting influence of maternal depression on the ratings of child behaviour is known as the depression-distortion hypothesis. This study investigated the depression-distortion hypothesis in a clinical sample of child psychiatric preschool children and extended the *depression-distortion-hypothesis* to maternal *psychopathology-distortion-hypothesis* in general. Subjects were 124 children, who were referred for treatment in a Child Psychiatric Family Day Hospital for preschool children, and their parents. Children were rated on the CBCL/1.5-5 and the C-TRF/1.5-5 by their mothers, kindergarten teachers and therapists. Maternal psychopathology was assessed by self-rating with the SCL-90-R and the BDI. The appropriateness of the depression-distortion hypothesis, as well as two alternatives, the accuracy and the combinatory model, were subsequently analyzed by structural equation modelling (SEM), including the ratings of all three informants. Model fit and parameter estimation supported the distortion model, suggesting that ratings of child behaviour by mothers may be biased by maternal psychopathology. Findings are discussed with regard to the existing cross-informant literature, with particular consideration of the distortion hypothesis and third person ratings of child psychopathology in preschool age.

Keywords

Preschool children, depression-distortion-hypothesis, cross-informant agreement, CBCL, structural equation modelling.

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Introduction

In the assessment of emotional and behavioural psychiatric symptoms in preschool children, the procedure of collecting and combining information from multiple sources, e.g. mother, father, therapist, kindergarten teacher, or foster parent, has become the standard of practice [3, 55]. However, research has consistently shown that the agreement between ratings of child behaviour by different informants is only low to moderate [14, 30, 43, 50, 62, 64, 72]. Although most of these studies have considered school-age children, there are also examples of cross-informant studies with preschool samples, reporting similar results [39, 42, 68].

Attempts to explain the general lack of agreement among informants have included among other reasons the personal characteristics of the informant (e. g. age, gender, social function, psychopathology), tendencies to simulate or dissimulate, use of different reference groups, characteristics of the child who is rated, and situation-specific behaviour [21, 54]. The present study focuses on the influence of maternal psychopathology on the symptoms and behaviour ratings of their clinical referred preschool age children. This factor is of particular importance, as usually mothers are the most important source of information about their child's psychiatric symptoms [51].

In general, mentally ill people, particularly when they are depressed, tend to view other people and their behaviour more negatively than healthy people [48]. This observation has led to the *depression-distortion-hypothesis* or distortion model [57]. The distortion model assumes that the cognitive and perceptual distortions, which are associated with psychiatric disorders, may affect maternal ratings of their children's behaviour (a more generalized model is described by the Attribution Bias Context model, [21]). The distortion assumption has been supported in previous studies with non-clinical and at-risk samples of children and

adolescents and their mothers [14, 26, 28, 47, 74, 75] and clinical referred children [18, 27, 35, 40, 41, 45], while no studies were found for clinical referred preschool children. Such samples are especially of interest for two reasons. First, the often-applied clinical instruments assessing psychopathology in parents or children are designed for clinical samples. Second, we expect especially in preschool psychiatry a greater variation of child and parental psychopathology, which is a precondition to observing a substantial true covariation between maternal and child psychopathology.

For example children of psychiatrically ill mothers show actually more symptomatic behavior than the children of healthy mothers [15, 52]. Maternal psychopathology appears therefore to be related to actual child psychopathology by means of genetic transmission, social learning processes, lack of maternal sensitivity, insecure attachment patterns, or inadequate or inconsistent parenting behaviour [31, 44, 49, 52, 65]. Higher maternal ratings may therefore also reflect a truly higher level of mental health symptoms in their children. This alternative assumption has been called the *accuracy model* [57]. Especially in the context of a child psychiatric preschool population and related nosological approaches [53, 63, 76], a reciprocal relationship between maternal and child symptom levels appears plausible. Children with an increased level of psychopathology or regulatory disorders may cause an increased psychopathology in their mothers [71]. Furthermore, the German Society of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy [29] consider a regulatory disorder as a symptom triad of infant behavioural problems, severe parental distress and dysfunctional interaction processes between parents and child.

Finally, maternal ratings of child psychiatric symptom behaviour might be influenced simultaneously by pathologic distortions by the mother *and* by a truly increased level of child psychiatric symptom behaviour in their children. This model, which would predict mixed results, will henceforth be referred to as *combinatory model*. The assumptions of the combinatory model have been supported in some studies with school-age children [15, 19].

Aims of the present study

We will describe cross-informant agreement on child mental health symptom ratings by mothers, teachers and therapist, addressing two aspects: *discrepancies* in the absolute degree of reported symptom behavior, and the *correspondence* (correlations) between cross-informant ratings. Both aspects have to be examined separately, as they may lead to different conclusions. With regard to correspondence, we assume that correlations between ratings of parents, kindergarten teachers and therapists will be low to moderate, according to the results of previous research as described above. With regard to discrepancies, we expect that mothers will report more problem behaviour than the other groups of informants, as has been shown in previous studies.

Considering the potential influence of maternal psychopathology on child behaviour ratings, we will compare the *distortion*, the *accuracy*, and the *combinatory model* by structural equation modelling (SEM). In SEM, the *accuracy* model will be tested by a direct association (path) between *maternal psychopathology* and *child psychopathology* (which are both considered to represent latent variables). The distortion model will be tested by a direct association (path) between *maternal psychopathology* and *maternal ratings of child psychopathology*, which is considered as one observed indicator of child psychopathology. The combinatory model, however, postulates the coexistence of both paths. The full description of the definition of the three models will be given below.

Methods

Procedure

This study was conducted as part of a more comprehensive evaluation at the Psychiatric Family Day Hospital for Infants and Preschool Children and their Parents of the Department of Child and Adolescent Psychiatry, University Hospital Münster, Germany. The Family Day Hospital treats child psychiatrically ill preschool children between zero and six years and their parents, whenever necessary. The application of a standardized child psychiatric behaviour rating is part of the routine assessment procedure on admission.

The present study includes 124 preschool children who were successively referred as child psychiatric patients to the Family Day Hospital. Only one child per family was included in this analysis in order to avoid confounding effects. On admission to the Child Psychiatric Family Day Hospital, all accompanying mothers completed the SCL-90-R, the BDI and the Child Behavior Checklist for the Preschool Age (CBCL/1.5-5). Children's kindergarten teachers were asked to complete the Caregiver-Teacher Report Form at Preschool Age (C-TRF). In addition, all preschool patients were rated by their therapist from the Family Day Hospital on the C-TRF. The cross informant syndrome scores, which were used in this study, were derived from the CBCL- and C-TRF scores.

Subjects

Children

Of the 124 children who were included in the study, 89 were boys (71.8%). Mean age of the children was 3.94 years ($SD = 1.63$). Note, that school entry in Germany is set at age six. The majority of the children (99.2%) were German; one child came from another EU country. Most of the children (78.2%) lived with both parents; 26 children (21.0%) lived in a single-parent family. The children had no sibling in 45 (36.3%) cases, 60 (48.4%) children had one sibling, and 19 (15.3%) children had two or more siblings.

Mother

Maternal age ranged from 19 to 49 years with a mean of $M = 33.32$ years ($SD = 5.69$). Information about school education was available from 86 mothers. Of those, 22 (17.7%) had completed 12-13 years of grammar school education leading to university entrance, 29 (23.4%) had completed 10 years of secondary modern school education and 31 (25.0%) had completed 9 years of secondary school. A substantial percentage of the mothers (44.4%) attended the Child Psychiatric day Hospital not only as an accompanying person to their psychiatrically ill child, but were also diagnosed as suffering from psychiatric illness themselves and received psychiatric treatment in the Family Day Hospital [8]. Due to privacy protection, information about the kindergarten teachers and therapists who participated in the study was not recorded.

Measures

ASEBA

The Achenbach System of Empirically Based Assessment (ASEBA) [3, 55] is a set of instruments which have been designed to assess child symptoms from the perspective of multiple informants. The ASEBA includes, among other instruments, the CBCL questionnaire for parents, and the C-TRF for teachers, kindergarten teachers, caregivers, diagnosticians and therapists. The CBCL and C-TRF versions for children between 1.5 and 5 years are frequently used in clinical assessment and research on preschool children with mental health disorders [13, 16, 20].

CBCL/1.5-5 and C-TRF/1.5-5

Children were rated on the Child Behavior Checklist for the Preschool Age (CBCL/1.5-5) and the Caregiver-Teacher Report Form for the Preschool Age (C-TRF/1.5-5) [3, 6]. CBCL/1.5-5 and C-TRF/1.5-5 consist of 100 problem items each, which are rated by parents or caretakers, respectively, on a 3-point-scale (0 = “not true” to 2 = “very true or often true”). A large proportion of all items (80%) are common to both questionnaires and build the so-called cross-informant syndrome scales, which will be described below. The psychometric qualities of the CBCL/1.5-5 and CTRF/1.5-5 have been confirmed in various studies [14, 73]. Above all, the Total Problems score seems to be relevant as a general indicator of clinical relevant psychopathology in young children [38]. Therefore, the SEM analyses conducted in this study will rely on the Total Problems scores of the CBCL/1.5-5 and CTRF/1.5-5. A Total Problem score is available in three scale metrics. Raw scores are recommended for research purposes excluding cross-informant studies. T-scores are recommended for clinical purposes, which take different thresholds of informants into account and adjusted mean and variance score differences by norm-tables. Cross-informant scores are recommended for cross-informant studies, but do not take different thresholds of informants into account.

Cross-Informant Syndrome-Scales

The use of the cross-informant syndrome scales is appropriate in cross-informant comparison studies, in order to ensure that differing item content is not reducing agreement

[67]. The cross-informant syndrome scales of the CBCL/1.5-5 and the C-TRF/1.5-5 include the following empirically based syndrome scales: Emotionally Reactive (7 items), Anxious/Depressed (8 items), Somatic Complaints (7 items), Withdrawn (8 items), Attention Problems (5 items), and Aggressive Behaviour (19 items). The scales Emotionally Reactive, Anxious/Depressed, Somatic Complaints, and Withdrawn can be combined to give the Internalizing broadband scale. The scales Attention Problems and Aggressive Behaviour are combined to give the Externalizing broadband scale. Additionally 26 items do not constitute a separate consistent scale and are subsumed under Other Problems. The Total Problems scale includes the complete set of 80 items. Consequently, the cross-informant syndrome scales are very similar to the syndrome scales of CBCL and C-TRF, with the exception of the syndrome scale Sleep Problems. This scale is not present in the C-TRF and therefore not included in the cross-informant syndrome scales.

SCL-90-R

Mothers completed the Symptom Checklist-90-Revised (SCL-90-R) [22], a well-established self-report inventory aimed to assess psychopathology in adults. The instrument consists of 90 items which measure psychological and psychosomatic symptoms during the last seven days. Subjects rate each item on a 5-point Likert scale (0 = “no problem” to 4 = “very serious”). The questionnaire yields scores on nine specific dimensions (Somatization, Obsessive-Compulsive, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation and Psychoticism) and three global scores (Global Severity Index, Positive Symptom Distress Index, and Positive Symptom Total). However, current international studies have questioned the validity of the subscales and strongly recommend the use of the Global Severity Index (GSI) as an index of general psychopathology [34, 67]. Subjects who exceed a cut-off score (GSI .57) are considered to exhibit psychiatric symptoms to a clinically relevant degree [60].

BDI

The Beck Depression Inventory [9, 10, 33] is an internationally accepted and widely used measure of the severity of depression in adult subjects. The questionnaire was included in

this study because depressive symptoms are one of the most common forms of psychopathology among women. The BDI is useful to assess not only severe depression, but also milder forms of dysphoria [75]. The self-report questionnaire consists of 22 groups of items and yields one global score. Subjects are asked to choose one item out of a group which describes best how they have felt during the last seven days. Items have been selected following DSM diagnostic criteria for major depression. Reliability and validity of the instrument have been proven in numerous studies (for a review on studies of the German version see Richter et al. 1998 [56]).

Data analysis

Statistical analysis in this study was based on raw scores of the cross-informant syndrome scales, as raw scores reflect the actual distributions of the extent of symptom behavior and should be favoured for statistical analysis of the CBCL/1.5-5 and CTRF/1.5-5 [3]. T-scores were used to describe the clinical referred sample of children. Pearson product moment correlations were calculated to examine the correspondence between informants on CIS-scores. Paired t-tests were conducted in order to reveal discrepancies in the severity of ratings.

To overcome the shortcomings of testing singular aspects of the accuracy, distortion, or combinatory model, we applied structural equation modelling to directly and simultaneously compare all aspects of the underlying hypothetical models with each other. We defined three structural equation models (SEM) to represent the accuracy, distortion, or combinatory model similar to previously defined models [15, 26, 28]. The underlying hypothetical models are then compared, which provides the best explanation for variance in mothers', teachers' and therapists' ratings by overall and comparative model-fit indices and significance of path coefficients. The SEM analysis focused on the broadband scale Total Problems scores of the CBCL/1.5-5 and CTRF/1.5-5, as this scale has been shown to be especially predictive of child psychopathology [38]. Model specification will be described below in more detail. The

model was defined and the analysis was conducted with the structural equation modelling program AMOS 8.0 [7].

To use all available data for analysis, AMOS 8.0 estimates structural equation by maximum likelihood methods for handling missing data in an optimal fashion [5]. However, missing data may produce a sampling error, which puts the validity of findings in question. Therefore, to test if the 21.3% missing data over all scales are not related to observed values, dummy variables were created for each of the five measures (SCL-90-R, BDI, CBCL/1.5-5 from mother, and CTRF/1.5-5 from teacher, therapist) with a '1' in case of missing data, and '0' if observed data are available. These five dummy variables were used as class variables for t-tests with the remaining four scales as dependent variables to check for the missing at random condition and from 20 tests one was significant ($p > .05$) and none after Bonferonie correction. Statistical analysis was conducted with the Predictive Analysis Software, PASW 18.0.0 (formerly Statistical Package for the Social Sciences, SPSS).

Results

Sample preconditions to study the distortion model

For subsequent testing of the distortion model, the sample preconditions should include a considerable variation in maternal psychopathology and in child psychopathology. Children show a maternal mean T-score of $M = 60.32$ ($SD = 22.58$), and with respect to a cut-off of 60, 53.8% show in CBCL Total Problem score a relevant degree of psychopathology. Mothers' mean SCL-90-R Global Severity Index was $M = 0.71$ ($SD = 0.44$) and score of 0.57 or above indicates mental distress to a clinically relevant degree, which applied to 54.9% mothers in our study. The maternal mean BDI sum score was $M = 14.70$ ($SD = 8.76$).

Child symptom behaviour ratings by mothers, teachers and therapists

Cross-informant correspondence

Cross-informant agreement (correspondence) between parents, teachers, and therapists was generally moderate. Cross-informant correlations were higher for Externalizing

symptoms than for Internalizing symptoms in mothers and teachers ($r_{\text{Ext}} = .54, p < .001$ vs. $r_{\text{Int}} = .36, p < .001$), mothers and therapists ($r_{\text{Ext}} = .39, p < .001$ vs. $r_{\text{Int}} = .09, n. s.$) and teachers and therapists ($r_{\text{Ext}} = .51, p < .001$ vs. $r_{\text{Int}} = .04, n. s.$). The agreement between mothers and teachers on Total Problems was significant ($r_{\text{Tot}} = .38, p < .001$), while there was no significant correlation between mothers and therapists or between teachers and therapists, respectively.

Cross-informant discrepancies

Over all scales of analysis, mothers gave higher ratings than teachers, who gave higher ratings than therapist, albeit that the difference in the teacher-therapists comparison was not significant. On the level Total Problem scores and both broadband scales (see Table 1), mothers' ratings of child behaviour were significantly higher than teachers ratings on Internalizing symptoms, Externalizing and Total Problems. Mothers' ratings of child symptoms behaviour were also significantly higher than therapist ratings on Internalizing symptoms, Externalizing symptoms, and Total Problem scores. Therapists' and teachers' ratings did not differ significantly from each other on the broadband scales.

-> Insert Table 1 about here

SEM analysis

Scale properties and intercorrelation between SCL and CBCL scores

Prior to reporting the SEM results, it is good practice to also report the scale properties and the underlying correlation matrix of indicators (observed variables: SCL-90-R Global Severity Index, BDI sum score, CBCL Total Problems, C-TRF Total Problems by Teacher, C-TRF Total Problems by Therapist) of the latent variables (maternal psychopathology, child psychopathology) in SEM [32]. The internal consistency of all scales (Table 2) was good to excellent, with Cronbach's alpha between .86 and .96. The intercorrelation matrix (Table 2) reveals a significant correlation between BDI and SCL scores. Cross-informant syndrome Total Problem scores rated by mothers correlated significantly with BDI and SCL scores.

Model specification

The structural equation models (Fig. 1) are based on the assumptions derived from the accuracy, distortion, and combinatory model about the association between maternal psychopathology, child psychopathology, and the maternal rating. We hypothesized that the observed Total Problems scores by mother, teacher, and therapist load on the latent factor 'Child Psychopathology'. Second, we assumed that the observed BDI sum score and SCL-90-R Global Severity Index load on the latent factor 'Maternal Psychopathology'. Third, we assumed that the latent factor 'Maternal Psychopathology' had an impact on maternal rating, either directly (according to the distortion model; *subsequently thereafter referred to as the distortion path*), or indirectly over the latent factor 'Child Psychopathology' (according to the accuracy model; *subsequently thereafter referred to as the accuracy covariation*), or through a combination of both (combinatory model). Importantly, the combinatory model includes both paths representing an association between maternal psychopathology and child outcome: the 'distortion' path and 'accuracy' covariation. Therefore, the other models can be viewed as subsets, or *nested models*, of the combinatory model, and they can be directly compared to the combinatory model with regard to model fit [17].

In order to retain degrees of freedom and achieve overidentification of the models, error variances of observed variables corresponding to the same latent parameter *and instrument* were constrained to be equal (Fig. 1). Such constraints can be justified by approximately comparable internal consistencies (Table 2), which indicate a comparable measurement error. Parameters were estimated and fit indices calculated separately for each model, implementing the method of maximum likelihood estimation. *As well as the model fit-indices, additionally the significance of parameter estimates for single paths or covariance are taken into consideration when rejecting or retaining a model.*

-> Insert Figure 1a,b,c about here

Parameter estimates

*Figure 2 shows the standardized regression weights (SRW; path coefficients or covariance). The measurement model of maternal psychopathology and child psychopathology show only significant indicators for the *distortion* and the *combinatory* model, while for the *accuracy**

model, the path 'Child Psychopathology' 'Total Problem Therapist' fails on significance and indicates to rejection of the *accuracy* model.

The models differ predominantly with regard to the 'accuracy' covariation and the 'distortion' path. The distortion path was significant in the *distortion* model (SRW = .40; $p < .001$) and in the *combinatory* model (SRW = .38, $p < .001$; see Fig. 2). In the *accuracy* model the 'accuracy' covariance was freely estimated and was high and significant (SRW = .40, $p < .001$). In the *combinatory* model, this coefficient was low and insignificant (SRW = .06, n. s.) and indicates to rejection of the *combinatory* model. In summary, the parameter estimates support only the *distortion* and not the *accuracy* or the *combinatory* model and closer examination of the measurement models indicates a measurement problem in the *accuracy* model. Moreover, a model misspecification (omission of a distortion path) lead to a superficial substantial covariation between maternal and child psychopathology in the *accuracy* model. In order to assure that the covariation between maternal and child psychopathology does not reflect a substantial effect we estimated the *accuracy* model again without maternal rating and observed a non-significant covariation of SRW = -.04 as recommended by one reviewer.

-> Insert Figure 2a,b,c about here

Overall model fit

The AMOS programme offers a host of fit indices representing the fit of structural equation models. According to recommendations from the current literature [17, 61], we selected the Chi-square statistic (χ^2), the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA) as measures of overall fit, and the Akaike Information Criterion (AIC) as comparative measure of fit and parsimony (Table 3).

-> Insert Table 3 about here

Structural equation models are considered to fit the data well when the test of the Chi-square statistic is non-significant, the ratio of the estimated Chi-square statistic to the degrees of freedom is less than three [72] and the CFI is close to .95 [37] or .97 [61]. The RMSEA [24, 25] represents adequate fit when scores are below .08 [17]. With respect to the selected fit

indices, the *distortion* and the *combinatory* models fit the data quite well (Table 3). In contrast, the *accuracy* model yields lower values ($CFI = .91$; $RMSEA = .10$) which suggest that the model should be rejected [61].

Comparison of model fit

As the *accuracy* model and the *distortion* model are nested models of the *combinatory* model, both can be directly compared to the *combinatory* model with regard to the χ^2 -statistic, following the formula by Bentler [11]. The resulting difference between the χ^2 -values of the *accuracy* and the *combinatory* model is significant on the level of $p < .05$ ($\chi^2_{(1)} = 9.55$), which indicates that the fit of the two models differs significantly [17]. In this case, the less restricted model (here the *combinatory* model) should be retained [61], because the *combinatory* model fits better. The second model check compares the difference between the χ^2 -values of the *distortion* and *combinatory* model, which is very small and insignificant ($\chi^2_{(1)} = 0.10$) which means that both models fits are equal. In such cases, the more restricted model (here the *distortion* model) should be favoured [61], because it need fewer parameters to fit the data.

As the *distortion* model and the *accuracy* model are not nested, they cannot be compared with regard to the χ^2 -statistic. However, the models can be compared on the basis of descriptive model fit indices, for example the Akaike Information Criterion (AIC) [4, 61]. The AIC addresses parsimony as well as model fit. It is used in the comparison of two or more models, with lower values indicating better fit [36]. According to this index (Table 3), the *distortion* model yields the best value ($AIC = 32.26$), followed by the *combinatory* model ($AIC = 34.16$) and finally the *accuracy* model ($AIC = 41.71$). In summary, all indicators of model fit consistently favour the *distortion* model, which explains the variance of maternal rating of child psychopathology in total by 38.4%, with 55.27% explained by child psychopathology, and 44.73% explained by maternal psychopathology. Maternal rating of child psychopathology is therefore substantially driven by maternal psychopathology.

Discussion

We considered the potential effect of maternal psychopathology on mothers' symptom behaviour ratings compared to kindergarten teachers' and therapists' ratings of pre-school children referred to the Family Day Hospital of the Child Psychiatric Unit of the University Münster. In general, cross-informant correspondence between mothers, kindergarten teachers, and therapists of mental health symptoms in our study was low to moderate. Correspondence between mothers and teachers was higher than between mothers and therapists, or teachers and therapists, with higher agreement on Externalizing than on Internalizing symptom scores. These findings are consistent with the results of many other studies on cross-informant agreement on the ASEBA scales [2, 14, 23, 42, 69]. Our main result on discrepancy, namely that mothers reported more symptomatic problem behaviour than kindergarten teachers and therapists, is also in line with the existing literature [40, 69].

In the analysis, we focussed on two explanations for the observed increased maternal scale scores: the distortion and the accuracy model. The distortion model postulates exaggerated ratings of highly distressed mothers, while the accuracy model states that these ratings reflect the actually heightened level of problem behaviour in the children of distressed mothers [57, 75].

In order to compare both models directly with each other, and additionally with a third model which combined both theoretical explanations ("combinatory model"), we followed a structural equation modelling approach and defined three structural equation models (Fig. 1).

Note, that our model specifications differ slightly from other structural equation testing of the *distortion* model [26, 28], as the path from maternal psychopathology end at mother's rating, and not at the residual term of mother's rating to focus on rating error caused by maternal psychopathology. The reason was mainly of a theoretical nature. We consider maternal ratings of child psychopathology also as a potential indicator of maternal psychopathology. Additionally, we achieved a more parsimony model by saving one parameter, which allowed testing of the model with smaller sample size. Additional computations following the alternative model specification from Gartstein [28] replicated our findings.

Results of the analysis (Fig. 2, Table 3) suggested favouring the *distortion* model, which obtained the best model fit and parsimony indices. Path and covariation coefficients revealed the significant influence of maternal psychopathology on mothers' behaviour ratings. Our findings are consistent with the results of recent studies [15, 26, 47, 66, 75] found that caregiver depressive symptoms proved to be one of the most important predictors of cross-informant disagreement, which is consistent with the distortion hypothesis. Comparably, Najman et al. [47] found that anxious and/or depressed mothers reported more child behaviour problems than healthy mothers or the (14-year-old) children themselves. Treutler and Epkins [66] extended their analysis to fathers, and observed that both parents' psychological symptoms were significantly related to their ratings of children's internalizing and externalizing behaviour. Taken together, there is substantial empirical evidence for the validity of the distortion model; moreover, there is increasing evidence that it may be appropriate to extend the distortion hypothesis from depression to general psychopathology [47, 21, 19, 75]. This issue needs to be investigated more thoroughly in further studies across instrument and maternal and child psychopathology, accompanied with expert ratings of maternal psychopathology to rule out a general response bias to reporting of own and other symptoms [26].

In addition to the evidence supporting the distortion bias, we also observe that ignoring a distortion influence has led to problems in the measurement model of the *accuracy* model. Ignoring the distortion path impedes agreement between maternal report, teacher, and therapist. Interestingly, we observed on a descriptive level a slightly negative correlation between indicators of maternal psychopathology and therapist rating of child psychopathology (see Tab. 1). This raises the question, of whether experienced therapists, who have been in contact with the mother (in contrast to teachers), over proportionally counterbalance their rating of the child in cases where they consider the mother to be distressed. This would mean that the therapists already incorporate the distortion influence into their evaluation ratings by a professional heuristic. Another consequence of ignoring a distortion influence led to a substantial covariation between maternal and child

psychopathology of SRW = .40. This substantial covariation can be misinterpreted in preschool psychiatry such that mothers with increased psychopathology increase the risk for psychopathology in their child or that a child with increased psychopathology increases the mother's risk for psychopathology risk for psychopathology in her mother. We did not find evidence for this interpretation. In general, our structural equation did not resolve fundamental differences between informants with respect to different thresholds (informant discrepancies, see Tab. 1) as the analysis focused on increasing the association (correspondence, see Tab. 2) between informants with respect to maternal psychopathology.

Strengths and limitations

The advanced statistical methodology, which allows for the consideration of multiple factors simultaneously, is an important strength of the present study. Second, maternal and child psychopathology were assessed objectively and validly by means of well-established questionnaires with known psychometric qualities. Third, child behaviour was rated by multiple informants, which enhanced the estimation of child psychopathology in the SEM model. Finally, our clinical sample, in contrast to the majority of risk-samples taken to test the distortion hypothesis, is ideally placed to distinguish between the concurrent models as our clinical sample includes children and mothers, who differ greatly in their psychopathological status.

Yet the study has several limitations. First, being a clinical sample, the sample was selective with proportionally more boys than girls and quite small, especially with respect to the implementation of SEM. However, there is evidence that sample size may be small in simple models like ours [61]. Our sample size of $N = 124$ fulfilled the criterion stated by Hatcher [32] and Bentler and Chou [12], demanding that the minimal number of subjects should be five times the number of free parameters in the model¹. Similar sample sizes were also successfully used in other SEM studies [70]. Moreover, we used selected fit indices like the RMSEA and the CFI, which are less affected by sample size [61]. Nonetheless, the results

¹ As there are 14 free parameters in the accuracy and distortion model and 15 free parameters in the combinatory model, the minimal sample size is $N = 75$.

should be interpreted with caution, and replication studies with larger samples are recommended.

Second, as this was a clinical study, mothers, teachers and therapists did not evaluate the child's behaviour in the same situation, but at home, in the kindergarten, and on admission to the Family Day Hospital. However, our analysis focussed on differences between mothers with and without psychopathology, which cannot be explained by situation-specific behaviour. Nevertheless, a replication in an experimental setting, with mothers, teachers and therapists evaluating exactly the same child behaviour, e. g. by use of videotaped material [40], might be useful to rule out possible effects of situation-specificity.

Third, this study focussed exclusively on the impact of maternal psychopathology on child behaviour ratings. Ideally, maternal psychopathology, like child psychopathology, should be assessed by multiple measures, e. g. self-report, interview, and report by others. For future studies, it would be helpful to establish an accepted way to measure maternal psychopathology, which would allow for the use of this important construct more frequently in other research contexts. Moreover, there are many other factors which may also influence the association between maternal psychopathology and child behaviour ratings, for instance maternal personality [58], previous experiences (memory effects) [21], or the use of different reference groups [59]. Depending on the specific circumstances, these effects may enlarge or outweigh the effects of maternal psychopathology. Future research with larger samples in standardized observation contexts and trained raters is needed to address multiple factors in one model.

Conclusion

The results of our study are in line with research on cross-informant agreement on child behaviour and psychopathology. The merits of our study are its integration of multiple perspectives and improved estimation of child psychopathology, recommendations for practitioners in child health services, and the use of maternal psychopathology as theoretical construct and as a moderator variable.

First to say, there is no “gold standard” to assess child psychopathology. The actual accepted procedure is to consider each informant as a valuable source which contributes a considerable amount of information not accounted for by the others [1]. However, it remains unclear how the outcomes obtained from different informants, which may widely diverge in clinical contexts, should be integrated. The distortion model helps to explain differing results on the basis of parental psychopathology and also how to integrate multiple perspectives.

Second, for practitioners it may be important to know that the child behaviour ratings of a parent with severe psychopathology may be substantially biased. Consequently, when there are hints to the existence of psychopathology in a parent, clinicians should focus on the ratings of other informants, e. g., the other parent, or the kindergarten teacher. Furthermore, clinical assessment of children should always include a screening for parental psychopathology, for example with the Symptom Checklist-90-Revised or a short form of this measure, for example the BSI, the SCL-25 or the SCL-27 [46].

Turned the other way round, negative behaviour ratings may be seen as a serious sign of psychopathology not only in the child, but also in the parent who rated the child. Child therapists should bear this in mind when evaluating diagnostic information, and be aware that it may be the parent who (also) requires and merits professional help. This result should not be misunderstood in the sense that maternal ratings are discredited, but they should be used more carefully and in a more sophisticated way.

Third, our approach to assessing maternal psychopathology leads to two further issues. We extended the existing literature on the distortion-accuracy model by considering not only maternal depression, but by introducing maternal psychopathology as a general term to describe the distress of mothers, independent of their potential psychiatric diagnosis. This approach may stimulate more research around maternal psychopathology as a meaningful moderator variable, which may also play an important role in other contexts. In particular, more research is necessary to determine reliable cut-off scores for measures of parental psychopathology, and to develop algorithms to correct the potentially biased rating outcome of a parent with significant psychopathology.

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Table 1 Cross-informant discrepancies (CIS mean scores) on CBCL and C-TRF broadband scales between mothers, kindergarten teachers, and therapists

	Mother	Therapist	<i>Paired t-test</i>	
	Mean $\pm$ SD	Mean $\pm$ SD	t(77)	p
Internalizing	14.62 $\pm$ 7.73	12.24 $\pm$ 7.08	2.12	.037
Externalizing	23.40 $\pm$ 9.31	15.10 $\pm$ 10.53	6.88	.000
Total Problems	50.00 $\pm$ 18.62	36.04 $\pm$ 17.34	5.23	.000

	Mother	Teacher	<i>Paired t-test</i>	
	Mean $\pm$ SD	Mean $\pm$ SD	t(74)	p
Internalizing	14.92 $\pm$ 7.10	12.49 $\pm$ 8.62	2.35	.022
Externalizing	23.97 $\pm$ 9.24	18.40 $\pm$ 10.78	4.99	.000
Total Problems	50.87 $\pm$ 18.73	40.17 $\pm$ 21.82	4.08	.000

	Teacher	Therapist	<i>Paired t-test</i>	
	Mean $\pm$ SD	Mean $\pm$ SD	t(60)	p
Internalizing	12.40 $\pm$ 8.35	12.11 $\pm$ 6.74	-0.21	n.s.
Externalizing	18.21 $\pm$ 11.40	15.51 $\pm$ 10.57	-1.94	n.s.
Total Problems	39.83 $\pm$ 22.53	35.91 $\pm$ 16.54	-1.19	n.s.

Table 2 Psychometric properties of observed variables for structural equation modeling

	Cronbach's Alpha	BDI	SCL- GSI	Total Problems Mother	Total Problems Teacher
BDI	.86				
SCL-GSI	.96	.74***			
Total Problems score Mother	.90	.34***	.42***		
Total Problems score Teacher	.94	.12	.06	.38***	
Total Problems score Therapist	.91	-.05	-.07	.18	.16

Note: BDI = Beck's Depression Inventory; SCL-GSI = Global Severity Index form the Symptom Checklist-90-Revised

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 3 Model fit of combinatory, accuracy and distortion model

	Distortion model		Accuracy model		Combinatory model	
	df = 6		df = 6		df = 5	
$\chi^2(p)$	4.26	(.642)	13.71	(.033)	4.16	(.527)
χ^2/df	0.71		2.28		0.83	
CFI	1.00		.91		1.00	
RMSEA	.000		0.102		.000	
AIC	32.26		41.71		34.16	

Note: CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; AIC = Akaike Information Criterion.

(c) Combinatory Model

Fig. 1a,b,c Hypothesized associations between maternal psychopathology (latent factor), child psychopathology (latent factor), and five manifest variables (BDI scores, SCL scores, and CROSS-INFORMANT SYNDROME Total Problems scores rated by mother, teacher and therapist), which are the basis of the structural equation model of (a) distortion model, (b) accuracy model, and (c) combinatory model. Variables in circles represent error/residual terms. For model details see text.

(a) Distortion Model

(b) Accuracy Model

(c) Combinatory Model

Fig. 2a,b,c Output diagram displaying standardized regression weights (path coefficients) between maternal psychopathology (latent factor), child psychopathology (latent factor), and five manifest variables (BDI scores, SCL scores, and CIS Total Problem scores rated by mother, teacher and therapist) in (a) the distortion model, (b) the accuracy model, and (c) the combinatory model.