

Parental Psychological Distress and Child/Adolescent Mental Health Across Two Decades: A Time-Varying Analysis of the UK Millennium Cohort Study

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Abstract

Background

Parental psychological distress is associated with child and adolescent internalizing/externalizing problems, but whether these associations vary continuously across development, between parents, and by child sex remains unclear.

Methods

Using six waves of the UK Millennium Cohort Study ($N = 14,565$; ages 2–17), we applied time-varying effect modeling to estimate age-varying associations of maternal and paternal distress with child and adolescent internalizing/externalizing problems, with each parent adjusted for the other and for child sex, socioeconomic status, parental age, and education.

Results

Associations with internalizing problems increased across childhood, peaked in early-to-mid adolescence, and declined; associations with externalizing problems were strongest in early childhood and decreased with age. Maternal distress was more strongly associated with both outcomes during childhood. From approximately age 13 onward, paternal distress became more strongly associated than maternal distress with internalizing problems, with significant differences at ages 15–16; this paternal predominance was specific to boys and was not observed for externalizing problems. Maternal and paternal associations converged earlier for boys' than girls' externalizing problems ($\approx$ age 11 vs. $\approx$ age 14).

Conclusions

Associations of parental distress with child psychopathology are domain-, age-, parent-, and sex-specific rather than uniform. Findings support parent-inclusive assessment and developmentally timed prevention.

Introduction

Child and adolescent mental health problems constitute a major global public health challenge [1]. Approximately one in seven adolescents worldwide experiences a mental disorder, and anxiety, depression, and behavioral disorders account for a substantial share of disability during this developmental period [2, 3]. A large body of research suggests that parental psychological issues are critical risk factor for child difficulties. Specifically, parental anxiety and depression are closely associated with child internalizing and externalizing problems [4–11].

Several theoretical perspectives can explain the link between parental psychological distress and children's emotional and behavioural problems, including attachment theory [12] and social learning and emotional contagion theories [13–15]. Parenting behaviours constitute the immediate causal mechanisms underlying the development of these processes [16, 17].

However, the existing evidence is primarily based on samples of mothers, and the role of fathers has been largely overlooked [18–20]. Critically, maternal and paternal symptoms are not independent risk factors [16]. Psychological distress between partners may interact over time [21]. Evidence suggests that paternal levels of anxiety and depression are of significant importance when studying children's mental health [9, 22]. Even after controlling for maternal distress, paternal distress remains a predictor of various difficulties in children from early childhood to mid-adolescence [6]. From a theoretical perspective, the relationship between fathers and children's problem behaviors is unique, as fathers influence children's autonomy and behavioral regulation through challenges, exploration, and risk management [23, 24]. While maternal distress often affects children through direct pathways such as daily care, sensitivity, and attachment, fathers tend to exert their influence primarily through indirect pathways, such as parental conflict, impaired co-parenting, and maternal distress [18, 25]. Therefore, research on children's problem behaviors should include both parents in the analytical framework.

The associations between parental distress and child problem behaviors may differ by problem domain [26–28]. Drawing on social role theory, which emphasizes that boys and girls are socialized differently in terms of behavioral norms and emotional display [29], child gender may further differentiate these associations [8, 30]. This suggests that child gender and problem domain should be examined jointly, rather than treated as independent demographic covariates. In addition, evidence regarding specific parent–child gender pairings remains limited and inconsistent [31]. Parent gender and child gender should therefore be examined jointly.

The association between parental distress and child problems varies across developmental stages. Young children, who are emotionally dependent and sensitive to emotions, are more vulnerable than adolescents, who have already mastered more effective coping strategies [32–35]. Evidences indicate that the association with parental anxiety may vary from infancy through adolescence depending on factors such as parent/child gender, outcome domains, the source of the report, and assessment intervals [17, 30]. Although existing longitudinal studies have taken into account temporal sequence, bidirectional effects, and changes within the family, most have only conducted average-effect analyses across broad time intervals or imposed linear or polynomial trajectories [36–38]. This can obscure the exact age at which the association shifts. Time-varying effect modeling (TVEM) addresses this limitation by estimating regression coefficients as smooth, nonparametric functions of a continuous time metric without requiring the investigator to prespecify linear, quadratic, or stage-based change [39, 40]; it is particularly well-suited to identifying developmental windows and turning points in intergenerational relationships.

This study used TVEM to estimate age-varying associations between parental distress and children's internalizing and externalizing problems. Specifically, three research questions are addressed. Firstly, how do the magnitude, nature and timing of these associations change developmentally? Secondly, does child gender moderate these associations, and does such moderation differ between internalizing and externalizing outcomes? Thirdly, after accounting for the partner's concurrent distress, do maternal and paternal distress show differential associations with child adjustment? The study makes three major contributions. First, by modelling both parents' symptoms simultaneously, it distinguishes parent-specific associations from covariance related to parental comorbidity, assortative mating and shared family stress. Second, TVEM models developmental change as a flexible, continuous function of age rather than as differences across a small number of age groups or prespecified polynomial terms [39]. Third, by jointly considering parent gender, child gender and problem domain, it identifies which factors are associated with which outcomes and when. In this way, the study moves beyond whether parental distress is associated with child psychopathology, instead examining how these associations are organised across childhood and adolescence.

Methods

Participants and Procedure

The data were drawn from the UK Millennium Cohort Study (MCS), which aims to investigate developmental, family, social, educational, and health-related processes during childhood and adolescence [41]. The cohort collected data through eight survey sweeps, beginning when participants were approximately nine months old and continuing into early adulthood.

This study used data from six waves of MCS, with the assessment time points roughly corresponding to ages 3, 5, 7, 11, 14, and 17. The analytic sample comprised 14,565 participants who had valid data at the baseline assessment used in the present analyses. The distribution of participants and demographic characteristics is presented in supplementary materials Table S1.

Child internalizing and externalizing problems were assessed using parent-reported questionnaires, whereas maternal and paternal psychological distress was assessed using parent self-reports. Measures of parental distress and child problem behaviors were obtained from the same assessment waves. Ethical approval for the MCS was obtained by the relevant research ethics committees, and informed consent was obtained from participating families at each wave in accordance with the procedures of the MCS.

Measures

Child Internalizing and Externalizing Problems

Child internalizing and externalizing problems were assessed using the Strengths and Difficulties Questionnaire (SDQ) [42]. The SDQ is a widely used behavioral screening instrument consisting of 25 items organized into five five-item subscales: emotional symptoms, peer problems, conduct problems, hyperactivity/inattention, and prosocial behavior. Items are rated on a three-point Likert-type scale ranging from 0 (“not true”) to 2 (“certainly true”), with higher scores indicating greater levels of the measured characteristic. The internalizing problem score is calculated by adding the scores for emotional symptoms and peer relationships, while the externalizing problem score is calculated by adding the scores for behavioral problems and hyperactivity/inattention.

In the MCS, the SDQ has demonstrated measurement invariance across developmental stages from approximately 5 to 14 years of age [10]. In the present study, Cronbach’s α coefficients for the internalizing problems score ranged from 0.60 to 0.80 across assessment waves, whereas coefficients for the externalizing problems score ranged from 0.70 to 0.80.

Parental Psychological Distress

Maternal and paternal psychological distress were assessed using the six-item Kessler Psychological Distress Scale (K6) [43]. The K6 is a brief and extensively used screening measure of nonspecific distress in population-based samples, with items reflecting symptoms commonly associated with anxiety and depression. Each item was rated on a five-point response scale ranging from “none of the time” to “all of the time”. Higher scores indicating greater levels of distress. In the MCS, the K6 was completed separately by mothers and fathers. The K6 has demonstrated good internal consistency in population-based and longitudinal studies, including research using the MCS [6]. In the present study, Cronbach’s alpha coefficients for the maternal and paternal K6 scores ranged from 0.80 to 0.90 across assessment waves.

Data Analysis

Descriptive statistics and Pearson correlations were computed in IBM SPSS Statistics 27.0. Age-varying associations were estimated using time-varying effect modeling (TVEM), with separate models for child internalizing and externalizing problems. Maternal and paternal K6 scores were entered simultaneously to account for partner’s distress. Models additionally included child gender, parent-distress-by-child-gender interactions, and prespecified covariates (parental age, educational attainment, and socioeconomic status [SES]). K6 scores were mean-centered before model entry and computation of interaction terms. Model equations are provided in Supplementary Table S2. Cases with missing dependent variable data were removed. Missing values among the independent variables and covariates in the retained sample were imputed using the MICE algorithm via the mice package in R, with estimates pooled according to Rubin’s rules.

TVEM analyses were conducted in SAS 9.4 using TVEM Macro Version 3.1.1. P-spline estimation was used, with a maximum of 10 knots for each time-varying parameter, allowing the model to automatically

select the optimal regression coefficient functions [39, 44]. A random intercept was included to account for the nonindependence of repeated observations within participants. Associations were considered statistically significant when the corresponding pooled 95% confidence intervals (CIs) did not include zero. If the intervals do not overlap, this indicates that there is a significant difference between the father and the mother [45–47].

Results

Descriptive statistics and bivariate correlations for all study variables are presented in supplementary materials Tables S3 and S4.

Age-Varying Associations of Parental psychological distress With Child Problems

Figure 1 presents the age-varying associations estimated using TVEM; the corresponding pooled coefficients and 95% confidence intervals are provided in supplementary materials Table S5.

Internalizing Problems

The paternal association strengthened across childhood and early adolescence, increasing from $\beta = 0.13$ (95% CI [0.10, 0.17]) at age 2 to a maximum of $\beta = 0.25$ (95% CI [0.22, 0.27]) at age 15. The coefficient subsequently declined to $\beta = 0.21$ (95% CI [0.18, 0.24]) at age 16 and $\beta = 0.12$ (95% CI [0.10, 0.15]) at age 17. Maternal association exhibits a similar inverted-U pattern, yet peaks earlier. It increased from $\beta = 0.14$ (95% CI [0.12, 0.17]) at age 2 to $\beta = 0.22$ at both ages 11 and 12 (95% CIs [0.20, 0.23] and [0.20, 0.23], respectively), before declining to $\beta = 0.18$ (95% CI [0.16, 0.19]) at age 15 and $\beta = 0.08$ (95% CI [0.06, 0.11]) at age 17. Thus, the maternal association peaked from late childhood to early adolescence, while its paternal counterpart peaked in mid-adolescence.

The relative impact of maternal versus paternal distress on child internalizing problems varied with age. Maternal effects were stronger during childhood, with significant between-parent differences at ages 4–7 and 9–10. For example, at age 5, the maternal coefficient was $\beta = 0.18$ (95% CI [0.17, 0.19]), compared with $\beta = 0.12$ (95% CI [0.11, 0.14]) for paternal distress. The two coefficients converged around age 13 ($\beta_{\text{paternal}} = 0.22$ [0.20, 0.24]; $\beta_{\text{maternal}} = 0.21$ [0.19, 0.23]). Thereafter, paternal distress surpassed maternal distress in its association with internalizing problems, reaching statistical significance at ages 15–16. At age 15, the paternal coefficient was $\beta = 0.25$ (95% CI [0.22, 0.27]), compared with $\beta = 0.18$ (95% CI [0.16, 0.19]) for the maternal coefficient.

Externalizing Problems

Rather than peaking in adolescence as internalizing problems did, these associations were most pronounced in early childhood and then weakened over time.

The maternal association weakened steadily with age. It was largest at age 2, with $\beta = 0.29$ (95% CI [0.26, 0.31]), and decreased progressively to $\beta = 0.17$ (95% CI [0.16, 0.19]) at age 14, $\beta = 0.10$ (95% CI [0.09, 0.12]) at age 16, and $\beta = 0.06$ (95% CI [0.03, 0.08]) at age 17. The paternal association remained fairly stable between ages 2 and 16, with coefficients ranging from $\beta = 0.11$ to 0.16, before dropping slightly to $\beta = 0.10$ (95% CI [0.07, 0.13]) at age 17.

During childhood and early adolescence, the maternal association was consistently stronger than the paternal one. Maternal–paternal differences were statistically significant from ages 2 to 12. At age 5, for example, the maternal coefficient was $\beta = 0.22$ (95% CI [0.21, 0.23]), whereas the paternal coefficient was $\beta = 0.12$ (95% CI [0.10, 0.14]). The two curves approached one another by approximately age 14, when the maternal coefficient was $\beta = 0.17$ (95% CI [0.16, 0.19]) and the paternal coefficient was $\beta = 0.16$ (95% CI [0.14, 0.19]). Although the paternal coefficient was numerically larger than the maternal coefficient from approximately age 15 onward, this reversal was not statistically reliable. For example, at age 16, the paternal coefficient was $\beta = 0.14$ (95% CI [0.12, 0.16]), compared with $\beta = 0.10$ (95% CI [0.09, 0.12]) for maternal distress; however, the corresponding maternal–paternal contrast was not statistically significant.

Sex-Specific Age-Varying Associations

The interaction effects between maternal and paternal distress and child sex were significant at certain ages (supplementary materials Table S5). Sex-stratified models revealed distinct developmental patterns in the relative magnitude of maternal and paternal associations (Fig. 2; supplementary materials Table S5). For internalizing problems, a paternal predominance emerged only among boys: paternal distress was more strongly associated with internalizing problems than maternal distress at ages 14–16. This contrast was largest at age 16 ($\beta_{\text{paternal}} = 0.23$, 95% CI [0.19, 0.27]; $\beta_{\text{maternal}} = 0.11$, 95% CI [0.09, 0.14]). Prior to this age range, maternal associations were stronger than paternal associations for both boys and girls. This difference was not observed among girls.

For externalizing problems, maternal distress showed the stronger association during childhood in both sexes, but the timing of convergence differed. The maternal–paternal difference became nonsignificant at approximately age 11 among boys but remained significant until approximately age 14 among girls. For example, at age 5, the maternal and paternal coefficients were $\beta = 0.23$ (95% CI [0.21, 0.25]) and $\beta = 0.15$ (95% CI [0.13, 0.18]), respectively, among boys, and $\beta = 0.20$ (95% CI [0.18, 0.22]) and $\beta = 0.09$ (95% CI [0.07, 0.11]), respectively, among girls. Thus, parent-specific associations converged earlier among boys than among girls.

Supplementary single-parent models estimated maternal and paternal associations separately, without adjusting for the other parent's distress (supplementary materials Figure S1; supplementary materials

Table S6). Overall, mutual adjustment altered the timing and magnitude of specific parent contrasts without changing the broader developmental patterns.

Discussion

Overview of the Findings

Using longitudinal data from the UK Millennium Cohort Study, this study examined whether links between parental psychological distress and child problem behaviors shifted across development, differed by parent sex, and varied according to child sex and symptom domain.

Three findings stand out. First, associations between parental distress and child internalizing problems increased through childhood, peaked in adolescence, and then declined. For externalizing problems, the pattern was reversed: associations were most pronounced earlier in development and tended to weaken with age. Second, maternal distress showed stronger links with both internalizing and externalizing problems during childhood. Paternal distress became relatively more strongly associated with internalizing problems during later adolescence, although no statistically significant paternal predominance emerged for externalizing problems. Third, these parent-specific patterns varied by child sex: the late-adolescent paternal predominance for internalizing problems was observed among boys but not girls, whereas maternal and paternal associations with externalizing problems converged earlier among boys than among girls.

Developmental and Domain-Specific Patterns

The stronger association with externalizing problems at younger ages is developmentally plausible, as young children depend heavily on parents for behavioral and emotional regulation [48–50]. At this stage, parent–child relationships are generally more harmonious, and children rely more on parents emotionally while showing greater reactivity to emotional signals [34]. Parental distress may reduce emotional availability and consistency, making it harder for children to regulate attention and behavior. The weakening of this association with age does not imply that parental distress becomes unimportant. Rather, children become less reliant on parents for moment-to-moment behavioral control, as peers, schools and other social contexts increasingly shape their behavior [51, 52].

Unlike the pattern observed for externalizing problems, the associations between parental distress and child internalizing problems peaked during adolescence. It is consistent with the evidence that early adolescence may be critical period when individuals are more sensitive to parental anxiety and depressive symptoms [53]. Older children acquire abilities to recognize parents' emotion, understand family interactions, and incorporate parental beliefs and coping strategies into their stress responses [54–56]. This stage is accompanied by adolescent physiological changes, increasing sensitivity to social evaluations, and renegotiation of parent-child relationships [57–59].

Developmental Shifts in Maternal and Paternal Associations

Maternal distress is more strongly associated with children's problem behaviors during childhood, possibly because mothers are more involved in children's care and emotional regulation [60]. Maternal distress affect children through reducing responsiveness, providing negative emotional demonstrations, and weakening emotional socialization [61]. These processes are important during childhood because children rely on parents to regulate. Early parenting may also affect attention and self-regulation abilities, which are crucial for children's later emotional and behavioral adaptation [62].

From age of 13, the association between paternal distress and adolescent internalizing problems is stronger than that between maternal distress; this difference reaches statistical significance at ages 15–16. Consistent with evidence that paternal depression may influence adolescent internalizing problems through parenting and communication [63, 64]. This result also supports the broader evidence that the mental health status of fathers independently affects offspring adaption [26].

This timing may reflect developmental changes in parent–child relationships. During adolescence, young people seek greater autonomy and increasingly renegotiate parental expectations, authority and decision-making [65–67]. Paternal distress may undermine adolescents' internal adjustment by reducing emotional availability, supportive communication and autonomy support, while modelling avoidant or negative coping. However, paternal predominance emerged only for internalizing problems; its association with externalizing problems was not stronger than that of maternal distress. Thus, parental influence does not shift uniformly from mothers to fathers with age. Rather, paternal distress may be particularly salient to adolescents' internal difficulties.

Child Gender as a Developmental Moderator

Child gender can moderate association between parental and child problems, but only at specific ages and symptoms. Paternal distress is more strongly associated with internalizing problems than maternal at age 14–16 in boys, but not in girls. For externalizing problems, mothers and fathers effects converges at age 11 in boys, while it converges at age of 14 in girls.

Paternal distress and internalizing problems associated stronger in adolescent boys may reflect gender differences in emotional socialization processes and coping. In adolescence, boys are less likely to directly express emotional difficulties, making paternal emotional climate and coping behaviors especially important [68]. The earlier convergence of maternal and paternal associations for boys' externalizing problems may indicate that other environmental influences become relatively important earlier for boys [69]. These findings should be distinguished from differences in symptom levels: boys generally showed more externalizing problems, whereas girls showed more internalizing problems in later adolescence. Thus, child gender did not determine which parent was universally more important, but modified parent-specific associations in a domain- and age-dependent manner, consistent with

developmental models emphasizing reciprocal relations among regulation, behavior, and social context [70].

Strengths and Limitations

This study drew on a large population-based cohort spanning early childhood to late adolescence. By modelling maternal and paternal distress separately, distinguishing internalizing from externalizing problems, and estimating age-varying associations, the analysis captured developmental heterogeneity beyond a single average parental effect. Sex-stratified analyses and adjustment for the other parent's distress further refined this characterisation.

These developmental patterns have implications for the timing and scope of family mental-health assessment. They support parent-inclusive rather than mother-only assessment: paternal distress was associated with both child outcomes across development and became particularly salient for adolescent internalizing problems, especially among boys. Where feasible, adolescent mental-health services should therefore assess paternal as well as maternal distress, which may reveal clinically relevant information otherwise overlooked.

Several limitations warrant consideration. First, the observational design and predominantly concurrent measurements preclude causal inference; the findings should therefore be interpreted as age-varying associations rather than causal effects. Second, the K6 assesses non-specific distress and cannot distinguish anxiety from depressive disorders diagnostically. Third, child problems were parent-reported, raising the possibility of reporting overlap and common-method bias, particularly when the reporter was also distressed. Future research should incorporate multiple informants and observational measures to strengthen assessment.

Future studies should test the proposed mechanisms directly. For childhood externalizing problems, these may include parental monitoring, consistency of discipline, emotional availability and child emotion regulation. For adolescent internalizing problems, particularly among boys, potential mechanisms include father–adolescent communication, autonomy support, coping models and perceived parental acceptance.

Conclusions

The correlations between parental distress and children's problem behaviors vary across different developmental stages, among different parents, in different symptom domains, and by child gender. During childhood, the association between maternal distress and children's internalizing and externalizing problems is relatively stronger; while paternal distress becomes more prominent in the later stage of adolescence, and this phenomenon is more evident among boys, but does not show a similar advantage in externalizing problems.

These findings support the developmental family systems perspective that parental distress is relational, outcome-specific, and changes with the child's developmental stage and gender. The mechanism at the

family level is deeply influenced by broader socioeconomic and structural contexts, and these environmental factors simultaneously shape the mental health of both parents and children. Parental distress is not a static and mutually substitutable risk factor, but a dynamic component of developmental risks, and the association between parental distress and children's problem behaviors changes with age growth and changes in developmental stages.

Declarations

Competing interests:

The authors declare no competing interests.

Ethical approval:

Ethical approval for the MCS was obtained from the relevant research ethics committees.

Consent to participate:

Informed consent was obtained from participating families at each wave in accordance with the procedures of the MCS.

Author Contribution

Conceptualization, H.W.; data curation, H.W. and L.Z.; formal analysis, H.W. and L.Z.; writing – original draft preparation, H.W., Y.G. and Y.L.; writing – review and editing, H.W. and Y.G.; All authors have read and agreed to the submitted version of the manuscript.

Data Availability

All datasets used for this study are freely available via the UK Data Service (<https://ukdataservice.ac.uk>).

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Figures

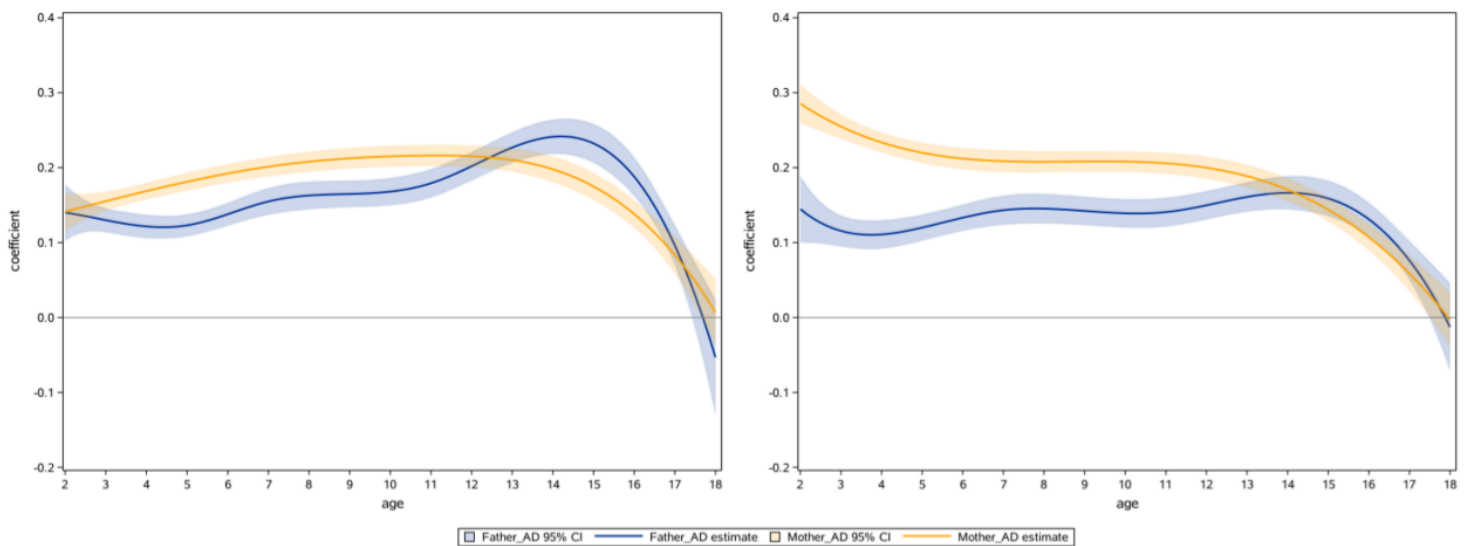


Figure 1

Coefficient curves for the age-varying associations between paternal and maternal psychological distress on child internalizing/externalizing problems (left: internalizing; right: externalizing). *Note. The association is statistically significant at ages when the 95 % confidence intervals, denoted by dashed lines, do not include zero.*

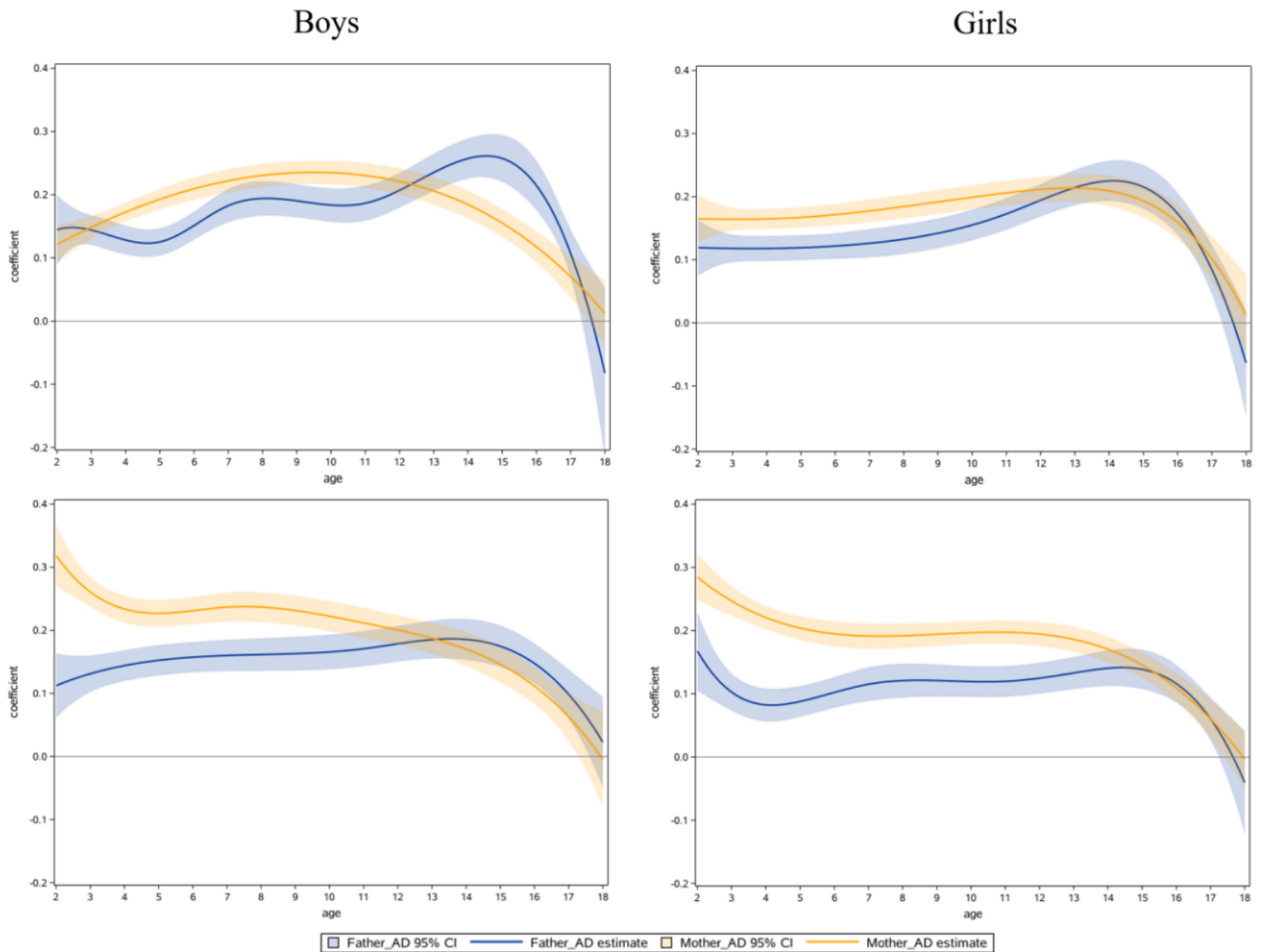


Figure 2

Coefficient curves for the age-varying associations between paternal/maternal psychological distress and child internalizing/externalizing problems, estimated separately in boys and girls (top: internalizing; bottom: externalizing).

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