NEW RESEARCH

Why Is Maternal Depression Related to Adolescent Internalizing Problems? A 15-Year Population-Based Study

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Objective: Exposure to maternal depression during early childhood is a well-documented risk factor for offspring's internalizing problems, but the long-term risk and the psychosocial mechanisms underlying the association remain largely unknown. We examined whether maternal depression during early childhood was associated with offspring internalizing problems in adolescence, and the extent to which negative parenting, peer victimization, and poor friendship quality during middle childhood mediated this association.

Method: We report on a population-based sample of children (n = 1,443) followed-up from 5 months to 15 years. We use yearly assessments of the exposure variable, that is, maternal depression (5 months to 5 years); the putative mediators, that is, peer victimization, friendship quality, and parenting practices (6−12 years); and assessment of the outcome variables at 15 years: self-reported major depressive (MD), generalized anxiety (GA), and social phobia (SP) symptoms. Structural equation modeling was used to test mediation by peer and family relationships.

Results: Exposure to maternal depression during early childhood was associated with higher levels of adolescent MD, GA, and SP. Peer victimization was the only significant mediator and explained 35.9% of the association with adolescent MD, 22.1% of that with GA, and 22.1% of that with SP.

Conclusion: Exposure to maternal depression prior to age 5 years was associated with depression, anxiety, and social phobia extending to adolescence via its impact on peer victimization during middle childhood. Particular attention should be paid to victimization as one potential psychosocial factor via which maternal depression is associated with adolescent internalizing problems.

Key words: maternal depression, adolescent internalizing problems, peer victimization, parenting, friendship quality

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It is estimated that 30% to 40% of women of childbearing age will meet *DSM* criteria for lifetime diagnosis of major depressive disorders.[1-5] Maternal depression is a risk factor for clinically relevant internalizing problems (ie, depressive and anxiety disorders) in the offspring,[5-8] with evidence of effects extending into middle childhood,[9,10] and mixed evidence of effects extending into adolescence[11,12] and young adulthood.[13,14] Longitudinal information on the offspring of depressed mothers extending to the teenage years is limited by the fact that relatively few studies can test such associations.[12] Indeed, investigating associations between exposure to maternal depression during early childhood (ie, prior to age 5 years) and mental health in adolescence requires longitudinal data spanning decades, population-based samples with sufficient numbers of offspring exposed to maternal depression, and well-validated measures of maternal, child, and adolescent mental health. We know even less about the mechanisms by which exposure to early maternal depression may lead to internalizing problems in the long term.[7]

Genetically informed studies suggest that maternal depression is related to higher risk of offspring's mental health problems via both genetic and environmental mechanisms.[5,15-19] Heritability of internalizing problems increases with age,[20] and stability of symptoms across development is explained primarily by genetic factors.[21] High genetic heritability applies to various and correlated internalizing problems (eg, depressive and anxiety symptoms).[22,23] Thus, the association between maternal depression and adolescent internalizing problems is, at least in part, genetically mediated. Nevertheless, environmental factors play an important role in the transmission of internalizing problems.[19,21] Identifying relevant environmental factors is important for prevention efforts, because such

factors are more amenable to interventions than genetic factors. Furthermore, environmental preventive measures may be efficacious regardless of whether the etiology is genetic or environmental.

Parenting practices represent a potentially important environmental mechanism through which maternal depression can influence children's mental health outcomes, especially in early childhood.[24,25] However, during middle childhood and adolescence, mechanisms linking maternal depression to mental health symptoms may be different as individuals become increasingly independent of their parents[26] and peer relationships become more important.[27] Mediation via peer relationships is plausible, because early exposure to maternal depression is related to lower subsequent empathic response, disrupted emotion regulation, and higher levels of interpersonal relationship difficulties.[28-30] These response patterns, established in early childhood, may set the stage for lower-quality interpersonal relationships in general, and for lower-quality peer relationships in particular,[29] and thus increase risk of social exclusion and victimization. In fact, maternal depression is related to children's lower capacity to maintain healthy relationships with both peers and parents,[18,28,31] and this association varies depending on the child's sex.[28] Thus, the quality of peer relationships that children of depressed mothers are able to develop may be a mechanism of cross-generational transfer of vulnerability to internalizing problems.

In the present study, we tested (1) the extent to which exposure to maternal depression during early childhood carries risk for adolescent symptoms based on *DSM* criteria for major depression (MD), generalized anxiety (GA), and social phobia (SP); and (2) whether associations are mediated by dysfunctional relationships with peers (ie, peer victimization and poor quality of friendships) and/or parents (ie, negative parenting). We also tested whether sex played a role in the differential vulnerability to maternal depression, given previous inconsistent sex differences findings.

METHOD

Participants

Participants were part of the Quebec Longitudinal Study of Child Development (1998−2011), a sample of 2,120 families with a 5-month-old infant born in 1997 to 1998. The sample was drawn from the Quebec Master Birth registry. All mothers giving birth after 24 weeks' gestation and speaking French or English were eligible. Families were assessed yearly between 5 months and 8 years and every 2 years between 8 and 12 years by trained interviewers in the family's home. Adolescent mental health was assessed via an online questionnaire at age 15 years. Respondents were the person most knowledgeable about the child (the mother in 98% of cases, between 5 months and 15 years), the teachers (6−12 years), and the study participants (12−15 years). Assessments used in the current study were performed at 5 months, 1.5, 2.5, 3.5, 4.5, 5, 6, 7, 8, 10, 12, and 15 years. Informed written consent from all participating families was obtained at each assessment and approved by the Health Research Ethics Committees of the Quebec Statistics Institute and the University of Montreal.

Measures

An exhaustive list of items included in the exposure, mediator, and outcome measures is presented in the supplemental material (see Supplements 1−3, available online). Questionnaires are also available online (http://www.jesuisjeserai.stat.gouv.qc.ca).

Main Exposure Variable: Maternal Depressive Symptoms During Early Childhood. Maternal depressive symptoms during the past week were assessed when the study child was 5 months, 1.5, 3.5, and 5 years using a short version of the Center for Epidemiologic Studies Depression Scale (CES-D; eg, "I felt depressed," "What I did was an effort").[32] Response categories ranged between 0 (none) to 3 (all the time). This validated short CES-D included 5 to 12 questions from the original CES-D.[33] Mean scores (standardized on a 0−10 scale) over the 4 assessments periods were used to compute the maternal depression exposure variable. Correlations among the 4 assessments varied between $r = 0.34$ and $r = 0.44$ (all $p < .0001$).

Outcome Variables: Offspring's Internalizing Problems at 15 Years. Self-reported symptoms of MD, GA, and SP were assessed at 15 years using the validated Mental Health and Social Inadaptation Assessment for Adolescents.[34] Adolescents rated whether they experienced *DSM-5*[35]−based symptoms never (1), sometimes (2), or often (3) over the past 12 months. Adolescents rated 8 items for MD (eg, "I lost interest in things I usually like"; $\alpha = 0.84$), 9 items related to GA (eg, "I found it difficult to control my worries"; $\alpha = 0.81$), and 8 items for SP (eg, "I feared or tried to avoid situations that involved a lot of people"; $\alpha = 0.84$).

Potential Confounders. We searched for variables that could confound associations between maternal depression and adolescent mental health on the basis of previous literature pertaining to risk factors and children's internalizing problems. Variables were selected if they were associated with maternal depression and any of the mediators or adolescent outcomes tested. Scores were averaged across informants and times of assessment to create a single mean score for each variable.

Child Internalizing Problems. Children's depressive and anxiety symptoms (DAS) were assessed during early childhood (mother-rated from 1.5 to 5 years; $\alpha = 0.78$) and middle childhood (teacher-rated from 6 to 12 years; $\alpha = 0.64$). Responses indicated whether the child never (0), sometimes (1), or often (2) exhibited internalizing problems in the past 12 months (eg, 'is nervous, high strung, or tense'; 'not as happy as other children'). Questions were derived from the Canadian National Longitudinal Study of Children and Youth,[36] which incorporates items from the Child Behavior Checklist,[37] the Ontario Child Health Study Scales,[38] and the Preschool Behavior Questionnaire.[39]

Socioeconomic Status. Family socioeconomic status (SES) at 5 months was derived from 5 variables including maternal and spouse's education and occupational status, and household income[40] (range −3 = low to 3 = high, with mean = 0 and SD = 1).[41] Low income at 5 months was based on Statistics Canada's guidelines pertaining to family income in the past year, the number of people in the household, and family zone of residence (urban versus rural, population density). Families contributing 20% or more of household income to food, shelter, and clothing were defined as low income.

Family Status. Family status between 5 months and 5 years was coded as "intact" (=1) if parents were married or living together at all assessments; "separated or divorced" (=2) if there was a separation; or "single" (=3) if a parent reported being a single parent for 75% or more of the assessments.

Family Functioning. The validated Family Dysfunction scale was completed by parents between 5 months and 6 years.[42] The scale includes eight items measuring how well the family operates on a daily basis. Scores ranged from 0 to 10, with higher values indicating higher levels of family dysfunction.

Mediators During Middle Childhood (6–12 Years). To construct robust mediator variables, we combined available sources of information from mothers, fathers, teachers, and target children. Scales reflecting different dimensions of the underlying concepts were used to create scores for each mediator. The final score for each mediator was the average of mother, father, teacher, and child-reported scores from ages 6 to 12 years.

Negative Parenting. We calculated the mean of mother (at 6, 7, 10, and 12 years) and father (at 6 and 10 years) coercive (eg, "grabbing or firmly shaking child") and intrusive (eg, "telling child exactly what to do when playing") interactions ($\alpha = 0.74$), measured with items from the Parent Practices Scale.[43]

Peer Victimization. An adapted version of the Self-report victimization scale[44] was used to measure frequency of peer victimization (eg, name calling; physical aggression; being teased). Four victimization scores were created using data from fathers and mothers (age 6 years), and teachers and children (6, 7, 8, 10, and 12 years). Victimization scores ranged from 0 to 10; the overall victimization score was the mean of the four victimization scores ($\alpha = 0.76$).

Poor Friendship Quality. Items ($\alpha = 0.52$) were taken from validated questionnaires such as the Friendship Qualities Scale.[45] Mothers, children, and teachers rated their perceptions of the child's friendships. Mothers rated items at ages 6 (5 items), 7 (3 items), 8 (3 items), and 10 years (2 items); for example, "How many days per week are you with your best friend?"; "Are you happy with your friend?"; "Have you fought with your best friend?" Children rated friendship quality at ages 6 (2 items), 8 (1 item), and 12 years (2 items); for example, "Does your friend say mean things to you?"; "Does your friend say he/she wants to play with you?"; "Do you bicker with your friend?" Teachers assessed two aspects of friendship, "joint behavior toward others" and "friendship between child and the best friend" at ages 6, 7, 8, 10, and 12 years. Mother, child, and teacher friendship perceptions were combined and recoded to a scale of 0 to 10.

Mean scores of the exposure, mediator, and outcome variables are reported in the supplementary material (see Table S1, available online).

Data Analyses

In preliminary analyses, control variables were identified on the basis of their correlations with exposure and outcome variables. The main analyses, which were conducted using structural equation modeling with robust standard error estimation in Mplus version 7.31,[46] proceeded in distinct steps. First, we ran separate simple mediation models,[47,48] to test the indirect link between maternal depression and each outcome (ie, MD, GA, and SP) via one potential mediator at a time (ie, peer victimization, negative parenting, and low friendship quality), while including the identified control variables (ie, family functioning, low income, family status, maternal education, maternal age, child's DAS). Simple mediation analyses were performed separately for boys and girls to identify sex-specific mediators. Mediation was tested via the significance of the indirect effect from the main predictor via the mediator to the outcome.[49] Thus, 18 models were estimated: 3 for each adolescent outcome (MD, GA, and SP) × 3 for each mediator (victimization; negative parenting, friendship quality) × 2 for each sex. The indirect effect is significant if

the product of the coefficient of the pathway from maternal depression to the mediator and the coefficient of the pathway from the mediator to the outcome is significant.[50] Because bootstrapped confidence intervals of the indirect effect are not available for weight-adjusted variables in Mplus, the R-Mediation package was used to build unbiased confidence intervals for indirect effects. Variables that significantly mediated the association between maternal depression and an adolescent mental health outcome for at least one of the two sexes were included in the final mediation models.

Next, final mediation models were estimated separately for each adolescent outcome. All models were saturated, that is, all variables measured at an earlier time were allowed to predict all variables measured at a later time. These models were tested as two-group models by sex to examine potential sex differences. To this end, we compared the fit of a freely estimated model (ie, in which all estimated parameters were allowed to freely vary between sexes) with the fit of a model in which all estimated parameters were constrained to be equal across sexes. Differences in fit between the freely estimated and constrained models were compared using the Satorra–Bentler scaled χ^2 difference test.[51,52] If necessary, cross-sex equality constraints were successively freed up based on the model modification indices provided in Mplus until the most parsimonious constrained model was obtained that did not significantly differ in fit from the model without any cross-sex constraints. Parameter estimates that did not reach statistical significance ($p \leq .05$) in the most parsimonious constrained model were fixed to zero to further maximize model parsimony. Only parameters with significance of $p \leq .05$ are reported. To examine the strength of the mediation effect of any specific mediator, the ratio of the mediator-specific indirect effect over the total effect from the predictor (maternal depression) to a given outcome (MD, GA, or SP) was calculated.[53]

RESULTS

The analysis sample includes 1,443 participants (68% of the original sample) with at least one measure of depression, anxiety, and social phobia at 15 years. To account for attrition, we conducted analyses with and without inverse probability weights, representing participants' probabilities of being included in the study sample conditional on variables related to attrition: (1) sex (males: 47.8% in analysis sample versus 57.6% in cohort sample, $\chi^2 = 17.67$, $p < .001$); (2) participants' ethnicity (nonwhite: 5.6% versus 15.8%, $\chi^2 = 60.34$, $p < .001$); (3) maternal depressive symptoms (mean score at T1) (1.35 versus 1.52,; $T_{2111} = 2.80$, $p = 0.005$]; (4) SES (mean at T1) (0.08 versus −0.20, $T_{2111} = -6.13$, $p < .001$); (5) family structure (single family: 6.5% versus 11.5%, $\chi^2 = 15.11$,

TABLE 1 Baseline Sample Characteristics

Characteristics	Child's Age at Assessment	Full Sample N = 2120	Analysis Sample n = 1443	p
Child Characteristics				
Sex, n (%)	5 mo			<.001
Girls		1040 (49.06%)	753 (52.18%)	
Ethnic Background, n (%)	5 mo			<.001
White		1993 (91.17%)	1361 (94.45%)	
Maternal Characteristics				
Depression	5 mo to 5 y	1.40 (1.16)	1.36 (1.12)	.0256
Family functioning	5 mo to 6 y	1.68 (1.45)	1.67 (1.44)	.6539
Mother's age at birth	5 mo	29.30 (5.23)	29.43 (5.10)	.0863
Mother's Education, n (%)	5 mo			<.001
No high school diploma		385 (18.19%)	233 (16.16%)	
High school diploma		555 (26.22%)	352 (24.41%)	
Post–high school diploma		611 (28.86)%	424 (29.40%)	
University diploma		566 (26.74)%	433 (30.03%)	
Single-parent family, n (%)	5 mo to 5 y			.001
Yes		161 (7.61%)	89 (6.18%)	
Low income, n (%)	5 mo to 5 y			<.001
Yes		431 (22.19%)	279 (19.79%)	
SES		−0.01 (1.00)	0.03 (1.00)	.0136

Note: *SES = socioeconomic status.*

$p = 0.001$; (6) family functioning (mean score at T1) (1.68 versus 1.78, $T_{2092} = 1.55$, $p = 0.121$) (Table 1). Results with and without weights did not differ significantly; the former are presented here.

Correlations between the exposure, mediator, outcome, and control variables are presented in the supplementary material (see Table S2, available online). Table 2 presents the simple indirect effects of maternal depression on adolescent mental health, that is, the association between maternal depression and adolescent MD, GA, and SP including a single mediator. Simple mediation analyses indicated that peer victimization mediated the association between maternal depression and MD, GA, and SP in boys and the association between maternal depression and MD and GA in girls. Negative parenting only mediated only the association between maternal depression and MD in boys and the association between MD and GA in girls. Therefore, peer victimization and negative parenting were included as mediators in the subsequent final models. Friendship quality was not included in any model because it did not mediate the association between maternal depression and adolescent outcomes.

Figures 1A, 1B, and 1C illustrate the final mediation models for MD, SP, and GA in both sexes, including controls. In all three models, although the mediation paths did not differ between sexes, the intercept for each adolescent mental health outcome was different for boys and girls. Fit information for the full mediation models and comparisons of full mediation models with the Satorra–Bentler scaled χ^2 test are presented in the supplementary material (see Tables S3 and S4, available online).

Major Depression Symptoms

Negative parenting did not significantly mediate the association between maternal depression and adolescent major depression when peer victimization was included as a mediator in the model. Peer victimization fully mediated the association between maternal depression and adolescent major depression symptoms (MD) equally for both sexes. No significant direct effect from maternal depression to adolescent MD remained. Effect size calculations indicated that 35.9% of the maternal depression–adolescent MD association was explained by peer victimization and 1% by negative parenting.

Generalized Anxiety Symptoms

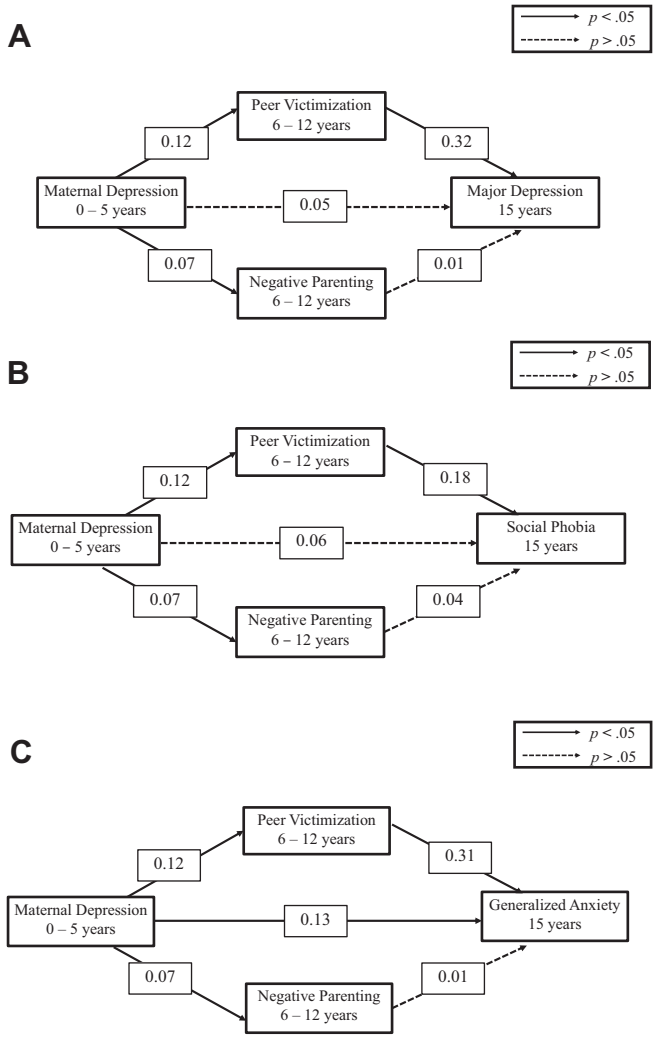
Negative parenting did not significantly mediate the association between maternal depression and generalized anxiety symptoms (GA) in either sex. Peer victimization partially mediated the effect of maternal depression on GA. This mediation was partial, as a significant direct effect from maternal depression to GA remained. Effect size calculation indicated that 22.1% of the depression–adolescent GA association was explained by peer victimization and 0.4% by negative parenting.

TABLE 2 Simple Indirect Effects (β Values and 95% CIs) of Maternal Depression on Adolescent Mental Health Outcomes in Simple Mediation Models[a] With Controls

Victimization		
	Boys	**Girls**
Major Depression	0.065[b] (0.026, 0.113)	0.040[b] (0.006, 0.080)
Generalized Anxiety	0.054[b] (0.019, 0.099)	0.036[b] (0.006, 0.072)
Social Phobia	0.043[b] (0.012, 0.086)	0.007 (−0.010, 0.027)
Negative Parenting		
	Boys	Girls
Major Depression	0.019[b] (0.000, 0.046)	0.032[b] (0.004, 0.069)
Generalized Anxiety	0.007 (−0.012, 0.031)	0.037[b] (0.011, 0.073)
Social Phobia	0.015 (−0.003, 0.040)	0.010 (−0.016, 0.039)
Friendship Quality		
	Boys	Girls
Major Depression	0.005 (−0.013, 0.026)	0.015 (−0.001, 0.040)
Generalized Anxiety	0.004 (−0.009, 0.022)	0.011 (−0.002, 0.032)
Social Phobia	0.004 (−0.009, 0.022)	0.010 (−0.003, 0.031)

Note: [a]*Simple mediation models are models with one exposure variable, one outcome variable, a single mediator variable, and control variables.* [b]*Association significant at* $p < 0.05$.

FIGURE 1 Mediation Models of the Association Between Exposure to Maternal Depression During Early Childhood and Adolescent Internalizing Problems at 15 Years



Note: Peer victimization (6–12 years) fully mediated the effect of exposure to maternal depressive symptoms (5 months to 5 years) on adolescent major depression (A) and partially mediated the association with generalized anxiety (B) (15 years) in girls and boys. Peer victimization was also a full mediator in the association with social phobia (C). Negative parenting was not a significant mediator. The following control variables were included in all the models: family functioning, low income, family status, maternal age, and education and child's depressive and anxiety symptoms during early childhood.

Social Phobia Symptoms

As with MD, peer victimization fully mediated the association between maternal depression and adolescent social phobia symptoms (SP) equally for both sexes. No significant remaining direct effect from maternal depression to adolescent SP emerged. In contrast, negative parenting was not a significant mediator of the association between maternal depression and adolescent SP. Effect size calculation indicated that 21.8% of the depression–adolescent SP association was explained by peer victimization and 2.6% by negative parenting.

We conducted additional analyses to test the possibility that the association between maternal depression in early childhood and adolescent mental health is mediated by maternal depression in middle childhood (age 7–12 years). The direct association between maternal depression in early childhood and adolescent outcomes became insignificant, but victimization remained a significant mediator (see Figures S1–S5, available online).

DISCUSSION

Using a large population-based cohort study covering infancy to adolescence, we found that children exposed to elevated symptoms of maternal depression during the first 5 years of life had higher rates of major depression, generalized anxiety, and social phobia symptoms in adolescence. When comparing the role of three potential relational mediators during middle childhood—negative parenting, poor friendship quality, and being victimized by one's peers—we found only victimization by peers to partially or completely explain the association between maternal depression and adolescent internalizing symptomatology, for both males and females.

Specifically, peer victimization (age 6–12 years) fully mediated the effect of exposure to maternal depressive symptoms (5 months to 5 years) on adolescent major depression and social phobia symptoms (15 years), and partially mediated the association with generalized anxiety, among boys and girls. Peer victimization explained 35.9% of the association with adolescent MD, 22.1% with GA, and 22.1% with SP. The overall pattern of results is in line with Tsypes and Gibb's finding that stressful relationships with peers mediate the association between maternal depression and a specific but severe type of internalizing symptomatology—namely, suicidal ideation.[28] The results are also in line with previous studies showing peer victimization in childhood to be associated with adolescent and adult suicidal behaviors, and with adult depression,[54-56] as well as maternal depression to be associated with lower peer relationship quality.[29,57]

Victimization by peers includes behaviors such as threats, insults, and criticisms and has often been associated with concurrent internalizing problems during childhood. We show that the well-being of adolescents exposed to early maternal depression was associated more with their experience of victimization than with poor quality of parent–child relationships or to poor quality of relationships with friends in middle childhood. Sensitivity analyses indicated that peer victimization remained a significant mediator even when family separation, disrupted family functioning, or economic downturn, which may have

followed maternal depression, were included in the models. Furthermore, peer victimization remained the only mediator when child internalizing problems or continued maternal depression during middle childhood were included in the models. These results should be interpreted with caution, as our study is not genetically informative. Unmeasured and unmodeled genetic influences that play an important role in the heritability of internalizing problems[21] were not assessed in the present study and may explain part of the observed associations.

Hammen *et al.* suggested that interpersonal difficulties in childhood play a functional role in future experiences of depression, because poor functioning in social roles engender lower social support and self-esteem, which may exacerbate vulnerability to depression.[57] Models of intergenerational transmission of depression have consistently documented dysfunctional parent−child relationships as mechanisms of intergenerational transmission.[27] Our results support the functional role of interpersonal relationships but point to a specific type of relationship as particularly relevant in the developmental chain—namely, peer victimization.

Following replication in other longitudinal studies, future work should test interventions for the prevention of intergenerational transmission that involve not only families affected by internalizing problems, but also the schools. Testing the impact of a bullying prevention program on the association between maternal depression and child internalizing problems could provide information about the putative causal role of peer victimization.

This study has important strengths, including the following: (1) its large-scale longitudinal nature; (2) repeated assessments of maternal depressive symptoms over 5 years; (3) detailed and multi-informant assessments of peer and parent relationships during 6 years in middle childhood; and (4) a validated self-report questionnaire based on *DSM-5* criteria for assessment of adolescent internalizing problems.[34] Furthermore, the study covers the three developmental periods from birth to adolescence, and few cohort studies include such detailed assessments of all three periods. Finally, our analytical approach relied on longitudinal data, used state-of-the art mediation models, and included a wide range of potential confounders, which provides confidence in the temporality of the associations.

Nevertheless, we faced the following limitations. First, attrition was higher among children exposed to maternal depression, resulting in a loss of power for detecting associations. Yet, detection of significant associations despite attrition suggests that its impact was limited. Furthermore, we conducted weight-adjusted analyses to address the potential bias resulting from attrition and obtained results similar to those obtained in the full sample. Second, we used continuous scales rather than categorical diagnostic categories to assess maternal depressive symptoms and adolescent internalizing problems. Thus, our results may not apply to adolescents with problems of clinical severity. However, this continuous approach is informative in population-based samples with low prevalence of clinically severe mental health problems but with relatively high prevalence of subclinical symptoms. The use of continuous scales also corresponds to a shift in the assessment of mental health problems favoring the assessment of number of symptoms rather than a cut-off for determining the presence versus absence of a mental health diagnosis.[35] Third, as in every structural equation modeling model, mathematically equivalent models to the one that we tested (ie, having equal fit) can be generated (eg, reversing the paths). However, strong theoretical and empirical rationale has been provided for the estimated paths, and the longitudinal design makes reverse causation unlikely. Finally, results for the friendship mediator should be interpreted cautiously due to the low reliability of this measure.

Exposure to maternal depression in early childhood was associated with internalizing problems in the offspring extending into adolescence. The findings highlight the importance of considering peer victimization as one of the environmental mechanisms, and of bullying prevention programs as a potentially promising target of intervention for children exposed to maternal depression.

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