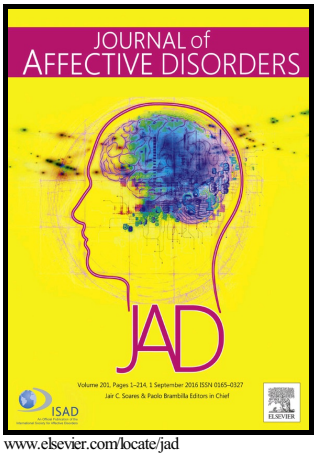

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Maternal psychological distress and child decision-making

Eirini Flouri[a*], Sofia Ioakeimidi[a], Emily Midouhas[a], George B. Ploubidis[b]

[a]Department of Psychology and Human Development, UCL Institute of Education, University College London, UK

[b]Department of Social Science, UCL Institute of Education, University College London, UK
[*]Correspondence and requests for reprints: Department of Psychology and Human Development, UCL Institute of Education, University College London, 25 Woburn Square, London WC1H 0AA, UK. Tel.: +02076126279. e.flouri@ucl.ac.uk

Abstract

Background

There is much research to suggest that maternal psychological distress is associated with many adverse outcomes in children. This study examined, for the first time, if it is related to children's affective decision-making.

Methods

Using data from 12,080 families of the Millennium Cohort Study, we modelled the effect of trajectories of maternal psychological distress in early-to-middle childhood (3-11 years) on child affective decision-making, measured with a gambling task at age 11.

Results

Latent class analysis showed four longitudinal types of maternal psychological distress (chronically high, consistently low, moderate-accelerating and moderate-decelerating). Maternal distress typology predicted decision-making but only in girls. Specifically, compared to girls growing up in families with never-distressed mothers, those exposed to chronically high maternal psychological distress showed more risk-taking, bet more and exhibited poorer risk-adjustment, even after correction for confounding. Most of these effects on girls' decision-making were not robust to additional controls for concurrent internalising and externalising problems, but chronically high maternal psychological distress was associated positively with risk-taking even

after this adjustment. Importantly, this association was similar for those who had reached puberty and those who had not.

Limitations

Given the study design, causality cannot be inferred. Therefore, we cannot propose that treating chronic maternal psychological distress will reduce decision-making pathology in young females.

Conclusions

Our study suggests that young daughters of chronically distressed mothers tend to be particularly reckless decision-makers.

Keywords

Cambridge Gambling Task; CGT; decision-making; maternal psychological distress

Introduction

There is much research to suggest that maternal psychological distress is associated with many adverse outcomes in children (Choe, Olson, & Sameroff, 2013; Ciciolla, Gerstein, & Crnic, 2014) This study examines, for the first time, if it is related to children's affective decision-making. Usually measured with gambling tasks, affective decision-making (henceforth decision-making) is associated with clinical diagnoses in both adults (Buelow & Suhr, 2009) and youth (Sonuga-Barke, Cortese, Fairchild, & Stringaris, 2016), but also with youth risky behaviours (such as smoking, alcohol and drug use) and internalising and externalising problems. In general, poor decision-making reflecting reward-hyposensitivity and diminished reward-seeking is related to internalising problems (Rawal, Collishaw, Thapar, & Rice, 2013). Poor decision-making, as reflected in enhanced responses to rewarding outcomes and deficits in the activity of motivational circuitry during anticipation of rewards, is generally related to externalising behaviours (Ernst et al., 2003). Although it differs by gender (Hooper, Luciana, Conklin, & Yarger, 2004), decision-making, if impaired, is associated with adverse outcomes in both boys and girls.

Although there is no research into the role of maternal (or paternal) psychological distress in offspring decision-making, there is some into the role of parental depressive symptomatology or parental depression. As far as we are aware, there are three studies, all with adolescents (Rawal et al., 2014; Qu, Fuligni, Galvan, Lieberman, & Telzer, 2016) or late adolescents (aged 16-20 years; Mannie, Williams, Browning, & Cowen,

2015), that have explored this. These studies generally suggest that parental depression or depressive symptomatology causes impaired decision-making in offspring but disagree over whether it increases or reduces risk-taking, the aspect of decision-making that is of interest to probably all the social and behavioural sciences. Two of these three studies have explored associations between exposure to parental depression or depressive symptoms and offspring risk-taking, but one suggests that such an exposure leads to diminished risk-taking in late adolescence (Mannie et al., 2015) and the other that it leads to increased risk-taking in middle adolescence (Qu et al., 2016). The impetus for the present investigation was to shed light into the link between parental psychological distress and offspring risk-taking in childhood, but also to examine the role of parental psychological distress in child decision-making in general. An important improvement over the previous studies was that, by using longitudinal data, it could explore prospectively the role of the timing and pattern of exposure to parental symptoms.

Method

Sample

The sample was drawn from the Millennium Cohort Study (MCS), a population-based longitudinal birth cohort study of children born in the UK over 12 months from 1 September 2000. MCS children were around 9 months old at Sweep 1, and around 3, 5, 7 and 11 years old at Sweep 2, 3, 4 and 5, respectively. MCS was designed to over-represent families living in areas of high child poverty, areas with high proportions of ethnic minority populations across England, and the three smaller UK countries. Parent-reported data were collected through interviews and self-completion questionnaires. Ethical approval was gained from NHS Multi-Centre Ethics Committees, and parents gave informed consent before interviews took place. At Sweep 1, 18,522 families participated in MCS. The numbers of productive families at Sweeps 2, 3, 4 and 5 were 15,590, 15,246, 13,857 and 13,287 respectively. In all, 19,244 families participated in MCS. MCS has data on maternal psychological distress in all families at all sweeps, and on child decision-making at Sweep 5. The study's analytic sample was children (singletons and first-born twins or triplets) whose mothers had valid data on psychological distress in at least one of Sweeps 2-5 and with at least one valid measure of child decision-making at Sweep 5 (N = 12,080, of whom 6053 were male). We excluded Sweep 1 as maternal psychological distress was measured differently at the beginning of MCS.

Measures

Decision-making was assessed with the Cambridge Gambling Task (CGT; Rogers et al., 1999), which measures decision-making under risk, at age 11 years. The task was administered in the homes of cohort members as part of the main interview. The standard software which administers the procedure was integrated into the computer-assisted personal interview (CAPI) scripts. Responses were recorded using in-built touchscreens on interviewers' CAPI machines. All interviewers were provided with scripts to read out while demonstrating the test to cohort members. On each CGT trial, participants are presented with a row of ten boxes across the top of the screen, of which some are red and some are blue. At the bottom of the screen are rectangles containing the words 'Red' and 'Blue'. Participants must guess whether a yellow token is hidden in a red box or a blue box. The task consists of five stages, each of which is a block of trials. In the first, decision-only stage, participants simply have to guess whether the token is hidden under a red or blue box. The latter four stages are gambling stages. Following the colour decision, participants can bet a proportion of their points (from an initial 100 on each stage) on their confidence in the location of the yellow token. Two of the gambling stages are practice sessions undertaken prior to a test session, so that participants' performance is ultimately assessed by the two test gambling stages. In the gambling stages, participants start with a number of points displayed on the screen, and select a proportion of these points, displayed in either rising or falling order, in a second box on the screen, to gamble on their confidence in this judgement. A stake box on the screen displays the current amount of the bet. Participants are informed that correct bets will be added onto their points score (and incorrect ones will be taken away) and that they should try to win as many points as possible. The task produces six outcome measures, all of which were examined in this study. One, *risk-taking,* is of particular interest, as explained above. Risk-taking is the mean proportion of points bet on trials where the most likely outcome was chosen. The remaining five are: *quality of decision-making, deliberation time, risk adjustment, delay aversion* and *overall proportion bet*. Quality of decision-making is the mean proportion of trials where the participant selects the correct colour outcome. Deliberation time is the mean time (in milliseconds) taken to make a box colour response. Risk adjustment is the extent to which betting behaviour is moderated by the ratio of boxes, and reflects the tendency to stake higher bets on favourable compared to unfavourable trials. Delay aversion is the difference in percentage bet in ascending versus descending conditions. Overall proportion bet is the mean proportion of points bet across all trials. The CGT is not normed

in children although previous studies have used it with both high-risk (Rawal et al., 2013) and clinical (DeVito et al., 2008; Sorensen et al., 2016) child populations.

Maternal psychological distress was measured at children's ages 3, 5, 7 and 11 years with the Kessler K6, a 6-item screener of psychological distress with robust psychometric qualities (Kessler et al., 2003). The K6 was developed with support from the U.S. Government's National Center for Health Statistics for use in the redesigned U.S. National Health Interview Survey. The scale was designed to be sensitive around the threshold for the clinically significant range of the distribution of nonspecific distress in an effort to maximise the ability to discriminate cases of serious mental illness from non-cases. The K6 is included in many national surveys both in the U.S. and elsewhere as a tool to identify those with serious mental illness (about 5-8% of the population). A score of 13+ on the K6 (when its items are scored 0-4) signals the presence of serious mental illness. More information on the K6 and its psychometric properties is available at: https://www.hcp.med.harvard.edu/ncs/k6_scales.php.

To minimise confounding we included important correlates of psychological distress in mothers (Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005) and child decision-making as *covariates* in the regression models. These were maternal age at the beginning of the study period (Sweep 2), child ethnicity (white, black, Indian, Pakistani/Bangladeshi, mixed and other), number of children in the household, maternal education (university degree or not) by the end of the study period (Sweep 5), number of family disruptions (family-status changes) throughout the study period (Sweeps 2-5), and number of sweeps in poverty (below the poverty line, defined as 60% of the UK median household income) throughout the study period.

Analytic approach

To explore how psychological distress may develop over time, we fitted a latent class model in Mplus. In latent class analysis, longitudinal trajectories are unknown but can be inferred from patterns of responses on observed indicators (in this case, maternal psychological distress scores) measured over time. Latent class analysis can summarise these patterns by creating longitudinal profiles in a parsimonious way (Nagin & Tremblay, 2005). We used the full information maximum likelihood method, which is naturally incorporated into the generalised latent variable modelling framework to estimate parameters and standard errors from the available data, under the assumption that missingness is at random given the variables in the model and that the models are correctly specified. To determine whether the identified maternal trajectories predicted later child outcomes, decision-making at age 11 years was regressed on the trajectory membership variables and

the covariates in linear regression models using SPSS. All regression models were stratified by gender in view of the gender differences in decision-making. Attrition/non-response and survey design were taken into account by using weights. In the linear regression models in SPSS, we used the Complex Samples General Linear Model module to account for this weighting. In general, there was little missingness. We had no missingness in the main and response variables, given that the analytic sample was those with valid data on both. Missingness was 0-9% in most of the covariates, with two exceptions: number of sweeps in poverty (18%) and number of family-status changes (20%).

Results

In Table 1 we present information criteria, log-likelihoods and the entropy coefficient, a measure of classification quality (values close to 1 indicate good allocation quality and low classification error) for different specifications of the latent class model. As expected, model fit improved with each additional class. Classification quality was satisfactory in all models. As can be observed in the table, Model 4 had good fit and a large entropy coefficient. Entropy started dropping with additional parameters/latent classes. On closer inspection, the additional classes largely replicated the patterns of already existing classes, but with a very small prevalence. We therefore selected the 4-class model as the most parsimonious description of the longitudinal patterns in the data. As can be seen in Figure 1 which shows the four longitudinal types of maternal psychological distress across the four time-points, the most prevalent class (73%) consisted of mothers with consistently low levels of distress throughout ('consistently low'). At the other extreme were mothers with 'chronically high' distress, the lowest prevalence class (4.8%). The two intermediate classes included mothers with levels of distress that were moderate at the first two time-points but either accelerated ('moderate-accelerating') or dropped ('moderate-decelerating') with time (8.6% and 13.6%, respectively).

Table 1 *Log-likelihood and Information Criteria for Alternative Latent Class Models of Maternal Psychological Distress*

No. of classes	Log-likelihood	AIC	BIC	ssa BIC	Entropy
1	-116107.109	232230.219	232289.413	232263.990	1
2	-108919.270	217864.539	217960.730	217919.417	.920
3	-106825.669	213687.339	213820.526	213763.324	.866
4	-105812.614	211671.229	211841.413	211768.321	.880
5	-104987.254	210030.508	210237.688	210148.707	.861

6	-104143.609	208353.218	208597.395	208492.525	.878
7	-103442.878	206961.756	207242.929	207122.170	.875

AIC = Akaike information criterion; BIC = Bayesian information criterion; ssa BIC = sample-size-adjusted Bayesian information criterion.

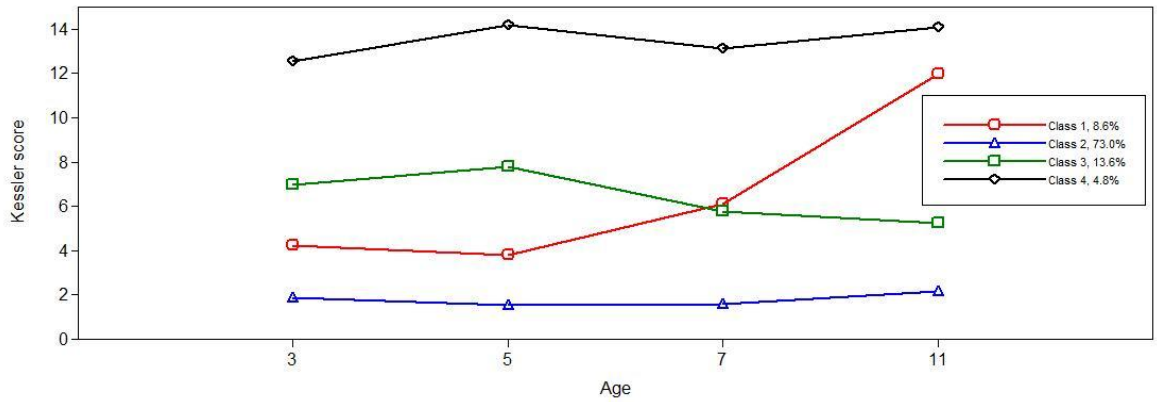

Figure 1. The four class solution of maternal psychological distress (Y axis) at child ages 3, 5, 7 and 11 years (X axis)

As can be seen in Table 2, which shows the class differences in demographic and socio-economic factors, all covariates were related to maternal distress types. The chronically high and the consistently low groups were the most and the least disadvantaged, respectively. For example, mothers with chronically high levels of psychological distress were younger, poorer and less educated than the rest. Those with consistently low levels of distress were older, less poor and more educated than the rest.

Table 2 *Descriptives of Key Variables by Latent Class*

	Class 1 (moderate acceleratin g)		**Class 2 (consisten tly low)**		**Class 3 (moderate deceleratin g)**		**Class 4 (chronical ly high)**		
Categorical variables									
	%	Adjuste d Residu al	%	Adjuste d Residu al	%	Adjuste d Residu al	%	Adjuste d Residu al	*Adjusted F*[1]
Mother is university-educated	9.8	-9.3	22.2	14.9	13.9	-6.1	5.4	-14.6	63.4***
Child ethnicity									4.8***
White	83.2	-2.6	88.4	6.1	82.3	-4.6	80.6	-3.5	
Mixed	3.8	.7	3.1	-1.7	4.1	1.5	3.4	.1	
Indian	2.1	.6	1.6	-2.4	2.3	1.2	2.8	1.5	
Pakistani/Banglad eshi	5.5	2.5	3.2	-5.6	5.3	2.6	6.4	3.2	

Black	3.8	1.3	2.8	-2.2	4.1	1.6	4.2	1.5	
Other	1.5	.8	1.0	-2.9	1.9	2.0	2.5	1.6	
Continuous variables									
	M (SE)	95% CI	M (SE)	95% CI	M (SE)	95% CI	M (SE)	95% CI	*Wald F*
No. of sweeps in poverty	1.5 (0.1)	[1.4, 1.7]	0.8 (0.0)	[0.7, 0.9]	1.4 (0.1)	[1.3, 1.5]	2.2 (0.1)	[2.03, 2.4]	107.2***
No. of family-status changes	0.5 (0.0)	[0.5, 0.6]	0.3 (0.0)	[0.3, 0.3]	0.4 (0.0)	[0.4, 0.5]	0.6 (0.1)	[0.5, 0.7]	35.0***
Mother's age[2]	30.8 (0.3)	[30.3, 31.3]	31.9 (0.1)	[31.6, 32.2]	30.6 (0.2)	[30.2, 31.0]	29.1 (0.3)	[28.5, 29.8]	37.2***
No. of siblings	1.7 (0.1)	[1.6, 1.8]	1.5 (.0)	[1.5, 1.6]	1.6 (0.0)	[1.6, 1.7]	1.7 (0.1)	[1.6, 1.8]	8.2***

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

[1]Adjusted F (for categorical variables) = F statistic for design-based Pearson chi-square that is converted to F test to account for the MCS sampling design.

[2]At the start of the study period (Sweep 2, at child's age around 3 years).

Next we carried out gender-stratified regression models predicting scores on each of the six CGT variables by class membership and the covariates. The decision to stratify by gender, informed by previous evidence for gender differences in decision-making, was supported by our data. Compared to girls, boys had higher scores on risk-taking, delay aversion and overall proportion bet, and lower on deliberation time and quality of decision-making. There was no gender difference in risk adjustment. Class membership did not predict any CGT outcomes in boys. Rather, social disadvantage, as approximated by low maternal education, poverty and young maternal age, tended to be associated with boys' CGT scores. In girls, class membership predicted three of the six CGT outcomes. Social disadvantage had less of an impact, predicting only quality of decision-making and risk adjustment (results available on request). As can be seen in Tables 3 and 4, which show the regression analysis results for the six outcomes in girls, compared to daughters of mothers with consistently low levels of distress, those exposed to chronically high levels of maternal psychological distress showed both more risk proneness (i.e., they took more risks and bet more) and poorer risk adjustment (i.e., they had more difficulties adjusting to changing probabilities of choice outcomes).

Supplementary analysis

To attempt to explain the statistically significant effects of maternal psychological distress on risk-taking, risk adjustment and overall proportion bet in females, we carried out a supplementary analysis (full details available on request). We reasoned that offspring internalising and externalising problems, both associated with maternal psychological distress and offspring risk-taking, may explain the effect of exposure to continuously high levels of maternal distress. A third variable we considered was pubertal status. Chronic maternal psychological distress, an important stressor and a proxy for a number of disadvantages, tends to be

associated with early puberty in girls (Ellis & Garber, 2000). In turn, pubertal status is strongly associated with risk-taking in young people (Smith, Chein, & Steinberg, 2013). We found that the effects of chronically high maternal psychological distress were largely robust to adjustment for pubertal status. In particular, we found that pubertal status in females - associated with risk-taking, overall proportion bet and quality of decision-making - did not explain the effect of maternal psychological distress on either risk-taking or overall proportion bet (although it did the effect on risk adjustment). However, when we covaried concurrent externalising and internalising problems (measured with the Strengths and Difficulties Questionnaire), two of the three effects of chronic maternal distress (on overall proportion bet and risk adjustment) were attenuated. Risk-taking continued to be predicted by chronically high maternal distress and was, as expected, associated - negatively and positively, respectively - with internalising and externalising problems. We tested if this persistent and positive effect of maternal distress on risk-taking in females in our sample varied by pubertal status. In our sample, about 85% of girls and 40% of boys had shown some signs of puberty at the time of measurement of decision-making. We therefore added pubertal status and interaction terms for pubertal status * maternal distress in the model including externalising and internalising problems and all the variables shown in tables 3-4. The interaction was nonsignificant, however.

Table 3 *Model Estimates Predicting Risk-taking, Quality of Decision-making and Deliberation Time in Girls*

	Risk-taking		**Quality of decision-making**		**Deliberation time**	
	Coeff. (SE)	95% CI	Coeff. (SE)	95% CI	Coeff. (SE)	95% CI
Constant	0.544***(0.070)	[0.407,0.681]	0.665***(0.070)	[0.528,0.802]	3434.587(479.916)	[2491.034,4378.141]
Class (Ref: Class 2- 'consistently low')						
Class 1 ('moderate-accelerating')	0.020(0.011)	[-0.003,0.042]	0.000(0.011)	[-0.022,0.022]	177.755(102.230)	[-23.237,378.748]
Class 3 ('moderate-decelerating')	0.007(0.008)	[-0.009,0.024]	-0.007(0.008)	[-0.023,0.008]	66.415(69.039)	[-69.322,202.151]
Class 4 ('chronically high')	0.040*(0.015)	[0.011,0.069]	0.001(0.013)	[-0.025,0.027]	-62.383(89.738)	[-238.816, 114.050]
Child's age	0.001(0.006)	[-0.011,0.013]	0.010(0.006)	[-0.001,0.022]	-6.890(42.553)	[-90.553,76.772]

Child's ethnicity (Ref: White)						
Mixed	0.015(0.017)	[-0.019,0.049]	0.023(0.018)	[-0.014,0.059]	-16.054(149.157)	[-309.310,277.201]
Indian	0.014(0.017)	[-0.018,0.047]	0.016(0.021)	[-0.025,0.057]	234.521(204.480)	[-167.503,636.546]
Pakistani/Bangladeshi	0.063***(0.015)	[0.033,0.093]	0.042*(0.016)	[0.010,0.074]	-276.018*(108.751)	[-489,831,-62.205]
Black	0.044*(0.016)	[0.014,0.075]	-0.048**(0.015)	[-0.077,-0.019]	-7.183(171.138)	[-343.655,329.289]
Other	0.041(0.026)	[-0.010,0.091]	-0.015(0.025)	[-0.064,0.035]	-361.323**(123.977)	[-605.072,-117.573]
Mother's age	0.000(0.000)	[-0.001,0.001]	0.001*(0.001)	[0.000,0.002]	4.681(4.080)	[-3.339,12.702]
Mother is university-educated	-0.003(0.006)	[-0.015,0.008]	0.033***(0.007)	[0.019,0.046]	-57.099(66.974)	[-188.774,74.577]
No. of family-status changes	0.004(0.005)	[-0.006,0.014]	0.003(0.005)	[-0.007,0.013]	-34.264(39.542)	[-112.007,43.478]
No. of siblings	-0.005(0.003)	[-0.010,0.001]	-0.001(0.003)	[-0.008,0.005]	20.280(21.647)	[-22.279,62.840]
No. of sweeps in poverty	0.003(0.003)	[-0.003,0.008]	-0.009**(0.003)	[-0.014, -0.004]	28.085(21.542)	[-14.268,70,438]

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

Table 4 *Model Estimates Predicting Risk Adjustment, Delay Aversion and Overall Proportion Bet in Girls*

	Risk adjustment		**Delay aversion**		**Overall proportion bet**	
	Coeff. (SE)	95% CI	Coeff. (SE)	95% CI	Coeff. (SE)	95% CI
Constant	-0.689(0.435)	[-1.544,0.166]	0.454***(0.108)	[0.241,0.667]	0.536***(0.065)	[0.408,0.663]
Class (Ref: Class 2-'consistently low')						
Class 1 ('moderate-accelerating')	-0.033(0.069)	[-0.168,0.103]	-0.002(0.019)	[-0.040,0.036]	0.020(0.011)	[-0.001,0.042]
Class 3 ('moderate-decelerating')	-0.065(0.050)	[-0.162,0.033]	0.017(0.013)	[-0.010,0.043]	0.008(0.008)	[-0.007,0.024]
Class 4 ('chronically high')	-0.180*(0.075)	[-0.327,-0.033]	0.025(0.021)	[-0.016,0.066]	0.036*(0.015)	[0.008,0.065]
Child's age	0.085*(0.038)	[0.010,0.160]	-0.010(0.010)	[-0.029,0.009]	-0.002(0.006)	[-0.013,0.010]

Child's ethnicity (Ref: White)						
Mixed	-0.139(0.106)	[-0.347,0.070]	-0.020(0.029)	[-0.076,0.037]	0.016(0.015)	[-0.015,-0.046]
Indian	0.066(0.151)	[-0.232,0.363]	0.034(0.031)	[-0.027,0.096]	0.014(0.016)	[-0.018,0.045]
Pakistani/Bangladeshi	-0.305**(0.094)	[-0.490,-0.120]	0.016(0.027)	[-0.038,0.070]	0.069***(0.015)	[0.040,0.099]
Black	-0.181*(0.078)	[-0.333,-0.028]	-0.022(0.040)	[-0.102,0.057]	0.043**(0.016)	[0.012,0.074]
Other	-0.081(0.151)	[-0.378,0.217]	0.040(0.033)	[-0.025,0.105]	0.047(0.026)	[-0.004,0.099]
Mother's age	0.006(0.003)	[0.001,0.013]	-0.002(0.001)	[-0.003,0.000]	0.000(0.000)	[-0.001,0.001]
Mother is university-educated	0.183***(0.039)	[0.107, 0.259]	-0.013(0.009)	[-0.031,0.006]	-0.005(0.006)	[-0.016,0.007]
No. of family-status changes	-0.018(0.033)	[-0.082,0.047]	0.011(0.008)	[-0.004,0.026]	0.001(0.005)	[-0.009,0.010]
No. of siblings	0.027(0.019)	[-0.010,0.063]	-0.002(0.004)	[-0.010,0.007]	-0.003(0.003)	[-0.009,0.003]
No. of sweeps in poverty	-0.046**(0.015)	[-0.077,-0.016]	0.003(0.004)	[-0.006,0.011]	0.003(0.003)	[-0.002,0.008]

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

Discussion

With this study, we attempted to explore the effect of parental psychological distress on decision-making in children. In a large, general population sample, we investigated the effect of timing and level of exposure to maternal psychological distress in early-to-middle childhood (ages 3-11 years) on decision-making at age 11. We found that chronic exposure to high levels to maternal distress predicted risk-taking, but only in girls, and in the opposite direction to that shown in the only other observational study we are aware of that examined a related research question (Mannie et al., 2015). In that study, with a sample of late adolescents aged 16-20 years with a parental diagnosis of depression and a control group with no family history of depression, the decision-making deficits of those exposed to parental depression reflected less, not more, risk-taking. Another study, however, using, like our study, a community sample of adolescents showed that higher parental

depressive symptoms led to increases in risk-taking and self-reported externalising behaviour over time (Qu et al., 2016). That study used a functional magnetic resonance imaging (fMRI) design to investigate how parental depressive symptoms are associated with neural reactivity to rewards during a risk-taking task, the Balloon Analogue Risk Task, in adolescents aged 15-17 years. It found that, at the neural level, adolescents of parents with greater depressive symptoms showed increased activation in the ventral striatum and the dorsolateral prefrontal cortex during risk-taking, suggesting that parental depression may contribute to changes in adolescents' neural reactivity to rewards, in turn increasing their risk-taking and externalising behaviour.

Why were parental depressive symptoms and psychological distress associated positively with risk-taking in children and adolescents, but parental depression was associated negatively with risk-taking in late adolescents? One possible explanation is that the association differs qualitatively by developmental stage, but it is not easy to attribute this discrepancy to differences in developmental stages based on evidence from only three studies. Another possibility is that this discrepancy may be due to the differences in the types of environments and parent-child interactions experienced by the offspring of parents who are clinically depressed [the sample used in Mannie et al. (2015)] and those of parents who are distressed or at risk of depression [as in our and Qu et al.'s (2016) studies]. High levels of maternal psychological distress or high but not clinical levels of maternal depressive symptoms may be enough to affect parenting practices but not to result in someone else taking the role of primary caregiver (Rutter, 1990). Thus, offspring of distressed (vs. depressed) caregivers might be more likely to be exposed to unresponsive or rejecting parenting, the type of parenting associated with child risk-taking (McCormick, Qu, & Telzer, 2016). Future research should test if this apparent contradiction in the evidence on the association between parental depressive symptomatology and offspring risk-taking is simply due to the non-comparability of the studies that produced it.

As far as our study is concerned however, we are confident of our findings. In our sample, chronic exposure to high levels of maternal psychological distress was positively associated with risk-taking in girls, even with controls for socio-demographic characteristics, pubertal status and concurrent internalising and externalising problems. This is an important finding because it suggests that girls who have been exposed to chronically high levels of maternal psychological distress, a group who experience a number of risk factors and associated disadvantages (Choe et al., 2013; Ciciolla et al., 2014), take more risks than their counterparts, which likely increases further the probability of adverse outcomes for them. Children at the cusp of adolescence (our sample) are poor decision-makers because of asymmetries in the development of the

affective and the rational cognitive brain regions at this stage (Smith, Xiao, & Bechara, 2012). Our study showed that, at this stage, daughters of chronically distressed mothers tended to be particularly reckless decision-makers. Importantly, this tendency was similar for those who had reached puberty and those who had not.

Limitations

As discussed, without clinical diagnoses of parental depression our results cannot be directly comparable with those of earlier studies linking parental mental health and offspring decision-making. Another limitation is the lack of ecologically valid measures of decision-making. It is important to associate the laboratory measures of risk proneness used in this study with more ecologically-valid indices of risk-taking. Finally, given the study design causality cannot be inferred. Therefore, we cannot propose that treating chronic maternal psychological distress will reduce decision-making pathology in young females.

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Highlights

- We link, for the first time, maternal psychological distress with child decision-making
- Chronically high maternal psychological distress predicts risk-taking in young females
- The link is robust to adjustment for confounding, pubertal status and problem behavior