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BRIEF REPORT

Maternal Psychological Distress and Children's Adjustment Problems: Mediation by Household Chaos

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Research over many decades has considered the crucial role of maternal psychological distress (e.g., depression, anxiety) for children's psychological adjustment (externalizing and internalizing problems), suggesting bidirectional influences over time. However, little is known about the extent to which household chaos (e.g., noise, disorganization, lack of calm) may mediate this mutual association, despite an understanding that chaos is a powerful stressor in the home. Conducting secondary data analysis in a large scale, prospective longitudinal study of families with children—the U.K.'s Millennium Cohort Study—we accounted for stability in both maternal psychological distress and children's internalizing and externalizing problems and examined the extent to which household chaos mediated the mutual association between maternal psychological distress and children's behaviors. Using what we term a mutual-mediation model, we found that both maternal psychological distress and children's adjustment problems predicted household chaos at Age 5, and in turn, that chaos predicted maternal psychological distress and child adjustment problems at Age 7. We found a dominance of children's externalizing problems in the prediction of household chaos, and all pathways were strongest for maternal psychological distress and externalizing problems compared to child internalizing problems. Our findings suggest that research would be well-minded to consider both child and parent effects on household chaos, as well as its mediation potential.

Keywords: household chaos, externalizing behavior, internalizing behavior, Millennium Cohort Study, psychological distress

Global health priorities increasingly acknowledge psychological adjustment and mental health (World Health Organization, 2022). Childhood adjustment problems including internalizing problems (anxiety, depression, emotional problems) and externalizing problems (aggression, oppositionality, conduct problems) are seen as primary precursors of diverse adult social, life-chance and mental-health outcomes, and around half of all adult mental-health disorders manifest before the age of 18 (Solmi et al., 2022). Importantly, the considerable prevalence of parents' psychological distress (Abel et al., 2019) is also of grave concern, since parents' own psychological needs are understood to be key drivers of the onset and maintenance of their children's adjustment difficulties. Indeed, the psychological health of parents and children are mutual influences, and understanding mechanisms that may mediate these associations is crucial. Here, we examine the potential role of household chaos in bidirectional associations between parent and child mental health.

Household chaos refers to a cluster of characteristics of the home environment such as noise, a lack of routine and order, and a sense of rush rather than calm (Evans & Wachs, 2010; Matheny et al., 1995), and is increasingly considered a proximal stressor that relates to diverse outcomes for both children and adults in the home (see Marsh et al., 2020, for a review). Although associated with disadvantage, household chaos is not a substitute for poverty or low socioeconomic status and is seen to have independent detrimental effects (e.g., Evans & Wachs, 2010). Moreover, many scholars have suggested that chaos has the potential to intensify the effects of other stressors, such as socioeconomic factors, parental executive function, and hostile parenting, on child outcomes (Marsh et al., 2020). In addition to this moderating role, chaos may also mediate the influence of proximal stressors on child and adult outcomes since these stressors can influence parents' capacity to maintain structure and organization in the home. Of particular interest in terms of this

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The ideas/data in this article have not been previously presented at conferences or communicated in any other way. Data are publicly available through the U.K. Data Service. The current analyses were not preregistered, and the study analysis code is available upon request.

Bonamy R. Oliver and Emily Midouhas contributed in conceptualization, data investigation, writing—original draft, and writing—review and editing.

Emily Midouhas contributed in formal analysis and data curation.

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mediation by chaos is the association between parental psychological distress and children's adjustment problems.

Most research in this area has focused on parental psychological distress as mediating associations between chaos and children's internalizing and externalizing behaviors (Coley et al., 2015; Zhang, 2022). However, another plausible model is that chaos has a mechanistic role in associations between parental psychological distress and child adjustment outcomes, since psychological distress has been shown to affect parental emotion regulation and executive function, which are likely to influence parents' ability to keep the household calm and routinized (Crandall et al., 2015; Geeraerts et al., 2021). This notion has been formally supported using maternal reports in a COVID-19-lockdown study of 230 children in Israel (Gordon-Hacker et al., 2023) as well as a cross-sectional study in the United States of more than 400 preschool children (Hur et al., 2015). In the latter study, significant mediation was only evident for maternal-reported outcomes, not observer-assessed behavioral self-regulation in children. While potentially due to shared method variance, this finding may also underline the importance of perception, since depressed parents may perceive their children more negatively (Gartstein et al., 2009), and potentially their household as more chaotic.

Although recognized for many years (Bell, 1968; Belsky et al., 1984), the crucial influence children have on their parents is commonly neglected in research. Here, we put forward a mutual-mediation model whereby chaos mediates both the influences of parental psychological distress on children's internalizing and externalizing behaviors and the influence of children's behaviors on parental psychological distress. Our posited model is founded on the understanding that children's behaviors can affect parental sense of competence (Latham et al., 2018) and parenting (Serbin et al., 2015), that most studies associating chaos with adult and child outcomes are not designed to unpick direction of effect (see Marsh et al., 2020), and that bidirectional processes between parents' and children's psychological distress and behaviors (Sifaki et al., 2021; Speyer et al., 2022), and chaos (Jaffee et al., 2012) are common.

Using data from the U.K. Millennium Cohort Study (MCS), a large, prospective cohort study, we examined longitudinal associations between maternal psychological distress and children's adjustment across early- and middle-childhood (Ages 3–7 years), testing a mutual-mediation model and hypothesizing that child internalizing and externalizing behaviors and parental psychological distress at Age 3 would influence child behaviors and parental distress at Age 7, with chaos at Age 5 mediating these pathways.

Method

In the following, we report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

Participants and Procedure

MCS (<https://www.cls.ioe.ac.uk/mcs>) is a longitudinal cohort study taking its sample from all U.K. births over a 1-year period, from September 1, 2000 (Plewis, 2007). Using a stratified cluster sampling approach, MCS was sampled to overrepresent areas with high proportions of ethnic minority, high child poverty. Parents gave informed consent to participate. MCS has ethical approval from U.K. National Health Service Multicentre Ethics Committees; additional approval was not required for this secondary analysis. Demographic

data were collected at Age 3, parental psychological distress and child adjustment at child Ages 3 and 7, and household chaos at Age 5. Our analytic sample comprised families who had data on all model variables—a complete-case sample of 8,388—and included one child per family (first born where there were twins or triplets). One quarter of mothers had a university degree or higher, around one fifth lived below the poverty line and four fifths had a partner at home. Around half of the children were female and 94% were from a White ethnic background. Full demographic information about the sample is given in Table 1.

Measures

Maternal Psychological Distress

Mothers self-reported their own psychological distress using the Kessler Psychological Distress Scale (K6+; Kessler et al., 2002). The K6+ is a six-item screener with questions about frequency of feelings in the past month (sad, nervous, restless/fidgety, hopeless, everything is an effort, worthless) and has robust psychometric qualities (Cronbach's $\alpha = .86$ and $.88$ at Ages 3 and 7, respectively).

Child Psychological Adjustment

Children's adjustment was measured using maternal reports on the Strengths and Difficulties Questionnaire (R. Goodman, 2001). Internalizing behaviors were measured with 10 items (e.g., "Often unhappy, down-hearted or tearful") from the emotional symptoms and peer problems scales at Ages 3 and 7 ($\alpha = .59$ – $.71$, respectively). Externalizing behaviors (e.g., "Often has temper tantrums or hot tempers") were measured with 10 items from the conduct problems and hyperactivity/inattention scales at Ages 3 and 7 ($\alpha = .78$ – $.81$). These externalizing and internalizing scales are recommended for the measurement of psychological adjustment in low-risk samples (A. Goodman et al., 2010).

Household Chaos

Mothers reported on three items indexing chaos at Age 5 including whether the household is calm (reverse-coded), disorganized, and whether you "can't hear yourself think" (Parkes et al., 2013; Cronbach's $\alpha = .66$). Items were originally taken from the Confusion, Order and Hubbub scale (Matheny et al., 1995).

Confounding Variables

We controlled for several parent (maternal education, income poverty status, and family structure) and child factors (child gender, age, and ethnicity). With regard to family-level covariates, income poverty status (below the poverty line, set for equivalized net family income at 60% of the U.K. national median household income) and family structure (two parents or not) were measured at our baseline time point (Age 3). Maternal education was measured with a binary indicator of whether the mother achieved a university degree or higher degree by the end of our study period (Age 7 years). Child age in years was measured at our baseline time point and ethnicity had six categories: White, mixed, Indian, Pakistani/Bangladeshi, Black, and other.

Data Analysis

We ran descriptive statistics for all variables and correlations between main variables. Then, we conducted cross-lagged structural equation path mediation models using Stata 18.0. Fully adjusted models were run without (Model 1a), and then with (Model 1b) chaos at Age 5. Mediation was tested with the Sobel test (Sobel, 1987), which provides direct, indirect, and total effects for each mediation path with bootstrapped standard errors (50 reps). Significant cross-lagged effects were tested for relative strength (child or mother for example) using a Wald test. In both models, each Age 7 dependent variable (maternal psychological distress and child externalizing and internalizing behavior) was regressed on all confounding variables. Both models accounted for the stratified sample design of MCS (Hansen et al., 2010).

Results

Table 1 includes weighted descriptive statistics for all study variables. Correlations among study variables (Table 2) were significant at $p < .001$ and in expected directions, indicating substantial within-domain stability over time and small to moderate cross-domain associations.

SEM Results

Both Models 1a and 1b (Table 3) fitted the data well (comparative fit index [CFI]: Model 1a = 1.000, Model 1b = .978; Tucker–Lewis Index [TLI]: Model 1a = 1.000, Model 1b = .889; root-mean-squared error of approximation [RMSEA]: Model 1a = 0.000, Model 1b = .042¹). In Model 1a, significant cross-lagged paths were found between maternal psychological distress and child

Table 1
Weighted Descriptive Statistics for All Study Variables (n = 8,388)

Variable	%
Maternal/household variables	
University degree or higher	24.60
Poverty status	19.43
Two-parent family	86.35
Child variables	
Gender	49.43
Ethnicity	
White	94.14
Mixed	2.32
Indian	0.88
Pakistani or Bangladeshi	1.01
Black	1.28
Other	0.37
	<i>M (SE)</i>
Maternal/household variables	
Psychological distress Age 3	2.74 (.039)
Psychological distress Age 7	2.20 (.034)
Household chaos at Age 5	7.16 (.033)
Child variables	
Child's age in years Age 3	3.12 (.004)
Externalizing problems Age 3	6.27 (.060)
Internalizing problems Age 3	2.56 (.031)
Externalizing problems Age 7	4.38 (.059)
Internalizing problems Age 7	2.42 (.040)

Note. SE = standard error.

externalizing and internalizing behaviors, with elevated maternal distress at child Age 3 associated with more problem behaviors at child Age 7 and vice versa; Model 1b showed that chaos at Age 5 reduced but did not fully attenuate these reciprocal associations. With regard to the confounding variables, only family poverty predicted higher levels of maternal distress at Age 7. All confounding variables were associated with externalizing problems at Age 7. More specifically, family poverty was associated with more externalizing problems and intact family status, maternal university degree status, female child and Indian, Pakistani/Bangladeshi, or Black ethnic background (relative to White) were related to fewer problems. Family poverty and intact family status were the only confounding variables that were associated with internalizing problems at Age 7.

Chaos significantly mediated all cross-lagged paths in the model (Table 4). Considering nonoverlapping confidence intervals based on bootstrapped standard errors for the indirect effects, the mediating effect of chaos between externalizing problems and maternal distress was stronger (40.5% of the effect mediated by chaos) than that between internalizing problems and maternal distress (10.2%). Additionally, the mediating effect of household chaos between psychological distress on externalizing problems (37.7%) was larger than that on internalizing problems (12.6%).

In terms of paths to and from chaos, maternal distress (Wald X_2 : $32.93 = p < .001$) and externalizing problems (Wald $X_2 = 33.41$, $p < .001$) had larger associations with chaos than internalizing problems, yet the magnitude of the associations of distress and externalizing problems with chaos did not significantly differ (Wald $X_2 = .02$, $p = .89$). Moreover, chaos was more strongly associated with externalizing problems than internalizing problems (Wald $X_2 = 25.11$, $p < .001$), and with externalizing problems compared to psychological distress (Wald $X_2 = 10.27$, $p < .01$) but its relationship with maternal distress did not differ from that with internalizing problems (Wald $X_2 = 2.54$, $p = .11$).

Standardized coefficients for the indirect effects are illustrated in Figure 1, indicating the largest coefficient was for the child externalizing effect at Age 3 on chaos followed by the maternal psychological distress effect at Age 3 on chaos. Cross-lagged paths were modeled but estimates are not shown in the figure for clarity.

Discussion

In a large prospective longitudinal study, we examined household chaos as a mediator of the bidirectional relationship between maternal psychological distress and children's externalizing and internalizing behaviors over time. Our findings support our posited mutual-mediation model whereby maternal distress and children's adjustment influence each other over time via household chaos. Although not, to our knowledge, previously explicitly modeled in this way, our results align with those showing chaos as mediating associations between maternal reports of distress and children's socioemotional outcomes (Gordon-Hacker et al., 2023; Hur et al., 2015), as well as reciprocal influences of parent and child psychological distress and behaviors (Sifaki et al., 2021; Speyer et al., 2022). We extend these findings, suggesting mutual influences on the home environment by parents and children that are in

¹ It is recommended that good model fit is achieved when CFI $\geq .95$, TLI $\geq .95$, and RMSEA < 0.07 (Hooper et al., 2008).

Table 2
Correlations Among Main Variables ($n = 8,388$)

Variable	1	2	3	4	5	6	7
Maternal variables							
1. Psychological distress Age 3	—						
2. Psychological distress Age 7	.507***	—					
3. Chaos Age 5	.240***	.243***	—				
Child variables							
4. Externalizing Age 3	.293***	.220***	.272***	—			
5. Externalizing Age 7	.226***	.263***	.281***	.552***	—		
6. Internalizing Age 3	.268***	.203***	.162***	.250***	.250***	—	
7. Internalizing Age 7	.256***	.312***	.205***	.290***	.438***	.404***	—

Note. 3, 5, and 7 refer to age of child in years; means are weighted (N s are unweighted).
*** $p < .001$.

turn important for negative psychological outcomes for them both, even after accounting for behavioral stability.

Research has shown that behavioral problems predict elevated chaos in the home (Johnson et al., 2022), and our stronger mediation by chaos of the reciprocal association between maternal distress and child externalizing problems than internalizing problems reflects this, as well as aligning with findings from a recent cross-sectional study (Foley et al., 2021). We speculate that internalizing problems may not manifest outwardly as externalizing problems do and thus contribute less to mothers' perceptions of their homes as chaotic. Additionally, both maternal distress and chaos are related to increased negative parenting behaviors including physical punishment and

inconsistent discipline (Dumas et al., 2005; Whitesell et al., 2015), which can result in coercive cycles between parents and children (Patterson, 1982), sustaining externalizing problems. We would expect disorder in the home to be higher when these negative cycles are more frequent. Moreover, we speculate that specific elements of home chaos may be pertinent for the association between maternal distress and externalizing problems. For example, noise has been linked to feelings of annoyance and stress in adults and to child behavior (Clark & Paunovic, 2018). We encourage further research to explore the differential role of specific chaos components using more comprehensive measures of household chaos than were available in MCS.

Table 3
Coefficients of Path Models Testing Longitudinal Associations Between Maternal Psychological Distress and Child Behaviors Mediated by Chaos Total (Model 1a/b; Fully Adjusted)

Model paths	Standardized β (SE; 95% CI)	
	Model 1a	Model 1b
Stability in maternal PD over time		
PD Age 3 \rightarrow PD Age 7	.468*** (.009)	.450*** (.010)
Stability in child behaviors over time		
Ext Age 3 \rightarrow Ext Age 7	.481*** (.009)	.458*** (.009)
Int Age 3 \rightarrow Int Age 7	.314*** (.010)	.310*** (.011)
Cross-sectional relationships between maternal PD and child behaviors		
PD Age 3 \leftrightarrow Ext Age 3	.293*** (.010)	.293*** (.010)
PD Age 3 \leftrightarrow Int Age 3	.267*** (.010)	.267*** (.010)
Ext Age 3 \leftrightarrow Int Age 3	.348*** (.010)	.348*** (.010)
PD Age 7 \leftrightarrow Ext Age 7	.150*** (.011)	.135*** (.011)
PD Age 7 \leftrightarrow Int Age 7	.193*** (.011)	.184*** (.011)
Ext Age 7 \leftrightarrow Int Age 7	.338*** (.010)	.329*** (.010)
Cross-lagged relationships between PD and child behaviors		
PD Age 3 \rightarrow Ext Age 7	.054*** (.010)	.034*** (.010)
PD Age 3 \rightarrow Int Age 7	.117*** (.010)	.103*** (.011)
Ext Age 3 \rightarrow PD Age 7	.056*** (.010)	.034*** (.011)
Int Age 3 \rightarrow PD Age 7	.050*** (.010)	.045*** (.010)
Chaos variables (mediators)		
Chaos Age 5: total \rightarrow PD Age 7	—	.113*** (.010)
Chaos Age 5: total \rightarrow Ext Age 7	—	.121*** (.009)
Chaos Age 5: total \rightarrow Int Age 7	—	.088*** (.010)
PD Age 3 \rightarrow Chaos Age 5: total	—	.167*** (.011)
Ext Age 3 \rightarrow Chaos Age 5: total	—	.207*** (.011)
Int Age 3 \rightarrow Chaos Age 5: total	—	.045*** (.011)

Note. SE = standard error; CI = confidence interval; PD = psychological distress; Ext = externalizing problems; Int = internalizing problems. 3, 5, and 7 refer to age of child in years.
** $p < .01$. *** $p < .001$.

Table 4
Direct, Indirect, and Total Effects for Model 1b

Model paths	Direct		Indirect		Total		% mediated by chaos
	<i>b</i> (SE)	β [95% CI]	<i>b</i> (SE)	β [95% CI]	<i>b</i> (SE)	β [95% CI]	%
PD _{age3} → Chaos _{age5} → Ext _{age7}	0.041 (0.012)	0.034 [0.018, 0.063]	0.024 (0.003)	0.020 [0.019, 0.029]	0.065 (0.012)	0.054 [0.041, 0.087]	37.7
PD _{age3} → Chaos _{age5} → Int _{age7}	0.092 (0.011)	0.103 [0.070, 0.113]	0.013 (0.002)	0.015 [0.009, 0.017]	0.105 (0.011)	0.117 [0.084, 0.126]	12.6
Ext _{age3} → Chaos _{age5} → PD _{age7}	0.024 (0.008)	0.034 [0.008, 0.041]	0.017 (0.002)	0.024 [0.013, 0.020]	0.041 (0.008)	0.058 [0.024, 0.057]	40.5
Int _{age3} → Chaos _{age5} → PD _{age7}	0.049 (0.014)	0.045 [0.022, 0.077]	0.006 (0.002)	0.005 [0.003, 0.009]	0.055 (0.014)	0.050 [0.028, 0.082]	10.2

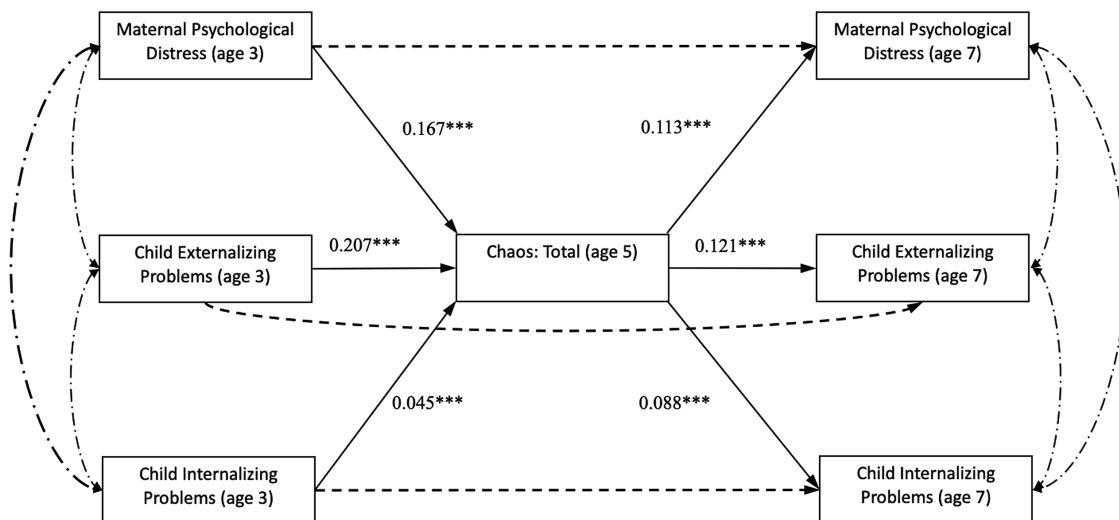
Note. SE = standard error; CI = confidence interval; PD = psychological distress; Ext = externalizing problems; Int = internalizing problems. Standard errors bootstrapped and normalized confidence intervals based on bootstrapped standard errors. All coefficients are significant at $p < .001$.

Our study has a number of strengths, not least the large, longitudinal sample, and prospective data, enabling our models to account for construct stability over time in our investigation of mutual-mediation processes. Yet, we also acknowledge limitations. Perhaps the most pertinent limitation is the sole use of maternal reports. Internalizing problems may be hard to detect (Tandon et al., 2009) and maternal reports are not optimal for their assessment (likely reflected in the low internal reliability for our measure). Moreover, there may be inflation of associations between variables due to rater and perceiver biases. However, of note, perceptions of chaos are seen as a function of both observed stimuli and individual differences in sensitivity (Wachs, 2013); recent experimental findings that those with higher sensory sensitivity may be more influenced by household chaos (Andrews et al., 2021) suggest that these individual perspectives are important. Nevertheless, our research would be strengthened by replication and by including observations and multiple reporters. It is also acknowledged that household chaos is a complex and multifaceted construct, and the internal reliability of our measure was low. While

this is common with scales of few items that aim to assess different aspects of a construct—and our items seem broadly to represent the scope of the original (Matheny et al., 1995)—we recognize that chaos is a construct that is more than the sum of its parts and that even the well-documented short form (six items) chaos scale may be in need of reconsideration (Larsen et al., 2022). Another limitation is the use of global measures of parental psychological distress and child behavior, measured with a 5-year gap, to capture transactional links. Such an approach has been compared to “taking still photos of a dance” (Houben et al., 2015, p. 905), missing out on the dynamic interactions between parent and child. Finally, we acknowledge the relative homogeneity of the sample regards race and ethnicity, as well as household composition. Further research with more diverse samples is warranted to explore the generalizability of these results.

Our findings indicate that the home environment context, in terms of disorder, noise, and lack of calmness, has a role to play in the mutuality of parent–child interactions and may be of interest to practitioners working with families to support child behavioral problems. Indeed,

Figure 1
Illustration of Longitudinal Associations Between Maternal Psychological Distress and Child Behavior Mediated by Household Chaos (Model 1b)



Note. Direct cross-lagged effects are not shown though estimated, only indirect effects (standardized coefficients) are shown. *** $p < .001$.

there may be key questions to be asked of the different components of chaos in associations between parental distress and child outcomes, and we encourage future research. We also suggest that full longitudinal mutual-mediation models with measures at all time points and using different family member perspectives would help us better understand these mechanistic processes.

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