

Association Between Parental Social Interaction and Behavior Problems in Offspring: a Population-Based Study in Japan

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Abstract

Purpose Research in parental social support has chiefly examined received social support. Studies have suggested that provided social support may also be protective for child mental health problems. We aim to investigate the association between parental social interaction (both received and provided social support) and offspring behavior problems.

Methods We analyzed the data of 982 households, including 1538 children aged 4 to 16 years, from the Japanese Study of Stratification, Health, Income, and Neighborhood (J-SHINE) survey conducted over 2010–2011. We used a 5-point Likert scale to assess social interaction including parental emotional and instrumental support received from and provided to the spouse, other co-residing family members, non-co-residing family members or relatives, neighbors, and friends. Behavior problems in offspring were assessed using parental responses to the Strengths and Difficulties Questionnaire. Associations between parental social interaction and behavior problems were analyzed using ordered logistic regression.

Results We found that higher maternal social interaction is significantly associated with lower odds of both difficult and prosocial behavior problems, while the same associations were not found for paternal social interaction. Further, maternal provided social support showed an independent negative association with prosocial behavior problems in offspring,

even when adjusted for received maternal social support and paternal social interaction.

Conclusions This study showed that maternal social interaction, but not paternal social interaction, might have a protective effect on offspring behavior problems. Further study is required to investigate the effect of the intervention to increase social participation among mothers whose children have behavior problems.

Keywords Social support · Child mental health · Problem behavior · Prosocial behavior · Japan

Introduction

Behavior problems in children are a significant public health concern and can be an early sign of potential mental health difficulties. Childhood mental disorders can persist into adulthood and lead to lower educational attainment, lower employment prospects, and in turn, lower socioeconomic status [1–3]. The prevalence of children with mental health problems severe enough to visit medical institutions in Japan during 2005–2006 was 4.6 % in nursery schools, 2.9 % in elementary schools, and 4.2 % in junior high schools, respectively [4]. Although genetic factors might be responsible for the occurrence of child mental disorders [5–7], they do not fully account for all mental health problems [8–10], suggesting that environmental factors may also be relevant.

Previous research suggests that aspects of a child's social environment, such as parental socioeconomic status [11, 12], the presence of family conflict [13], or parental social support [14–16], play a significant role in determining child mental health problems. Social support generally refers to two major types of support: instrumental and emotional support [16]. Instrumental support is defined as any type of tangible and

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practical support such as financial assistance, provision of information, help with housekeeping, and so on [16]. Instrumental support could allow parents to invest more time and care into their children by relieving them from the pressure of limited resources and financial stress. On the other hand, emotional support is defined as support given by family, friends, or peers, including actively listening to a parental problem or giving sympathy to someone, which can help the person to feel comforted and encouraged [16].

Further, social support has two directions: receiving and providing [17, 18]. It is well-known that receiving social support is good for health [19, 20]. Further, previous research has suggested that providing emotional support, such as supportive listening to others, was associated with improved confidence, self-esteem, and role-functioning compared with those receiving help [21]. Other studies have also shown that providing support is associated with higher levels of mental health [22], reduced depression [23], and life satisfaction [24]. Therefore, not only does receiving social support have benefits for wellbeing but providing social support also has a beneficial effect.

However, previous studies on parental social support [14–16] have only focused on the context of received support. Provided parental social support may also have a protective effect on child mental health problems through better parental mental health [22, 25]. To the best of our knowledge, no study has examined the impact of both received and provided parental social support on the mental health problems of offspring. Moreover, few studies have simultaneously investigated the impact of paternal and maternal social support on child mental health problems.

We hypothesized that more frequent parental social interaction, that is, both social support received from others (i.e., the spouse, other co-residing family members, non-co-residing family members or relatives, neighbors, or friends) by the parent, and social support provided to others by the parent, might be protective for child mental health problems, or more specifically, child behavior problems. Thus, the purpose of this study is to investigate the association between parental social interaction, including provided and received social support, and offspring behavior problems.

Materials and Methods

Sample

We based our analysis on data from the Japanese Study of Stratification, Health, Income, and Neighborhood (J-SHINE) survey [26]. The survey was conducted in four municipalities in and around metropolitan Tokyo from October 2010 until February 2011. Participants were residents ranging from 25 to 50 years of age who were randomly selected from the electoral

roll. Trained surveyors made at least five visits to reach the originally selected sample after sending an invitation letter. If they agreed to participate in the study, the participants were asked to provide written informed consent. The questionnaire was administrated by a computer-aided personal instrument (CAPI). The CAPI questionnaire was accessible via the internet from the participant's personal computer or on a provided laptop computer. Details of the questionnaire adopted in the J-SHINE surveys are available at <http://park2010.itc.u-tokyo.ac.jp/dhsb/project.html>. The protocol and informed consent procedure of J-SHINE were approved by the ethics committees of the Graduate School of Medicine of The University of Tokyo. The total sample size of the main survey was 4357 (response rate = 31.3 %) and 1873 spouses/partners of the initial respondents also provided valid responses (response rate = 61.9 %). Of this sample, we extracted the data of 982 households that included both a mother and father, and children aged 4 to 16 years (n of children = 1538).

Assessment of Parental Social Interaction

We focused on parental social interaction, i.e., received and provided social support, within the respondent's social network. As per a previous study [27], social interaction was assessed by summation of both the respondent's and their spouse's social support, including instrumental and emotional support. Received instrumental and emotional support was assessed using the following question: "When you need some help in your daily life, how much practical support do you receive from the people around you?" and "When you need some help in your daily life, how much helpful guidance do you receive from the people around you?," respectively. Provided instrumental and emotional support was assessed as follows: "When people around you are in trouble, how much practical support do you provide them?" and "When people around you are in trouble, how much helpful guidance do you provide them?," respectively. "People" was defined as the respondent's spouse, other co-residing family members, non-co-residing family members or relatives, neighbors, and friends. Respondents and their spouse (i.e., the mother or father of the child) answered questions individually and specified their own level of agreement using the 5-point Likert scale. We summed up the scores separately for received and provided support, and summed up both scores to obtain the total social interaction score. We divided the total into high, middle, and low tertiles.

Assessment of Offspring Behavior Problems

Behavior problems in offspring were assessed based on parental responses to the Strengths and Difficulties Questionnaire (SDQ) [28] for children aged 4–16 years using a validated Japanese version of the questionnaire [29]. The SDQ is a

Likert psychometric scale (0, not true; 1, somewhat true; 2, certainly true) that asks parents to rate offspring behavior and comprises 25 items that describe behavioral difficulties in four subscales and prosocial behavior problem in one subscale. Behavioral difficulties are included emotional symptoms, conduct problems, hyperactivity-inattention problems, and peer relationship problems. One scale of prosocial behavior problems measures consideration of other people's feelings, such as showing kindness if someone is hurt, or volunteering to help others. Each subscale of the SDQ was scored by summing up five items ranging from 0 to 10. If some items were missing, the scores were scaled up in proportion if at least three items were correctly marked. For the total difficulties score, we summed up four subscales of behavioral difficulties (range 0–40). Then, the total difficulties score and prosocial problem score were allocated among the clinical, borderline, or normal range as proposed by Matsuishi et al. [29].

Characteristics of Parents, Children, and Households

Maternal or paternal characteristics including age, educational level and psychological health were assessed via questionnaire. Parental educational level was grouped into three categories: graduated from high school or less, some college, and college or more. In this study, psychological distress, which showed a strong relationship with social support [30–33], was assessed using a translated and validated version of the K6 scale [34], for which internal consistent reliability and validity were reported to be acceptable for the Japanese version [35]. The K6 scale employs 5-point response options from 0 (=none of the time) to 4 (=all of the time) with a scale score range of 0–24. In this study, parents were classified into two groups: those with and without psychological distress according to recommended cut-off points (a total K6 score of 5 or more, and 0–4, respectively) [36].

Child characteristics were age and sex, and household variables included annual household income and number of children living in the household. Annual household income was reported from 15 income bands. We equalized household income by dividing the median of each band, with the square root of the number of household members. Further, equalized income was divided into three categories by their distribution levels: less than 3 million yen ($n=263$, 26.9 %), 3 to 4.19 million yen ($n=266$, 27.1 %), and more than 4.2 million yen ($n=306$, 31.2 %).

Statistical Analysis

The associations between parental social interaction and behavior problems were assessed using ordered logistic regression analysis, in which the odds ratio (OR) was interpreted as the probability of outcome (i.e., behavior problem) by a one unit increase of the explanatory variable (i.e., social support).

We used the order of the severity of behavior problems measured by the SDQ as ordered outcomes (i.e., clinical range, borderline, and normal). Considering the correlated nature of data for siblings from the same parent, we adjusted for the clustering of a sibling's correlation in the analysis; we specified to which family each child belongs and adapted the standard errors and variance-covariance matrix of the estimators but not the estimated coefficients. The first set of models examined the association between parental social interaction and child behavior problems, adjusting for child age and sex. Maternal and paternal social interaction was modeled separately. In model 2, we added household variables to model 1. We next adjusted the maternal characteristics separately for maternal social interaction and support (received and provided) and paternal characteristics for paternal social interaction and social support in model 3. In model 4, both maternal and paternal characteristics were adjusted for at the same time. Lastly, model 5 was adjusted for received or provided social support to confirm which type of support was more strongly associated with behavior problems among offspring.

We conducted sensitivity analyses in two ways. First, we excluded the support between parents and “other co-residing family members” from the parental social interaction score, because “other co-residing family members” except for their spouse could possibly include their own children. To clarify our hypothesis, we focused on scores of received/provided social support between the parent and their spouse, non-co-residing family members, neighbors, and friends. Second, we adjusted for grandparents of offspring living in the household, because co-residence with grandparents could influence parental need for social support.

Results

Characteristics of Sample

Table 1 describes household and child characteristics. Over 80 % of SDQ respondents were the mothers of the offspring. Mean ages of mothers and fathers were 39.5 years (standard deviation (SD), 5.4) and 41.5 years (SD, 6.2), respectively. The sex ratio of the children was almost identical (782 male; 50.9 %). Children's mean age was 9.6 years (SD; 3.6), and about half of the children (50.9 %) had no siblings, while 41.6 % had one sibling.

Prevalence and Severity of Total Difficulties and Prosocial Problems

Further, frequency of problem behavior by SDQ and characteristics of households and children is shown in Table 2. Prevalence of total difficulties among offspring in the clinical and borderline range was 8.4 and 10.5 %, respectively.

Table 1 Characteristics of households and children

	Number (%)
Households (<i>n</i> = 982)	
Respondents to SDQ	
Mother	1249 (81.2)
Father	255 (16.6)
Other/unknown	34 (2.2)
Equivalent household income	
Less than 3 million	263 (26.9)
3–4.19 million	266 (27.1)
More than 4.2 million	306 (31.2)
Refusal/unknown	147 (15.0)
Number of siblings	
0	500 (50.9)
1	408 (41.6)
2	74 (7.5)
Maternal age	
<30	42 (4.3)
30–34	128 (13)
35–39	300 (30.6)
40–44	321 (32.7)
45+	178 (18.1)
Unknown	13 (1.3)
Maternal education	
High school or less	257 (26.2)
Some college	467 (47.6)
University or more	244 (24.9)
Unknown	14 (1.43)
Maternal psychological distress (K6 score)	
<5	723 (73.6)
5+	256 (26.1)
Unknown	3 (0.3)
Paternal age	
<30	28 (2.9)
30–34	105 (10.7)
35–39	214 (21.8)
40–44	310 (31.6)
45+	308 (31.4)
Unknown	17 (1.7)
Paternal education	
High school or less	241 (24.5)
Some college	179 (18.2)
University or more	545 (55.5)
Unknown	17 (1.7)
Paternal psychological distress (K6 score)	
<5	706 (71.9)
5+	272 (27.7)
Unknown	4 (0.4)
Children (<i>n</i> = 1538)	
Child age	
4–6	392 (25.5)
7–9	380 (24.7)
10–12	381 (24.8)
13–15	298 (19.4)
16	87 (5.7)
Child sex	
Male	782 (50.9)
Female	748 (48.6)
Unknown	8 (0.5)

Similarly, prevalence of prosocial behavior problems in the clinical and borderline range was 9.2 and 10.4 %, respectively. Younger and distressed mothers tended to have offspring with total difficulties in the clinical or borderline range. Fathers who were younger or had lower educational levels tended to have offspring with total difficulties in the clinical or borderline range. In contrast, both maternal and paternal characteristics were not associated with prosocial behavior problems.

Association Between Parental Social Interaction and Behavior Problems in Offspring

Table 3 summarizes the results of the ordered logistic regression model for the association between parental social interaction and total difficulties in offspring. In model 4, the offspring of mothers who had high total social interaction scores were 31 % less likely to show total difficulties (OR, 0.69; 95 % confidence interval (CI), 0.48–1.00) than children of mothers with low total social interaction scores. Similarly, both mothers who received high social support and provided high social support had lower odds of having a child with behavioral difficulties (OR, 0.64; 95 % CI, 0.43–0.93, OR, 0.56; 95 % CI, 0.39–0.81, respectively). On the other hand, paternal social interaction did not show any association with total difficulties.

Association Between Parental Social Interaction and Prosocial Behavior Problems in Offspring

Prosocial behavior problems were 52 % less likely in the offspring of mothers who showed high social interaction (OR, 0.48; 95 % CI, 0.33–0.71) compared to the offspring of mothers with low total social interaction scores (Table 4). Similarly, mothers who received and provided high social support had lower odds of having a child with prosocial behavior problems (OR, 0.59; 95 % CI, 0.40–0.86; OR, 0.48; 95 % CI, 0.34–0.70, respectively). Further, in the final analysis to determine the independent effect of received and provided social support in model 5, the offspring of mothers who provided high social support were 49 % less likely to show prosocial behavior problems than the offspring of mothers who provided low social support (OR, 0.51; 95 % CI, 0.33–0.79), independent from maternal received social support. On the other hand, paternal social interaction was not associated with prosocial behavior problems of offspring.

Sensitivity Analyses

Even after the exclusion of support between parents and co-residing members in model 5, the main results did not change substantially in the sensitivity analyses; maternal social interaction was still associated with both total difficulties and prosocial behavior problems in offspring. Similarly, the association was still stable even after we adjusted for grandparents of offspring

Table 2 Frequency and characteristics of households and children with problem behavior by SDQ ($n = 1538$)

	Total difficulties ($n, \%$)			Prosocial behavior ($n, \%$)		
	Normal	Borderline	Clinical	Normal	Borderline	Clinical
Frequency	1247 (81.1)	162 (10.5)	129 (8.4)	1236 (80.4)	160 (10.4)	142 (9.2)
Equivalent household income						
Less than 3 million	355 (28.5)	43 (26.5)	42 (32.6)	357 (28.9)	48 (30.0)	35 (24.7)
3–4.19 million	299 (24.0)	62 (38.3)	38 (29.5)	313 (25.3)	42 (26.3)	44 (31.0)
More than 4.2 million	398 (31.9)	35 (21.6)	26 (20.2)	365 (29.5)	43 (26.9)	51 (35.9)
Refusal/unknown	195 (15.6)	22 (13.6)	23 (17.8)	201 (16.3)	27 (16.9)	12 (8.5)
<i>p</i> for χ square test	<0.01			0.13		
Number of siblings						
0	332 (26.6)	67 (41.4)	48 (37.2)	357 (28.9)	47 (29.4)	43 (30.3)
1	711 (57.0)	77 (47.5)	57 (44.2)	679 (54.9)	90 (56.3)	76 (53.5)
2	204 (16.4)	18 (11.1)	24 (18.6)	200 (16.2)	23 (14.4)	23 (16.2)
<i>p</i> for χ square test	<0.01			0.98		
Maternal age						
<35	176 (14.3)	25 (19.4)	20 (22.7)	195 (16.0)	23 (14.5)	18 (12.8)
35–39	379 (30.9)	63 (39.4)	40 (31.3)	394 (32.4)	48 (30.2)	40 (28.4)
40–44	459 (37.4)	41 (25.6)	48 (37.5)	444 (36.5)	55 (34.6)	49 (34.8)
45+	214 (17.4)	25 (15.6)	11 (8.6)	183 (15.1)	33 (20.8)	34 (24.1)
<i>p</i> for χ square test	<0.01			0.11		
Maternal education						
High school or less	332 (27.1)	45 (27.8)	43 (33.6)	350 (28.8)	42 (26.4)	28 (19.7)
Some college	594 (48.5)	81 (50.0)	59 (46.1)	586 (48.2)	78 (49.1)	70 (49.3)
University or more	300 (24.5)	36 (22.2)	26 (20.3)	279 (23.0)	39 (24.5)	44 (31.0)
<i>p</i> for χ square test	0.55			0.11		
Maternal psychological distress (K6 score)						
<5	973 (78.2)	104 (64.2)	68 (52.7)	928 (75.2)	108 (67.5)	109 (77.3)
5+	271 (21.8)	58 (35.8)	61 (47.3)	306 (24.8)	52 (32.5)	32 (22.7)
<i>p</i> for χ square test	<0.01			0.08		
Total score of maternal social interaction						
Lower	362 (29.2)	50 (30.9)	58 (45.7)	353 (28.7)	57 (35.9)	60 (42.3)
Middle	486 (39.1)	60 (37.0)	42 (33.1)	469 (38.1)	67 (42.1)	52 (36.6)
Higher	394 (31.7)	52 (32.1)	27 (21.3)	408 (33.2)	35 (22.0)	30 (21.1)
<i>p</i> for χ square test	<0.01			<0.01		
Maternal social support, received						
Lower	374 (30.1)	50 (30.9)	66 (52.0)	374 (30.4)	56 (35.2)	60 (42.3)
Middle	489 (39.4)	65 (40.1)	37 (29.1)	477 (38.8)	66 (41.5)	48 (33.8)
Higher	379 (30.5)	47 (29.0)	24 (18.9)	379 (30.8)	37 (23.3)	34 (23.9)
<i>p</i> for χ square test	<0.01			0.02		
Maternal social support, provided						
Lower	346 (28.0)	50 (30.9)	59 (46.5)	344 (28.0)	57 (36.1)	54 (38.0)
Middle	450 (36.4)	61 (37.7)	41 (32.3)	437 (35.6)	59 (37.3)	56 (39.4)
Higher	442 (35.7)	51 (31.5)	27 (21.3)	446 (36.4)	42 (26.6)	32 (22.5)
<i>p</i> for χ square test	<0.01			<0.01		
Paternal age						
<35	135 (11.3)	19 (12.0)	18 (14.3)	145 (12.0)	16 (10.2)	11 (7.9)
35–39	249 (20.3)	54 (34.0)	33 (26.2)	276 (22.8)	30 (19.1)	30 (21.4)
40–44	432 (35.3)	51 (32.1)	43 (34.1)	420 (34.7)	55 (35.0)	51 (36.4)
45+	408 (33.3)	35 (22.0)	32 (25.4)	371 (30.6)	56 (35.7)	48 (34.3)

Table 2 (continued)

	Total difficulties (n, %)			Prosocial behavior (n, %)		
	Normal	Borderline	Clinical	Normal	Borderline	Clinical
<i>p</i> for χ square test	<i><0.01</i>			0.60		
Paternal education						
High school or less	299 (24.5)	43 (27.0)	41 (31.8)	303 (24.9)	45 (28.7)	35 (25.2)
Some college	206 (16.8)	40 (25.2)	30 (23.3)	212 (17.5)	35 (22.3)	29 (20.9)
University or more	718 (58.7)	76 (47.8)	58 (45.0)	700 (57.6)	77 (49.0)	75 (54.0)
<i>p</i> for χ square test	<i><0.01</i>			0.28		
Paternal psychological distress (K6 score)						
<5	905 (73.0)	120 (74.1)	83 (64.3)	878 (71.4)	117 (73.6)	113 (79.6)
5+	335 (27.0)	42 (25.9)	46 (35.7)	352 (28.6)	42 (26.4)	29 (20.4)
<i>p</i> for χ square test	0.10			0.11		
Total score of paternal social interaction						
Lower	376 (30.6)	54 (33.5)	43 (33.9)	372 (30.5)	51 (32.5)	50 (35.5)
Middle	457 (37.2)	58 (36.0)	52 (40.9)	462 (37.9)	56 (35.7)	49 (34.8)
Higher	396 (32.2)	49(30.4)	32 (25.2)	385 (31.6)	50 (31.9)	42 (29.8)
<i>p</i> for χ square test	0.54			0.79		
Paternal social support, received						
Lower	415 (33.9)	56 (34.8)	44 (34.7)	414 (34.0)	52 (33.3)	49 (35.3)
Middle	442 (36.1)	61 (37.9)	52 (40.9)	443 (36.4)	61 (39.1)	51 (36.7)
Higher	368 (30.0)	44 (27.3)	31 (24.4)	361 (29.6)	43 (27.6)	39 (28.1)
<i>p</i> for χ square test	0.67			0.96		
Paternal social support, provided						
Lower	393 (32.2)	59 (36.9)	47 (37.0)	389 (32.1)	59 (37.8)	51 (36.2)
Middle	469 (38.4)	58 (36.3)	47 (37.0)	467 (38.5)	50 (32.1)	57 (40.4)
Higher	360 (29.5)	43 (26.9)	33 (26.0)	356 (29.4)	47 (30.1)	33 (23.4)
<i>p</i> for χ square test	0.64			0.26		
Child age						
4–6	305 (24.5)	51 (31.5)	36 (27.9)	322 (26.1)	39 (24.4)	31 (21.8)
7–9	293 (23.5)	42 (25.9)	45 (34.9)	304 (24.6)	42 (26.3)	34 (24.0)
10–12	316 (25.3)	35 (21.6)	30 (23.3)	320 (25.9)	24 (15.0)	37 (26.1)
13+	333 (26.7)	34 (16.1)	18 (14.0)	290 (23.5)	55 (34.4)	40 (28.2)
<i>p</i> for χ square test	<i><0.01</i>			<i>0.02</i>		
Child sex						
Male	628 (50.4)	81 (50.0)	73 (56.6)	584 (47.5)	101 (63.1)	97 (68.8)
Female	611 (49.0)	81 (50.0)	56 (43.4)	645 (52.5)	59 (36.9)	44 (31.2)
<i>p</i> for χ square test	0.46			<i><0.01</i>		

Significant values ($p < 0.05$) are set in italics. Total numbers of cells in each group are not the same due to the missing value

co-residing in the household, though we found significant association between the presence of grandparents in the household and maternal received and provided support. The results of sensitivity analyses are not presented but available upon request.

Discussion

We found that high maternal social interaction is inversely associated with total difficulties and prosocial behavior

problems in offspring, while similar associations were not found in paternal social interaction. Furthermore, we found that offspring of mothers who provided high social support were less likely to show prosocial behavior problems, independent of received social support. This is consistent with previous research that highlights the association between social support and child behavior problems [15]. Our findings further add to the literature by showing that both received and provided social support have a robust protective effect on child behavior problems.

Table 3 Models predicting SDQ total difficulties by parental social interaction ($n = 1538$)

	Model 1 ^a OR (95 % CI)	Model 2 ^b OR (95 % CI)	Model 3 ^c OR (95 % CI)	Model 4 ^d OR (95 % CI)	Model 5 ^e OR (95 % CI)
Total score of maternal social interaction					
Lower	Reference	Reference	Reference	Reference	
Middle	<i>0.68 (0.49–0.95)</i>	<i>0.71 (0.51–1.00)</i>	<i>0.71* (0.51–1.00)</i>	<i>0.71** (0.50–1.01)</i>	
Higher	<i>0.64 (0.45–0.92)</i>	<i>0.70 (0.49–0.99)</i>	<i>0.69 (0.48–0.99)</i>	<i>0.69*** (0.48–1.00)</i>	
<i>p</i> for trend	<i>0.02</i>	<i>0.04</i>	<i>0.05</i>	0.06	
Maternal social support, received					
Lower	Reference	Reference	Reference	Reference	Reference
Middle	<i>0.64 (0.46–0.88)</i>	<i>0.69 (0.50–0.97)</i>	<i>0.69 (0.49–0.96)</i>	<i>0.68 (0.48–0.95)</i>	<i>0.77 (0.54–1.11)</i>
Higher	<i>0.58 (0.40–0.83)</i>	<i>0.64 (0.45–0.92)</i>	<i>0.65 (0.45–0.94)</i>	<i>0.64 (0.43–0.93)</i>	<i>0.81 (0.43–1.26)</i>
<i>p</i> for trend	<i><0.01</i>	<i>0.02</i>	<i>0.02</i>	<i>0.02</i>	0.33
Maternal social support, provided					
Lower	Reference	Reference	Reference	Reference	Reference
Middle	<i>0.70 (0.50–0.99)</i>	<i>0.72 (0.51–1.01)</i>	<i>0.72 (0.51–1.02)</i>	<i>0.70 (0.48–1.00)</i>	<i>0.77 (0.53–1.10)</i>
Higher	<i>0.55 (0.39–0.78)</i>	<i>0.59 (0.42–0.84)</i>	<i>0.57 (0.38–0.78)</i>	<i>0.56 (0.39–0.81)</i>	<i>0.67**** (0.44–1.02)</i>
<i>p</i> for trend	<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	0.05
Total score of paternal social interaction					
Lower	Reference	Reference	Reference	Reference	
Middle	<i>0.91 (0.65–1.27)</i>	<i>0.92 (0.65–1.30)</i>	<i>0.93 (0.66–1.31)</i>	<i>0.87 (0.61–1.23)</i>	
Higher	<i>0.79 (0.56–1.10)</i>	<i>0.80 (0.56–1.13)</i>	<i>0.81 (0.57–1.15)</i>	<i>0.88 (0.61–1.25)</i>	
<i>p</i> for trend	0.17	0.20	0.24	0.44	
Paternal social support, received					
Lower	Reference	Reference	Reference	Reference	Reference
Middle	<i>1.03 (0.74–1.42)</i>	<i>1.01 (0.72–1.41)</i>	<i>1.00 (0.72–1.40)</i>	<i>0.94 (0.67–1.33)</i>	<i>0.98 (0.68–1.40)</i>
Higher	<i>0.84 (0.59–1.20)</i>	<i>0.86 (0.60–1.23)</i>	<i>0.85 (0.59–1.22)</i>	<i>0.93 (0.65–1.36)</i>	<i>0.98 (0.63–1.50)</i>
<i>p</i> for trend	0.36	0.42	0.39	0.73	0.87
Paternal social support, provided					
Lower	Reference	Reference	Reference	Reference	Reference
Middle	<i>0.80 (0.58–1.11)</i>	<i>0.81 (0.58–1.13)</i>	<i>0.80 (0.58–1.11)</i>	<i>0.84 (0.6–1.18)</i>	<i>0.84 (0.59–1.20)</i>
Higher	<i>0.79 (0.56–1.14)</i>	<i>0.84 (0.58–1.20)</i>	<i>0.86 (0.59–1.23)</i>	<i>0.97 (0.67–1.41)</i>	<i>0.98 (0.64–1.52)</i>
<i>p</i> for trend	0.20	0.31	0.38	0.80	0.89

Full estimation results are available upon request from the authors. Significant values ($p < 0.05$) are set in italics

* $p = 0.053$; ** $p = 0.058$; *** $p = 0.053$; **** $p = 0.059$

^a Controlled for SDQ respondents and child characteristics (age and sex)

^b Adding to model 1, controlled for household variables (annual household income and the number of children)

^c Adding to model 2, controlled for maternal characteristics (age, education level, and psychological distress) for maternal social interaction and social support, and paternal characteristics for paternal social interaction and social support

^d Adding to model 3, controlled for both maternal and paternal characteristics (age, education level, and psychological distress)

^e Adding to model 4, controlled for social support both received and provided

Three possible pathways may explain the association between maternal social interaction and total difficulties in offspring. First, social interaction directly affects maternal mental health [32] and better parenting [37, 38], which is linked to the child's development of behavior regulation and cognitive skills [39, 40]. Second, mothers who showed higher social interaction could be more likely to interact with offspring using a responsive and sensitive parenting approach, which promotes warm and supportive attachment between parents

and offspring [41]. The importance of attachment for mental health problems among children is well established [42, 43]. Third, the offspring of mothers who showed high social interaction might be living in environments that are rich in social resources such as collective efficacy, including informal social control by neighbors and friends. It has been suggested that collective efficacy creates a feeling of mutual support in parental caregiving [44] and may have a preventive effect on mental health problems among children in the community

Table 4 Models predicting SDQ prosocial behavior by parental social interaction ($n = 1538$)

	Model 1 ^a OR (95 % CI)	Model 2 ^b OR (95 % CI)	Model 3 ^c OR (95 % CI)	Model 4 ^d OR (95 % CI)	Model 5 ^e OR (95 % CI)
Total score of maternal social interaction					
Lower	Reference	Reference	Reference	Reference	
Middle	0.74* (0.55–1.00)	0.71 (0.52–0.97)	0.70 (0.51–0.95)	0.71 (0.51–0.98)	
Higher	0.48 (0.33–0.70)	0.48 (0.33–0.71)	0.48 (0.32–0.70)	0.48 (0.33–0.71)	
<i>p</i> for trend	<0.01	<0.01	<0.01	<0.01	
Maternal social support, received					
Lower	Reference	Reference	Reference	Reference	Reference
Middle	0.73 (0.54–1.00)	0.71 (0.52–0.97)	0.71 (0.52–0.97)	0.72 (0.52–1.00)	0.84 (0.59–1.20)
Higher	0.59 (0.42–0.85)	0.60 (0.41–0.87)	0.59 (0.41–0.86)	0.59 (0.40–0.86)	0.85 (0.55–1.33)
<i>p</i> for trend	<0.01	<0.01	<0.01	<0.01	0.43
Maternal social support, provided					
Lower	Reference	Reference	Reference	Reference	Reference
Middle	0.79 (0.57–1.08)	0.75 (0.54–1.03)	0.73** (0.52–1.01)	0.71 (0.51–1.00)	0.76 (0.52–1.09)
Higher	0.50 (0.36–0.71)	0.49 (0.35–0.71)	0.48 (0.33–0.68)	0.48 (0.34–0.70)	0.51 (0.33–0.79)
<i>p</i> for trend	<0.01	<0.01	<0.01	<0.01	<0.01
Total score of paternal social interaction					
Lower	Reference	Reference	Reference	Reference	
Middle	0.85 (0.61–1.18)	0.85 (0.61–1.19)	0.85 (0.61–1.19)	0.87 (0.62–1.22)	
Higher	0.88 (0.63–1.23)	0.89 (0.63–1.25)	0.88 (0.62–1.24)	0.94 (0.66–1.33)	
<i>p</i> for trend	0.45	0.5	0.47	0.71	
Paternal social support, received					
Lower	Reference	Reference	Reference	Reference	Reference
Middle	1.01 (0.73–1.39)	1.00 (0.72–1.39)	1.00 (0.72–1.39)	0.97 (0.69–1.37)	1.00 (0.69–1.44)
Higher	0.93 (0.66–1.32)	0.94 (0.66–1.34)	0.95 (0.67–1.35)	0.97 (0.67–1.41)	1.06 (0.67–1.68)
<i>p</i> for trend	0.71	0.74	0.88	0.88	0.82
Paternal social support, provided					
Lower	Reference	Reference	Reference	Reference	Reference
Middle	0.85 (0.62–1.17)	0.86 (0.62–1.19)	0.83 (0.60–1.14)	0.88 (0.63–1.21)	0.89 (0.62–1.27)
Higher	0.8 (0.57–1.13)	0.81 (0.57–1.15)	0.78 (0.55–1.11)	0.85 (0.60–1.22)	0.87 (0.55–1.36)
<i>p</i> for trend	0.20	0.22	0.16	0.38	0.53

Full estimation results are available upon request from the authors. Significant values ($p < 0.05$) are set in italics

* $p = 0.052$; ** $p = 0.057$

^a Controlled for SDQ respondents and child characteristics (age and sex)

^b Adding to model 1, controlled for household variables (annual household income and the number of children)

^c Adding to model 2, controlled for maternal characteristics (age, education level, and psychological distress) for maternal social interaction and social support, and paternal characteristics for paternal social interaction and social support

^d Adding to model 3, controlled for both maternal and paternal characteristics (age, education level, and psychological distress)

^e Adding to model 4, controlled for social support both received and provided

[45]. Thus, neighborhoods rich with collective efficacy—where mothers who show high social interaction are more likely to live—could affect behavior problems in offspring.

The reason why maternal provided social support showed an independent protective effect on prosocial behavior problems, and received social support did not, is unknown. One possible reason is that the associations between maternal behavior and offspring behavior might also be caused by the same genetic factors. Previous research has

shown that prosocial behavior in children is inherited genetically [46, 47]. In our study, prosocial behavior problems in offspring may be partly due to this reason, and the same genetic factor might be shared among mothers who show low social interaction. Another possible reason is that mothers who provide social support may help to develop the social skills of their offspring [48]. Mothers play an important role as socializers for offspring because of their primary roles as caregiver [46]. Moreover, as mentioned in

the Introduction, providing social support to others might be beneficial to individuals' wellbeing rather than just receiving support [21, 24], which in turn might have a positive effect on child behavior. We can assume that mothers who showed high social interaction place importance on having stable and harmonious social environments around them, which in turn leads offspring to learn prosocial behavior [49, 50].

Paternal social support did not show significant association with behavior problems in offspring. One possible reason is gender difference in social support [51, 52]. Previous research reported that fathers are less likely to be influenced by emotional support than mothers [51]. Alternatively, we might underestimate the effect of paternal social interaction in other settings, such as the workplace, because resources of social support differ between men and women [52]. Thus, paternal social interaction might be protective for behavior problems in offspring if we measure paternal social interaction, including the work environment. Further research is needed to elucidate the impact of paternal social interaction on behavior problems in offspring, including parental social interaction in the workplace.

We recognize that this study has several limitations. First, because our analysis was cross-sectional, it was difficult to infer causal association. For example, parents who have offspring with less behavior problems might have more opportunities to interact with the people around them (i.e. reverse causation). Second, we focused on limited dimensions of social support, that is, emotional and instrumental support. Other types of social support, such as financial or informational support, might also be associated with behavior problems in offspring. However, the types of support in this study are easier for parents to receive and provide [32]. Third, although the parental version of the SDQ has been widely used, respondent bias may exist. As the scoring of child behavior, especially prosocial behavior, may be more susceptible to parents' characteristics [53], it may be that mothers who have positive social interactions perceive their child's behavior to be more prosocial. Lastly, the generalizability of our findings is limited because of the low response rate.

Beyond these limitations, there are several promising directions for future research. A longitudinal survey is needed to elucidate the causality of maternal social interaction and behavior problems in offspring, and to follow people's relationships and social support, which could change over time. Furthermore, interventional programs for child behavior problems to promote increased social participation among mothers, or interventions to reduce maternal social isolation, require further investigation. Although we found no association between paternal social support and behavior problems in offspring, interventions that boost both maternal and paternal social interaction might be effective for the prevention of child behavior problems.

In conclusion, this study showed that high maternal social interaction, but not paternal social interaction, had a protective effect on total difficulties in offspring. Specifically, the offspring of mothers who provided social support are less likely to show prosocial behavior problems. Further study is needed to examine the mechanism of how maternal and paternal social support affects behavior problems in offspring.

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Compliance with Ethical Standard

Conflict of Interest Manami Ochi and Takeo Fujiwara declare that they have no conflict of interest.

References

1. Caspi A, Elder GH, Bem DJ. Moving against the world—life-course patterns of explosive children. *Dev Psychol.* 1987;23(2): 308–13. doi:10.1037/0012-1649.24.6.824.
2. Kessler RC, Foster CL, Saunders WB, Stang PE. Social consequences of psychiatric disorders. I. Educational attainment. *Am J Psychiatry.* 1995;152(7):1026–32.
3. Miech RA, Caspi A, Moffitt TE, Wright BRE, Silva PA. Low socioeconomic status and mental disorders: a longitudinal study of selection and causation during young adulthood. *Am J Sociol.* 1999;104(4):1096–131. doi:10.1086/210137.
4. Izumi M, Okuyama M. A survey of children with mental health problems in Japanese nursery, elementary and junior high school. *J Jpn Pediatr Soc.* 2008;112(3):476–82.
5. Faraone SV, Perlis RH, Doyle AE, Smoller JW, Goralnick JJ, Holmgren MA, et al. Molecular genetics of attention-deficit/hyperactivity disorder. *Biol Psychiatry.* 2005;57(11):1313–23. doi:10.1016/j.biopsych.2004.11.024.
6. Bailey A, Lecouteur A, Gottesman I, Bolton P, Simonoff E, Yuzda E, et al. Autism as a strongly genetic disorder: evidence from a British twin study. *Psychol Med.* 1995;25(1):63–77.
7. Rutter M, Macdonald H, Lecouteur A, Harrington R, Bolton P, Bailey A. Genetic factors in child psychiatric disorders—2. Empirical findings. *J Child Psychol Psychiatry.* 1990;31(1):39–83. doi:10.1111/j.1469-7610.1990.tb02273.x.
8. Rhee SH, Waldman ID. Genetic and environmental influences on antisocial behavior: a meta-analysis of twin and adoption studies. *Psychol Bull.* 2002;128(3):490–529. doi:10.1037/0033-2909.128.3.490.
9. Rutter M, Moffitt TE, Caspi A. Gene-environment interplay and psychopathology: multiple varieties but real effects. *J Child Psychol Psychiatry.* 2006;47(3-4):226–61. doi:10.1111/j.1469-7610.2005.01557.x.
10. Kim-Cohen J, Caspi A, Taylor A, Williams B, Newcombe R, Craig IW, et al. MAOA, maltreatment, and gene-environment interaction predicting children's mental health: new evidence and a meta-analysis. *Mol Psychiatry.* 2006;11(10):903–13. doi:10.1038/sj.mp.4001851.

11. Bradley RH, Corwyn RF. Socioeconomic status and child development. *Annu Rev Psychol.* 2002;53:371–99. doi:10.1146/annurev.psych.53.100901.135233.
12. Fujiwara T. Socioeconomic status and the risk of suspected autism spectrum disorders among 18-month-old toddlers in Japan: a population-based study. *J Autism Dev Disord.* 2014;44(6):1323–31. doi:10.1007/s10803-013-1988-3.
13. Repetti RL, Taylor SE, Seeman TE. Risky families: family social environments and the mental and physical health of offspring. *Psychol Bull.* 2002;128(2):330–66. doi:10.1037//0033-2909.128.2.330.
14. Burchinal MR, Follmer A, Bryant DM. The relations of maternal social support and family structure with maternal responsiveness and child outcomes among African American families. *Dev Psychol.* 1996;32(6):1073–83. doi:10.1037/0012-1649.32.6.1073.
15. Ryan RM, Kalil A, Leininger L. Low-income mothers' private safety nets and children's socioemotional well-being. *J Marriage Fam.* 2009;71(2):278–97.
16. Taylor SE, Seeman TE. Psychosocial resources and the SES-health relationship. *Ann N Y Acad Sci.* 1999;896(1):210–25.
17. Vaananen A, Buunk BP, Kivimaki M, Pentti J, Vahtera J. When it is better to give than to receive: long-term health effects of perceived reciprocity in support exchange. *J Pers Soc Psychol.* 2005;89(2):176–93. doi:10.1037/0022-3514.89.2.176.
18. Liang J, Krause NM, Bennett JM. Social exchange and well-being: is giving better than receiving? *Psychol Aging.* 2001;16(3):511–23. doi:10.1037//0882-7974.16.3.511.
19. Berkman LF, Glass T. Social integration, social networks, social support, and health. *Soc Epidemiol.* 2000;1:137–73.
20. Berkman LF, Leo-Summers L, Horwitz RI. Emotional support and survival after myocardial infarction: a prospective, population-based study of the elderly. *Ann Intern Med.* 1992;117(12):1003–9.
21. Schwartz CE, Sendor RM. Helping others helps oneself: response shift effects in peer support. *Soc Sci Med.* 1999;48(11):1563–75. doi:10.1016/s0277-9536(99)00049-0.
22. Schwartz C, Meisenholder JB, Ma YS, Reed C. Altruistic social interest behaviors are associated with better mental health. *Psychosom Med.* 2003;65(5):778–85. doi:10.1097/01.psy.0000079378.39062.d4.
23. Crandall JE. Social interest as a moderator of life stress. *J Pers Soc Psychol.* 1984;47(1):164.
24. Caprara GV, Steca P. Self-efficacy beliefs as determinants of prosocial behavior conducive to life satisfaction across ages. *J Soc Clin Psychol.* 2005;24(2):191–217.
25. Weinstein N, Ryan RM. When helping helps: autonomous motivation for prosocial behavior and its influence on well-being for the helper and recipient. *J Pers Soc Psychol.* 2010;98(2):222–44. doi:10.1037/a0016984.
26. Takada M, Kondo N, Hashimoto H. Japanese study on stratification, health, income, and neighborhood: study protocol and profiles of participants. *J Epidemiol.* 2014. doi:10.2188/jea.JE20130084.
27. Liang J, Maeda D. National Survey of the Japanese Elderly, 1987. Inter-university Consortium for Political and Social Research (ICPSR) [distributor]; 2005.
28. Goodman R. The strengths and difficulties questionnaire: a research note. *J Child Psychol Psychiatry.* 1997;38(5):581–6. doi:10.1111/j.1469-7610.1997.tb01545.x.
29. Matsuishi T, Nagano M, Araki Y, Tanaka Y, Iwasaki M, Yamashita Y, et al. Scale properties of the Japanese version of the strengths and difficulties questionnaire (SDQ): a study of infant and school children in community samples. *Brain Dev.* 2008;30(6):410–5. doi:10.1016/j.braindev.2007.12.003.
30. Turney K. Perceived instrumental support and children's health across the early life course. *Soc Sci Med.* 2013;95:34–42. doi:10.1016/j.socscimed.2012.08.017.
31. Elgar FJ, McGrath PJ, Waschbusch DA, Stewart SH, Curtis LJ. Mutual influences on maternal depression and child adjustment problems. *Clin Psychol Rev.* 2004;24(4):441–59. doi:10.1016/j.cpr.2004.02.002.
32. Thoits PA. Mechanisms linking social ties and support to physical and mental health. *J Health Soc Behav.* 2011;52(2):145–61. doi:10.1177/0022146510395592.
33. Lin N, Ye XL, Ensel WM. Social support and depressed mood: a structural analysis. *J Health Soc Behav.* 1999;40(4):344–59. doi:10.2307/2676330.
34. Andrade L, Caraveo-Anduaga JJ, Berglund P, Bijl RV, De Graaf R, Vollebergh W, et al. The epidemiology of major depressive episodes: results from the International Consortium of Psychiatric Epidemiology (ICPE) surveys. *Int J Methods Psychiatr Res.* 2003;12(1):3–21. doi:10.1002/mp.138.
35. Furukawa TA, Kawakami N, Saitoh M, Ono Y, Nakane Y, Nakamura Y, et al. The performance of the Japanese version of the K6 and K10 in the World Mental Health Survey Japan. *Int J Methods Psychiatr Res.* 2008;17(3):152–8. doi:10.1002/mp.257.
36. Sakurai K, Nishi A, Kondo K, Yanagida K, Kawakami N. Screening performance of K6/K10 and other screening instruments for mood and anxiety disorders in Japan. *Psychiatry Clin Neurosci.* 2011;65(5):434–41.
37. Hashima PY, Amato PR. Poverty, social support, and parental behavior. *Child Dev.* 1994;65(2):394–403. doi:10.1111/j.1467-8624.1994.tb00758.x.
38. Crnic KA, Greenberg MT. Minor parenting stresses with young children. *Child Dev.* 1990;61(5):1628–37. doi:10.1111/j.1467-8624.1990.tb02889.x.
39. Bronfenbrenner U. Ecology of the family as a context for human development: research perspectives. *Dev Psychol.* 1986;22(6):723.
40. Sameroff AJ. Development systems: contexts and evolution. In: Mussen PH, editor. *Handbook of child psychology: formerly Carmichael's manual of child psychology.* New York: Wiley; 1983. p. 237–94.
41. Bowlby J. *Attachment and loss: attachment.* 2nd ed. New York: Basic Books; 1982.
42. Schore AN. Effects of a secure attachment relationship on right brain development, affect regulation, and infant mental health. *Infant Ment Health J.* 2001;22(1-2):7–66. doi:10.1002/1097-0355(200101/04)22:1<7::aid-imhj2>3.0.co;2-n.
43. Morris AS, Silk JS, Steinberg L, Myers SS, Robinson LR. The role of the family context in the development of emotion regulation. *Soc Dev.* 2007;16(2):361–88. doi:10.1111/j.1467-9507.2007.00389.x.
44. Tendulkar SA, Koenen KC, Dunn EC, Buka S, Subramanian SV. Neighborhood influences on perceived social support among parents: findings from the project on human development in Chicago neighborhoods. *PLoS One.* 2012;7(4):e34235. doi:10.1371/journal.pone.0034235.
45. Xue YG, Leventhal T, Brooks-Gunn J, Earls FJ. Neighborhood residence and mental health problems of 5- to 11-year-olds. *Arch Gen Psychiatry.* 2005;62(5):554–63. doi:10.1001/archpsyc.62.5.554.
46. Grusec JE. Socialization processes in the family: social and emotional development. *Annu Rev Psychol.* 2011;62:243–69. doi:10.1146/annurev.psych.121208.131650.
47. Reiss D, Neiderhiser JM. The interplay of genetic influences and social processes in developmental theory: Specific mechanisms are coming into view. *Dev Psychopathol.* 2000;12(3):357–74. doi:10.1017/s0954579400003060.
48. Bandura A. *Social learning theory.* Englewood Cliffs: Prentice; 1977.
49. Zhou Q, Eisenberg N, Losoya SH, Fabes RA, Reiser M, Guthrie IK, et al. The relations of parental warmth and positive expressiveness to children's empathy-related responding

- and social functioning: a longitudinal study. *Child Dev.* 2002;73(3):893–915. doi:[10.1111/1467-8624.00446](https://doi.org/10.1111/1467-8624.00446).
50. Eisenberg N. Emotion, regulation, and moral development. *Annu Rev Psychol.* 2000;51:665–97. doi:[10.1146/annurev.psych.51.1.665](https://doi.org/10.1146/annurev.psych.51.1.665).
51. Vaux A. Variations in social support associated with gender, ethnicity, and age. *J Soc Iss.* 1985;41(1):89–110.
52. Turner HA. Gender and social support—taking the bad with the good. *Sex Roles.* 1994;30(7-8):521–41. doi:[10.1007/bf01420800](https://doi.org/10.1007/bf01420800).
53. Stone LL, Otten R, Engels RC, Vermulst AA, Janssens JM. Psychometric properties of the parent and teacher versions of the strengths and difficulties questionnaire for 4- to 12-year-olds: a review. *Clin Child Fam Psychol Rev.* 2010;13(3):254–74. doi:[10.1007/s10567-010-0071-2](https://doi.org/10.1007/s10567-010-0071-2).