Effect of parental depression on asthmatic children's problem behavior and academic performance: using actor and partner interdependence model of parental variables

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Abstract

Background

The health issues of children with asthma is emerging to be a social problem because in many cases it is a disease that requires repetitive and long-term treatment, and the financial burden of parents raising children with asthma is relatively greater than parents raising normal children. It is necessary for health care providers to approach the mental health of parents in addition to managing the health of asthmatic children so that asthmatic children recover, smoothly adjust to school life like other normal children. This study attempts to determine the factors on the problem behavior and academic performance of the children with asthma.

Methods

The data of 236 pairs of children and parents from the 10th Panel Study on Korean Children were used and analysis was performed using SPSS 20.0 and AMOS 20.0.

Results

Parental depression had actor and partner effects on marital conflict, and marital conflict perceived by the father had actor and partner effects on parent-child interactions, while marital conflict perceived by the mother had actor effect on parent-child interactions. Parent-child interaction perceived by the father was found to affect the problem behavior of children, and parent-child interaction perceived by the mother was seen to affect the problem behavior of children. The problem behavior of children affects academic performance.

Discussion

This study is significant since it prepares basic data for improving the academic performance of children with asthma. We suggest research that longitudinally confirms the influence using variables presented in this study is necessary.

Background

Recently, the number of patients complaining of respiratory diseases due to particulate matter has been increasing, and more specifically, dust has been reported to seriously affect the health of asthmatic children [1]. In many cases, asthma begins in early-childhood (43.2% of asthmatic patients are below the age of 12) and continues to adulthood [2]. The health issues of children with asthma is emerging to be a social problem because in many cases it is a disease that requires repetitive and long-term treatment, and the financial burden of parents raising children with asthma is relatively greater than parents raising normal children [3]. Furthermore, parents of asthmatic children have the greater psychological burden of performing many roles since they experience the disease process and growth of their children at the same time [4].

If the parents of asthmatic children experience financial and psychological burdens at the same time, the probability of them experiencing depression increases. Their depression is an important factor connected to the recovery and school life of the children [5]. A previous study of asthmatic children [6] reported that parental depression is related to their use of medical institutions, emergency room visits, hospitalizations, and asthmatic complications. Some studies studies [7, 8] have reported that parental depression increases the attitude of parental neglect, resulting in a negative effect on children's recovery. Asthmatic children are highly dependent on parents due to the disease, and since school-going children grow through close interaction with their parents, their experience of an unstable parent-child relationship may cause them to display problem behavior such as depression, anxiety, withdrawal behavior, and sleep disorders [9].

The repeated display of problem behavior of school-going children tends to be sustained and reinforced as children grow, and such children will eventually experience maladjustment to school life and decreased academic competence. In particular, a previous study [10] related to asthmatic children confirmed that family factors are among those that have the greatest influence on children, affecting their adjustment to daily life. Negative emotions of parents negatively influence interaction between parents and children, ultimately causing problem behavior in children [11]. These factors have been found to reduce learning flow and performance of children at school. Eventually, parents' mental health and the relationship between parents and children become crucial factors that affect not only children's health but also their adjustment and performance at [11, 12]. Accordingly, it is necessary for health care providers to approach the mental health of parents in addition to managing the health of asthmatic children so that asthmatic children recover, smoothly adjust to school life like other normal children, and improve their performance at school.

Depression of parents who raise children with asthma, however, is not just a personal problem but a mental health issue that affects both parents: if one of the parents experiences depression, it will be transferred to the other, causing negative emotions such as marital conflict, which will negatively affect the relationship between parents and children, and the children's social life [5]. Accordingly, research on asthmatic children and parents needs to collect data on parents and children as a unit and make efforts to understand the phenomena by analyzing the data of parents using actor and partner interdependence model. Since married couples are in an interdependent relationship, the Actor-Partner Interdependent Model proposed by Kenny [13] is used to analyze the interrelationships between variables related to parental depression. If couples' data are separately analyzed, interpersonal dynamics between the couple cannot be examined. Even if data were collected from all couples and interdependent data were analyzed by treating them as independent data, it would violate one of the main assumptions of inferential statistics, i.e., data independence, resulting in smaller estimated standard errors and possibly Type I errors. Accordingly, this study attempted to prepare basic data to develop a program for asthmatic children and parents. Using asthmatic children and parents as subjects, the study attempted to determine the relationship between children's problem behavior and performance in school based on actor and partner effects that are outcomes of parental depression, marital conflict, and interaction between children and parents.

Method

Subjects

The subjects of the present study were children and parents who participated in the 10th year (2017) Panel Study on Korean Children (Korea Institute of Child Care and Education, KICCE). The Panel Study on Korean Children that is used in the present study is a longitudinal survey of children born in 2008, their parents, and community environment. Currently, data up to 10th year (2017) of the Panel Study on Korean Children are released to the general public. The present study used the data of parents who were 19 years or older and their children.

The Panel Study on Korean Children targeted households that gave birth to a newborn baby from April to July 2008 at the sample medical institutions that had 500 or more annual deliveries in 2006. It excluded households not included in the sample survey and the ones who declined to participate in the survey. Subjects who were excluded from the survey were cases where the mother of a newborn baby was not able to communicate in Korean, the mother's postnatal health was very poor, the newborn or mother had a serious illness, the newborn was expected to be adopted, the mother had given birth to more than one child, and the mother was 18 years or younger. The Panel Study on Korean Children recruited a preliminary sample of 2,562 households of which 2,150 households with a newborn were selected as the final sample. Sampling of the Panel Study on Korean Children employed a stratified multi-stage sampling technique in which birthing medical institutions were selected in the 1st stage, households who gave birth at the selected medical institutions as a pilot sample in the 2nd stage, and the final sample was drawn from the pilot sample households that were willing to participate in the panel survey in the 3rd stage. The sample maintenance rate presented by the research team of the Panel Study on Korean Children (69% for the 10^{th} panel survey) was confirmed for the sample validity of the present study. The final subjects for the present study were 236 children who experienced asthma symptoms, 236 fathers, and 236 mothers of the children from among those who participated in both panel survey and health survey.

Measurement

Depression

Depression was measured with an abbreviated depression scale (K6) consisting of six items developed by Kessler et al. [14] for the US National Health Interview Survey (NHIS) and used to measure the mental health of the general public. Each item was measured on a 5-point Likert scale: No feeling at all (1 point), not feeling very much (2 points), often feeling (3 points), almost feeling (4 points), always feeling (5 points): the higher the score, the higher the level of depression. Depression is classified as normal for the range 6–13 points, mild/moderate for 14–18 points, and severe for 19–30 points. The reliability of the instrument measured by Cronbach's α in the study of Kessler et al. [14] was.89. In the current study, Cronbach's alphas for the fathers' and mothers' instruments were.93 and.92, respectively.

Marital conflict

The marital conflict scale was developed by Markman et al. [15] and translated and modified by the research team of the Panel Study on Korean Children and consists of a total of eight items measured on a 5-point scale: strongly disagree (1 point), disagree (2 points), neutral (3 points), agree (4 points), strongly agree (5 points). The reliability of the instrument measured by Cronbach's α was.96 in the study of Markman et al. (2001), and in the current study it was.91 (father) and.92 (mother).

Parent-child interaction

For parent-child interaction, the research team of the Panel Study on Korean Children extracted a few items asking about parent-child interactions based on home environment, activities, and cognitive stimulation from the Early Childhood Longitudinal Study-Kindergarten cohort (ECLS-K). The research team of the Panel Study on Korean Children obtained permission to use the instrument from the ECLS research institute and used it as the final measuring instrument after the confirmation of reverse translated content by a third party from the ECLS. The instrument consists of a total of nine items on a 4-point scale: never (1 point), once or twice a week (2 points), 3 to 6 times a week (3 points), every day (4 points); items were measured by parents. The higher the sum of the scores, the higher the interaction between parent and child. Cronbach's alphas for father's and mother's instruments in the study were.89 and.82, respectively.

Problem behavior of children

To measure problem behavior in the survey of the Panel Study on Korean Children, the behavior evaluation scale of the Child Behavior Checklist (CBCL) developed by Kim et al. [16]. For the current study questions related to internalizing and externalizing problems were extracted and used. Internalizing problems refer to internalized and overly controlled behavior, such as passive and withdrawn behavior, emotional insecurity, and physical symptoms, and externalizing problems refer to attention problems, less controlled behavior such as aggressive behavior. The instrument consists of a total of 100 items measured on a 3-point scale: never (0 point), sometimes (1 point), often (2 points): these items are measured by the child. The higher the score, the higher the level of problem behavior. The reliability of the instrument measured by Cronbach's α was.77-.86 in the study of Kim et al. [16], and the reliability of the instrument in the study was.80-.82.

Academic performance of children

The academic performance of children refers to the results of a longitudinal effect study of comprehensive childcare services of Samsung Childcare Center by Rhee et al. [17], which supported and presented by the research team of the Panel Study on Korean Children. Academic performance scale is composed of a total of 10 items (5-point scale: not yet (1 point), beginning (2 points), in progress (3

points), intermediate (4 points), proficient (5 points), not applicable (0 point)) in three areas: four items of Korean language; five items of mathematics; and one item of overall competence on school performance. This scale measured by web-based questionnaire and teacher in charge of child in school. The Cronbach's alpha reliability coefficient in the current study was.98.

Data collection and analysis

The data of this study was provided by the Panel Study on Korean Children through their homepage (http://panel.kicce.re.kr/kor/publication/02.jsp). In addition, the construct and correlations and multicollinearity of measurement variables were determined by Pearson correlation coefficients, and the reliability of instruments was confirmed using Cronbach's alpha. Measurement invariance test was conducted to determine if the data of mothers and fathers had homogeneity in the measurement instrument. The maximum likelihood method was used to test the goodness of fit of the model, and confirmatory factor analysis was performed to confirm the validity of latent variables. The evaluation of the goodness of fit of the model was confirmed using χ^2, χ^2/df, RMSEA, SRMR, GFI, AGFI, CFI, NFI or Tucker-Lewis Index (TLI), which are absolute goodness of fit indices. The statistical significance of direct effect, indirect effect, and total effect was determined using bootstrapping. Test of structural model invariance across the groups is an analysis technique that studies path coefficients between measurement models, and analysis for the study was conducted through the process of metric invariance constraints and cross-group equality constraints.

Results

General characteristics of the subjects

The average ages of fathers and mothers were 40.1(±3.5) years and 37.6(±3.6) years, respectively. 89 (37.7%) fathers were under high school graduates, 51 (21.6%) college graduates, 96 (40.7%) had bachelors or higher degrees, and 32 (13.5%). 59 (25.0%) of the mothers were under high school graduates, 89 (37.7%) college graduates, 88 (37.3%) had bachelors or higher degrees. In terms of occupation, 107 (45.3%) of the fathers were manager or white collar job, while 115 (48.7%) mothers were full-time housewives and 81 (34.3%) were manager or white collar job. The average household income was KRW 464 million. 140 (59.3%) of the children were male and 96 (40.7%) female.

Correlations between measurement variables

Each measured variable was found to be normally distributed with the absolute values of skewness (0.59∼0.79) and kurtosis (−0.83∼1.91) of less than two and four, respectively. All variables had statistically significant correlations at the significance level of 0.05, and no multicollinearity was found among the variables since the absolute value of correlation coefficients among the variables were no greater than 0.8 (Table 1).

Measurement invariance test

Measurement invariance test was conducted to determine if the data of paternal and maternal depression, marital conflict, and parent-child interaction had homogeneity in the measurement instrument, and four competing models were compared. The first model was a default model. For the second model, factor coefficients were restricted; for the third, error covariances were restricted; and for the fourth, factor coefficients and error covariances were restricted. Metric invariance tests, which were conducted to compare the goodness of fit using χ^2, TLI, CFI, and RMSEA (indices that are not sensitive to the number of cases), determined that metric invariance was secured.

Hypothesis tests

To test the effect of parental depression, marital conflict, and parent-child interaction on children's problem behavior and academic performance, the normality of measurement variables was tested. The univariate normality of each measurement variable satisfied normality assumptions with the absolute values of skewness and kurtosis equal to or less than two. However, the assumptions of multivariate normality were not satisfied, since the multivariate kurtosis index was at 16.26 and Critical Ratio (C.R) at 9.26 at significance level of.05. If multivariate normality is not satisfied, a problem of upward skewing of the critical value can occur when parameters are estimated. However, studies have shown that even if multivariate normality is not achieved, if the sample size is 120 or higher, maximum likelihood method can be used to estimate parameters. Based on these reports, models were estimated without transforming the data. The goodness of fit of hypothetical models was evaluated using GFI, AGF, CFI, NFI,TLI, RMSEA, and SRMR. If GFI, AGFI, CFI, NFI, TLI are.90 or higher, the goodness of fit of the model is considered to be favorable. For RMSEA and SRMR, if the value is smaller than.05, it is considered an indicator of good fit, while values between.05 and.10 indicate an average fit, and values of.10 or higher indicate low goodness of fit. Hypothetical models of this study were tested using the maximum likelihood method and the results were χ^2 = 76.20, df = 30, RMSEA =.04, SRMR =.05, GFI =.94, AGFI =.92, CFI =.93, NFI =.92, and TLI =.92, which indicated that the hypothesized data fit the model well, confirming the model. Fourteen out of a total of 18 hypotheses were retained in this study (Table 3).

Depression of fathers had an actor effect (β =.46, p <.001) and a partner effect (β =.14, p =.018) in marital conflict, and depression of mothers had an actor effect (β =.49, p <.001) and a partner effect (β =.21, p <.001) in marital conflict. Marital conflict of fathers had an actor effect (β = -.27, p <.001) and a partner effect (β = -.12, p <.001) in parent-child interaction. Marital conflict of mothers had an actor effect (β = -.15, p =.047) in parent-child interaction. The parent-child interaction of fathers had a direct effect (β = -.16, p <.001) on the internalizing problem behavior of children, and mothers' parent-child interaction also had a direct effect (β = -.18, p <.001) on the internalizing problem behavior of children. Mothers' parent-child interaction was found to have a direct effect (β = -.16, p =.013) on the externalizing behavior problem of children. In addition, mothers' depression was found to have a direct effect on internalizing (β =.26, p <.001) and externalizing behavior problems (β =.30, p <. 001). Furthermore, parental depression

and marital conflict were found to have an indirect effect on internalizing and externalizing behavior problems. The internalizing problem behavior (β = -.16, p =.033) and externalizing problem behavior (β = -.23, p <.001) were found to have a direct effect on children's academic performance, and parental depression, marital conflict, and parent-child interaction were found to have an indirect effect on children's academic performance.

Test of group differences according to household income

To identify significant differences of path coefficients between groups of more and less than average household incomes of subjects, the critical ratios for the difference between free and constrained models for the 18 paths existing in the research models were determined. The results showed a statistically significant difference in the path in which mothers' depression influences fathers' marital conflict (critical ratio for difference = 2.27, p <.05). The standardized path coefficients from mothers' depression to fathers' marital conflict in the group that earned less than the average income was β =.43 (p <.001), while that of the group that earned more than the average income was β =.07 (p =.059).

Discussion

This study was conducted using asthmatic children and their parents as subjects to determine the actor and partner effects of parental depression, marital conflict, and interaction between children and parents on children's problem behavior and academic performance.

First, the results showed that parental depression has actor and partner effects on marital conflict. This finding is consistent with the results of an earlier study that reported that parental depression affects marital conflict and negatively affects children's physical and emotional development [18]. Depression is a negative emotion with mutual transfer phenomenon, and the transfer phenomenon of depression can be strong and rapid in relationships in which daily stress is experienced in the same space where parents raise children [19]. In particular, because parents of asthmatic children have greater psychological burden of performing many roles as parents since they continuously experience the disease process and growth of children at the same time [4], the transfer phenomenon of parental depression is strong and fast and ultimately becomes the cause of marital conflict and negatively influences the growth and development process, resulting in problem behavior and affecting academic performance of children. Since this study found that maternal depression has a direct influence on children's internalizing and externalizing problem behavior, the effect of maternal depression on children appears to be greater than that of paternal depression. Therefore, it is necessary for health care providers who care for asthmatic children to periodically check parents' depression in the process of managing children's asthma. Medical institutions need to make efforts to provide positive impetus to children's growth and development by helping the husband and wife to maintain a positive relationship. This may be done by including programs that reduce parental depression in the process of managing children's asthma. In addition, the results of the hypothesis test according to household incomes showed that the influence of maternal depression on

fathers' marital conflict was found to be large in the group that earns less than the average income. The reason is that since asthma is a disease that requires repetitive and long-term treatment, and the financial burden of parents raising children with asthma is relatively greater than that of parents raising normal children [3], the level of depression of mothers in families of lower income is high due to financial burden related to the treatment process of children and it also influences fathers who are responsible for financial activities of the family. Accordingly, it is necessary for the government to prepare a financial support system for families raising asthmatic children.

Second, marital conflict perceived by fathers had actor and partner effects on parent-child interactions, while marital conflict perceived by mothers had an actor effect on parent-child interactions. These results are similar to that of a study on Italian parents and children [20] that marital conflict is a factor that influences parent-child interaction. In light of the emotional security theory, the finding indicates that if the relationship between parents is negative, especially if marital conflict is high, children will perceive their home as an environment that threatens their safety, which impacts parent-child interaction negatively [21]. In particular, since the importance of fathers in families is high in South Korea, marital conflict perceived by fathers appears to negatively influence parent-child interaction perceived by mothers. Accordingly, health care providers need to find methods that can increase interactions between parents and children through the reduction of marital conflict, so that asthmatic children perceive that they are growing and receiving treatments in a safe environment.

Third, parent-child interaction perceived by father was found to affect the internalizing problem behavior of children, and parent-child interaction perceived by mother was seen to affect the internalizing and externalizing problem behavior of children. These findings are similar to findings of a study on Canadian school age children, which reported that interaction between the mother and child affects the problem behavior of children [22]. Since the interaction between fathers and children has a significant role to play in the socialization of children, the parent-child interaction perceived by fathers appears to influence the internalizing problem behavior in children, such as passive and withdrawn behavior, emotional insecurity, and physical symptoms. Mothers, however, appear to affect the internalizing and externalizing problem behavior of children due to their strong emotional interaction with children. Therefore, creating programs and management systems that can maintain positive interaction between parents and children at medical institutions and in society is necessary to prevent asthmatic children's problem behavior.

Fourth, the findings of this study indicate that children's problem behavior influences their academic performance. Such results are similar to the findings of a longitudinal study conducted on children in the U.S. [23], which reported that children's problem behavior is related to academic performance. It appears that children who display problem behavior repeatedly have low academic performance because children's problem behavior negatively influences concentration and memory that are related to learning. Because asthmatic children have limited physical activities and peer relations at school due to their illness, and possibly have a low attendance rate due to repeated treatment process, it is important for them to reduce problem behavior so that they can adjust to school life well. Therefore, it is necessary for home, school, and medical institutions to observe asthmatic children's display of problem behavior with

interest, and to improve children's adjustment to school by preventing the decline of their academic performance through identification and management of problem behavior early. This study is significant because it prepares basic data for the improvement of academic performance of children with asthma by studying parents' psychological variables, children's problem behavior, and their academic performance at the same time.

Abbreviations

AGFI: Adjusted goodness-of-fit-index; CFI: comparative fit index; CR: Critical Ratio; df: degrees of freedom; GFI: Goodness of Fit Index; NFI: Normed Fit Index; RMSEA: Root Mean Squared Error of Approximation; SRMR: Standardized Root Mean Square Residual; TLI: Turker-Lewis index

Declarations

Ethics approval and consent to participate

This study utilizes secondary data. The 10th year Korea Institute of Child Care and Education survey was conducted after the approval of the Institutional Bioethics Review Board, and this study was also conducted after obtaining approval from the Public Institutional Bioethics Review Board (IRB No. P01-201904-23-002) of the Ministry of Health and Welfare. The survey received written informed consent from study participants.

Consent for publication

Not applicable.

Availability of data and materials

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

HJW developed a hypothesis, searched the literature, reviewed the relevant articles, analyzed the data, interpreted the findings, and wrote a manuscript. KJM and LH developed the hypothesis, reviewed the relevant article, and wrote the manuscript. All authors have read and approved the manuscript.

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Tables

Table 1 General Characteristics

Variables		n	%
Father’s age (yr) (M±SD=40.1±3.5)	<36	59	25.0
	36-40	91	38.6
	40<	86	36.4
Mother’s age (yr) (M±SD=37.6±3.6)	<36	92	39.0
	36-40	93	39.4
	40<	51	21.6
Father’s education	Under high school	89	37.7
	College	51	21.6
	Over bachelor's degree	96	40.7
Mother’s education	Under high school	59	25.0
	College	89	37.7
	Over bachelor's degree	88	37.3
Father’s occupation	Manager or white collar job	107	45.3
	Service sector or sales person	48	20.3
	Engineer or machine fabricators	41	17.4
	Others	40	17.0
Mother’s occupation	Manager or white collar job	81	34.3
	House wife	115	48.7
	Others	40	17.0
Family income (million won) (M±SD=464.9±200.8)	<400	98	41.5
	≥400	138	58.5
Sex of child	Male	140	59.3
	Female	96	40.7

M=mean, SD=standard deviation

Table 2 Correlation of Variables

(N=263)

Variables	X1	X2	X3	X4	X5	X6	X7	X8	X9
X1: Depression (Father)	1								
X2: Depression (Mother)	35*	1							
X3: Marital conflict (Father)	53*	.36*	1						
X4: Marital conflict (Mother)	30*	.54*	.63*	1					
X5: Parent-child interaction (Father)	-.13*	-.10*	-.29*	-.20*	-				
X6: Parent-child interaction (Mother)	-.16*	-.16*	-.19*	-.13*	.24*	1			
X7: Internalizing problem behavior (Child)	.11*	.17*	.18*	.18*	-.16*	-.13*	1		
X8: Externalizing problem behavior (Child)	.14*	.28*	.12*	.19*	-.15*	-.12*	.22*	1	
X9: Academic performance of child	-.18*	-.31*	-.13*	-.27*	.13*	.19*	-.28*	-.69*	1

Table 3 The Test of Measurement Equivalence

Model		χ^2	df	TLI	CFI	RMSEA
Depression						
Model 1	Unconstrained model	119.00	53	.92	,93	.06
Model 2	Measurement weights constrain	129.73	61	.92	.93	,05
Model 3	Measurement residual constrain	91.89	43	.91	.93	.05
Model 4	Measurement weights and residual constrain	109.89	63	.91	,93	,05
Marital conflict						
Model 1	Unconstrained model	269.36	103	.93	.94	.04
Model 2	Measurement weights constrain	335.45	117	.89	.90	.05
Model 3	Measurement residual constrain	213.50	95	.94	.95	.03
Model 4	Measurement weights and residual constrain	273.59	109	.90	.91	.05
Parent-child interaction						
Model 1	Unconstrained model	352.30	169	.92	.92	.03
Model 2	Measurement weights constrain	378.24	178	.89	.90	.03
Model 3	Measurement residual constrain	303.72	159	.90	.92	.01
Model 4	Measurement weights and residual constrain	340.45	179	.90	.91	.04

Table 4 The Result of Hypothetical Model

Independent variables		Dependent variables	β	B	S.E	C.R	*p*	*Direct effect*		*Indirect effect*		*Total effect*	
								β	*p*	β	*p*	β	*p*
FD	à	FMC	.46	.46	.05	8.04	<.001	.46	<.001	-	-	.46	<.001
MD	à	FMC	.21	.20	.06	8.42	<.001	.21	<.001	-	-	.21	<.001
FD	à	MMC	.14	.15	.06	2,37	.018	.14	.018	-	-	.14	.018
MD	à	MMC	.49	.52	.06	8.42	<.001	.49	<.001	-	-	.49	<.001
FMC	à	FPCI	-.27	-.19	.05	-3.39	<.001	-.27	<.001	-	-	-.27	<.001
MMC	à	FPCI	-.13	-.12	.05	-1.41	.068	-.13	.068	-	-	-.13	.068
FD	à	FPCI	-	-	-	-	-	-	-	-.13	.012	-.13	.012
MD	à	FPCI	-	-	-	-	-	-	-	-.17	.035	-.17	.035
FMC	à	MPCI	-.12	-.19	.05	-3.39	<.001	-.12	<.001	-	-	-.12	<.001
MMC	à	MPCI	-.15	-.13	.05	-2.60	.047	-.15	.047	-	-	-.15	.047
FD	à	MPCI	-	-	-	-	-	-	-	-.15	.027	-.15	.027
MD	à	MPCI	-	-	-	-	-	-	-	-.10	.049	-.10	.049
FPCI	à	IPB	-.16	.15	.06	-2.07	<.001	-.16	<.001	-	-	-.16	<.001
MPCI	à	IPB	-.18	.37	.06	-3.21	<.001	-.18	<.001	-	-	-.18	<.001
FMC	à	IPB	-	-	-	-	-	-	-	.10	.042	.10	.042
MMC	à	IPB	-	-	-	-	-	-	-	.10	.007	.10	.007
FD	à	IPB	.11	.07	.04	1.17	.064	.11	.064	.01	.002	.12	.028
MD	à	IPB	.26	.61	.04	3.87	<.001	.26	<.001	.04	.008	.31	.006
FPCI	à	EIP	-.13	.36	.06	-0.52	.601	-.13	.601	-	-	-.13	.601
MPCI	à	EIP	-.16	.17	.06	-2.49	.013	-.16	.013	-	-	-.16	.013
FMC	à	EIP	-	-	-	-	-	-	-	.12	.007	.12	.007
MMC	à	EIP	-	-	-	-	-	-	-	.19	.025	.19	.025
FD	à	EIP	.14	.20	.04	1.52	.102	.14	.102	.12	.030	.26	.011
MD	à	EIP	.30	.18	.04	4.62	<.001	.30	<.001	.13	.040	.43	.011
FD	à	APC	-	-	-	-	-	-	-	-.16	.042	-.16	.042
MD	à	APC	-	-	-	-	-	-	-	-.18	.007	-.18	.007
FMC	à	APC	-	-	-	-	-	-	-	-.13	.031	-.13	.031
MMC	à	APC	-	-	-	-	-	-	-	-.12	.038	-.12	.038
FPCI	à	APC	-	-	-	-	-	-	-	.18	.034	.18	.034
MPCI	à	APC	-	-	-	-	-	-	-	.24	.009	.24	.009
IPB	à	APC	-.16	.11	.01	2.01	.033	-.16	.033	-	-	-.16	.033
EIP	à	APC	-.23	.35	.01	3.68	<.001	-.23	<.001	-	-	-.23	<.001

FD=Father's depression, MD=Mother's depression, FMC=Father's marital conflict, MMC=Mother's marital conflict, FPCI=Fathers' parent-child interaction, MPCI= Mothers' parent-child interaction, IPB= Internalizing problem behavior, EIP= Externalizing problem behavior, APA=Academic performance of child, SE=Standard error, C.R=Critical ratio

Table 5 The Homogeneity Test of Coefficients Applying an Invariance Constraint for each Path

	Model	Critical ratio for difference
Model 1	Depression (Father) -> Marital conflict (Father)	0.36
Model 2	Depression (Father) -> Marital conflict (Mother)	-0.63
Model 3	Depression (Mother)-> Marital conflict (Father)	2.27*
Model 4	Depression (Mother)-> Marital conflict (Mother)	0.34
Model 5	Marital conflict (Father) -> Parent-child interaction (Father)	-0.15
Model 6	Marital conflict (Father) -> Parent-child interaction (Mother)	1.03
Model 7	Marital conflict (Mother) -> Parent-child interaction (Father)	-0.54
Model 8	Marital conflict (Mother) -> Parent-child interaction (Mother)	1.47
Model 9	Parent-child interaction (Father) -> Internalizing problem behavior	-0.19
Model 10	Parent-child interaction (Father) -> Externalizing problem behavior	-1.11
Model 11	Parent-child interaction (Mother) -> Internalizing problem behavior	-1.41
Model 12	Parent-child interaction (Mother) -> Externalizing problem behavior	-1.93
Model 13	Depression (Father) -> Internalizing problem behavior (child)	-0.84
Model 14	Depression (Father) -> Externalizing problem behavior (child)	-0.30
Model 15	Depression (Mother)-> Internalizing problem behavior (child)	-0.40
Model 16	Depression (Mother)-> Externalizing problem behavior (child)	-0.51
Model 17	Internalizing problem behavior -> Academic performance of child	-1.76
Model 18	Externalizing problem behavior -> Academic performance of child	0.84

*p<.05