The Longitudinal Interplay of Affective and Cognitive Empathy Within and Between Adolescents and Mothers

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This is an informal copy of the author's manuscript. The final version of this article was published in Developmental Psychology, Vol 50(4), Apr 2014, 1219-1225

http://psycnet.apa.org/journals/dev/50/4/1219/

DOI: 10.1037/a0035050

Author note:

Data of the RADAR study were used. RADAR has been financially supported by main grants from the Netherlands Organisation for Scientific Research (GB-MAGW 480-03-005, GB-MAGW 480-08-006), and Stichting Achmea Slachtoffer en Samenleving (SASS), and various other grants from the Netherlands Organisation for Scientific Research, the VU University Amsterdam and Utrecht University.

Abstract

This four-year study examined longitudinal interplays between adolescents' and mothers' self-reported empathic concern (EC) and perspective taking (PT). We investigated 1) whether adolescents' EC predicted rank-order change in their PT over time, or vice-versa; 2) whether mothers' empathy predicted relative increases in adolescents' empathy; 3) whether adolescent gender moderated the over-time links from mothers' to adolescents' empathy; and 4) whether the rank-order stability of EC and PT over time differed within and between respondents. Adolescents' EC positively predicted their PT over time, but not vice-versa. Mothers' PT positively predicted adolescent PT over time for girls, but not for boys. The rank-order stability of adolescents' EC was greater than their PT. Maternal PT and EC were equally stable, and more stable than for adolescents. This study contributes the first empirical evidence that the developmental order of adolescents' empathy runs from affective to cognitive empathy, in contrast to prior theoretical and experimental literature that has emphasized the reverse direction. It further provides the first longitudinal evidence of intergenerational empathy transmission. These findings support the notion that adolescence is a developmentally sensitive period for PT.

Keywords: empathy; perspective taking; empathic concern; intergenerational transmission; adolescence

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One of the most important developments in adolescence is the transition from the relative self-centeredness of childhood to the increased capacity for empathic responding that characterizes adulthood (e.g., Eisenberg, Cumberland, Guthrie, Murphy, & Shepard, 2005; Hoffman, 2000). Mature empathy has both affective and cognitive dimensions. Empathic concern (EC) is an affective empathy dimension involving compassionate, sympathetic responses to others' misfortunes. Perspective taking (PT) is a cognitive empathy dimension that involves understanding others' viewpoints (Davis, 1983). Dispositional empathy is positively associated with prosocial behavior (Hoffman, 2000) and successful conflict resolution (De Wied, Branje, & Meeus, 2007). Although previous research has addressed *mean-level* empathy development in adolescence (Davis & Franzoi, 1991; Eisenberg et al., 2005), such studies describe only aggregate change, and cannot address how these empathy dimensions interact over time, within and between adolescents and mothers, in terms of *rank-order* change and stability.

Three important issues have remained unstudied in prior empathy development research. The first issue concerns the developmental order of EC and PT in adolescence: Whether adolescents' EC predicts rank-order change in their PT over time, or vice versa. Addressing this point empirically can provide useful information about the extent to which either dimension might predict relative change in the other over time, which could be used for the early identification of children who might benefit from support in developing their empathic dispositions. The second issue concerns the over-time transmission of empathy from mothers to adolescents, namely whether mothers' EC and PT predict rank-order change of these dispositions in their children over time. Understanding to what extent maternal empathy predicts adolescents' empathy might be of interest to parents or family therapists wishing to promote adolescents' empathy. The final issue concerns the rank-order stability of EC and PT in adolescents, as compared to their mothers. Studying rank-order stability can provide unique insight into the relative malleability of individual differences in EC and PT in adolescence (in addition to aggregate change). Because lower rank-order stability indicates greater potential for relative change, practitioners could use this information to focus interventions on different empathy dimensions at different ages. The present study addresses these gaps in the literature through a four-year longitudinal study.

The Longitudinal Interplay of Affective and Cognitive Empathy Dimensions

Although there is general consensus that affective and cognitive empathy dimensions are interdependent (Davis, 1983; De Corte et al., 2007; Hawk et al., 2012), these dimensions are still distinguishable in the sense that they rely on different brain circuits (Singer, 2006), and are associated with distinct behavioral and relational outcomes (Davis, 1983; De Wied et al., 2007; Soenens, Duriez, Vansteenkiste, & Goossens, 2007). This raises the question of whether and how the development of these interrelated but distinct dimensions is associated over time. Some theories have emphasized a developmental order from the cognitive to the affective, by highlighting the importance of cognitive maturation for EC development (Eisenberg et al., 2005; Hoffman, 2000), or considering PT essential for experiencing EC (Decety, 2007; Lamm, Batson, & Decety, 2007). De Waal (2007) has argued against this emphasis on "top-down" development, instead suggesting that empathy develops in layers of increasing complexity that rely upon – and modulate – more primitive layers. Affective empathic processes probably have earlier phylogenetic origins than higher-order, cognitive processes; indeed, even rats engage in affectively-motivated prosocial behavior when confronted with a companion's distress (Bartal, Decety, & Mason, 2011). The emergence of affective and cognitive empathy components in humans might mirror this developmental order. Early in life, moral reasoning relies mostly on brain structures associated with emotion, which become increasingly coupled with cognition-related structures over time (Decety, Michalska, & Kinzler, 2012).

Different theories have thus emphasized different directions of over-time associations between EC and PT, but according to Preston and De Waal (2002) the emphasis in prior literature appears to be on a developmental order from cognitive to affective empathy. This could be related to the fact that experimental research has focused on the effects of perspective taking instructions on feelings of sympathy (e.g., Lamm et al., 2007). It is, after all, easier to instruct participants to engage in perspective taking than to sympathize with others. Nevertheless, some experimental studies have reported “spontaneous perspective taking” prompted by initial, affective responses to another’s distress (e.g., Hawk, Fischer, & Van Kleef, 2011), which suggests that associations might run in either direction, even in the experimental context. Ultimately, only longitudinal research can speak to questions of developmental order. We addressed this issue by exploring whether adolescents’ EC at one time point predicted rank-order change in their PT later on, and/or vice versa.

Intergenerational Empathy Transmission

Theorists have stressed the influence of parents on empathy development in childhood, and recent studies suggest that parents remain an important source of influence in adolescence (Miklikowska, Duriez, & Soenens, 2011; Soenens et al., 2007). Furthermore, adolescent and parental empathy are known to be correlated (Davis, 1983; Hawk et al., 2012; Soenens et al., 2007; cf. Strayer & Roberts, 2004). It has even been argued that empathic dispositions are transmitted from parents to their children (Soenens et al., 2007), although heritability and parental socialization could play different roles for EC and PT, and at different ages. Heritability estimates are substantial for EC, but not for PT (Davis, Luce, & Kraus, 1994), and these genetic contributions emerge in the first years of life (Knafo, Zahn-Waxler, Van Hulle, Robinson, & Rhee, 2008). Conversely, research shows that mother-adolescent PT correspondence is mediated by maternal support (Soenens et al., 2007), suggesting that PT is transmitted more gradually in adolescence by means of socialization processes. In adolescence, we therefore expected to find stronger mother-to-child transmission of PT, compared to EC. Furthermore, Eisenberg, Spinrad, and Sadovsky (2006) noted that children’s empathic dispositions correspond primarily with same-sex parents and siblings. This might suggest same-sex modeling, as similarity is an important factor in the imitation of others’ behavior (Preston & De Waal, 2002).We therefore predicted stronger mother-to-child empathy transmission for girls than for boys.

The Developmental Timing of EC and PT: Rank-Order Change and Stability

Different developmentally sensitive periods might exist for EC and PT (Singer, 2006). Limbic and para-limbic brain regions, associated with emotional processing, undergo a developmental spurt before adolescence. In contrast, pre-frontal brain regions that are implicated in PT continue to mature during adolescence (Casey, Jones, & Somerville, 2011; Choudhury, Blakemore, & Charman, 2006). If self-reports parallel these neurological findings, we might expect the rank-order stability of adolescents’ PT to be lower than EC. Furthermore, we might expect rank-order stability of both dispositions to be lower in adolescents than in mothers, since various facets of personality tend to stabilize with increasing age (Roberts & DelVecchio, 2000). Because lower rank-order stability implies greater potential for inter-individual change, adolescents’ EC might predict relative change in PT more strongly than vice versa, and mother-to-adolescent transmission might be stronger for PT than EC.

The Present Study

Using cross-lagged panel modeling, we addressed four specific issues in the present longitudinal study. First, we explored the developmental interplay between adolescents' EC and PT, providing the first investigation of the developmental interplay between EC and PT in adolescents. Bidirectional prediction is defensible, but over-time prediction from EC to PT would likely be stronger if adolescents' EC is more stable than PT. Second, we investigated whether mothers' empathy predicts adolescents' empathy over time, and third, whether adolescent gender moderates this "transmission". We expected to find stronger mother-to-adolescent transmission of PT than of EC, and stronger transmission to daughters than sons. Finally, we compared the rank-order stability of EC and PT within and between respondents. We expected greater rank-order stability for adolescents' EC than for PT. We also predicted that the rank-order stability of PT and EC would be greater for mothers than for adolescents.

Method

Participants

Participants were 474 Dutch adolescents (271 boys, 203 girls; age at T1: $M = 14.03$, $SD = 0.45$) and their mothers (age at T1: $M = 45.47$, SD = 4.46), participating in an ongoing longitudinal study (RADAR; Van Lier et al., unpublished paper). Most adolescents had a Dutch ethnic background ($N = 451$), although some had a Surinamese/Antillean ($N = 7$), or other background ($N = 14$; 2 missing).

Procedure

Participants were recruited by telephone and visited by a trained interviewer. All participants provided informed consent. Each year, participants completed a large questionnaire. Although IRI data were collected in the RADAR study from 2006 to 2011, we used data from

2007 onward for the sake of measurement consistency, because two subscales (Fantasy and Personal Distress) were dropped after the first year[1]. We thus refer to the 2007 wave as T1.

Measures

Empathy. Adolescents' and mothers' self-reports on two seven-item subscales of the Interpersonal Reactivity Index (IRI) (Davis, 1983) respectively assessed EC (e.g., "I am often concerned about people less fortunate than me") and PT (e.g., "Sometimes I try to understand my friends better by imagining how they see things"). Each subscale was rated on a 5-point Likert scale (0 = *Doesn't describe me at all*; 4 = *Describes me very well*). The Dutch IRI has adequate internal consistency and validity, and an invariant factor structure between adolescents and mothers (Hawk et al., 2012). Latent variable reliability ranged from acceptable to good, with Raykov's (2001) ρ's between .71 and .84 for EC, and between .78 and .86 for PT. For descriptive statistics and latent variable correlations, see Table 1.

Strategy of Analyses

All analyses were conducted in Mplus (v. 7, Muthén & Muthén, 1998-2012). Because some variables were moderately skewed (lowest $\gamma_1 = -1.72$, $SE = .11$), we used robust maximum likelihood estimation (Satorra & Bentler, 1994). The percentage of missing values for each variable varied between 6.8% and 8% at T1, and between 15.3% and 15.5% at T4. Because data were missing completely at random, MCAR test $\chi^2(2118) = 2129.57$, χ^2/df ratio = 1.01, $p = .43$ (Little, 1988), we included respondents with partially missing data using full information maximum likelihood (FIML). We considered RMSEA ≤ .05, and CFI ≥ .95, supplemented by SRMR ≤ .08, to indicate good fit (Kline, 2011).

We took a model building approach, based on the two-step process suggested by Anderson and Gerbing (1988). Model fit at each step is displayed in Table 2. We first constructed a measurement model (M_0), with latent variables representing EC and PT to partial out measurement error and establish measurement invariance between respondents (Kline, 2011). Given the complexity of the final model and the modest sample size (parameter-to-*N* ratio = 0.48), we used item parceling (Kline, 2011), with three parcels per latent variable[3]. Error variance of the same parcels was correlated over time within respondents. This measurement model had a good fit. Based on Chen's (2007) criteria (CFI decrease ≤ .01, and RMSEA increase ≤ .015), we were able to establish measurement invariance for each construct by constraining factor loadings over time and between respondents (M_1)[4], indicating that the IRI scales were interpreted similarly at different ages and by mothers and adolescents. Standardized factor loadings varied between .62 and .80 for EC, and between .46 and .88 for PT.

Next, we constructed a baseline model with auto-regressive ("stability") paths and T1 within-time correlations (M_2). This model had an acceptable fit. Adding within-time correlations at T2-T4 (M_3) further improved fit. We then sequentially tested whether including within- and between-respondent crosspaths improved model fit as indicated by chi-square difference tests, retaining paths that significantly improved model fit before testing the next path. We added within-respondent crosspaths first, adolescent crosspaths before mother crosspaths, and paths from EC to PT before PT to EC. We then added between-respondent crosspaths predicting PT, first from mother to adolescent, and then the reverse. We then tested between-respondent crosspaths predicting EC in the same order. The resulting final model (M_7) is displayed in Figure 1. This final model showed improved fit over the baseline model[5].

Results

Within-Respondent Associations

We found large T1 correlations between EC and PT for adolescents and mothers. The only within-individual crosspaths that significantly improved model fit were those predicting adolescents' PT from EC (M_4). A non-significant Wald test indicated that these coefficients could be constrained over time (M_5). The positive regression coefficients indicated that adolescents' EC in one wave predicted their PT in the subsequent wave (β's = .19, *p*'s < .01, see Figure 1). Adding crosspaths from adolescents' PT to EC did not improve model fit[6], nor did crosspaths between mothers' EC and PT.

Intergenerational Transmission

We found small, significant T1 associations between mothers' and adolescents' EC and PT. To examine intergenerational transmission, we assessed mother-to-adolescent crosspaths. Supporting predictions, adding crosspaths from mother PT to adolescent PT improved model fit (M_6). Wald tests indicated that these coefficients could be constrained over time (M_7). The positive path coefficients (β's between .05 and .07, *p*'s ≤ .01) suggested that mothers' higher PT predicted higher adolescent PT in the subsequent year. Including mother-to-adolescent crosspaths for EC did not improve model fit, nor did any adolescent-to-mother crosspaths.

Gender Moderation of Mother-to-Adolescent PT Transmission

To examine whether PT transmission was stronger for girls than for boys, we tested for gender moderation using multi-group analysis. All path coefficients could be constrained between boys and girls, except crosspaths from mothers' PT to adolescents' PT, $\chi^2_{\text{Wald}}(1) = 3.96$, $p < .05$, suggesting that adolescent gender moderated PT transmission. The path coefficients were significant and positive for girls (β's between .10 and .11; *p*'s = .003), but non-significant for boys (β's < .02; *p*'s > .53). The resulting model (M_8) had a good fit.

Comparing the Rank-Order Stability of EC and PT Within- and Between Respondents

To compare the rank-order stability of EC and PT within and between respondents, we temporarily constrained the stability coefficients of each variable over time (Wald test *p*'s between .05 and .89). We then tested whether the rank-order stability of EC differed significantly from the rank-order stability of PT within respondents. Supporting predictions, the rank-order stability of adolescents' EC was higher than PT, $\chi^2_{\text{Wald}}(1) = 12.05$, $p < .001$, whereas the stabilities of mothers' EC and PT did not differ, $\chi^2_{\text{Wald}}(1) = 0.09$, $p = .76$. Finally, we tested whether the rank-order stability of EC and PT could be constrained between adolescents and mothers. As predicted, the rank-order stability of EC and PT was significantly lower in adolescents than mothers, $\chi^2_{\text{Wald}}(1) = 12.63$, $p < .001$ and $\chi^2_{\text{Wald}}(1) = 27.41$, $p < .001$, respectively.

Discussion

Empathy is a multi-dimensional construct, with affective and cognitive components that are related both within individuals and between parents and their children. Although different theories have suggested a developmental interplay between empathic concern and perspective taking (e.g., Decety, 2007; De Waal, 2007; Eisenberg et al., 2005; Hoffman, 2000), the direction of their over-time associations has remained unexplored in earlier research. We found that adolescents' EC predicted PT over time, but not vice-versa. Furthermore, empathy is commonly found to be correlated between parents and their children (Eisenberg, Spinrad, & Sadovsky, 2006), and some have suggested that PT, in particular, is transmitted from mothers to adolescent children (Soenens et al., 2007). Longitudinal studies are uniquely suitable for demonstrating such intergenerational transmission over time. Extending upon previous work, we found that mothers' PT positively predicted PT for daughters, but not for sons. Finally, recent neurological insights suggest that adolescence is a developmentally sensitive period for brain regions integral to PT, whereas those underlying EC stabilize earlier in life. Our findings regarding the rank-order stability of EC and PT suggest that this developmental order is reflected in adolescents' self-reports, as well.

The Longitudinal Interplay between Affective and Cognitive Empathy Dimensions

Some developmental theories have emphasized the importance of cognitive maturation for EC development, suggesting a developmental order from PT to EC (e.g, Decety, 2007; Hoffman, 2000). In contrast, De Waal (2007) argued that cognitive components of empathy build upon affective components, based on insights from the phylogenetic development of empathy. In line with the latter account, we found that adolescents' EC predicted relative increases in their PT one year later. Although causality cannot be inferred from correlational data alone, these results suggest that adolescents' tendency to feel compassion for the misfortunes of others might promote their ability to understand others' points of view. Furthermore, these findings indicate that affective empathy provides an early marker of adolescents' relative level of cognitive empathy later on. This finding could prove useful for identifying children at risk of developing relatively lower levels of PT and supporting them in developing this important interpersonal skill. Our findings do not contradict existing experimental evidence, which has focused on how PT can enhance EC (Hawk et al., 2011), but they do indicate that such experimental studies cannot necessarily speak to the developmental interplay between cognitive and affective empathy, which should be addressed using longitudinal methods.

Intergenerational Transmission

There are known similarities between parents' and children's EC and PT, especially between parents and offspring of the same gender (Eisenberg et al., 2006). Previous authors have suggested that, for EC, these similarities might be hereditary and emerge in early childhood

(Davis et al., 1994; Knafo et al., 2008), whereas PT might be transmitted more gradually throughout adolescence (Soenens et al., 2007). In line with these arguments, we found longitudinal evidence for mother-daughter PT transmission. Mothers' PT predicted relative increases in daughters' PT one year later. Although the absence of mother-to-son PT transmission is in line with previous research suggesting same-sex modeling (Eisenberg et al., 2006), this interpretation remains speculative because fathers were not included in our sample. Additionally, male adolescents might be less susceptible to parental influences. We found no evidence for EC transmission in adolescence, but prior research suggests that this might occur at an earlier age (Knafo et al., 2008). Alternatively, if some parenting behaviors stimulate EC while others reduce it, suppression might render the effect undetectable (Strayer & Roberts, 2004). Our findings suggest that the predictive value of maternal empathy is especially relevant in mother-daughter relationships. Though the present study cannot speak to the mechanisms by which mothers' higher PT predicted relative increases in daughters' PT, previous research suggests that mothers' empathy-related behaviors might play a role (Miklikowska et al., 2011). Such an interpretation implies that mothers wishing to stimulate PT in daughters would do well to practice it themselves.

The Developmental Timing of Affective and Cognitive Empathy

In line with neurological studies suggesting that brain structures underlying EC develop in childhood whereas those implicated in PT develop throughout adolescence (Singer, 2006), we found that the rank-order stability of adolescents' EC was significantly higher than PT. The rank-order stabilities of mothers' EC and PT did not differ, and were higher than for adolescents. This is in line with previous research indicating that empathic dispositions stabilize with age (Davis & Franzoi, 1991). For adolescents, individual differences in EC appeared to be quite stable compared to PT, which suggests that interventions or attempts to promote adolescents' empathy might be best targeted at PT, but also that any interventions targeting EC at a younger age might carry over to PT during adolescence.

Strengths and Limitations

This is the first empirical study to investigate the developmental order of cognitive and affective empathy in adolescence, offering an important complement to prior theoretical work on developmental order (Hoffman, 2000), longitudinal studies on trajectories of mean-level development (e.g., Davis & Franzoi, 1991; Eisenberg et al., 2005), and neuroimaging studies suggesting that brain regions underlying cognitive empathy continue to develop in adolescence (Singer, 2006). Furthermore, we were able to provide the first longitudinal evidence for mother-to-child PT transmission, which had heretofore been supported solely by cross-sectional data (Soenens et al., 2007). The robustness of the transmission effect is bolstered by the fact that respondents reported independently on their *general* empathic dispositions. The IRI was embedded in a large questionnaire packet, and neither respondent was primed to think specifically about their relationship with the other, which could have otherwise inflated the links between respondents. Although our effect sizes perhaps appear modest by conventional standards, they are in fact quite substantial for a cross-lagged panel model. Raaijmakers, Engels, and Van Hoof (2005) pointed out that coefficients in cross-lagged panel models are typically less than half the size of those found in cross-sectional studies, because cross-lagged panel models partial out many sources of shared variance, which cross-sectional and experimental studies typically do not do. Furthermore, time-lagged effects tend to weaken with longer time intervals, and the fact that we consistently found significant results with one-year measurement intervals suggests even more robust, short-term processes that deserve further study.

Nevertheless, certain limitations are noteworthy. Most importantly, causality cannot be inferred on the basis of this study alone, because the data are correlational (Kline, 2011). The results do suggest that it could be worthwhile for future researchers to conduct experiments to investigate whether early interventions promoting adolescent EC indirectly stimulate later PT, and whether promoting mothers' empathic behavior results in greater adolescent PT over time. Second, the IRI assesses individuals' *tendencies* to engage in EC and PT, and does not measure their empathic abilities or responses in specific situations. It might be more appropriate to examine this latter issue using behavioral measures. Including additional surveys could offer convergent evidence, and outside observer reports could safeguard against biased self-reporting. Parents can be poor judges of adolescent empathy, however, according to Cliffordson's (2001) findings that parent and adolescent reports of adolescents' EC were only moderately correlated ($r = .34$), and their reports of adolescents' PT were not significantly correlated at all. One reason self-reports are widely used is because empathy is an internal process, which may or may not be evident in behavior. We were unable to test whether PT is transmitted by the same-sex parent, because we did not assess fathers' empathy, and future studies should aim to include whole-family assessments. Finally, we did not test for mediators that potentially drive the intergenerational transmission of PT, because our sample size was too modest for more complex modeling. Future studies should investigate these issues with larger samples.

Conclusion

This study is the first to demonstrate that dispositional EC predicts PT in adolescence, and provides longitudinal support for PT transmission from mothers to daughters. The fact that we found within- and between-respondent crosspaths predicting adolescent PT, combined with the relatively low rank-order stability of this disposition, supports the notion that adolescence is a developmentally sensitive period for PT.

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Table 1. *Descriptive Statistics and Latent Variable Correlations*[2].

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. T1 Adolescent EC	2.46	0.62															
2. T2 Adolescent EC	2.44	0.65	.78***														
3. T3 Adolescent EC	2.39	0.66	.68***	.73***													
4. T4 Adolescent EC	2.45	0.58	.65***	.70***	.81***												
5. T1 Mother EC	2.97	0.47	.11	.10	.11	.14*											
6. T2 Mother EC	2.98	0.50	.14*	.12*	.16**	.10	.80***										
7. T3 Mother EC	2.95	0.49	.14*	.11	.18**	.13*	.85***	.83***									

Note. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Table 1. CONTINUED

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
8. T4 Mother EC	2.98	0.48	.13*	.10	.16*	.12*	.81***	.85***	.90***								
9. T1 Adolescent PT	2.11	0.58	.63***	.54***	.45***	.41***	.11	.11	.17**	.17**							
10. T2 Adolescent PT	2.11	0.63	.53***	.76***	.56***	.51***	.14*	.10	.21***	.19***	.64***						
11. T3 Adolescent PT	2.18	0.62	.54***	.56***	.69***	.56***	.04	.09	.16**	.14*	.59***	.64***					
12. T4 Adolescent PT	2.22	0.63	.48***	.52***	.52***	.64***	.13*	.13*	.23***	.18**	.59***	.61***	.68***				
13. T1 Mother PT	2.73	0.51	.07	.04	.08	.08	.59***	.47***	.47***	.50***	.15**	.12*	.15***	.17**			

Note. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$..

Table 1. CONTINUED

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
14. T2 Mother PT	2.77	0.50	<.01	.01	.09	.06	.50***	.66***	.51***	.52***	.13*	.09	.18**	.18***	.78***		
15. T3 Mother PT	2.79	0.53	.06	.05	.10	.11	.50***	.55***	.66***	.60***	.14**	.18***	.20***	.16**	.75***	.74***	
16. T4 Mother PT	2.81	0.53	.02	.02	.06	.06	.52***	.52***	.54***	.64***	.12*	.08	.13*	.13*	.79***	.78***	.83***

Note. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

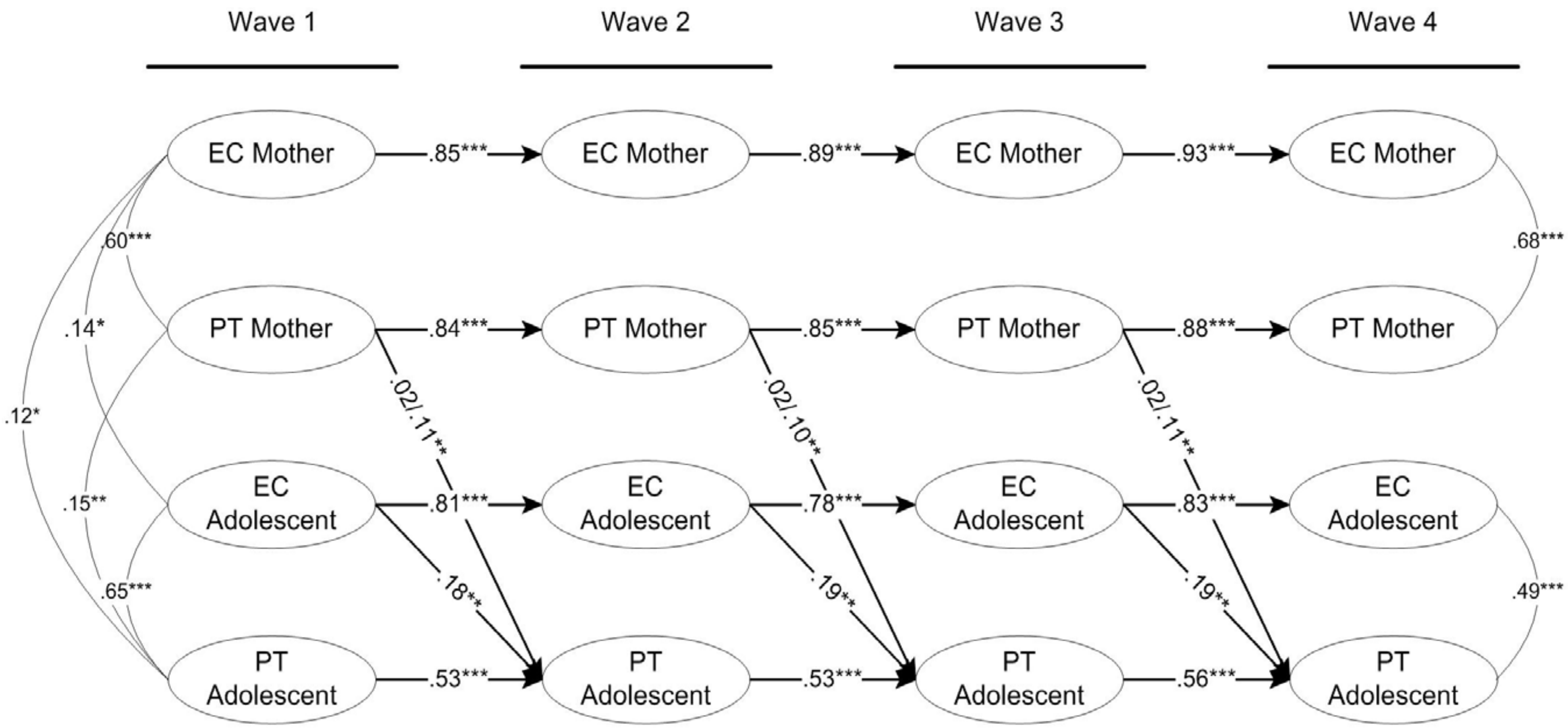
Table 2. *Overview of Model Fit Indices.*

Model	χ^2SB	df	c	RMSEA	CFI	SRMR	$\Delta\chi^2$SB	df
M0: Measurement model	1165.01	888	1.049	0.026	0.975	0.041		
M1: Factor invariance model	1230.30	916	1.054	0.027	0.972	0.050	61.55**	28
M2: Stablility and T1 Correlation	1787.60	1012	1.053	0.040	0.930	0.086	561.22**	96
M3: Correlated Change	1481.17	1000	1.054	0.032	0.957	0.064	331.24**	12
M4: Adolescent EC to PT paths	1464.50	997	1.053	0.031	0.958	0.062	13.73**	3
M5: Adolescent EC to PT paths†	1465.43	999	1.054	0.031	0.958	0.062	1.57	2
M6: Mother PT to Adolescent PT paths	1457.69	996	1.054	0.031	0.959	0.059	7.73*	3
M7: Mother PT to Adolescent PT paths†	1458.91	998	1.054	0.031	0.959	0.059	1.22	2
M8: Gender Moderation	2676.56	2069	1.030	0.035	0.944	0.076	1209.92**	1071

Note. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$, † effect is constrained over time.

Figure Captions

Figure 1. Cross-lagged panel model of adolescents' and mothers' EC and PT over time.



Standardized estimates of significant effects are displayed. Observed variables, residuals, residual correlations and within-time correlations omitted for the sake of clarity. When two values are assigned to a path, the first refers to boys and the second to girls. Model fit indices: χ^2SB(998) = 1458.91, p < .001, RMSEA = .031, CFI = 0.959, SRMR = 0.059. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Footnotes

1. Preliminary tests showed that we could not establish factor loading invariance between mothers' PT in the wave of 2006 and mother's and adolescents' PT in the waves from 2007 onward. This might have been due to the reported changes in the questionnaires after 2006.

2. Observed score correlations available upon request.

3. Details of this parceling solution can be found in Hawk et al. (2012).

4. We also tested these constraints for each variable separately using Wald tests, within and between respondents.

5. We arrived at the same model using a model pruning approach, beginning with a fully saturated model and then iteratively removing crosspaths with standardized coefficients smaller than .05.

6. In order to directly compare the strengths of EC to PT crosspaths with those of PT to EC crosspaths, we tested a model that estimated both simultaneously. The EC to PT paths (β's between .18 and .19, *p*'s < .001) were clearly superior to the PT to EC paths (β's < .01, *p*'s = .95), and were significantly different from each other, $\chi^2_{Wald}(1) = 8.76$, $p < .01$.