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Pathways to Children's Externalizing Behavior: A Three-Generation Study

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Abstract

This study, based on Family Interactional Theory (FIT), tested a longitudinal model of the intergenerational effects of the grandmothers' parent-child relationships and the grandparents' smoking on the grandchildren's externalizing behavior via parents' psychological symptoms, tobacco use, and child rearing. Using Mplus, we obtained a structural equation model that demonstrated generational associations from grandmothers (G1) to parents (G2) to their oldest children (G3) and thus was in accord with FIT. We identified a pathway from the grandmother's parenting to the grandchildren's externalizing behavior via the parents' psychological symptoms, their smoking, and their child rearing. Parents' psychological symptoms in adolescence were associated with their tobacco use in their late twenties, controlling for the continuity of their psychological symptoms and their tobacco use. Our three-generational model adds to the literature on parent-child relationships (G1), smoking from adolescence to early adulthood (G2), and externalizing behavior in the G3 child.

Keywords

intergenerational transmission; parenting; smoking; externalizing

Introduction

Externalizing behavior, a concept introduced by Achenbach (1991; 1992), has been used extensively in the classification of children's behavioral problems. Externalizing behaviors include a lack of emotional control, interpersonal aggressiveness, and a lack of adherence to societal norms. This behavioral pattern has been shown to relate to a number of disadvantageous outcomes, including low academic competence (Masten et al., 2005) and vulnerability to and persistence of substance use (Wills, Anette, Mendoza, Gibbons, & Brody, 2007; Tomlinson, Brown, & Abrantes, 2004). Thus, it is important to conduct an in-depth study of earlier environmental factors associated with externalizing behaviors and the nature of their relationships. A number of these psychosocial factors have been addressed in the literature; namely, the parents' relationship with their children (Reitz, Dekovic, & Meijer, 2006; Richmond & Stocker, 2008; Rothbaum & Weisz, 1994), and with their own parents (Belsky, Jaffee, Sligo, Woodward, & Silva, 2005; Conger, Neppl, Kim, & Scaramella, 2003; Cowan, Cohn, Cowan, & Pearson, 1996), as well as the parents'

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Please note that we followed Reviewer 1's advice and re-ran all of the analyses controlling for the parents' (G2) alcohol, marijuana and other illicit drug use. Hence, most of the numbers in Figure 1, Tables 1 and 2, and Appendix A have changed slightly. Rather than bolding these changes we have provided new versions of Figure 1, Tables 1 and 2, and Appendix A.

psychological well-being (Campbell, 1994; Harnish, Dodge, & Valente, 1995; Shaw, Winslow, Owens, & Hood, 1998; Whitbeck et al., 1992). Theory and research have supported intergenerational consistencies in parenting styles, both positive and negative (Belsky et al., 2005; Bowlby, 1969; Conger et al., 2003). Our study extends this research by examining some of the above factors in a prospective, developmental model designed to illuminate their interrelationships.

Another set of environmental factors noted in the literature concerns parental tobacco use, its relationship to the child rearing these parents experienced (Fleming, Kim, Harachi, & Catalano, 2002; O'Byrne, Haddock, Poston, & Mid America Heart Institute, 2002), to their parents' smoking (Chassin, Presson, Rose, Sherman, & Prost, 2002; Farkas, Distefan, Choi, Gilpin, & Pierce, 1999), as well as to their children's externalizing behaviors (Ashford, van Lier, Timmermans, Cuijpers, & Koot, 2008; Williams et al., 1998). The goal of the present study is to integrate this network of intergenerational variables into a developmental model of children's externalizing behavior.

The present study contributes to the literature in three important ways: 1) it is one of the few longitudinal, three-generational studies; 2) it is the only study that examines the interrelationship of these constructs (grandmother's parent-child relations, parents' child rearing, parents' psychological symptoms, and grandparents' and parents' tobacco use) as predictors of children's externalizing behavior; and 3) the data span a period of more than 20 years.

The model proposed for the present study stems from an extension of Family Interactional Theory (FIT) (Brook, Brook, Gordon, Whiteman, & Cohen, 1990). FIT concerns the parent and child risk factors for the children's maladaptive functioning as exemplified by externalizing behavior. The present study represents an elaboration of the original conception of FIT to incorporate three generations. This elaboration postulates that people's parenting of their children may be determined, in part, by the parenting they experienced as children, and by their exposure to family members' substance use, as well as their own history of psychological adjustment, and their own substance use. The longitudinal data available enables us to provide evidence for the extension of this theory from two to three generations. FIT suggests that the first or grandmother generations' (G1) parent-child relations and grandparent tobacco use will be related to the second generation's or parents' (G2) psychological functioning, tobacco use, and child rearing. (Please note that we did not have any data from grandfathers, but we did have data regarding their tobacco use that was obtained from the grandmothers. Hence, throughout this study, we refer to grandmother-parent relations and the grandparents' tobacco use.) Compared to the grandmothers' parent-child relations, child rearing in the second generation will have the most proximal association with their offspring's behavior (G3) and the highest correlations with the latter's externalizing behavior.

Associations between Parents' Child Rearing and Children's Outcomes

One aspect of the environment, which may contribute to children's externalizing behavior, is the parents' child rearing practices. Bandura's Social Learning Theory (1986) suggests that while parenting, parents model behaviors for their children. In contrast, Patterson and his colleagues (Stoolmiller, Patterson, & Snyder, 1997) suggest that it is the ineffectiveness of the parents' disciplinary practices, rather than the parents' modeling of aggression that contributes to their children's externalizing behaviors. Behaviors and attributes such as less parental involvement, hostility, and limited monitoring have been significantly related to children's externalizing behaviors. Rothbaum and Weisz (1994) performed a meta-analysis of 47 studies and concluded that a variety of adverse parenting practices were highly predictive of children's externalizing behavior. The present study, in accordance with the

postulates of FIT, examines several significant dimensions of the mutual attachment relationship between the parent and child.

The Grandmothers' Parent-Child Relations and the Parents' Child Rearing

Given the evidence that parents contribute to externalizing behavior through their relationships with their children, what influences parenting behavior? Proponents of attachment theory (Bowlby, 1969) maintain that the parent's relationship with the child is a product of the parent's internal model of his or her relationship with an attachment figure in the previous generation. Indeed, parenting styles and behaviors have been shown to be fairly consistent from generation to generation (e.g., for aggressive behavior) [Belsky et al., 2005; Conger et al., 2003].

A second factor that mediates the relation between the grandmothers' parent-child relations and the parents' child rearing is the parents' psychological well-being (Harnish et al., 1995; Whitbeck et al., 1992). Building on the research of Harnish et al. (1995), the current study will not only examine parental depression as a mediator, but it will also encompass the parents' anxiety and interpersonal difficulties in adolescence and in young adulthood. Examining this part of the path will involve assessing the well-established relative stability of psychological symptoms during the period from adolescence to the late twenties (Weissman et al., 1999; Woodward & Fergusson, 2001). This stability has been found for both symptoms of depression and anxiety.

Parents' psychological symptoms are likely not only to have a mediated effect (Harnish et al., 1995), but also a direct effect on children's externalizing behavior. Several researchers have reported direct relationships between parental depression and children's externalizing behavior (Foster, Garber, & Durlak, 2008; Low & Stocker, 2005; Luoma et al., 2001; Van den Bergh & Marcoen, 2004). Finally, the findings of an adolescent twin study are supportive of a direct link between parents' psychological symptoms and children's externalizing behavior (Burcusa, Iacono, & McGue, 2003).

Grandmothers' Parent-Child Relations, Parents' Tobacco Use, and Children's Externalizing Behavior

There are no studies that examine the pathway from the grandmothers' parent-child relations and parents' tobacco use to their children's externalizing behavior. Therefore, we focus on literature that studies components of this pathway from grandmothers to externalizing behavior in their grandchildren. The present study will assess a path from the grandmothers' parent-child relations to parental tobacco use measured at two time points to their children's externalizing behaviors. Research is consistent with the grandmothers' parent-child relations contributing to their children's smoking behavior. O'Byrne et al. (2002) found that adolescents who reported experiencing positive parenting were less likely to initiate smoking, and if they did smoke were more ready to quit than those who reported a less healthy parent child relationship. Other investigators, using multiple reporters and longitudinal data, albeit with a young sample, found support for an association between parenting and children's smoking (Fleming et al., 2002). Research also suggests that smoking behavior is relatively stable between adolescence and adulthood (Chassin et al., 2002; Pierce & Gilpin, 1996). Finally, parental tobacco use has been related to children's externalizing behavior (Williams et al., 1998).

Grandparents' Tobacco Use, Parents' Tobacco Use, Parents' Psychological Adjustment, and Children's Externalizing Behavior

Research showing that parental smoking is related to offspring smoking supports this study's proposed path from grandparents' tobacco use to parental tobacco use to children's

externalizing behavior. Several investigators have found that parents' smoking predicts children's smoking initiation, smoking frequency, and nicotine dependence (Chassin et al., 2002; Farkas et al., 1999; Kandel & Wu, 1995; Kardia, Pomerleau, Rozek, & Marks, 2003). These studies suggest that modeling, as proposed by Bandura (1986), contributes to the intergenerational transmission of smoking, but they do not preclude an additional role for the genetic effects of smoking. None of these studies, however, assessed the longitudinal relationship of the grandparents-as-parents' smoking during their children's adolescence and their children's smoking in adulthood. Our study predicts a path from the grandparents' modeling of smoking behavior and exposing their adolescents to environmental smoke to smoking by these adolescents-as-parents' to the third generation's externalizing behavior. Hence, parental tobacco use should mediate between the grandparents' tobacco use and the children's externalizing behavior.

Parental smoking is also likely to be related to their psychological symptoms and child rearing, and ultimately to externalizing behavior in their children. Among adolescents, smokers have been found to be at a higher risk for developing depression than have nonsmokers (Orlando, Ellickson, & Jinnett, 2001; Windle & Windle, 2001; Wu & Anthony, 1999). This research has suggested that the self-medicating properties or calming effects of tobacco use dissipate as nicotine induces changes in brain biochemistry (Orlando et al., 2001; Windle & Windle, 2001). As this occurs, smokers become more aware of their emotional distress. Earlier, we described the evidence for the association of parents' psychological symptoms with their child rearing in a path leading to children's externalizing behavior. In addition, parents who are smokers, even if they report protective personality characteristics, appear to be less nurturing towards and provide less structure for their children than parents who are nonsmokers (Brook, Balka, Fei, & Whiteman, 2006). The present study will assess longitudinally whether smoking in early adulthood is linked to psychological symptoms in the path to children's externalizing behavior and whether smoking is also directly linked to their child rearing.

We will assess the relationship of the parents' psychological symptoms to their tobacco use over time and the relationship of the parents' tobacco use to their psychological symptoms over time. Longitudinal cross-domain effects (paths) will be examined while controlling for both cross-domain covariation at each time point and stability in each domain over time.

Based on the above analysis and related literature, there are seven major hypotheses involving intergenerational effects on externalizing behavior in the G3 child.

1. The grandmothers' parent-child relationships (G1/G2) are associated with psychological symptoms in the parents (G2), which, via their child rearing, predicts externalizing behavior in the children (G3).
2. The grandmothers' parent-child relationships (G1/G2) are associated with parent smoking which is linked to externalizing behavior in the children (G3).
3. The grandparents' cigarette smoking (G1) is related to the parents' cigarette smoking which is linked to G3's externalizing behavior.
4. The relationship of the grandparents' cigarette use and the grandchildren's externalizing behavior is also mediated by the parents' psychological symptoms and child rearing.
5. The parents' psychological symptoms, when they are late adolescents, are associated with the parents' tobacco use when they are in their twenties with control on the continuity of both their psychological symptoms and cigarette smoking.

6. The parents' tobacco use when they are in their late teens and early twenties is related to their psychological symptoms when they are in their twenties, with control on the continuity of the parents' cigarette smoking and their psychological symptoms.
7. Parents' tobacco use has a direct effect on children's externalizing behavior and an indirect effect on children's externalizing behavior via parents' child rearing.

Method

Participants and Procedure

The second generation parents were members of a community sample residing in one of two upstate New York counties¹ when the sample was selected in 1975, Time 1 (T1). At that time, only their mothers (G1), this study's grandmothers, were interviewed. Interviews of both the grandmothers-as-mothers and the parents-as-youths (G2) were conducted in 1983, Time 2 (T2, N=756), 1985–1986, Time 3 (T3, N=739), and in 1992, Time 4 (T4, N=750). Two more interviews of the second generation were conducted in 1997, Time 5 (T5, N=749) and in 2004, Time 6 (T6, N=504). The mean age (S.D.) of the parent sample was 14.6 (S.D.=2.8) at T2, 16.8 (S.D.=2.9) at T3, 22.3 (S.D.=2.8) at T4, 27.2 (S.D.=2.9) at T5, and 35.1 (S.D.=3.0) at T6. Some of the participants who were not interviewed at some earlier waves were interviewed at later waves. The retention rate was over 95% until T6. At T6, for budgetary reasons, our sample was reduced. The 1983 T2 sample is the base from which the current sample was drawn. The originally sampled families were generally representative of the population of families in Albany and Saratoga, two upstate New York counties, with respect to gender, family intactness, family income, and education. There was a close match of the participants on family income, maternal education, and family structure with the 1980 survey conducted by the U.S. Census Bureau. For example at T2, 75% of the then children lived with married parents, and 19% lived with a mother who was not currently married; the comparable census figures were 79% and 17%, respectively.

In the T6 sample, 61.7% or 311 of the parental generation had at least one child. (Only the parent who had participated in our longitudinal study was interviewed). The analyses for this study were based on those participants (63% female) whose oldest or only children at T6 were between 5–18 years old (N=230), the age range for which the externalizing measure was appropriate (Achenbach, 1991 & 1992). At T6, the parents' in this study had a mean (SD) age of 35.6 (3.1) years. At the interview, 68.3% of these participants were married and, on average, had two children (SD=0.9). With the exception of the participants' gender ($\chi^2(1)=20.66$, $p<0.001$), there were no significant differences between those who were included in the present study (N=230) and the rest of the longitudinal sample on the measures administered in the present study (e.g., the measures of the parents' psychological symptoms at T3 and T5). With regard to the third generation children, the sample was 54.8% female and 45.2% male. The children had a mean (SD) age of 11.4 (3.7) years.

¹Albany County was identified as one of the poorest counties in the New York State, and adjacent Saratoga County as one of the wealthiest. These were chosen for study by means of a sample survey. Primary sampling units were created from enumeration districts and block groups, which, when taken together, comprised the entire area and population of the target counties. The primary sampling units in each county were stratified by urban/rural status, the proportion of Whites, and median income. A systematic sample of primary sampling units in each county was then drawn with probability proportional to the number of households, and probabilities equal for members of all strata. Segments of blocks were then selected with probability proportional to size (number of households), and each was surveyed in the field with a proportion of the households being selected according to the predetermined sampling ratio. Address lists were compiled in this process, and interviewers were sent to the selected addresses. Those households with at least one child between the ages of 1-10 years were qualified for the study. In each qualified household, the interviewer, by use of a set of Kish Tables, randomly selected one child from those in the appropriate age range (Cohen & Cohen, 1996).

Extensively trained and supervised lay interviewers administered the interviews in private. Written informed consent was obtained from the parents as youths and young adults and from their mothers in 1983, 1986, and 1992, and from the parents only in 1997 and 2004. The Institutional Review Boards of the Mount Sinai School of Medicine, New York Medical College, and the New York University School of Medicine approved the study's procedures. For more details about the sampling procedures and the original sample, see Cohen and Cohen (1996) and Brook, Whiteman, Gordon, & Cohen (1986).

Measures

Grandparents' Tobacco Use at T2—A latent variable of grandparents' tobacco use at T2 was hypothesized. This latent variable included two manifest variables: the grandmother's and the grandfather's current cigarette smoking. The questions regarding the grandmother's and grandfather's smoking were asked of the grandmother at T2. The items were: "How many cigarettes do you smoke a day? Would you say..." with the answer choices being scored as: (1) None; (2) Used to smoke, but stopped; (3) Less than half a pack a day; (4) Half a pack to one pack a day; and (5) More than one pack a day. The grandmother was also asked: "How many cigarettes does the child's father or father substitute (e.g., grandfather) smoke a day? Would you say..." with the same range of answer choices as listed above.

Grandmothers' Parent-Child Relations at T2 and T3—A latent variable of the grandmothers' parent-child relationship (when the G2 parent was a youth) was hypothesized. The grandmother reported the data. At each point in time, two multi-item scales were included: (1) Conflictual relations with the parent as a youth included 5 items [$\alpha=0.88$ (T2) and $\alpha=0.90$ (T3)], e.g., "Does what he/she wants to instead of what you tell him/her" (Schaefer & Finkelstein, 1975). The answer options ranged from (1) "Not at all like the child" to (4) "Very much like the child." (2) Maternal satisfaction with child included 6 items [$\alpha=0.75$ (T2) and $\alpha=0.80$ (T3)], e.g., "I am satisfied with my child's overall accomplishments." (Original). The answer options ranged from (1) "Never" to (5) "All the time."

Parents' Psychological Symptoms at T3 and at T5—Latent variables of parents' psychological functioning at T3 and at T5 were hypothesized. These latent constructs each consisted of three multi-item scales that measure depression [5 items, $\alpha=0.74$ (T3) and $\alpha=0.82$ (T5)], e.g., "Over the last few years, how much were you bothered by feeling low in energy or slowed down?" (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974), anxiety [4 items, $\alpha=0.65$ (T3) and $\alpha=0.74$ (T5)], e.g., "Over the last few years, how much were you bothered by feeling fearful?" (Derogatis et al., 1974), and interpersonal difficulties [6 items, $\alpha=0.72$ (T3) and $\alpha=0.79$ (T5)], e.g., "Over the last few years, how much were you bothered by feeling easily annoyed or irritated with other people?" (Derogatis et al., 1974). For each of these three scales the answer options ranged from (1) "Not at all" to (5) "Extremely."

Parents' Tobacco Use at T4 and at T5—We hypothesized one latent variable of parents' tobacco use at T4 and one at T5. At each time point, two manifest variables of the parents' tobacco use were assessed. At both times the questions asked about the frequency of smoking cigarettes during the past two months (current) and during the five years prior to T4 and prior to T5. The answer options for each question were: none (0); less than daily (1); 1–5 cigarettes a day (2); about half a pack a day (3); about a pack a day (4); and about 1.5 packs a day or more (5) At T4 and at T5 we combined the two manifest variables to form a latent variable of parent tobacco use.

Parents' Child Rearing Practices at T6—A latent variable of child rearing practices at T6 was hypothesized. This construct was measured by six scales. (1) Time spent with the child included 2 items ($\alpha=0.70$), e.g., “About how many hours a day on average do you spend doing recreational or educational activities with your child?” (Original). The answer options ranged from less than an hour per day (1) to eight or more hours a day (9). (2) Child-centeredness included 5 items ($\alpha=0.88$), e.g., “Do you give your child a lot of care and attention?” (Schaefer, 1965). (3) Affection included 4 items ($\alpha=0.88$), e.g., “How frequently do you show your love to your child?” (Schaefer, 1965). (4) Availability included 1 item [e.g., “Are you always available when your child needs you?” (Original)]. The Child-centeredness, Affection, and Availability scales had answer options ranging from (1) “Not at all like me” to (5) “Exactly like me.” (5) Discipline included 3 items ($\alpha=0.61$), e.g., “How often do you reject your child if he/she does something you do not like?” (Avgar, Bronfenbrenner, & Henderson, 1977). The answer options ranged from (1) “Never” to (5) “Often.” (6) Satisfaction with the child included 4 items ($\alpha=0.84$), e.g., “How satisfied are you with your child's achievement?” (Original). The answer options ranged from (1) “Never” to (5) “All the time.”

Children's Externalizing Behavior at T6—A manifest variable of children's externalizing behavior was measured at T6 using an adaptation of Achenbach's (1991) Child Behavior Checklist [(CBCL); $\alpha=0.79$]. The CBCL is a rating scale for parents that assesses behavioral and emotional problems in 5–18 year-old children. The measure consisted of 9 items, i.e. “is disobedient at home; doesn't seem to feel guilty after misbehaving; gets in many fights; screams a lot; argues a lot; is cruel, bullies, or is mean to others; is disobedient at school; lies or cheats; and teases a lot.” Each item was graded on a 3-point scale (0=not true, 1=somewhat or sometimes true, and 2=very true or often true).

Analytical Plans

Latent variable structural equation models were employed to examine the empirical credibility of the proposed paths. As suggested by Newcomb and Bentler (1988), we used a partial covariance matrix as the input matrix to the measurement and structural models. In this matrix we controlled for the third generation's age and gender, the second generation's gender, age, and marital status at T6, and their alcohol, marijuana, and other illicit drug use at T2, and the first generation's educational level. We controlled for the three substances because smokers are also likely to use these substances. See appendix A for this matrix.

We estimated the hypothesized models (see the Introduction Section) by using Mplus 6.1 (Muthén & Muthén, 2010). There were no missing data for the measurement of the children's externalizing behavior at T6. Less than 2% of the data were missing for some of the independent variables. We used Mplus's default option [i.e., full information maximum likelihood approach, Little & Rubin, 2002] to treat the missing data. The advantage of FIML is that the results are less likely to be biased, even if the data are not missing completely at random (Muthén, Kaplan, & Hollis, 1987). We chose three fit indices to assess the fit of the models: (a) the root mean square error of approximation (RMSEA); (b) Bentler's comparative fit index (CFI); and (c) the standardized root mean square residual (SRMR). For the CFI, values between .90 and 1.0 indicate that the model provides a good fit for the data, while the RMSEA and SRMR should each be below .10 (Kelloway, 1998).

To test the effects of T3 parents' psychological symptoms on T4–T5 parents' tobacco use, we included the following pathways and co-variations in the model: (1) the direct path from parents' tobacco use reported at T4 to that reported at T5; (2) the direct path from T3 to T5 parents' psychological symptoms, (3) the co-variation between T3 psychological symptoms and T4 tobacco use, and (4) the co-variation between T5 psychological symptoms and T5

tobacco use. By including these pathways and co-variations, we also tested the association of T4 parents' tobacco use with T5 parents' psychological symptoms.

A total effects and total indirect effects analysis was performed on each predictor of the children's externalizing behavior. The total effects of a latent construct consist of the sum of its direct and indirect effects on the dependent variable. The z -statistics of the standardized total effects and total indirect effects analyses were obtained.

Results

Using Mplus 6.1, we tested the measurement model as well as the structural model, controlling for the third generation's age and gender, the second generation's gender, age, and marital status at T6, and their alcohol, marijuana, and other illicit drug use at T2, and the first generation's educational level. The following fit indices were obtained for the overall model: RMSEA=0.055; Bentler's CFI=0.94; and SRMR=0.061. These results reflect a satisfactory model fit. For the measurement model (see Table 1), all factor loadings were significant ($p < 0.01$). The findings show that the indicator variables were satisfactory measures of the latent constructs. For the structural model, standardized parameter estimates, as well as the associated t -statistics for the sample, are presented in Figure 1.

As noted in Figure 1, the majority of our hypotheses were supported by the data. We used one-tailed tests because we hypothesized relationships. More specifically, our findings suggested that: (1) The grandmothers' parent-child relationships (G1/G2) were negatively related to G2's psychological symptoms in adolescence ($\beta = -0.27$, $z = -3.70$), which in turn were related to G2's psychological symptoms in their late twenties ($\beta = 0.54$, $z = 9.89$). G2's psychological symptoms in their late twenties were negatively related to G2's child rearing ($\beta = -0.16$, $z = -2.15$), which was ultimately negatively related to G3's externalizing behavior ($\beta = -0.21$, $z = -2.97$); (2) The grandmothers' parent-child relationships (G1/G2) were negatively related to G2's smoking ($\beta = -0.17$, $z = -2.32$) in adolescence, which in turn was related to G2's smoking in their late twenties ($\beta = 0.87$, $z = 41.74$), which ultimately was related to G3's externalizing behavior ($\beta = 0.15$, $z = 2.30$); (3) The grandparents' tobacco use was related to G2's tobacco use in adolescence ($\beta = 0.26$, $z = 3.02$); (4) The grandparents' tobacco use was negatively related to the grandmothers' parent-child relationships ($\beta = -0.18$, $z = -1.90$); (5) G2's psychological symptoms in adolescence were associated with G2's tobacco use in their twenties ($\beta = 0.08$, $z = 2.08$); (6) The relationship of G2's tobacco use in late adolescence with G2's psychological symptoms in their late twenties was not statistically significant ($\beta = 0.05$, $z = 0.73$, $p > 0.05$); and (7) The path from G2's tobacco use in their late twenties to their child rearing was not significant ($\beta = 0.10$, $z = 1.38$, $p > 0.05$).

In addition, we found that: (1) G2's psychological symptoms in adolescence were directly associated with G3's externalizing behavior ($\beta = 0.15$, $z = 2.14$); (2) the correlation between G2's psychological symptoms in adolescence and their tobacco use reported at T4 was not significant ($r = 0.08$, $z = 1.05$, $p > 0.05$); and (3) the correlation between G2's psychological symptoms and tobacco use in their late twenties was significant ($r = 0.24$, $z = 2.87$).

An examination of the total effects and total indirect effects (if applicable) of each latent and manifest variable estimated in the analysis of G3's externalizing behavior at T6 helps in the interpretation of the structural coefficients. Table 2 presents the standardized total effects and total indirect effects of the proposed latent and manifest variables on children's externalizing behavior at T6. The z values of the total effects were all statistically significant ($p < 0.05$, based on a one-tailed test). With one exception (i.e., G2's smoking in the late twenties), the z values of the total indirect effects were all statistically significant ($p < 0.05$, based on a one-tailed test), which further supported our hypothesized mediational model.

The total explained variance for each of the seven latent constructs was obtained controlling for G1 education at T2, G2 gender, age, and marital status at T6 and their alcohol, marijuana and illicit drug use at T2 and G3 age and gender at T6. For example, according to the model (Figure 1), three latent constructs, i.e., parents psychological symptoms at T3, parents tobacco use at T5, and parent child rearing at T6 had a direct effect on children's externalizing behavior. The total explained variance of the children's externalizing behavior by these three constructs was 9.4%. We also calculated the total explained variance for the other latent constructs. These R^2 s were as follows: T6 parents' child rearing (3.1%), T5 parents' tobacco use (77.6%), T5 parents' psychological symptoms (29.4%), T4 parents' tobacco use (11.2%), T3 parents' psychological symptoms (7.4%), and T2–T3 grandmother–parent relations (3.2%).

Discussion

This study pursues the implications of FIT across generations by examining child rearing practices, which are transmitted from grandparents to parents, to the grandchildren's externalizing behavior. We also obtained significant information on the second generation by following these respondents over several important developmental periods, up until the fourth decade of life.

Our findings extend the literature in a number of important ways. Our results highlight the significance of the association of the grandmothers' parent-child relations with externalizing behaviors in their grandchildren. In accordance with FIT, there is intergenerational transmission of adverse effects from grandmothers to parents to grandchildren. We identified a pathway from the grandmothers' parent-child relations via parental attributes and child rearing to the grandchildren's externalizing behavior. Another pathway involves grandparents' tobacco use. Thus, both the grandmothers' parent-child relations and the grandparents' tobacco use were associated with the parents' later tobacco use, which, in turn, predicted the grandchildren's externalizing behavior. The pathway from grandmothers' parent-child relations to the parents' subsequent tobacco use is consistent with previous studies which found that parenting behavior is related to offspring smoking behavior (Fleming et al., 2002; O'Byrne et al., 2002). The path from the grandparents' tobacco use to the parents' later smoking concurs with the findings of Kardia et al. (2003), who also found that parents' smoking histories were related to the smoking rate of their adult children.

Parents' psychological symptoms are related to parents' tobacco use with control on the continuity of their psychological symptoms and of their tobacco use. Parents' tobacco use was not associated with parents' psychological symptoms with control on the continuity of their tobacco use and of their psychological symptoms. However, the relationship of parents' tobacco use reported at T4 and parents' psychological symptoms at T5 is mediated by parents' tobacco use reported at T5.

The findings also demonstrated that some parental personality attributes (e.g., depression) are associated with adverse child rearing practices, which in turn, predict the children's externalizing behavior. Our findings extended those of Harnish et al. (1995) by showing that a latent construct including not only depression, but also anxiety and interpersonal difficulty, had a role in the intergenerational transmission of adverse parenting practices. The parents' psychological symptoms in adolescence take on added importance as they serve to mediate between the grandmothers' parent-child relations and the grandchildren's externalizing behavior, hence supporting the first longitudinal pathway noted above.

The results point to the importance of the parents' child rearing practices (e.g., Availability and Discipline) since they act as a mediator for all of the grandparent and parent domains

(see Figure 1). These results are consistent with those of Harnish et al. (1995), who reported that mother-child interaction serves as a partial mediator of the effect of maternal depressive symptoms on children's behavioral problems. Parents who have a history of depressive symptoms may be critical of their children and this harshness may provoke externalizing behavior (Whitbeck et al., 1992).

In addition to serving as a mediator of the transmission of parenting practices from generation to generation, the second generation's late adolescent psychological symptoms also directly predict their offspring's externalizing behavior. One possibility is that behavioral problems are at least partially genetically transmitted or reflect inherited temperamental characteristics. Burcusa et al., (2003) report a genetic relationship between psychological symptoms and externalizing disorders. While genetic factors may play a role, environmental factors are also of importance.

Furthermore, whereas the parenting studies cited above examined the relationship of parenting practices to smoking behavior over a limited age span, childhood to adolescence, this study extended the finding to later developmental periods (from G2's adolescence to G2's smoking in early adulthood). Additionally, by collecting data into G2's adulthood, we were able to link the results from the studies noted above on the association of parenting practices and offspring smoking to research on the impact of parental tobacco use on children's externalizing behavior. One possible mechanism through which exposure to parental cigarette smoking influences children's externalizing behavior is by affecting neurodevelopment and the neural structure in the brain of the offspring, which, in turn, may affect behavior (Ernst, Moolchan, & Robinson, 2001; Slotkin, 2004; Weitzman, Byrd, Aligne, & Moss, 2002). Alternatively, as suggested above, smoking is associated with an increase in parents' psychological symptoms which, in turn, might be associated with a deterioration in the quality of their child rearing practices which predicts an increase in their children's externalizing behavior (Brook et al., 2006; Breslau, Novak, & Kessler, 2004; Orlando, Ellickson, & Jinnett, 2001). Lastly, as has been suggested regarding smoking during pregnancy, an as yet unmeasured, underlying environmental characteristic that varies across families and that is related to both smoking and offspring externalizing behavior may account for the relationship between smoking and children's behavior (D'Onofrio et al., 2008).

It is important to note that these pathways leading to the children's externalizing behavior emerged despite control on several demographic factors (i.e., the children's age and gender, the parents' age, gender, and marital status, and the grandparents' educational level).

Altogether, the results highlight the role of the grandmothers' relationships with the parents in the development of externalizing behavior in the grandchildren. Thus, the grandmothers' conflict and dissatisfaction with the parents are manifested in the parents' psychological symptoms, in the parents' smoking, and indirectly in the parents' adverse child rearing practices. These parental behaviors are all related to the children's externalizing behavior. Therefore, we have extended the FIT model to incorporate the influence of the grandparents on the parents and through the parents on the children. Understandably, the parents appear to have a greater impact on the children's externalizing behavior than the grandparents, a finding that is supported by the differential total effects, $-.21$ and $-.07$, respectively.

There are several caveats regarding the findings of the present study. First, the majority of the sample for this study consisted of non-Hispanic whites; therefore, our results can only generalize to other non-Hispanic white samples. It would be worthwhile to investigate the applicability of this model to other ethnic and racial groups. Second, the information was obtained from the participants via self-report interviews rather than via direct observation or

reports from secondary sources. Self-report of smoking is one factor for which, due to social norms, under-reporting might be a concern. For this reason, numerous studies have compared participants' self-report of tobacco abstinence/use to the results of biochemical assessments. Fendrich, Mackesy-Amiti, Johnson, Hubbell, & Wislar (2005) surveyed adults regarding their smoking behavior and found that, when compared to results of a subsequent "surprise" cotinine test, self-reports had a sensitivity of 78%. Thus, it may be that a small percentage of self-reported "non-smokers" may actually be smokers. In addition, differentiating between prenatal and postnatal smoking might have clarified the mechanism by which parents' smoking predicts children's externalizing behavior. A previous study found that children's exposure to postnatal, parental cigarette smoking was associated with an increased risk for both internalizing symptoms and externalizing behaviors (Brook, Zhang, & Fagan, 2008). Third, we did not interview grandfathers and hence relied on the limited data about them that was reported by the grandmothers. Future research would benefit from obtaining data directly from grandfathers. Fourth, although we employ structural equation modeling and our latent/manifest constructs were ordered temporally, we were limited in our ability to make inferences of a causal nature. It is possible there are confounding variables, which account for some of the relationships (e.g., genetic vulnerability is a case in point). However, as indicated above, we have controlled for a number of possible confounding variables. Fifth, we assumed that the parents' child rearing practices predicted the offspring's externalizing behavior. A future study may benefit from examining how the child's externalizing behavior relates to later child rearing. The findings would also be more rigorous if there was not a single reporter for both the parents' child rearing and the children's externalizing behavior. It would also be of interest to study the cross-sectional relationships of the parallel variables in this study but we did not have comparable measures at each point in time.

Despite these limitations, the findings from the present study indicate that this study represents an important step toward creating an understanding of how grandparents' tobacco use and grandmothers' parent-child relations relate to the next generation's adverse psychological symptoms and family environment and ultimately to the third generation's externalizing behavior. The results presented in this study are in accord with a broadened perspective of FIT. Thus, the grandmothers' parent-child relations are associated with the parents' psychological symptoms. Future research should focus on the development of psychological symptoms and tobacco use as they relate to subsequent behavior in children. This study illuminates the complexity of factors associated with externalizing behavior in children. As part of our model, we were able to assess cross-domain relations over time. Cross-domain in this study refers to the fact that one domain (e.g., parents' psychological symptoms) affects a different domain (e.g., parents' tobacco use) over time, controlling for any temporal relation between them and the stability of each domain.

Understanding the extent and timing of these cross-domain relations can assist researchers in identifying the significant developmental ages and risk and protective factors on which to focus in prevention and treatment programs. The pattern of findings suggests that interventions for externalizing behavior might target: a) parents' developmentally appropriate parenting practices throughout their offspring's childhood and adolescence; b) parents' (and potential parents') smoking in their twenties, as well as when their children are adolescents; and c) psychological attributes of adolescents and young adults.

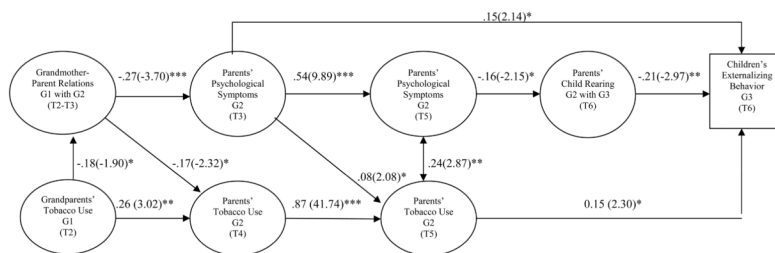
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Note: 1. RMSEA=0.055; SRMR=0.061; CFI=.94; Chi-Square=369.56, df=218;
 2. * p<.05; ** p<.01; *** p<.001 (one-tailed tests);
 3. Children's age range: 5-18;
 4. G1=First Generation; G2=Second Generation; G3=Third Generation;
 5. G1 education at T2, G2 gender, G2 age and marital status at T6, G2 alcohol use, marijuana use, and other illicit drug use at T2, G3 age at T6, and G3 gender were statistically controlled.

Figure 1. Standardized Pathways (z statistic) to Children's Externalizing Behaviors (N=230).

Table 1

Factor loadings for the measurement model (N=230).

	Child Rearing G2 with G3 (T6)	Parent's Psychological Symptoms G2 (T5)	Parents' Tobacco Use G2 (T4-T5)	Parents' Psychological Symptoms G2 (T3)	Parents' Tobacco Use G2 (T3-T4)	Grandmother-Parent Relations G1 with G2 (T2-T3)	Grandparents' Tobacco Use G1 (T2)
T6 Time spent with the child	1.00						
T6 Child-centeredness	3.62 (3.89)						
T6 Affection	2.55 (3.76)						
T6 Availability	.60 (3.68)						
T6 Discipline	-.70 (-2.93)						
T6 Satisfaction with the child	1.17 (3.28)						
T5 Depression		1.00					
T5 Anxiety		.87 (16.24)					
T5 Interpersonal difficulties		1.27 (18.14)					
T5 Current tobacco use			1.00				
T5 Tobacco use in the past five years			1.09 (25.64)				
T3 Depression				1.00			
T3 Anxiety				.85 (12.61)			
T3 Interpersonal difficulties				1.21 (13.23)			
T4 Current tobacco use					1.00		
T4 Tobacco use in the past five years					.95 (26.67)		
T3 Maternal satisfaction with child						1.00	
T3 Conflictual relations with the parent						-0.92 (-8.28)	
T2 Maternal satisfaction with child						.89 (10.82)	
T2 Conflictual relations with the parent						-.82 (-7.00)	
T2 Grandmother's current tobacco use							1.00
T2 Grandfather's current tobacco use							1.58 (2.43)

¹ All factor loading were significant at $p < 0.01$ (one-tailed test);

² Children's age range: 5-18;

³ G1=First Generation; G2=Second Generation; G3=Third Generation;

⁴ G1 education at T2, G2 gender, G2 age and marital status at T6, G2 alcohol use, marijuana use, and other illicit drug use at T2, G3 age at T6, and G3 gender were statistically controlled.

Standardized Total Effects and Total Indirect Effects of Each of the G1 and G2 Psychosocial Latent Constructs on G3 Externalizing Behaviors (N=230).

Table 2

Latent Variables	G3 Children's Externalizing Behavior (T6)	
	Standardized Total Effects (t-statistic)	Standardized Total Indirect Effects (t-statistic)
T6 Parents' Child Rearing (G2 with G3)	-.21 (-2.97)**	Not Applicable
T5 Parents' Tobacco Use (G2)	.13 (1.93)*	-0.02 (-1.24)
T5 Parents' Psychological Symptoms (G2)	.03 (1.71)*	.03 (1.71)*
T4 Parents' Tobacco Use (G2)	.11 (1.93)*	.11 (1.93)*
T3 Parents' Psychological Symptoms (G2)	.18 (2.60)**	.03 (2.23)*
T2-T3 Grandmother-Parent relations (G1 with G2)	-.07 (-2.63)**	-.07 (-2.63)**
G1 Grandparents' Tobacco Use (G1)	.04 (1.99)*	.04 (1.99)*

Note:

* p<0.05;

** p<0.01 (one-tailed test);

² Children's age range: 5-18;

³ G1=First Generation; G2=Second Generation; G3=Third Generation;

⁴ G1 education at T2, G2 gender, G2 age and marital status at T6, G2 alcohol use, marijuana use, and other illicit drug use at T2, G3 age at T6, and G3 gender were statistically controlled.

Appendix A

Partial Covariance Matrix of the Manifest Variables

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W		
T6 Children's externalizing behavior (A)	6.214																								
T6 Time spent with the child (B)	-0.705	8.336																							
T6 Child-centeredness (C)	-1.277	2.515	9.827																						
T6 Affection (D)	-0.876	1.348	5.591	6.657																					
T6 Availability (E)	-0.282	0.157	1.294	0.915	0.473																				
T6 Discipline (F)	0.971	-0.447	-1.317	-1.125	-0.282	3.035																			
T6 Satisfaction with the child (G)	-2.266	0.715	2.518	1.486	0.409	-0.981	5.128																		
T5 Parents' Current tobacco use (H)	0.502	-0.035	0.521	0.149	0.200	0.020	-0.198	3.469																	
T5 Parents' Tobacco Use in the Past 5 Years (I)	0.750	-0.191	0.422	0.027	0.102	-0.101	-0.101	3.141	3.606																
T5 Depression (J)	1.448	-0.019	-0.750	-1.016	-0.293	0.431	-0.569	1.067	1.044	10.759															
T5 Anxiety (K)	0.724	0.494	0.025	-0.415	-0.106	0.173	-0.444	0.975	0.915	7.039	8.543														
T5 Interpersonal difficulties (L)	1.747	0.618	-1.461	-1.787	-0.354	0.572	-1.374	1.404	1.548	10.179	8.773	15.112													
T4 Parents' Current tobacco use (M)	0.623	-0.233	0.435	-0.062	0.123	0.088	0.060	2.847	3.107	0.429	0.400	0.555	3.850												
T4 Parents' Tobacco use In the Past 5 Years (N)	0.562	0.000	0.215	-0.251	0.093	0.161	0.035	2.706	3.012	0.864	0.861	0.968	3.473	3.886											
T3 Depression (O)	0.959	0.927	-0.399	-0.823	-0.297	0.895	-0.942	0.469	0.629	3.972	3.291	4.399	0.252	0.612	8.440										
T3 Anxiety (P)	1.158	0.806	-0.171	-0.557	-0.225	0.316	-0.957	0.414	0.628	2.779	2.884	3.741	0.338	0.566	4.703	6.275									
T3 Interpersonal difficulties (Q)	1.139	1.089	0.142	-0.439	-0.275	0.331	-1.022	0.893	1.081	3.736	3.897	5.871	0.636	0.877	6.639	5.679	10.997								
T3 Confictual relations with the parent (R)	0.826	0.551	-0.476	-1.190	-0.114	0.687	-0.105	1.059	0.917	1.696	1.392	1.881	0.787	0.894	0.919	0.524	1.517	11.548							
T3 Maternal satisfaction with child (S)	-1.442	-1.564	-0.777	0.058	0.060	-0.935	0.016	-1.332	-1.408	-1.218	-0.885	-1.111	-1.425	-1.360	-2.168	-1.577	-2.275	-5.131	9.156						
T2 Confictual relations with the parent (T)	0.983	-0.546	-0.970	-0.717	-0.108	0.239	-0.351	0.057	-0.049	0.694	0.960	0.925	-0.016	-0.300	0.447	0.013	0.953	6.920	-3.601	11.686					
T2 Maternal satisfaction with child (U)	-0.880	-1.136	-0.181	-0.270	0.056	-0.278	0.198	-0.528	-0.605	-0.619	-0.487	-0.374	-0.851	-0.647	-1.438	-1.200	-1.640	-3.948	5.415	-4.259	7.503				
T2 Grandmothers' current tobacco use (V)	0.374	0.217	-0.137	-0.079	0.026	-0.084	0.245	0.404	0.300	0.400	0.165	0.488	0.423	0.207	-0.281	0.123	0.350	0.397	-0.301	0.436	-0.454	2.106			
T2 Grandfathers' current tobacco use (W)	0.189	-0.340	-0.508	-0.250	-0.015	0.139	0.218	0.471	0.440	-0.174	0.153	-0.059	0.697	0.573	-0.540	-0.303	-0.257	0.669	-0.336	0.157	-0.576	0.866	2.188		

Note: G1 education at T2, G2 gender, G2 age and marital status at T6, G2 alcohol use, marijuana use, and other illicit drug use at T2, G3 age at T6, and G3 gender were statistically controlled.