Developmental Cascades: Linking Academic Achievement and Externalizing and Internalizing Symptoms Over 20 Years

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A developmental cascade model linking competence and symptoms was tested in a study of a normative, urban school sample of 205 children (initially 8 to 12 years old). Internalizing and externalizing symptoms and academic competence were assessed by multiple methods at the study outset and after 7, 10, and 20 years. A series of nested cascade models was tested through structural equation modeling. The final model indicated 2 hypothesized cascade effects: Externalizing problems evident in childhood appeared to undermine academic competence by adolescence, which subsequently showed a negative effect on internalizing problems in young adulthood. A significant exploratory effect was consistent with internalizing symptoms containing or lowering the net risk for externalizing problems under some conditions. These 3 cascade effects did not differ by gender and were not attributable to effects of IQ, parenting quality, or socioeconomic differences. Implications are discussed for developmental models of cascades, progressions, and preventive interventions.

Keywords: competence, cascade, internalizing, externalizing, academic

More than 30 years ago, Kohlberg, LaCrosse, and Ricks (1972) concluded from a comprehensive review of extant research that the best and broadest predictors of adult adjustment from childhood were measures of social and cognitive adaptation that reflected cumulative cognitive development and socialization. In contrast, they noted that emotional problems were neither broad nor robust as predictors of adult adjustment, even though dimensions of emotion and temperament showed stability over time. At the same time, Kohlberg et al. lamented the paucity of longitudinal data in the field. Since this classic article was published, the emergence of developmental psychopathology has underscored the importance of understanding linkages among various forms of competence and symptoms, particularly the transactional and progressive associations that can be detected only in longitudinal studies (Hinshaw, 2002; Masten, Burt, & Coatsworth, in press; Masten & Curtis, 2000; Rutter & Sroufe, 2000). Nonetheless, there remain surprisingly few longitudinal studies that control for preexisting and ongoing concurrent associations so that models of bidirectional influences and progressive effects from one domain of adaptation to another can be evaluated in a developmental perspective. This study focused on linkages among externalizing behaviors, internalizing symptoms, and academic achievement over multiple assessments spanning 20 years in order to test a cascade model of externalizing behavior and academic achievement in relation to each other and internalizing symptoms over time.

Traditional measures of “competence” and “symptoms” may be linked within and across time for a number of reasons (Hinshaw, 1992; Masten et al., in press; Masten & Curtis, 2000). One set of possibilities is methodological, stemming from overlapping constructs, items, or informants that may produce spurious associations. In addition, there are at least three major substantive reasons why domains of competence and psychopathology may become linked across time:

1. Symptoms undermine adaptive functioning.

Aggressive or disruptive behavior, for example, could interfere with learning in a classroom and alienate peers or teachers.

2. Failures in adaptive functioning contribute to symptoms.

By definition, salient developmental tasks constitute major criteria by which children are judged in society, by others, and by themselves, and failure in these tasks could have many negative con-
sequences on self-perceptions or judgments of others that lead to increased internalizing or externalizing symptoms over time. We posit that competence in age-salient developmental tasks plays a central role in the long-term risks for development associated with emotional and behavioral problems.

These two substantive ways that competence and symptoms may influence each other could occur simultaneously or in various combinations over time, producing phenomena variously described in developmental psychopathology theory in terms of amplification, snowballing, transactional, cascade, or progressive effects, depending on the nature of the domains and processes presumed to be involved (Cicchetti & Tucker, 1994; Dodge & Pettit, 2003; Hinshaw & Anderson, 1996; Masten & Coatsworth, 1998; Patterson, Reid, & Dishion, 1992; Sameroff, 2000). Such progressions would account for what appear to be spreading or diffusing effects over time, including those long ago noted by Kohlberg et al. (1972) for antisocial behavior.

Although the first two possibilities emphasize the causal connections of competence and symptoms to the exclusion of other factors, it is important to point out a third major possibility. Competence and symptoms could become linked when

3. some other cause contributes to both competence and symptoms,

creating a spurious effect, the illusion of a causal link in either direction that is actually related to unmeasured variables and the causal processes or continuity they represent (Masten et al., in press; Masten & Curtis, 2000).

In terms of cascade effects and continuity, externalizing behavior has shown considerable stability from quite early in childhood, and there are indications of transactional and spreading effects in relation to other domains of adaptation, particularly academic achievement (Dodge & Pettit, 2003; Hinshaw, 1992; Maguin & Loeb, 1996). The evidence available suggests that antisocial behaviors and academic skills are linked even before school begins (Hinshaw & Anderson, 1996). Nonetheless, antisocial behavior appears to undermine academic achievement throughout the school years (Bardone, Moffitt, Caspi, Dickson, & Silva, 1996; Chen, Rubin, & Li, 1997; Hawkins et al., 2003; Masten et al., 1995; Risi, Gerhardstein, & Kistner, 2003; Williams & McGee, 1994). The evidence is not as clear in the other direction, particularly during the early school years. However, by secondary school, academic failure does appear to contribute to worsening antisocial symptoms, perhaps as a result of disaffection from normative schoolmates and activities and association with deviant peers (e.g., Deater-Deckard, 2001; Dishion, Patterson, Stoolmiller, & Skinner, 1991; Patterson, Forgatch, Yoerger, & Stoolmiller, 1998; Williams & McGee, 1994). Conversely, it has also been noted in the developmental literature that higher levels of academic performance are associated with desistance from law-breaking behavior (Maguin & Loeb, 1996; Thornberry, Lizotte, Krohn, Smith, & Porter, 2003). Elder and Conger (2000), in summarizing conclusions from their comprehensive study of Iowa farm families, noted the salience of academic success in “minimizing problem behavior of all kinds” (p. 215), particularly antisocial and risk-taking behavior. Moreover, preventive interventions that boost competence at school have shown corresponding reductions in the risk for developing problem behaviors (e.g., Hawkins, Catalano, Kosterman, Abbot, & Hill, 1999), though it is not clear whether such interventions work by reducing the corrosive effects of externalizing behavior or by improving academic skills.

Evidence linking internalizing symptoms to academic achievement over time is sparser and less consistent by comparison, although internalizing symptoms have shown more stability and predictive validity than Kohlberg et al. (1972) and other early reviewers anticipated. Anxiety, depression, and general internalizing symptoms have predictive significance for a spectrum of emotional disorders and problems and also have shown signs of reciprocal linkages over time with peer social adjustment (Harrington & Clark, 1998; Lewinsohn, Rohde, Klein, & Seeley, 1999; Masten et al., in press; Masten & Coatsworth, 1995; Pine, Cohen, Gurley, Brook, & Ma, 1998; Rubin, Bukowski, & Parker, 1998; Rubin, Chen, McDougall, Bowker, & McKinnon, 1995). The evidence linking internalizing problems with academic achievement suggests that objective and perceived academic failures are related to change in internalizing symptoms and, conversely, that achievement gains predict changes in depressive symptoms, although the evidence is somewhat inconsistent with respect to time intervals and gender (Chen, Rubin, & Li, 1995; Cole, Martin, & Powers, 1997; Kellam, Rebok, Mayer, Ialongo, & Kalodner, 1994; Maughan, Rowe, Loeb, & Stouthamer-Loeb, 2003).

With regard to the academic consequences of internalizing problems, evidence is limited and mixed. For youth who meet criteria for psychiatric diagnoses of anxiety disorders and depression (i.e., those above diagnostic thresholds), serious academic problems have been noted both currently and in the future (Bardone et al., 1996; Bernstein & Borchardt, 1991; Kovacs & Devlin, 1998). For broader studies of the predictive significance of scores on a continuously distributed internalizing symptom dimension, there are few studies testing whether internalizing symptoms predict changes in the course of academic achievement, and results are inconsistent (e.g., Cole, Martin, Powers, & Truglio, 1996; Roeser, Eccles, & Sameroff, 2000).

Given that externalizing symptoms could also be viewed as indicating poor competence in the domain of rule-governed behavior, a widely expected developmental task faced by children, it is also important to consider how externalizing and internalizing symptoms might influence each other over time. Longitudinal data in the literature present a complex picture (see Angold, Costello, & Erkanli, 1999; Cicchetti & Toth, 1991; Lahey, Loeb, Burke, Rathouz, & McBurnett, 2002; Rubin, Hymel, Mills, & Rose-Kransor, 1991). Some data implicate externalizing symptoms as a predictor of changes in internalizing symptoms, as expected on the basis of failure models (Capaldi, 1992; Garber, Quiggle, Panak, & Dodge, 1991; Kiesner, 2002; Lahey et al., 2002; Loeb & Keenan, 1994; McGee, Feehan, Williams, & Anderson, 1992; Robins, 1986). Moreover, some studies suggest that peer rejection or academic achievement (or both) could play a mediating role in linkages between externalizing behaviors and internalizing symptoms, though relevant data are limited and inconsistent (Kiesner, 2002; Panak & Garber, 1992; Rubin et al., 1991, 1998).

In regard to the possibility that internalizing symptoms may influence externalizing symptoms over time, findings again are somewhat mixed, though data are mounting to suggest that internalizing symptoms may constrain the development of antisocial or risk-taking behavior, providing a kind of braking system that may be related to inhibition, withdrawal, or the protection afforded by self-isolating behavior when peers are deviant (Farrington, 1995;
Kellam, 1990; Loeber & Keenan, 1994; Mesman, Bongers, & Koot, 2001; Moffitt, Caspi, Harrington, & Milne, 2002; Verhulst, Eussen, Berden, Sanders-Woudstra, & Van Der Ende, 1993). Thus, even as internalizing symptoms index a higher risk for future depression and anxiety, they could, in some situations, index lower risk for externalizing problems.

The risk literature for externalizing and internalizing symptoms and for academic achievement also provides clues about potential common causes that could underlie associations among these domains of adaptation, converging on intellectual ability, parenting quality, and socioeconomic status (SES) as three salient risk markers (Cicchetti & Toth, 1991; Farrington, 1995; Hinshaw, 1992; Loeber, 1990; Masten & Coatsworth, 1998; Masten & Curtis, 2000; Mcloyd, 1998). Numerous other risk factors and more differentiated aspects of these global markers of psychosocial advantage and disadvantage could be delineated (e.g., executive functioning, harsh parenting, residential mobility related to poverty); however, this trio represents a strong set of broad psychosocial risk indicators. These risk factors tend to covary with each other as well as with past, present, and future child achievement and symptoms. On the lower end, intellectual functioning, parenting, and SES have been implicated as risk factors for externalizing symptoms and academic problems; on the higher end, these factors have been implicated as assets for good conduct and academic success (Bradley & Corwyn, 2002; Elder & Conger, 2000; Farrington, 1995; Hinshaw, 1992; Maguin & Loeber, 1996; Masten et al., 1988, 1999; Tremblay & Craig, 1995). Psychosocial disadvantage and low quality of parenting and parent–child relationships have been noted as risk factors for internalizing symptoms and disorders as well (Cicchetti & Toth, 1991; Harrington & Clark, 1998; Lewinsohn, Clarke, Seeley, & Rohde, 1994). Nonetheless, it is rare for these salient predictors of competence and symptoms to be controlled when causal models about cascades and progressions are tested.

Taken together, the literature linking broad externalizing, internalizing, and academic behavior domains over time suggests that there may be developmental cascades by which functioning in one domain of adaptive behavior spills over to influence functioning in other domains in a lasting way. Capaldi, Dishion, Patterson, Reid, and their colleagues at the Oregon Social Learning Center (Eugene, OR) have argued for such progressions in their coercion–dual failure models of how antisocial behavior leads to academic and social problems that in turn contribute to depression and other internalizing symptoms (Capaldi, 1992; Patterson, 1986; Patterson, Reid, & Dishion, 1992). Similarly, numerous investigators have noted the heterotypic, negative, and broad implications of antisocial behavior in childhood for later adaptation (Moffitt et al., 2002). In the internalizing spectrum of problems, Cicchetti and Schneider-Rosen (1986) were early proponents of a developmental theory of depression in which failure to master the social, cognitive, and emotional tasks in one era of development creates vulnerabilities for future failure and depression as individuals face new challenges.

In dynamic systems theory, more generally, changes in one area of functioning can trigger a sequence of consequences that ultimately have large developmental effects (Sameroff, 2000; Thelen, 1989). Describing such developmental cascades, Thelen (1989) noted, “Changes in any one domain therefore may become amplified and have system-wide reverberations” (p. 94). Implicit in all theories of development that focus on the transactions among individuals and other systems is the possibility of spreading effects that result from dynamic interactions over time. Interventions to prevent or contain such progressions of behavior along maladaptive pathways in development require better understanding of positive and negative cascades in development.

This study tested a cascade model in which externalizing behavior undermines academic achievement, which in turn not only increases subsequent externalizing behavior but also raises the risk for later internalizing symptoms. Data to test this model were drawn from a longitudinal study of a normative school cohort of 205 children who have been followed up three times, after approximately 7, 10, and 20 years, to early adulthood. This study was unusual in its focus on competence, defined as success in salient developmental tasks, with multiple methods and informants of multiple competence domains as well as internalizing and externalizing symptoms. Earlier examinations of the structure and coherence of competence in this longitudinal study have indicated that the competence domain of conduct (rule-abiding or compliant vs. rule-breaking or antisocial behavior) predicted changes in academic achievement across the first 10 years of the study, although the reverse was not found (Masten et al., 1995). Traditional symptom measures of internalizing and externalizing problems were not included in these prior analyses.

This article includes four assessments of symptoms and academic competence available to date in this 20-year study, in order to test a cascade model linking externalizing symptoms, internalizing symptoms, and academic achievement over time from childhood to adulthood. Overall, the analytic strategy, using structural equation modeling, was designed to conduct a long-term, longitudinal, and robust test of cascade effects.

The conceptual model is presented in Figure 1 (represented as Model 2 in the nested comparison models presented below). Concurrent associations in time are not shown, though all three domains were expected to covary within time. Across time, we expected stability within each domain of functioning, beyond any stability related to covariance with other domains. In other words, we expected coherence within these broad aspects of adaptive functioning. Given the literature and earlier analyses from this study, we expected strong coherence for externalizing and academic achievement across each follow-up, particularly once the cohort reached the high school years and beyond. Moreover, academic attainment is cumulative in nature, which means that stability would be expected to increase over time. More modest stability was expected for internalizing symptoms because this domain of behavior appears to have less cumulative accretion over time than externalizing and academic domains of behavior and less coherence over long periods of time in the limited longitudinal data available that spans childhood to adulthood.

The cascade aspect of this model is based on two broad hypotheses. First, externalizing symptoms were expected to undermine academic attainment across time, beginning in childhood. Second, given the extant literature, academic achievement in adolescence and beyond was expected to influence both externalizing and internalizing symptoms over time. As a result of these two general expectations, externalizing symptoms were expected to cascade to academic achievement and then indirectly via academic achievement to internalizing symptoms. Transactional effects were expected between academic and externalizing symptoms across time, particularly during the school years. We viewed these two broad
hypotheses as providing the most parsimonious cascade model based on the current literature.

All other cross-domain longitudinal linkages were viewed as exploratory, though some held particular interest. Given the growing number of studies indicating that social inhibition or anxiety may contain the growth of antisocial behavior in adolescence, internalizing scores could show a negative predictive relation to change in externalizing symptoms scores, even though these two kinds of symptom scores usually covary positively, particularly within time. As described earlier, however, the longitudinal evidence in this regard, though intriguing, is not consistent. The effects of externalizing behavior on internalizing symptoms were also examined in exploratory analyses.

To test the conceptual model, we considered a series of five conceptually based, nested models. In addition to the hypothesized model, four alternatives were considered, one model that was more parsimonious than the hypothesized cascade model (reflecting no cascades) and three other alternative models that were less parsimonious (reflecting additional cascades). The most parsimonious alternative model allowed only the paths reflecting continuity within the three domains of interest over time (externalizing, academic, internalizing). The model shown in Figure 1 represents the conceptual model, which was the most parsimonious cascade model considered. Three additional hierarchically nested models included additional exploratory cascade effects, reflecting cascade possibilities described above. First, earlier academic to externalizing and internalizing cascades were added. Next, externalizing by internalizing cascade paths were added. Finally, paths from internalizing to academic competence were added in the most comprehensive cascade model tested.

Once the most plausible model among these five alternative models was identified, the effects of gender and key control variables were examined. Gender differences in cascade and continuity effects were tested in a systematic set of nested models. Finally, significant cascade effects were specifically put to the further test of including latent variables and paths to control for IQ, parenting, and SES pertinent to those cascades.

Method

Sample and Procedure

Participants were drawn from a sample of 205 children (91 boys and 114 girls) whose families have participated in a longitudinal study of competence and resilience (Garmezy & Tellegen, 1984; Masten et al., 1988, 1995, 1999; Roisman, Masten, Coatsworth, & Tellegen, 2004). This cohort was recruited when the children were 8 to 12 years old, attending third through sixth grade in two elementary schools in the same catchment area, a diverse urban neighborhood in Minneapolis, Minnesota. The original cohort was followed up after 7, 10, and 20 years, with high retention rates (e.g., 90% participated in the 20-year follow-up, when the cohort was around age 30).

The participants' schools were located in a lower- to middle-class area of Minneapolis; SES among the children’s families ranged from 7 to 92.3 on the 100-point Duncan Socioeconomic Index, with a sample mean of 43 (the equivalent of skilled labor or clerical positions). Twenty-nine percent of the sample was composed of ethnic–racial minorities, including biracial children (18% African American, 7% American Indian, 3% Hispanic, and 1% Asian). The sample also included 26 sibling pairs.

Extensive multimethod, multi-informant data were collected on the cohort at the outset of this longitudinal project (T1), with unusually thorough data on competence and symptoms of psychopathology, family history and activities, and many other attributes of child and family. There was a less extensive assessment about 7 years after the study began (T2), conducted primarily by mail, including adolescent and parent reports, plus school records, and resulting in follow-up data for 88% of the cohort. The 10-year follow-up (T3) was again extensive, including interviews, self-report questionnaires, and test sessions with the participant as well as the parent or guardian who was part of the study. Follow-up informan was obtained for nearly the entire cohort (98%) at T3. The most recent follow-up at around age 30 (T4) was designed to be conducted by mail, including many of the same questionnaires as the assessment around age 20 (10-year follow-up), with some modification to be developmentally appropriate. In some cases, at the preference of participants, these questionnaires were completed in person or by telephone. Five of the original cohort members could not be located, and 2 had died. Of the known living original cohort of 203, 183 of the young adults (90%) participated. Nonparticipants at Time 4 (for any reason, including death) were more likely to be male, $\chi^2(1, N = 205) = 8.02, p < .01$.

For most assessments, there were multiple informants, including the target child and the participating parent or guardian. For example, at T2, for
176 adolescents who provided self-reports, 100% of their parents also provided data about them. At T3, when 189 of the original 205 target youth provided self-report data, 95% of their parents also provided data. At T4, parent-informant data were available for 86% of the 183 young adult participants.

For each assessment of this study, an effort was made to assess multiple domains of competence reflecting important developmental tasks of the present, past, and future as well as externalizing and internalizing problems. Analyses for the current study made use of multimethod, multi-informant data on academic competence, externalizing problems, and internalizing distress from each of the four assessments of this long-term longitudinal research project (T1 to T4). Measures are described below by domain, with descriptions of how variables were developmentally tailored to participants as they aged.

Procedures during all phases of this 20-year investigation were reviewed and approved by the local institutional review board. When the members of the longitudinal cohort were children, permission from a parent or guardian was obtained for a child to participate; the child also was provided an opportunity to assent or decline participating in each aspect of the data collection after the procedures were explained in age-appropriate language. For parents and also for the participants in adulthood, adults were informed and consented to their own participation.

Measures

Academic competence. T1 academic competence (Acac1) was assessed by four indicators: the total score on the Peabody Individual Achievement Test (Dunn & Markwardt, 1970), grade point average from the school record in the 1st year of the study, a teacher rating from the Devereux Elementary School Behavior Rating Scale (Spivack & Swift, 1967), and a composite variable based on three structured questions from the parent interview (e.g., “How is X doing in school”; α = .80). Standardized total scores on the Peabody Individual Achievement Test were consistent with the normative nature of the sample (M = 97.0, SD = 12.3). During middle adolescence, T2 academic competence (Acac2) was assessed by using six sources of information. These included the following: self-reported grade point average, grade point average as gleaned from official school records, clinical ratings based on participant and parent versions of a Status Questionnaire (SQ) item tapping level of educational success (e.g., “How well is X doing in school”; rater ICC = .97 for parent and .94 for adolescent SQs), and two additional scores based on items from adolescent or parent Competence Rating Scales (CRS) that were adapted from the Perceived Competence Scales developed by Harter (1982), in consultation with her (see Masten et al., 1995). The adolescent score was based on one self-report item (“some teenagers do very well in their classroom”), and the score from the parent-reported measure was a composite of two corresponding CRS items ratings (α = .93). The T3 academic competence (Acac3) construct around age 20 was based on four indicators: clinical ratings of achievement based on adolescent self-report SQs (rater ICC = .93), parallel but independent ratings based on parent SQ reports (rater ICC = .85), interviewer’s ratings of grades and attainment based on an interview with the adolescent (rater ICC = .85), and interviewer ratings of academic performance based on parent interview (rater ICC = .84). The indicators used to assess participants’ level and quality of T4 academic competence (Acac4) included a clinical rating of educational success based on participants’ descriptions of their educational experiences (rater ICC = .90) and parallel two-item SQ composites from participant (α = .66) and parent (α = .62), tapping level of educational attainment and educational success. For additional information about the assessment of academic competence in this study, the reader is referred to Masten et al. (1995, 1999); Neumann, Hubbard, and Masten (1995); and Roisman et al. (2004).

Externalizing problems. T1 externalizing problems (Ex1t) were assessed via parental report. Parents filled out the Developmental Questionnaire, a symptom checklist used in psychiatric assessments at clinics in Minneapolis prior to publication of the Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983) that nonetheless contained much overlap with the CBCL, using a similar three-category response format. Two indicators of externalizing problems—aggression and delinquency—were computed from items closely paralleling items on the CBCL. Aggression consisted of the following items: demands a lot of attention, suddenly changes from happy to sad, bullies other children, showing off, and stubborn (α = .76). Delinquency consisted of the following items: has run away, vandalism, fire-setting, stealing, drug/alcohol use, swearing, lying, sniffling glue, and truancy (α = .62). For T2 externalizing (Ex2t), Achenbach’s CBCL (Achenbach, 1991a; Achenbach & Edelbrock, 1983) and Youth Self-Report (YSR; Achenbach, 1991b; Achenbach & Edelbrock, 1987) measures were available to assess broadband externalizing problems, and aggression and delinquency scores were available for both parent and self-report. At T3, the cohort was too old for the Achenbach measures available at the time, and externalizing problems (Ex3t) were assessed by using six broad indicators, including two variables derived from independent clinical ratings of “seriousness of trouble with the law” based on the parent and adolescent SQs (rater ICC = .77 for parent and .92 for adolescent), a composite of antisocial ratings based on a parent interview (α = .80), a composite of aggressive–disruptive interactions with peers based on the adolescent interview (α = .83), and composite scores on two aggression items from the T3 versions of the CRS (see Masten et al., 1995; α = .60, for parent report; α = .54 for self-report). At T4, around age 30, externalizing problems (Ex4t) were assessed by the recently published adult versions of Achenbach’s (1997) CBCL and YSR, namely, the Young Adult Behavior Checklist (YABCL) for parental informants and the Young Adult Self-Report (YASR). Scores on the externalizing subscales of Aggression, Delinquency, and Intrusive were taken from this measure. Standardized (T scores) means for externalizing (the broadband total score) on the YSR and the YASR were consistent with the normative nature of the sample: 54.1 (SD = 10.0) for the YSR, and 49.3 (SD = 9.3) for the YASR.

Internalizing symptoms. At T1, symptoms of internalizing problems (Int1t) were identified by parental informants, who filled out a symptom checklist containing much overlap with the CBCL, as described earlier for Ex1t. Three indicators of internalizing problems were computed to parallel Achenbach’s factor structure: Anxious/Depressed (tense, fearful, worries, cries easily, perfectionistic, depressed, feeling unloved, feelings of inferiority, and feeling lonely; α = .80), Withdrawn (depressed, slow or lacking energy, and shyness; α = .42), and Somatic Complaints (body aches, headaches, and stomach problems; α = .78). At T2, for internalizing symptoms (Int2t), CBCL and YSR measures were available. Self- and parent-report subscales of Anxious/Depressed, Withdrawn, and Somatic Complaints were taken from this measure. At T3, internalizing symptoms (Int3t) were assessed by using the commonly used and well-validated Symptoms Checklist—90—Revised (SCL—90—R), a self-report measure of distress with diverse internalizing symptoms (Derogatis, 1977/1983). Three indicators were derived from subscales representing the broad internalizing dimension: Anxiety (α = .88), Depression (α = .89), and Somatization (α = .82). At age 30 (Time 4), Achenbach’s (1997) YABCL for parental informants and the YASR were administered to assess internalizing symptoms (Int4t); scores on the Anxious/Depressed and Withdrawn subscales were used in accordance with the hierarchical factor structure of this measure. Again, the broadband T scores for the Achenbach measure suggested a sample with a generally normative level of symptoms and distribution on this measure: Internalizing (T score) means were 51.5 (SD = 9.4) for the YSR and 49.5 (SD = 9.9) for the YASR.

Control variables. In childhood and at the 10-year follow-up, general intellectual functioning (IQ1t) was estimated on the basis of the two subtests of Wechsler scales that have shown the highest correlation with the full-scale IQ: Vocabulary and Block Design. At T1, two subtests of the Wechsler Intelligence Scale for Children—Revised (Wechsler, 1974) were administered; at T3, the comparable subtests of the Wechsler Adult Intelligence Scale—Revised (Wechsler, 1981) were administered (IQ2t). Parenting quality was estimated on the basis of global parenting composite scores derived from independent interviews of parent and child or adoles-
cent at Times 1 and 2, which included many questions about the nature of
their relationship and other aspects of parenting (see Masten et al., 1988,
1999). At Time 1, two global parenting quality scores, each capturing
closeness, warmth, and structure, were derived from the parent interview
(12 ratings; \( \alpha = .94 \)) and child interview (10 ratings; \( \alpha = .89 \)). The quality
of parenting in middle adolescence (T3) focused on closeness, because struc-
ture and discipline were no longer age-appropriate indicators of parenting
quality. Four composite variables were used as indicators of parenting
quality at T3; these were derived from (a) a composite of eight clinical
ratings of relationship quality based on the parent interview (\( \alpha = .95 \)), (b)
a global rating of closeness based on the adolescent interview (ICC = .87),
(c) a composite score derived from ratings of SQs completed by partici-
pants (\( \alpha = .86 \)), and (d) a composite score derived from ratings of SQs
completed by parents (\( \alpha = .84 \)) (see Masten et al., 1999).

SES was indexed by a single indicator, the Duncan Socioeconomic Index
(Hauser & Warren, 1997), utilizing values available for the most pertinent
U.S. Census at the time of a particular assessment. This score was calcu-
lated for the occupation of head of household (whichever stable parenting
adult in the household had a higher index), both at the outset of the study
(SES1) and at the 10-year assessment (SES3).

Statistical Analysis

The main statistical analyses for this study were carried out with Mplus
Version 3.01 (Muthén & Muthén, 2004). There were three data issues to
consider in this analysis: (a) missing data, (b) nonnormality of some
indicators, and (c) dependence of observations among siblings. Descriptive
statistics (not presented) showed that the percentage of missing data varied
by indicator and time, ranging from 0% to 16% with a mean of 8% over all
indicators and times. In order to maintain relatively high power, the
missing data were treated as ignorable (i.e., missing at random) and a
variant of maximum likelihood estimation was used that allowed for the
total sample of 205 to be analyzed. Descriptive statistics also indicated that
several of the indicators were skewed (usually positively). To account for
the nonnormality, we used a robust maximum likelihood estimator (MLR
in Mplus; see chapter 15 in Muthén & Muthén, 2004). Dependence of
observations among the 26 sibling pairs was addressed by an embedded
cluster model in each structural model. Under this scenario, the MLR
estimator is robust to nonindependence of observations.

To determine acceptable absolute fit of the models, the standardized
root-mean-square residual (SRMR) was used in conjunction with the
comparative fit index (CFI), though two other indices were included for
comparison: the Tucker–Lewis Index and the root-mean-square error of
approximation. For fit to be judged acceptable, SRMR had to be less than
.08 and the CFI had to be greater than .90 (simultaneously). However, it
should be noted that these criteria were admittedly arbitrary as it is unclear
what the absolute fit reference standard should be when a robust estimator
is used with the sample size of this study (Hu & Bentler, 1998, 1999;
Marsh, Hau, & Wen, 2004). Relative fit was evaluated with a scaled
chi-square difference test for nested models (Satorra, 2000). Each of the
more parsimonious models was compared with the next most complex
model.

Measurement models. The main analysis consisted of testing a series
of nested cascade models (see below). Prior to this, the measurement
models were evaluated for each construct at each time point. Initially,
disaggregated indicators were used for each construct. Based on prelimi-
nary analyses not presented, good model fits were obtained at Times 1 and
3 but not at Times 2 and 4. The misfit at the latter time points was largely
due to the CBCL items, which was remedied by taking composites within
informant (parent and target) for those two time points and allowing
common informant composites to have correlated residuals. The final
indicators, including such aggregation, are shown in Table 1, listing infor-
mant, standardized loadings, and \( R^2 \) values based on the most plausible
model from the cascade analysis discussed below (Model 4).

Cascade analysis. A series of theoretically determined nested models
were fit by using the robust methods described above to determine the most
plausible model. Table 2 shows the important directed paths of the models.
Model 1 is the continuity model consisting of first-lag directed arrows
within constructs. All the remaining models have the same continuity
structure as Model 1 but also add diagonal-directed arrows specifying
various types of cascade effects. Thus, Model 1 is the most parsimonious,
and Model 5 is the least parsimonious. In addition to the continuity paths,
all the models in Table 2 had within-time cross-sectional construct corre-
lations; for example, Ext1, Aca1, and Int1 were all correlated with each
other. When the same measures were used at different times, their residuals
were allowed to correlate—for example, parent report on the CBCL at T2
and on the YABCL at T4. Standardized results were considered for all
models because different indicators were used at different time points.

Model 2 ("hypothesized cascades") added seven cross-domain paths to
the basic continuity model, representing our key cascade hypotheses noted
above. Model 3 ("academic cascades beginning earlier") added an addi-
tional two paths from academic competence at T1, representing a poten-
tially earlier time frame for effects of school performance. Model 4
("adding Ext x Int links") added an additional six paths describing the
exploratory direct links between externalizing and internalizing problems
for each time interval. Finally, Model 5 ("full cascade model") added an
additional three paths from internalizing problems to academic competence
and thus included all possible cross-domain paths with a single time lag.

Gender analysis. Subsequent to the cascade analysis, we wanted to
assess to what extent the most plausible model (Model 4, see below) was
invariant across gender. Gender differences were tested by constraining
different parameters across groups for the most plausible model. Similar to
the cascade analysis, a series of three nested models were tested, beginning
with the most parsimonious. The most constrained model (Model A)\(^2\) had
the following paths equal across gender groups: the measurement model
paths (37 paths, not shown), the cascade paths (15 paths, see Model 4 in
Table 2), and the continuity paths (9 paths, see Model 1 in Table 2). To
ensure convergence, we allowed the cross-sectional correlation paths, the
repeated measures paths, and the residual paths to vary. The next model
(Model B) allowed the continuity paths to vary across gender groups, so
only the measurement model paths and the cascade paths were constrained
to be equal. The final and least constrained (i.e., least parsimonious) model
(Model C) allowed all the paths to vary across groups, except for the
measurement model paths.

Control variable analysis. A final goal of the analysis was to deter-
mine whether the significant cascade paths of the most plausible model
(Model 4, see below) would persist when intellectual functioning, parent-
ing quality, and SES were introduced into the model. That is, we wanted
to test whether significant directed cascade paths between two latent
variables might be explained by common dependency on the control
variables. As noted above, latent variable models were used for IQ and
parenting quality because multiple indicators were available for both. SES
was specified as a manifest variable because there was only one indicator.
The control variables were embedded in the larger most plausible cascade
model to create spurious association or "third variable" models for each
cascade path. If a directed cascade path was significant in the cascade
analysis (without the control variables), then the control variables had
directional paths to the two latent variables on each side of the path. Figure
2 shows an example of such a model for one cascade path. T1 indicators
of control variables were used for T1 to T2 and T2 to T3 cascades, and T3
indicators were used as controls for T3 to T4.

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1 More complex second- and third-lag continuity models were also
tested but did not have significantly better fit.

2 Letters are used to denote the gender models to distinguish them from
the cascade models, which use numerals.
Table 3 shows the results for relative and absolute model fit for the cascade analysis. The SRMR and CFI values indicate that Model 1 had unacceptable fit (CFI = .896, SRMR = .113), as did Model 2 (CFI = .905, SRMR = .082). Model 3 had marginal fit (CFI = .908, SRMR = .077). Model 4 had acceptable fit (CFI = .914, SRMR = .073), as did Model 5 (CFI = .915, SRMR = .071). The results for relative fit are in the left-hand columns of Table 3. The $c$ coefficient in the table is the scaling constant used in the chi-square difference tests (see Satorra, 2000). Recall that when the chi-square difference test is significant, the more parsimonious model is rejected in favor of the model with more parameters. The chi-square difference tests show that Model 4 fits significantly better than the three more parsimonious nested models (Models 1 to 3) but fits equally well as Model 5.

The totality of the absolute and relative fit results argues for the adoption of Model 4 as the most plausible model among those tested. Model 4 was the most parsimonious model to have accept-

$\text{Note. } DQ =$ Developmental Questionnaire; GPA = grade point average; PI = Parent Interview; PIAT = Peabody Individual Achievement Test; CBCL = Child Behavior Checklist; YSR = Youth Self-Report; CRS = Competence Ratings Scales; SQ = Status Questionnaire; Rater-P = rating based on parent information; Rater-S = rating based on target information; AI = Adolescent Interview; SCL-90 = Symptom Checklist–90—Revised; YABCL = Young Adult Behavior Checklist; YASR = Young Adult Self-Report.
Table 2
Hierarchically Nested SEM Models Tested in the Cascade Analysis

<table>
<thead>
<tr>
<th>T1 to T2 cascade path</th>
<th>T2 to T3 cascade path</th>
<th>T3 to T4 cascade path</th>
</tr>
</thead>
</table>
| Model 1—Continuity model (included in all subsequent models) | Model B had significantly better fit than the more constrained model but equal fit to the most unconstrained model. Thus, Model B is the most plausible model. Recall that Model B constrained the measurement model paths and the cascade paths to be equal across the gender groups, but the continuity paths and cross-sectional correlations were allowed to vary. Inspection of the individual paths for both gender groups indicated differences in certain continuity and cross-sectional correlations. These differences are noted in Figure 3 (the G superscript). The continuity path of Int3 to Int4 was significant and positive for males but not significant for females. The cross-sectional correlations of Ext with Aca at T1 and T2 were both significant and negative for females but not significant for males. Finally, the cross-sectional correlation of Ext2 and Int2 was significant and positive for females but not significant for males. The significant cascade paths (Ext1 to Aca2, Int2 to Ext3, and Aca3 to Int4) did not differ by gender.

Control Variable Analysis

The goal of the control variable analysis was to examine the sensitivity of the significant cascade paths in Model 4. Recall that in Model 4, there were three significant cascade paths, Ext1 to

able absolute fit, and it had significantly better fit than the simpler models but equally as good a fit as the more complex model (i.e., Model 5). Figure 3 shows the standardized path coefficients for the significant paths of Model 4. Omitted from the figure are the indicators and their factor loadings, which are listed in Table 1 (all factor loadings were significant). Figure 3 shows that all the continuity paths were positive and significant, with the exception of the path between Int3 and Int4, which was marginally significant (p < .06). Three of the directed cascade paths were significant and negative: Ext1 to Aca2, Int2 to Ext3, and Aca3 to Int4. In addition, there was a significant positive correlation between Ext and Int at T1 and T3 and negative correlations of Ext and Aca at T1 and T2. Path coefficients (and standard errors) for all of the cascade paths included in Model 4 are provided in Table 4.

Gender Analysis

Table 5 shows the results of relative and absolute fit for the gender analysis. As indicated by the CFI and SRMR columns, none of the models had acceptable absolute fit. However, the goal here was to assess gender differences, so the relative fit of the models was most important. The chi-square difference tests of relative fit indicate that Model B was significantly better fitting than Model A but equally good fitting as Model C. That is, Model B had significantly better fit than the more constrained model but equal fit to the most unconstrained model. Thus, Model B is the most plausible model. Recall that Model B constrained the measurement model paths and the cascade paths to be equal across the gender groups, but the continuity paths and cross-sectional correlations were allowed to vary. Inspection of the individual paths for both gender groups indicated differences in certain continuity and cross-sectional correlations. These differences are noted in Figure 3 (the G superscript). The continuity path of Int3 to Int4 was significant and positive for males but not significant for females. The cross-sectional correlations of Ext with Aca at T1 and T2 were both significant and negative for females but not significant for males. Finally, the cross-sectional correlation of Ext2 and Int2 was significant and positive for females but not significant for males. The significant cascade paths (Ext1 to Aca2, Int2 to Ext3, and Aca3 to Int4) did not differ by gender.

<table>
<thead>
<tr>
<th>T1 to T2 cascade path</th>
<th>T2 to T3 cascade path</th>
<th>T3 to T4 cascade path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 2—Hypothesized cascades (total of 7 cross-domain paths)</td>
<td>EXTABS &lt; .05, Aca ABS &lt; .05, Int &lt; .05</td>
<td>EXTABS &lt; .05, Aca ABS &lt; .05, Int &lt; .05</td>
</tr>
<tr>
<td>Model 3—Academic cascades beginning earlier (total of 9 cross-domain paths)</td>
<td>EXTABS &lt; .05, Aca ABS &lt; .05, Int &lt; .05</td>
<td>EXTABS &lt; .05, Aca ABS &lt; .05, Int &lt; .05</td>
</tr>
<tr>
<td>Model 4—Adding Ext×Int links (total of 15 cross-domain paths)</td>
<td>EXTABS &lt; .05, Aca ABS &lt; .05, Int &lt; .05</td>
<td>EXTABS &lt; .05, Aca ABS &lt; .05, Int &lt; .05</td>
</tr>
<tr>
<td>Model 5—Full cascade model across each time span (total of 18 cross-domain paths)</td>
<td>EXTABS &lt; .05, Aca ABS &lt; .05, Int &lt; .05</td>
<td>EXTABS &lt; .05, Aca ABS &lt; .05, Int &lt; .05</td>
</tr>
</tbody>
</table>

**Note:** Numbers denote time point of data collection. Arrows designate estimated paths. All models also include measurement model paths and the cascade paths to be equal across the gender groups, but the continuity paths and cross-sectional correlations were allowed to vary. Inspection of the individual paths for both gender groups indicated differences in certain continuity and cross-sectional correlations. These differences are noted in Figure 3 (the G superscript). The continuity path of Int3 to Int4 was significant and positive for males but not significant for females. The cross-sectional correlations of Ext with Aca at T1 and T2 were both significant and negative for females but not significant for males. Finally, the cross-sectional correlation of Ext2 and Int2 was significant and positive for females but not significant for males. The significant cascade paths (Ext1 to Aca2, Int2 to Ext3, and Aca3 to Int4) did not differ by gender.
Aca2, Int2 to Ext3, and Aca3 to Int4. The spurious association models based on the control variables were embedded in Model 4. Figure 2 shows an example of the spurious association model for the Ext1-to-Aca2 cascade path. The Time 1 control variables pointed to Ext1 and Aca2 and to Int2 and Ext3. The Time 3 control variables pointed to Aca3 and Int4. The control variables were allowed to correlate within time and between times.

To simplify the presentation, we do not report fits indices for the overall models but focus on the three cascade paths with and without the control variables. The main finding is that when the control variables were incorporated into Model 4, the previously significant cascade paths were still significant. In fact, the standardized regression weights were slightly larger in absolute value with the control variables in the model. On the other hand, certain continuity paths, such as Aca1 to Aca2, were no longer significant with the control variables in the model, in this case likely reflecting the strength of IQ scores as reliable markers of academic achievement. A full set of results pertaining to these analyses is available from the authors upon request.

Discussion

Results of this study are consistent with a broad cascade model by which functioning in one domain of behavior spreads to other domains, both directly and indirectly from childhood into adulthood. The general pattern observed in this study suggests that externalizing problems evident at the outset of the study undermined academic achievement by adolescence, which in turn contributed to externalizing problems in young adulthood. Thus, over and above whatever cascades and bidirectional influences may have already occurred by the outset of this study, externalizing problems evident in childhood appeared to forecast problems in all three domains by young adulthood, progressing from externalizing to academic to internalizing domains of adaptation. This pattern held for both genders and also with potential “common cause” variables (IQ, parenting, SES) controlled.

Expected reciprocal effects between externalizing symptoms and academic achievement were not significant across time, although the pattern of results was consistent with this possibility. The modest sample size may have affected the ability to detect some nonzero cascade paths; some of the paths between externalizing and academic achievement were close to significant with relatively large standardized coefficients (e.g., Ext3 to Aca4; see Table 4). Additionally, a negative correlation between externalizing and academic achievement was found within Times 1 and 2. This concurrent correlation could reflect transactional or unidirectional influences within a time frame too short for this study to capture. Similarly, externalizing and academic domains were already associated at the outset of the study, which again could reflect earlier unidirectional or bidirectional effects between these two major domains of adaptive functioning.

These results are congruent with recent and growing longitudinal literature suggesting influences over time across domains of adaptive functioning and also with Kohlberg et al.’s (1972) assertion decades ago that externalizing behavior problems and indicators of cumulative cognitive skills in childhood broadly forecast adult adjustment. In contrast, internalizing symptoms demonstrated little in the way of negative cascades over time to academic achievement in this normative sample. It is possible that internalizing symptoms have a shorter time window of influence than could be identified in this study as a result of the relatively long lag between assessments. It is also conceivable that negative cascades in the academic domain occur for subgroups that fall in the clinical range on internalizing problems. In addition, we surmise that the academic domain is not where the cascade effects for internalizing symptoms are likely to be most prominent. Social functioning has been most closely tied in the literature to internalizing symptoms, and the study of cascades between social competence and internalizing symptoms may reveal a different picture.

The linkages of internalizing and externalizing symptoms appear to be complex. These symptom domains were concurrently and positively linked from the outset of the study and, particularly for girls, in the emerging adulthood years. It is conceivable that these associations also reflect unidirectional or bidirectional influences of externalizing by internalizing symptoms occurring in short time intervals embedded within the concurrent associations of this study.

Results also suggest that internalizing symptoms predict a relative decline in externalizing problems from adolescence into emerging adulthood. This finding is consistent with the possibility that internalizing symptoms counteract growth in externalizing problems or that less internalizing (less inhibited) youth are more likely to increase (or decline more slowly) in externalizing problems than are their more inhibited counterparts. This result joins growing evidence that internalizing problems may index a process or personality trait that influences risk for externalizing behavior during adolescence and emerging adulthood, such as inhibition (Kerr, Tremblay, Pagani, & Vitaro, 1997). It also underscores the complexity of designating a particular domain of behavior as pervasively good or bad, risky or protective. What are termed internalizing symptoms may reflect behaviors that serve adaptive purposes under some conditions or for some outcomes, at the same time as they promote risk in other circumstances or for other outcomes. As noted above, effects also could differ by level of internalizing behavior, which we did not study.

The expected continuity over time within domains of adaptation was found. In the case of internalizing symptoms, spanning the 10-year interval from emerging adulthood to young adulthood, continuity was stronger for males, whereas females showed little coherence in this symptom domain over the transition to adulthood represented by this interval. This could be due to inadequate
measurement of internalizing symptoms, as well as to greater change within and across individual females over the transition from adolescence to adulthood.

Implications

The likelihood that one kind of problem may lead to another has important implications. Conceptually, such findings underscore the importance of models that encompass cascade as well as transactional effects and additional ways that co-occurring or sequential problems could arise (Angold, Costello, & Erkanli, 1999; Caron & Rutter, 1991; Masten et al., in press; Masten & Curtis, 2000). Once patterns of cross-domain influence and timing are identified and replicated, the processes by which they occur can be more specifically examined. Methodologically, such findings emphasize the importance of assessing multiple domains of behavior from the outset of a study and then repeatedly over time, in order to differentiate cascades from associations among competence and symptom domains present at the outset of a study and carried forward in time.

Figure 3. Standardized path coefficients for significant paths of Model 4. $R^2$ values are in parentheses. $\chi^2(537, N = 205) = 860.26; \Delta \chi^2(3, N = 205) = 4.84, ns$; comparative fit index = .914; Tucker–Lewis Index = .899; root-mean-square error of approximation = .054; standardized root-mean-square residual = .073. Numbers denote time point of data collection. Ext = externalizing problems; G = significant gender difference; Aca = academic competence; Int = internalizing problems. All numeric paths are significant at $p < .05$, except *$p < .06$.

Table 3

<table>
<thead>
<tr>
<th>SEM analyses</th>
<th>Difference test of relative fit</th>
<th>Absolute fit statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td># c.p.</td>
<td>$df$</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>552</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>545</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>543</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>537</td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>534</td>
</tr>
</tbody>
</table>

Note. SEM = structural equation modeling; # c.p. = number of cascade paths; $c$ = weighting constant for computing the chi-square statistic using the robust estimation method; Comp. = model comparison; $cd$ = weighting constant for the difference between two chi-square statistics using the robust estimation method; CFI = comparative fit index; TLI = Tucker–Lewis Index; RMSEA = root-mean-square error of approximation; SRMR = standardized root-mean-square residual.

From the perspective of intervention, and particularly prevention, the possibility of developmental cascades and progressive adaptation problems spreading across domains of functioning has profound implications. It becomes critically important to study the processes, timing, and conditions of spreading and amplifying effects and to learn when to do what to interrupt negative progressions. This observation is not new. For example, Patterson and his colleagues at the Oregon Social Learning Center have argued this case for many years in the coercion model (Patterson, 1986; Patterson et al., 1992), as did Kellam and his collaborators in their developmental epidemiological model and prevention trials (Kellam & Rebok, 1992; Kellam et al., 1994). Many of the best intervention studies of our time were designed with such considerations in mind, either explicitly or implicitly (e.g., Fast Track [Dodge & Pettit, 2003]; Seattle Social Development Project [Hawkins et al., 2003]). Our point is simply that a far more systematic approach may be needed to fully address the issues raised by the possibility of cascades and transactions and that our prevention science and practice will be the better for it. It is quite
conceivable that the best way to prevent one kind of problem is to intervene earlier in another domain. Better knowledge of what, when, and how cascades occur will facilitate more strategic intervention. It is also conceivable that mental health professionals have underestimated or neglected the centrality of academic success and failure in the progression of mental health symptoms, because it falls under the purview of school professionals (Masten, 2003). Compartmentalizing the domains of child functioning in training, funding, research, and social services programs may also be contraindicated. There is growing recognition of this problem in the United States, with calls for more integrated sciences and services for children (e.g., National Advisory Mental Health Council’s Workgroup on Child and Adolescent Mental Health Intervention Development and Deployment, 2001; Power, 2003).

Limitations

This study had a number of limitations. The sample size of this longitudinal study was modest, but the method of analysis was complex. As noted above, some of the hypothesized cascade paths had relatively large standardized path coefficients, but their p values were just above alpha and thus were judged as inconclusive. Replication with a larger sample size might show additional significant paths. An additional limitation was that the sample, though diverse and similar to the local school district population of the time, was not a representative one. Thus, caution is in order about generalizing from this study. The intervals between assessments were long, varied, and not well suited to pinpointing when particular cascades may normatively occur or the precise processes by which they occur. This was a “big picture” study of broad adaptive patterns over time. Moreover, to limit the scope of this article, we focused this study on two major symptom domains and only one major developmental task domain (academic competence). Other major domains of developmental task competence, particularly peer social competence, have been strongly implicated in the cascade–transaction literature linking symptoms and adaptive behavior in age-salient developmental tasks (Dodge & Pettit, 2003; Masten, 2005; Masten & Curtis, 2000). The longitudinal literature on peer relationships strongly suggests cross-domain effects among peer acceptance or friendship, externalizing and internalizing symptoms that need to be examined further from the perspective of developmental cascades. Finally, this study focused on a normative cohort with a dimensional and variable-focused approach. Thus, these findings may not pertain to comorbidity issues in clinical samples. For example, internalizing behavior may demonstrate containment effects on externalizing behavior only in the normal range of functioning and not at the extremely high end or for youth with psychiatric disorders. Our sample was too small to examine this question, which is an important topic for future consideration in larger studies.

Table 4
Path Coefficients for All Cascade Paths Included in Model 4

<table>
<thead>
<tr>
<th>Cascade path</th>
<th>$\hat{\beta}^*$</th>
<th>$\hat{\beta}$</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext1 $\rightarrow$ Aca2</td>
<td>$-0.28$</td>
<td>$0.21$</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Ext1 $\rightarrow$ Int2</td>
<td>$-0.28$</td>
<td>$0.32$</td>
<td>.7929</td>
<td></td>
</tr>
<tr>
<td>Aca1 $\rightarrow$ Ext2</td>
<td>$0.06$</td>
<td>$0.55$</td>
<td>.5386</td>
<td></td>
</tr>
<tr>
<td>Aca1 $\rightarrow$ Int2</td>
<td>$-0.28$</td>
<td>$0.75$</td>
<td>.0629</td>
<td></td>
</tr>
<tr>
<td>Int1 $\rightarrow$ Ext2</td>
<td>$-0.28$</td>
<td>$3.11$</td>
<td>.2683</td>
<td></td>
</tr>
<tr>
<td>Ext2 $\rightarrow$ Aca3</td>
<td>$-0.03$</td>
<td>$0.02$</td>
<td>.0777</td>
<td></td>
</tr>
<tr>
<td>Ext2 $\rightarrow$ Int3</td>
<td>$-0.28$</td>
<td>$0.22$</td>
<td>.2037</td>
<td></td>
</tr>
<tr>
<td>Aca2 $\rightarrow$ Ext3</td>
<td>$-0.14$</td>
<td>$0.09$</td>
<td>.1080</td>
<td></td>
</tr>
<tr>
<td>Aca2 $\rightarrow$ Int3</td>
<td>$-0.28$</td>
<td>$0.79$</td>
<td>.1162</td>
<td></td>
</tr>
<tr>
<td>Int2 $\rightarrow$ Ext3</td>
<td>$-0.07$</td>
<td>$0.02$</td>
<td>.0039</td>
<td></td>
</tr>
<tr>
<td>Ext3 $\rightarrow$ Aca4</td>
<td>$0.22$</td>
<td>$0.14$</td>
<td>.1150</td>
<td></td>
</tr>
<tr>
<td>Ext3 $\rightarrow$ Int4</td>
<td>$-0.59$</td>
<td>$1.22$</td>
<td>.6312</td>
<td></td>
</tr>
<tr>
<td>Aca3 $\rightarrow$ Ext4</td>
<td>$-1.28$</td>
<td>$0.68$</td>
<td>.0608</td>
<td></td>
</tr>
<tr>
<td>Aca3 $\rightarrow$ Int4</td>
<td>$-2.66$</td>
<td>$0.92$</td>
<td>.0040</td>
<td></td>
</tr>
<tr>
<td>Int3 $\rightarrow$ Ext4</td>
<td>$0.10$</td>
<td>$0.09$</td>
<td>.2983</td>
<td></td>
</tr>
</tbody>
</table>

Note. $\hat{\beta}^*$ = standardized path coefficient; $\hat{\beta}$ = unstandardized path coefficient; Ext = externalizing problems; Aca = academic competence; Int = internalizing problems; numbers denote time point of data collection.

Table 5
Fit Statistics and Model Comparisons for the Gender Analysis

<table>
<thead>
<tr>
<th>Model</th>
<th>Equality constraints</th>
<th>df</th>
<th>c</th>
<th>$\chi^2$</th>
<th>Difference test of relative fit</th>
<th>Absolute fit statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Comp. $cd$</td>
<td>$\Delta\chi^2$</td>
</tr>
<tr>
<td>A</td>
<td>MM + cascades + continuity</td>
<td>1,146</td>
<td>0.994</td>
<td>1,879.14</td>
<td>A vs. B</td>
<td>0.868</td>
</tr>
<tr>
<td>B</td>
<td>MM + cascades</td>
<td>1,137</td>
<td>0.995</td>
<td>1,849.80</td>
<td>B vs. C</td>
<td>1.145</td>
</tr>
<tr>
<td>C</td>
<td>MM</td>
<td>1,122</td>
<td>0.993</td>
<td>1,831.36</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. SEM = structural equation modeling; c = weighting constant for computing the chi-square statistic using the robust estimation method; Comp. = model comparison; cd = weighting constant for the difference between two chi-square statistics using the robust estimation method; CFI = comparative fit index; TLI = Tucker–Lewis Index; RMSEA = root-mean-square error of approximation; SRMR = standardized root-mean-square residual; MM = measurement model.
effects differ in the extremely maladaptive range of symptoms or above diagnostic thresholds. Gender differences in the timing and nature of progressions also warrant closer examination in larger samples.

In future models and studies of cascades and transactions, it will be important to consider the developmental processes involved in the timing and significance of adaptive successes and failures. Developmental cascades undoubtedly reflect many processes by which individual functioning and context shape the course of development. However, we hypothesize that the significance of cascades across major domains of adaptive functioning is fundamentally related to the nature, salience, and timing of developmental tasks in human societies. Thus, for example, as peer relations become a salient domain of social adjustment, certainly by early in elementary school, the potential influence of peer rejection on internalizing symptoms would be expected to rise. The immediate impact of failure in an age-salient developmental task on the psychological well-being of individuals would be expected to peak when success in that domain is most salient to the individual, family, or society, although the cumulative developmental costs could continue to mount over time. Symptoms that undermine academic achievement during the school years, for example, could influence perceived success and subjective well-being as academic problems occur and could also be very costly over time in terms of subsequent developmental task attainment in other domains (e.g., see Roisman et al., 2004).

Developmental task expectations in societies may result from the implicit recognition within a given culture of when it is important to achieve what kind of adaptive behavior in order to progress successfully through life in that society. Once they emerge, developmental task expectations are likely to influence the interpretation of adaptive behaviors for all the stakeholders in a child’s development, including the child, parents, teachers, and community. Developmental cascades and developmental tasks are integrally related, and the significance of behaviors traditionally described as symptoms of psychopathology will be understood best in the context of the waxing and waning salience of developmental tasks.

References


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