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Randomized clinical trials, developmental theory, and antisocial youth: Guidelines for research

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Abstract
The design of effective interventions for antisocial adolescents has been greatly influenced by research-based developmental theories. However, randomized clinical trials (RCTs) demonstrating effectiveness of these treatments have contributed minimally to alterations and refinements of these theories. In this article, nine guidelines for research that may enhance the contributions of RCTs to developmental theory are proposed: (1) use mediational analyses to test and refine theories of change; (2) use moderator analyses to test differential pathways to change; (3) assess change processes separately for different types of antisocial behavior; (4) use constructive and dismantling designs to isolate effects of intervention components on targeted mediators and outcomes; (5) assess the time-sensitive nature of change mechanisms with theoretically relevant spacing of multiple assessments and long-term follow-ups; (6) expand the nomological net of developmental theories by assessing intervention effects on nontargeted constructs; (7) use RCTs to disentangle direction of effects questions in developmental theories; (8) conduct secondary analyses of RCTs to assess extra-treatment influences on antisocial behavior; and (9) assess the generalizability of mediator and moderator effects. Use of these guidelines may promote a recursive and iterative relationship between RCTs and theory building. Improved developmental theories may yield more effective interventions, and theory-testing interventions may engender more comprehensive and better informed theories.

This article focuses on the use of randomized clinical trials (RCTs) to test and refine theories pertaining to the continuity and discontinuity of antisocial behavior among adolescents and young adults. These trials are treatment outcome studies in which youth exhibiting problem behaviors and their families are randomly assigned to participate in treatment or comparison groups and are assessed on measures of maladaptive behaviors and their potential causes at preintervention, postintervention, and follow-up intervals. RCTs provide the strongest evidence of causal relations between a participant's exposure to treatment conditions and changes in deviant behavior, and well-implemented RCTs (e.g., sufficient power, high treatment fidelity, and low participant attrition) are considered the gold standard of evaluation research. They can largely remedy problems of nonexperimental outcome studies, including the equivalence of participants in different groups, bidirectionality (distinguishing cause from effect), and third variable influences (extraneous variable causing changes in both antecedent and outcome variables).

Developmental theories have guided the conduct of a substantial body of correlational and longitudinal research focusing on predic-

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tors of antisocial behaviors in adolescents and young adults. It is important that researchers have reached a general consensus regarding the most salient predictors of serious antisocial behaviors among America's youth (Hawkins, Herrenkohl, Farrington, Brewer, Catalano, & Harachi, 1998; Lipsey & Derzon, 1998; Reid & Eddy, 1997). In general, these predictors pertain to individual characteristics of the young people (e.g., problem solving skills, cognitive bias) and of the social systems in which they are embedded, including the family (e.g., affective relations, discipline strategies), peers (e.g., association with deviant peers), school (e.g., dropout, poor school performance), and neighborhood (e.g., criminal subculture).

In turn, these research findings have influenced developmental theories, and the theories and empirical research have both facilitated the development and validation of effective treatment models. For example, the Surgeon General's report on youth violence (U.S. Department of Health and Human Services, 2001) and Elliott's highly respected Blueprints Series (Elliott, 1998) cite only three treatments of adolescent criminal activity as having established effectiveness based on RCTs, and each of these models explicitly targets theory- and empirically driven predictors of antisocial behavior. These treatments include multisystemic therapy (MST; Henggeler, Schoenwald, Borduin, Rowland, & Cunningham, 1998), multidimensional treatment foster care (MTFC; Chamberlain & Mihalic, 1998), and functional family therapy (Alexander et al., 1998).

Whereas developmental theories have informed the development of effective interventions, RCTs have rarely been used to test and refine extant theories of the etiology, continuity, and discontinuity of antisocial behavior among adolescents and early adults. To date, RCTs targeting antisocial adolescents have focused on maximizing effectiveness and obtaining main effects of treatment. Little attention has been given to the potential contributions of RCTs to the enhancement of theories of psychopathology. Maximizing effectiveness is a legitimate first stage of inquiry, but second generation research that elucidates the mechanisms of change (how the treatment yields positive outcomes) and establishes boundaries of effectiveness (who benefits, who does not, and why) is overdue in the adolescent treatment literature (Kazdin, 1997).

Hence, in this article, nine guidelines for research on antisocial youth that may enhance the contributions of RCTs to developmental theories are proposed. Use of these guidelines is illustrated using examples from the aforementioned evidence-based treatments of serious antisocial behavior in adolescents as well as related research. These guidelines may facilitate a recursive and iterative relationship between RCTs and theory building. Thus, theories may yield more effective interventions and theory-testing interventions may engender more comprehensive and better informed theories. The guidelines are presented after a brief discussion of several theories that have influenced the development of successful interventions.

Theories Influencing Effective Interventions

Multiple theories and overarching perspectives on human development have influenced the design of effective interventions for treating serious antisocial behavior in adolescents.

Social ecological perspectives

Social ecological perspectives (Bronfenbrenner, 1979) emphasize that human development evolves from complex interdependencies of individuals and the nested multiple environments (family, school, peer group, neighborhood, community) in which they are immersed. Thus, multiple risk and protective factors at multiple levels of analysis may explain more variance in adaptive and maladaptive behaviors than single-factor or single-level conceptualizations.

Coercive process theory

Coercion theory (Patterson, Reid, & Dishion, 1992) focuses on the processes by which disturbances in parent–child interactions lead to the development and escalation of antisocial behavior among children. This theory has

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substantial support from both nonexperimental studies and RCTs focusing on parenting skills (Forgatch & DeGarmo, 1999). Coercion theory gives a central role to aversive cycles of caregiver–child interactions that over time result in children learning that antisocial behavior is highly effective in controlling the behavior of others. The caregiver's attempts to change disruptive behaviors are met with forms of noxious resistance by the child, resulting in the caregiver ultimately withdrawing demands for change, thereby negatively reinforcing aversive behavior. A repetition of these episodes over time undermines parental discipline and may result in disturbances in caregiver–child bonding, with concomitant disconnection from family ties. As a byproduct of these intrafamilial processes, youngsters may increase their association with deviant peers, an action likely to contribute to the maintenance or escalation of antisocial behavior.

Family systems theories

Family systems theories (Minuchin, 1974; Watzlawick, Weakland, & Fisch, 1974) emphasize both family communication processes and structural aspects of family functioning (e.g., whether there are adequate boundaries between marital and parental subsystems) as important determinants of adaptive and maladaptive functioning. They also embrace reciprocal rather linear causality and accentuate the interdependencies of family relationships (e.g., marital, parental, and sibling subsystems).

Structural–organizational theory

According to structural–organizational perspectives on development (e.g., Cicchetti & Toth, 1995; Sroufe & Rutter, 1984), there is a coherence or continuity of competence over time such that successful or unsuccessful mastery of developmental tasks at an earlier stage may equip adolescents with a blueprint for success or failure at future age-related challenges. Several studies of youth from economically disadvantaged families have found that individual competence during adolescence was the strongest predictor of multiple indices of overall adjustment in adulthood (Felsman & Vaillant, 1987; Werner & Smith, 1992). Thus, the achievement of relatively high levels of academic and social competence during adolescence may lay the foundation for finding alternatives to antisocial behavior in early adulthood and later life.

Resilience perspectives

Developmental theory and empirical research focusing on the construct of resilience, or the achievement of relatively adaptive outcomes despite significant adverse circumstances or conditions, has cast a wide net on potential protective or competence-enhancing factors. Emotionally supportive parent–child relationships and individual competencies, especially academic competence, have consistently emerged as predictors of "relatively adaptive outcomes" across a wide range of adverse conditions (Luthar, 1999; Luthar, Cicchetti, & Becker, 2000).

Social control theory

According to social control theory (Hirschi, 1969), bonding with prosocial adults and commitment to mainstream social institutions (e.g., schools, religious organizations) inhibit criminal behaviors via social influence processes leading to adoption of conventional societal values. In contrast, alienation from these institutions may result in the acquisition of counterculture values consistent with criminal careers.

Conclusion

Collectively, these theories or perspectives and related research have converged on consistent predictors of youth antisocial behavior. Predictors include characteristics of individuals as well as multiple social environments (e.g., family school, peer group, neighborhood). Moreover, in keeping with resilience perspectives and structural–organizational theory, protective factors (i.e., those that predict better outcomes in the face of adversity), in addition to risk factors, may be important in determining long-term outcomes. The effective interventions target these empirically de-

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rived, multiple risk and protective factors, and their "theories of change" reflect an integration of the aforementioned theories or perspectives.

Guidelines for Theory-Building RCTs

In a first generation of research, empirically based developmental theories and overarching perspectives on human development (e.g., social ecological) guided the creation of complex, multifaceted interventions that have demonstrated effectiveness across RCTs in treating antisocial adolescents. However, the extant treatment-outcome studies have largely focused on pragmatic goals (i.e., whether the treatment is effective), devoting little attention to how and for whom interventions yield beneficial outcomes. As a result, RCTs have contributed minimally to theories of antisocial behavior. In order to stimulate a second generation of theory-building RCTs, the following guidelines are proposed.

Conduct mediational analyses to test and refine theories of change

RCTs with delinquent youth often have compared treatment and comparison groups on both psychosocial variables (e.g., family and peer relationships, school functioning, etc.) and antisocial behavior outcomes (e.g., criminal behavior, illicit drug use, etc.). However, the failure of these studies in most cases to examine risk and protective factors as putative mediators of beneficial treatment outcomes has limited the contributions of RCTs to theories of antisocial behavior.

The effective interventions for youth antisocial behavior attempt to change theory-relevant and empirically supported risk factors (e.g., negative parenting practices) and protective factors (e.g., academic performance), which, in turn, are expected to engender changes in delinquent behaviors. Thus, theories of change underlying these interventions suggest that beneficial effects stem from treatment-induced changes in risk or protective factors. Borrowing from the work of Baron and Kenny (1986) and Holmbeck (1997), mediator status can be assigned to intervening risk or protective factors if the following conditions are met: (a) the treatment engenders significant changes in the dependent measures; (b) the treatment produces significant changes in the putative mediators;) changes in mediators are associated with changes in the dependent measures; and (d) treatment effects on the dependent measures are reduced significantly when the influence of mediators on outcome measures is statistically controlled.

Mediational analyses: Assessing developmental theories. Mediational analyses may be the best strategy for assessing the processes through which treatments influence ultimate outcomes (West & Aiken, 1997). However, only two RCTs to date (Eddy & Chamberlain, 2000; Huey, Henggeler, Brondino, & Pickrel, 2000) have assessed the putative mediators of change in adolescent criminal behavior. In comparing MTFC with a Group Care comparison group, Eddy and Chamberlain (2000) assessed whether targeted changes in family management skills and deviant peer associations mediated the beneficial effects of MTFC on antisocial behaviors among a high-risk sample of chronic and serious juvenile delinquents. Their findings indicated significant mediation effects for both variables that collectively accounted for 32% of the variance in antisocial behavior. Similarly, Huey et al. (2000) assessed the mechanisms through which MST decreased delinquent behavior in participants of two RCTs (Henggeler, Melton, Brondino, Scherer, & Hanley, 1997; Henggeler, Pickrel, & Brondino, 1999). The results for both samples demonstrated that the beneficial effects of MST on antisocial behavior were mediated by improved family relationships (i.e., family cohesion, parental monitoring, etc.) and decreased affiliation with deviant peers.

Although they did not use formal mediational analyses, Mann, Borduin, Henggeler, and Blaske (1990) integrated nonexperimental research and RCT methodology to assess two hypotheses derived from structural and strategic family systems theories (Minuchin, 1974; Watzlawick et al., 1974). First, they examined the hypothesis that cross-generation alliances (i.e., mother–adolescent vs. father) are associated with antisocial behavior. Forty-five fam-

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ily triads (mother–father–adolescent) with a male delinquent were compared with 16 families with a well-adjusted adolescent on a behavior observation task coded by trained observers. Delinquent families exhibited significantly more cross-generation alliances than did well-adjusted families. Second, Mann et al. (1990) tested the hypothesis that family therapy techniques focusing on the disengagement of the mother–adolescent alliances and concomitant strengthening of father–adolescent and marital dyads will reduce both cross-generation alliances and delinquent behavior. Consistent with their hypothesis, MST, which places heavy emphasis on family therapy interventions, significantly reduced both cross-generation alliances and delinquent behavior. Moreover, decreases in cross-generation alliances were correlated with reductions in antisocial behaviors. Although correlations do not demonstrate mediation, this finding does provide some evidence that adolescents' externalizing behaviors may improve as marital and parental subsystems are strengthened.

Theory validation: Importance of mediational analyses. RCTs yielding beneficial effects of specific interventions do not necessarily validate the presumed "mechanisms of change" underlying the treatment. In conducting a meta-analysis of treatment-outcome studies using cognitive behavior therapy (CBT) with children, Durlak, Fuhrman, and Lampman (1991) examined the major tenet of CBT that changes in cognitions lead to changes in dysfunctional behaviors. Inconsistent with this assumption, correlations between cognitive and behavioral changes were not significant. Thus, the beneficial effects of CBT could not be attributed to changes in cognitive processes.

Similarly, Huey et al. (2002) tested the hypothesis that the beneficial effects of MST in reducing suicide attempts among youth in psychiatric crisis could be attributed to increased parental control and reduced negative affect among adolescents, two putative mediators targeted by the intervention. However, their results did not support this hypothesis. Thus, factors other than those specified in the purported model of change accounted for the beneficial effects of MST. These examples illustrate that mediational findings are necessary to corroborate theories of change underlying positive treatment effects.

Causal chains. Mediational analyses can be extended to developmental theories in which multiple mediators influence each other in causal chains (West & Aiken, 1997). In the Heart Disease Prevention Project, Judd and Kenny (1981) demonstrated that a multicomponent intervention first increased participants' knowledge of diet and heart disease, which subsequently led to altered dietary behaviors and ultimately resulted in improvements in blood cholesterol and triglyceride levels. Treatment-induced changes in putative mediators may not have simultaneous effects on outcomes; instead, interventions may set into motion a chain reaction in which mediators influence each other successively in causal sequences over time, leading ultimately to changes in the targeted antisocial behaviors. Thus, treatment components first may change more distal mediators (e.g., parent psychopathology or drug use), which then may alter more proximal ones (e.g., parenting behavior) and, in turn, engender changes in the targeted antisocial outcomes. Researchers conducting RCTs may extend mediator analyses to include assessment of possible causal chains suggested by extant developmental theories.

Missing links. Mediators in causal chains may also be unknown. Explanatory clinical trials that refine theories of antisocial behavior may examine potential missing links in causal chains and known mediational processes. For example, several RCTs have demonstrated that improving parenting practices reduces antisocial behavior in children (Forgatch & DeGarmo, 1999) and adolescents (Eddy & Chamberlain, 2000; Huey et al., 2000), but the mechanisms through which these changes occur are not clear. Improvements in parenting may influence a myriad of both individual factors (e.g., shifts to mainstream values, greater security of attachment, assertiveness with peers, increases in self-efficacy) and characteristics of family environments (e.g., improved marital relationships, greater family cohesion), which are more proximal causes of change in antiso-

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cial behaviors. For example, Brody and Ge (2001) found that negative parenting practices compromised youths' ability to self-regulate cognitions, emotions, and behaviors, which, in turn, was associated with disturbances in psychological functioning and greater alcohol use. Thus, researchers may need to consider both distal and proximal missing links in causal chains and include measures of these variables in their RCTs.

Causal chains: Examples from comorbid psychopathology. Although comorbid psychiatric disorders are ubiquitous among delinquent youth, little is known about how the course of one disorder (e.g., conduct disorder) affects the onset and course of another (e.g., alcohol dependence disorder). Evidence for predictive relations among disorders comes from correlational studies demonstrating increased risk of a secondary disorder given the presence of a primary disorder. However, these studies, do not establish a causal relationship. One disorder might affect another directly or indirectly and successively via a causal chain of mediators. Depression might directly affect a substance use disorder as individuals increasingly use drugs to reduce negative affect. Alternatively, depression may result in withdrawal from the emotional support of significant others, in turn, leading to reliance on drugs as a coping strategy.

Kessler and Price (1993) suggested that interventions focusing on primary psychiatric disorders might prevent the onset, or reduce the severity, of co-occurring secondary disorders. Thus, RCTs focusing on the treatment of one disorder might include measures of symptoms (including DSM-IV diagnostic criteria) of either a co-occurring nontargeted disorder (e.g., depression) or an as yet undeveloped secondary disorder (where empirical evidence suggests its onset often follows the primary disorder), as well as other proximal and distal putative mediators. These RCTs should include multiple long-term follow-ups that assess via mediational analyses whether reductions in symptoms of the targeted disorder are accompanied by subsequent reductions in symptoms of the nontargeted disorder and whether these effects are direct or a result of mediational chains.

Theory as a guidepost for mediator analyses. The selection of mediators and subsequent mediator analyses should be guided by relevant theories. Holmbeck (1997) documented "conceptual clarity" problems (e.g., describing as mediator effects those better characterized as moderator effects) in published studies using mediator or moderator analyses. In part, these problems stemmed from the failure of researchers to clarify the theory-driven processes and mechanisms by which mediation is purported to occur. Thus, it is incumbent on researchers conducting RCTs to describe in detail how, consistent with a given theoretical framework, treatment-induced increases and decreases in specific mediators may lead to changes in specific outcome measures (Holmbeck, 1997).

Conduct moderator analyses to assess differential pathways to change

The effects of specific treatments on antisocial behaviors of adolescents and young adults may depend on a variety of individual and/or environmental characteristics referred to as moderator variables. Moderators establish boundaries or limits on treatment effectiveness by elucidating those circumstances in which interventions yield or do not yield beneficial outcomes (e.g., the intervention is effective with older, but not younger children). Commonly assessed moderator variables in RCTs with antisocial youth include gender, ethnicity or race, age, socioeconomic status, and initial level of severity of the presenting and related problems. The effective interventions for chronic juvenile offenders, however, have rarely found moderator effects associated with individual demographics (i.e., gender, race, ethnicity), symptom profiles, or personality characteristics. In fact, decades of research examining attribute by treatment interactions have yielded few guidelines for matching clients to treatments. In one of the largest RCTs ever conducted, the Project MATCH Research Group (1997) assessed 16

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matching hypothesis through comparing three manualized treatments of 1726 alcoholic outpatients. The results were disappointing with only one finding confirming a matching effect.

Thus, the extant literature on moderators of treatment effects following the aforementioned line of inquiry has been relatively unproductive to date. Contributions to the theory have been minimal. However, two alterations in the foci of this research may yield more positive and theory-relevant results. These are briefly described below.

Assess moderators of mediator effects. A major tenet of developmental psychopathology is that there are different pathways to adaptive and maladaptive behaviors (Cicchetti, 1984). Thus, researchers conducting RCTs (with appropriate mediator analyses) with antisocial youth may want to consider that mediators of reductions in externalizing behavior may be moderated by the level of other variables (Baron & Kenny, 1986: Holmbeck, 1997), thereby reflecting varied trajectories of change. For example, treatments that increase caregiver strictness and limit setting may be effective with many antisocial youth, but they may be ineffective or even have iatrogenic effects in cases of low levels of emotional bonding (e.g., new stepparent–stepchild relationship) or severe disruptions in parent–child attachment mechanisms. Thus, an intervention that engenders change in one putative mediator may have different effects on antisocial behaviors, depending on the level of other variables. A treatment that improves adolescents' social skills may reduce delinquent behaviors only among those youngsters who also have high levels of academic competence. Thus, academic competence may moderate the effects of changes in social skills on antisocial behavior.

Assess relational moderators. The paucity of significant moderator effects may stem from the almost exclusive focus of researchers on characteristics of individuals as opposed to families and other social environments as putative moderator variables (Rohrbaugh, Shoham, & Racioppi, 2001). Dysfunctional behaviors are inextricably linked to a complex matrix of social influences, but RCTs have rarely considered the potential moderating effects of relational environments. In an exception, Dadds, Sanders, Behrens, and James (1987) examined marital problems as a moderator in comparing the effectiveness of a parent-training program on children's behavior problems. Families were randomly assigned to receive parent training alone or parent training plus marital enrichment and were blocked on marital problems (with half of each group experiencing significant marital distress). Both groups improved in parenting behaviors and children's behavior problems at posttest. At the 6-month follow-up, however, maritally distressed families who received parent training alone, but not those who also received marital enrichment, lost their earlier improvements in child behavior problems. This research demonstrated that an important relational variable (i.e., marital distress) moderated the effects of changes in parenting on child behavior problems.

Theory as a guidepost for moderator analyses. Although many of the extant RCTs with antisocial youth include moderator analyses (i.e., most often using the aforementioned demographic variables), few of these studies provide a conceptual or theoretical rationale for how and why the treatment might be more effective with one subgroup versus another. Thus, it appears that the selection of moderator variables has been based more on convention than on theoretical considerations. Moreover, the preoccupation with finding main effects has led to a paucity of studies that hypothesize significant moderator effects. As is the case with mediator analyses, researchers should provide a theoretical explanation of the process by which treatment effects may be moderated by specific variables. Hypothesizing that older children may benefit more from cognitive treatments of depression than younger children due to their more advanced cognitive skills (and thus, greater adeptness at using cognitive restructuring interventions) is an example of this type of explanation.

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Assess change processes separately for different types of antisocial behavior

Different forms of antisocial behavior, including covert delinquency, aggressive crimes or violence, and drug abuse, may share common risk or protective factors and mechanisms of change yet different change processes and developmental pathways may also influence them. A current controversy focuses on whether different antisocial behaviors are part of a single underlying syndrome, in keeping with "general problem theory" (Jessor, VanDenBos, Vanderryn, Costa, & Turbin, 1995), or whether the antisocial behaviors, although correlated, are fundamentally different behaviors involving unique developmental pathways, consistent with "differentiated problem theory" (Loeber, Farrington, Stouthamer–Loeber, & Van Kammen, 1998). Nonexperimental longitudinal studies addressing this question have obtained mixed results (Jessor et al., 1995; Loeber et al., 1998; Nagin & Tremblay, 1999).

RCTs could provide experimental tests of these alternative hypotheses. Interventions that target mediators of one form of antisocial behavior (e.g., parenting skills training for aggressive behaviors) could also assess effects on other antisocial behaviors (e.g., drug use). For example, RCTs involving MST or MTFC might assess whether changes in targeted mediators (i.e., parenting skills and deviant peer association) have equally strong influences on observed changes in different antisocial behaviors (e.g., property crimes, aggressive crimes, and illicit drug use) or whether other mediating processes are involved. For youth with drug addictions fueled by the drive to self-medicate negative emotions (e.g., comorbid anxiety problems), changes in parenting and peer groups may be necessary but insufficient for altering substance abuse problems. RCTs that include measures of several antisocial behaviors at multiple points in time may detect causal chains in which prior reductions in one type of antisocial behavior (e.g., drug use) lead to subsequent declines in another (e.g., aggressive behaviors). Similarly, where empirical support for the sequential development of antisocial behavior has been determined in nonexperimental longitudinal studies (e.g., status offenses precede property crimes), RCTs designed to treat the antisocial behavior earlier in the sequence could assess whether mediated decreases in the focal problem (e.g., status offenses) reduced the risk of onset of the secondary problems (e.g., property crimes) that typically occur later in the developmental sequence.

A recent RCT involving a 4-year follow-up of MST versus usual community services in the treatment of 80 substance-abusing delinquents (Henggeler, Clingempeel, Brondino, & Pickrel, 2002) found statistically significant differences in favor of MST for aggressive crimes but not property crimes. This study suggests that the emphasis of MST on changing the youth's social ecology during middle adolescence might be more effective in altering aggressive behavior than nonaggressive delinquent behavior in adulthood. It is possible that the focus of MST on changing aversive family processes, in keeping with the thrust of coercion theory, has greater impact on future aggressive behavior. However, in the absence of mediational analyses, the pathways of influence remain to be determined.

Use constructive and dismantling designs to isolate effects of interventions on targeted mediators and outcomes

Constructive and dismantling designs are two strategies for determining the unique effects of targeted mediators separate from a multidimensional treatment package. A constructive research design adds an additional program component to the full multicomponent treatment package. The additional component targets a construct that is not addressed by the full package but that extant theory or empirical research suggests might affect the outcome measures. An ongoing RCT focusing on the treatment of substance-abusing delinquents is comparing traditional MST with MST enhanced by components of the Community Reinforcement Approach (CRA; Budney & Higgins, 1998) and two comparison groups. The components of CRA used in the MST enhancement focus on close monitoring of drug use through biological indicators and the application of rewards and punishments based

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on results, as well as the integration of specific training in drug refusal skills. Thus, this enhancement focuses directly on altering drug use via contingency management procedures, whereas the major focus of MST is to alter characteristics of the youth's social ecology (e.g., ineffective parental discipline and monitoring, association with drug-using peers, lack of school involvement) that may maintain or exacerbate drug use.

Dismantling designs compare the total treatment package (e.g., components A, B, and C), treatment groups containing fewer components (e.g., A + B, A + C, and/or B + C), and an appropriate usual services comparison group in order to determine the extent to which the more streamlined groups have beneficial effects comparable to the complete program. Thus, if certain components (e.g., academic tutoring) are omitted, is there still a change in targeted mediators (e.g., school performance), and, if not, are the reductions in antisocial behavior equivalent to the full package? Dismantling designs may inform developmental theory by providing critical information pertaining to the influence of treatment-engendered change in *specific* mediators isolated from the direct and interactive effects of change in multiple mediators (targeted by multiple program components) on the outcome measures of interest. Dismantling strategies, however, might be more appropriate for studying mediators of the effects of multimodal treatments (i.e., including multiple modules) than more individualized and integrated interventions such as MST and MTFC.

Although multidimensional, ecologically based interventions have demonstrated the most effectiveness in the treatment of youth antisocial behavior, more comprehensive programs are not necessarily always better. For example, Azrin, Donohue, Teichner, Crum, Howell, and DeCato (in press) found that a pure cognitive program was just as effective as a multicomponent contingency management approach in reducing drug and alcohol use. Thus, dismantling designs yield information regarding whether leaner and less expensive interventions are equally effective and whether there are program components that work against the overall program, producing iatrogenic effects. Dismantling studies can determine whether some components are more necessary than others (Kazdin, 1997).

Assess the time-sensitive nature of change mechanisms with theoretically relevant spacing of multiple assessments and long-term follow-ups

Extant treatment outcome studies with antisocial youth using RCT methodology have paid little attention to time as a theoretically relevant variable in assessing treatment effects. Researchers typically include measurements at preintervention, postintervention, and one or two follow-up intervals extending 12–18 months after the termination of treatment. The selection of intervals is guided more by convention and pragmatic considerations than by clinical or developmental theory. RCTs that provide a theory-based reason for the number and spacing of measurement periods are nonexistent.

Time-related questions are critical for developing and refining a theory of clinical and developmental change. First, how many therapy sessions over what period of time does it take for the program component to engender change in the targeted mediators? Second, what are the time-varying effects of change in mediators (e.g., disciplinary practices) on change in antisocial outcomes (e.g., delinquent behavior)? Third, to what extent do treatment-engendered changes in mediators and their subsequent beneficial effects on antisocial outcomes persist after the termination of treatment (e.g., how long and to what extent will caregivers continue to monitor their adolescents' whereabouts and activities)? What treatment components and naturally occurring factors contribute to longer lasting changes in adolescent behavior?

Ideally, interventions designed to both assess effectiveness and inform theory would give greater attention to "time between assessments" and include multiple measurements prior to, during, and following treatment (Loeber & Farrington, 1994). Each of these recommendations is briefly discussed.

Spacing of assessments. Although theories of the etiology and maintenance of psychopath-

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ology often incorporate different risk and protective factors within different age ranges or developmental periods, they rarely specify the time intervals in which causes are expected to have different types of effects. Treatment-engendered changes in risk and protective factors may have different effects, depending on the time interval between causes and effects. Gollob and Reichardt (1987) underscore the principle that the size of an effect depends on the time interval with the following example:

> the effects of taking two aspirin on reducing headache pain may be zero in 2 minutes after ingestion, may be substantial after 30 minutes, may be near maximum after 2 or 3 hours, may be much reduced after 5 hours, and may be zero again after 24 hours. (p. 82)

Assuming this example reflects the true state of affairs, the selection of time intervals is critical. Dramatically different findings and interpretations would be obtained if intervals were 2, 4, and 6 min (no effect); versus 20, 30, and 40 min (linear effect); or 60, 180, and 300 min (curvilinear effect). Elucidating these varied effect sizes at different time lags is critical to understanding the time-sensitive physiological mechanisms through which aspirin reduces headache pain.

The spacing of assessment intervals may also be critical to understanding potential causes of change in adolescent's antisocial behaviors. Treatment-induced changes in a caregiver's monitoring of the adolescent's friends, activities, and whereabouts may have dramatically different effects on the youth's antisocial behaviors depending on the specific time intervals since the change in the caregiver's monitoring. The typical pretest, posttest, and two follow-up intervals 4–6 months apart may not detect the more time-sensitive, episodic, and nonlinear nature of behavior change.

Preintervention assessments. The measurement of targeted risk and protective factors and antisocial behaviors at a single assessment period prior to treatment is a standard practice in clinical trials with antisocial youth. This one-shot approach, however, does not allow detection of pretreatment trends, developmental patterns, and interrelations among risk or protective factors and antisocial behaviors. RCTs that demonstrate significant treatment-induced alterations in previous linear and nonlinear trends, rather than simply showing changes from a single pretest, may better inform developmental theory regarding the time-sensitive nature of behavior change. The assessment of pretreatment developmental sequences would also help in assessing maturation and regression effects and in verifying the equivalence of treatment and comparison groups (Loeber & Farrington, 1994).

Intraintervention assessments. Repeated measurements of target behaviors and key variables during the treatment process may shed light on the potentially complex and time-sensitive nature of behavior change. RCTs with antisocial adolescents have rarely measured variables of interest during the intervention itself; instead, the majority of studies have relied on preintervention and postintervention evaluations to assess behavior change. This strategy assumes that interventions have linear, orderly, and cumulative effects on outcomes during the course of treatment when, in fact, behavior change may be nonlinear, disorderly, and discontinuous (Eddy, Dishion, & Stoolmiller, 1998).

Several studies have shown dramatic changes in symptoms before the termination of therapy sessions (Dishion & McMahon, 1998; Kolko, 1996; Moros, Telfer, & Barlow, 1993). Change may also occur in a nonlinear pattern across sessions. In a study of therapist and client behaviors during a parenting skills intervention with antisocial youth, Stoolmiller, Duncan, Bank, and Patterson (1993) found that increases in client "resistance" (i.e., noncompliance with therapist recommendations for change) at the midpoint of treatment (ostensibly in response to "teach and confront" interventions), followed by decreases in resistance by termination, was associated with reduced police arrests more than 2 years after treatment. Their findings supported the hypothesis that "teach and confront" interventions that trigger resistance are best introduced during the midpoint of treatment, subsequent to the development of a positive therapist–client relationship.

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Empirical investigations of within-treatment techniques and interventions that engender change in maladaptive behaviors have come under the rubric of "therapy process research" with minimal extrapolation to theories of developmental psychopathology. Clinical theories usually focus on "what can" and developmental theories on "what does" lead to change in maladaptive behaviors. Greater attention to the "what can" question may have heuristic value for developmental theory. Knowing that specific therapist–client interpersonal events at specific points in time during treatment lead to alterations in dysfunctional behaviors may offer clues regarding what might produce change outside the context of interventions. Moreover, for antisocial adolescents, agency-initiated treatments may be naturally occurring events that need to be taken into account by developmental psychopathologists conducting nonexperimental, longitudinal studies.

Postintervention assessments. Multiple assessments following treatment permit the determination of potentially complex patterns of change that may inform life-course developmental models of psychopathology. Treatment effects may increase, decrease, or exhibit curvilinear patterns over time. Overall, the standard paradigm involving two follow-ups assessed 4–6 months apart has not enhanced our understanding of time-sensitive effects. More frequent measurements over longer time frames are optimal for evaluating the often uneven and episodic nature of behavior change.

Whereas the typical pattern for treatment outcome studies has been for effect sizes to dissipate over time (i.e., maximum effects at posttest and decreasing effects across follow-up intervals), preventive trials occasionally have found increases in positive effects or even delayed beneficial effects over time (Greenberg, Domitrovich, & Bumbarger, 2001). Increasing positive effects may occur because some causes may have stronger effects the longer that they last. Delayed positive effects may occur because some causes take longer than others to exert their impact.

According to organismic–developmental theory (Cicchetti & Toth, 1995; Sroufe & Rutter, 1984), child development proceeds from a global and relatively undifferentiated condition to a state of increasing differentiation and complexity. Thus, treatment-related learning experiences that are integrated into children's cognitive systems may take time to contribute to this differentiation process. Weisz (1997) argues that interventions with children and adolescents may be viewed as "perturbations" that interact with an ongoing process of developmental change. Thus, positive treatment effects may not emerge full-blown until months or years after termination of the typical treatment outcome study.

Assessing possible effects across developmental transitions may require "bridging mechanisms" that provide the foundation for long-term change (Ramey & Ramey, 1998). For example, interventions that produce changes in individual competencies resulting in greater mastery of developmental tasks during adolescence may equip youngsters with the bridging mechanisms (i.e., greater self-confidence, self-efficacy, motivation to achieve) that increase the likelihood of successful mastery of developmental tasks at early adulthood and subsequent life transitions. Moreover, consistent with the concept of niche seeking (Scarr & McCartney, 1983), youth who achieve greater mastery of developmental tasks in adolescence may choose environments that are more likely to reinforce and sustain these competencies. Thus, improvements in individual competencies in adolescence may mediate successful adjustment to life changes at later developmental periods.

Long-term follow-up intervals may also reveal delayed negative effects of interventions, and assessing mediators including causal chains or other mechanisms leading to these effects may inform developmental theory. Initial and early follow-up of the Cambridge–Somerville Youth Study (McCord & McCord, 1959) revealed that the intervention had no effects. However, longer term follow-ups (McCord, 1992) indicated that the program had negative effects on the participants. Moreover, a specific component of the program—summer camps with dense concentrations of high-risk youth—had especially pernicious effects (Dishion, McCord, & Poulin, 1999). These

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findings led to a reconceptualization of the theory of change guiding the design of the original intervention.

Expanding the nomological net: Assess intervention effects on nontargeted constructs

RCTs should assess nontargeted side effects of treatment, and thus expand the nomological net of developmental theories (Eddy et al., 1998). Consistent with social ecological perspectives (Bronfenbrenner, 1979) and family systems theories (e.g., Minuchin, 1974; Watzlawick et al., 1974), risk or protective factors and antisocial behaviors are interdependent, occur in clusters, extend across multiple contexts (e.g., family, school, and neighborhood), and may influence each other reciprocally and synergistically over time. Consequently, interventions may affect factors not targeted by program components and these nontargeted effects may inform developmental theories. Parenting skills training may affect, not only targeted relationships (e.g., caregiver–adolescent communication), but also nontargeted ones (e.g., marital, sibling, peer). Changes in the mother–adolescent relationship may reverberate throughout the family system, resulting in changes in other intrafamilial dyads and concomitant effects on relationships outside the family. To detect a broader range of effects associated with interventions, researchers should measure other constructs that, according to related theories or empirical findings, may be possible side effects. Specific theories of the etiology of antisocial behavior emphasize a relatively small subset of constructs (i.e., characteristics of caregiver–child and peer relationships). Although researchers pay homage to social ecological perspectives, the expansion and integration of minitheories consistent with a multifactor, multilevel conceptualization of human development has yet to be undertaken.

In an ongoing 6-year follow-up of substance-abusing delinquents who had participated in an RCT comparing MST and usual community services, measures of nontargeted constructs (e.g., social or occupational functioning, quality of relationships with friends and romantic partners) as well as constructs directly targeted by the intervention (i.e., criminal behavior, illicit drug use) were included. Finding that changes in targeted mediators during adolescence lead to changes in nontargeted factors in early adulthood, which, in turn, engender reductions in criminal behavior, would inform theories of change across life transitions. For example, MST-induced improvements in academic and social competencies may result in greater mastery of adolescent developmental tasks. The continuity of these competencies into early adulthood, consistent with structural–organizational perspectives on development (e.g., Cicchetti & Toth, 1995; Sroufe & Rutter, 1984), may yield improved social or occupational functioning and better relationships with family and friends. Reductions in criminal behaviors may be byproducts of these changes. Failing to include measures of these nontargeted constructs would not permit an assessment of this plausible causal chain.

Use RCTs to disentangle direction of effects questions in developmental theory

Disentangling the direction of effects and the nature of reciprocal influences is essential to the refinement of extant theories of antisocial behavior. RCTs adopting transactional models of development could shed light on the direction of effects among risk or protective factors and antisocial behaviors. Transactional models of development in which risk or protective factors and antisocial behaviors are assumed to influence each other in reciprocal or bidirectional ways have rarely been incorporated into theories of antisocial behavior or tested empirically. Antisocial behaviors may influence risk and protective factors, but most often they have been treated as static outcomes rather than dynamic influences on their putative causes. Although incompetent parenting practices may contribute to delinquency, delinquent behaviors may also engender a deterioration in parent–child relationships and caregiver disciplinary practices. Frequent and intense anxiety may cause substance abuse (e.g., youngsters use drugs to self-medicate negative affect), but drug problems may also

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lead to escalations in anxiety symptoms (e.g., adolescents become more distressed regarding negative consequences of drug use). Vicious cycles in which increases in risk factors and antisocial behaviors each cause changes in the other, such that both escalate over time, have rarely been examined empirically.

RCTs provide an optimal opportunity for disentangling direction of effects questions in developmental theories. For example, the nature of interdependencies between negative parenting practices and adolescent substance use remains unclear. Problematic parenting may cause substance use, substance use may cause problematic parenting, or each variable may cause the other. An RCT with a program component directly targeting substance abuse (e.g., contingency management) could assess whether a treatment-induced reduction in drug use mediated a decrease in negative parenting practices. Similarly, an RCT with a program component directly targeting parenting (e.g., parenting skills training) could assess whether treatment-induced improvements in parenting mediated decreases in drug problems. Results supporting mediation in both, one, or neither of these cases would provide important information regarding possible causal pathways.

RCTs with multiple preintervention and postintervention assessments could also elucidate treatment-induced effects on reciprocal influence processes. Suppose, for example, that preintervention assessments detected a vicious cycle in which negative parenting practices and adolescent substance use lead to increases in both problems over time. Interventions that directly target parenting or substance use may engender changes not only in putative mediators and outcomes but also in the relations between variables of interest. Thus, postintervention analyses might assess whether treatment-induced changes altered the "deviation-amplifying relations between constructs" detected from the preintervention data.

Conduct secondary analyses of RCTs to assess extratreatment influences on antisocial behavior

As noted previously, RCTs have demonstrated that several interventions are effective in the treatment of juvenile offenders (e.g., Elliott, 1998; U.S. Department of Health and Human Resources, 2001). However, the effect sizes, portions of variance, and sustainability of effects accounted for by the treatment conditions remain modest. For example, Eddy and Chamberlain (2000) found that the mediating influences of improved parent–child management practices and decreased deviant peer association accounted for 32% of the variance in the antisocial behavior measures. This leaves 68% of the variance unaccounted for by two of the most robust predictors of delinquency.

Portions of variance in antisocial behavior outcome measures unexplained by treatment group effects may be accounted for by characteristics of the adolescents and their social environments. Secondary analyses of RCTs that control statistically for treatment group effects and then examine the direct, mediator, and moderator influences of theoretically relevant variables may inform refinements in extant developmental theories as well as possible treatment enhancements. Clinical researchers have seldom used RCTs for this secondary goal, and thus, potentially valuable data and grant resources may be underutilized.

Secondary analyses of RTCs targeting substance abuse among adolescent populations may provide valuable information regarding the relations between comorbid internalizing and externalizing problems and alcohol or drug use trajectories. Substance-abusing delinquents may be an especially challenging population, which is due in large part to their high prevalence of comorbid externalizing and internalizing disorders (Loeber & Keenan, 1994; White & Labouvie, 1994). Comorbid psychopathologies may maintain or exacerbate adolescents' use of alcohol and illicit drugs over time. Portions of variance in substance use behaviors unexplained by treatment group may be accounted for by the effects of comorbid psychopathologies on adolescents and their families. Examining these linkages after statistically controlling for treatment group effects may inform empirically driven theories of change underlying substance abuse interventions. In turn, refinements in theory may facilitate the develop-

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ment of enhancements that improve the efficacy or effectiveness of treatments for delinquents with substance use disorders.

For example, controlling for the effects of treatment condition (MST vs. usual services), Clingempeel, Henggeler, Pickrel, Brondino, and Randall (2002) examined main and interaction effects of three putative protective factors (parent–child warmth, academic competence, and social competence) assessed during adolescence (mean age = 15.2 years) in predicting change in levels of marijuana and cocaine use in emerging adulthood (mean age = 20.4 years) among a sample of 80 substance-abusing or substance-dependent juvenile offenders. After controlling for treatment effects and preintervention drug use, higher academic achievement predicted less marjuana use only at high levels of social competence. More adolescent marijuana use predicted increases in subsequent cocaine use, but greater cocaine use predicted decreases in subsequent marijuana use. Thus, adolescent protective factors had different effects on marijuana and cocaine use among high-risk adolescents. Additional research examining separate etiologies for use of different drugs across developmental transitions is warranted.

Assess generalizability of mediator and moderator effects: Balancing internal and external validity

The extent to which RCTs contribute to developmental theory may depend upon researchers achieving a balance of internal and external validity. Internal validity focuses on the degree of confidence that the treatment, and no other factors, caused the change in the maladaptive outcomes. External validity focuses on the extent to which findings of RCTs can be generalized beyond the specific participants, research settings, and circumstances of the original study to other participants, settings, and circumstances.

The relevance of RCTs to clinical practice has been questioned, which is partly attributable to the lack of attention to external validity. Thus, results supporting a theory of change at a university research center, using graduate students as therapists, step-by-step treatment manuals, and homogeneous client populations (i.e., all have the same single diagnosis) may not apply to community settings, heterogeneous client populations, and local therapists.

In regard to informing developmental theories of antisocial behavior, it is important that the limits of generalizability are investigated. It is important to know, for example, the extent to which the beneficial effects of treatment and the mechanisms of change responsible for the positive results are found by different teams of investigators in different settings (e.g., university research center vs. community mental health center) and with different populations of antisocial youth.

In the treatment of antisocial behavior, MST has demonstrated effectiveness in multiple settings, with diverse population of antisocial youth, and with different teams of investigators (Henggeler, 1999). What is missing in these first generation RCTs are mediational analyses to determine the processes by which MST achieves beneficial outcomes across multiple studies. A second generation of MST studies currently underway will go beyond establishing treatment effectiveness and seek to address these mediator questions in varied contexts.

Conclusion

A first generation wave of research used empirically based developmental theories and both social ecological and resilience perspectives to develop effective interventions for antisocial adolescents. Randomized clinical trials have demonstrated the effectiveness of these interventions, but to date, treatment outcome studies have contributed minimally to refinements and alterations of extant theories of the onset, continuity, and discontinuity of antisocial behavior. To stimulate theory-building RCTs, the following guidelines were proposed and discussed: (1) use mediational analyses to test and refine theories of change; (2) use moderator analyses to test differential pathways to change; (3) assess change processes separately for different types of antisocial behavior; (4) use constructive and dismantling designs to isolate effects of intervention components on targeted mediators

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and outcomes; (5) assess the time-sensitive nature of change mechanisms with theoretically relevant spacing of multiple assessments and long-term follow-ups; (6) expand the nomological net of developmental theories by assessing intervention effects on nontargeted constructs; (7) use RCTs to disentangle direction of effects questions in developmental theories; (8) conduct secondary analyses of RCTs to assess extratreatment influences on antisocial behavior; and (9) assess the generalizability of mediator and moderator effects.

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