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Domains of Risk in the Developmental Continuity of Fire Setting

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Abstract

Juvenile fire setting is a serious, dangerous, and costly behavior. The majority of research examining youth fire setting has been cross-sectional. We sought to examine early risk attributes that could differentiate fire setters from non-fire setters, in addition to examining their association with the developmental continuity of fire-setting behavior into late childhood. Using a sample of 361 youth drawn from 4 different U.S. communities, this study examined the association between a broad array of risk variables from the child, parent, and family domains, and fire-setting behavior over the course of 2 developmental periods: prior to 4th grade, and between 4th and 6th grade. Youth were classified into 1 of 4 groups (non-fire setters, desisters, later-onset fire setters, and persisters) based on their reported fire-setting behavior during these periods. Children who set fires had higher levels of risk on most of the variables assessed. Persistence of fire setting was associated with elevated parental depressive symptoms and more interparental conflict and ineffective discipline. The findings highlight the need for multi-component preventive interventions to address the breadth of risk experienced by fire-setting youth and their families.

JUVENILE FIRE setting represents a behavior that can become serious, dangerous, and costly. Juveniles are arrested for a greater share of arsons than any other type of crime, accounting for 50% of the fire-setting offenders, according to the Federal Bureau of Investigation (U.S. Department of Justice, 1999). Additionally, fire setting may be a marker of more seriously disturbed youth, as fire-setting youth tend to exhibit a variety of aggressive and antisocial acts (Stickle & Blechman, 2002). Youth who are actually adjudicated for arson have increased probability of being placed in a residential treatment facility. Even preadolescent youth represent a large proportion of fire setters who have caused serious damage; for example, over one-third of the juvenile arson arrests in 1997 involved children age 12 or younger (U.S. Department of Justice, 1999).

Despite the lack of strong theory in this area, knowledge about fire setting has been greatly advanced through the research and conceptual framework developed by Kolko and Kazdin (e.g., 1985, 1992), most of which has focused on youth between the ages of 6 and 13. In the last 20 years, three general domains have emerged for risk factors associated with fire setting: characteristics of the child, aspects of parenting, and the broader family climate. Among the

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child factors that have been identified as risk factors for fire-setting behavior are being male (Gruber, Heck, & Mintzer, 1981; Jacobson, 1985; Sakheim & Osborn, 1999; Showers & Pickrell, 1987), having higher impulsivity or traits of Attention-Deficit/Hyperactivity Disorder (ADHD) (Geller, 1992; Sakheim & Osborn, 1986), having social skill deficits and poor peer relations (Kolko, Kazdin, & Meyer, 1985; Sakheim & Osborn, 1999; Sakheim, Osborn, & Abrams, 1991; Sakheim, Vigdor, Gordon, & Helprin, 1985), displaying other conduct problems or antisocial behavior (Heath, Hardesty, Goldfine, & Walker, 1985; Showers & Pickrell, 1987), or having been abused (Jayaprakash, Jung, & Panitch, 1984; Ritvo, Shanok, & Lewis, 1982; Showers & Pickrell, 1987). Parenting factors that have been empirically linked to fire-setting behavior include harsh (Jayaprakash et al., 1984) or lax (Kolko & Kazdin, 1990) discipline, lack of parental involvement (Kolko & Kazdin, 1990), less parental acceptance of the child (Kolko & Kazdin, 1990), and limited monitoring and supervision (Kazdin & Kolko, 1986; Kolko & Kazdin, 1990; Sakheim & Osborn, 1999). Family factors associated with fire-setting behavior include low socioeconomic status (Heath, Hardesty, Goldfine, & Walker, 1983; Kolko, 1985), marital discord (Kolko & Kazdin, 1990), parental psychopathology/depression (Kazdin & Kolko, 1986; Kolko & Kazdin, 1990), and stressful life events (Kolko & Kazdin, 1990).

Although past studies have been helpful in identifying risk factors, little is known about the continuity of fire setting or its correlates and predictors. The vast majority of research on fire setting has been cross-sectional, confounding the timing of the measurement of risk with the measurement of fire setting (for exceptions, see Kolko, Day, Bridge, & Kazdin, 2001; Kolko & Kazdin, 1992). The two longitudinal studies that have been conducted suggest that different risk factors may predict initiation versus repetition of fire setting. For example, Kolko and Kazdin (1992) found that late-starting fire setting (starting a fire at 1-year follow-up but not at the initial interview) was associated with limited family sociability, whereas recidivism was associated with child hostility, lax discipline, family conflict, and limited parental acceptance. Their second longitudinal study found that high levels of covert antisocial behavior predicted recidivism 1 year later (Kolko et al., 2001). A second limitation of the fire-setting research is its developmental framework. Due in part to the low base rate of fire setting, past studies have examined this behavior among youth within a broad age range. For example, both of Kolko and colleagues' longitudinal studies on fire setting were conducted with children who were ages 6 to 13 at the fire-setting incident, defining recidivists as those who set a fire in the next year regardless of age. It may be the case that risk factors operate differently for early-onset versus late-onset fire setting, as has been found for other antisocial behaviors (e.g., Moffitt, 1993).

This study advances knowledge about fire setting by examining simultaneously a broad array of risk factors that have been found by different investigators within the individual child, parenting, and family domains. Such a focus creates the possibility of identifying potential targets for early intervention. We examined early risk factors, defined as those occurring during the early elementary years (grades K–3). We sought to (a) identify risk variables that differentiate fire setting from non-fire-setting groups, and (b) examine whether the various risk factors are related to the developmental timing or continuity of fire setting. We took a developmental approach in our assessment of fire setting, examining early risk correlates and predictive factors as they relate to fire-setting behavior from early childhood to early adolescence. We examined whether persisting fire setters across two distinct periods of development differed systematically in the presence of various antecedent risk factors compared to youth who engaged in fire setting during only one of the time periods.

This study also incorporated a number of measurement techniques designed to maximize generalizability and improve the quality of research on fire setting. First, we surveyed youth from four different geographic areas of the United States, making this the most geographically

diverse study of fire setting to date. Most studies have been confined to one community; having greater variability allowed us to draw inferences across different geographical contexts and to specifically test for whether children raised in urban environments were more likely to set fires, as FBI statistics have suggested for arson crimes (U.S. Department of Justice, 1999). We also utilized reports from multiple informants to inform our risk indices; we included interviewers/observers, teachers, peer-reported sociometrics, and school records of academic achievement, in addition to the standard parent and child reports of information. Finally, we drew our study sample from a nonreferred community sample that included children across the range of behavior problems.

Method

PARTICIPANTS

Participants were 361 youth who were part of the normative comparison sample from a larger longitudinal study examining the development and prevention of conduct problems among children (Fast Track; Conduct Problems Prevention Research Group, 1992, 2000). None of these youth participated in the preventive intervention components of the Fast Track Project. Participants were selected from four different areas of the country, each representing a different cross-section of the United States population: (a) Durham, NC ($n = 95$); (b) Nashville, TN ($n = 95$); (c) Seattle, WA ($n = 82$); and (d) rural central Pennsylvania ($n = 92$).

Schools were identified at each of the four sites based on measures of poverty and low parental education levels that were characteristic of the parents of children in the schools, and on the location of the schools' "catchment areas" in high-crime areas (Lochman & the Conduct Problems Prevention Research Group, 1995). As part of the larger intervention study design, schools were randomly assigned to intervention and comparison conditions. A normative sample of children ($n = 387$) was drawn from the comparison schools. From these schools, 100 kindergarten children were selected at each site (87 in Seattle) on the basis of their race, gender, and level of teacher-reported behavior problems, including 10 children per site at each decile of the distribution of scores on the Teacher Screen (14 items from the Teacher Observation of Child Adaptation-Revised [TOCA-R]; Werthamer-Larsson, Kellam, & Wheeler, 1991). This stratification procedure ensured that the sample would be representative of the population in these schools.

Of the original sample, data on fire-setting items were missing for 26 youth in the normative sample, resulting in 361 participants in this study. The sample employed in this study included 179 girls and 182 boys, with 51% Caucasian ($n = 185$), 45% African American ($n = 162$), and 4% "other" ethnic minority ($n = 14$) background. Because race was confounded with study site in our sample, we examined racial and geographic differences by examining urban Caucasian ($n = 94$) in comparison to urban African American ($n = 161$) and rural Caucasian ($n = 91$) youth.

PROCEDURE

Although comprehensive assessments were conducted annually beginning in kindergarten as part of the broader Fast Track project, only those procedures and measures relevant to the current study are described here. The data in this study are based on child- and parent-report, interviewer ratings of parent-child observation, teacher report, peer sociometric ratings, and school archival records. Data were obtained from the children and their primary caregivers (95% were mothers) during annual interviews conducted each summer in the home. While one research assistant interviewed the primary caregiver, a second assistant interviewed the child in a separate room. Interviewers read the various measures to the parents and children and recorded their responses. Observational data were obtained from the Parent-Child Interaction

Task (PCIT), which consisted of four structured parent-child activities (free play, parent-directed play, parent-directed Legos task, and toy cleanup) conducted during the summer interview (see Conduct Problems Prevention Research Group, 1999, for more details). Teacher-report data were gathered in the spring of each academic year, as were peer sociometric data. School records were accessed at the end of Grade 1 to obtain academic grades.

Creation of fire-setting groups—Children were classified into one of four different groups, based upon their history of fire setting across two time periods: birth through third grade (T1) and fourth through sixth grade (T2). These time windows were chosen because the modal peak for fire setting has been identified to occur around 8 years of age (Jacobson, 1985), and preadolescent children may be at greater risk for recidivism than older youth (Stewart & Culver, 1982). Selection of informants was based on the age of the child. Prior to Grade 4, greater reliance was placed on parent report because of the questionable validity of children's self-reports of symptomatology prior to age 10 (Edelbrock, Costello, Dulcan, Kalas, & Conover, 1985). In subsequent years, both parent and youth reports were utilized. Fire setters were operationally defined as children who had engaged in any form of fire-related behavior, as specified below.

At T1, the following items were used as indicators of fire-setting behavior: (a) parent endorsement of “sometimes” or “often true” (1 or 2) on the “sets fires” in the past 6 months item from the Child Behavior Checklist (CBCL; Achenbach, 1991a), administered in kindergarten, Grade 1 and Grade 2; (b) positive endorsement of the item “Did s/he set any fires?” on any administration of the Parent Daily Report (PDR), which was given three times each year between kindergarten and Grade 3; or (c) parent endorsement of yes on “Has s/he ever started fires without permission?” from the Diagnostic Interview Schedule for Children (DISC; Costello, Edelbrock, & Costello, 1985), administered when the youth were in Grade 3.

At T2, fire setting was assessed by the presence of any of the following criteria: (a) rating of 1 or 2 on the CBCL “sets fires” item in the past 6 months (Grades 4–5); (b) “yes” response to the PDR fire-setting item (Grades 4–5); (c) positive endorsement by either youth or parent on the DISC question regarding starting a fire without permission in the past year (Grade 6); or (d) youth endorsement of purposely setting a fire (or trying to) to a house, building, or other property in the past year on the Things That You Have Done (Elliott, Huizinga, & Menard, 1989) measure, administered in Grades 4, 5, and 6.

Endorsement on any one of the measurement items at each time period was considered a sufficient basis for classification as a fire setter during that period. Although such a grouping heuristic is less detailed than using interviews such as the Fire-setting Risk Interview, a precedent has been set for using such either/or criteria (e.g., Kolko et al., 1985, 2001), and parent-child correspondence between reports of fire setting has been found to have moderate to high correlations (Kolko & Kazdin, 1988). The four comparison groups included *non-fire setters* (had not set a fire at T1 or T2; $n = 299$), *desisters* (fire setting indicated at T1 but not T2; $n = 27$), *later-onset firesetters* (fire setting indicated only at T2; $n = 18$), and *persisters* (fire setting indicated at both T1 and T2; $n = 17$).

MEASURES

Antecedent constructs were grouped into three domains: child, parenting, and family. Composites were created based on multiple indicators from different measures and different reporters where possible. Composite scores were derived by standardizing scale scores and then computing the mean of the standardized scales. Measures were derived from a number of different sources, as summarized in Table 1, including interviews with the primary caregiver after their child finished kindergarten and again after Grade 1. Child report of parental

monitoring was obtained after the child finished Grade 3. Reported alpha coefficients are based on each *scale* included as an item in the overall construct, except where noted.

Child domain—In addition to demographic variables such as child gender and race, there were seven composites created in the child domain (see Table 1). In order to differentiate the more fine-grained types of disruptive behavior, narrow-band scales were employed. Items for these constructs were derived based upon the factor analyses of the CBCL and YSR published by Stormshak, Bierman, and the Conduct Problems Prevention Research Group (1998), and were supplemented with other appropriate items (e.g., sociometrics) and constructs relevant to fire setting (e.g., covert antisocial behavior). *Aggressive behavior* was based upon four different indicators, including parent, teacher, and peer report. From the parent-report CBCL, aggressive narrow-band scales were computed based on nine items (see Stormshak et al., 1998). A parallel scale was created using the Teacher's Report Form (TRF; Achenbach, 1991b) in kindergarten, with those same nine items. Sociometric interviews were conducted to generate peer nominations of aggressive children in Grade 1 based on the item "Some kids start fights, say mean things, and hit other kids." Nominations were totaled and standardized within each classroom as an index of aggressiveness. Finally, the sum of aggressive behaviors (e.g., fights, breaks things, and yells at others) from the Social Health Profile (Lochman & the Conduct Problems Prevention Research Group, 1995) was utilized at Grade 1.

Oppositional behavior was measured through a combination of parent and teacher report. Oppositional narrow-band scores were created on the basis of seven items from the CBCL, such as "argues a lot, sulks a lot," and "temper tantrums" (as described in Stormshak et al., 1998). A parallel teacher-report score was created based on the same items drawn from the TRF in kindergarten. The sum of oppositional behaviors (e.g., breaks rules, stubborn) from the Social Health Profile at Grade 1 comprised another measure of oppositional behavior.

The *impulsivity/hyperactivity* composite was based on six different measures, including parent, teacher, and peer report. Based on five parallel items from the CBCL and TRF (e.g., can't sit still, restless, talks too much), narrow-band hyperactivity scores were created for each measure. Both parents and teachers were administered respective versions of the ADHD Checklist (DuPaul, 1991) in Grade 1, from which impulsivity scales were derived based on eight items for teachers (e.g., fidgets or squirms in seat, blurts out answers) and six items for parents (e.g., talks excessively, interrupts or intrudes). Parents' endorsement of three hyperactivity items on the PDR (noisy in house, running around house, hyper/overactive) averaged across its three administrations comprised another component of the impulsivity/hyperactivity construct. Finally, peer nominations of kids who "get out of their seat a lot, do strange things, and make a lot of noise" from the sociometric interview at Grade 1 with the child's classmates were standardized within each classroom and used as another indicator of hyperactivity.

School records were examined to collect information on *academic achievement* in language arts and math at the end of Grade 1. Letter grades in these two subjects were transformed into a 13-point scoring system, where A = 13 and F = 1, and were then standardized and averaged (see Conduct Problems Prevention Research Group, 1999).

Social preference was based on one sociometric peer-report measure. During sociometric interviews with the classmates of target children, each child was asked to pick classmates they liked most (LM) and classmates they liked least (LL) at the end of Grade 1. Social preference scores were computed by standardizing the like-most and like-least nominations within classrooms and by calculating the difference between these standardized scores (LM – LL). The social preference score has been shown to have adequate validity in prior research (e.g., Cole, Dodge, & Coppotelli, 1982).

Children's *covert antisocial behavior* was assessed using a three-item index derived from the CBCL. Parents' reports of the frequencies of the "cruel to animals," "steals at home," and "steals outside the home" items were averaged to create the covert antisocial behavior composite.¹

Physical abuse history was gathered based on parent and interviewer ratings from the Developmental History interview (adapted from Dodge, Bates, & Pettit, 1990) administered when children were in kindergarten. Parents were asked to rate their concern that their child had been harmed by themselves or another family member on a 5-point scale (ranging from 0 = *no concern* to 4 = *definite incident of harm* by family member); interviewers subsequently rated their perception that the target child had been harmed based upon the parent's description. The abuse history variable was dichotomized so that if either the parent or interviewer indicated a probable or definite incident of physical harm, physical abuse history was coded as 1. If the parent and interviewer both indicated no concern, minor concern, or possible harm, physical abuse history was coded 0.

Parenting domain—There were four constructs in the parenting domain. *Appropriate discipline* was assessed through a combination of parent-and observer-reported measures. Parents completed the Parent Questionnaire (PQ; adapted from the Parent Practices Scale, Strayhorn & Weidman, 1988), which includes a 7-item scale on appropriate/consistent discipline (e.g., "When you give your child a command, what fraction of the time do you make sure that your child does it?"). At the conclusion of the PCIT in Grade 1, the observer completed the Coder Impressions Inventory (CII), an adaptation of the Oregon Social Learning Center Observer Impressions Inventory (Capaldi & Patterson, 1989) based on the observer's overall impressions of the parent, the child, and their interactions. The appropriate discipline dimension of the CII is based on 13 items (e.g., the parent gave rationales, the parent treated the child with respect), which are rated on 3-point scales.

A *harsh discipline/physical punishment* composite was created on the basis of six different measures, including parent and observer reports. The pQ harsh/physical discipline scale, consisting of four items (e.g., "How often do you tell your child you may leave if he/she doesn't behave?") was administered to parents. Parents also filled out the Conflict Tactics Scale, which included an 11-item physical punishment scale with items such as "spanked child" and "threatened to throw something at child." Another component of harsh discipline/physical punishment was parents' reports of punitiveness on the Parenting Practices Inventory (e.g., "How often do you have to threaten your child with punishment?"). The items are coded on a 4-point scale describing specific frequency ratings. The harsh discipline (5 items) and physical discipline (2 items) scales of the observer-rated CII were included at Grade 1. Observers also rated negative attention using a modified version of the Behavioral Coding System (BCS; Forehand & McMahon, 1981), which was included in the harsh discipline/physical punishment composite. Subsequent to completing the interviews with the families, the parent interviewer completed the Post-Visit Inventory (PVI; Dodge et al., 1990), which contained a 5-item harsh discipline scale rating whether specific behaviors had occurred (e.g., mother shouted at child, mother hit child) during the course of the interview.

Supervision was based on the total score on Child's Report of Parental Monitoring (drawn from Capaldi & Patterson, 1989), which contains 11 items measuring parental monitoring rules and the child's report of parental monitoring practice, and was administered at the end of Grade 3.

¹Based on the meta-analytic study reported by Frick et al. (1993), both stealing and cruelty to animals fall closer to the covert end of an overt-covert dimensional scale of child conduct problems.

The *warmth/involvement* composite consisted of five different measures, including information from the parent, the parent interviewer, and an observer. The warmth/involvement scale of the pQ (e.g., “How often do you praise your child? How often do you and your child laugh together?”), consisting of 10 items rated on a 5-point scale, was included in this composite. In kindergarten, observers used the Interaction Rating Scale (IRS; Crnic & Greenberg, 1990) to generate a rating of parental warmth based on global ratings of parental gratification, sensitivity and involvement during the entire PCIT interaction. At Grade 1, both observer-rated parental warmth consisting of 12 items on the CII (e.g., friendly relations between parent and child, parent is a positive and reinforcing parent) and observer ratings of positive attention using the BCS were used as indicators of parental warmth. Finally, the parent interviewer rated three behaviors indicative of parental warmth (spoke to child with positive tone, gave attention when child talked, positively reinforced positive behaviors) using the PVI subsequent to the interview.

Family domain—Four constructs were created in the family domain, in addition to a family constellation variable (i.e., whether the child lived in a single vs. dual-parent family). *Family stress* was measured by the total score on the Life Changes instrument, which is a 16-item parent-report measure that assesses major life stressors experienced by the child during the previous year (e.g., move, medical problems, divorce or separation of parents). Each item is weighted 2 for major events and 1 for minor events, based on parental report of the severity of the event on the family.

Parental depression was assessed by the Center for Epidemiological Studies-Depression Scale (CES-D), which is a 20-item scale that has demonstrated high internal consistency and adequate discriminant validity in other samples (Radloff, 1977).

Relationship adjustment was measured by a 28-item adaptation of the 32-item Dyadic Adjustment Scale (Spanier, 1976), administered to parents who had been living with a romantic partner for at least a year ($n = 268$).

Interparental hostility was assessed by the Conflict Tactics Scale (Straus, 1979), which assess the history of family aggressive behavior and was administered in kindergarten. Items include “yelled, insulted, or swore at your partner,” and “threatened to hit your partner.” Separate verbal and physical aggression scales regarding the parent's behavior toward the partner and the parent's impression of their partner's behavior toward them were combined to create the interparental hostility construct.

Results

To identify potential differences between groups in the risk constructs, separate univariate F-tests were conducted for each antecedent risk construct. Categorical variables (i.e., gender, race, physical abuse history, single-parent status) were analyzed using chi-square tests. The alpha values for all univariate analyses (both ANOVAs and chi-squares) were adjusted using a multistage Bonferroni procedure (Seaman, Levin, & Serlin, 1991), adjusted separately for the child, parent, and family domains. Finally, Scheffe's criteria for post-hoc analyses, which account for multiple comparisons, were used to examine differences among the fire-setting groups.

CHILD DOMAIN

Univariate tests were significant for all six of the continuous risk antecedents in the child domain; however, the Scheffe post-hoc tests did not find group differences for social preference. Child physical abuse history, $\chi^2(3) = 12.90, p < .01$, and child gender, $\chi^2(3) = 14.55, p = .002$, were also found to significantly differentiate the fire-setting groups. There were no

differences by child race, or between rural and urban Caucasian youth in their representation in the four groups (see Table 2).

Fire setters versus non-fire setters—Compared to non-fire setters, persisters displayed higher levels of aggressive behavior, oppositional behavior, impulsivity/hyperactivity, and covert antisocial behavior (all $ps < .001$). Desisters also displayed more aggressive and covert antisocial behavior and were more likely to be physically abused ($ps < .03$) than non-fire setters. Boys were more prevalent in the desisting and persisting groups, compared to their representation in non-fire setters ($p < .03$). Later-onset fire setters did not differ from the non-fire setters.

Differentiating fire-setting groups—Three of the child variables were found to differentiate the fire-setting groups. Persisters evidenced more impulsive/hyperactive behavior ($p = .02$) than did youth in the desisting group. The desisting fire setters had significantly better academic achievement at Grade 1 than did the later-onset group ($ps = .02$). The later-onset fire setters had proportionally more girls, compared to the desisting group ($p = .03$).

PARENT DOMAIN

Fire setters versus non-fire setters—Three of the four variables within the parent domain were found to differentiate the persistent fire setters from the non-fire-setting group: Persistent fire setters had parents who provided less appropriate discipline ($p < .001$), more harsh discipline ($p < .001$), and less warmth/involvement ($p = .02$). Children who were classified as later-onset fire setters had parents who also provided more harsh discipline ($p = .01$) compared to the non-fire setters.

Differentiating fire-setting groups—Two variables within the parent domain differentiated the fire-setting groups. Children who persisted in their fire setting had parents who provided less appropriate discipline ($p = .01$) and more harsh discipline ($p = .001$) in comparison to children who desisted.

FAMILY DOMAIN

Univariate tests revealed differences on parental depression and interparental hostility. Single-parent family status was also found to significantly differentiate the fire-setting groups, $\chi^2(3) = 20.34, p = .001$.

Fire setters versus non-fire setters—Within the family domain, persisters were found to differ from non-fire setters on two of the four continuous variables. Persisters came from families with significantly more parental depression ($p < .001$) and more interparental hostility (within dual-parent families, $p = .01$). Youth in the desisting and persisting groups were more likely to come from single-parent families than were non-fire setters ($p < .05$).

Differentiating fire-setting groups—Persistent fire setters had parents with more depression and more interpersonal hostility compared to desisting fire setters (both $ps < .04$).

CUMULATIVE RISK

We dichotomized each continuous standardized risk factor (using 1.5 as a cutoff value), and computed the cumulative number of risk factors for each youth, including the binary gender (boys), abuse history (abused), and single-parent family status variables. We then conducted two different analyses to examine the association between cumulative risk and fire-setting status. First, we used a Mann-Whitney-Wilcoxon test to assess whether being a fire setter was associated with the numbers of risk factors present. The rank sum statistic was significant at

15,291.5, $p < .0001$. The percentage of youth who became fire setters (collapsed across group) was 1.5% among the children with no risk factors, 13.2% among the children with one risk factor, 19.6% among the children with two risk factors, and 40.3% among the children with three or more risk factors (see Figure 1).

Next, we tested for differences in the number of risk factors present as a function of fire-setting group. The ANOVA testing for group differences was significant, $F(3,357) = 19.66$, $p < .001$. Post-hoc analyses revealed fewer risk factors for non-fire setters ($M = 1.32$) as compared to both desisters ($M = 2.61$) and persisters ($M = 2.76$) ($ps < .001$). Figure 2 shows the percentage of youth in each group with various cumulative risk indicators.

Discussion

A concurrent link has been established between fire-setting behavior in children and non-fire-setting psychopathology, leading researchers to view fire setting as an “advanced level of antisocial behavior” (Forehand et al., 1991; Stickle & Blechman, 2002). The three most commonly found behavior problems among children who set fires are aggression, antisocial/delinquent behavior, and hyperactivity/impulsivity (Kolko, 1985). In the current study, each of these behaviors was significantly associated with fire setting, as were several other variables in the child, parenting, and family domains. This study replicated the growing body of research on risk for fire setting, demonstrating the important link between this set of risk factors and the presence of youth fire setting. We extended previous research by tracking fire-setting behavior across two developmental periods; by using a more diverse, nonreferred sample; and by gathering information on risk from multiple sources. At least one of the fire-setting groups displayed elevated risk on 13 of the 19 risk factors compared to non-fire setters. These results were robust to our careful procedures for controlling for Type I error. The pattern of risk factors for fire setting was similar in our community-based sample to what has been found by previous studies on clinical or adjudicated samples, providing evidence for generalizability.

In terms of distinguishing among the fire-setting groups, persisters as a group had the most risk factors within and across domains. Children with three or more risk factors were at a particularly high risk for early or persistent fire setting (see Figure 1). Differences were not found between persisters and youth who set fires during the later, but not earlier, developmental window. However, persisters differed from desisters on a number of dimensions. Among the child characteristics, impulsivity was the only variable that distinguished persisters from desisters. More striking is the fact that persisters had higher levels of risk on numerous parenting and family characteristics; persistent fire setters had parents who used more harsh and less appropriate discipline, were more depressed, and had more spousal hostility compared to children who desisted. Parents of persistent fire setters were also the lowest in parental warmth, being the only group to show a difference from the non-fire setters. Thus, the family environment of those youth who go on to persist in their fire setting after early childhood is marked by parental psychopathology, interparental conflict, and the use of discipline strategies that are likely to be ineffective.

When we assessed risk factors associated with a particular developmental time frame, only 2 of the 19 variables distinguished desisters (i.e., children who set fires prior to fourth grade, but not subsequently) from later-onset fire setting (i.e., children who set fires between fourth and sixth grade): gender and academic achievement. There were proportionally more girls in the later-onset group (50%), compared to the desisting group (22%). We found that later-onset fire setters had poorer academic achievement, as measured by official school records, compared to desisters. It may be the case that the relationship between low academic achievement and later-onset fire setting is a result of these youth becoming disengaged from the scholastic arena

and more involved in delinquent activities, or is related to more general intellectual deficiencies.

Social preference, race, geographical context (urban vs. rural), parental supervision, family stress, and adjustment in the parental relationship (among dual-parent families) did not differ between the non-fire setters and the various fire-setting groups. Geographical context has not previously been assessed as a risk factor for fire setting, as most samples have been homogeneous on this dimension. Arson rates have been highest in large cities and lowest in rural areas (U.S. Department of Justice, 1999), but this difference may not extend to other forms of fire setting.

There are limitations inherent in this study that need to be taken into account in considering the results. Our sample was drawn from more impoverished schools, limiting the external validity of these findings to more disadvantaged geographic areas. Also, caution must be taken in our analyses of urban versus rural geographical context, as we had only one rural site (Pennsylvania), and were only able to run this comparison for Caucasian youth, due to a site-by-ethnicity confound. Nonetheless, given the prospective longitudinal nature of the study, the diverse sample, and the multiple measured constructs used in this study, these results are indicative of early and reliable differences for fire-setting youth in multiple domains, which are evident to multiple informants.

The set of risk factors that is associated with youth fire setting appears to be more generalized than specific; that is, these risk indicators are also associated with a broad array of pernicious outcomes for youth, including other forms of psychopathology, such as child delinquency (Loeber & Farrington, 2000). The findings are informative for considering to whom we might target fire-setting prevention efforts. In addition to universal preventive interventions that teach children about fire safety, prevention programs for fire setting should specifically target children who are high on risk in other facets of their behavior, especially children who display other types of aggression, opposition, impulsivity, or antisocial behavior. An index summary of risk might identify subpopulations that are particularly vulnerable for fire setting and might be appropriate targets for indicated prevention programs. For example, about 40% of the children with three or more risk factors were or became fire setters at some point in time. Likewise, it is important for preventionists to be aware that male gender is a risk factor for early-onset fire setting (desisters and persisters), but that the group of children that sets fires only after Grade 3 was equally composed of boys and girls.

These results also bear implications for the treatment of fire setting, as some of the risk factors identified, such as harsh parental discipline and child oppositional behavior, are appropriate targets for behavioral intervention. Collaboration between fire department officials and mental health agencies is critical in generating referrals, as more children who set fires are detected through fire departments compared to mental health agencies (Kolko, 1988). After identification has been made, the next step is to outreach to families and utilize strategies to engage them in mental health treatment, such as those outlined by Webb, Sakheim, Towns-Miranda, and Wagner (1990). It will be important in initial assessments for clinicians to address aspects of the family and child that may require attention and intervention apart from fire setting, and to attend to these on an individual basis. Kolko and colleagues note the importance of comprehensive assessment and caution that "only after teasing apart the various factors influencing this behavior will clinicians come to understand the actual behavior of setting a fire is often more complicated than it seemed at first glance" (Kolko, Nishi-Strattner, Wilcox, & Kopet, 2002, p. 183). Treatments for fire setting need to address the multilevel nature of the problem, with attention to the needs of the child, family, and even the greater community. In particular, this study suggests that parental discipline styles and family factors may be additional targets of treatment that may be important to reduce the risk of recidivism. Specific

educational interventions for fire setting, such as those outlined by Pinsonneault, Richardson, and Pinsonneault (2002), will often need to be supplemented with more generalized clinical interventions, such as cognitive-behavioral therapy and social skills training to address child externalizing problems, as well as parent training or behavioral family therapy to address parental disciplinary strategies, warmth, and conflict. It is hoped that continued research addressing risk factors, course, and treatment of fire setting will pave the way toward decreasing the scope and impact of this problem.

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FIGURE 1.

Fire-setting status as a function of number of risk factors. *Note.* None of the desisters or persisters had zero risk factors.

FIGURE 2.
Number of risk factors by fire-setting group.

TABLE 1

Measures Comprising Antecedent Constructs by Domain

Measures	Grades Administered ^a	Source	Number of Items
Child Domain			
Aggressive behavior ($\alpha = .80$)			
Child Behavior Checklist	K, 1	P	9
Teacher's Report Form	K	T	9
Aggressive (SM)	1	C	1
Social Health Profile	1	T	5
Oppositional behavior ($\alpha = .64$)			
Child Behavior Checklist	K, 1	P	7
Teacher's Report Form	K	T	7
Social Health Profile	1	T	3
Impulsivity/hyperactivity ($\alpha = .86$)			
Child Behavior Checklist	K, 1	P	5
Teacher's Report Form	K	T	5
ADHD Checklist-Teacher	1	T	8
ADHD Checklist-Parent	1	P	6
Parent Daily Report	K, 1	P	3
Hyperactive (SM)	1	C	1
Academic achievement ($\alpha = .44$)*			
Grades	1	SR	2
Social preference			
Like most-like least (SM)	1	C	2
Covert antisocial behavior			
Child Behavior Checklist	K, 1	P	3
Physical abuse history			
Developmental history	K	P, I	2
Parenting Domain			
Appropriate discipline ($\alpha = .61$)			
Parent Questionnaire	K, 1	P	7
Coder Impressions Inventory	1	O	13
Harsh discipline/physical punishment ($\alpha = .68$)			
Parent Questionnaire	K, 1	P	4
Conflict Tactics Scale	K, 1	P	11
Parenting Practices Inventory	K	P	3
Coder Impressions Inventory	1	O	7
Behavior Coding System	1	O	1
Post-Visit Inventory	K, 1	I	5
Supervision			
Child report of parental monitoring	3	Y	11
Warmth/involvement ($\alpha = .69$)			
Parent Questionnaire	K, 1	P	10
Interaction Rating System	K	O	6
Coder Impressions Inventory	1	O	12
Behavioral Coding System	1	O	1
Post-Visit Inventory	K, 1	I	3
Family Domain			
Family stress ($\alpha = .47$)*			
Life changes	K, 1	P	16
Parental depression ($\alpha = .70$)*			
CES-D	K, 1	P	20
Relationship adjustment ($\alpha = .85$)*			
Dyadic Adjustment Scale	K, 1	P	28
Interparental hostility ($\alpha = .79$)*			
Conflict Tactics Scale	K, 1	P	26

Note. Reported alpha coefficients are based on each *scale* included as an item in the overall construct, except where noted with *. CES-D = Center for Epidemiological Studies-Depression Scale; SM = Sociometric peer interviews. Sources include: Teachers (T), Classmates (C), Parent (P), Interviewer (I), School Records (SR), Observer (O), and Youth (Y).

^aK = kindergarten, 1 = Grade 1, 3 = Grade 3.

TABLE 2

Mean Values for Antecedent Risk Factors by Fire-Setting Status

Construct	Non-Fire Setters		Fire Setters	
	Non-Fire Setters (N) (n = 299)	Desisters (D) (n = 27)	Later-Onset Fire Setters (L) (n = 18)	Persisters (P) (n = 17) Differences
Child Domain (n = 304)				
Aggressive behavior	-.22	.27	.16	.67N < D, P
Oppositional behavior	-.21	.05	.13	.59N < P
Impulsivity/hyperactivity	-.21	.01	.23	.70N < P; D < P
Social preference	.20	-.23	-.22	-.47ns
Covert antisocial behavior	-.22	.22	.10	.56N < D, P
Academic achievement	.10	.39	-.40	-.33D > L
Physical abuse history (abused) ^a	.05	.22	.17	.06N < D
Gender (boys) ^a	.46	.78	.50	.76N < D, P; D > L
Race (urban African-American) ^a	.56	.72	.77	.81ns
Context (rural Caucasian) ^a	.47	.30	.57	.25ns
Parent Domain (n = 334)				
Appropriate discipline	.10	.06	-.19	-.81N, D > P
Harsh discipline	-.10	-.03	.36	.56N < L, P; D < P
Supervision/monitoring	.03	-.07	-.02	-.32ns
Warmth/involvement	.09	.04	-.32	-.41N > P
Family Domain (n = 361; 225 dual-parent families)				
Family stress	-.09	.21	.02	.40ns
Parental depression	-.12	-.08	.37	.95N, D < P
Relationship adjustment	.05	-.06	-.05	-.19ns
Interparental hostility	-.09	-.10	-.04	1.01N, D < P
Family constellation (single parent) ^a	.45	.74	.61	.88N < D, P

Note. All differences listed are significant at $p < .05$. All continuous variables are standardized as z-scores.

^a Dichotomous risk factor. Relative frequencies (per group) are provided in place of means.