Education and Treatment for Boys Who Set Fires: Specificity, Moderators, and Predictors of Recidivism
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Given the relative absence of treatment outcome studies, information about the specificity and utility of interventions for children who set fires has not been reported. In a treatment outcome study with young boys referred for firesetting that compared brief home visitation from a firefighter, fire safety education (FSE), and cognitive–behavioral treatment (CBT), we examined the specificity, potential moderators, and predictors of recidivism. FSE exerted specific effects on some fire knowledge and safety measures, as expected; CBT tended to show specific effects only on positive problem solutions. Potential moderators of FSE and CBT were suggested in an exploratory analysis (e.g., exposure to fire models/materials, child’s general fire knowledge, and family functioning). Fire history, fire attraction, and externalizing behaviors were among the predictors of firesetting recidivism. Implications of these findings for assessment and intervention are discussed in the context of future research directions.

Fire safety education (FSE) and cognitive–behavioral treatment (CBT) are perhaps the most common approaches to intervention with firesetting children and their families (Kolko, 2002a). FSE generally seeks to address the child’s experience with, exposure to, and interest in fire, through instruction and practice in safety skills (e.g., Pinsonneault, 2002). In contrast, CBT frequently involves targeting individual forms of behavioral dysfunction and environmental conditions by enhancing prosocial skills and parent–child relationships (e.g., Kolko, 2002b). Training in fire safety education may be the most frequently used intervention approach across programs (see Pinsonneault, 2002), but it is occasionally supplemented by the incorporation of specific behavioral or other clinical techniques. Efforts to incorporate the two approaches have been reported in several program descriptions (Cole, Grolnick, & Schwartzman, 1999; Cook, Hersch, Gaynor, & Roehl, 1989; Webb, Sakheim, Towns-Miranda, & Wagner, 1990) and anecdotal clinical studies or case reports (Bumpass, Brix, & Preston, 1985; Bumpass, Fagelman, & Brix, 1983; Cox-Jones, Lubetsky, Fultz, & Kolko, 1990; De-Salvatore & Hornstein, 1991; Hanson, Mackay, Atkinson, Staley, & Pignatiello, 1995; McGrath, Marshall, & Prior, 1979).

Despite the widespread use of these approaches, only a few outcome studies that incorporate them have been reported in the scientific literature. An early Australian study (Adler, Nunn, Northam, Lebnan, & Ross, 1994) found no significant differences in the outcomes of an intervention program that combined FSE and clinical methods (behavior modification) for two subgroups of child firesetters, one classified as “curious” and the other designated as “pathological.” In the United States, Kolko (2001) randomly assigned referred child firesetters to one of two skill-based conditions, FSE or CBT, and compared these more intensive conditions with a brief intervention consisting of cases whose parents made initial contact with their local fire department and requested a brief home visit from a firefighter (FHV). The FHV cases were included in this trial because this condition represents a routine community practice in the fire service that has yet to be studied (see Kolko, 1988), and it permits an evaluation of the relative benefits of the two more intensive conditions in comparison to this more efficient alternative approach. All three conditions showed a significant reduction in the frequency of fires reported by children or parents after intervention and at 1-year follow-up; similar results were found for matchplay. However, both FSE and CBT showed greater improvement than FHV in the number of fires reported by children at posttreatment, CBT showed a significant reduction in the proportion of cases with any matchplay at posttreatment,
and both FSE and CBT showed a significant reduction in the proportion of cases with any matchplay at follow-up. The follow-up firesetting recidivism rates based on aggregated child and parent reports were 50% for FHV, 24% for CBT, and 15% for FSE. Relative to FHV, the CBT and FSE conditions showed significant improvements on other measures of fire-related involvement at posttreatment (e.g., ratings of severity of primary fire problem) and follow-up (e.g., scores on deviant fire behavior factor). To our knowledge, this is the only randomized clinical trial in the published literature that compares these two intervention approaches with child firesetters.

These few studies notwithstanding, there is virtually no information regarding the specificity of FSE or CBT, moderators of treatment, or predictors of recidivism, which are needed to guide practitioners or policy decision makers working in this area. To understand the mechanisms of action underlying an intervention, it is important to learn whether the outcomes targeted by a particular intervention actually change as predicted, because moderators of intervention efficacy can suggest which children will be most helped by a given treatment (Kraemer, Wilson, Fairburn, & Agras, 2002). For example, modest evidence has been found for the specificity of CBT (e.g., greater impact on cognitive distortion), but not for family therapy (e.g., no greater impact on family functioning) in the treatment of depressed adolescents (Kolko, Brent, Baugher, Bridge, & Birmaher, 2000). In the juvenile firesetter arena, a common assumption guiding services is that educational interventions (e.g., FSE) are designed to promote fire safety knowledge, skill, and competence, and that psychological interventions (e.g., CBT) seek to improve child, parent, and family functioning. To promote best practices with this population, it is important to determine whether FSE and CBT demonstrate these specific improvements, as would be expected based on their respective conceptual underpinnings.

There is also a prevailing assumption that FSE is more efficacious with children exhibiting heightened curiosity about fire or who are exposed to firesetting materials, and that CBT is more effective with children presenting with heightened psychopathology or with dysfunctional parents or families (see Federal Emergency Management Agency [FEMA], 1983). These logical assumptions are designed to make the treatment selection and implementation process more efficient and effective. Unfortunately, studies examining these potential moderators of treatment have not been reported. At best, the field has generated anecdotal suggestions that outcome may be influenced by diverse child, parent, and family characteristics, such as inability to perceive cause–effect relationships, cognitive deficits (Bumpass et al., 1983), poor engagement (Bumpass et al., 1985), inattentiveness and accident-proneness, exposure to incendiaries or models, and poor parental management and supervision (Hanson, Mackay-Soroka, Staley, & Poulton, 1994). The exploration of a few potential moderator variables designed to identify the children for which FSE (e.g., curiosity, exposure) and CBT (e.g., psychopathology, family dysfunction) are likely to be effective would have practical implications, as has been found among children with attention-deficit/hyperactivity disorder (ADHD), for whom there is evidence for moderators of treatment response (i.e., parental depression, severity of children’s ADHD) following medication management and combination treatment (Owens et al., 2003).

There is also minimal evidence for the correlates of recidivism (Brett, 2004). In one intervention study, group fire safety skills training was more effective than individual fire awareness discussions with young, hospitalized firesetters in reducing contact with fire-related materials at posttraining and 6-month follow-up, according to parental reports of firesetplay (Kolko, Watson, & Faust, 1991). Firesetting recidivism at 6-month follow-up was associated with a diagnosis of ADHD but not with fire safety knowledge or contact with fire-related toys. Follow-up matchplay was associated with less contact with fire stimuli at pretraining as well as limited fire safety knowledge, greater contact with fire-related stimuli in an analogue task, and picking up a simulated pack of matches at posttraining assessment. In the Adler et al. (1994) study, only the child’s psychopathology was a significant correlate of firesetting recidivism at 12-month follow-up, but not age, number of fires, smokers in home, or study condition. In a prospective longitudinal study of children’s involvement with fire over a 2-year follow-up period, 50% and 59% of firesetters in a nonpatient and patient sample, respectively, became recidivists (Kolko, Day, Bridge, & Kazdin, 2001). In the nonpatient sample, involvement in fire-related acts and covert antisocial behavior predicted recidivism, beyond demographics. In the patient sample, involvement in fire-related acts and covert antisocial behavior were the only predictors of follow-up firesetting beyond any initial involvement in matchplay. The possibility of confirming these or identifying other correlates of recidivism highlights the importance of evaluating these outcomes with a new sample of clinically referred child firesetters.

Three novel aims are addressed in this study, each devoted to understanding how interventions work for children who set fires and with whom these interventions are most effective. First, we examined the specific effects of FSE and CBT on outcomes targeted uniquely by each intervention to learn more about their proposed mechanisms of action. We hypothesized that FSE would produce significant changes in fire-related curiosity, knowledge, and skills, whereas CBT would produce significant changes in the clinical functioning of children and their parents or families. Second, potential moderators of outcome were examined for FSE and CBT; as these interventions were expected to have different treatment moderators. For example, we hypothesized that FSE would be more effective among children with heightened curiosity about fire and exposure to fire models/materials, whereas CBT would be more effective among children, parents, and families with greater clinical dysfunction. Finally, child, parent, and family variables that predicted long-term firesetting status in a longitudinal study (Kolko et al., 2001) were examined as predictors of firesetting recidivism in our
completed intervention study. We hypothesized that firesetting history and child psychopathology measures would correlate with continued fire setting at follow-up.

**METHOD**

**Participants**

Study participants included 46 boys, ages 5 to 13 years, referred by several sources (e.g., City of Pittsburgh Bureau of Fire, parental solicitation) for firesetting behavior (see Kolko, 2001). Inclusion criteria were that each child’s involvement in a fire occurred during the past 3 months, burned or damaged property, and was documented through an arson investigator report or confirmation by the child or parent. Exclusion criteria included specialized medical conditions, concurrent treatment, family instability (e.g., parent suicidality, pending divorce), and current psychosis or suicidality. Participants were an average age of 9.6 years (SD = 2.1) at the start of treatment with an average WISC-R full-scale IQ composite of 89.6 (SD: 19.7; range: 76–128). Twenty-seven participants (59%) were African American, 15 (33%) were Caucasian, and 4 (9%) were biracial. Thirty-eight participants (83%) had a DSM-III-R Axis I diagnosis (ADHD, Conduct Disorder). Twenty-three children (50%) lived with their biological mothers only, 13 (28%) with both biological parents, 5 (11%) with adoptive parents, and 5 (11%) in other arrangements. Twenty-six families (58%) received federal financial assistance.

**Group Assignment and Comparability**

Participants who met study inclusion criteria completed an Institutional Review Board-approved informed consent form and baseline questionnaires before being assigned to an intervention condition. Cases that were directly referred to the study for services were randomly assigned to CBT or FSE, with the groups balanced on age (7–9 vs. 10–12 years), socioeconomic status (< II vs. III–V; Hollingshead & Redlich, 1958), and number of parent figures (one vs. two). A third group of cases were assigned to FHV because these families had already made arrangements to receive services from their local firehouses just prior to their referral to the study and did not want to alter their intervention plans. In all, the study included 21 cases in CBT, 17 in FSE, and 16 in FHV, of whom 46 (85%) completed intervention and postassessment. The three intervention conditions were comparable in all demographic and diagnostic characteristics (e.g., age, ethnicity, child IQ, parental education, welfare status), the number of fires and matchplay incidents reported separately by children and their parents at intake, details of their referral firesetting incident (e.g., time since the fire, site and severity of the fire, intention, motive), clinical status (e.g., severity of behavioral and emotional problems, diagnoses), and parent and family status (e.g., severity of parental depression and parenting practices, family cohesion and conflict).

**Intervention Staff, Training, and Supervision**

FSE and FHV were each administered by firefighters from the Pittsburgh Bureau of Fire who conducted their interventions in the office or home, respectively. Six firefighters were selected for the study by the fire chief, a firefighter liaison, and the principal investigator, using multiple criteria (e.g., experience working with child firesetters) and interviews. Three firefighters were assigned to each of the two fire service conditions. Three CBT therapists were selected by the principal investigator and project coordinator based on minimal educational (e.g., Master’s degree) and experiential requirements (e.g., prior work with behavior-disordered children and CBT). Intervention staff for the three conditions were balanced by ethnicity (two African Americans, one Caucasian), and FSE and FHV included both men and women, whereas CBT included only women. Staff members received extensive training in their respective interventions (e.g., session-by-session discussion of manual with investigator and coordinator, reading of assigned relevant background literature, review of “master” videotapes). In addition, each staff member independently implemented his or her intervention with two pilot cases before participating in the trial with study cases.

**Intervention Structure/Process**

Children and parents receiving FSE and CBT met individually with a firefighter or therapist in semiestructured, manualized weekly sessions. The CBT and FSE conditions did not differ significantly in the average number of sessions (7.4 vs. 5.5), weeks (8.7 vs. 8.7), or hours of service delivered to children (7.3 vs. 7.5) or parents (4.5 vs. 5.7). The FHV condition consisted of an initial 1-hour session and a follow-up contact approximately 8 weeks later to parallel the duration of intervention of the FSE and CBT conditions. Several procedures were instituted to minimize dropout across all three conditions (e.g., prompt and convenient scheduling, family orientation session, immediate rescheduling after no-shows, reminders about assessment compensation).

**Intervention Conditions**

**Cognitive–Behavioral Treatment (CBT).** CBT targeted the clinical correlates of fire setting (Kolko, 2002b). By teaching generalized self-control and establishing environmental conditions that encourage behaviors other than fire setting, these procedures sought to alter the psychological significance of fire setting, the child’s social–cognitive repertoire, and the functional context in which it occurs. Children and/or parents participated in sessions both separately and together with a clinician. Child treatment began with a session involving the graphing
technique (see Bumpass et al., 1985; Kolko & Ammerman, 1988), in which key aspects of the affective and cognitive parameters of the fire (e.g., intensity of anger or sadness) were graphically represented in relation to key aspects of the functional context of the fire (e.g., key antecedents, events, or other consequences). Next, the participants received three sessions of training and applications of problem-solving skills and self-instructions (e.g., problem identification, generation of alternative solutions) geared toward critically evaluating the risks/benefits of involvement in negative behaviors (Weissberg, Gesten, Caplan, & Jackson, 1990), followed by one to two sessions of training in assertion and interpersonal conflict resolution skills (Michelson, Sugai, Wood, & Kazdin, 1983). Two sessions were devoted to providing parents with psychoeducational information about the environmental context of fire setting (e.g., motives) and training in behavior management practices (e.g., monitoring, reinforcement, response cost; Adler, Nunn, Northam, Lebnan, & Ross, 1994; Holland, 1969). A home-based contingency was jointly developed that designated positive consequences for desired behavior (e.g., appropriate play) and negative consequences for fire-related activity (e.g., possession of incendiary materials).

Fire Safety Education (FSE). FSE incorporated procedures based on the existing educational interventions (e.g., Kolko & Kazdin, 1991) and other prevention curricula (e.g., Adler, Nunn, Northam, Lebnan, & Ross, 1994; Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996; FEMA, 1979; National Fire Protection Association, 1979, 1982). FSE provided information about and instruction in fire safety skills and prevention practices to discourage involvement in fire-related activities. The children and/or parents met separately or, at times, together with a firefighter/educator.

Children learned about the dangers and effects of fire before being trained in personal safety strategies (e.g., uses/abuses of fire) and prevention practices (e.g., giving matches to an adult). Children practiced fire protection and evacuation strategies (e.g., stop, drop, and roll; emergency phone calls; see FEMA, 1979; Jones, Ollendick, McLaughlin, & Williams, 1989), and methods to report and control a fire (National Fire Protection Association, 1979). Parents received similar background information and an overview of fire prevention, discussed home fire safety guidelines, and oversaw the child’s completion of a fire safety project (FEMA, 1979). Role-plays were used to enhance retention, generalization, and maintenance. Children received a certificate of achievement upon completion of the program.

Firefighter Home Visit (FHV). This two-contact condition was designed to capture some of the routine educational practices used in most fire departments based on interviews with program directors and local firefighters, and a national survey of intervention programs (Kolko, 1988). This condition was selected for comparison purposes because it reflects a “treatment as usual” condition and because it may provide a common and cost-effective alternative approach to addressing this problem. In the first contact, children received information about the danger of fires (e.g., to themselves, family), reviewed fire safety materials (e.g., coloring book on fire safety), and were asked to follow a “no-fire contract.” Each parent received a home fire-safety handout (e.g., secure all incendiary materials). In the second contact, the firefighter visited or called the family to review specific concepts and elaborate on key topics (e.g., playing with matches or lighters begins as a simple activity). This additional contact was conducted 8 weeks after the first session to directly parallel the duration of intervention of the FSE and CBT intervention conditions.

Intervention Credibility, Fidelity, and Attrition

Children and parents completed a 10-item questionnaire (5-point Likert scale ratings) to evaluate the degree to which they perceived each of the three conditions as credible and beneficial in reducing firesetting behavior (for details, see Kolko, 2001, p. 362). There were four questions each to assess CBT (e.g., wanting to learn how to change my behavior), FSE (e.g., wanting to learn fire safety skills), and FHV (e.g., wanting to learn about firefighters). The ratings showed clear comparability in the perceived credibility and benefit of the three conditions for both children and parents.

Several procedures were implemented throughout the intervention phase to enhance program integrity, such as use of specific manuals for all three conditions, review of weekly progress notes and case summary ratings, and a weekly supervision meeting conducted by the principal investigator and project coordinator with the staff in the three conditions. Supervision meetings included a review of each case followed by a brief discussion of the content of session tapes and recommendations for enhancing the administration of specific methods.

To monitor fidelity, each condition had an individualized treatment fidelity rating scale, developed to provide structured and objective ratings of the degree to which the material was administered as specified in each manual (for details, see Kolko, 2001, p. 362). Each manual described the specific components of each skill domain or topic on a session by session basis. Ratings of each domain or skill were made on a 3-point Likert scale that reflected the level of correct administration (1 = content not covered; 2 = content covered minimally/partially or was somewhat unclear, confusing, or disorganized; 3 = most/all content covered as stated and in a clear way). A trained independent observer rated randomly selected videotapes or audiotapes for 30% of the sessions completed in FSE and CBT and calculated the overall percentage of correctly administered intervention content. Supervisors reported high levels of protocol fidelity for CBT (M = 92%; SD = 7%; range = 85%–99%) and FSE (M = 86%; SD = 10%; range = 81%–98%). Structured ratings were also completed by each firefighter or therapist to provide an assessment of participant motivation and progress after each session. These ratings were generally high and revealed no significant differences between CBT and FSE.
A total of 85% (46/54) of the sample completed intervention. Of the 8 children who withdrew from the study, 4 were from CBT, 2 were from FSE, and 2 were from FHV $\chi^2(2, N = 54) = 0.49, p < .61$. There were no significant differences between dropouts and completers in child demographics, diagnoses, firesetting frequency, or parent ratings of the child’s behavioral or emotional problems, or level of social competence ($ps = .84–.11$).

Assessment Procedures

Children and their caregivers completed self-report instruments and interviews with separate, trained research associates at (a) pretreatment (intake), (b) posttreatment (on average, 13 weeks later), and (c) 1-year follow-up. The Fire History Screen (FHS; see Kolko & Kazdin, 1988) was also administered by phone at a 3-month follow-up. Research associates were unaware of the child’s intervention condition.

Outcome Measures

**Matchplay and Firesetting Behavior.** Parents and children each completed questions from the FHS to document the presence of any child involvement in matchplay and fire setting within 6 months of the first assessment. At each subsequent assessment, respondents were asked about any new incidents since the prior assessment. As used in our prior research (Kolko, 2002a), a report of firesetting by *either* the child or parent was used to indicate the presence or occurrence of “any firesetting,” and the same approach was used to identify “any matchplay.” Reports of the absence of the behavior by *both* informants were used to code the absence of each behavior. This integration of reports from the two informants was used to strengthen the validity of this specific outcome measure; these two perspectives often differ in their reports on various children’s antisocial behavior, yet both sources contribute important information about this low-frequency but high-severity behavior (Kolko & Kazdin, 1988). The FHS has been used extensively to contrast subgroups based on their history of fire involvement (e.g., Kolko, 2002a; Kolko & Kazdin, 1989b).

**Fire-Specific Measures to Evaluate Specificity, Moderation, and Recidivism**

We included several factors from two instruments used to obtain information about the levels of fire-related and general “risk factors.” The Firesetting Risk Interview (FRI; Kolko & Kazdin, 1989a) is an 86-item parent self-report instrument that comprises 8 factors reflecting fire-specific characteristics (e.g., curiosity about fire, involvement in fire-related acts, exposure to peers/family fire models) and 7 factors reflecting behavioral or environmental characteristics (e.g., child negative behavior, frequency of harsh punishment). Most of the scales for these 15 factors are based on multiple choice items rated on Likert scales (5 points); some are rated on a dichotomous (yes/no) basis. The subscales have good internal consistency (Kolko & Kazdin, 1989a). In addition, most of the scales discriminate firesetters from nonfiresetters and some have predicted 1-year recidivism (Kolko & Kazdin, 1992).

The 46-item Children’s Firesetting Interview (CFI; Kolko & Kazdin, 1989b) includes a smaller set of six factors believed to be important to obtain from the child’s perspective (e.g., curiosity about fire, involvement in fire-related activities, exposure to fire models/materials, supervision and discipline). The items are assessed on structured scales using multiple choice (1 to 5) items and yes/no items. The CFI is administered in a similar way to the FRI, but it also includes the use of certain props (e.g., simulated matchpack, phone) for use in role-plays. Most of the scales have moderate to high internal consistency and differentiate firesetters from nonfiresetters (Kolko & Kazdin, 1989b). Some have predicted firesetting recidivism (Kolko & Kazdin, 1992).

**Fire-Related Activities.** We selected two fire-related factors because of their frequent depiction in the literature as key influences on treatment selection and outcome. The first factor, the child’s Exposure to Fire Models/Materials, was assessed on 1- to 5-point Likert scales with the 13-item FRI factor (Kolko & Kazdin, 1989a) and the 6-item CFI factor (Kolko & Kazdin, 1989b) that reflect the child’s exposure to individuals who are involved with fire (e.g., number of friends who smoke) and materials that are used in fire-related activities (e.g., availability of matches, lighters, or other fire starting materials in home). We opted to average the factor scores from the two informants because both contributed useful information about the environmental risks to which the child was exposed. These two respective factors have been found to possess good internal consistency ($\alpha = .66, .61$) and short-term test–retest reliability ($r = .73, .81$).

The second factor, Involvement in Fire-Related Activities, is taken from the CFI (Kolko & Kazdin, 1989b) and captures the level or extent of the child’s behavior (e.g., hiding matches or lighters). This small factor includes three items that are rated on 5-point (1 to 5) Likert scales (e.g., frequency of hiding matches, lighters, or other fire-starting materials, frequency of having others tell someone in the family about the child’s play with fire). This factor has been found to have modest internal consistency ($\alpha = .47$) and good test–retest reliability ($r = .65$).

**Fire Curiosity and Attraction.** To capture interest in fire, we included the 7-item Curiosity about Fire subscale from the FRI (Kolko & Kazdin, 1989a) and the 10-item Curiosity about Fire subscale from the CFI (Kolko & Kazdin, 1989b), which included the same 7 items on the FRI plus 3 additional items. The items are rated on 1- to 5-point Likert scales (e.g., wants to play with fire, thinks fire is special or magical, likes to talk about fire). Here too we averaged the scores for the two informants to create an aggregate. These two respective factors have been found to possess good internal consistency ($\alpha = .85, .69$) and short-term test–retest reliability ($r = .87, .46$).
The 23-item Fire Attraction and Interest Scale (FAIS; Kolko & Kazdin, 1992) was also administered to children (α = .83) and parents (α = .91) to evaluate additional aspects of fire that children may like and find appealing. These items are rated on 1- to 5-point Likert scales (e.g., “I like to play with toys or other materials that remind me of fire”). We calculated a mean based on the aggregated reports of the two informants. The FAIS differentiates between children with and without a history of firesetting recidivism (Kolko & Kazdin, 1992).

**Fire Knowledge and Safety Skill.** We included scores from the 15-item Fire Knowledge and the 8-item Fire Safety Competence factors of the CFI to reflect the child’s understanding of fire setting and its effects, and the level of the child’s fire safety skill related to fire prevention and emergency preparedness (Kolko & Kazdin, 1989b). The Fire Knowledge factor asks the child to indicate whether a specific item will burn when touched by a lighted match (e.g., pieces of wood, bricks, skin, shampoo), yielding the total number of correct responses. The Fire Safety Competence factor consists of open-ended questions designed to evaluate the child’s responses to several fire-related situations (e.g., identify dangers to playing with fire, how to put out fire in fireplace, what to do if clothes catch on fire). These two respective factors possess good internal consistency (α = .63, .74) and short-term test–retest reliability (r = .62, .58).

We also administered the 20-item Fire Knowledge Test (FKT) that surveys the child’s knowledge of fire safety concepts included in the Learn Not to Burn program (National Fire Protection Association, 1979). The items are completed by selecting one of two response choices across a broad range of content (e.g., three elements necessary for fire to occur, what people die from in fire tragedies), yielding a score for the total number of items answered correctly. Schoolchildren exposed to the Learn Not to Burn curriculum have made significant gains on the FKT, relative to controls (α = .77; National Fire Protection Association, 1979). The Parent Questionnaire (PQ), a companion to the FKT, reflects the level of the child’s fire awareness and knowledge based on parent report, and has revealed improvements for trained (versus control) students. The 8 dichotomous items evaluate parallel content to the FKT (e.g., child has discouraged family members from using fire inappropriately, child understands the dangers or hazards of fire) and yield a total score for the number of safety items that the child knows or has done.

**Clinical Functioning Measures to Evaluate Specificity, Moderation, and Recidivism**

**Child Characteristics.** Parents completed the Children’s Hostility Inventory (Kazdin, Rodgers, Colbus, & Siegel, 1987), which differentiates firesetters, nonfiresetters, and firesetters classified as high or low in anger (Kolko, Kazdin, & Meyer, 1985). Children completed a Social Problem Solving (SPS) task that classified their proposed solutions for hypothetical problem situations as either positive (assertive or request for authority figure intervention) or negative (aggressive or irrelevant) using an existing codebook (Dodge & Coie, 1987). Given this dichotomous coding scheme, we simply report herein the proportion of responses coded as being positive. Parents completed the Child Behavior Checklist (CBCL) to evaluate the child’s overall severity of internalizing and externalizing psychopathology (Achenbach & Edelbrock, 1983). The widely disseminated and well-evaluated CBCL has also been found to differentiate firesetters from nonfiresetters (Kolko et al., 1985).

**Parent/Family Characteristics.** Parents’ monitoring and discipline practices were examined using the parent-completed Child Rearing Inventory (Kolko & Kazdin, 1991), which has differentiated parents of firesetters and nonfiresetters (Loeber & Dishion, 1984). The measure includes monitoring, discipline, and acceptance factors. Parents also completed the 12-item general family functioning subscale from the Family Assessment Device (FAD; Epstein, Baldwin, & Bishop, 1983), a measure of family functioning. Lower scores on this scale reflect greater overall family dysfunction.

**Data Reduction and Analysis**

The primary outcome variable in this study was child firesetting, based on a report by either the child or parent on the FHS at posttreatment, 3-month follow-up, or 12-month follow-up. Specificity analyses were completed for the interventions using condition × time (pre, post) repeated measures analyses of variance (ANOVAs). In accord with the conceptual underpinnings of the two primary intervention approaches, three outcomes were selected to evaluate the specificity of FSE (i.e., fire curiosity/attraction, knowledge, and skill) and six were selected for CBT (i.e., child hostility, child externalizing problems, child problem-solving, parenting practices, family cohesion/conflict, family functioning).

To evaluate the role of the few proposed moderators of treatment, regression analyses were considered (Generalized Estimation Equation, Random Effects Regression), but the small sample size and accompanying limited power as well as the highly skewed distribution for the primary outcome variable (number of firesetting incidents) precluded use of these approaches. Therefore, we created a dichotomized firesetting outcome variable (presence/absence) by aggregating child and parent reports of firesetting across the three subsequent timepoints (posttreatment, 3-month follow-up, 12-month follow-up). To be categorized as present, the behavior had to be reported at least once by either informant. The behavior was categorized as absent when both informants reported the absence of firesetting at all three timepoints. The few potential moderators then were dichotomized (median split) and the effects of intervention on any firesetting recidivism were compared at each level of the moderator (e.g., older age) in Chi-square tests. To assess potential treatment moderation, we examined differences in effect size for the firesetting outcome across the three interventions (FHV, CBT, FSE) at each level (low/high) of the proposed
As shown in Table 1, we found significant interactions on two of the five measures in this domain. Specifically, the level of improvement found on the CFI Fire Safety Skills factor was highest for FSE, relative to the other two conditions. Likewise, the level of improvement on the Parent Questionnaire was highest for FSE, followed next by CBT and FHV.

We also found significant time effects for several fire-specific measures which reflected at posttreatment a reduction in overall attraction to fire on the FAIS and scores on the Curiosity about Fire aggregate. In addition, gains were documented on the child-completed CFI Fire Safety Skills factor, the FKT, and the parent-completed PQ.

Clinical Functioning Measures. No statistically significant condition × time interactions were found on this set of measures. However, a trend was found on the SPS task, which showed a significant increase in positive solutions for CBT and a decrease in the other two conditions (p < .09). Three significant time effects were found, reflecting decreased scores on the Children’s Hostility Inventory, fewer externalizing problems on the CBCL scale, and improved general Family Functioning on the FAD.

Moderators of Intervention

The second aim of the study was to identify variables that modulated the efficacy of an intervention (see Table 2). Given the small sample size, it was feasible only to examine a small set of putative moderators in a few exploratory analyses. Specifically, our literature review suggested the conceptual importance of evaluating three potential moderators each of FSE (curiosity about fire, exposure to fire models/materials, child fire safety knowledge) and of CBT (child psychopathology, parenting practices, family dysfunction). Because of heightened skew and kurtosis in the number of firesetting incidents documented at pretreatment, we dichotomized this outcome variable into cases with or without any firesetting recidivism. Where the effects of these interventions on firesetting recidivism differed between high and low values of a proposed moderator variable by .30 (medium effect size) or greater, the variable was considered to exert a potential moderating influence. Thus, variables showing differences in treatment effect (expressed as percent setting an-
The recidivism rate was lowest after FSE and CBT and highest after FHV (see Figure 1).

Clinical Functioning Measures. The three interventions had similar firesetting recidivism, irrespective of the severity of the child’s externalizing behavior problems or the level of parent management practices reported. Intervention condition was unrelated to firesetting recidivism among participants from families with a lower level of family dysfunction (FAD), whereas intervention condition was strongly related to outcome among participants with a higher level of family dysfunction. Specifically, FSE appeared to be very effective and FHV very ineffective with highly dysfunctional families.

Characteristics of Recidivists

Fire-Specific Measures. The third aim of the study was to identify variables that predicted firesetting recidivism independent of treatment condition (see Table 3). We found that a greater number of matchplay incidents and firesetting incidents predicted any firesetting recidivism. Three other predictors of any firesetting recidivism were found, namely, curiosity about fire, scores on the FAIS, and involvement in firesetting acts. No other variables tested in this domain shown any association to recidivism.

Clinical Functioning Measures. Of the few measures of the child’s clinical functioning that were tested, only the level of the child’s externalizing behavior problems was related to any firesetting recidivism (see Table 3). There were no significant relationships between any of the parental or family clinical functioning variables tested and any firesetting recidivism.

We also conducted a logistic regression analysis that included all six of the univariate predictors of recidivism to firesetting (see Table 3) entered as a single model. The model predicting recidivism status was significant, \( \chi^2(6, N = 45) = 16.42, \)


DISCUSSION

To our knowledge, this study is the first to examine the specificity and moderators of two complementary intervention approaches for boys who set fires, and characteristics associated with recidivism at 1-year follow-up. Two skills-based interventions representing mental health (CBT) and fire service (FSE) approaches were compared with a minimal contact intervention in which a firefighter made a home visit to discuss fire safety (FHV). There was modest support for the specificity of FSE, but less evidence for the specificity of CBT. Two fire-specific measures and one general clinical measure were identified as potential intervention moderators. The frequency of firesetting and matchplay, fire attraction, and severity of child externalizing behavior were among the predictors of firesetting recidivism. These findings are discussed in the context of key recommendations for practice and research.

Initial analyses examined the relative level of overlap among the two outcome measures (firesetting and matchplay) and the two informants (children, parents). As both continuous and dichotomous variables, the two outcomes were moderately related at both postassessment and follow-up. Thus, children who had set another fire after intervention also tended to play with matches at each timepoint. There was also higher parent–child agreement for matchplay than for fire setting at

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TABLE 2
Results of Tests to Identify Moderators of Intervention

<table>
<thead>
<tr>
<th>Intake characteristic</th>
<th>FHV</th>
<th>CBT</th>
<th>FSE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Fire-specific measures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curiosity about Fire</td>
<td>3</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>Aggregate</td>
<td>2</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>Low</td>
<td>3</td>
<td>25.0</td>
<td>6</td>
</tr>
<tr>
<td>High</td>
<td>3</td>
<td>46.7</td>
<td>6</td>
</tr>
<tr>
<td><strong>Exposure to Fire Models/Materials</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggregate</td>
<td>5</td>
<td>31.3</td>
<td>6</td>
</tr>
<tr>
<td>Low</td>
<td>1</td>
<td>9.1</td>
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</tr>
<tr>
<td>High</td>
<td>1</td>
<td>58.9</td>
<td>1</td>
</tr>
<tr>
<td><strong>Fire Knowledge Test</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Aggregate</td>
<td>5</td>
<td>29.4</td>
<td>8</td>
</tr>
<tr>
<td>Low</td>
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<td>10.0</td>
<td>6</td>
</tr>
<tr>
<td>High</td>
<td>1</td>
<td>55.6</td>
<td>6</td>
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<td><strong>Clinical functioning measures</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>CBCL Externalizing</td>
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<td>25.0</td>
<td>5</td>
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<tr>
<td>Low</td>
<td>2</td>
<td>18.2</td>
<td>5</td>
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<td>High</td>
<td>2</td>
<td>81.8</td>
<td>5</td>
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<td>Child Rearing Inventory</td>
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<td>20.0</td>
<td>5</td>
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<tr>
<td>Low</td>
<td>4</td>
<td>25.3</td>
<td>6</td>
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<tr>
<td>High</td>
<td>4</td>
<td>74.7</td>
<td>5</td>
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<tr>
<td>FAD General Functioning</td>
<td>5</td>
<td>33.3</td>
<td>3</td>
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<tr>
<td>Low</td>
<td>1</td>
<td>83.3</td>
<td>7</td>
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<tr>
<td>High</td>
<td>1</td>
<td>16.7</td>
<td>3</td>
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</table>

Note. FHV = home visit from a firefighter; CBT = cognitive–behavioral treatment; FSE = fire safety education; CBCL = Child Behavior Checklist (Achenbach & Edelbrock, 1983); FAD = Family Assessment Device (Epstein, Baldwin, & Bishop, 1983).

$p < 0.01$, though no single variable showed any robust relationship to recidivism, as follows: number of matchplay incidents (OR = 1.03, CI = .97–1.09), number of firesetting incidents (OR = 1.11, CI = .98–1.3), curiosity about fire (OR = 1.20, CI = 0.84–1.13), FAIS (OR = 1.04, CI = .96–1.12), involvement in fire-related acts (OR = 1.03, CI = .69–1.53), and CBCL externalizing behavior problems score (OR = 1.03, CI = .96–1.11). The analysis correctly classified 82.4% of the cases.
posttreatment, but moderate informant agreement for both outcomes at follow-up. Although such agreement has been found in prior studies (Kolko & Kazdin, 1989a, 1989b), this is the first study to examine the level of overlap and agreement for these two outcomes following intervention. These findings highlight the need to document both of these fire-related outcomes and to collect self-reports from multiple informants in an effort to ensure the most comprehensive depiction of initial presenting problems and treatment outcome.

In terms of the specificity of intervention, FSE was found to improve parents’ and children’s fire safety knowledge (parent report) and children’s fire safety skills (child report) more so than CBT or FHV, as expected. Improvements in knowledge have been documented in other fire safety interventions (Kolko et al., 1991). In contrast, CBT was somewhat associated with greater improvement than the other two interventions only in positive problem-solving skills, but the interventions did not differ in changes in several targeted child behaviors or parental practices. Specificity was demonstrated for FSE based on several measures of the specific skills that were taught during the intervention, whereas the measures used for CBT examined a more diverse array of constructs, including the severity of the child’s deviant behaviors and levels of prosocial child and parent behaviors. FSE was not more effective in reducing curiosity about or attraction to fire, suggesting that these characteristics may require either more intensive training or alternative methods that more directly reduce interest in fire. In addition, the brevity of CBT may have restricted the achievement of changes in CBT-specific outcomes, particularly because multiple skills were targeted in a short period of time. All told, treatment specificity has been difficult to document, even when studies include larger samples, longer treatment durations, and more conceptually specific intervention content (Kolko et al., 2002).

It is important to understand whether children with varied demographic and clinical characteristics respond differentially to educational and clinical interventions, because the content of both interventions derives from alternative, albeit contemporary, conceptual models (Kolko et al., 2001) and they are not always available in community programs (see Kolko, 2002b; Pinsonneault, 2002). Based on exploratory analyses, a few fire-specific measures, notably child fire knowledge and exposure to fire models/materials, appeared to serve as moderators of firesetting outcome. Specifically, FSE was found to be more effective than FHV among children with heightened fire safety knowledge and exposure to fire models/materials. FHV was found to be less effective than either FSE or CBT among families with heightened general dysfunction. Such findings provide suggestive evidence for the role of child and family characteristics in influencing the firesetting outcomes produced by educational and clinical interventions (Owens et al., 2003). FSE’s greater effectiveness among children with higher rather than lower levels of fire safety knowledge was also unexpected and may warrant further scrutiny by program staff responsible for assigning those children who are believed to benefit from participation in educational interventions. At the same time, these results indicate that the three interventions had comparable effects across a broad range of other fire-specific and clinical functioning variables. Given the absence of other studies that have evaluated treatment moderators with this population, it is

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**Figure 1.** Potential moderators of treatment efficacy in boys who set fires.
difficult to know whether these findings are indeed representative or may be biased due to the small sample size. Despite the difficulty in studying this unique but compelling population, clinical trials are needed that include moderator analyses so that data are available to help inform the match between clients and interventions (Kolko et al., 1991).

Firesetting recidivism was associated with a small set of fire-specific characteristics and one characteristic related to the child’s clinical status. Recidivists had a higher frequency of matchplay and firesetting incidents, similar to what we reported with a nonreferred firesetter sample after a 2-year follow-up (Kolko, 2001). Firesetters also were found to have greater involvement in fire-related acts, such as hiding matches or lighters and pulling fire alarms. These three variables highlight the presence of an extensive and diverse history of inappropriate involvement with fire, beyond fire setting alone. Further, recidivists acknowledged having a heightened curiosity about, personal interest in, and attraction to fire, which may be among the primary reasons for a child’s ongoing contact or involvement with unsanctioned use of fire. Finally, recidivists were described by parents as showing heightened externalizing behavior problems. That recidivists were characterized by both heightened fire interest/attraction and behavior problems suggests that it may be beneficial to integrate methods designed to intervene with both of these sets of problems. It is also important to note that several proposed variables were not found to be correlated with recidivism, including age, exposure to fire models/materials, child hostility problems, and level of family dysfunction.

The limitations of this study deserve mention. Children were randomized only to the CBT and FSE conditions. Most families who received the FHV condition were made known to the study after they had already requested and been scheduled for a visit to or from the local fire department prior to study randomization. We opted to include these cases because of FHV’s relevance as a highly preferred “treatment as usual” condition.

### TABLE 3

Results of Tests to Identify Predictors of Any Firesetting Recidivism

<table>
<thead>
<tr>
<th>Intake characteristic</th>
<th>No</th>
<th>Yes</th>
<th>F</th>
<th>df</th>
<th>p</th>
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<tr>
<td>Age</td>
<td>9.6</td>
<td>9.7</td>
<td>0.01</td>
<td>1.44</td>
<td>.94</td>
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<tr>
<td>Matchplay incidents (#)</td>
<td>4.3</td>
<td>14.9</td>
<td>7.20</td>
<td>1.45</td>
<td>.01</td>
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<tr>
<td>Firesetting incidents (#)</td>
<td>3.7</td>
<td>10.1</td>
<td>12.09</td>
<td>1.45</td>
<td>.001</td>
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<td>CFI Fire Safety Skill/Competence</td>
<td>13.5</td>
<td>16.6</td>
<td>4.38</td>
<td>1.44</td>
<td>.04</td>
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<td>CFI Knowledge about Fire</td>
<td>17.2</td>
<td>18.8</td>
<td>0.95</td>
<td>1.44</td>
<td>.34</td>
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<td>FAIS</td>
<td>11.9</td>
<td>12.8</td>
<td>0.80</td>
<td>1.45</td>
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<td>Fire Knowledge Test</td>
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<td>8.58</td>
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<td>.005</td>
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<td>Exposure to Fire Models/Materials</td>
<td>12.5</td>
<td>12.4</td>
<td>0.00</td>
<td>1.44</td>
<td>.96</td>
</tr>
<tr>
<td>Involvement in Fire-Related Acts</td>
<td>5.6</td>
<td>7.8</td>
<td>8.57</td>
<td>1.44</td>
<td>.005</td>
</tr>
<tr>
<td>Parent Questionnaire</td>
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<td>6.0</td>
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<td>.86</td>
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### Clinical functioning measures

<table>
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<th>Measure</th>
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<th>Yes</th>
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<th>df</th>
<th>p</th>
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<tr>
<td>Children’s Hostility Inventory</td>
<td>6.2</td>
<td>7.3</td>
<td>1.29</td>
<td>1.45</td>
<td>.26</td>
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<tr>
<td>CBCL Externalizing behavior problems</td>
<td>61.4</td>
<td>70.6</td>
<td>5.29</td>
<td>1.45</td>
<td>.03</td>
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<td>CBCL Internalizing problems</td>
<td>56.9</td>
<td>60.1</td>
<td>0.76</td>
<td>1.45</td>
<td>.39</td>
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<td>Child Rearing Inventory</td>
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<td>70.9</td>
<td>0.47</td>
<td>1.45</td>
<td>.50</td>
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<td>FAD General Functioning scale</td>
<td>1.8</td>
<td>2.0</td>
<td>0.60</td>
<td>1.45</td>
<td>.44</td>
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<tr>
<td>Parent Perception Inventory</td>
<td>6.3</td>
<td>6.4</td>
<td>0.01</td>
<td>1.40</td>
<td>.92</td>
</tr>
</tbody>
</table>

Note. CFI = Children’s Firesetting Interview (Kolko & Kazdin, 1989b); FAIS = Fire Attraction and Interest Scale (Kolko & Kazdin, 1992); CBCL = Child Behavior Checklist (Achenbach & Edelbrock, 1983); FAD = Family Assessment Device (Epstein, Baldwin, & Bishop, 1983).
Still, predictors of treatment effects might have changed had FHV cases been randomized. Also, the length of intervention was fairly brief, limited to approximately eight sessions in CBT or FSE and only two sessions in FHV. Although the duration for CBT was twice that used in the author’s prior intervention study (Kolko et al., 1991), more group differences might have resulted with a longer intervention covering additional content areas (e.g., social competence, peer influences). Finally, the limited power afforded by our sample size may have minimized the ability to detect group differences, insofar as several trends favoring certain conditions reported by others were not found. Given the small sample, we had to limit the number of statistical tests conducted, especially in exploring moderator effects. These analyses are thus more exploratory than definitive, and require replication with a larger sample. This work has several key implications for research and practice. Given the difficulty of conducting a large randomized clinical trial in this area, future studies could extend our evaluation of moderator effects by examining individual characteristics impacting intervention, using an alternating treatment design to determine treatment equivalence, assuming no effects of order of treatment. Thus, if each treatment was uniquely associated with specific outcomes across subjects and regardless of treatment order, this would make a strong case for the significance of that intervention condition. On the practice side, FSE was no more effective than CBT with children who were curious about or attracted to fire, and CBT was no more useful than FSE with children exhibiting behavioral or emotional problems, assumptions that the field has generally maintained implicitly for decades. Our current findings therefore suggest that the two intervention conditions may be efficacious with similar types of children. Our findings on the characteristics of recidivists also highlight important child behavioral characteristics as well as contextual or environmental characteristics that may need to be targeted during intervention. Emphasizing the importance of evaluating both fire-specific and general clinical functioning characteristics, our findings provide initial information that might guide program developers and managers in their efforts to more carefully target children at heightened risk for recidivism.

In summary, this study examines intervention specificity and moderators in the first controlled comparison of educational and clinical approaches to intervention with boys who set fires. In accord with expectations, FSE changed certain fire knowledge and safety measures, and CBT modestly changed assertive problem solutions. Specific effects on other proposed variables were not found. Moderators of the outcomes of each primary intervention also were identified (e.g., exposure to fire models/materials, child’s general fire knowledge, family functioning), suggesting that each of these two approaches may be more effective with certain subgroups of firesetting children or their families. Likewise, fire history, fire attraction, and clinical characteristics were among the predictors of firesetting recidivism. We hope that these results will stimulate further refinements in the content of community-based intervention programs serving children who set fires, so that the overall outcome with this important behavioral and public health problem is improved.

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Authors’ Notes

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