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Cost Effectiveness of School and Home Interventions for Students With Disruptive Behavior Problems

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Abstract

This study examines the cost effectiveness of two interventions for disruptive behavior problems: First Step Next (FSN), a school-based intervention, and a multicomponent intervention that combined FSN with a home-based intervention, homeBase (hB). Analyses were based on findings from a large-scale comparative efficacy trial (Frey et al., 2022). Intervention costs were estimated using an activities-based ingredients method (Levin & McEwan, 2001). For each disruptive behavior examined (attention deficit-hyperactivity disorder [ADHD], conduct disorder [CD], and comorbid ADHD and CD), we defined intervention response as movement from the clinical range into the borderline or normative range or from the borderline range into the normative range at post-intervention. Comparative cost-effectiveness analyses involved calculating incremental cost-effectiveness ratios (ICERs), which showed that the combined intervention was always more cost effective. Improvement in comorbid ADHD and CD was the costliest to achieve, followed by CD, and then ADHD. Sensitivity analyses showed that FSN + hB had a high probability of being cost effective across a range of estimates indicating stakeholder willingness to pay to reduce disruptive behavior problems. This study expands the literature by estimating the costs of implementing a school-based intervention alone or alongside a home-based intervention with elementary students and comparing their cost effectiveness.

Keywords

cost-effectiveness analysis, behavior disorders, early intervention

Attention deficit hyperactivity disorder (ADHD) and conduct disorder (CD) are two of the most common childhood psychiatric disorders. When school-age children experience them, they are likely to receive services from specialized instructional support personnel (i.e., school social workers, school counselors, school psychologists), school-based mental health professionals, and special education teachers due to potentially disruptive symptoms manifested at school (Briesch et al., 2012; Merikangas et al., 2011). When not effectively treated, disruptive behavior disorders are associated with greater out-of-school suspensions, grade retention, special education, health-care utilization, delinquency, and crime into adulthood (Noltemeyer et al., 2015; Pelham et al., 2007; United States Department of Labor, Bureau of Labor Statistics, 2018a). These outcomes come at significant costs to individuals, their families, and society. Annual costs of ADHD in children and adolescents, for example, have been estimated at US$14,756 per individual, including US$4,900 for special education, grade retention, and school discipline; and US$42.5 billion annually to society (Pelham et al., 2007, 2005; United States Dollars, that is, costs relative to the value of the United States dollar [USD] in 2005). Furthermore, public expenditures for CD from Grades 6 through 12 were US$70,000 (2000 USD) higher than for children without CD, with the greatest additional costs incurred in adolescence (Foster & Jones, 2005). The high prevalence rates of ADHD, CD, and comorbid ADHD and CD, along with their associated costs, indicate the need for efficacious, cost-effective early interventions. Although some school-based efficacious psychosocial interventions have been identified (Kaminski & Claussen, 2017; Sumi et al., 2013; Walker et al., 1998; Webster-Stratton et al., 2004), few studies have examined their costs and cost effectiveness.

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Building on evidence from a comparative efficacy trial (Frey et al., 2022), this study examines the cost effectiveness of First Step Next (FSN), a classroom-based intervention for students with disruptive behavior disorders, and an alternative, multicomponent intervention that combined FSN with homeBase (FSN + hB), a brief, home visiting intervention offered to parents of children with disruptive behavior disorders. The trial showed that both FSN and FSN + hB, which are described briefly in the "Method" section and extensively elsewhere (Feil et al., 2014, 2020; Sumi et al., 2013; Walker et al., 2009, 2015), were effective in reducing ADHD, CD, and comorbid ADHD and CD. For example, those in the FSN condition were 3.0 times more likely than students in the control condition to make statistically significant improvement in ADHD-related behavior and 2.3 times more likely in CD-related behavior. First Step Next's effects on students with oppositional defiant disorder (ODD) did not reach statistical significance. Although hB was not effective in improving ADHD, CD, and ODD on its own, when added to FSN in the combined intervention condition, effects were stronger than when FSN was offered alone. Specifically, students were 5.0 times more likely than control students to improve in ADHD-related behavior and 3.2 times more likely to improve in CD-related behavior.

Whether these approaches are cost effective interventions for children exhibiting disruptive behavior symptoms in school is unknown. Although cost effectiveness studies of interventions offered in educational settings (Hollands et al., 2014, 2016; Hunter et al., 2018) and interventions specifically targeting disruptive behavior problems (Foster et al., 2007; Jensen et al., 2005; Sampaio et al., 2021; Tran et al., 2018) remain rare, their utility for educational decision making is clear: Given limited funds to support educational goals, cost-effectiveness analyses (CEA) provide information about the relative merits of alternative intervention approaches by considering both their costs and impacts. The objective of CEA is to identify the intervention option with the lowest cost in relation to impact, or alternatively, the greatest impact in relation to cost so that intervention goals can be achieved in a resource-efficient manner. However, efficiency may not be the only or primary goal driving intervention choice (Crowley et al., 2018; Levin & Belfield, 2015; National Academies of Sciences, Engineering, and Medicine, 2016). Other values such as increasing equity, contextual fit, reach, or population served may obviate the need for CEA. Thus, comparative CEAs are likely to be most meaningful to decision makers when the interventions under scrutiny are true alternatives (Hollands et al., 2016), as is the case for FSN and combined FSN + hB.

There is some evidence that the greater impact from multicomponent interventions for disruptive behavior problems more than offsets their greater cost. In a study of the Incredible Years, Foster et al. (2007) showed that providing teacher- and parent-based components or teacher- and child-based components was more likely to be cost effective than the control or child-based intervention only. In contrast, Tran et al. (2018) found that an intervention targeting parents of children with ADHD was more cost effective than an alternative intervention involving parents, teachers, and children; although the multicomponent intervention was more effective, it also cost twice as much. Similarly, a cost-effectiveness analysis of treatment options in the Multimodal Treatment Study (MTA; Jensen et al., 2005), a large, cross-site comparative efficacy study of 600 children who met diagnostic criteria for ADHD, showed that the stimulant-only condition was more cost effective than the combined stimulant and behavioral intervention option with respect to improving ADHD. The latter was more impactful, but the difference was not strong enough to offset the greater cost (US$7,827 for combined treatment, US$1,180 for stimulant treatment; 2000 USD). Notably, the relative advantage of stimulant treatment was reduced for children with comorbid CD. More recent studies of combined stimulant and behavioral interventions that systematically varied the sequence with which components were offered paint a more nuanced picture, as cost effectiveness varied with sequencing (Page et al., 2016). Specifically, outcomes were stronger when low-intensity behavior modification was initiated prior to stimulant medication (Pelham et al., 2016). This sequence was also lower cost, and thus was more cost effective (Page et al., 2016).

The current study extends previous research by examining the cost effectiveness of FSN and combined FSN + hB for children in the early elementary grades who are exhibiting disruptive behavior in school. It evaluates cost effectiveness with respect to three clinical outcomes: ADHD, CD, and comorbid ADHD and CD. The study does not include hB when offered alone, or ODD as an outcome, because efficacy analyses did not indicate statistically significant impact (Frey et al., 2022). Similar to CEAs studies of interventions for disruptive behavior problems (Jensen et al., 2005; Tran et al., 2018), the outcome measure focused on improvement in problem behavior from baseline to post-intervention. Consistent with the study's main outcomes paper (Frey et al., 2022), intervention response was defined as movement from the clinical range for ADHD, CD, or comorbid ADHD and CD symptoms into the borderline or normative range or from the borderline range into the normative range. Movement from the clinical to borderline range was included as an indicator of incremental improvement in Frey et al. (2022) because (a) Achenbach and Rescorla (2001) distinguish between borderline and clinical scores, noting the former are "of concern" (p. 90) but are less severe than behaviors in the clinical range and (b) the Institute of Education Sciences' What Works Clearinghouse (United States Department of Education, Institute for Education Sciences, National

Center for Education Evaluation and Regional Assistance, n.d.) recommends documentation of practical improvements in behavior, which we believe this incremental improvement represents. Although results from the efficacy trial point to greater impact for the combined intervention, whether the stronger impacts more than offset the greater costs is not known. It is also possible that cost effectiveness would vary with the outcome being studied, particularly for outcomes like CD and comorbid ADHD and CD, where the effect of the combined intervention was not quite as strong as that for ADHD (Frey et al., 2022).

Method

Participants

Project staff recruited elementary schools in Kentucky to participate in the study. Between 2015 and 2020, and after receiving institutional review board approval from the University of Louisville and participating school districts, 379 teacher–parent–student triads from 100 schools in five districts consented/assented to participate in the comparative efficacy trial across five cohorts (Cohort 1 [C1] through Cohort 5 [C5]). Triads were randomized to one of four conditions: FSN only ($n = 94$), hB only ($n = 96$), combined FSN + hB ($n = 94$), and wait-list control ($n = 95$). Participating students were distributed roughly evenly across kindergarten through third grade. Nearly one quarter of students (23%) were on an Individualized Education Program (IEP), and 71% were eligible for reduced-price or free meals at school. Students were primarily male (74%) and either Black (52%) or White (37%). See Frey et al. (2022) for information about the demographic composition of participating teachers, parents, and coaches. The CEA used outcome data from all five cohorts.

In preparation for delivering the interventions, the principal investigator and project managers worked with school administrators to identify participating elementary schools. Principals were contacted and, if they agreed, a meeting with potential teachers was held to describe the study. Consented teachers then distributed waiver of consent letters to parents describing the project's purpose and screening procedures that would be used to identify eligible students. Eligible families and students were identified using a two-step process to verify the student was struggling with behavior at school *and* at home. At Step 1, teachers attended a brief training by the project managers on how to complete the systematic screening for behavior disorders (SSBD; Walker et al., 2014) and then completed Stages 1 and 2 of the SSBD to identify students in their classrooms at elevated risk for externalizing behavior. At Step 2, project staff contacted parents of identified students, beginning with the student ranked highest in risk, and conducted a phone interview involving the externalizing scale of the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001). Project staff attempted to recruit the family to participate in the project if the student was in the borderline or clinical range on the CBCL externalizing scale. If a student met SSBD criteria but not CBCL criteria, if project staff were unable to screen or recruit the highest ranked student, or if a family declined to participate, the study team repeated the process with the next highest ranked student in the classroom until one student per participating teacher was identified. Of the study participants, 68% were the top-ranked student on the SSBD and 22% were the second highest-rated student. All 379 students met SSBD screening criteria and were in the borderline or clinical range on the CBCL externalizing scale at screening.

Involved staff received training prior to intervention implementation, and supervision throughout to support high-quality delivery. First Step Next coaches attended a 2-day FSN workshop (5.5 hours on day 1, 4 hours on day 2) on how to deliver the intervention. Each coach then spent 3 to 4 weeks in a nonparticipating classroom practicing FSN delivery. During this process, the project managers monitored implementation in person and offered feedback to coaches during debrief sessions. Finally, FSN coaches attended an hour-per-week group supervision meeting with the FSN managers throughout the intervention for support and problem solving.

Coaches delivering the hB intervention received training on the Motivational Interviewing Training and Assessment System (MITAS; Frey et al., 2017), which included three 4-hour workshops that introduced participants to the core elements of motivational interviewing (MI), facilitated development of the relational and technical components of MI, and promoted skills needed to foster and encourage client-centered change talk. The hB coaches then completed three 45- to 75-minute individual coaching sessions in which the coaches implemented each hB step with an experienced coach in the role of parent; the experienced coach then provided individualized feedback to the coach trainee. The hB coaches also attended weekly supervision sessions facilitated by a project manager during which they listened to and discussed audio-recorded conversations with parents and shared implementation successes and challenges.

Teachers in triads randomized to the FSN only or combined FSN + hB conditions also participated in a 1-hour FSN training workshop where they learned about the universal principles of positive behavior support, the FSN program, and FSN implementation procedures. During implementation, coaches provided teachers with one-on-one consultation and support as needed [see Feil et al. (2020) and Walker et al. (2018) for details]. Teachers randomized to the control or hB only condition did not receive any training as part of the project.

Intervention implementation. FSN (Walker et al., 2015) is an established teacher- and child-focused intervention that, in addition to the current study, has been examined in three large-scale randomized controlled trials (RCTs; Feil et al., 2014, 2020; Walker et al., 2009) and a large-scale effectiveness study (Sumi et al., 2013). The intervention consists of three major program tasks, generally carried out over a 2-month period: social skills instruction, green card game, and home-school connection. During social skills instruction, a behavioral coach helps the focus student develop problem-solving skills and improve self-regulation through delivery of *Super Student Skills*. During the green card game, a color-coded card functions as a tool for the teacher to provide subtle but direct and immediate nonverbal feedback that encourages continued use of the Super Student Skills or encourages the child to stop, think, and change their behavior from inappropriate to appropriate. The child receives points for meeting daily criteria for such behavior, and these points are exchanged for reinforcers provided by the parents, and classmates also share in a reinforcer as well, if the child meets criteria. The green card game is easily integrated into daily lessons and activities. For the home–school connection component, caregivers receive daily feedback in the form of a note or phone call from the FSN coach and materials focused on promoting positive parenting strategies.

hB consists of three to six 60-minute home visits delivered over several months by a trained coach (Frey et al., 2013, 2015, 2019). During the hB sessions, parents are encouraged to modify their parenting practices consistent with universal principles of positive behavior support (Sprague & Golly, 2013). The intervention is delivered within a multistep process for increasing parents' intrinsic motivation to adopt these principles. During each step (i.e., engage in values discovery; assess current practices; share performance feedback; offer extended consultation, education, and support), the coach uses MI to guide and strengthen the parent's or caregivers' engagement with and commitment to behavior change (Miller & Rollnick, 2012).

Measures and Data Sources

Clinical outcomes. Teachers rated disruptive behavior at baseline and post-intervention (M [SD] = 2.6 months after baseline [0.7 months]) using two *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*)-oriented scales from the Teacher Report Form (Achenbach & Rescorla, 2001): attention deficit/hyperactivity problems (ADHD) and conduct problems (CD). The ADHD scale (α = .88) and the CD scale (α = .84) each consist of 13 items scored on a 3-point scale (0 = *Not true* [*as far as you know*], 1 = *somewhat or sometimes true*, 2 = *very true or often true*). Scales were normed on a sample of 1,753 children who were 44% male, 60% White, 20% Black/African American, 9% Hispanic/Latino, and from a variety of U.S. states and socioeconomic backgrounds. Child Behavior Checklist scoring manuals describe scores in the 93rd to 97th percentiles (1.5 *SD*s above mean) as in the borderline range, and scores at or above the 98th percentile (2 + *SD*s above mean) as in the clinical range for a given scale (Achenbach & Rescorla, 2001). Comorbid ADHD and CD indicated scores in the borderline or clinical range on both scales. Teachers received US$50 each time they completed study surveys to thank them for their time.

Costs. Intervention costs were estimated using an activities-based ingredients method (Levin & McEwan, 2001), which entailed collecting data about the amount and unit price of resources used in pre-intervention, intervention delivery, and implementation support activities (e.g., weekly group supervision meetings). Both intervention and control students continued to be offered "business as usual" services in school. Costs estimated in this study are for intervention activities (FSN or combined FSN and hB) which were offered over and above business as usual services to students in the control arm. Measures and methods are similar to those detailed in Frey et al. (2019) in a cost analysis of FSN with preschool students and will be described only briefly here.

Personnel. Personnel included coaches, teachers, and project managers. First Step Next and hB coaches, who spent the most time on the study relative to other personnel, submitted timesheets bi-monthly summarizing time spent on the intervention. Hours incurred with a study participant before the intervention was delivered were allocated to pre-intervention activities. Once the interventions began, 1 hour per coach per week was allocated to support activities. The remainder was allocated to intervention activities. Project managers conducted recruiting, screening, and training activities; their hours were estimated retrospectively by reviewing project records and outlook calendars showing project-related meetings. They also devoted 1 hour per week to support activities throughout the intervention. Because teachers participating in FSN found the burden of completing time logs to be too high, we relied on reports from coaches and project managers for average time spent on pre-intervention and classroom intervention activities. These conversations indicated a per-teacher average of 16.5 hours in all, including 1 hour on recruitment, 1.5 hours on screening, 1 hour on training, 10 hours on classroom intervention (30 minutes per day × 20 days of intervention), and 3 hours receiving support from coaches.

Hourly wage and fringe benefits rates for coaches, who were master's-level professionals (e.g., school social workers, educators) and part-time employees of the University of Louisville, came from payroll records. Hourly wages for project managers were calculated by dividing annual salaries

by 2,080 working hours per year; fringe benefits rates were from project budget records. Teacher wages were from the Bureau of Labor Statistics (BLS) Occupational Employment Statistics for Kentucky, Occupation code 25-2012, Elementary Teachers, Except Special Education (United States Department of Labor, Bureau of Labor Statistics, 2018a). Teacher fringe benefits rates were from BLS Employer Costs for Employee Compensation (United States Department of Labor, Bureau of Labor Statistics, 2018b).

Supplies. Supplies were needed for pre-intervention (e.g., teacher recruitment packets, student screening kits, student screening surveys) and intervention activities. First Step Next supplies included manuals, timers, and supplemental books, as well as food and snacks provided for teacher training sessions. hB supplies included the manual, a Jenga game, and an iPad. Amounts and unit costs came directly from project expense records and university procard/credit card receipts.

Overhead. Recommendations for including overhead costs differ (National Academies of Sciences, Engineering, and Medicine, 2016). This study used a conservative overhead rate of 20% of personnel costs.

Analysis Strategy

The analysis was conducted from the provider perspective. The study time horizon was 5 years, but intervention with each cohort occurred during 1 school year, over an average of 2.6 months ($SD = 0.7$) from baseline assessment to study follow-up. All costs were reported in 2018 USD, the last year in which cost data were collected. Costs incurred in other years were adjusted to 2018 USD using the Implicit Price Deflator for Personal Consumption Expenditures (United States Bureau of Economic Analysis, 2021). The CEA involved calculating incremental cost-effectiveness ratios (ICERs) for (a) FSN in relation to control and (b) combined FSN + hB in relation to control (Hollands et al., 2014, 2016; Jensen et al., 2005). Given uncertainty in estimates of costs and impacts, we also conducted sensitivity analyses, described below.

Because the comparator (control) did not involve any intervention, we estimated incremental costs as the cost per student of receiving (a) FSN or (b) the combined FSN and hB intervention. Costs per student were estimated from FSN and hB implementation with C2 and C4 participants after piloting cost data collection methods and measures with C1. These two groups (i.e., C2 and C4 triads vs. triads from C1, C3, and C5) were comparable with respect to student demographics, screening characteristics, student outcomes at baseline, and FSN and hB dosage, justifying the application of cost estimates to the broader sample. In all, 87 students in C2 and C4 received FSN (either alone or in combination with hB), and 87 students received hB (either alone or in combination with FSN) in C2 and C4. Total costs for FSN and hB were estimated as the sum of resource costs across all activities (i.e., pre-intervention, intervention, and support), with resource costs estimated as resource quantity multiplied by resource unit price (e.g., coaching hours multiplied by coach hourly wage plus fringe rate). Costs for the combined intervention were estimated as the sum of FSN and hB costs, adjusted to avoid double counting (e.g., students would be screened once, not once for FSN and once for hB). As in Frey et al. (2019), we calculated both average costs per student and the additional cost of serving one more student after intervention training and services were already in place. Average costs reflected total costs divided by the number of students served. Additional cost per student was estimated by identifying the additional resources that would be needed (e.g., for FSN, screening, coach and teacher delivery time, student supplies) and ignoring those that would remain invariant or fixed (e.g., coach training). The CEA utilized costs per additional student with average costs used in secondary analyses.

Incremental effectiveness of (a) FSN compared with control or (b) combined FSN + hB compared to control was estimated as the difference in the proportion of students who responded to the intervention (i.e., moved from the borderline range into the normative range or from the clinical range into the borderline or normative range) compared with the proportion of controls exhibiting such movement from pre- to post-intervention. We multiplied the difference in proportions by the intervention condition sample size to estimate the incremental gain in the number of students who responded to the intervention. Incremental cost-effectiveness ratios were estimated as incremental costs divided by incremental gain in students who responded to intervention. Lower ICERs would indicate greater cost effectiveness by pointing to lower cost to achieve response in a student.

Sensitivity analysis. Because of uncertainty in ICER estimates, we evaluated the probability that intervening was cost effective at a range of ICER thresholds indicating a stakeholder's maximum willingness to pay (WTP) per child to achieve meaningful improvement in disruptive behavior problems. We simulated 1,000 Δ cost (C), Δ effect (E) pairs, which generated 1,000 ICERS, using the SPSS RV.NORMAL command. This command returns a random value from a normal distribution with a specified mean and standard deviation and can be looped to provide the desired number of random values. Point estimates for Δ C and Δ E were the means, and we set each standard deviation generously at one quarter of the respective mean. We plotted the simulated values on cost-effectiveness planes. For a given WTP value or ICER threshold, λ, the probability that intervention was cost effective was calculated as the proportion of Δ C, Δ E pairs falling below a ray of slope λ passing through the origin. We estimated probabilities for WTP values (λs) ranging

Table 1. Baseline Equivalence of Student Demographic and Screening Characteristics.

Characteristic *M*(*SD*)	Control		First Step Next		First Step Next and homeBase	
	(*n* = 95)		(*n* = 94)		(*n* = 94)	
Demographic characteristic						
Age (years)	6.8	(1.3)	6.9	(1.3)	6.8	(1.2)
Female (%)	23	(24.2)	26	(27.7)	27	(28.7)
African American (%)	47	(49.5)	50	(53.2)	53	(56.4)
Caucasian (%)	39	(41.1)	36	(38.3)	31	(33.0)
Grade level						
Kindergarten	21	(22.1)	21	(22.3)	26	(27.7)
First grade	25	(26.3)	25	(26.6)	18	(19.1)
Second grade	25	(26.3)	21	(22.3)	31	(33.0)
Third grade	24	(25.3)	27	(28.7)	19	(20.2)
Eligible for lunch program (%)	68	(71.6)	68	(72.3)	68	(72.3)
Percent with an IEP	23	(24.2)	21	(22.3)	23	(24.5)
Screening characteristic						
SSBD (Teacher report)						
Percent ranked first	59	(62.1)	67	(71.3)	62	(66.0)
Critical Events Index	8.4	(3.3)	8.4	(2.9)	8.2	(2.8)
CBCL Externalizing Behavior (Parent report)	26.6	(8.1)	25.1	(8.8)	25.0	(8.8)
Parent motivation to participate in treatment	45.3	(6.4)	44.7	(6.7)	46.5	(5.9)

Note. Parent motivation to participate in treatment represents the mean score across 11 items ($\alpha = .90$; e.g., "I am eager to participate in treatment," "I want my child's behavior to improve"; Nock & Photos, 2006). Reported demographic and screening characteristics were equivalent (i.e., no statistically significant differences) across conditions for all measures. SSBD = systematic screening for behavior disorders (SSBD Critical Events Index scores ≥5 exceed risk criteria for externalizing behavior); CBCL = Child Behavior Checklist (Raw scores ≥16 for boys and ≥15 for girls are in the clinical range); IEP = Individualized Education Program.

from US$1,000 to US$100,000. We summarized the results by plotting cost-effectiveness acceptability curves (CEACs), which show the probability that an intervention will be cost effective across a range of WTP thresholds. To aid in interpreting CEAC findings, we evaluated λ against annual costs of ADHD in total (US$14,756, 2000 USD) and to schools (US$4,700, 2000 USD) (Pelham et al., 2007), and annual (US$10,000, 2005) and 7-year (US$70,000, 2005 USD) public costs of conduct disorder (Foster & Jones, 2005) when adjusted to 2018 US$. Although the study's definition of intervention response includes clinical and borderline disorder, these estimates are the most relevant guides we could find for interpreting the study's ICER thresholds.

Results

Table 1 summarizes the key demographic and screening characteristics of participants randomized to FSN, combined FSN + hB, and control condition. The three conditions were statistically similar on all measures, including parents' motivation to participate in treatment (Nock & Photos, 2006). Across the five cohorts, students randomized to one of the two FSN conditions completed 66% of 30 program days on average (e.g., roughly 20 days). While 8% of students did not complete any FSN program days, 11% completed all 30. On average, parents randomized to one of the hB conditions completed two of four hB steps (*SD* = 1.3). Over half (55%) completed three or four steps; 6% completed two, 14% one, and 24% none.

Costs: FSN and Combined Intervention

The total cost of delivering FSN to 87 students in Cohorts 2 and 4 was estimated at US$280,660 (see Table S1, available online), an average of US$3,226 per student (see Table 2). Across resource categories, the majority of per-student costs were for personnel (US$2,554, 79%). Across activities, the majority of per-student costs were for direct intervention delivery (US$1,943, 60%), with smaller shares of the cost attributable to pre-intervention (US$763, 24%) and ongoing support (US$520, 16%). In all, personnel spent 69.2 hours per student on average (see Table 3), with coaching accounting for two-thirds of this time. Across activities, direct intervention by coaches and teachers accounted for 63% of total hours. Delivering the combined intervention to 87 students was estimated to cost US$330,678 (see Table S1), US$50,018 more than delivering FSN alone. Average cost per student was estimated at US$3,801 (see Table 2), US$575 more than FSN. The additional cost was largely due to coaching (US$337, 59%) and a small increase in supplies costs for

Table 2. Average Costs per Student: First Step Next and Combined Intervention (2018 USD).

Resource	Cost per unit	Units	Pre-intervention	Intervention	Support	Total	Share by resource
First Step Next costs[a]							
Personnel							
Program managers	US$42.15	5.8	US$184	US$0	US$61	US$245	8%
Coach	US$28.29	46.9	US$224	US$910	US$193	US$1,327	41%
Teacher	US$59.50	16.5	US$203	US$599	US$180	US$982	30%
Subtotal—personnel	US$36.90	69.2	US$611	US$1,509	US$434	US$2,554	79%
Supplies							
Teacher recruitment packets	US$1.58	1.0	US$2			US$2	0%
Student screening kit	US$577.56	0.0	US$13			US$13	0%
Student screening surveys	US$5.20	1.0	US$5			US$5	0%
First Step Next kits	US$509.31	0.2		US$105		US$105	3%
Super Student books	US$26.25	0.4		US$10		$10	0%
Timers	US$15.75	0.6		US$10		US$10	0%
First Step Next 3-pack	US$50.41	0.1		US$7		US$7	0%
Food	US$9.45	1.0	US$9			US$9	0%
Subtotal—supplies			US$30	US$132	US$0	US$161	5%
Overhead			US$122	US$302	US$87	US$511	16%
Total First Step Next costs			US$763	US$1,943	US$520	US$3,226	
Share of costs by activity			24%	60%	16%	100%	
Combined intervention: Additional homeBase costs[b]							
Personnel							
Program managers	US$36.47	2.2	US$44	US$0	US$35	US$79	14%
Coach	US$26.77	12.6	US$90	US$164	US$83	US$337	59%
Subtotal—personnel	US$28.19	14.7	US$134	US$164	US$118	US$416	72%
Supplies							
Jenga game	US$16.49	0.1	US$0	US$2	US$0	US$2	0%
homeBase manuals	US$12.60	0.1	US$0	US$2	US$0	US$2	0%
iPads	US$577.56	0.1	US$0	US$72	US$0	US$72	0%
Subtotal—supplies			US$0	US$76	US$0	US$76	13%
Overhead			US$27	US$33	US$24	US$83	14%
Additional homeBase costs			US$160	US$273	US$142	US$575	100%
Share of costs by activity			32%	39%	28%	100%	
Combined intervention total costs: First Step Next + homeBase							
Personnel							
Program managers	US$40.61	8.0	US$228	US$0	US$96	US$324	9%
Coach	US$27.97	59.5	US$313	US$1,075	US$276	US$1,663	44%
Teacher	US$59.50	16.5	US$203	US$599	US$180	US$982	26%
Subtotal—personnel	US$35.37	84.0	US$745	US$1,673	US$551	US$2,970	78%
Supplies			US$30	US$208	US$0	US$237	6%
Overhead			US$149	US$335	US$110	US$594	16%
Total combined intervention costs			US$923	US$2,216	US$662	US$3,801	100%
Share of costs by activity			24%	58%	17%	100%	

Note. USD = United States Dollars.

[a]First Step Next costs include costs for student screening and associated teacher training, along with student recruitment to the intervention. [b] When offered as a standalone intervention, homeBase would include student screening and recruitment costs. In this study, it is part of a combined intervention with First Step Next, which already includes those costs.

coaches (US$76, 13%). As with FSN, costs for personnel and intervention delivery represented the greatest shares.

Costs of serving an additional student once intervention was in a steady state (i.e., after capacity building occurred and support structures were in place) were US$2,538 for FSN and $2,730 for FSN + hB (see Table S2). The added US$200 per student for the combined intervention reflected 6.6 additional coaching hours (see Table 2) and overhead. Costs were 25% to 30% lower than average costs per student and weighted more heavily to personnel and direct intervention activity.

Comparative Cost Effectiveness

For all clinical outcomes at posttest, more students in the FSN and combined FSN + hB condition had improved compared with students randomized to the control condition (see Table 4). These differences were statistically significant at a type 1 error rate of .05 and indicate that both approaches were effective in reducing cases of externalizing behavior problems in children. In the FSN condition, response to the intervention was somewhat greater among those meeting criteria for only ADHD or CD compared with

Table 3. Personnel Hours: First Step Next and Combined Intervention.

	Average hours per student					Hours per additional student				
Personnel Category	Pre-intervention	Intervention	Support	Total[a]	Share by resource	Pre-intervention	Intervention	Support	Total[a]	Share by resource
First Step Next personnel hours										
Program managers	4.1	0.0	1.7	5.8	8%	3.5	0.0	0.0	3.5	6%
Coach	8.9	33.6	4.3	46.9	68%	0.0	33.6	0.0	33.6	63%
Teacher	3.5	10.0	3.0	16.5	24%	3.5	10.0	3.0	16.5	31%
Total	16.5	43.6	9.1	69.2	100%	7.0	43.6	3.0	53.6	100%
Share by activity	24%	63%	13%	100%		13%	81%	6%	100%	
Combined intervention: Additional homeBase personnel hours										
Program managers	1.3	0.0	0.9	2.2	12%	0.0	0.0	0.0	0.0	0%
Coach	3.4	6.0	3.2	12.6	70%	0.0	6.0	0.0	6.0	64%
Parents	0.0	3.3	0.0	3.3	19%	0.0	3.3	0.0	3.3	36%
Total	4.6	9.4	4.1	18.1	100%	0.0	9.4	0.0	9.4	100%
Share by activity	26%	52%	23%	100%		0%	100%	0%	100%	
Combined intervention total personnel hours: First Step Next + homeBase										
Program managers	5.4	0.0	2.6	8.0	9%	3.5	0.0	0.0	3.5	6%
Coach	12.3	39.7	7.5	59.5	68%	0.0	39.7	0.0	39.7	63%
Teacher	3.5	10.0	3.0	16.5	19%	3.5	10.0	3.0	16.5	26%
Parents	0.0	3.3	0.0	3.3	4%	0.0	3.3	0.0	3.3	5%
Total	21.2	53.0	13.2	87.3	100%	7.0	53.0	3.0	63.0	100%
Share by activity	24%	61%	15%	100%		11%	84%	5%	100%	6%

[a]First Step Next personnel hours include time for student screening and associated teacher training, along with student recruitment to the intervention. [b] When offered as a standalone intervention, homeBase would include personnel hours for student screening and recruitment. In this study, it is part of a combined intervention with First Step Next, which already includes this time.

Table 4. Intervention Response by Outcome and Condition.

	Control		First Step Next			First Step Next plus homeBase		
	Improved[a]		Improved[a]			Improved[a]		
Outcome	*n*	%	*n*	%	*OR*(*CI*)[b]	*n*	%	*OR*(*CI*)[b]
ADHD	15	15.8%	34	36.2%	3.0** [1.4, 6.3]	45	47.9%	5.0*** [2.4, 10.3]
CD	18	18.9%	34	36.2%	2.3* [1.1, 4.8]	41	43.6%	3.2** [1.6, 6.5]
Comorbid ADHD and CD	13	13.7%	27	28.7%	2.5** [1.1, 5.8]	34	36.2%	2.9*** [1.2, 6.7]

Note. ADHD = attention deficit hyperactivity disorder; CD = conduct disorder.
[a]Improved refers to the number and proportion of students in the control, First Step Next, or combined (First Step Next plus homeBase) intervention arm who moved from a clinical diagnosis to a borderline score or a borderline score to a normative score on the Teacher Report Form at posttest.
[b] OR = odds ratio; CI = 95% confidence interval. ORs and CIs are from logistic regression models. For ADHD and CD, improvement (1 = *improved at post*; 0 = *not improved at post*) was defined as either (a) movement from clinical into the borderline or normative range or (b) movement from borderline into the normative range on the diagnostic outcome of interest (e.g., ADHD or CD). For comorbid ADHD and CD, improvement (1 = *no longer comorbid*; 0 = *still comorbid*) was defined as movement out of comorbidity for participants in the borderline or clinical range on ADHD and CD at baseline. Thus, participants were no longer considered comorbid if they moved into the normative range on either one or both of the diagnostic variables (e.g., ADHD and/or CD) at posttest.

those meeting comorbid criteria. In the combined condition, the response was strongest for ADHD, then CD, and then comorbid ADHD and CD.

ICERs suggest the combined intervention was more cost effective among the three clinical outcomes (see Table 5), with incremental costs per case US$3,600 to US$4,800 lower than those for FSN. Findings also indicate that improvement in comorbid ADHD and CD was the costliest to achieve, followed by CD, and then ADHD. However, for all outcomes, the small increase in cost to add the hB component was more than offset by the stronger response to the intervention. Secondary analyses using average costs per student led to similar conclusions (see Table S3).

Sensitivity analysis. Cost-effectiveness planes for FSN + hB, which were more cost effective than FSN, are shown in Figure S1 online. Figure 1 shows CEACs summarizing the likelihood that FSN + hB was cost effective at a range of

Table 5. Cost Effectiveness of Interventions to Reduce Disruptive Behavior Problems (2018 USD).

			Improvement at posttest[b]		Incremental gain		
	Intervention *n*	Incremental cost[a]	Intervention	Comparator	%	# Students	ICER[d]
Comparison[a]	(1)	(2)	(3)	(4)	(5) = (4) − (3)	(6) = (5) × (1)	(7) = (2) × (1) / (6)
ADHD							
FSN v control	94	US$2,536	36.2%	15.8%	20.4%	19	US$12,433
FSN + hB v control	94	US$2,730	47.9%	15.8%	32.1%	30	US$8,503
CD							
FSN v control	94	$2,536	36.2%	18.9%	17.3%	16	US$14,661
FSN + hB v control	94	US$2,730	43.6%	18.9%	24.7%	23	US$11,051
Comorbid ADHD and CD							
FSN v control	94	US$2,536	28.7%	13.7%	15.0%	14	US$16,909
FSN + hB v control	94	US$2,730	36.2%	13.7%	22.5%	21	US$12,131

Note. USD = United States dollars; ADHD = attention deficit hyperactivity disorder; CD = conduct disorder; FSN = First Step Next; hB = homeBase.
[a]Incremental costs are the costs of serving an additional student (as reported in Table 3) in relation to a "business as usual" control arm. [b] Improved refers to the proportion of students in the control, First Step Next, or combined (First Step Next plus homeBase) intervention arm who moved from a clinical diagnosis to a borderline score or a borderline score to a normative score on the Teacher Report Form at posttest. [c] Incremental gain refers to the additional students who improved as a result of intervention, in relation to the comparator (non-intervention control). [d] ICER = incremental cost-effectiveness ratio. For each clinical outcome, the smaller ICER indicates the more cost-effective intervention approach.

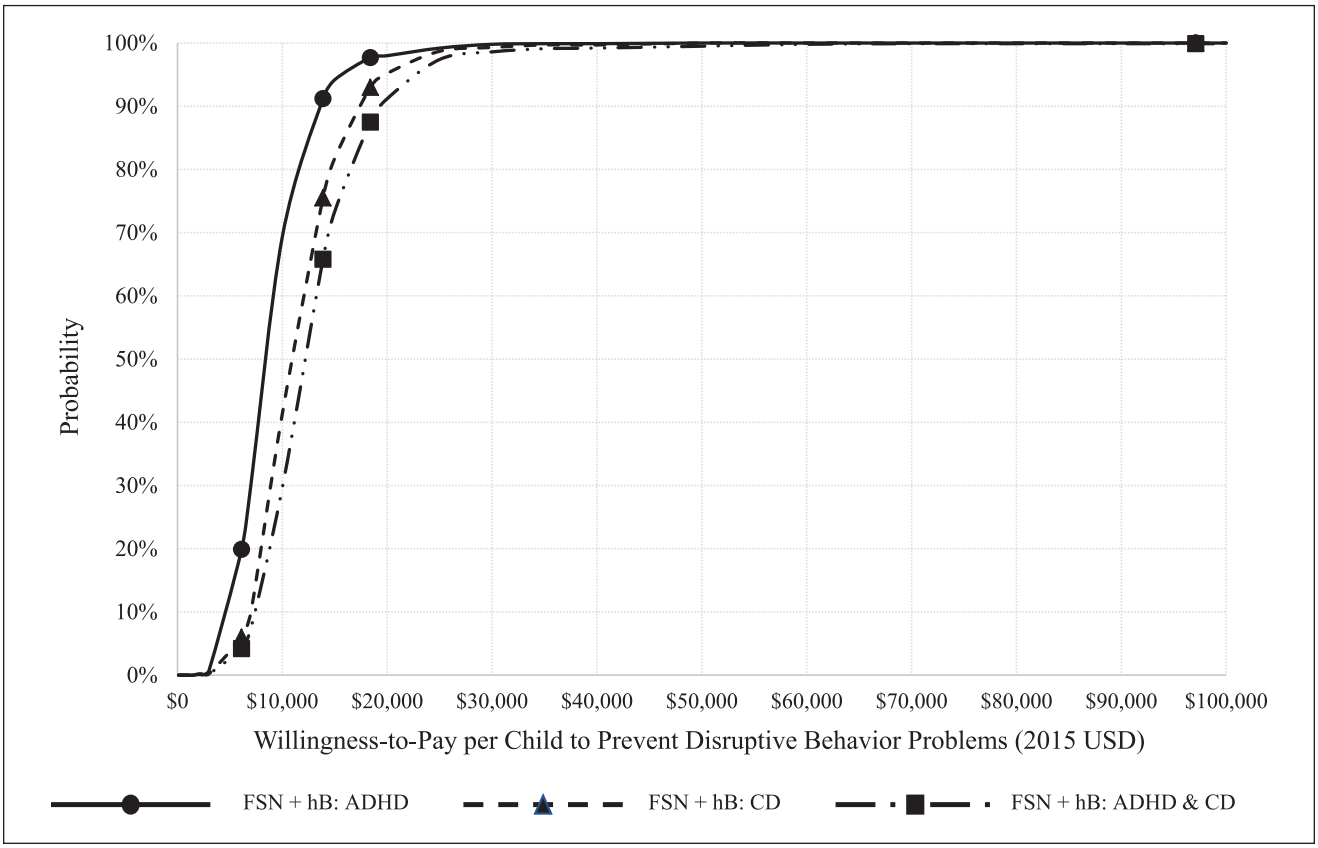

Figure 1. Probability that FSN + hB is cost effective with respect to reducing ADHD, CD, and comorbid ADHD and CD.
Note. The tick marks on the cost-effectiveness acceptability curves represent meaningful willingness-to-pay (WTP) thresholds, adjusted to 2018 US$. From left to right: WTP of US$6,109 represents annual costs of ADHD to schools (Pelham et al., 2007). WTP of US$13,781 represents annual public costs of conduct disorder (Foster & Jones, 2005). WTP of US$18.939 represents total annual costs of ADHD (Pelham et al., 2007). WTP of US$97,096 reflects public costs of conduct disorder from Grades 6 through 12 (Foster & Jones, 2005).

thresholds encompassing various per-child costs of disruptive behavior problems. The likelihood of cost effectiveness was somewhat greater for ADHD compared with CD and comorbid ADHD and CD throughout much of the range. Although stakeholders valuing the cost of achieving such improvement against annual schooling costs for ADHD disorder (US$6,109 in 2018 USD; Pelham et al., 2007) would likely find the cost effectiveness of FSN + hB to be low, comparisons to more comprehensive annual disruptive behavior disorder costs (e.g., US$13,871 for public costs of CD, or US$18,398 for total annual ADHD costs; 2018 USD) bring the likelihood to over 90% for ADHD, at least 75% for CD, and 65% for comorbid ADHD and CD. When compared with values of US$20,000 or greater to improve disruptive behavior problems—roughly 1 year of total ADHD costs and less than 2 years of public CD costs—FSN + hB had a 90% or greater likelihood of being cost effective for all outcomes considered.

Discussion

School administrators, specialized instructional support personnel, school-based mental health professionals, special education teachers, and families are continually faced with the challenge of how to respond to students who display challenging behavior. Commonly, these students meet diagnostic criteria for ADHD or CD (Briesch et al., 2012; Merikangas et al., 2011) or even comorbid ADHD and CD *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM*-5; American Psychiatric Association, 2013). Effective early interventions like FSN and FSN + hB, which were delivered in this study to students at significantly elevated risk for disruptive behavior disorder, can set students on healthier trajectories, with promise for better outcomes at school and at home. This study expands the literature base by examining the costs and cost effectiveness of delivering the FSN intervention alone and in combination with hB. The current study suggests that the combined (FSN + hB) intervention is a better investment of limited resources than offering FSN alone. Although it costs more per student, the value added in terms of student response more than offsets the cost. Thus, while Frey et al. (2022) demonstrated hB had very modest effects when delivered alone but was a significant addition to the FSN intervention, this study added a cost element to these findings, further validating hB's value as an important adjunct to FSN, and potentially other classroom-based interventions. Specifically, regardless of clinical outcome—ADHD, CD, or comorbid ADHD and CD—adding a home component was the more cost-effective approach.

This study's detailed cost and resource use estimates, organized by activity and including quantity and unit price information, increase the utility and generalizability of cost information for decision makers (American Institutes for Research, Cost Analysis Standards Project, 2021; Crowley et al., 2018; National Academies of Sciences, Engineering, and Medicine, 2016). Cost estimates are strikingly similar to the previous analysis: US$3,627 per preschool child on average (Frey et al., 2019, converted to 2018 USD) and US$3,226 per elementary school child (Frey et al., 2019, converted to 2018 USD). Compared with other evidence-based parenting programs, such as Incredible Years (US$3,230 per child; Foster et al., 2007; Washington State Institute for Public Policy [WSIPP], 2019) and Parent-Child Interaction Therapy (US$2,104 per child; French et al., 2018; WSIPP, 2019), the cost of adding hB is substantially less, at US$575 per child. The reduced cost appears largely the result of dosage; hB requires less time, and therefore personnel costs are less. The dosage distinction may explain the very modest effects when implemented alone (Frey et al., 2022). It may also make hB an attractive supplement to interventions delivered by school personnel, with limited time for intensive, home-based support.

This study provides further support for the cost effectiveness of multicomponent interventions for disruptive behavior disorders (Foster et al., 2007; Page et al., 2016; Pelham et al., 2016), extending findings to three clinical outcomes: ADHD, CD, and comorbid ADHD and CD. ICERs fall within the range reported for other behavioral interventions (Jensen et al., 2005; Tran et al., 2018). Sensitivity analyses suggest that stakeholders with WTP thresholds of US$20,000 per child to reduce disruptive behavior problems (2018 USD) will find investing in FSN + hB to be cost effective more than 90% of the time. Although focused on problem behavior at both clinical and borderline levels, this threshold is far lower than the lifetime costs of disruptive behavior disorder; ADHD, for example, has been valued at over US$50,000 (2017 USD) due primarily to healthcare costs and lost productivity (WSIPP, 2019), CD at over US$70,000 (2000 USD) (Foster & Jones, 2005), and comorbid ADHD and CD at over US$80,000 (2000 USD; Jones et al., 2009) in public expenditures alone. At these levels, FSN + hB would be cost effective with near certainty.

Limitations

This study has some limitations. First, cost data were available for two of five cohorts. We demonstrated their equivalency to the other three, but having cost data for all five would have been preferable. Second, coaching costs were not available at the student level. Rather, they were averaged across students served, limiting our ability to examine moderation of findings by child demographics, intervention dosage, or risk, which by design was quite high in this study. Sensitivity analyses examining cost effectiveness across a range of ICERs indicated high probability of cost effectiveness at WTP thresholds of US$20,000 per child to

improve disruptive behavior problems, giving confidence in the robustness of our findings. We note, however, some imprecision in using costs of disruptive behavior disorder to help guide interpretation of ICERs. Although the most relevant values available to contextualize the CEACs, our estimate of intervention response included borderline and clinical disorder. Comparisons should be interpreted with this is in mind. Third, although disruptive behavior problems are common across schools in the United States, this analysis is based on findings from Kentucky schools. Costs may be different in other locales. Fourth, we did not include follow-up data, or maintenance of gains, in this analysis as these data were not available from teachers, and the analysis was conducted from a provider perspective. Fifth, this study indicates that at reasonable WTP values, both FSN and the multicomponent intervention are likely to be cost effective. Although findings suggest that FSN + hB is more cost effective among the sample of students studied, whether conclusions generalize to the population level is less clear given some overlap in confidence intervals reported in Table 4. Studies employing larger samples, broader perspectives (e.g., parent, healthcare related to counseling and medication), and longer follow-up would help extend evidence from this study.

Future Directions

School administrators and stakeholders are tasked with determining how best to support children experiencing behavior problems in the classroom. Efficacious approaches have been established that can improve well-being and school success among these children (Kaminski & Claussen, 2017). This study, like a handful of others, indicates that multicomponent interventions with one or more behavioral components are both effective and cost effective. Findings from the MTA study (Jensen et al., 2005) suggest that the cost effectiveness of combined FSN + hB for children with ADHD or comorbid ADHD might be further enhanced by adding a pharmacological component, perhaps sequenced to occur after behavioral intervention at school and home has commenced (Page et al., 2016; Pelham et al., 2016). Replicating the study with a different evidence-based teacher or teacher-child focused intervention offered in combination with hB could also help determine if the additive effect of hB generalizes across school-based interventions.

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Supplemental material

Supplemental material is available on the webpage with the online version of the article.

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