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# Comprehensive Cost Analysis of First Step Next for Preschoolers with Disruptive Behavior Disorder: Using Real-World Intervention Data to Estimate Costs at Scale

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## Abstract

While the long-term societal costs for youth with disruptive behavior disorders are well documented, there is a dearth of information about the comprehensive costs of implementing even the most well-regarded early intervention programs, and the costs of scaling effective interventions are even less well understood. This study estimated the costs of delivering and disseminating First Step Next (FSN), an established tier two school-based early intervention, in preschool and kindergarten settings, including the training and ongoing technical assistance that support sustained, high-quality implementation. Using the Ingredients Method, we estimated (a) the per student costs of implementation, (b) the incremental cost of offering FSN to an additional student, and (c) the cost to disseminate FSN to 40 preschool and kindergarten students, including a sensitivity analysis to examine potential areas of cost savings. The per child cost to implement the FSN intervention with 29 triads in two cohorts was $4330. The incremental cost per additional student was only $2970, highlighting efficiencies gained once intervention infrastructure had been established. The cost of disseminating the intervention to a single cohort of 40 students was $170,106, or $4253 per student. The range in sensitivity analysis was $3141–$7829 per student, with variability in personnel wages having the greatest impact on cost estimates. This research expands on existing literature by providing a more comprehensive understanding of the cost of effective disruptive behavior interventions based on real-world implementation data, using these data to estimate dissemination costs, and showing how dissemination costs are particularly sensitive to personnel wages.

**Keywords** Cost analysis · Behavior disorders · Preschool · Early intervention

Disruptive behavior disorders involve a constellation of symptoms including oppositional, defiant, or aggressive behaviors, and are one of the most prevalent disorders in young children (Egger and Angold 2006). Left untreated, they may result in persistent impairment and comorbid psychiatric disorders such as attention deficit hyperactivity, depression, and anxiety disorders (Burke et al. 2010). Despite the prevalence of these disorders, there is a dearth of comprehensive economic

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evaluation of early preventative interventions (Aos et al. 2004; Lynch 2004), including fundamental cost analyses that can help support high-quality implementation by detailing resources needed to achieve intervention impact and their associated costs. This study adds to existing literature by providing a comprehensive cost analysis of First Step Next (FSN), an empirically based early intervention offered at the beginning of a child's school career to improve school success, based on data from an efficacy trial. In estimating total, average, incremental, and dissemination costs, the study provides a more extensive set of cost-related information for intervention implementers, developers, and program planners than is generally found in prevention cost studies.

## First Step Next Intervention

The First Step early intervention program (Walker et al. 1997), along with its recent revision (FSN; Walker et al. 2018), is an established school intervention with a parent engagement component. The intervention, which is designed to be implemented with one child per classroom who is screened for having the highest risk in each preschool classroom for disruptive behavior, consists of three major program tasks (social skills instruction, green card game, home-school connection) implemented across four implementation phases (preparation, coach, teacher, maintenance). For the social skills instruction task, the coach delivers a curriculum, which consists of seven super student skills. The coach typically meets with the student outside of the classroom once per day for 7–10 consecutive days, for approximately 10 min each session. The green card game is played in the classroom with all students. While the game is being played, a red-green card is displayed to cue the target child that he or she is displaying appropriate behavior. When the card is on green, he/she earns points toward a group contingency reinforcement activity, delivered immediately after the game concludes. The game is initially played for only 20 min and gradually increases over the course of the intervention. The coach runs the game for approximately 10 days, and then responsibility for running the game is gradually turned over to the teacher. The teacher phase lasts for 10 days followed by a maintenance phase (also 10 days) in which the coach is involved on an as needed basis.

The home-school connection task includes an initial meeting with the parent, teacher, and coach. During the coach phase, the coach also meets with child's parent (or caregiver) to explain the parent role in the home-school point system and in providing parenting strategies that may help the child master super student skills in the home setting. The parent is also asked to sign and return a home-school note daily and engage the child in a 5- to 10-min reinforcement activity after school on days the child wins the green card game. The preschool intervention takes approximately 2 months to complete. A similar but abbreviated "booster" intervention takes place during the initial weeks of kindergarten to help solidify gains made in the preschool year. A complete program description is provided in Walker et al. (2018).

Note that two recent large-scale First Step randomized controlled trials (Feil et al. 2014; Walker et al. 2009) and a large-scale effectiveness study (Sumi et al. 2013) have all produced moderate to large effect sizes on a range of important school-related outcomes, such as social competency, problem behavior, and academic engaged time. The recent revision, FSN, keeps First Step core features but makes them more user friendly and updates or streamlines its components (Walker et al. 2018).

## Problems and Prospects in Cost Analyses of Disruptive Behavior Interventions

Providing agencies with comprehensive cost estimates of tested and effective interventions can help ensure implementation capable of achieving impact (Proctor et al. 2011; Raghavan 2012; United States Department of Education 2017). Economic evaluation guidelines (Crowley et al. 2018; National Academies of Sciences, Engineering, and Medicine 2016; Sanders et al. 2017) recommend that cost estimates reflect the opportunity cost of providing the intervention, valuing all resources, even those that are not paid for directly. However, many cost studies do not fully capture the training and capacity building, ongoing implementation and technical support, and overheard that are needed for high-quality implementation, limiting their utility for program planners and other stakeholders. Examples include cost estimates for two of the most effective interventions for disruptive behavior problems in young children, the Incredible Years (Menting et al. 2013) and Parent Child Interaction Therapy (PCIT; Zisser and Eyberg 2017). A cost analysis of the Incredible Years with group parent and child training components (Washington State Institute for Public Policy [WSIPP] 2018; Foster et al. 2007) yielded a cost of $3970 per family (2015 dollars) inclusive of training, intervention, materials, childcare, and transportation costs, but whether ongoing support for interventionists was included is not clear. WSIPP estimated PCIT at an average cost of $2993 per target child (2017 dollars), but which key intervention activities were included is also not clear. Neither study included overhead costs.

Total and average cost estimates provide important basic information about resource requirements and associated costs, and they also help delineate how many participants can be served within a given budget allocation. As efficacious interventions are implemented more broadly, however, additional

cost-related questions become relevant (Crowley et al. 2018; National Academies of Sciences, Engineering, and Medicine, 2016). For example, understanding the costs of serving an additional participant once staff are trained and infrastructure is in place can be informative, particularly because such costs are often substantially lower than average costs. When costs have been estimated using the Ingredients Method (Levin et al. 2012), these marginal or incremental costs may be readily estimable by summing the cost of ingredients that vary with, or are needed to serve, the extra participant, and ignoring costs that are fixed.

Cost estimates have also been called for to support broader dissemination of efficacious interventions (Gottfredson et al. 2015), yet many scale implementation studies do not address costs (see, e.g., Kozica et al. 2016; Moessner et al. 2016; Olweus et al. 2019; Velasco et al. 2015). Although estimates of the marginal cost per participant can inform decisions to expand program delivery over a small range (Alfonso et al. 2019), they are generally insufficient to estimating costs at scale as fewer costs are fixed and margins beyond the individual participant need to be considered. For example, expanding delivery of FSN to large numbers of additional students at new sites is likely to necessitate additional capacity building and infrastructure investment. In this case, the marginal costs of bringing new staff and schools on board need to be included in the analysis alongside marginal participant costs. When interventions are disseminated broadly, differences in wages, characteristics of the population served, number of implementing sites, and staff turnover further add to the complexity of estimating costs at scale (Brabson et al. 2019; O'Connor et al. 2018).

## The Present Study

To our knowledge, cost studies of effective early intervention programs have not estimated total and average costs, incremental costs per participant, and broader dissemination costs, including attention to sources of variability in scale estimates, within a single study. This study used the Ingredients Method (Levin and McEwan 2001) to estimate each of these costs in relation to FSN, thereby increasing the utility of intervention cost information for stakeholders. First, we estimated the total and per student costs of implementing FSN for 2 years, in preschool and kindergarten, using data from our current, ongoing efficacy trial of FSN. Next, we estimated the incremental (or marginal) cost of FSN, or the cost of adding one student within a school or preschool center after staff are trained and the program has been implemented. We then used this information to estimate the cost to disseminate FSN to 40 students within one district. Finally, we show how dissemination cost estimates are sensitive to several real-world cost drivers.

# Method

The study in which this cost analysis took place examined the efficacy of the FSN intervention for improving behavioral and academic outcomes to support learning in preschool and kindergarten settings. We conducted the research in Head Start, pre-k, and kindergarten programs in Kentucky, Oregon, and Illinois. After recruiting participants through procedures described below, school sites were randomly assigned to FSN or a business as usual comparison group. The cost analysis used data from the 8 Kentucky intervention sites, which offered preschool and kindergarten follow-up intervention to two cohorts of students who were one year apart in school during the 2015–2016 through the 2017–2018 school years.

## Participants

The eight Kentucky sites (two early childhood centers, six elementary schools) had two to six preschool teachers each ($M = 3.6$, $SD = 1.6$). Across the sites, 29 teacher-child-parent triads participated in FSN in two cohorts. Children had a mean age of 4.1 years ($SD = 0.3$) and were predominately African American (69%) and male (70%). Mean aggressive and maladaptive behavior screening scores denoted moderate or severe disruptive behavior.

## FSN Implementation

### Pre-intervention Recruitment and Screening

The principal investigator and research managers (referred to as "FSN managers" from here forward) worked with Jefferson County Public School administrators to identify participating early childhood centers. School administrators from those sites were contacted and, if they agreed, a meeting with potential teachers was held to describe the study. Teachers who consented to participate in the study subsequently distributed waiver of consent letters to parents. The letters described the study's purpose and the class-wide screening procedure. The FSN managers trained teachers to complete the Early Screening Procedure, which involved completing surveys to identify children at elevated risk for school failure based on teacher-observed externalizing problem behaviors. Study staff scored teacher screenings (5 students per classroom) and ranked students in order of risk. They then contacted parents of the highest ranked child in each classroom and invited them to participate. If the parents agreed, staff set up a meeting to obtain informed consent. If they declined, parents of the next highest ranked child were invited to participate. We repeated this process until we obtained parent consent for one eligible child in each classroom or all families of eligible children declined. Eighty-five percent of parents contacted agreed to participate.

### Coach and Teacher Training

Coaches and teachers were trained separately. Coaches were trained at a 2-day workshop (5.5 h on day 1, 4 h on day 2) offered in a district resource center. Each coach was then assigned to a non-participating early childhood classroom, where they spent 3 to 4 weeks practicing the intervention. They were also monitored closely by the FSN managers, who were present daily at the training site to debrief before and after coaches went into classrooms. The FSN managers also observed coaches regularly and offered feedback. Teachers who were randomized to the intervention group participated in a 2-h training session prior to implementation. Additional details can be found in Walker et al. (2018).

### Intervention

After parental consent was obtained, the intervention was implemented in the preschool year as described in the introduction to this paper. A kindergarten booster phase developed for the efficacy trial occurred during the initial 2 or 3 months of the following year to assist the child in maintaining his or her behavioral gains. Kindergarten teachers were invited and consented to participate. Activities were like those offered in the preschool year but abbreviated in that the green card game was played for a shorter duration and the number of days in each phase was reduced. Twenty-seven of 29 students (93%) received booster intervention services as two kindergarten teachers agreed to data collection but not to implementing FSN.

### Ongoing Support

Coaches attended an hour per week group supervision meeting with the FSN managers, throughout the intervention. The purpose of support is primarily to trouble shoot challenging cases and share successes.

## Data Sources

The Ingredients Method requires data about the quantity and unit prices of all key ingredients or resources used to carry out the intervention, which are multiplied together to determine cost. Resources financed directly (e.g., coach labor, supplies) and indirectly (e.g., teacher time, overhead) need to be included for cost estimates to be comprehensive and reflect the opportunity cost of delivering FSN. Data sources for each FSN key ingredient are described below.

### Personnel Wage and Fringe Benefit Rates

For the FSN managers, annual salaries were divided by 2080, the number of hours in a work year, to determine an hourly wage; fringe benefit rates were from project budget records. Hourly wage and fringe benefit rates for coaches, who were masters level professionals (e.g., school social workers, former educators) and part-time itinerant employees of the University of Louisville, came from payroll records. *Teacher wages* were estimated from the Bureau of Labor Statistics (BLS) Occupational Employment Statistics for the state of Kentucky, Occupation code 25-2012, Kindergarten Teachers, Except Special Education (United States Department of Labor 2018a). To teach preschool in Kentucky, teachers must be certified in interdisciplinary early education, birth to primary, through the Kentucky Department of Education. Thus, kindergarten and preschool teachers are on the same pay scale. *Teacher fringe benefit* rates were from BLS Employer Costs for Employee Compensation (United States Department of Labor 2018b). Sensitivity analyses described below used the same fringe benefits, but Kentucky wage rates varied with staff credentials: (a) coaching by paraprofessionals (occupational code 25-9041) or a school psychologist (occupational code 19-3031) and (b) intervention oversight by a special education teacher (occupational code 25-2052) or school psychologist.

### Personnel Hours

Coaching was the most resource-intensive personnel position. *Hours spent by coaches* came directly from hourly time sheets submitted prospectively on a bi-monthly basis throughout their involvement in the study. We used notes from supervision meetings, where interventionists were assigned to students, to identify intervention start and stop dates for each coach and then allocated hours across major activities (pre-intervention, intervention, and support). Any hours incurred prior to the intervention start date were allocated to pre-intervention. Hours from the coach's first to last intervention dates were assigned to intervention and support activities. One hour per week was allocated to support, the rest to intervention.

Hours spent by the FSN managers on recruitment, screening, and training were estimated retrospectively from project records and outlook calendars showing these activities. We allocated 1 h per week for the duration of the intervention period to ongoing support activities.

Teachers were involved in recruitment, screening, training, intervention, *and* support activities. Although we attempted to have all teachers complete logs showing time spent on FSN activities, most were resistant to this activity, and the data were too incomplete to be usable. Thus, average pre-intervention time estimates were based on FSN manager knowledge of FSN (preschool recruitment 1 h; screening 45 min; training 2 h). Conversations with coaches indicated teacher support took approximately 3 h per teacher. Discussions with preschool teachers indicated they spent approximately 30 min each day when the intervention was implemented, or 10

intervention hours total per teacher. Kindergarten teachers reported less time on intervention-related activities: 1 h for recruitment and 2.5 h on the intervention. These estimates are in line with the few logs we received; limitations in teacher time estimates are discussed under study limitations.

#### Supplies

This category included supplies needed for pre-intervention (teacher recruitment packets, student screening kits, student screening surveys) and intervention (FSN preschool kits and refills, FSN kindergarten materials, intervention timers, supplemental books) activities, as well as food and snacks provided for teacher training sessions. The amounts and unit costs came from project expense records and university procard/credit card receipts. Though new to FSN, kindergarten booster materials are available from the publisher upon request.

#### Overhead

Because recommendations for including overhead in cost estimates differ (National Academies of Sciences, Engineering, and Medicine 2016; Education Endowment Fondation 2018), we estimated costs with and without overhead at 20% of personnel costs.

#### Inflation

We used the Implicit Price Deflator for Personal Consumption Expenditures (Economic & Analysis) to adjust all nominal unit prices to constant 2015 dollars, the year in which the intervention started. This involved multiplying 2016 and 2017 nominal prices (i.e., prices observed in years 2 and 3 of the intervention) by the 2015 quarter three index value (coinciding with the start of the school year) divided by the nominal quarter three index value. Adjusting to constant 2015 dollars allowed us to combine data from the two cohorts so that we had a larger sample on which to base cost estimates ($N = 29$; $n = 14$ in cohort 1, $n = 15$ in cohort 2) and to add values across two intervention years.

### Analysis Plan

Our objectives were to estimate the total and average cost per student of FSN as implemented in the efficacy study, the incremental cost of delivering FSN to one more student, and the cost of disseminating FSN to 40 students within one school district.

#### Total Costs and Average Costs per Student

We calculated the total cost of implementing the FSN intervention with 29 triads by summing the costs of key ingredients for all major activities: pre-intervention (recruitment, screening, and training), intervention, and support. Because personnel time and associated costs typically drive the overall costs of social programs, we also reported the hours devoted by staff to each major activity. We calculated the average cost per student by dividing the total FSN cost by the 29 students served in the two cohorts.

#### Incremental Cost of Serving One More Student

We first identified which resources would vary if one additional student received FSN, versus which would remain invariant or fixed. We assumed the additional student would be at a school already participating in the intervention and that a trained coach would be assigned; thus, no additional school recruitment or coach training costs would be incurred. Because coach support occurred in a group, no additional support resources would be required, and so coach support costs would also be fixed. Adding one more student, however, would necessitate additional classroom screening, teacher training in preschool, intervention delivery by coach and teacher during the preschool and kindergarten years, and teacher support. Incremental personnel resources (e.g., hours per student) were the averages per student shown in Table 2 and were multiplied by the relevant wage and fringe rate for that personnel category to determine incremental personnel costs. Incremental supplies consisted of one teacher recruitment packet, one set of screening surveys, and a super student book; other supplies that were used by coaches for multiple students, like intervention timers and the FSN kit, would remain fixed. Supply costs are described above. Incremental overhead costs were estimated at 20% of incremental personnel costs. The total incremental cost per student was estimated by summing the costs of all incremental (or variable) resources.

#### Cost of Disseminating FSN to 40 Students in One School District

To estimate the cost of disseminating the intervention in an authentic educational setting, we again used cost analysis results as a foundation. Our dissemination scenario involved offering 2 years of FSN to a single cohort of 40 students, whom we assumed attended 10 sites, each with four participating classrooms. A special education resource teacher would serve as the FSN manager, and school social workers would implement the intervention to students. We assumed a university faculty member or similarly qualified professional would conduct initial training and provide some consultation support. We also assumed students would stay in the same school for preschool and kindergarten, and there would be no coach turnover during the two intervention years.

We developed a dissemination cost model that accounted for the cost of key ingredients used in each of the major activities reported previously. For each ingredient, we first determined the unit over which the cost varied. We then multiplied the unit cost estimated in the efficacy trial by the number of units needed in the dissemination scenario. For example, we multiplied the training cost per coach in the efficacy trial by 10 coaches to be trained in the dissemination effort. As a second example, coach intervention costs varied with the number of students served. We multiplied the coach intervention cost per student in the efficacy trial by 40 students served in dissemination. We worked through each key ingredient similarly and calculated costs with and without overhead. We summed the elements to calculate a total cost to disseminate FSN to 40 students and divided by 40 to estimate the average dissemination cost per student.

### Sensitivity Analysis

Because many different factors can affect real-world implementation costs (Brabson et al. 2019; O'Connor et al. 2018), we examined the effect of four cost drivers on the dissemination costs calculated above. Sensitivity scenario 1 varied the number of schools and coaches needed to serve 40 students from a low of 8 schools/coaches to a high of 12 schools/coaches; fewer schools and coaches would be more cost efficient. Scenario 2 varied coach turnover, which had been nil in the base case to a lower rate of 30% and a higher rate of 50% between the preschool and kindergarten years. Scenario 3 varied the credentials of the coaches and managers, with the lower cost option utilizing paraprofessionals as coaches and school social workers as managers and the higher cost option utilizing school psychologists in both roles. Scenario 4 varied student risk and mobility. Higher risk necessitated more intervention time per student (+ 15% compared to the base case) while lower risk necessitated less (− 15% compared to the base case). Low student mobility was defined as no loss to kindergarten follow-up (as in the base case) whereas higher mobility was defined by a 15% loss of students served in kindergarten. Because mobility and risk tend to be positively correlated, the two options in scenario 4 were low need/low mobility and high need/high mobility. To conduct the sensitivity analyses, we adjusted relevant inputs to the dissemination cost model (e.g., personnel wages under scenario 3), re-estimated costs, and compared them to the base case. Unlike the other analyses, all sensitivity analyses modeled costs with overhead to keep comparisons more manageable.

## Results

### Total and Average Costs per Student

The total and average costs per student (in constant 2015 dollars) to implement the FSN intervention with 29 triads are reported in Table 1. Intervention costs for the preschool and kindergarten year totaled $125,556 with overhead ($105,634 without), or $4330 per student ($3643 without overhead). Most of the investment (80%) occurred in the preschool year, with 20% in kindergarten. Fifty-five percent of the costs incurred were for intervention activities, while pre-intervention activities accounted for 34%. At 11% of total costs, ongoing support was a relatively small investment. Personnel comprised the largest share of total costs, accounting for 80% of the total, followed by overhead at 16%.

To better understand investments in personnel and allow potential adopters to estimate costs of their own staff, we examined the hours spent by different personnel types (i.e., managers, coaches, teachers) on pre-intervention, intervention, and support activities in each of the 2 years of intervention. Estimates are reported in Table 2. Coach time accounted for 72% of all personnel hours, with managers accounting for 12% and teachers accounting for 17%. Fifty-nine percent of all hours were incurred in providing the intervention, with 31% going to pre-intervention activities and 10% to support. Training accounted for 25% of personnel costs. Managers spent the greatest share of their time on pre-intervention activities, while the greatest share of coach and teacher hours were spent delivering the intervention.

### Incremental Costs

Table 3, available online, summarizes the incremental cost of serving an additional student once an intervention infrastructure (e.g., trained coaches, fixed supplies, ongoing support system) has been established. At $2287 ($1911 without overhead) for preschool and $683 ($569 without overhead) for kindergarten, the total cost per additional student is $2970 ($2480 without overhead). This is 31% lower than the average per student cost and highlights the significant efficiencies to be gained once FSN infrastructure is in place. Importantly, and understandably since existing infrastructure reduces the need for additional training and ongoing support on the margin, an even larger share of incremental costs is in support of direct intervention services to students, 77% compared to 55% of average costs.

### Dissemination Costs

The total cost (2015 dollars) of serving 40 students in 10 early childhood sites was estimated to be $123,900 with overhead ($104,499 without) during preschool and $46,205 with overhead ($38,664 without) during kindergarten, for a total of $170,106 with overhead ($143,163 without). The per student cost for 2 years of intervention was $4253 when overhead was included, and $3579 when it was not. Incremental costs were estimated at $2970 with overhead ($2480 without). Like the actual cost analysis, most of the investment, 73%, occurred in

**Table 1** Total and average costs per student: First Step Next (2015 dollars)

| | Total FSN costs | | | | Average FSN cost per student | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre-intervention | Intervention | Support | Total[a] | Pre-intervention | Intervention | Support | Total | Share of cost by resource[b] |
| Preschool | | | | | | | | | |
| Personnel | $30,866 | $39,700 | $8190 | $78,756 | $1064 | $1369 | $282 | $2716 | 78.6% |
| Equipment | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | 0.0% |
| Supplies | $1377 | $3902 | $0 | $5279 | $47 | $135 | $0 | $182 | 5.3% |
| Other | $394 | $0 | $0 | $394 | $14 | $0 | $0 | $14 | 0.4% |
| Overhead | $6173 | $7940 | $1638 | $15,751 | $213 | $274 | $56 | $543 | 15.7% |
| Total | $38,810 | $51,543 | $9828 | $100,180 | $1338 | $1777 | $339 | $3454 | |
| Share of cost[c] | 38.7% | 51.5% | 9.8% | | | | | | |
| Cost minus overhead | $32,637 | $43,603 | $8190 | $84,429 | $1125 | $1504 | $282 | $2911 | |
| Kindergarten | | | | | | | | | |
| Personnel | $2961 | $14,251 | $3644 | $20,856 | $102 | $491 | $126 | $719 | 82.2% |
| Equipment | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | 0.0% |
| Supplies | $0 | $349 | $0 | $349 | $0 | $12 | $0 | $12 | 1.4% |
| Other | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | 0.0% |
| Overhead | $592 | $2850 | $729 | $4171 | $20 | $98 | $25 | $144 | 16.4% |
| Total | $3553 | $17,451 | $4373 | $25,376 | $123 | $602 | $151 | $875 | |
| Share of cost | 14.0% | 68.8% | 17.2% | | | | | | |
| Cost minus overhead | $2961 | $14,600 | $3644 | $21,205 | $102 | $503 | $126 | $731 | |
| Total | | | | | | | | | |
| Personnel | $33,827 | $53,952 | $11,834 | $99,612 | $1166 | $1860 | $408 | $3435 | 79.3% |
| Equipment | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | 0.0% |
| Supplies | $1377 | $4252 | $0 | $5629 | $47 | $147 | $0 | $194 | 4.5% |
| Other | $394 | $0 | $0 | $394 | $14 | $0 | $0 | $14 | 0.3% |
| Overhead | $6765 | $10,790 | $2367 | $19,922 | $233 | $372 | $82 | $687 | 15.9% |
| Total | $42,363 | $68,993 | $14,200 | $125,556 | $1461 | $2379 | *$490* | $4330 | |
| Share of cost | 33.7% | 55.0% | 11.3% | | | | | | |
| Cost minus overhead | $35,597 | $58,203 | $11,834 | $105,634 | $1227 | $2007 | $408 | $3643 | |

[a] Preschool costs were 80% and kindergarten costs were 20% of the total spent across two intervention years

[b] The share of costs by resource is calculated by dividing the resource cost in a given year by the total FSN cost for that year

[c] The share of cost by activity (e.g., pre-intervention, intervention) is calculated as the activity cost divided by total FSN cost in a given year

the preschool year, with 27% in kindergarten. The share of costs going to different resources and activities was similar to the actual cost analysis, with personnel and intervention costs remaining the major cost drivers. These costs are summarized in Table 4, available online.

Sensitivity analyses systematically varied four cost drivers and assessed the implications for total, average, and incremental dissemination costs: (a) the number of schools and coaches needed to serve 40 students (scenario 1); (b) coach turnover rates (scenario 2); (c) coach and site management credentials (scenario 3); and (d) student characteristics (scenario 4). Because we had low- and high-cost options for each scenario, sensitivity analyses produced a range of total dissemination costs. For simplicity, all estimates included overhead. Results displayed in Fig. 1 show that FSN cost estimates were indeed sensitive to these cost drivers. Although the average base cost per student was $4253, the least and most expensive scenarios were $3141 (reflecting low-cost inputs across all scenarios) and $7829 (reflecting high-cost inputs across all scenarios). Incremental costs varied from $2216 to $4749. Figure 1 also illustrates that variation in intervention costs, rather than pre-intervention and support costs, accounts for most the variation in dissemination cost estimates.

Figure 2 provides a different picture of the dissemination sensitivity analysis. Focusing on average cost per student, it shows pre-intervention, intervention, support, and total costs per student for the base case and the four scenarios. Both low-cost and high-cost options are displayed. Figure 2 shows that average costs per student varied from a low of $3634 per student, a savings of $600 per student compared to the base

**Table 2** Average personnel hours per student by personnel type and intervention activity

| | Pre-intervention activities | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Recruitment | Screening | Training | Total | Intervention | Support | Total[a] | Share of hours by personnel type[b] |
| Preschool | | | | | | | | |
| Program managers | 2.2 | 1.8 | 5.7 | 9.7 | 0.0 | 1.6 | 11.3 | 11.7% |
| Coaches | 0.0 | 0.0 | 22.9 | 22.9 | 42.1 | 4.0 | 69.0 | 71.5% |
| Teachers | 1.0 | 0.8 | 1.5 | 3.2 | 10.0 | 3.0 | 16.2 | 16.8% |
| Total | 3.2 | 2.5 | 30.1 | 35.9 | 52.1 | 8.6 | 96.5 | |
| Share of hours[c] | 3.4% | 2.6% | 31.2% | 37.2% | 54.0% | 8.9% | 79.0% | |
| Kindergarten | | | | | | | | |
| Program managers | 0.7 | 0.0 | 0.1 | 0.8 | 0.0 | 1.1 | 1.9 | 7.4% |
| Coaches | 0.0 | 0.0 | 0.5 | 0.5 | 17.6 | 3.0 | 21.1 | 82.5% |
| Teachers | 0.8 | 0.0 | 0.0 | 0.8 | 1.8 | 0.0 | 2.6 | 10.2% |
| Total | 1.5 | 0.0 | 0.6 | 2.1 | 19.4 | 4.1 | 25.6 | |
| Share of hours | 5.8% | 0.0% | 2.4% | 8.2% | 75.7% | 16.1% | 21.0% | |
| Total | | | | | | | | |
| Program managers | 2.9 | 1.8 | 5.8 | 10.5 | 0.0 | 2.7 | 13.2 | 10.8% |
| Coaches | 0.0 | 0.0 | 23.5 | 23.5 | 59.7 | 7.0 | 90.2 | 73.8% |
| Teachers | 1.8 | 0.8 | 1.5 | 4.0 | 11.8 | 3.0 | 18.8 | 15.4% |
| Total | 4.7 | 2.5 | 30.7 | 38.0 | 71.5 | 12.7 | 122.2 | |
| Share of hours | 3.9% | 2.1% | 25.2% | 31.1% | 58.5% | 10.4% | | |

[a] Preschool personnel hours were 78% and kindergarten personnel hours were 21% of the total hours across two intervention years

[b] The share of hours by personnel type is calculated by dividing the personnel hours in a given year by the total FSN hours for that year

[c] The share of hours by intervention activity (e.g., pre-intervention, intervention) is calculated by dividing the activity hours in a given year by the total FSN hours for that year

case, to a high of $6817 per student, an increase of $1564 above the base case. Like Fig. 1, Fig. 2 shows that intervention costs drive variability in dissemination costs. Figure 2 also shows that dissemination costs were very sensitive to staff credentials and associated wage rates (scenario 3), reflecting that personnel costs make up the clear majority of FSN costs. They were somewhat sensitive to differences in student mobility and risk (scenario 4), which ultimately affect intervention costs, but were not very sensitive to variation in the number of implementing sites and teachers or to staff turnover, which affect pre-intervention and support costs but not intervention costs.

## Discussion

The long-term societal costs for youth with disruptive behavior disorders are well documented (Aos et al. 2004), yet comprehensive cost analyses that inform high-quality implementation capable of achieving impact are scarce (National Academies of Sciences, Engineering, and Medicine 2016; Tran et al. 2018). The current study helps to fill this gap, providing a systematic and replicable comprehensive cost analysis of FSN, an empirically based early intervention offered at the beginning of a child's school career to improve school success.

The study's total and average cost estimates are quite comprehensive. They are also rare in that they include training to implementation proficiency (33% off the total cost), ongoing support (12% of the total cost), teacher salary costs (17% of the personnel costs), and overhead (20% of personnel costs). At $4330 (2015 dollars, $3643 without overhead) in average cost per family for 2 years of intervention, FSN costs are also well-aligned with two other evidence-based interventions for children with disruptive behavior disorders, the Incredible Years and Parent-Child Interaction Therapy described in this paper's introduction. Similar to other prevention and early intervention programs that are labor intensive and require little in terms of supplies and/or equipment (e.g., Menting et al., 2013; Zisser and Eyberg 2017), our results demonstrated that approximately 80% of FSN costs were driven by personnel hours.

In response to calls for greater utility and informational content in economic evaluations of early intervention and prevention programs, including cost analyses (National Academies of Sciences, Engineering, and Medicine 2016), this study goes beyond most extant studies in several ways.

**Table 3** Incremental cost per student (2015 dollars)

| | | Incremental hours or units[a] | | | | Incremental costs[b] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Unit cost | Pre-intervention | Intervention | Support | Total | Pre-intervention | Intervention | Support | Total[c] | Share of cost[d] |
| Preschool | | | | | | | | | | |
| Personnel | | | | | | | | | | |
| Manager/supervisor | $41.18 | 6.5 | | | 6.5 | $267 | | | $267 | |
| Coach | $23.67 | | 42.1 | | 42.1 | | $997 | | $997 | |
| Teacher | $38.05 | 3.2 | 10.0 | 3.0 | 16.2 | $123 | $380 | $114 | $618 | |
| Sub-total personnel | | 9.7 | 52.1 | 3.0 | 64.8 | $390 | $1377 | $114 | $1881 | 82.3% |
| Supplies | | | | | | | | | | |
| Screening survey | $2.98 | 1.0 | | | | $3 | | | $3 | |
| Teacher recruitment packet | $1.49 | | 1.0 | | | | $1 | | $1 | |
| Super student book | $25.00 | | 1.0 | | | | $25 | | $25 | |
| Sub-total supplies | | | | | | $3 | $26 | $0 | $29 | 1.3% |
| Overhead | | | | | | $78 | $275 | $23 | $376 | 16.5% |
| Total—preschool | | 9.7 | 52.1 | 3.0 | 64.8 | $471 | $1679 | $137 | $2287 | |
| Cost minus overhead | | | | | | $393 | $1404 | $114 | $1911 | |
| Kindergarten | | | | | | | | | | |
| Personnel | | | | | | | | | | |
| Manager/supervisor | $51.54 | 0.7 | | | 0.7 | $36 | | | $36 | |
| Coach | $24.70 | | 17.6 | | 17.6 | | $435 | | $435 | |
| Teacher | $38.06 | 0.8 | 1.8 | 0.0 | 2.6 | $30 | $69 | | $99 | |
| Sub-total personnel | | 1.5 | 19.4 | 0.0 | 20.9 | $66 | $503 | $0 | $569 | 83.3% |
| Supplies | | | | | | | | | $0 | 0.0% |
| Overhead | | | | | | $13 | $101 | $0 | $114 | 16.7% |
| Total—kindergarten | | 1.5 | 19.4 | 0.0 | 20.9 | $79 | $604 | $0 | $683 | |
| Cost minus overhead | | | | | | $66 | $503 | $0 | $569 | |
| Total | | | | | | | | | | |
| Personnel | 11.2 | | 71.5 | 3.0 | 85.7 | $456 | $1881 | $114 | $2451 | 82.5% |
| Supplies (preschool only) | | | | | | $3 | $26 | $0 | $29 | 1.0% |
| Overhead | | | | | | $91 | $376 | $23 | $490 | 16.5% |
| Total | | | | | | $550 | $2283 | $137 | $2,970 | |
| Share of total[e] | 13.1% | | 83.4% | 3.5% | | 18.5% | 76.9% | 4.6% | | |
| Cost minus overhead | | | | | | $459 | $1907 | $114 | $2480 | |

This table shows the cost of the resources that vary when an additional student is served: *personnel*: in the preschool year, the student is screened and the teacher is trained. In kindergarten, the teacher is recruited. The intervention is conducted in both years by a coach who has been previously trained. The coach is supported by activities that are already taking place; there is no additional cost. Unit costs reflect weighted average hourly wage and fringe benefit rates for a given personnel category. They are derived by dividing the category-specific personnel expenditure per student by the category-specific hours per student. *Supplies*: the only supplies needed are a teacher recruitment packet, student screening surveys, and a super student book. Unit costs reflect the cost of 1 survey, 1 teacher recruitment packet, or 1 super student book. *Overhead*: 20% of personnel costs

[a] We assumed hours spent in incremental pre-intervention, intervention, and support activities would equal the average reported in Table 2; for FSN managers, hours reported here are less than Table 2 because some hours reported in Table 2 were for fixed activities (e.g., school recruitment, coach training). Incremental supply units always equal to 1

[b] Incremental costs are the product of the unit cost and incremental hours or units

[c] Preschool costs were 80% and kindergarten costs were 20% of the total spent across two intervention years

[d] The share of costs by resource is calculated by dividing the resource cost in a given year by the total FSN cost for that year

[e] The share of costs by intervention activity (e.g., pre-intervention, intervention) is calculated by dividing the activity cost in a given year by the total FSN cost for that year

**Table 4** First Step Next dissemination costs (2015 dollars)

| | Total dissemination costs | | | | Average dissemination cost per student | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre-intervention | Intervention | Support | Total[a] | Pre-intervention | Intervention | Support | Total | Share of cost by resource[b] |
| Preschool | | | | | | | | | |
| Personnel | $32,945 | $54,759 | $9300 | $97,004 | $824 | $1369 | $232 | $2425 | 78.3% |
| Supplies | $756 | $6275 | $0 | $7030 | $19 | $157 | $0 | $176 | 5.7% |
| Other | $465 | $0 | $0 | $465 | $12 | $0 | $0 | $12 | 0.4% |
| Overhead | $6589 | $10,952 | $1860 | $19,401 | $165 | $274 | $46 | $485 | 15.7% |
| Total FSN costs | $40,754 | $71,986 | $11,160 | $123,900 | $1019 | $1800 | $279 | $3098 | |
| Share of cost by intervention activity[c] | 32.9% | 58.1% | 9.0% | 72.8% | | | | | |
| Cost minus overhead | $34,165 | $61,1034 | $9300 | $104,499 | $854 | $1526 | $232 | $2612 | |
| Kindergarten | | | | | | | | | |
| Personnel | $1207 | $34,059 | $2443 | $37,709 | $30 | $851 | $61 | $943 | 81.6% |
| Supplies | $0 | $955 | $0 | $955 | $0 | $24 | $0 | $24 | 2.1% |
| Other | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | 0.0% |
| Overhead | $241 | $6812 | $489 | $7542 | $6 | $170 | $12 | $189 | 16.3% |
| Total FSN costs | $1448 | $41,825 | $2932 | $46,205 | $36 | $1046 | $73 | $1155 | |
| Share of cost by intervention activity | 3.1% | 90.5% | 6.3% | 27.2% | | | | | |
| Cost minus overhead | $1207 | $35,013 | $2443 | $38,664 | $30 | $875 | $61 | $967 | |
| Total | | | | | | | | | |
| Personnel | $34,152 | $88,818 | $11,743 | $134,713 | $854 | $2220 | $294 | $3368 | 79.2% |
| Supplies | $756 | $7229 | $0 | $7985 | $19 | $181 | $0 | $200 | 4.7% |
| Other | $465 | $0 | $0 | $465 | $12 | $0 | $0 | $12 | 0.3% |
| Overhead | $6830 | $17,764 | $2349 | $26,943 | $171 | $444 | $59 | $674 | 15.8% |
| Total FSN costs | $42,203 | $113,811 | $14,092 | $170,106 | $1055 | $2845 | $352 | $4253 | |
| Share of cost by intervention activity | 24.8% | 66.9% | 8.3% | | | | | | |
| Cost minus overhead | $35,373 | $96,047 | $11,743 | $143,163 | $884 | $2401 | $294 | $3579 | |

Major assumptions: FSN is disseminated to 40 students at 10 schools in 1 school district. Students stay in the same school in both intervention years. They are served by 10 coaches in the 2 years. The intervention is managed by a school social worker, who provides ongoing support. The school social worker is trained with intervention coaches

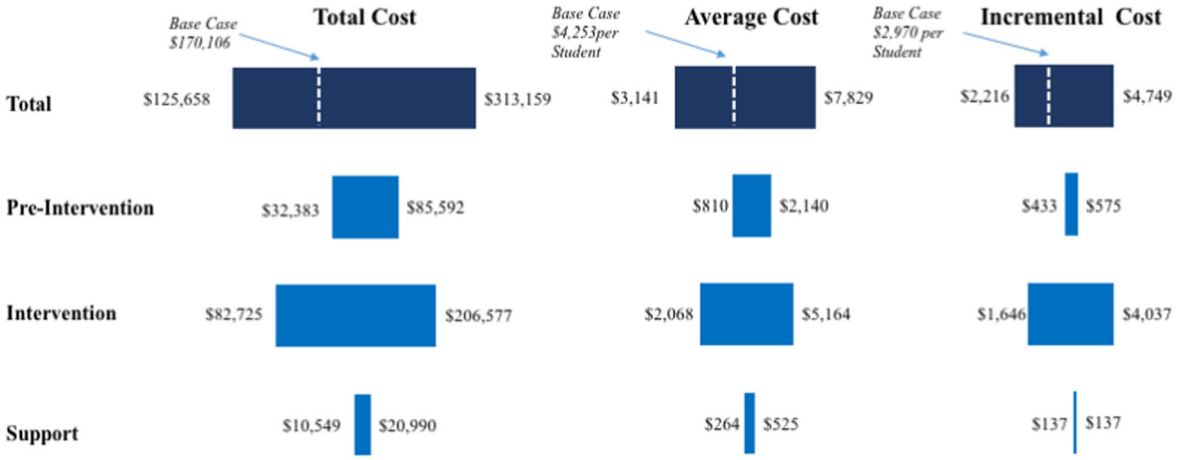
[a] Preschool costs were estimated to account for 82% and kindergarten costs 18% of total dissemination costs across two intervention years

[b] The share of costs by resource is calculated by dividing the resource cost in a given year by the total FSN cost for that year

[c] The share of costs by intervention activity (e.g., pre-intervention, intervention) is calculated by dividing the activity cost in a given year by the total FSN cost for that year

First, the study's incremental cost estimate of $2970 per additional student served ($2480 without overhead) demonstrates efficiencies obtained once an infrastructure is in place. Specifically, the per student cost once FSN staff are trained and ongoing support has been established was roughly a third less than the average cost, with most of the incremental resources going directly towards intervention activities, important information for consumers.

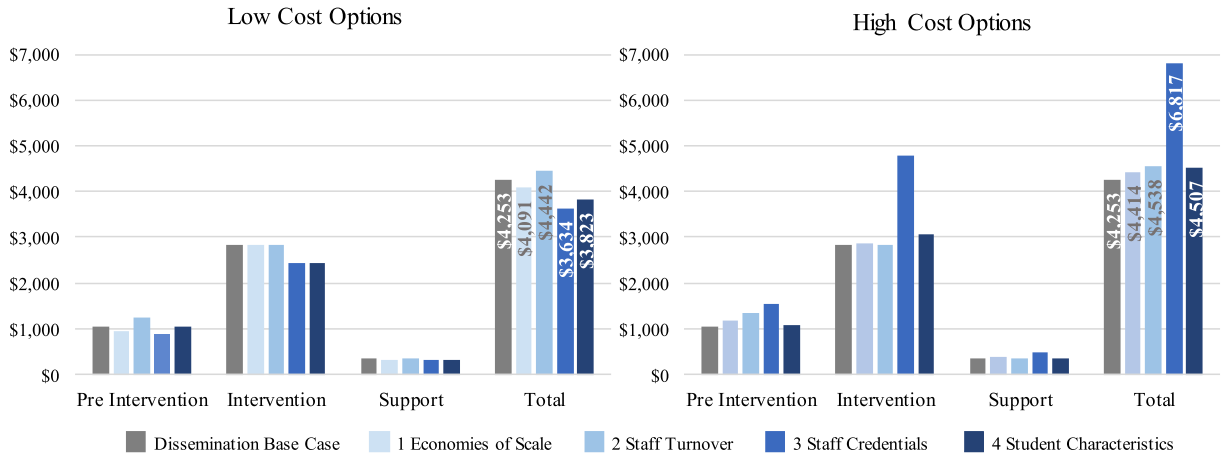
Second, with greater need for translation and dissemination of effective interventions (Gottfredson et al. 2015; Proctor et al. 2011; Spoth et al. 2013), this study used total and average cost estimates as the foundation for estimating the costs of disseminating FSN to 40 students in one district. The analysis clearly showed that the most important drivers of dissemination costs were wage and fringe benefit rates for personnel, particularly personnel costs associated with direct intervention. Student risk and mobility were a distant second in terms of impact on dissemination costs, and the impact was due to their implications for intervention time by coaches. Other sources of variability, such as staff turnover and economies of scale with respect to the number of schools and coaches required to serve 40 students, had far less impact on dissemination costs. These findings suggest that optimizing personnel-heavy interventions like FSN may be possible through high-quality training of lower wage personnel. Although not examined in this study, FSN's structured




*Key assumptions: Dissemination Base Case. 40 students served by 10 coaches in 10 schools; special education teacher provides site-based management. Other inputs (e.g., coach credentials and wages, intervention time, supplies) are as in efficacy trial. Scenario 1. Lower cost: 8 schools/coaches ("economies of scale"). Higher cost: 12 schools/coaches. Scenario 2. Lower cost: 30% coach turnover. Higher cost: 50% coach turnover. Scenario 3: Lower cost: Coaches are paraprofessionals, site-based management by school social worker. Higher cost: School psychologists serve as coaches and site-based managers. Scenario 4: Lower cost: -15% intervention time due to lower risk; also low mobility, meaning no loss to kindergarten follow-up. Higher cost: +15% intervention time due to higher risk; 15% loss of students served to kindergarten follow-up.

**Fig. 1** Dissemination cost sensitivity analysis—variation by major activity (2015 dollars)

training and manualized intervention approach, coupled with ongoing support, may indeed allow lower-cost personnel to deliver the intervention with fidelity and achieve improved outcomes for youth with disruptive behavior disorders.




*Key assumptions: Dissemination Base Case. 40 students served by 10 coaches in 10 schools; special education teacher provides site-based management. Other inputs (e.g., coach credentials and wages, intervention time, supplies) are as in efficacy trial. Scenario 1. Lower cost: 8 schools/coaches ("economies of scale"). Higher cost: 12 schools/coaches. Scenario 2. Lower cost: 30% coach turnover. Higher cost: 50% coach turnover. Scenario 3: Lower cost: Coaches are paraprofessionals, site-based management by school social worker. Higher cost: School psychologists serve as coaches and site-based managers. Scenario 4: Lower cost: -15% intervention time due to lower risk; also low mobility, meaning no loss to kindergarten follow-up. Higher cost: +15% intervention time due to higher risk; 15% loss of students served to kindergarten follow-up.

**Fig. 2** Dissemination cost sensitivity analysis: average cost per student in relation to key cost drivers (constant 2015 dollars). Key assumptions: dissemination base case. Forty students served by 10 coaches in 10 schools; special education teacher provides site-based management. Other inputs (e.g., coach credentials and wages, intervention time, supplies) are as in efficacy trial. Scenario 1: lower cost: 8 schools/coaches ("economies of scale"). Higher cost: 12 schools/coaches. Scenario 2: lower cost: 30% coach turnover. Higher cost: 50% coach turnover. Scenario 3: lower cost: coaches are paraprofessionals, site-based management by school social worker. Higher cost: school psychologists serve as coaches and site-based managers. Scenario 4: lower cost: − 15% intervention time due to lower risk; also low mobility, meaning no loss to kindergarten follow-up. Higher cost: + 15% intervention time due to higher risk; 15% loss of students served to kindergarten follow-up

Examining whether cost efficiencies can be gained without sacrificing intervention impact would provide valuable information for FSN dissemination.

Finally, this study's emphasis on providing resource use alongside intervention cost estimates enhances their utility for stakeholders operating in diverse locales with differing wage rates and supplies costs (Levin and McEwan 2001; National Academies of Sciences, Engineering, and Medicine 2016). They can turn to resource information provided in Tables 2 and 3, substitute local unit costs, and estimate a more geographically or locally relevant FSN cost estimate.

## Limitations

Though there is much value in the FSN cost estimates provided in this study, there are also some limitations. The analysis was limited to one site in a multi-site study and the number of students ($N = 29$) was relatively small with a limited range of demographic characteristics. Replicating costs in subsequent FSN implementation studies could enhance the generalizability of all of our cost estimates, ideally allowing for point and interval estimation.

We were not able to estimate teacher and FSN manager time prospectively. Although we tried to support teachers in completing prospective time logs, their resistance amidst the heavy demands of teaching resulted in retrospective estimates. Fortunately, teacher time and FSN manager time, which was also estimated retrospectively, appear to be relatively small shares of the total personnel time, limiting the effect of imprecise measurement on cost estimates. Coach time was measured prospectively through time logs completed throughout the intervention, an important aspect of our method as coaches represented 70% of all personnel hours.

Though parents did not incur direct costs in carrying out the home component of FSN, they did give their time to the intervention and it is possible that some took time off from work to attend meetings with teachers and coaches. Although the parent role is not meant to be labor intensive, with developers estimating 10–15 min per day, we did not collect time, cost, or lost wage data from parents involved in this study, an area for future study that would provide an even more complete picture of resources used in FSN implementation.

Additionally, sensitivity analyses did not take into consideration all possible variables and did not estimate costs without overhead. Intended to be illustrative rather than exhaustive, their focus on common issues or school district features likely to be faced in scale implementation (e.g., wages, turnover, student risk) gives them relevance.

## Implications and Conclusions

This type of research has important implications for both policy makers and educational leaders. Indeed, cost is a key implementation outcome and one of the standards for evidence related to research on prevention interventions (Flay et al. 2005; Gottfredson et al. 2015). One possible explanation for poor implementation efforts in school settings is that administrators adopt programs without providing adequate resources to implement them, in part because of a lack of comprehensive cost information. Our sensitivity analysis provides valuable information to administrators and policy makers regarding program adoption decisions. Specifically, it enables detailed program planning about job descriptions, qualifications, and needed supports for high-quality implementation in authentic school settings. It also shows that investments in training and support infrastructure, activities that support high-quality implementation and can enable robust intervention impact, are a relatively small portion of the total cost. We would argue they should not be omitted. Further, it allows decision-makers to weigh the advantages and disadvantages of implementing the FSN intervention in preschool only—estimated at $3098 per child—or preschool plus the kindergarten follow-up year which added roughly $1155 to the per student total cost in our dissemination model.

Without the needed investment, intervention outcomes may not always be as robust as in controlled research trials. For behaviorally at-risk youth and their families, research demonstrating that reductions in disruptive behavior disorders improve long-term outcomes *and* are cost-effective is needed to help stimulate investment at scale for effective interventions. Further research on FSN could add to this by examining the relationship between intervention costs and improvement in children's behavior.

**Availability of Data and Material** In addition to the tables presented in this manuscript, we have several tables that contain the raw data used to create the cost analysis. These are available upon request.

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## Compliance with Ethical Standards

**Conflict of Interest** Ed Feil and Hill Walker are two of the authors of the First Step Next intervention. The other authors declare that they have no competing interests.

**Research Involving Human Participants: Statement of Human Rights** The study has been approved by the appropriate institutional and/or national research ethics committee (i.e., Oregon Research Institute and University of Louisville, and Jefferson County Public Schools) and has been performed in accordance with the ethical standards

as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

**Research Involving Human Participants: Informed Consent** Informed consent was obtained from all individual participants included in the study.

**Consent for Publication** This manuscript contains no individual data requiring consent for publication.

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