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Supporting Strategic Investment in Social Programs: a Cost Analysis of the Family Check-Up

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Abstract
High-quality evidence about the costs of effective interventions for children can provide a foundation for fiscally responsible policy capable of achieving impact. This study estimated the costs to society of the Family Check-up, an evidence-based brief home-visiting intervention for high-risk families implemented in the Early Steps multisite efficacy trial. Intervention arm families in three sites were offered 4 consecutive years of intervention, when target children were ages 2 through 5. Data for estimating total, average, and marginal costs and family burden (means and standard deviations, 2015 USD, discounted at 3% per year) came from a detailed database that prospectively documented resource use at the family level and a supplemental interview with trial leaders. Secondary analyses evaluated differences in costs among higher and lower risk families using repeated measures analysis of variance. Results indicated annual average costs of $1066 per family (*SD* = $400), with time spent by families valued at an additional $84 (*SD* = $99) on average. Costs declined significantly from ages 2 through 5. Once training and oversight patterns were established, additional families could be served at half the cost, $501 (*SD* = $404). On the margin, higher risk families cost more, $583 (*SD* = $444) compared to $463 (*SD* = $380) for lower risk families, but prior analyses showed they also benefited more. Sensitivity analyses indicated potential for wage-related cost savings in real-world implementation compared to the university-based trial. This study illustrates the dynamics of Family Check-up resource use over time and across families differing in risk.

Keywords Family check-up · Economic evaluation · Home visiting · Evidence-based · Prevention · Problem behavior

In recent years, federal and state policy efforts have increasingly favored investing resources in evidence-based behavioral health programs and policies over other strategies (Jennings and Hall 2011; White and VanLandingham 2015). Prominent examples include the Maternal, Infant, and Early Childhood Home Visiting Program (MIECHV) and the Teen Pregnancy Prevention Initiative (Haskins and Margolis 2015), as well as the efforts of the United States Preventive Services Task Force (2017). The Washington State Institute for Public Policy and the Pew-MacArthur Results First Initiative have also helped broaden the focus of evidence-based policymaking to include economic evidence about costs and the return on investment from alternative policy options (Lee et al. 2012; Pew Center on the States 2012).

Yet, the success of evidence-based policy initiatives targeting preventive interventions for children and families is jeopardized when stakeholders lack adequate information about how best to fund these programs. To achieve improved outcomes and the economic benefits promised by research studies, public investments need to go beyond direct program delivery costs to include the capacity building, ongoing oversight, and booster training that ensure frontline and management personnel have the tools, skills, and support they need to carry out programs successfully over time. When these activities are not captured in cost estimates and resource allocation decisions, programs and policies are less likely to achieve their objectives (National Academies of Sciences, Engineering, and Medicine 2016).

Comprehensive cost analyses of evidence-based programs can provide a foundation for adequate investment when

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programs are being considered for broad dissemination or smaller replication projects (Foster et al. 2007) and serve as a benchmark against which program impacts and return on investment can be evaluated. To support program investment capable of driving impact, this article presents a comprehensive cost analysis of an evidence-based, brief, tailored home visiting program known as the Family Check-up (FCU), which was delivered in the Early Steps multisite trial to high-risk families in three diverse locales for 4 consecutive years, beginning when target children were age 2.

The Family Check-Up and the Early Steps Multisite Trial

The FCU (Dishion et al. 2008, 2014; Shaw et al. 2006, 2009) is a three-session health promotion and maintenance intervention for families with children at higher risk for behavioral concerns. It is typically offered to families annually for a number of years, followed by brief tailored intervention where indicated. The FCU was designed to strengthen parenting behaviors and parent-child relationships to build child competence and prevent conduct problems, emotional problems, and related sequelae like early substance use and misuse, school failure, depression, and risky sexual behavior (Dishion and Stormshak 2007; Gill et al. 2014). Its efficacy has been established in three longitudinal trials, and it has been eligible for MIECHV funding since MIECHV's inception.

The intervention begins with a comprehensive ecological assessment of the family context, child functioning, and parenting behaviors (Brennan et al. 2013) conducted in the family home. A second meeting (i.e., initial interview or Getting-to-Know-You [GTKY] session) is used to understand concerns deemed critical to the child's functioning. The third home visit is a tailored feedback session often leading to a recommendation to participate in brief interventions from the Everyday Parenting Curriculum (Dishion et al. 2011) or to seek services that support the child's overall wellbeing. In current clinical and community practice, the GTKY session precedes the ecological assessment to enhance rapport and prepare parents for the assessment and feedback process, and, for some families, subsequent brief intervention.

The Early Steps Multisite Trial

The FCU Early Steps multisite trial (FCU-ESM) study is a randomized controlled trial testing the efficacy of the FCU in families recruited from the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) in three geographically and culturally diverse locales (Charlottesville, VA, Pittsburgh, PA, and Eugene, OR); follow-up through early adulthood is still pending. Families receiving WIC assistance were invited to participate in the FCU-ESM if they met two criteria: (a) they had a child between the ages of 2 and 3 years and (b) they scored at least 1 *SD* above the normative mean in two of three risk domains: familial (i.e., maternal depression, daily parenting challenges, substance use problems, teen parent status), child (i.e., conduct problems and high-conflict relationships with adults), and/or sociodemographic (i.e., low educational achievement and income in comparison to WIC criterion). Families randomized to the intervention condition were offered the FCU annually from ages 2 to 5, with 85% retention through age 5 (Brennan et al. 2013).

Intent-to-treat (ITT) analyses with the FCU-ESM sample demonstrated that the FCU reduced internalizing and externalizing behavior problems (Dishion et al. 2008; Shaw et al. 2006, 2009) and increased inhibitory control (Lunkenheimer et al. 2008) through age 4. It also reduced teacher and parent reports of oppositional defiant behaviors (Dishion et al. 2014) and increased children's academic achievement (Brennan et al. 2013) at age 5. In parents, the FCU reduced maternal depression (Shaw et al. 2009), reduced neglect (Dishion et al. 2015), and increased caregiver social support (McEachern et al. 2013).

Several studies showed the FCU had stronger effects on ESM families at higher risk, including those with high levels of maternal depression and low levels of child inhibition (Shaw et al. 2006), children with higher rates of problem behavior at age 2 (Dishion et al. 2008), families with the highest level of family adversity (Dishion et al. 2015), and families living in the most impoverished neighborhoods (Shaw et al. 2016). To further understand differential effectiveness, Pelham and colleagues (Pelham et al. 2017) used two-step mixture modeling to determine whether specific constellations of family characteristics at baseline were predictive of stronger FCU impact. This analysis yielded five distinct classes that varied with respect to income, child behavior problems, number of children, parental education, parental mental health concerns, parental neglect, legal problems, and other characteristics. FCU effects on the change in children's problem behavior from age 2 to 5 varied greatly across classes, ranging from $d = -.01$ to $d = -.82$. As in prior studies (Dishion et al. 2008, 2014, 2015; Shaw et al. 2006), stronger effects were observed in the higher risk classes. Whether it costs more to serve families who benefited more from the FCU is not known.

The Present Study

Guided by best practices for conducting cost analyses (Crowley et al. 2018; National Academies of Sciences 2016), this study estimated the comprehensive costs of the FCU as implemented in the FCU-ESM. *Primary analyses* addressed three topics: (a) total and average costs per family of delivering the FCU to 367 families for 4 years, when target

children were ages 2 through 5, including major cost drivers. This information could inform project budgeting and show how resources were distributed, on average, to participants. Disaggregating investments by major resource (e.g., labor, supplies) and activities (e.g., training, intervention) could also help motive adequate investment. (b) The marginal cost of delivering the FCU to an additional family. This information could show the cost of expanding service delivery to an additional family once infrastructure (fixed investments in, e.g., training and support) was in place. (c) Family burden in terms of time and cost to families. As interventions are unlikely to appeal if they are too time consuming or costly, burden estimates could inform uptake.

Secondary analyses evaluated whether the costs of serving higher and lower risk families were significantly different. Based on the stronger impacts and responsiveness reported for higher risk families (Pelham et al. 2017), we hypothesized that resource investments and costs would be greater for these families than for lower risk, less responsive families.

Finally, because intervention cost estimates tend to be sensitive to wage rates (Frey et al. 2019), we conducted *sensitivity analyses* that estimated average and marginal costs for the FCU as implemented by lower and higher wage personnel. These analyses involved social workers and social work managers in key personnel positions—consistent with current real-world implementation of the FCU—and also removed costs specific to the efficacy trial (e.g., travel to San Diego, CA, for training) so that sensitivity estimates would be more reflective of variability in real-world implementation costs.

Method

Participants in the FCU-ESM

The FCU-ESM sample included 731 families recruited from WIC program rolls who were screened for the trial between January 2003 and March 2005 in Charlottesville, VA, Eugene, OR, and Pittsburgh, PA. Of 1666 families screened, 879 (52.7%) met eligibility criteria, and 731 (83% of those eligible) were consented to participate. There were 188 families in Charlottesville, 271 in Eugene, and 272 in Pittsburgh. All families had target children between the ages of 2 and 2.9 years when intervention began and, as previously described, were at increased risk in familial, child, and/or sociodemographic domains (at least two of three to be eligible). Families were randomly assigned to the intervention arm ($N = 367$) or a "business as usual" control condition ($N = 364$) before the trial started. Figure 1 shows the flow of participants through age 5 and includes retention rates at each age.

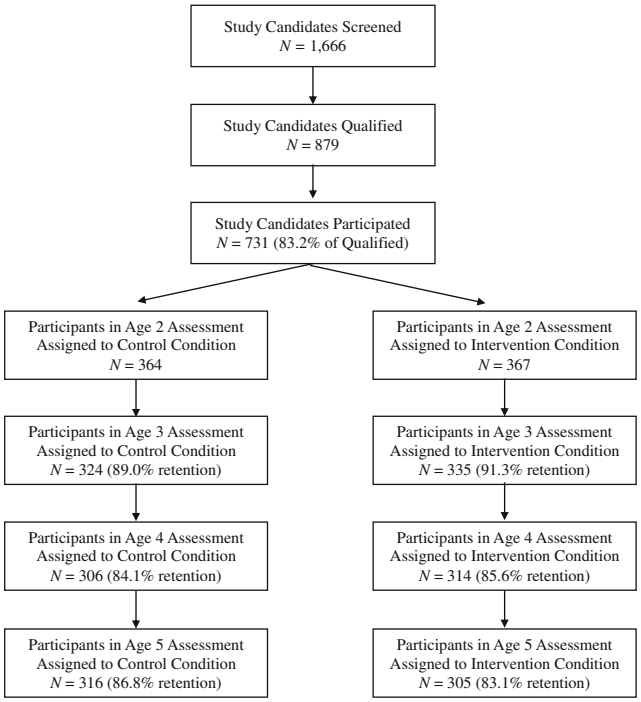


Fig. 1 Flow of participants in the Family Check-Up Early Steps multisite trial

Table 1 reports sociodemographic characteristics for intervention arm families, including families who were "more responsive" compared to "less responsive" to the FCU based on prior analyses (Pelham et al. 2017). Families were classified as more or less responsive using the following procedure. Because the Early Steps intervention targeted early behavior problems that lie on the pathway to initiation and escalation of substance use and other behavior problems in adolescence, a primary child outcome was aggressive/oppositional behavior, as rated by the primary caregiver when the child was 2, 3, 4, and 5 years old (Achenbach and Rescorla 2001). Multiple-group latent growth modeling was used to examine the effect of the FCU on early trajectories of aggressive/oppositional behavior within each of five classes of families identified in a latent class analysis. The more responsive subgroup ($n = 116$) consisted of families who meaningfully benefited from the FCU: those belonging to class 2 (low income, lower education, very high maternal depression, high single parenthood; $n = 51$, $d = -.30$), class 4 (high child behavior problems, very high number of children, high parental neglect, high maternal depression; $n = 14$, $d = -.82$), and class 5 (high legal problems, very high neglect, extremely high parental mental health treatment; $n = 51$, $d = -.63$). The less responsive subgroup ($n = 251$) consisted of families who did not meaningfully benefit from randomization to the FCU: those assigned to class 1 (relatively high income, low risk; $n = 97$, $d = -.01$) and class 3 (low income, high single parenthood, otherwise

Table 1 Sociodemographic characteristics for the sample and by responsiveness to the Family Check-Up as delivered in the Early Steps multisite trial

	All families ($N = 367$)	Responsiveness to the Family Check-Up[a]	
		More responsive ($N = 116$)	Less responsive ($N = 251$)
Participants	367	116	251
Target child age at recruitment (months)	30.0	30.1	29.9
(*SD*)	(3.2)	(3.2)	(3.1)
Race			
African American	27.9%	21.1%	31.0%
European American	50.1%	55.1%	47.8%
Biracial	13.0%	16.7%	11.3%
Other	9.0%	7.0%	9.9%
Ethnicity			
Hispanic	13.4%	11.9%	14.1%
Non-Hispanic	86.6%	88.1%	85.9%
Gender			
Female	50.5%	55.1%	48.4%
Male	49.5%	44.9%	51.6%
Family income < $20,000 in 2002	69.2%	81.9%**	63.5%
Family members per household (#)	4.4	4.7	4.3
(*SD*)	(1.6)	(1.9)	(1.4)
Education			
HS diploma or less	56.0%	53.3%	57.1%
Some post-high school education	39.7%	41.9%	38.7%
BA degree or higher	4.4%	4.8%	4.2%
Cumulative risk score[b]	2.04	2.49**	1.83
(*SD*)	(1.26)	(1.07)	(1.28)

[a] More compared to less responsive families: ** $p < .001$

[b] Mean count of seven binary indicators of sociodemographic risk: (1) teen parent status, (2) primary caregiver education level, (3) single adult in the home, (4) household overcrowding, (5) household member legal conviction, (6) primary caregiver drug or alcohol problem, and (7) neighborhood dangerousness

low risk; $n = 154$, $d = -.08$). As Table 1 shows, the more responsive group had significantly greater baseline risk than the less responsive group ($t = 4.80$, $p < .001$).

Intervention Delivery

Table 2 describes the key ingredients or resources used in the FCU-ESM (labor, supplies, travel, and overhead). It also details major intervention activities (preintervention training and capacity building, intervention delivery, and ongoing support and technical assistance). After the initial multisite training was completed, 367 intervention arm families (95 in Charlottesville, 136 in Eugene, and 136 in Pittsburgh) were each offered the FCU for 4 consecutive years. Because families were recruited over a 26-month period, there was some overlap in intervention delivery across age, meaning, for example, some families started age 3 intervention while others were completing age 2. Age 2 intervention and follow-up occurred from Oct. 2003 to Jan. 2006; age 3 from Apr. 2004 to Dec. 2006; age 4 from Jun. 2005 to Jun. 2007; and age 5 from Oct. 2006 to Feb. 2009. To support high-quality implementation, interventionists received ongoing technical support and consultation and annual booster training throughout the trial.

Cost Analysis Measures

This study uses the Ingredients Method (Crowley et al. 2018; Levin and McEwan 2001; National Academies of Sciences, Engineering, and Medicine 2016) and data collected prospectively to estimate the cost of offering the FCU to families for 4 consecutive years, when focal children were ages 2 through 5, from a societal perspective. This method required information about the *major resources* used to carry out the FCU and *unit costs* associated with each. Consistent with the study's societal perspective, all resources were included and valued, even those like overhead and parent time not paid for directly.

Table 2 Key ingredients and major activities in the Family Check-Up Early Steps multisite trial

Major ingredients or resources used in the FCU ESM[a]	Major activities in the FCU ESM trial[a]
Labor	Pre-intervention training and capacity building
Principal investigators (PIs) at each site oversaw the intervention. They participated in initial and onsite training, management meetings, and annual booster training sessions. One of the PIs certified interventionists in the FCU beginning at age 3.	*Initial multisite training:* PIs, site coordinators, lead clinicians, and interventionists hired at the start of the project attended a 4-day multisite meeting in San Diego, CA, where they were trained in the Family Check-Up and intervention protocols to be used in the trial.
Parent consultants ("interventionists") delivered the intervention to treatment families. They also participated in training activities and supervision meetings and received FCU certification training. Site-based leads participated in administrative meetings at the start of each field period and served as liaisons between parent consultants and managers at each site.	*On-site training:* An additional 2-day training was held at each site to further train key personnel to deliver the FCU with fidelity.
Two examiners conducted a home-based assessment at each age.	*Interventionist certification*: Parent consultants sent videotaped home visit sessions to the clinical director for feedback about strengths and any adjustments needed to ensure high-quality FCU delivery. Parent consul tants were certified when the clinical director indicated 6 videotaped ses sions met quality standards. Certification was estimated at 7 h for the clinical director and 4 h per interventionist.
Site coordinators managed the intervention and ensured fidelity.	Intervention delivery
Supplies[b]	*Annual assessment:* Two examiners (BA-level/undergraduate research assistants) conducted a 1.25-h home-based assessment at each age.
(a) Each intervention family received a family manual. (b) Interventionists received an FCU binder, computer, portable DVD player, camcorder, tripod, and memory cards so that some family interactions could be videotaped and used to guide intervention.	*Family Check-Up and follow-up intervention:* Interventionists implemented the FCU with families at each age. This involved family contact, collateral contact, case preparation, driving to family homes, scheduling, and maintenance tasks (e.g., scoring assessments).
Travel	Ongoing support and technical assistance
(a) Interventionists and examiners drove to family homes for assessment and intervention contacts. (b) PIs, interventionists, and site coordinators traveled to San Diego, CA, for annual training and booster training.	*Intervention management:* (a) The PIs, site coordinators, and lead interventionists met approximately weekly for 1 h during each field pe riod to discuss intervention progress and address any issues. (b) Site coordinators and lead interventionists also met biweekly for 1 h for months at the start of each field period to further coordinate.
Overhead	*Technical assistance to interventionists:* (a) Lead interventionists and interventionists at each site met for a 1-h weekly supervision meeting throughout each field period. (b) All interventionists attended an annual 2-day multisite booster training meeting in San Diego, CA.
Overhead captured additional resources used in the intervention but not paid for directly, including office space for staff, meeting rooms, office supplies, telephone and video-conferencing capability, and the like. It was estimated at 20% of personnel costs.	

[a] FCU-ESM = Family Check-Up Early Steps multisite trial

[b] Technology has advanced significantly since the start of the trial in 2002. The interventionist supplies identified above reflect those used currently in the intervention because this information has the greatest utility

Resource Use

Data for quantifying resource use by target child age came primarily from the *Parent Consultant Logs (PACL) Database*. Parent consultants recorded all intervention activity conducted with individual families from ages 2 through 5 (2003–2009) in the PACL. Each record summarized a single activity and included the following: (a) a de-identified family code with project site embedded; (b) date of activity, time involved (with a separate field for driving time), mode of activity (e.g., phone, in-person, email), and location; (c) type of activity (e.g., assessment, family contact, collateral contact, case preparation, scheduling, no show); (d) purpose of any direct contact (e.g., GTKY visit, feedback visit, to make referrals); (e) who participated; (f) behavioral issues discussed (e.g., child problem behaviors, general development) and parent-identified needs (e.g., managing an energetic child, self-advocacy); and (g) parent consultant's assessment of underlying concerns (e.g., coercive patterns, co-parenting). These data were used to estimate *time spent by parent consultants delivering the intervention* to each family at each age, in total and across key intervention activities: assessment, contact with families, collateral contact, case preparation, scheduling, driving time, and time lost to failed appointments. A supplemental *Resource Use Questionnaire* developed by the first and second authors provided information about the remaining key ingredients and major intervention activities described in Table 2: training, ongoing support and technical assistance, supplies, and training-related travel. The questionnaire was administered verbally to senior staff involved with the trial since its inception.

Unit Cost

Publicly available, national-level unit costs were used because site-level information was incomplete. This approach ensured a consistent costing strategy across sites and over time. It also meant that variability in costs across families would reflect differences in resource use rather than a mixture of resource use and unit cost differences. The intervention was conducted from 2003 to 2009, but unit costs, which are shown in Table 3, were in constant 2015 USD to increase their relevance to

present-day program planning (Crowley et al. 2018; National Academies of Sciences, Engineering, and Medicine 2016). Any unit costs that were not in 2015 USD (e.g., supplies, which were in 2016 USD) were converted to 2015 USD by multiplying the nominal unit cost by a ratio of the Consumer Price Index for 2015 to the Consumer Price Index for the nominal year (Bureau of Labor Statistics 2016). Because intervention was offered for 4 years, constant dollar costs were discounted to intervention start at a rate of 3% per year (Crowley et al. 2018; National Academies of Sciences, Engineering, and Medicine 2016).

Family Burden and Opportunity Cost

In this home-based intervention, the burden experienced by families was measured in time spent on the FCU (i.e., assessments, intervention contacts, scheduling among the primary parent, other parent or alternative caregiver, and collateral contacts) as recorded in the PACL. To value this time, each participant was assigned a wage rate from the March Supplement to the Current Population Survey that corresponded to their highest level of education attainment (less than high school, high school, some college, 2-year college, 4-year college). The average wage for individuals age 20–30 was used. Fringe benefits were valued at 33.8% of total compensation, the same rate used for FCU ESM staff.

Analysis Plan

Analyses examined total, average, and incremental costs (2015 USD); cost drivers; and family time burden and cost in the full sample and in more and less responsive subgroups. The cost analysis followed an intent-to-treat approach, with costs per participant based on the entire set of families randomized to the intervention condition rather than only those who actually received intervention. The *total cost* of delivering the FCU from ages 2 to 5 was the sum of the cost of key ingredients across all years: total cost $= \sum_{a=2}^{5}\sum_{i=1}^{n} \mathrm{Qi} \times \mathrm{Pi}$, where Q is the amount of ingredient i, P is the unit cost of ingredient i, there are n key ingredients, and the intervention is carried out from ages 2 to 5. To estimate the *average cost per family*, the total cost was divided by the number of intervention arm families. To understand *major drivers of FCU costs*, costs were disaggregated by *age, major intervention activity* (e.g., preintervention training and capacity building, intervention delivery), and *key resources* (e.g., labor, materials, and supplies). This involved summing costs by subcategory and describing which bore the largest share of cost.

The *marginal cost* of delivering the intervention to one additional family was estimated by summing the costs of resources which varied (assessment, contact, collateral contact, case preparation, scheduling, failed contact, driving time, mileage, family intervention manuals and supplies, related overhead) and ignoring those that would remain fixed (training, ongoing support, equipment, training-related travel) when an additional family was served.

The *average family burden of the FCU* was estimated by summing time that directly involved families, including collateral contacts. The *opportunity cost of family time* was estimated by multiplying each parent's or collateral participant's time by their wage rate.

Variability in FCU costs in relation to intervention responsiveness was examined by estimating incremental costs and burden separately for more and less responsive subgroups. Incremental costs were the focus because these were the costs that varied across families.

Statistical Testing

Repeated measures analysis of variance (RM-ANOVA) with one within-subject factor (cost or burden) and four levels (ages 2–5) was used to test whether average costs, incremental costs, and burden per family differed significantly with child age. Mauchly's test of sphericity was examined and degrees of freedom were adjusted where indicated. RM-ANOVA with one within-subject factor (incremental cost or burden), four levels (age), and one between-subject factor (responsiveness) was also used to evaluate whether the costs for more responsive families were greater than costs for less responsive families. When differences were significant, pairwise comparisons (e.g., age 2 compared to age 3, more responsive versus less responsive incremental costs) were conducted to better understand the source of the difference.

Sensitivity Analyses

We used Bureau of Labor Statistics (BLS) data to vary the wages of parent consultants, coordinators, and senior managers, consistent with current practice in which MSWs serve as parent consultants and coordinators; analyses also included MSW managers as senior staff (BLS 2015; NAICS 621420, Occupation Codes 11-9150 for MSWs, 21-1020 for MSW managers). The base case applied the median hourly wage, a low-cost scenario used the 25th percentile hourly wage, and a high-cost scenario used the 75th percentile hourly wage. Overhead rates were 10% of labor costs in the base case, 5% in the low-cost scenario, and 20% in the high-cost scenario. Resource inputs were from the efficacy trial, except for travel to San Diego, CA, which would not occur in real-world implementation, and assessment travel and time, as current

Table 3 Unit costs of resources used in the Family Check-Up Early Steps multisite trial (2015 USD)

Resource	Unit cost	Source[a]
Personnel–hourly wages		Bureau of Labor Statistics (BLS 2015: Sector, Job, and NAICS Codes)
Principal investigators	$63.40	College, University, Professional Schools; Post-secondary Psychology Teachers-90th percentile wage (61, 00–0000, 611300)
Coordinator, parent consultant (PC)	$29.96	Life, Physical, and Social Services Occupations; R&D in the Social Sciences and Humanities - median wage (54, 19–0000, 541720)
Undergraduate research assistants / examiners	$11.84	Social Science Research Assistants - 10th percentile wage (54, 19–4061, n/a)
Fringe benefits as a % of total compensation	31.3%	BLS, 2017: Percentage of total compensation
Supplies per PC, except where noted		Bestbuy.com[b] except REACH Institute for manuals
Laptop computer	$542.99	
Video camera	$229.99	
Tripod	$49.44	
Portable DVD player	$89.99	
Memory card per family	$18.99	
DVD per family	$5.33	
Parent consultant manual	$104.25	
Family FCU manual	$21.00	
Travel per trainee, except where noted		
Mileage per family	$122.69	Internal Revenue Service, 2015
San Diego training		
Airfare	$377.00	Bureau of Transportation Statistics, 2017
Per diem lodging	$142.00	General Services Administration, 2015
Per diem meals, expenses	$71.00	General Services Administration, 2015
Taxi[b]	$75.00	Taxi Fare Finder, 2016
Participants–implicit hourly wage[b]		Current Population Survey, March supplement, average for ages 21–30
Less than high school	$6.09	
High school	$9.97	
Some college	$10.82	
Associate's degree	$12.79	
BA degree	$16.97	

[a] Sources. Wages: Bureau of Labor Statistics. (2015). Occupational Employment Statistics. *OES research estimates by state and industry, May 2015.* Finge benefits: Bureau of Labor Statistics. (2017). Employer costs for employee compensation: Historical listing. *National compensation survey: March 2004–May 2017.* Mileage: Internal Revenue Service. (2015). Standard mileage rates. Airfare: Bureau of Transportation Statistics. (2017). Annual U.S. domestic average itinerary fare in current and constant dollars. Per diem logding, meals, expenses: General Services Administration. (2015). FY 2015 per diem rates for San Diego, CA. Taxi fare: Taxi Fare Finder. (2016). U.S. taxi cab rate ranking chart-sample fares. Participant wages: https://www.census.gov/data/tables/time-series/demo/income-poverty/cps-pinc.html

[b] Unit costs for Best Buy supplies and taxi fares are in 2016 USD; participant wages are in 2014 USD. These costs were converted to 2015 USD prior to analysis using the Consumer Price Index (Bureau of Labor Statistics 2016)

practice now includes one streamlined GTKY visit that includes the assessment.

Results

Total Costs, Average Costs, and Cost Drivers

The total cost of delivering the FCU to all 367 families from ages 2 to 5 was $1,565,220, an average of $391,305 (SD = $105,809) per year. On average, the FCU cost $4265 (SD = $1602) per family from ages 2 through 5, as described in Table 4, or $1066 (SD = $400) per year. Figure 2 shows that average investments varied significantly at each age, declining from a high at age 2 through age 4. Costs increased significantly at age 5, when extra effort was made to reach as many families as possible, but were still significantly below age 2. Table 3 shows that the major cost driver by activity was intervention delivery (range from ages 2 to 5: 49% to 59%), though training (range: 0% to 15%) and ongoing support (range: 14% to 29%) costs were not insignificant. Like many preventive interventions, labor (range: 69% to 78%) drove resource costs, with parent consultants representing the majority (74% of labor, 55% of total FCU cost).

Table 4 Average cost per family of delivering the Family Check-Up from ages 2 through 5 in the Early Steps multisite trial (2015 USD)

	Average cost per family[a] mean (SD)	Share of total cost
By activity		
Training	$345.02 ($56.12)	8.1%
Intervention	$2343.41 ($1348.69)	54.9%
Oversight	$948.16 ($69.90)	22.2%
Overhead	$628.31 ($265.90)	14.7%
FCU total	$4264.90 ($1601.84)	
By resource		
Labor	$3141.54 ($1329.52)	73.7%
Examiners	$142.92 ($48.08)	3.4%
Parent consultants	$2338.99 ($1324.49)	54.8%
Managers	$659.64 ($103.99)	15.5%
Supplies	$257.83 ($28.17)	6.0%
Travel	$237.22 ($47.61)	5.6%
Overhead	$628.31 ($265.90)	14.7%
FCU total	$4264.90 ($1601.84)	

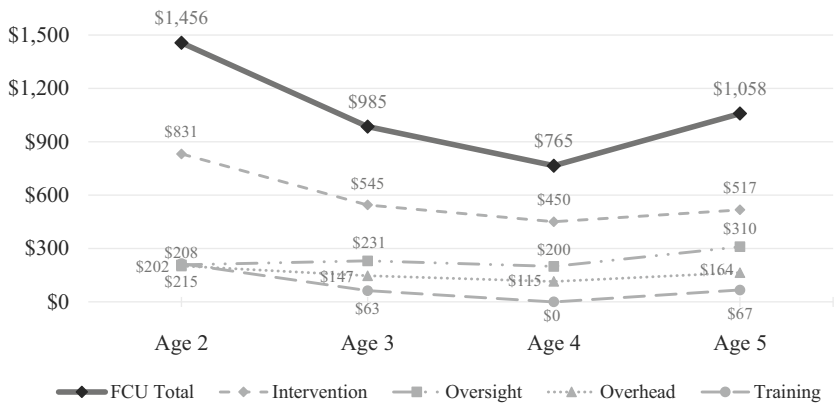
[a] $N = 367$ families

Marginal Costs

Marginal costs are reported in Table 5. Across the entire sample, the marginal cost of serving an additional family totaled $2005 ($SD = $1617) for 4 years of intervention, or $501 ($SD = $404) per family per year, approximately half the average cost. Direct family contact (25% of marginal cost) was the major driver, but incremental case preparation time (22%) cost nearly as much. Incremental driving costs (16%) also represented a large share. Like average costs, marginal costs varied significantly by age (F (3, 363) = 41.21, $p < .001$), declining from age 2 ($645, $SD = $457) to age 5 ($380, $SD = $606, F (1, 365) = 57.10, $p < .001$). Table 4 shows that staff averaged 46 ($SD = 35$) contacts and 41 ($SD = 32$) hours per family in total, or 11 ($SD = 2$) contacts and 10 ($SD = 2$) hours at each age, largely in direct intervention contacts, preparation, and driving. As hypothesized and shown in Table 5 and Fig. 3, more responsive families cost more, in total (F (1, 365) = 7.14, $p = .008$) and at each age except for age 4 (age-specific details available upon request). Marginal intervention (F (1, 365) = 8.10, $p = .005$) and overhead (F (1, 365) = 7.08, $p = .008$) costs drove these differences.

Family Burden

From ages 2 to 5, families averaged 23 h ($SD = 26$) or 6 h ($SD = 6$) at each age, most in direct intervention contact. Burden was greater for more responsive families, who spent 28 h ($SD = 31$), compared to 21 h ($SD = 23$) for less responsive families (F (1, 365) = 5.81, $p = .016$). Time spent by families from ages 2 through 5 was valued at $335 ($SD = $398) on average and $405 ($SD = $485) for more responsive families, significantly greater than that for less responsive families, $303 ($SD = $347, F (1,365) = 5.28, $p = .022$).



*$N = 367$ families. Repeated measures analysis of variance, with follow-up pairwise comparisons, was used to evaluate differences in costs over time. Average costs varied significantly with age (F (3, 363) = 212.93, $p < .001$), declining from age 2 to 3 (F (1, 365) = 358.02, $p < .001$) and 3 to 4 (F (1, 365) = 100.40, $p < .001$), increasing from 4 to 5 (F (1, 365) = 127.35, $p < .001$), though still significantly below age 2 (F (1, 365) = 130.30, $p < .001$).

Fig. 2 Average Family Check-Up Early Steps multisite trial cost per family, ages 2–5 (2015 USD)

Table 5 Marginal Family Check-Up Early Steps multisite trial contacts, time, and cost per family from ages 2 through 5

	All families ($N = 367$)				More responsive families ($N = 116$)				Less responsive families ($N = 251$)			
	Contacts (#)	Time (h)	Cost[a]	Share of cost	Contacts (#)	Time (h)	Cost[a]	Share of cost	Contacts (#)	Time (h)	Cost[a]	Share of cost
Assessment	3.5	6.9	$98.09	4.9%	3.5	6.9	$98.33	4.2%	3.4	6.9	$97.98	5.3%
	(1.0)	(1.9)	($26.78)		(0.9)	(1.9)	($25.97)		(1.0)	(1.9)	($27.20)	
Intervention												
Direct contact	17.2	11.5	$500.59	25.0%	22.1	14.7	$639.26	27.4%	14.9	10.0	$436.50	23.6%
	(19.2)	(17.1)	($731.79)		(24.3)	(18.9)	($812.42)		(15.9)	(16.0)	($683.61)	
Collateral contact	1.3	0.3	$11.64	0.6%	2.3	0.5	$21.06	0.9%	0.8	0.2	$7.28	0.4%
	(4.8)	(1.0)	($44.24)		(7.9)	(1.6)	($70.96)		(2.0)	(0.5)	($22.10)	
Preparation	8.2	10.2	$444.20	22.2%	9.1	11.4	$498.44	21.4%	7.8	9.6	$419.13	22.6%
	(5.5)	(6.5)	($284.29)		(6.2)	(7.0)	($307.41)		(5.2)	(6.2)	($269.92)	
Scheduling	14.7	1.5	$65.36	3.3%	17.1	1.7	$74.16	3.2%	13.6	1.4	$61.30	3.3%
	(12.2)	(1.3)	($54.02)		(13.7)	(1.3)	($55.88)		(11.3)	(1.2)	($52.75)	
Failed contact	0.9	0.7	$31.34	1.6%	0.8	0.6	$27.22	1.2%	0.9	0.8	$33.24	1.8%
	(1.4)	(1.3)	($58.06)		(1.3)	(1.1)	($46.35)		(1.4)	(1.4)	($62.73)	
Travel												
Drive time		9.6	$324.72	16.2%		11.1	$388.57	16.6%		8.9	$295.21	15.9%
		(10.8)	($434.57)			(11.4)	($455.44)			(10.4)	($422.25)	
Mileage			$121.69	6.1%			$125.38	5.4%			$119.98	6.5%
			($47.33)				($42.82)				($49.25)	
Supplies			$111.99	5.6%			$111.99	4.8%			$111.99	6.0%
			($0.00)				($0.00)				($0.00)	
Overhead			$295.19	14.7%			$349.41	15.0%			$270.13	14.6%
			($267.63)				($294.25)				($251.07)	
FCU total	45.7	40.7	$2004.81		54.9	47.0	$2333.84		41.4	37.7	$1852.74	
	(34.7)	(31.9)	($1616.88)		(44.1)	(35.0)	($1774.43)		(28.5)	(30.0)	($1518.39)	

[a] 2015 USD. Marginal costs included contacts, time, and costs incurred when serving an additional family; fixed costs (e.g., training, ongoing support, equipment) were not included. Values are means with standard deviations in parentheses

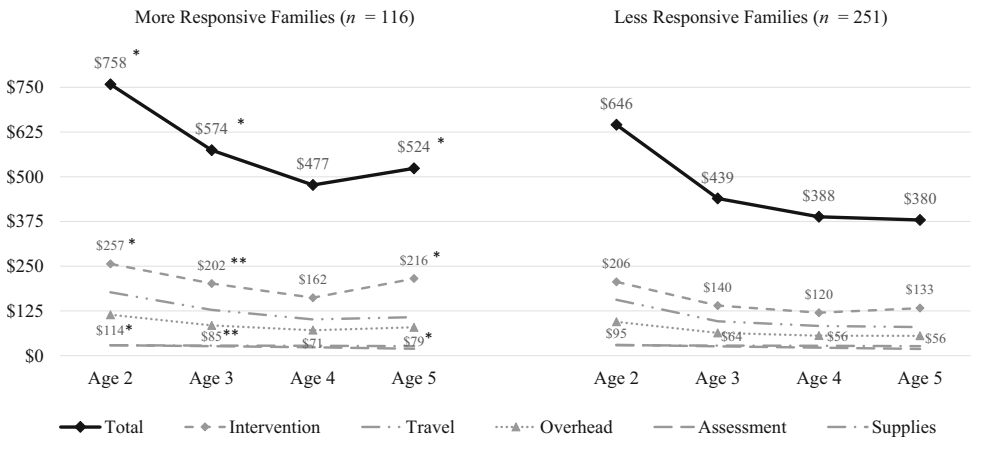


Fig. 3 Marginal FCU cost per family: more compared to less responsive families, ages 2–5 (2015 USD)

* Marginal costs included contacts, time, and costs incurred when serving an additional family; fixed costs (e.g., training, ongoing support, equipment) were not included. One-way analysis of variance was used to evaluate differences in marginal costs between more and less responsive families. * $p < .05$, ** $p < .01$.

Table 6 Sensitivity analysis of Family Check-Up Early Steps multisite trial costs (2015 USD)

	Four years of intervention				Annual average			
	Primary	Sensitivity scenarios			Primary	Sensitivity scenarios		
	analysis	Base	Low	High	analysis	Base	Low	High
Factors that vary in sensitivity analysis								
Hourly wage rates								
Managers	$63.40	$31.11	$25.44	$38.79				
Parent consultants	$29.96	$18.69	$15.41	$23.68				
Overhead (% of labor costs)	20%	10%	5%	20%				
Average cost per family: *M*, (*SD*)								
All families ($N = 367$)	$4264.90	$2340.61	$1920.66	$3082.27	$1066.23	$585.15	$480.17	$770.57
	($1601.84)	($911.33)	($719.24)	($1256.38)	($400.46)	($227.83)	($179.81)	($314.10)
More responsive ($N = 116$)[a]	$4597.91	$2532.64	$2072.93	$3345.66	$1149.48	$633.16	$518.23	$836.42
	($1754.49)	($855.76)	($787.22)	($1377.80)	($438.62)	($213.94)	($196.81)	($344.45)
Less responsive ($N = 251$)	$4111.00	$2251.87	$1850.28	$2960.54	$1027.75	$562.97	$462.57	$740.14
	($1505.08)	($998.40)	($675.67)	($1179.24)	($376.27)	($249.60)	($168.92)	($294.81)
Marginal cost per family: *M*, (*SD*)								
All families ($N = 367$)	$2004.81	$1143.64	$949.84	$1491.40	$501.20	$285.91	$237.46	$372.85
	($1616.88)	($888.88)	($702.36)	($1223.81)	($404.22)	($222.22)	($175.59)	($305.95)
More responsive ($N = 116$)a	$2333.84	$1329.12	$1096.60	$1746.35	$583.46	$332.28	$274.15	$436.59
	($1774.43)	($983.25)	($776.04)	($1355.27)	($443.61)	($245.81)	($194.01)	($338.82)
Less responsive ($N = 251$)	$1852.74	$1057.92	$882.02	$1373.57	$463.19	$264.48	$220.51	$343.39
	($1518.39)	($829.85)	($656.18)	($1141.77)	($379.60)	($207.46)	($164.05)	($285.44)

Note: Wage rates were from the Bureau of Labor Statistics (2015). Manager wages were Social and Community Service Managers (NAICS 62-1420, Occupation Code 11-9150). Parent Consultant Wages were for Social Workers (NAICS 62-1420, Occupation code 21-1020). The base case was the median hourly wage, low was 25th percentile hourly wage, high was 75th percentile hourly wage. Sensitivity analyses also removed costs of travel to San Diego, CA, combined assessment activity into the GTKY visit, and removed assessment driving costs

[a] Marginal costs included contacts, time, and costs incurred when serving an additional family; fixed costs (e.g., training, ongoing support, equipment) were not included. Differences in average and marginal costs among more compared to less responsive families were evaluated using one-way analysis of variance. $p < .01$

Sensitivity Analysis

Sensitivity analyses reported in Table 6 indicate the potential for savings in real-world implementation with MSW and MSW managers rather than university staff. At $585 (*SD* = $227) per year, the average cost per family in the sensitivity base case was approximately half that of the efficacy trial; even the high-cost scenario, $771 (*SD* = $314), yielded a 28% savings. A similar pattern of savings was found for more and less responsive families and marginal costs.

Discussion

Through a comprehensive cost analysis that captured direct delivery and intervention infrastructure costs, this study found that the FCU as delivered in the ESM efficacy trial was provided to families for about $4265 for 4 years or $1066 per year. Estimates fall squarely within the range reported for programs supported by MIECHV funds (Health Resources and Services Administration 2017). This work also illustrates the dynamics of resource utilization by illuminating both average and marginal cost of intervention delivery. Once staff were trained and oversight patterns established, an additional family cost $501 per year, roughly half the average. At roughly 6 h and an implicit cost of $84 per year, the burden on families was not high.

Detailed resource use documentation across key intervention activities on an individual family level has implications for project budgeting. Interventionist preparation time accounted for approximately one fifth of marginal costs, nearly equal to direct service, and underscores the need to include adequate case preparation time in project budgets. Family-level records also illustrated that the types and level of investment were significantly impacted by the risk level of families served. Higher risk families cost more, but investment was rewarded with larger impact. Analyses not detailed suggested cost differences reflected

greater follow-up treatment among higher risk families. By using screening data to understand the level of risk within targeted populations, cost projections could more accurately support desired service rates.

This work provides some of the first empirical evidence of how home visiting costs are related to the developmental age of participants, highlighting that demands on public budgets are not static. While it is not possible to discern whether declining costs are due to age (less perceived need for intervention), length of intervention (efficiency or fatigue), or both, estimates provide evidence of the dynamic nature of prevention program investments.

This paper's cost estimates reflect resource use and related costs of the FCU as delivered in the ESM trial, which showed favorable impact on intervention families and target children through age 5 (Dishion et al. 2008, 2014, 2015; Lunkenheimer et al. 2008; McEachern et al. 2013; Shaw et al. 2006, 2009). Sensitivity analyses highlighted significant cost efficiencies—approximately 25–50% compared to the efficacy trial—that could arise from personnel savings in real-world implementation. The trial involved senior academic researchers in key management and oversight roles. Parent consultants were university-employed masters-level social workers or psychologists, and in one case, doctoral level. Because the FCU is manualized, has a strong training protocol, and offers support to implementing sites and agencies, high-fidelity implementation by less credentialed personnel is quite feasible and far less costly. Combining the GTKY session and assessment into one session has further reduced parent burden and intervention cost, with savings in interventionist contact, travel time, and mileage. This type of thoughtful intervention optimization, in which costs savings accrue while attention to fidelity is maintained, merits further analysis.

Limitations

This study relied on a detailed database for estimating resource use and costs, but it had some limitations. Cost estimates are based on national prices from national sources rather than local prices incurred for key ingredients at each project site. Although there was some loss of specificity, estimates better reflect average costs to be expected across diverse locales. Mileage reimbursement information was not available at two of the three sites, and the resulting mileage cost estimate may be imprecise. However, as mileage costs are a very small portion of total FCU costs, this is not a consequential concern. At any given time, parent consultants also worked with children in a 1- to 3-year age band, allowing technical support to focus on a single developmental period. Real-world implementation would likely involve parent consultants serving a broader age range of children who would enter and exit the intervention continuously.

Conclusions

Ultimately, cost analyses can be deployed to provide insight about the dynamics of investing in effective behavioral interventions and can support the crafting of evidence-based and fiscally responsible policy. With pressures to create more efficient government and effective policies likely to grow, high-quality and comprehensive estimates will be increasingly important.

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Compliance with Ethical Standards

Conflicts of Interest The authors declare that they have no conflicts of interest.

Ethical Approval All research protocols involving human participants were approved by the institutional review board of the University of Pittsburgh and with the 1964 Helsinki declaration and its later amendments.

Informed Consent Informed consent was obtained from all participants included in the study.

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