Maternal and Child Health Journal (2019) 23:470–478
https://doi.org/10.1007/s10995-018-2657-0

Standardized Cost Estimates for Home Visiting: Pilot Study of the Home Visiting Budget Assistance Tool (HV-BAT)

Benjamin Yarnoff[1] · Olga Khavjou[1] · Christina Bradley[1] · Julie Leis[2] · Jill Filene[2] · Amanda Honeycutt[1] · Rachel Herzfeldt-Kamprath[3] · Kyle Peplinski[3]

Published online: 13 December 2018

Abstract

Purpose Using a standardized approach and metrics to estimate home visiting costs across multiple evidence-based models and regions could improve the consistency and accuracy of cost estimates, allow stakeholders to observe trends in cost allocation, analyze how home visiting costs vary, and develop future program budgets. Between October 2015 and December 2018, we developed and pilot-tested the Home Visiting Budget Assistance Tool (HV-BAT) to standardize the collection of home visiting program costs and analyze costs for local implementing agencies (LIAs). *Methods* We recruited LIAs that implemented at least one of nine evidence-based home visiting models in 15 states implementing the Maternal, Infant, and Early Childhood Home Visiting (MIECHV) Program. LIAs reported their costs to implement a home visiting model using the HV-BAT and provided feedback on the tool. We estimated annual total cost and cost per family served for each LIA, examined cost summary statistics for the sample, and analyzed whether and how LIA characteristics affected home visiting costs using regression analyses. *Results* Of the 168 LIAs invited to participate in the HV-BAT pilot study, 75 agreed to participate, and 45 across 14 states completed the HV-BAT. We estimated home visiting costs of approximately $8500 per family per year, but costs varied across LIAs (range $1970–$39,770; standard deviation = $5794). The marginal cost of adding a family declined as the number of families served by an LIA increased. Feedback from LIAs indicated that users had difficulty providing some details on costs (e.g., mileage for specific services), needed more detailed instructions, and desired a summary of subtotals and total costs reported in the HV-BAT. *Conclusions* The HV-BAT provides an approach to standardize cost data collection for home visiting programs. Pilot study results indicate that there may be significant economies of scale for home visiting services. This study provides preliminary estimates of costs that can help in program planning and budgeting.

Keywords Home visiting · Costs · Early childhood · Tools for program planning

Significance

What is already known on this subject?

Assessment of benefits of home visiting programs compared with costs can be improved with standardized cost data collection. Previous studies analyzing home visiting costs were mostly restricted to one home visiting model and narrow geographic regions.

What this study adds?

We developed and pilot tested the Home Visiting Budget Assistance Tool to standardize collection of home visiting program cost data and to analyze home visiting program costs for local implementing agencies (LIAs) that implemented evidence-based models using MIECHV funding.

Disclaimer The views expressed in this publication are solely the opinions of the authors and do not necessarily reflect the official policies of the U.S. Department of Health and Human Services and the Health Resources and Services Administration, nor does mention of the department or agency names imply endorsement by the U.S. Government.

✉ Kyle Peplinski
kpeplinski@hrsa.gov

[1] RTI International, 3040 Cornwallis Road, Research Triangle Park, NC 27709, USA

[2] James Bell Associates, 3033 Wilson Blvd. #650, Arlington, VA 22201, USA

[3] Division of Home Visiting and Early Childhood Systems, HRSA, Maternal and Child Health Bureau, 5600 Fishers Lane, Rockville, MD 20857, USA

Our study provides home visiting cost estimates for a diverse sample of 45 LIAs in 14 states across eight different models.

Introduction

The Maternal, Infant, and Early Childhood Home Visiting (MIECHV) Program, administered by the Health Resources and Services Administration's (HRSA) Maternal and Child Health Bureau (MCHB), in partnership with the Administration for Children and Families, supports the delivery of evidence-based home visiting programs that aim to "improve maternal and child health, prevent child abuse and neglect, encourage positive parenting, and promote child development and school readiness" (42 U.S.C. § 711 (d)(1)(A)). Evaluations of home visiting programs have shown short-term benefits, such as improvements in maternal and child health outcomes (Avellar and Supplee 2013; Heckman et al. 2017; Olds et al. 1998), and longer-term benefits, such as improved academic outcomes through middle school (Heckman et al. 2017).

To assess how the benefits of home visiting programs compare with costs, it is important that cost estimates reflect a standardized set of cost metrics. Although prior studies have analyzed home visiting costs, most were restricted to one home visiting model and narrow geographic regions (Filene et al. 2014; DuMont et al. 2011; Boulatoff and Jump 2007). For example, DuMont et al. (2011) reported costs of the Healthy Families New York program. Boulatoff and Jump (2007) analyzed costs for a universal home visiting program implemented in a mid-western community, and Filene et al. (2014) collected data on costs to deliver the Family Connections home visiting model in five sites. The most comprehensive previously published analysis of home visiting costs was conducted using data from 25 local implementing agencies (LIAs) in 13 states and included costs of five home visiting models (Healthy Families America [HFA], Nurse-Family Partnership [NFP], Parents as Teachers [PAT], SafeCare, and Triple P), finding an average cost per family served of approximately $6900 (adjusted to 2016 dollars; Burwick 2014). The Mother and Infant Home Visiting Program Evaluation (MIHOPE) will include a cost analysis and effectiveness study that will examine the financial costs of operating the programs and how those costs are related to impacts. MIHOPE is the legislatively mandated program evaluation of the MIECHV program, which was initiated in 2011 [42 U.S.C. §711 (g)(2)]. While MIHOPE will evaluate costs and cost effectiveness of the four home visiting models participating in the study [Early Head Start-Home Based Option (EHS), HFA, NFP, and PAT], the HV-BAT aimed to develop comprehensive standard metrics of cost for the field of home visiting, rather than metrics specific to a particular study in order to have broader applicability across all home visiting models. Using a standardized approach and metrics to estimate home visiting costs across multiple evidence-based home visiting models and regions could improve the consistency and accuracy of cost estimates, allow stakeholders to observe trends in cost allocation, analyze how home visiting costs vary, develop future program budgets, and inform return on investment analyses.

The purpose of this study was to develop and pilot test a tool to standardize the collection of home visiting program cost data and to analyze home visiting program costs for the LIAs that participated in the pilot study. In this paper, we describe findings from our pilot study of the Home Visiting Budget Assistance Tool (HV-BAT), an Excel-based instrument we developed to collect standardized cost metrics from LIAs that implement one or more evidence-based home visiting models. We describe lessons learned from the pilot, present home visiting cost estimates for participating LIAs, and discuss how HRSA's MCHB, MIECHV awardees, and evidence-based home visiting models could use the HV-BAT to support program planning, budgeting, and research on the costs and benefits of home visiting.

Methods

The HV-BAT pilot study was conducted with the support of HRSA's MCHB, state MIECHV awardees, and representatives from nine evidence-based home visiting models. To qualify for pilot study participation, LIAs had to be implementing at least one of the evidence-based home visiting models that were being implemented with MIECHV funding at the time of the study: Child First, EHS, Family Check-Up, Family Spirit, HFA, Home Instruction for Parents of Preschool Youngsters (HIPPY), NFP, PAT, or SafeCare Augmented. To obtain geographic representation across the United States, we worked with 15 MIECHV awardees to identify LIAs for participation: Arizona, Connecticut, Florida, Hawaii, Massachusetts, Michigan, Missouri, Montana, Nevada, Oklahoma, Oregon, Pennsylvania, South Carolina, Texas, and Wisconsin. We selected states to participate based on a number of criteria: geographic diversity, the home visiting models implemented in the state, and the number of LIAs in the state.

We identified a standardized set of home visiting cost metrics and developed the Excel-based HV-BAT based on an environmental scan and input from home visiting model representatives and HRSA's MCHB. The environmental scan involved reviewing the peer-reviewed literature and resources that home visiting models had created for their LIAs. Eight home visiting models shared budgeting resources, including start-up manuals (two home visiting models), sample budgets (three home visiting models), and worksheets or tools to estimate costs (three home visiting

models), but the budget categories differed across home visiting models. Incorporating home visiting model and HRSA's MCHB feedback on an initial draft of home visiting cost metrics, we identified eight cost categories that captured programmatic costs and ten LIA characteristics that may drive variation in costs (Table 1). To our knowledge, no systematic categorization of total programmattic costs for home visiting programs existed in the literature, but the literature did provide insight into important programmatic cost categories. For personnel costs, we also identified seven program activities to assess how staff allocated their time across the activities (Table 1). Data collected through the HV-BAT differs from the required budget reporting that MIECHV awardees submit to HRSA in a number of critical ways. The HV-BAT collects cost information at the LIA level rather than the state level, which enable cost estimates for LIAs providing the home visiting model. Similarly, the data collected through the HV-BAT reflects actual spending rather than budgeted spending. Finally, the HV-BAT collects data on program characteristics that enable the examination of factors that drive cost variation. The HV-BAT pilot study protocol and tool were approved by the Office of Management and Budget (OMB) in March 2017 (OMB #0906-0025). The RTI Institutional Review Board (IRB) determined that this study was non-human subjects research.

Home visiting model representatives from each of the nine home visiting models emailed LIAs that implemented their home visiting model in each of the selected states, inviting them to participate in the pilot study. LIAs that implemented multiple home visiting models were only invited to participate in the pilot study by one home visiting model. If they agreed to participate, LIAs were sent the HV-BAT via email and asked to provide cost and descriptive data only for the selected home visiting model for the most recently completed fiscal year. We also asked each LIA to complete a questionnaire to provide feedback on the usability of the HV-BAT and the feasibility of providing the data requested. LIAs attended a training webinar on the HV-BAT pilot study process and the data needed to complete the tool. LIAs were given 6 weeks to complete the HV-BAT. Each LIA was supported by a study technical assistant who sent email reminders about HV-BAT completion and answered questions. LIAs did not receive monetary or other remuneration after completing the tool.

Technical assistance (TA) team members used a checklist to conduct data quality reviews on completed HV-BATs. The review sought to identify implausible or missing data, inconsistencies, and potential inaccuracies. The TA team followed up with LIAs to clarify and correct data issues identified during review.

Analysis

The final analysis file was created by combining data from the completed HV-BATs. To calculate total costs for each LIA, we summed costs for each of the eight resource categories (e.g., labor, consumable supplies, and non-consumable supplies, and travel). An annualized cost estimate for non-consumable supplies (e.g., equipment) was included by dividing the purchase price of an item by its expected years of use. The annual time period for which LIAs reported costs varied because of different fiscal year definitions across the LIAs. Some LIAs operated on the federal fiscal year (October–September) and others used July–June or January–December. To adjust cost estimates to the 2016 federal fiscal year, we used the gross domestic product price index (U.S. Bureau of Economic Analysis 2017).

We calculated cost per family served by dividing total LIA costs by the average monthly number of families served by the LIA. We then calculated weighted mean cost per

Table 1 Information captured in the HV-BAT: cost categories, personnel activities, and LIA characteristics that may drive variation in costs

Cost categories	Personnel activities	LIA characteristics that may drive variation in costs
1. Salary and personnel	1. Service delivery	1. Home visitors per family per year
2. Overhead and infrastructure	2. Outreach	2. Home visits per family per year
3. Contracted services	3. Home visiting program coordination	3. Percentage of families that required services in a language other than English
4. Model costs, tools and curricula	4. Supervising	4. Percentage of home visits successfully completed
5. Training	5. Administration	5. Whether the agency provided other services or shared a facility with an agency that provided other services
6. Consumable supplies	6. Executive activities	6. Whether the agency received outreach services from another agency
7. Non-consumable supplies	7. Other	7. Percentage of home visits in rural areas
8. Travel		8. Percentage of home visits in frontier areas
		9. Percentage of families with incomes below the federal poverty line (FPL), using each of three categories (0–200% of FPL, 0–100% of FPL, 0–50% of FPL)
		10. Years implementing the model

HV-BAT Home Visiting Budget Assistance Tool, *LIA* local implementing agency

family served as the sum of costs across all LIAs divided by the sum of families served. We examined the percentage of total costs for each resource category (e.g., labor, consumable supplies, non-consumable supplies) and the percentage of labor costs allocated to each home visiting program activity (e.g., service delivery, outreach, administration).

Using bivariate regression analysis, weighted by the number of families served, we explored the relationship between cost per family served and each LIA characteristic that may drive variation in costs (Table 1). When determining whether a variable had an impact on costs, we considered statistical significance ($p < 0.05$) and borderline statistical significance ($p < 0.10$) of the estimated coefficients.

We used multivariate regression analysis to examine the impact on total home visiting program costs of changes in the extensive and intensive margins. The extensive margin reflects the extent to which adding more participants raises costs; the intensive margin captures how providing more services to each participant affects costs. Using total cost as the dependent variable and number of families served, number of families served squared, and average number of visits per family per year as explanatory variables, we estimated linear regression models. We used coefficient estimates from the regressions to examine how the predicted cost of adding a family varies in relation to the number of families served, exploring whether economies of scale are present in providing home visiting services.

Results

Home visiting model representatives invited 168 LIAs to participate in the HV-BAT pilot study; the number invited per home visiting model ranged from 1 to 47. Of the 168 LIAs that were invited, 75 agreed to participate, and 45 submitted their HV-BAT and a pilot feedback questionnaire (Table 2).

Table 2 LIA recruitment and participation status, by home visiting model

Home visiting model	No. of LIAs		
	Invited to participate	Agreed to participate	Participated
Child First	8	2	2
EHS	20	5	2
Family Check-Up	1	1	1
Family Spirit	1	0	0
HFA	47	20	9
HIPPY	11	6	2
NFP	33	19	14
PAT	40	15	10
SafeCare	7	7	5
Total	168	75	45

LIA local implementing agency, *EHS* Early Head Start, *HFA* Healthy Families America, *HIPPY* Home Instruction for Parents of Preschool Youngsters, *NFP* Nurse Family Partnership, *PAT* Parents as Teachers

Pilot Findings

Extensive data quality review and follow-up with LIAs was needed to ensure accurate cost reporting. We followed up with 42 of the 45 pilot LIAs to clarify or correct data entries. Although LIAs were instructed to report costs for the most recent fiscal year, only 14 LIAs reported costs for the 2016 federal fiscal year, which began on October 1, 2015; most reported costs for a fiscal year that began on July 1, 2015. LIAs spent an average of 11 h to complete the HV-BAT (range of 2–31 h). About half of LIAs said they had some difficulty providing some of the requested cost information, and 20% reported having program costs not captured in the HV-BAT. Issues that caused difficulty for respondents were providing mileage costs separately for specific services, reporting on multiple categories of poverty (i.e., 0–50% of FPL, 0–100% of FPL, and 0–200% of FPL), and entering costs for part-time staff. Costs that LIAs described as not being captured in the HV-BAT were cell phones, travel, and liability insurance costs. Although LIAs could have reported those costs in the pilot HV-BAT, they were unsure about where to report them. To address feedback on difficulties and perceived cost exclusions, we developed more detailed instructions for responding to each question and revised the HV-BAT to allow for reporting of total mileage costs, a single poverty category, and part-time staff members and their salaries.

We also requested LIA suggestions for HV-BAT improvement and feedback on the tool. Fourteen LIAs (31%) noted that the tool was straightforward, user-friendly, and easy to use; six (13%) reported that the hover-over "Help" feature included in the tool was beneficial; and three (7%) said they appreciated the timely and detailed TA responses. LIAs suggested that the tool could be improved with the addition of clearer instructions, by aligning reporting categories with the budget reporting or existing invoice templates, and by including cost subtotals for each resource and an annual total.

Cost Analysis Results

Table 3 shows characteristics of the 45 LIAs that participated in the pilot study. Almost three-fourths of pilot LIAs reported costs for NFP (14 LIAs), PAT (10 LIAs), or HFA (9

LIAs). On average, LIAs had been implementing the home visiting model for which they reported costs for 9.7 years (range of 1–25 years). The average number of families served per month was 98 (range of 15–270; median of 90). The average number of visits per family was 2.3 per month, translating to about 28 annual visits per family. On average, 79% of home visits were reported as successfully completed.

The mean annual cost per family served was $8497, but substantial variation was identified across LIAs (standard deviation = $5794) (Table 4). On average, the largest portion of costs were for labor expenditures ($6225), followed by overhead ($1076), and contracted services ($467). The remaining costs were for consumable supplies, training, travel, non-consumable supplies, and home visiting model-related costs. We also examined the distribution of labor costs across program activities; labor costs were allocated to service delivery ($3001), administrative activities ($1004), home visiting program coordination ($687), providing supervision ($647), outreach ($375), executive activities ($315), and other non-specified activities ($195). We found that LIAs serving < 100 families had an average cost per family served of $12,556 versus $7117 per family served for LIAs that served 100 or more families. Additionally, comparing the standard deviations reveals much greater variation in average cost per family for smaller LIAs ($12,858 vs. $2571).

Figure 1 shows the distribution of annual costs per family served across LIAs; the height of the bar for each value shown represents the number of LIAs with costs per family served in that range. Several LIAs had costs between $6000 and $12,000 (n = 21), and another group had costs clustering around $14,000 (n = 8). Because the distribution of costs per family served show two high-cost outliers, we also calculated the weighted mean for all LIAs that had costs within two standard deviations of the mean. This sensitivity analysis resulted in annual costs of $7780 per family served.

Table 3 Pilot LIA sample statistics

LIA characteristic	%/Mean	Min	Max
Home visiting model (%) (N = 45)			
Child First (n = 2)	4.4%	–	–
EHS (n = 2)	4.4%	–	–
Family Check-Up (n = 1)	2.2%	–	–
HFA (n = 9)	20.0%	–	–
HIPPY (n = 2)	4.4%	–	–
NFP (n = 14)	31.1%	–	–
PAT (n = 10)	22.2%	–	–
SafeCare (n = 5)	11.1%	–	–
Years implementing the model (years and %) (N = 45)			
Total years implementing the model (years)	9.7	1	25
<5	26.7%	–	–
5–9	35.6%	–	–
10+	37.8%	–	–
Agency provides other services or shares facility with an agency that provides other services (%) (N = 45)	73%	0%	100%
Agency receives outreach services from another agency (%) (N = 44)	14%	0%	100%
% of visits in rural areas (mean) (N = 43)	36%	0%	100%
% of visits in frontier[a] areas (mean) (N = 43)	1%	0%	23%
% of visits that were successfully completed (mean) (N = 44)	79%	43%	100%
% of families that required services in a language other than English (mean) (N = 45)	19%	0%	95%
% of families in FPL categories (mean)			
0–200% of the FPL (N = 39)	93%	48%	100%
0–100% of the FPL (N = 35)	64%	15%	100%
0–50% of the FPL (N = 34)	31%	0%	91%
Average monthly number of families served per program[b] (N = 45)	98.4	15	270
Average monthly number of visits per family (N = 45)	2.3	1.0	4.0

"–" not applicable

[a]Areas identified by the USDA as areas of low population and high geographic remoteness (U.S. Department of Agriculture 2016)

[b]Based on responses to the HV-BAT question "In the past fiscal year, what was your average monthly caseload?"

Table 4 Summary of average cost per family served by resource category, labor activity, and LIA size

Average cost per family	Mean ($)	Standard deviation ($)
Total	8497	5794
Total cost by resource category		
Labor	6225	4342
Overhead and Infrastructure	1076	1090
Contracted services	467	1065
Model costs, tools and curricula	90	132
Training	135	273
Consumable supplies	230	381
Non-consumable supplies	65	158
Travel	208	159
Labor cost by activity		
Service delivery	3001	2073
Outreach	375	440
Home visiting program coordination	687	1151
Supervising	647	596
Administration	1004	1209
Executive	315	519
Other	195	544
Total cost by LIA Size		
< 100 families served	12,556	12,858
≥ 100 families served	7117	2571

Bivariate regression analysis indicated that the percentage of families served in frontier areas [i.e. defined by the United States Department of Agriculture as areas of low population and high geographic remoteness (U.S. Department of Agriculture 2016)] was negatively and statistically significantly associated with cost per family served. However, an average of only 1% of families lived in frontier areas, so the finding suggests that some other factor was likely highly correlated with serving families in a frontier area. The average annual number of home visits per family was also borderline statistically significant ($p = 0.10$), but none of the other variables included in the bivariate regression analysis had a statistically significant association with cost per family served.

Results from specification 1 of the multivariate regression analysis suggest that the additional cost to serve one additional family is approximately $9500 when an LIA delivers the home visiting model to a small number of families (Table 5). As the number of families served increases, the marginal cost to serve one additional family decreases by about $18 for each additional family. For example, the first family served has a marginal cost of approximately $9500 and the hundredth family served has a marginal cost of approximately $7700 (i.e., $\$9500 - \$18 \times 100$ families).

For regression specification 2 that included average annual number of visits per family, we found that the coefficient on number of visits per family was not statistically significant ($p = 0.20$). However, the point estimate suggests that a 10% increase in the average annual number of visits per family (approximately 2.8 extra visits per family on average each year), was associated with an increase in total LIA costs of $26,295 per LIA (i.e., 2.8 visits *$9391 per extra visit), or an increase of 3% in mean annual costs for the LIA to deliver the home visiting model. This estimate may be biased downward by additional costs associated with low retention, which is correlated with a lower number of visits per family. This finding suggests that as the number of home visits provided to families as part of the home visiting model increases, costs will also increase.

Figure 2 shows how the predicted marginal cost of providing home visiting services changes in relation to the number of families served by LIAs. Results are shown for the range of families served by the pilot LIAs. The findings suggest economies of scale in providing home visiting services,

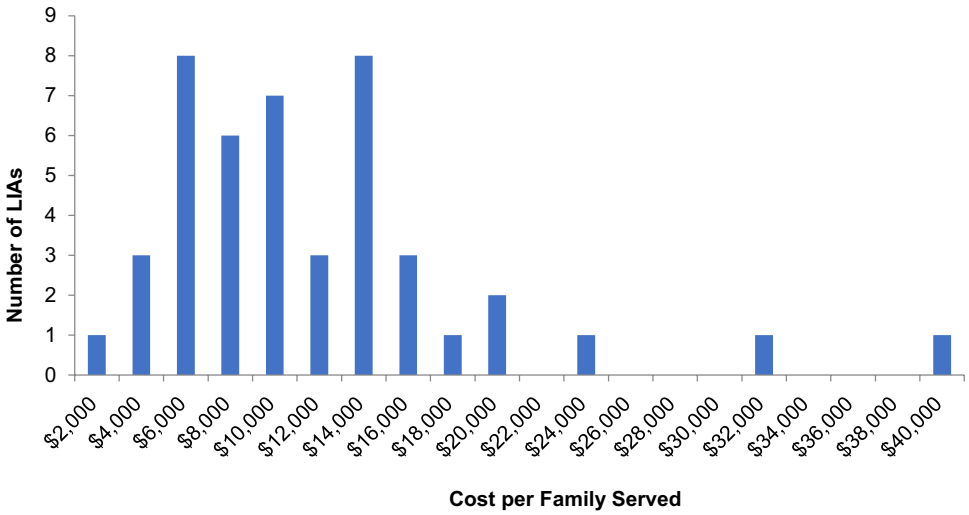

Fig. 1 Distribution of estimated annual costs per family served across LIAs

Table 5 Multivariate regression results of the impact of average monthly number of families served and average visits per family per year on total annual costs

Independent variable	Specification 1	Specification 2
Average monthly number of families served	9468** (3930)	9631** (3903)
Average monthly number of families served squared	−18.40 (14.98)	−17.68 (14.88)
Average visits per family per year		9391 (7328)
Constant	168,104 (205,683)	−120,610 (304,011)
Observations	45	45
R-squared	0.324	0.350

Specification 1 included monthly number of families served and average monthly number of families served squared as explanatory variables

Specification 2 included explanatory variables from Specification 1 and average number of visits per family per year

Standard errors in parentheses

Average monthly number of families served and average monthly number of families served squared were jointly statistically significant ($p < 0.01$)

All regressions were weighted by number of families served

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

because the marginal cost of adding a family declines as the number of families served by an LIA increases.

Discussion

We developed and pilot tested an Excel-based tool, the HV-BAT, which was designed to standardize the collection and reporting of home visiting program costs. Using data from the pilot study we found that almost three-fourths (73%) of LIA costs were for labor, and approximately half (48%) of labor costs were reported as directly delivering home visiting services. For the LIAs in the pilot, delivering evidence-based home visiting services cost approximately $8500 per family per year, but costs varied widely across LIAs. The high costs reported by two LIAs appeared to be driven by high fixed operating costs (e.g. overhead and infrastructure and non-consumable supplies) and a lower than average number of families served. Additionally, the average cost per family was lower for LIAs serving more families than for LIAs serving fewer families. An LIA serving 15 families would have additional costs of about $9400 to serve another family, whereas an LIA serving 270 families would have additional costs of only $4900 to serve another family. Our results suggest that there may be considerable economies of scale for organizations in the delivery of home visiting services.

To provide context for these findings, we compared our cost estimates to previously published cost study results. Boulatoff and Jump (2007), Burwick et al. (2014), and Filene et al. (2014) estimated home visiting costs using methods similar to our study and included costs for labor, home visiting model training fees, travel, and other relevant costs. Estimated costs per family per year from those studies, adjusted to 2016 dollars, were $6100, $6900, and $7300, respectively, figures closer to our estimate of $8500. However, our cost

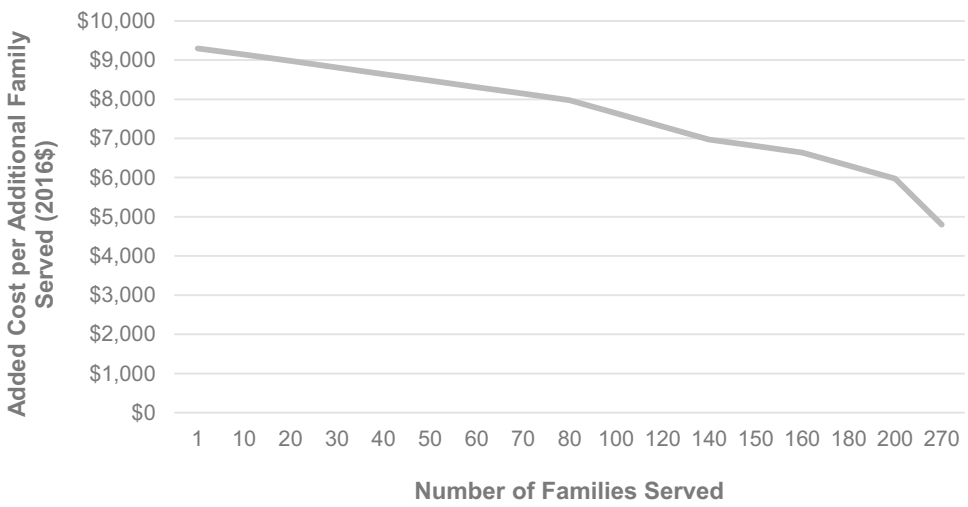

Fig. 2 Estimated marginal cost of an additional family served based on estimates from multivariate regression

estimates are considerably higher than estimates published by Washington State Institute for Public Policy (WSIPP) for PAT ($1800), HIPPY ($2100), and HFA ($5100). The differences between the WSIPP estimates and ours may result from using different approaches. The WSIPP cost estimates account for salaries, travel costs, and training costs, but do not appear to include fringe benefits, office space costs, or the value of consumable supplies (WSIPP 2017). Several of the WSIPP estimates noted that total annual costs reflected the cost to complete a home visit multiplied by the number of completed visits. Our study used a different approach, calculating annual cost per family served as total home visiting program costs, including administrative and overhead costs, divided by the number of families served. In addition to capturing costs of completed visits, our approach included costs to prepare and travel for home visits that cannot be completed, because those efforts are a routine cost incurred by home visiting programs. Our study also focused exclusively on costs to implement programs using MIECHV funding, which may differ from other estimates due to additional oversight related to use of federal grant funds.

Limitations

The results from this pilot study should be interpreted in the context of several limitations. First, although we conducted extensive data quality review, there may be remaining inconsistencies and errors in LIA data we received. For example, although we asked LIAs to report salaries that included fringe benefits, it is unclear whether the salary data consistently included fringe benefits. Additionally, from the pilot study, we learned that some of the questions about LIA characteristics were confusing. As a result, data from those questions may reflect inconsistency in reporting. For example, review of LIA responses suggests that many reported the number of LIA visits per family recommended by home visiting models, rather than the actual average number of visits received per family. To improve data quality for future use of the HV-BAT, the final HV-BAT includes detailed instructions on how LIAs should calculate and report each metric.

Second, although 168 LIAs were invited to participate in the pilot study, only 75 agreed to participate, and 45 submitted a completed HV-BAT. The relatively small sample size did not allow us to conduct subgroup analyses, such as analyzing costs separately for each different home visiting model. Third, LIAs that participated in the study are likely to be different in some systematic way from LIAs that declined to participate, which could bias pilot cost results. For example, cost estimates may reflect upward bias if LIAs that chose to participate have higher than average administrative costs. Fourth, because of the relatively small number of LIAs and MIECHV awardees included in this pilot study, the results should not be viewed as generalizable to all home visiting LIAs and awardees. Despite this limitation, the pilot study sample was diverse by design, including 45 LIAs in 14 awardee states.

Implications for Practice and Research

Based on pilot feedback, we developed a question and answer document to accompany the final HV-BAT and created a results page in the HV-BAT that summarizes LIA costs in tables and figures. These improvements should help to standardize and improve the quality of data provided by LIAs.

Findings from this study may be useful for program and budget planning. For example, MIECHV awardees and home visiting model representatives could use information from the HV-BAT to identify trends in the average cost per family served for LIAs in a jurisdiction or that deliver the same home visiting model. Results are also useful for estimating the financial impact of expanding programs to include more families. Given economies of scale suggested by our findings, the additional estimated annual cost to serve a new family is $7800 for an LIA serving 100 families, the approximate average number of families served by LIAs in the pilot. For an LIA that serves 200 families, estimated cost to add a family is $6000 per year. MIECHV awardees may also find the HV-BAT useful for contractual monitoring of costs expended by the LIAs they contract with to provide evidence-based home visiting services. Fiscal sub-recipient monitoring has been a key priority of technical assistance for the MIECHV Program.

Cost estimates from LIAs could be used in further home visiting research on how costs compare with short- and longer-term benefits. These estimates are important inputs for cost-effectiveness analysis highlighted in the Report of the Second Panel on Cost-Effectiveness in Health and Medicine (Sanders et al. 2016). The HV-BAT could also be used to develop a home visiting cost prediction tool that would support program planning for awardees and LIAs. To develop such a tool, additional data would need to be collected from a representative sample of LIAs using the HV-BAT and analyzed to determine how factors such as the numbers of families served with each home visiting model, geographic location, and other LIA characteristics affect annual home visiting costs.

Conclusions

The HV-BAT was designed to standardize data collection of costs incurred by LIAs in implementation of home visiting programs; the tool has been improved based on LIA feedback and the HV-BAT pilot study process. Pilot study cost results illustrate how costs vary for a selected sample of diverse LIAs. Importantly, the results indicate that there may be significant economies of scale for organizations implementing home visiting services, meaning that the cost of providing services to additional families decreases with a higher number of families served. Results provide preliminary estimates of costs that can help in program planning and budgeting and be useful for home visiting research. However, because of the convenience sample used for this study and limitations of the pilot version of the tool, further research is needed to improve estimates.

Acknowledgements This article was funded by the U.S. Department of Health and Human Services, Health Resources and Services Administration, under contract number HHSH25034002T.

References

Avellar, S. A., & Supplee, L. H. (2013). Effectiveness of home visiting in improving child health and reducing child maltreatment. *Pediatrics, 132*(Supplement 2), S90–S99.

Boulatoff, C., & Jump, V. K. (2007). Blueprint of a cost analysis approach for early intervention: Application to a home visiting program to prevent child abuse and neglect. *Journal of Early Intervention, 30*, 73–84.

Burwick, A., Zaveri, H., Shang, L., Boller, K., Daro, D., & Strong, D. A. (2014). Costs of early childhood home visiting: An analysis of programs implemented in the Supporting Evidence-Based Home Visiting to Prevent Child Maltreatment initiative: Final report. Submitted to the Doris Duke Charitable Foundation, New York, NY

DuMont, K., Kirkland, K., Mitchell-Herzfeld, S., Ehrhard-Dietzel, S., Rodriguez, M. L., Lee, E., et al. (2011). A randomized trial of Healthy Families New York (HFNY): Does home visiting prevent child maltreatment? Submitted to the National Institute of Justice, U.S. Department of Justice, Washington, DC

Filene, J. H., Brodowski, M. L., & Bell, J. (2014). Using cost analysis to examine variability in replications of an efficacious child neglect prevention program. *Journal of Public Child Welfare, 8*, 375–396.

Heckman, J. J., Holland, M. J., Makino, K. K., Pinto, R., & Rosales-Rueda, M. (2017). *An analysis of the Memphis Nurse-Family Partnership Program* [NBER Working Paper No. 23610]. National Bureau of Economic Research.

Olds, D., Henderson, C. R., Cole, R., Eckenrode, J., Kitzman, H., Luckey, D., et al. (1998). Long-term effects of nurse home visitation on children's criminal and antisocial behavior: 15-year follow-up of a randomized controlled trial. *Journal of the American Medical Association, 280*(14), 1238–1244.

Sanders, G. D., Neumann, P. J., Basu, A., et al. (2016). Recommendations for conduct, methodological practices, and reporting of cost-effectiveness analyses: Second panel on cost-effectiveness in health and medicine. *Journal of the American Medical Association, 316*(10), 1093–1103. https://doi.org/10.1001/jama.2016.12195.

U.S. Bureau of Economic Analysis (2017). *Price indices for gross domestic product*. Retrieved from https://www.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey.

U.S. Department of Agriculture (2016). *Frontier and remote area codes*. Retrieved from https://www.ers.usda.gov/data-products/frontier-and-remote-area-codes/.

Washington State Institute for Public Policy (WSIPP) (2017). *Benefit-cost technical documentation*. Retrieved from http://www.wsipp.wa.gov/BenefitCost?topicId=9.