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Assessing the Implementation and Cost of High Quality Early Care and Education:

A Review of the Literature

OPRE 2016-31

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Assessing the Implementation and Cost of High Quality Early Care and Education

A Review of the Literature

OPRE Report 2016-31

April 2016

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OVERVIEW

This report summarizes the findings of a literature review conducted as part of the Assessing the Implementation and Cost of High-Quality ECE (ECE-ICHQ) project funded by the Office of Planning, Research and Evaluation within the Administration for Children and Families at the U.S. Department of Health and Human Services. The project's goal is to create a technically sound and feasible instrument that will provide consistent, systematic measures of the implementation and costs of education and care in center-based settings that serve children from birth to age 5. The ultimate measures will inform research, policy, and practice by improving understanding of variations in what centers do to support quality, their associated costs, and how resources for ECE may be better aligned with expectations for quality. We reviewed the literature and research syntheses in three areas—ECE quality, implementation science, and ECE costs—to create a conceptual framework that will guide measurement development.

Research reveals some associations between the features of an ECE center and quality, or children's outcomes, but the lack of clear evidence means that ECE-ICHQ data collection must start broad. Group size and adult-child ratio, staff education and credentials, environment and materials, and training and professional development have some demonstrated associations with both teacher-child interactions (as an indicator of quality) and child outcomes in at least some studies. However, most of the evidence of the association between specific program features, program quality, and child outcomes is correlational and few studies have been able to speak to the combined effects of program features. The primary implication for this work is that measurement needs to start broad. Centers may be able to achieve quality with different combinations of features.

Factors at the center level that can affect implementation are important to measure. Different pathways to similar outcomes may come from differences in implementation that affects *how* program features are put into operation and supported. Implementation science identifies a broad set of factors that support the infrastructure and environment necessary for successful implementation, as well as specific activities— staff selection, use of tools, training, coaching, and quality assurance and improvement—that support strong implementation.

Current measurement of the cost-to-quality relationship provides little direction for those who wish to invest in quality. Existing evidence indicates that a positive relationship exists between cost and quality; higher-quality centers tend to have higher costs. Yet, some evidence exists that centers at different quality levels allocate resources in ways that are meaningful but that are not captured in comparisons of total or full costs. The field needs more specific measures of costs that can map to what is being done within a center to pursue quality.

There is a need to align measures of implementation and cost to inform the direction of efforts to improve quality. The literature review reveals a need for disaggregated measures that can allow researchers to better assess how an ECE center functions and allocates resources in ways that may support quality. These disaggregated measures of implementation and costs can be used with measures of quality to examine the relationship between implementation, costs, and quality that has been difficult to pursue in the past.

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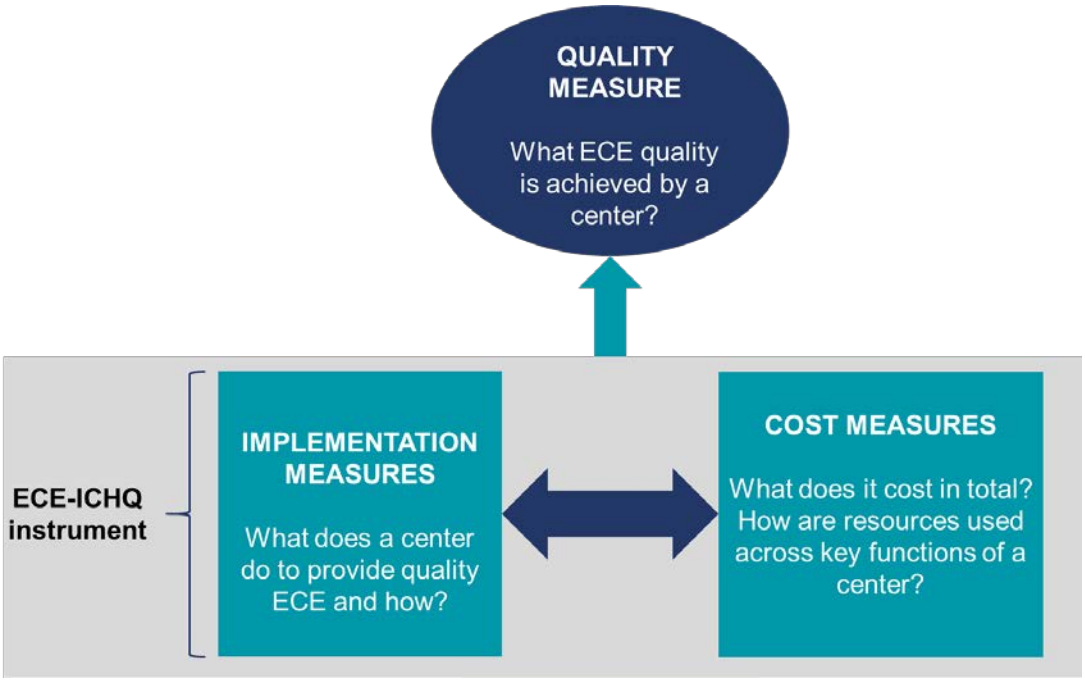
Measures of implementation and cost of ECE are needed for use and testing together with measures of quality to shed light on what it takes—in terms of activities, capacities, and money—to achieve high quality within a center. Implementation measures need to reflect what ECE centers are doing to educate and care for children and how they are doing it. Cost measures need to capture the way ECE centers allocate the resources they have to work with. The Office of Planning, Research and Evaluation (OPRE) in the Administration for Children and Families (ACF) at the U.S. Department of Health and Human Services (DHHS) launched a new project—Assessing the Implementation and Cost of High-Quality ECE (ECE-ICHQ)—to develop measures of implementation and cost for an ECE center. The measures will inform research, policy, and practice by improving understanding of variations in what centers do to support quality, their associated costs, and how resources for ECE may be better aligned with expectations for quality.

The project's goal is to create a technically sound, feasible, and useful instrument that will provide consistent, systematic measures of the implementation and costs of education and care in center-based settings that serve children from birth to age 5 ("ECE centers"). By "costs" we mean how much it costs to operate a center, including costs incurred by the center, as well as the value of in-kind contributions such as space or labor. These measures will provide information on the relationship between existing capacities and activities to promote, support, or improve quality—and costs. The ultimate goal is to produce measures of implementation and costs that can be used with measures of quality to examine the variation in ECE center capacities and resources that can make a difference in the early childhood experiences of children (Figure ES.1).

Figure ES.1. ECE quality and ECE-ICHQ measures



The ECE-ICHQ measurement approach will assign costs to key functions of an ECE center to describe the distribution of resources within total costs. ECE-ICHQ also will identify the resources associated with the specific organizational capacities and implementation activities that support quality. Producing cost measures by function can help us learn how resources are distributed within ECE centers in ways that may influence quality as well as a center's capacity to support quality.

To begin to build measures of implementation and costs that can complement measures of quality, this literature review addresses four research questions:

1. What are the features of high quality ECE?

2. What are the key implementation factors necessary to deliver high quality center-based ECE services?

3. What factors directly contribute to increases or decreases in costs of providing high quality center-based ECE services?

4. What is the relationship between quality center-based ECE services and costs?

This review draws from 49 studies spanning three areas of research:

1. **Research on ECE quality** to help define high quality center-based ECE and program features that support it in order to determine what to look for and measure about what a center does to provide quality
2. **Implementation science research** to identify the contextual and organizational factors and implementation activities most likely to produce the intended effects, such as improvements in quality, to guide measurement about how a center implements quality
3. **Cost studies and cost analysis** to provide information on the methods and means to measure costs, particularly costs related to the implementation and/or quality of services (including services provided in sectors other than ECE)

What are the features of high quality ECE?

To understand the features that support quality within ECE centers, we drew primarily from seven sources—six recent research reviews and one meta-analysis—that linked features of ECE to child outcomes (such as improved school readiness) and/or classroom practices (such as instructional and emotional support as measured by classroom observation) as an indicator of quality. Recognizing that the research on specific program features is not currently as well developed as the research based on evaluations of particular programs as a whole or global quality measures such as the Environment Rating Scales, we expand our discussion to include program features that have yet to be rigorously tested as predictors of child outcomes or classroom practices but are hypothesized to be important by experts. We identified these emergent features through the resources we reviewed and by examining existing ECE program standards, such as state licensing requirements, state quality rating and improvement systems (QRIS) and prekindergarten standards, and accreditation standards of the National Association

for the Education of Young Children (NAEYC). Existing ECE program standards reflect features that experts in the ECE community have endorsed as important.

Four of the nine features that were discussed in the resources we reviewed—group size and adult-child ratio, staff education and credentials, environment and materials, and training and professional development—have been demonstrated to be associated with both teacher-child interactions and child outcomes in at least some studies. Table ES.1 summarizes the level of evidence for each of the nine program features. Curriculum has been shown to be associated with child outcomes; however, the reviews that reported on these associations did not describe any studies that examined associations between curriculum and teacher-child interactions. Three features—staff compensation and benefits, assessment and evaluation, and leadership and administrative practices—have a limited evidence base in terms of associations with child outcomes or teacher-child interactions because they have not been tested to date, according to the resources we reviewed.

Table ES.1. Level of evidence for features of ECE programs (associations with targeted outcomes and practices)

	Associated with child outcomes	Associated with observed teacher-child interactions	Endorsed by experts
Group size and adult-child ratio	X[a]	X[a]	X
Staff education and credentials	X[a]	X[a]	X
Staff compensation and benefits			X
Physical environment and materials	X[a]	X[a]	X
Training and professional development	X[a]	X[a]	X
Curriculum	X[a]		X
Assessment and evaluation			X
Leadership and administrative practices			X

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Note: This table summarizes levels of evidence for each quality element based on association with outcomes and practices as reported in reviewed literature. In the first two columns, cells marked with an "X" indicate there was evidence of an association, and blank cells indicate that no evidence of an association was reported.

[a] Some null findings also were reported.

ECE = early care and education

The mixed nature to the findings overall makes it difficult to draw conclusions for the ECE-ICHQ project. Most of the evidence of the association between specific program features, program quality, and child outcomes is correlational and few studies have been able to speak to the combined effects of program features. There is at least some evidence that specific program features may not be sufficient on their own to support quality and child outcomes, but may be essential for facilitating quality. The primary implication for this work is that measurement needs to start broad. Programs may be able to achieve desirable outcomes with different combinations of features. We do not expect that all of the features identified above will be present within every program in the same way. Another important implication for this project is that there is

likely more than one pathway to high quality ECE. Different pathways to similar outcomes may come from differences in implementation that affects *how* program features are put into operation and supported.

What does it take to implement high quality ECE?

We examined eight frameworks that convey the core principles and factors common to implementation of evidence-based programs and practices. The eight frameworks were developed through literature reviews of empirical studies and theory development across a variety of service areas. Each framework presents an approach to the measurement and evaluation of implementation of evidence-based programs to guide key stakeholders in translating research to practice.

Practitioner, organizational, and contextual implementation factors

Practitioner, organizational, and contextual factors form the basis of an infrastructure—or general capacity--that supports successful implementation of any program or practice by building a healthy, vibrant, and cohesive environment within an organization and among practitioners. Although some of the factors may not be directly reflected in costs (or may have costs that are difficult to assess), they are important to capture as part of the general capacity an ECE center has to implement program features.

Practitioner factors. The match between the qualifications, skills, and competencies of the practitioner and those needed to deliver a program or practice is a central ingredient in implementation. This practitioner-level factor of implementation capacity is represented in six of the frameworks

Organizational factors. While recognizing that the factors are not distinct and could be included in multiple categories, the organizational factors identified as important for implementation fall into three main categories: (1) openness to change, (2) work climate, and (3) supports and infrastructure.

Contextual factors. Five frameworks incorporate common contextual factors—the existing theory and research, funding priorities, and policies—that can support or inhibit the adoption of specific programs or practices.

Implementation activities

Beyond the general capacities needed to create and sustain the infrastructure and environment for implementation, there also are core activities that move implementation from descriptions of what *should* occur to actions and practices that *do* occur. Five key activities form the core of effective implementation for any program or practice: (1) recruitment, hiring and selection of practitioners with the required skills and competencies; (2) selection and use of tools that clearly convey the key concepts, principles, procedures, and practices of an innovation; (3) training that delivers content knowledge to practitioners, (4) technical assistance (TA) or coaching that includes observation and feedback, and (5) a quality assurance (QA) and quality improvement (QI) process.

The five implementation activities will be important to examine in assessing the capacity to implement quality in ECE programs. Investments in these activities may yield the most benefit toward achieving quality, and they can be readily identifiable as cost ingredients. Implementation activities and costs may vary across ECE centers that have seemingly similar program features because of variations in the stage of implementation of a feature, or group of features. Implementation of quality takes time and resources, but the level of investments may be different at each stage. While the ECE-ICHQ measures will be based on data collection at a particular point in time, it may be important to capture the stage of implementation of particular program features given the potential differences in activities and related costs at different stages.

How are the costs of ECE measured and what contributes to variation in costs?

We identified and reviewed 30 resources that included information on approaches to measuring costs. The 30 resources were 21 empirical studies, two policy briefs, one design report, and six cost tools. While the project is focused on center-based ECE, we did not exclude cost studies that may have been done in home-based settings; however, none surfaced in our search.

Features of cost studies

Many of the studies reviewed used broad measures of costs (total costs or full costs) in their analysis. Results from studies that delineated costs into finer categories indicate that broad measures can mask important differences in cost allocations between centers. A consistent finding across several of the studies is that labor costs account for a large proportion of total costs. One way to better understand the allocation of labor resources is to collect data on staff time use. Burwick et al. (2014) used data on staff time use to determine the proportion of program costs allocated to delivering home visiting services to families. Through this strategy, the authors found differences in resource allocation by program model and implementing agency type.

Features of existing cost tools

We reviewed six existing cost tools designed for use in a range of settings, including ECE settings and educational programs more broadly, after-school programs, substance abuse treatment programs, and home visiting programs. Five of the tools included staff compensation and benefits, and three included the cost of materials. Training and professional development, and assessment and evaluation are each included in three of the tools. Two of the tools explicitly considered the value of in-kind donations and volunteer services.

Do costs vary by contextual factors?

Nearly all the cost studies we reviewed examined how center characteristics are related to costs.

- **Enrollment level or capacity.** Findings were consistent that, as a provider serves more children, more staff, materials, and space are required, leading to increased costs. However, costs per child are lower for larger providers due to economies of scale.

- **Hours of operation.** Full-day services incur more costs than half-day services, and full calendar year services incur more costs that those that operate during the school year only. However, there does not appear to be a linear relationship between hours and days of operation and costs.
- **Staffing structure.** The number and type of staff, which are influenced by a provider's capacity, the age of the children being served, and regulations, affect costs directly though the direction of the effect is not entirely clear.
- **Ages of children served.** It is more costly to serve younger children than older children because regulatory standards require more caregivers to be present when serving younger children, resulting in higher personnel costs.

A few studies also explored other characteristics such as for-profit status, auspice, and funding sources with less consistent results.

The extant research on ECE costs suggests a need for a measure that does not just calculate total costs but also captures differences in how resources are allocated and how costs are connected to the implementation of program features. Another next step to take from the existing literature is to look at the decisions that centers make to support what goes on in the classroom that also plays out in costs, and quality. Decisions that affect implementation and costs include staffing structures, the qualifications of staff, how staff use their time, and the professional development opportunities the center provides for staff. Finally, consideration of center characteristics and contextual factors is key in any examination of the cost-quality relationship in ECE.

How is quality related to costs?

Research on the association between quality and costs in ECE center-based programs is limited (and is non-existent for home-based settings).However, the existing evidence from the empirical studies we reviewed indicates that a positive relationship exists between cost and quality; higher-quality centers tend to have higher costs.

- The Cost, Quality, and Child Outcomes (CQO) study found that on average, a 1-point difference in quality scores on a 7-point scale, as measured by the Environment Rating Scales (ERS), was associated with a 10 percent difference in a center's total variable costs (Helburn, 1995).
- Three studies examined the relationship between cost and quality using state-specific data and found that costs were 13 to 27 percent higher in centers of higher quality than in centers of lower quality (as defined within each study) (Marshall et al., 2001; Marshall et al., 2004a; Marshall et al., 2004b).
- A study of 745 public and private preschool programs in the Abbott districts in New Jersey found a statistically significant 2 percent difference in per-child costs associated with a 1-point difference on the ECERS-R. The authors posit that this difference is smaller than estimates from the CQO study because the study sample is much more homogeneous and of higher average quality than the CQO sample. (Belfield & Schwartz, 2007).

- Using state-level data, Levin and Schwartz (2007) estimated that states that provided higher quality preschool have costs that are 5 to 7 percent higher than the average state.

Although the studies consistently found a positive association between cost and quality, the estimated magnitude of the relationship ranged considerably across studies. Our analysis indicates that the definition and approaches for measuring cost and quality, as well as consideration of center characteristics and other contextual factors, may all contribute to variation in estimates and limit the field's current understanding of the cost-quality relationship in ECE settings.

Conclusions, implications, and framework for the ECE-ICHQ project

This literature review helped identify what is important to examine for variations in implementation and costs that can affect quality within an ECE center to inform the field and help determine the next steps in the ECE-ICHQ project.

Research reveals some associations between the features of an ECE center and quality, or children's outcomes, but the lack of clear evidence means that ECE-ICHQ data collection must start broad. Group size and adult-child ratio, staff education and credentials, environment and materials, and training and professional development have some demonstrated associations with both teacher-child interactions and child outcomes in at least some studies. However, most of the evidence of the association between specific program features, program quality, and child outcomes is correlational and few studies have been able to speak to the combined effects of program features. The primary implication for this work is that measurement needs to start broad. Centers may be able to achieve quality with different combinations of features.

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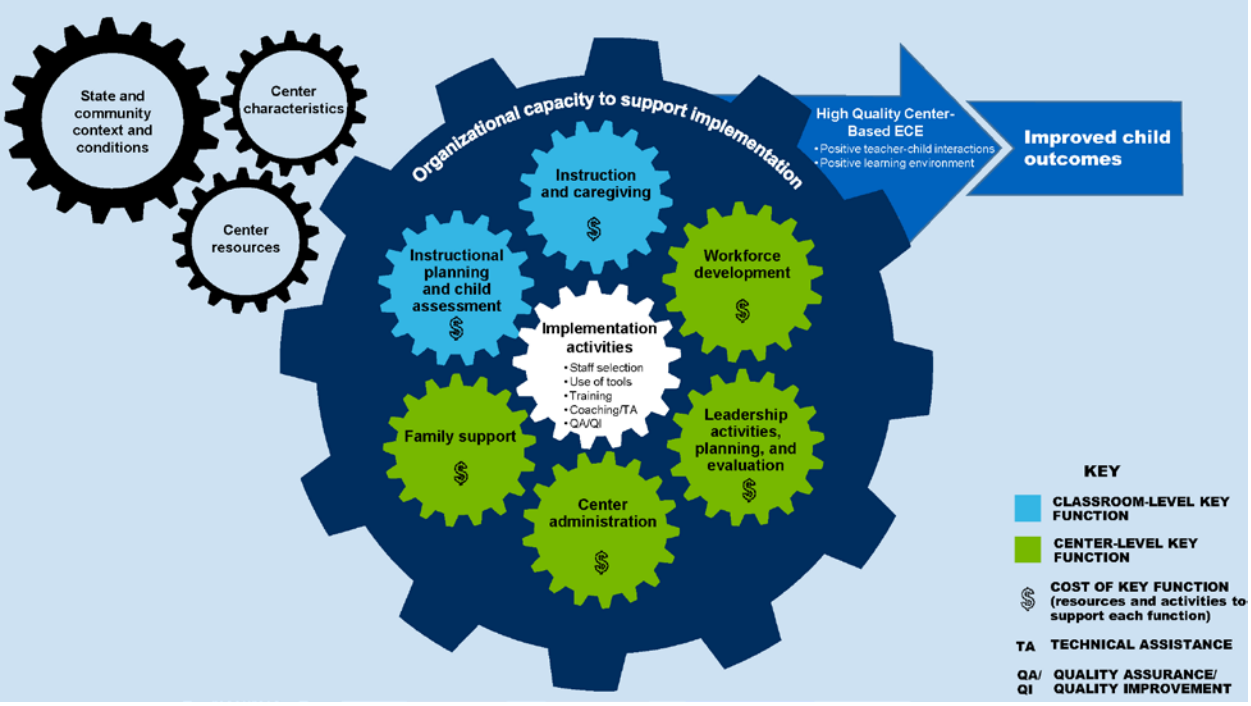
The gaps in measurement that we identified in the literature review reveal the need to align measures of implementation and cost to inform the direction of efforts to improve quality. The literature review reveals a need for disaggregated measures that can allow researchers to better assess how an ECE center functions and allocates resources in ways that may support quality. These disaggregated measures of implementation and costs can be used with measures of quality to examine the relationship between implementation, costs, and quality that has been difficult to pursue in the past.

A draft conceptual framework for the ECE-ICHQ project

The ECE-ICHQ project has a unique charge and an opportunity to bring together different literatures and ways of conceptualizing ECE quality, implementation, and costs. The project team, together with OPRE and with advice from members of a technical expert panel (TEP), developed a draft conceptual framework that will guide the approach to data collection and measurement development. The findings from this review led us to consider key functions that take place in ECE centers of all types (including community-based centers, Head Start programs, and public pre-kindergarten). These are functions (1) for which cost estimates can be produced and (2) that encompass the features identified by research or endorsed by experts as associated with quality. Information that is collected about program implementation and costs can be organized by these key functions.

In the draft framework (Figure ES.2), we present in one figure the key functions of an ECE center, what those functions cost, and how they are driven by a number of elements that influence whether and how a center can achieve high quality and improve children's outcomes. We elected to depict various elements of the framework as gears because they drive how the center operates to achieve quality. The blue and green gears in the middle represent the key functions that we expect to find in all ECE centers *may* contribute to quality, depending on how they are implemented. However, we expect the relative role of each function (and size of the circles) to vary from one ECE center to the next. The way each ECE center carries out each function is driven by: (1) the implementation activities that support the functions (the gear in the middle), (2) the organizational capacity in which they operate (the large gear that holds them), and (3) the resources and characteristics of the ECE center, as well as the state and community context (the three gears located to the left of the large gear).

Figure ES.2. Conceptual framework for assessing the implementation and cost of high quality early care and education (ECE-ICHQ)



Although it is outside the project's scope to measure the observed quality of ECE that is being provided, this framework shows that we will be measuring how classroom- and program-level functions are carried out in pursuit of high quality. The elements of high quality and improved outcomes for children are included on the right side of the framework to connect the measurement work to the intended goals of ECE centers.

Next steps

A phased approach to data collection in the Multi-Case Study will enable us to refine our definitions of key functions (as cost categories and for examining implementation activities) as well as to develop the items to be studied for the entire range of elements identified by this review as important to the measurement framework. These elements include the context in which the ECE center operates, the characteristics of the center (such as the ages of children served, funding sources, enrollment, etc.), and the center's organizational capacity, program features, and implementation activities. An iterative refinement process in each of the three phases will ensure that the resulting data collection tools and measures are useful to their intended audiences. The development process this project follows could inform similar future work focused on home-based settings but the measures produced through this project will not be applicable in family child care and home-based settings given substantial differences in structure and implementation of services in those settings compared to centers.

Together, the ECE-ICHQ implementation and cost measures should advance the field in its understanding of how centers invest in quality. The ECE-ICHQ measures will be field-tested for consistency and reliability in measurement across constructs and users. Once developed and tested, the ECE-ICHQ measures could be validated with a measure (or measures) of quality to ensure they do indeed capture variations in implementation and costs that are meaningful in explaining differences in quality.

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I. INTRODUCTION

Growing evidence about the benefits of high quality care for young children, particularly low-income children, has led to a strong commitment at the federal and state levels to improve the quality of early care and education (ECE). The Race to the Top Early Learning Challenge Fund (RTT-ELC) and the reauthorization of the Child Care and Development Fund (CCDF) emphasize improving quality across ECE settings and increasing access to and use of high-quality care especially by low income children. As a result, the use of Quality Rating and Improvement Systems (QRIS) has expanded across the states and there is a heightened interest in understanding the full costs of providing high quality ECE. Because of competing demands and limited resources, policymakers, administrators, and other key stakeholders need information to help them effectively target funds to increase quality in ECE. One challenge is the lack of consensus about how to specifically define quality. Quality includes many dimensions that can refer to the child, the teacher, the classroom setting, the organization, or the leadership. Regardless of the way quality is defined, existing measures of quality alone do not provide enough information to determine the areas within ECE provider organizations or centers that need investment of time, attention, or money to improve quality. In addition, existing cost analyses of ECE are not currently broken down at a level that shows how resources are allocated within ECE centers to support quality.

Measures of implementation and cost of ECE are needed for use and testing together with measures of quality to shed light on what it takes—in terms of activities, capacities, and money—to achieve high quality within a center. Implementation measures need to reflect what ECE centers are doing to educate and care for children and how they are doing it. Cost measures need to capture the way ECE centers allocate the resources they have to work with. The Office of Planning, Research and Evaluation (OPRE) in the Administration for Children and Families (ACF) at the U.S. Department of Health and Human Services (DHHS) launched a new project—Assessing the Implementation and Cost of High-Quality ECE (ECE-ICHQ)—to develop measures of implementation and cost. OPRE contracted with Mathematica Policy Research and its consultant Elizabeth Davis of the University of Minnesota to conduct the project. The measures will inform research, policy, and practice by improving understanding of variations in what centers do to support quality, their associated costs, and how resources for ECE may be better aligned with expectations for quality.

ECE-ICHQ Working Definitions Associated with Providing ECE Services

ECE center: A specific physical location where early care and education classroom-based services are provided to children ranging in ages from 0 to 5

ECE provider: Organization or agency that delivers ECE services

ECE program: All of the services provided at a particular ECE center

The project's goal is to create a technically sound, feasible, and useful instrument that will provide consistent, systematic measures of the implementation and costs of education and care in center-based settings that serve children from birth to age 5 ("ECE centers"). By "costs" we mean how much it costs to operate a center, including costs incurred by the center, as well as the value of in-kind contributions such as space or labor. We use the term "provider" when referring more broadly to an organization or agency that delivers ECE services. We use "program" to refer to all of the services delivered by a particular center.

To begin to build measures of implementation and costs that can complement measures of quality, this literature review addresses four research questions:

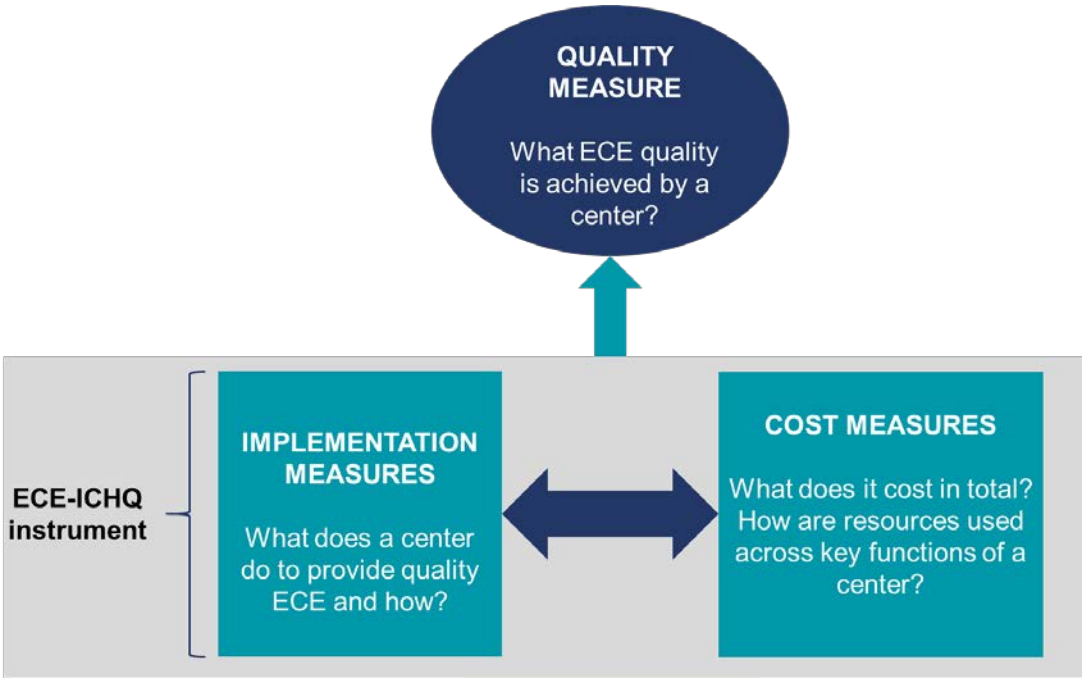
1. What are the features of high quality center-based ECE?
2. What are the key implementation factors necessary to deliver high quality center-based ECE services?
3. What factors directly contribute to increases or decreases in costs of providing high quality center-based ECE services?
4. What is the relationship between quality center-based ECE services and costs?

The current work will not specifically define or measure quality; however, program features that are hypothesized to support quality—as identified through the literature and expert opinion—will inform what is important to look for and take into account when measuring implementation and costs of quality ECE. Throughout this report, we discuss how quality is currently defined and measured in the field both at the classroom and program levels and draw implications for the project. Current measures of ECE quality largely focus on the classroom, but support for quality at the program level can also be an important element contributing to variations in the level of quality ECE centers can achieve. We will explore both aspects of quality in this literature review and development of measures. The unique contribution of the project is its use of an implementation science lens to measure differences in context, capacities, and implementation of quality features at the classroom and program level. Implementation science studies programs and practices that achieve their intended outcomes to identify programmatic and practitioner factors that are important for successful implementation (Berkel, Maurico, Schoenfelder, & Sandler, 2011; Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). These differences may be reflected in total costs and how resources are used within a center and, ultimately, in the level of quality achieved.

What will ECE-ICHQ measure?

ECE-ICHQ will create an instrument to measure implementation and costs of early care and education within centers serving children from birth to age 5. The project focuses on implementation to document what an ECE center is doing, and how, to support quality. The measures of implementation and costs will provide information on the relationship between existing capacities and activities to promote, support, or improve quality—and costs. The ultimate goal is to produce measures of implementation and costs that can be used with existing observational measures of quality to examine the variation in ECE center capacities and resources that can make a difference in the early childhood experiences of children (Figure I.1).

Figure I.1 ECE quality and ECE-ICHQ measures



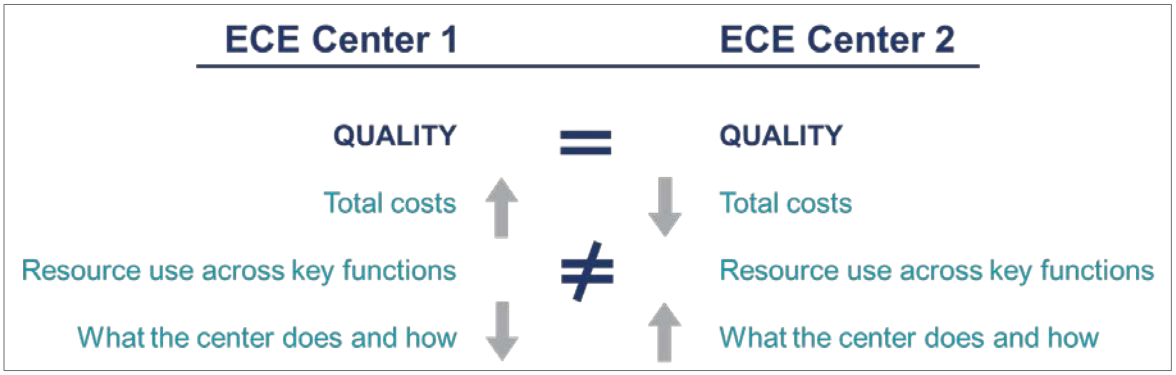
The ECE-ICHQ measurement approach will assign costs to key functions of an ECE center, such as workforce development, instruction and caregiving, and center administration, to describe the distribution of resources within total costs. ECE-ICHQ also will identify the resources associated with the specific organizational capacities and implementation activities that support quality. Producing cost measures by function can help us learn how resources are distributed within ECE centers in ways that may influence quality as well as a center's capacity to support quality.

The team drew from implementation science to create the framework for measuring implementation of ECE center functions (from classroom instruction and monitoring individual child progress to strategic program planning and evaluation). Implementation measures will capture what each center is doing to support quality and how these efforts are implemented. Measuring the "how" will involve understanding (1) the infrastructure in place to support quality (the staff, leadership, and organizational capacity to effectively implement quality); and (2) the prevalence and intentionality of implementation activities that may support quality (such as how a curriculum is selected and the training and coaching that support teacher practice quality in delivery).

The project team will develop and test implementation and cost measures together. By doing so, the measures will provide information to help practitioners, researchers, and policymakers understand the interplay among implementation capacity and resources that can affect the level of quality an ECE center can achieve. The measures will provide a way to examine what supports quality at any level of costs; adding implementation measures removes the assumption that quality will always cost more. For example, if Center 1 and Center 2 have the same levels of quality but Center 2 has lower costs, the ECE-ICHQ measures will identify what Center 2 is doing differently to achieve quality. The difference between the centers may be in

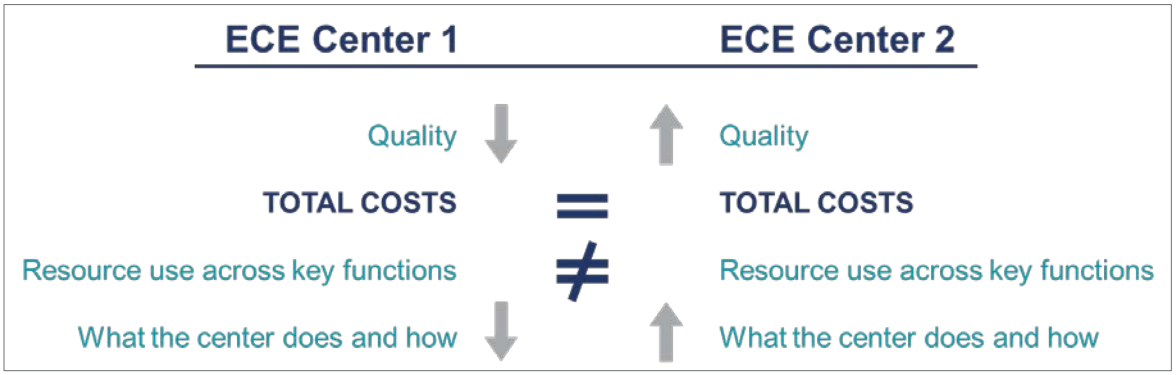
implementation--what the center does to support quality, and how, that also results in a different allocation of resources even within the same total costs (Exhibit I.1). Center 2 may invest more time and resources relative to Center 1 in child assessment, for example; staff conduct regular assessments with children and receive training on using the results to individualize instruction.

Exhibit I.1. ECE-ICHQ measurement scenario: quality is the same



The influence of implementation could similarly play out in a scenario in which Center 1 and Center 2 have the same costs but Center 2 achieves a higher level of quality. The ECE-ICHQ measures may again show that the difference stems from what Center 2 does differently to support quality—through what it does, how it does it, and how it allocates its resources (Exhibit I.2).

Exhibit I.2. ECE-ICHQ measurement scenario: total costs are the same



Purpose and methodology of the literature review

The literature review provides the initial base of information to address each research question. The purpose of the literature review is to inform development of a conceptual framework that will guide how the project will define and measure the implementation and costs that can support quality and synthesize findings about relationships among costs, quality, and implementation. The literature review documents the evidence for how the presence and interplay between the elements of the framework ultimately affect the ability to implement and support high quality services in center-based ECE. Based on findings from the literature review, the project will build the information needed to develop implementation and cost measures and test the resulting instrument for functionality by a range of users.

This review draws from 49 studies spanning three areas of research:

1. **Research on ECE quality** to help define high quality ECE and program features that support it in order to determine what to look for and measure in ECE centers
2. **Implementation science research** to identify the contextual and organizational factors and implementation activities most likely to produce the intended effects, such as improvements in quality
3. **Cost studies and cost analysis** to provide information on the methods and means to measure costs, particularly costs related to the implementation and/or quality of services (including services provided in sectors other than ECE)

The review consisted of two steps: (1) searching for relevant literature, and (2) summarizing key information about each study.

Step 1: Searching for relevant literature

We assembled an initial list of 28 resources, drawing from the project team's substantive expertise and experience in the relevant fields. The initial list included existing reviews related to ECE quality; studies related to implementation science, in general and applied to ECE specifically; and cost studies and measures. Appendix Tables A.1 and A.2 list the initial resources we reviewed.

The research team supplemented the initial lists of resources by (1) incorporating findings from recent or ongoing research studies, including the Head Start Leadership, Excellence, and Data Systems Project (Head Start LEADS); the Evaluation of Head Start Coaching; and the Early Childhood Teachers' Use of Child Progress Monitoring Project (CPM); (2) asking members of the project's technical expert panel (TEP) for their input on key resources to review; (3) soliciting feedback from colleagues during the 2014 meeting of the Child Care Policy Research Consortium; and (4) conducting a targeted search of electronic databases.

Table I.1 lists parameters used for the search of electronic databases (conducted in late 2014). To ensure that the review is current and feasible, we limited the literature search to studies conducted from 1994 through 2014. The electronic search yielded 174 studies. The study team developed criteria to screen references obtained from this search for relevance. The screening process eliminated studies that were off-topic (for example, ones that only pertain to the cost of child care to families, or studies that focus on cost-benefit analysis but did not itemize costs). We also eliminated duplicate references and references not published in English. This yielded a final list of 49 studies included in the review.

Table I.1. Search parameters

Keywords	Quality NEAR (childcare OR "child care" OR daycare OR "day care" OR "nursery school*" OR prekindergarten OR "pre-kindergarten" OR "pre-k" OR "nonparental care" OR "non-parental care" OR "early care" OR "early learning" OR "early childhood education" OR preschool OR "pre-school" OR "infant care" OR "toddler care") AND Cost* NEAR (childcare OR "child care" OR daycare OR "day care" OR "nursery school*" OR prekindergarten OR "pre-kindergarten" OR "pre-k" OR "nonparental care" OR "non-parental care" OR "early care" OR "early learning" OR "early childhood education" OR preschool OR "pre-school" OR "infant care" OR "toddler care") AND program* OR intervention* OR service* OR model* OR center* OR classroom* AND "child* develop*" OR "child* outcomes" OR "school readiness" OR effect* OR efficacy OR impact* OR fidelity AND Data OR study OR evaluat* OR analysis OR research OR trial OR experiment* OR implement*
Databases searched	Academic Search Premier; EconLit; Education Research Complete; ERIC; PsycINFO; Sage, Scopus, SocIndex with Full Text

Source: ECE-ICHQ project team.

Step 2: Summarizing key information about each study

Four members of the study team served as reviewers of the resulting literature. They documented key information from each study, including the characteristics of the study itself (such as type and design) and the context in which the study was conducted (type of setting, characteristics of the program and participants). Reviewers noted the key findings of each study, including whether and how associations among cost, quality, and implementation were assessed; measures used; data sources and respondents; frequency of data collection; cost categories examined; and unit of analysis (center versus classroom, per child hour, per labor hour**)**. Reviewers recorded information from each study using a common template, stored in a spreadsheet for easier sorting, tallying, and filtering of information (Table I.2). The study team revised the list of dimensions and the accompanying template as necessary after piloting it with an initial set of studies. Reviewers met weekly to discuss the studies and any questions they encountered.

Table I.2. Key dimensions summarized from each study reviewed

Key dimensions	Response categories/information required
Study background/context	
Study type	Empirical Theoretical Research synthesis, literature review, meta-analysis
Study design	Descriptive Implementation Correlational Experimental Quasi-experimental
Type of program services/interventions studied and population served	What services/interventions were provided? Who was the target population for the services/interventions?
Study setting(s)	Where were services/interventions provided? Describe country, region, state, city, and type of agency.
If ECE study, describe center characteristics.	For example: auspice, ages of children served
Cost measures and methods	
Estimates provided	Total, by category
Cost categories calculated and definitions of each	For example: expenditures, revenues, full costs, budgeted costs, start-up costs, infrastructure costs, in-classroom labor costs, administrative labor costs, other direct costs, professional development costs, indirect costs
Time frame covered/reference period for data collection	Day, week, month, year
Data sources	For example: financial records, director/staff interviews, budgets, grant applications, secondary data analysis (specify data set[s])
Unit of analysis	For example: per child care hour, per child, center level, per classroom
Adjustments for inflation	Yes/no; describe
Adjustments for geographic differences	Yes/no; describe
Adjustments for donated time and labor	Yes/no; describe
Factors affecting cost	
Center characteristics	Describe characteristics examined (for example, auspice, capacity, hours of operation, density of child care subsidy receipt), variation in characteristics, and whether costs varied by these characteristics.
Contextual factors	Describe features examined, variation in features, and whether costs varied by these features.
Quality features and practices	
Quality elements identified	
Structural quality elements	Elements recorded as discussed within report. For example: group size, child/adult ratio, staff education
Process quality elements	Elements recorded as discussed within report. For example: professional development, curriculum
Time frame covered/reference period	Day, week, month, year
Data sources	For example: staff interviews, direct observation
Unit of analysis	For example: program, classroom

Key dimensions	Response categories/information required
Factors affecting quality	
Center characteristics	Describe characteristics examined (for example, auspice, capacity, hours of operation, density of child care subsidy receipt), variation in characteristics, and whether quality varied by these characteristics
Contextual factors	Describe features examined, variation in features, and whether quality varied by these features
Associations of quality factors with child outcomes	Describe whether associations between the quality feature or practice and child outcomes were examined and the results of the analysis. Include discussion of mediators or moderators, if examined.
Associations between quality factors	Describe whether associations between the quality features and/or practices were examined and the results of the analysis. Include discussion of mediators or moderators, if examined.
Implementation frameworks	
Number, type, and service area of studies reviewed for framework	Describe studies that informed development of the framework (how many, the type of study, service area covered, other key features); note if framework was theoretical and not empirically based
Practitioner factors	Describe factors or characteristics each framework identifies at the practitioner level.
Organizational factors	Describe factors each framework identifies at the organizational level as contributing to the general capacity for implementation.
Contextual factors	Describe external factors identified/included in framework that influence implementation.
Implementation factors identified	Describe the inputs and activities included in framework identified as contributing to successful implementation of interventions.
Associations Among Cost, Quality, and Implementation	
Associations between cost and quality	Describe whether associations were examined and the results of the analysis. Include discussion of mediators or moderators, if examined.
Associations between quality and implementation	Describe whether associations were examined and the results of the analysis. Include discussion of mediators or moderators, if examined.
Associations between cost and implementation	Describe whether associations were examined and the results of the analysis. Include discussion of mediators or moderators, if examined.

Source: ECE-ICHQ project team.

The project team identified key themes and gaps in the literature through an analysis of the findings gathered to address the ECE-ICHQ research questions. We produced an annotated outline describing findings and shared it with the ECE-ICHQ TEP. During the first in-person TEP consultation, in March 2015, we discussed their feedback on the literature review and its implications for the project. Four members of the TEP also provided feedback on a full draft of the review. This report summarizes the findings from the literature review and incorporates the TEP input.

Road map to the report

In this report, we present the literature review findings organized to address each of the four research questions. In Chapter II, we summarize findings about the features of high quality ECE. In Chapter III we use evidence from the implementation science literature to identify key implementation factors necessary to deliver high-quality services. In Chapter IV, we summarize the factors that contribute to increases or decreases in costs based on the components of existing cost measures and their use in the studies included in the review, and in Chapter V, we describe the relationship between quality ECE services and costs found in the studies reviewed. We conclude in Chapter VI with a discussion of the implications of the literature review findings for project activities and for the early childhood field, and we present a draft conceptual framework that will guide the initial data collection.

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II. WHAT ARE THE FEATURES OF HIGH QUALITY ECE?

Extensive research has shown the benefits for young children of high quality ECE programs, particularly those provided in formal child care or preschool centers. These benefits include short-term improvements in social skills, fewer behavior problems, and improved language, reading, and math skills, as well as lasting benefits into adulthood, such as more years of education and higher earnings (Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Burchinal, Zaslow, & Tarullo, in press; Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002; Schweinhart et al., 2005; Vandell, Belsky, Burchinal, Vandergrift, & Steinberg, 2010). There is increasing evidence that children's experiences during the first years of life are fundamental for early brain development and subsequent growth in cognitive and behavioral skills that affect long-term well-being and success (Garner et al., 2012; Harvard Center on the Developing Child, 2007; Heckman, 2011; Shonkoff, Boyce, & McEwen, 2009; Shonkoff et al., 2012; Ursache, Blair, Stifter, & Voegtline, 2013).

This chapter draws primarily on seven sources—six recent research reviews and one meta-analysis—pertaining to the effects of ECE on child outcomes and specific features of ECE programs that have been linked to quality (Table II.1). In some cases, we sought out the original source cited in reviews to obtain additional details about study findings. We also incorporate information from literature reviews that focus on specific features of quality ECE (for example, a literature review of coaching) when they were available.

Table II.1. Resources reviewed pertaining to ECE quality, by type of program considered, and developmental period examined

		Types of ECE programs considered			
	Type of resource	Community-based centers	Head Start or Early Head Start	State pre-kindergarten	Child ages examined
Barnett, 2011	Research review	X	X	X	0–5
Boller, Tarrant, & Schaack, 2014	Research review	X	X	X	0–5
Camilli, Vargas, Ryan, & Barnett, 2010	Meta-analysis	X	X	X	3–5
Pianta, Barnett, Burchinal, & Thornburg, 2009	Research review	X	X	X	3–5
Minervino, 2014	Research review	X	X	X	3–5
Yoshikawa et al., 2013	Research review	X	X	X	3–5
Zaslow et al., 2010	Research review	X	X	X	0–5

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Note: Cells marked with an "X" indicate the feature was examined.

ECE = early care and education

All seven sources reviewed evidence, to the extent it was available, pertaining to different types of center-based ECE programs, including community-based centers, Head Start or Early Head Start, and state pre-kindergarten programs. These studies linked features of ECE to child

outcomes (such as improved school readiness) and/or classroom practices (such as instructional and emotional support as measured by classroom observation). Four of the sources focused on ECE programs for 3- to 5-year-olds only (Camilli et al., 2010; Pianta et al., 2009; Minervino, 2014; Yoshikawa et al., 2013).[1] The meta-analysis and two of the research reviews drew primarily from studies that used experimental or quasi-experimental designs (Barnett, 2011; Camilli et al., 2010; Yoshikawa et al., 2013). The remaining resources also considered correlational studies, while emphasizing their limitations (Boller, Tarrant, & Schaack, 2014; Pianta, Barnett, Burchinal, & Thornburg, 2009; Minervino, 2014; Zaslow et al., 2010).

Features of ECE programs that support quality

Rigorous evaluations of model preschool programs (such as the Perry Preschool program) and large-scale state programs (such as Oklahoma's Universal Prekindergarten program) have produced sizable, positive outcomes for children and have been used as a basis for identifying program features that are important for quality. However, it is difficult to assess the isolated effects of specific program features on quality, or children's outcomes, based on ECE program evaluations because each feature is part of the broader set of features that defines a particular program. For example, without comparing different aspects of the program through a rigorous research design, it is not possible to know which features of Perry—its teacher training, curriculum, child assessment, length of services offered, or something else alone or in combination—drove the observed impacts on child outcomes.

Much of the information that does exist about the relationship between specific program features and quality, or children's outcomes, is based on correlational studies, making it challenging to draw strong conclusions about their relative importance. In correlational studies, there is always a possibility that the differences (or lack thereof) that we see between classrooms or programs may be due to other characteristics that have not been documented or observed. Nevertheless, we review this evidence because it provides the best available information about program features that support high-quality ECE.

In the following sections, we discuss findings from the reviewed resources pertaining to specific ECE program features, as listed in Table II.2. To the extent that information was available, we describe associations between program features and child outcomes. We also describe associations between program features and observed teacher-child interactions because supportive and stimulating teacher-child interactions have been shown through research to be key indicators of ECE quality (Hamre, 2014; Pianta et al. 2009; Yoshikawa et al., 2013).

Some program features have a limited research base, but are hypothesized to be important by experts. We identified these emergent features through the resources we reviewed[2] and by

[1] Currently, there is limited evidence about what constitutes high quality for infants and toddlers. However, ongoing work, such as the Learning about Infant and Toddler Early Education Services (LITES) project sponsored by the Office of the Assistant Secretary for Planning and Evaluation (ASPE) in DHHS, is examining this question.

[2] For example, Boller, Tarrant, and Schaack (2014) identified features that have been targeted in quality improvement initiatives in the United States and in other countries. Minervino (2014) identified essential program features based on characteristics of pre-kindergarten programs that have been implemented at scale and shown to improve child outcomes.

examining existing ECE program standards. Existing ECE program standards reflect features that experts in the ECE community have endorsed as important. In our discussion of each program feature, we also describe relevant state licensing requirements, state quality rating and improvement (QRIS) and prekindergarten standards, and accreditation standards of the National Association for the Education of Young Children (NAEYC), to illustrate how each feature is currently operationalized in practice and policy.

Table II.2. ECE program features examined in research reviews of ECE quality

	Barnett, 2011	Boller et al., 2014	Camilli et al., 2014	Pianta et al., 2009	Minervino, 2014	Yoshikawa et al., 2013	Zaslow et al., 2010
Group size and adult-child ratio		X		X	X	X	X
Staff education and credentials		X		X	X	X	X
Staff compensation and benefits		X			X	X	
Physical environment and materials						X	
Training and professional development		X		X	X	X	
Curriculum		X		X	X	X	
Assessment and evaluation	X	X		X	X	X	
Leadership and administrative practices		X			X		

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Note: Cells marked with an "X" indicate the feature was examined, and blank cells indicate the feature was not examined.

ECE = early care and education.

Group size and adult-child ratio. Findings across the five reviews that looked at how group size (the total number of children in a classroom) and adult-child ratio (the rate of adults to children in a classroom) are associated with outcomes indicate that results have been inconsistent. For example, Zaslow et al. (2010) found three studies in which smaller group size was associated with positive social and cognitive outcomes.[3] However, they also cite one study that did not find a significant association, and another study that found positive outcomes associated with larger group size. In the same review, Zaslow et al. (2010) found significant associations between lower adult-child ratio and child outcomes in six studies, but no significant association in one study.

[3] All three studies included center-based settings, but some may also have included home-based settings.

One review points out that programs for preschool-aged children that have yielded positive impacts typically have adult-child ratios better than 1:10 (Minervino, 2014). Several reviews noted that positive associations have been found between group size and adult-child ratios and the quality of interactions between children and teachers (Boller et al., 2014; Pianta et al., 2009; Zaslow et al., 2010). For example, a study of approximately 700 4-year-olds in a variety of nonmaternal care settings found a significant positive association between adult-child ratio and the quality of caregiving (as captured by an observational measure of caregiver sensitivity, stimulation of cognitive development, and classroom emotional climate); this, in turn, was significantly associated with children's cognitive and behavioral outcomes (NICHD Early Child Care Research Network, 2002).It is important to note that all of the studies reviewed were correlational; none used an experimental or quasi-experimental design to test the causal effect of this feature.

States vary widely in their licensing requirements with regard to group size and ratios, and some QRIS require smaller group sizes and better ratios at higher rating levels. In 2011, across states that license child care centers, adult-child ratio requirements ranged from 1:7 to 1:15 for preschool classrooms with 3-year-olds and 1:8 to 1:20 for classrooms with 4-year-olds (National Center on Child Care Quality Improvement, 2013). Group size requirements ranged from 14 to 30 for preschool classrooms with 3-year-olds and 20 to 36 for classrooms with 4-year-olds (National Center on Child Care Quality Improvement, 2013). For children under 3, adult-child ratios ranged from 1:3 to 1:12, with the lowest ratios for the youngest children (National Center on Child Quality Improvement, 2013). Similarly, group sizes for this age group ranged from 6 to 22, with the smallest group sizes for the youngest children (National Center on Child Quality Improvement, 2013).

Of the 38 states with a QRIS, 17 have group size standards beyond basic licensing requirements (Build Initiative & Child Trends, 2014). Professional organizations such as the NAEYC recommend group sizes of 20 children or fewer and maximum ratios of 1:9 or 1:10, depending on the age of the child (Pianta et al., 2009). Most state pre-kindergarten programs have group sizes of 20 or lower and adult-child ratios of 1:10 or better (Barnett et al., 2013). Similarly, the Head Start Program Performance Standards (Administration for Children and Families [ACF], 2015) require group sizes of 13 to 20 in center-based settings, depending on the ages of children served. All Head Start classes are required to be staffed by at least two adults (ACF, 2015).

Staff education and credentials. The evidence pertaining to staff education and credentials is mixed. Five research reviews addressed formal teacher education/credentialing (Boller et al., 2014; Pianta et al., 2009; Minervino, 2014; Yoshikawa et al., 2013; Zaslow et al., 2010) but none addressed director education and credentials. Although some studies have found better outcomes among children with more highly educated teachers, none of these studies has implemented a rigorous design to test whether a causal effect exists. Two of the four reviews considered whether more highly educated teachers engage in more supportive and/or stimulating interactions with their students than their less educated peers—this was found to be true in some studies but not in others. For example, Early et al. (2007) used data from seven large-scale studies of preschool programs to investigate whether teacher education is related to classroom quality and academic outcomes. They found a positive association between teacher education (measured by whether the teacher has a bachelor's degree) and prereading skills in one data set,

and math skills in another data set. They did not find a significant association between teacher education and receptive language in any of the data sets. In terms of classroom quality, they found a significant positive association with teacher education in two data sets, and a negative association in another.

Staff education levels are another common target of regulation, and increased requirements are seen as a way to improve quality. Most state-funded preschool programs require lead teachers to have a bachelor's degree (Barnett et al., 2013). Increasingly, Head Start teachers also are required to have similar qualifications. By September 30, 2013, federal regulations required at least half of Head Start teachers to have either a bachelor's degree or an advanced degree in early childhood education, or a bachelor's or advanced degree in any subject, along with experience relating to early childhood education (Office of Head Start, 2008). In 2011, 57 percent of all Head Start preschool teachers met these qualifications (Office of Head Start, 2015). In 2014, Program Information Report (PIR) data suggested that 71 percent of all Head Start center-based preschool teachers met these qualifications (Office of Head Start, 2015). As part of most QRIS, center director education and qualifications are also part of the rating system, with higher ratings awarded based on director education (including graduate work in early childhood development) (Build Initiative & Child Trends, 2014).

Staff compensation and benefits. ECE quality has been hypothesized to be linked to programs' ability to attract and retain skilled staff through competitive compensation and benefits packages. Factors such as wage supplements, retention and transfer bonuses, and loan forgiveness are also thought to influence staff retention (Boller et al., 2014). However, the causal effects of staff compensation and benefits have not been evaluated (Boller et al., 2014; Yoshikawa et al., 2013). As of October 2014, 17 QRIS included standards in their rating systems pertaining to staff benefits such as health insurance, paid leave, and differentiated salary scales (Build Initiative & Child Trends, 2014). Programs that have been rigorously evaluated and shown positive outcomes have tended to provide above-average salaries to teachers (Yoshikawa et al., 2013; Minervino, 2014).

Physical environment and materials. The literature has not extensively examined the unique contribution of the physical environment. Only one of the sources we reviewed noted evidence indicating that the availability of varied materials to support classroom activities is positively associated with child outcomes (Yoshikawa et al., 2013). However, licensing regulations require programs to maintain a safe and clean space for children and staff. Beyond health and safety concerns, high quality settings are expected to provide environments that are developmentally appropriate and well equipped to facilitate children's learning. It is hypothesized that a well-designed space helps to keep children more engaged and enables better interactions between children and their teachers and peers. An ECE center's physical environment and materials are assessed as part of the NAEYC accreditation process, and nearly all QRIS include standards pertaining to furnishings, room arrangements, play space and equipment, and learning materials (National Association for the Education of Young Children, 2015; Build Initiative & Child Trends, 2014).

Training and professional development. Several reviews cited the ongoing training and professional development of teachers as a key program feature that supports quality. Existing evidence indicates that participating in training or workshops to obtain credits does not result in

higher quality. For example, an experimental evaluation of the Program for Infant/Toddler Care (PITC), an on-site training program for infant and toddler caregivers, did not find any statistically significant effects on program quality or child outcomes (Weinstock et al., 2012). Researchers note that trainings may be more likely to produce positive results, if the content of the training is focused and aligned with specific skills or desired outcomes in teachers or children (Pianta et al., 2009; Minervino, 2014; Yoshikawa et al., 2013). In addition, there is some evidence that one-on-one supports for teachers in the form of coaching or mentoring have positive associations with, or impacts on, child outcomes. For example, an experimental study of the My Teaching Partner (MTP) program compared pre-kindergarten teachers who received training through web-based videos to another group of pre-kindergarten teachers who received individual consultations in addition to the standard training. Results indicated that the teachers who received individualized consultation had more positive interactions with students and that students in those teachers' classrooms showed greater gains in language skills (Pianta et al., 2008; Mashburn et al., 2010).

Many states, as part of their licensing regulations, require child care center staff to complete additional training each year, although the training typically focuses on health and safety issues (National Association for Regulatory Administration, 2014). QRIS standards also often include training requirements for teachers. Twenty-eight QRIS include standards pertaining to in-service teacher training, with topics ranging from business practices to domains of child development (Build Initiative & Child Trends, 2014).

Curriculum. Another program feature that has been hypothesized to be linked to quality is the implementation of developmentally-appropriate curricula. Findings from four reviews indicate that curriculum implementation can have a positive impact on child outcomes. The evidence suggests that how a particular curriculum is implemented matters just as much as which specific curriculum is used. Yoshikawa et al. (2013) note that the evidence supporting curricula that focus on particular developmental domains is particularly strong relative to global curricula that aim to address several domains simultaneously. The evidence on which specific curricula produce improved child outcomes is limited. Only a few curricula have been found to be effective, and even fewer have been implemented at scale or been shown to have replicable effects across several studies. The What Works Clearinghouse (WWC) has reviewed 16 curricula designed for preschool-aged children. Of these 16 curricula, 8 were found to have positive effects compared to a specific curriculum or multiple, unspecified curricula. These eight curricula all focused on specific developmental domains (math or reading), and only three of the eight were supported by several studies and/or large samples of children.[4] Some of the most successful curricula that have been identified incorporate intensive training components for teachers, as well as assessments for monitoring children's progress (Yoshikawa et al., 2013).

The proposed revisions to the Head Start Program Performance Standards includes enhanced standards for curricula (Federal Register, 2015). According to the QRIS Online Compendium (Build Initiative & Child Trends, 2014), 31 of 38 QRIS include requirements pertaining to curriculum in their standards for center-based settings. The stringency of requirements and the rating level at which curriculum standards are required to be met varies by system, but most

[4] We obtained this information using the "Find What Works" tool on the WWC website (http://ies.ed.gov/ncee/wwc/).

QRIS require use of a curriculum that is developmentally appropriate.[5] Some QRIS have identified specific curricula that meet their requirements, such as the Creative Curriculum for Preschool (in 10 QRIS) and the High Scope Preschool Curriculum (in 9 QRIS) (Build Initiative & Child Trends, 2014).

Assessment and evaluation. Ongoing assessment and evaluation to inform instruction and decision making are also believed to support program quality. Several of the resources we reviewed stated the importance of assessment and evaluation (Table II.4); however, they all indicated that the research base on implementation and efficacy of these practices is limited. Recent literature reviews on the use of data for continuous quality improvement and assessment to individualize instruction in ECE settings also concluded that the research base in this area is lacking (Akers et al., 2014; Derrick-Mills et al., 2014). A signal of the ECE field's growing recognition of the role of child assessment in improving practice is that a majority of existing QRIS (25 of 38) include standards pertaining to the use of child assessments. Increasingly child assessments are included in curriculum planning and individualization of instruction and provision of additional support services (Build Initiative & Child Trends, 2014).

Leadership and administrative practices. One question for ECE is whether the ways that agencies manage administrative functions and supervise staff influence ECE quality. Much of the research supporting the associations between leaderships and administrative policies and practices and quality comes from fields outside of ECE. For example, a recent literature review drew from studies on educational leadership and management, health care management, nonprofit management and leadership, public management and leadership, and organizational development and learning to formulate recommendations for the ECE field (Derrick-Mills et al., 2014). Among the conclusions from that review is that effective leaders transform the culture of an organization by serving as role models for a particular behavior, delegate and motivate staff, communicate expectations clearly, and demonstrate interest in continuous improvement (Derrick-Mills et al., 2014). Two of the resources we reviewed discussed the role of leadership and administrative practices in ECE settings. Minervino (2014) described how leaders of exemplary pre-kindergarten programs built a culture of high expectations and continuous improvement, and recruited and retained staff who buy into and reinforce that culture throughout the organization. Boller et al. (2014) noted that some quality improvement initiatives in ECE have focused on this area but did not find any research that has investigated their associations with outcomes for children or improved classroom practices.

Key findings and implications for ECE-ICHQ

Four of the nine features that were discussed in the resources we reviewed—group size and adult-child ratio, staff education and credentials, environment and materials, and training and professional development—have been demonstrated to be associated with both teacher-child interactions and child outcomes in at least some studies. Table II.3 summarizes the level of evidence for each of the nine program features. Curriculum has been shown to be associated with child outcomes; however, the reviews that reported on these associations did not describe any

[5] Typically, the curricula are assessed based on their alignment with states' Early Learning Standards. Early Learning Standards are written guidelines that states have produced identifying skills and knowledge that children should possess before they start kindergarten.

studies that examined associations between curriculum and teacher-child interactions. Three features—staff compensation and benefits, assessment and evaluation, and leadership and administrative practices—have a limited evidence base in terms of associations with child outcomes or teacher-child interactions because they have not been tested to date, according to the resources we reviewed.

Table II.3. Level of evidence for features of ECE programs (associations with targeted outcomes and practices)

	Associated with child outcomes	Associated with observed teacher-child interactions	Endorsed by experts
Group size and adult-child ratio	X[a]	X[a]	X
Staff education and credentials	X[a]	X[a]	X
Staff compensation and benefits			X
Physical environment and materials	X[a]	X[a]	X
Training and professional development	X[a]	X[a]	X
Curriculum	X[a]		X
Assessment and evaluation			X
Leadership and administrative practices			X

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Note: This table summarizes levels of evidence for each quality element based on association with outcomes and practices as reported in reviewed literature. In the first two columns, cells marked with an "X" indicate there was evidence of an association, and blank cells indicate that no evidence of an association was reported.

[a] Some null findings also were reported.

ECE = early care and education

The mixed nature to the findings overall makes it difficult to draw conclusions for the ECE-ICHQ project. Most of the evidence of the association between specific program features, program quality, and child outcomes is correlational and few studies have been able to speak to the combined effects of program features. There is at least some evidence that specific program features may not be sufficient on their own to support quality and child outcomes, but may be essential for facilitating quality. For example, better adult-child ratios may increase individual children's exposure to responsive and stimulating caregiving, enhancing the effect of this program feature on children's functioning. Another example is that to implement some types of intensive curricula a certain level of pre-service training may be necessary.

The primary implication for this work is that measurement needs to start broad. Programs may be able to achieve desirable outcomes with different combinations of features. We do not expect that all of the features identified above will be present within every program in the same way. The ECE-ICHQ team will work to keep the measurement development process as useful for practice as possible by including a range of program features that may support quality, whether or not they have already been empirically tested in the research literature. As discussed, several program features (such as leadership and administrative practices), hypothesized to be important to quality but yet to be established in the research literature, have already been adopted

by the ECE community, as shown by their inclusion in NAEYC accreditation and QRIS standards. These and others recommended by the TEP and emerging from the literature review will be considered for inclusion in the measure.

Another important implication for this project is that there is likely more than one pathway to high quality ECE. For example, some programs may achieve high quality with lower educated staff by accessing ongoing coaching and mentoring. Other programs may hire staff with more advanced qualifications and trainings and invest less in ongoing training. Different pathways to similar outcomes may come from differences in implementation that affects *how* program features are put into operation and supported. While regulations or standards such as those to achieve NAEYC accreditation or a QRIS rating can capture the existence of specific features, there is little information on how features are implemented or the infrastructure and environment that exist to support implementation. The next chapter discusses the use of implementation science frameworks to examine the "how"—how do organizational capacity and specific activities support the implementation of program features in ways that support quality.

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III. WHAT DOES IT TAKE TO IMPLEMENT HIGH QUALITY ECE?

To understand and measure what it takes to implement quality effectively, the team must identify key factors that contribute to the capacity to support and implement quality within an ECE center. Factors related to implementation can include strengths, as well as hidden barriers, in an ECE center's capacity to support high quality ECE.

The project team looked at the literature on implementation science to consider how to measure the general capacity of ECE centers to implement program features that may support high quality ECE. Implementation science defines a core set of programmatic and practitioner factors that are common among programs and practices that achieve their intended outcomes (Berkel, Maurico, Schoenfelder, & Sandler, 2011; Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). From this literature, the team will identify implementation factors and implementation activities that can be measured across a variety of ECE settings, contexts, and a range of program features that may account for some of the variation in quality and costs.

Implementation Terms

Implementation factors: Potential influences on implementation that are present within the center itself (practitioner and organizational factors) and the community and state within which it operates (contextual factors).

Implementation capacity: The sum of implementation factors that can help support or inhibit implementation

Implementation activities: Actions taken within the center to implement specific program features.

A growing body of research stresses the importance of general organizational capacity in supporting implementation of a program or practice to achieve good results (Hulleman, Rimm-Kaufman, & Abry, 2013; Wandersman et al., 2008). General capacity is defined by factors at the organizational, individual practitioner, and community levels that may increase the likelihood that *any* program or practice can succeed in a given organization and context (Flaspohler et al., 2008).

For this section of the review, we examined eight frameworks that convey the core principles and factors common to implementation of evidence-based programs and practices. The eight frameworks were developed through literature reviews of empirical studies and theory development across a variety of service areas (presented in Table III.1). Each framework presents an approach to the measurement and evaluation of implementation of evidence-based programs to guide key stakeholders in translating research to practice. The frameworks are presented in order from bigger-picture conceptual models to those that encompass specific "how to" steps or recommendations.

Table III.1. Research base for implementation frameworks

Framework	Research base
Conceptual Model for Considering the Determinants of Diffusion, Dissemination, and Implementation of Innovation in Health Service Delivery and Organizations (Greenhalgh, Robert, MacFarlane, Bate, & Kyriakdou, 2004)	Extensive, systematic review of 495 research studies (213 empirical and 282 non-empirical), primarily in health care, conducted for the United Kingdom Department of Health
Framework for Implementation; Core Implementation Components; Multilevel Influences on Successful Implementation (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005)	Review of research literature on implementation of practices in programs across agriculture, business, child welfare, engineering, health, juvenile justice, manufacturing, medicine, mental health, nursing, and social services. Ultimately, 377 articles were identified as significant; 22 of which reported results of experimental analyses. Many of the articles focused on health.
Interactive Systems Framework (ISF) for Dissemination and Implementation (Wandersman, Duffy, Flaspohler, Noonan, Lubell, Stillman, …, & Saul, 2008)	A framework to support the translation from research to practice of evidence-based programs developed through working group discussions of experts undertaken by the Child Maltreatment and Youth Violence areas within the Division of Violence Prevention at the Centers for Disease Control and Prevention.
Consolidated Framework for Implementation Research (Damschroder, Aron, Keith, Kirsh, Alexander, & Lowery, 2009)	A meta-theoretical framework developed through a review and synthesis of 19 existing theories or models of influences on implementation.
Framework for Effective Implementation (Durlak & DuPre, 2008)	Review of 81 studies including quantitative or qualitative data on factors affecting implementation to identify 23 factors that were common among at least 5 studies and produced consistent findings from rigorous analyses, when available.
Quality Implementation Framework (Meyers, Durlak, & Wandersman, 2012)	Meta-framework that identifies four implementation phases and 14 critical "how-to" steps that are associated with quality implementation built through a review of 25 frameworks built from reviews of implementation studies of evidence-based programs.
Evidence-Based System for Innovation Support (EBSIS) (Wandersman, Chien, & Katz, 2012)	Build out of the ISF to specify components that bridge a support system to a delivery system in implementation; draws from similar research base as ISF.
Active Implementation Frameworks for Program Success (Metz, Halle, Bartley, & Blasberg, 2013)	Operationalization of Fixsen et al. (2005) framework that defines implementation drivers and recommended practices for each based on commonalities among successfully implemented programs.

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Practitioner, organizational, and contextual implementation factors

Studies have observed variability in implementation of a program or practice across providers (Durlak & DuPre, 2008). Implementation is never perfect and runs along a continuum from full adoption and assimilation of a program or practice within an organization to limited or non-use. Each framework shows that factors related to the practitioner, organization, and broader context influence the implementation of programs and practices in ways that can affect outcomes. Variation in these factors, for example, may account for variation in quality in ECE centers, even when the program features or costs are similar.

Practitioner, organizational, and contextual factors form the basis of an infrastructure—or general capacity--that supports successful implementation of any program or practice by building a healthy, vibrant, and cohesive environment within an organization and among practitioners. Although some of the factors may not be directly reflected in costs (or may have costs that are difficult to assess), they are important to capture as part of the general capacity an ECE center has to implement program features.

Practitioner factors. The match between the qualifications, skills, and competencies of the practitioner and those needed to deliver a program or practice is a central ingredient in implementation. As discussed in the previous chapter, teacher qualifications and skills are also a feature of ECE quality. Although not often studied, director qualifications and skills are expected to be important to quality and are included in most quality standards such as QRIS or accreditation standards. This practitioner-level factor of implementation capacity is represented in six of the seven frameworks in Table III.2.[6] Also common across the frameworks is the extent to which practitioners feel an investment in the goals of a practice, believe that the proposed methods will help achieve the goals, and are convinced that they can make a difference.

Table III.2. Practitioner factors in implementation frameworks

Practitioner factors	Greenhalgh et al., 2004	Fixsen et al., 2005	Wandersman et al., 2008	Damschroder et al., 2009	Durlak & DuPre, 2008	Meyers et al., 2012	Metz et al., 2013
Qualifications, skills, and competencies to provide the innovation	X	X	X		X	X	X
Buy-in and belief in intended goals	X	X	X	X	X	X	
Self-efficacy and motivation	X	X	X	X	X	X	
Relationship and degree of commitment to organization				X			
Professionalism: involvement / participation in professional organizations and activities	X						
Low turnover	X			X			

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Note: Wandersman et al., 2012 is not included because it focuses only on capacities that are direct activities to put an innovation into practice.

The Consolidated Framework for Implementation Research (CFIR) discusses the perceptions that staff hold about their role in, and commitment to, an organization as important

[6] Wandersman et al., 2012 is not included in Table III.2.

to the success of implementation (Damschroder et al., 2009). These perceptions can be assessed through their organizational citizenship behavior, such as how much extra work they are willing to take on and whether they speak well of the organization. Of particular relevance for the ECE area, Damschroder et al. (2009) discuss emotional exhaustion as part of the larger construct of a person's relationship with the organization; burnout may negatively influence implementation.

Findings based on two of the frameworks found that professionalism of practitioners, as reflected in their engagement in extracurricular professional activities and associations, had a positive influence on the successful implementation of a practice, as did low turnover among practitioners (Greenhalgh et al., 2004; Damschroder et al., 2009).

Organizational factors. Table III.3 summarizes the organizational factors identified within each of seven frameworks as important for building the capacity to effectively implement programs or practices that support positive outcomes.[7] While recognizing that the factors are not distinct and could be included in multiple categories, the team has organized the factors into three categories: (1) openness to change, (2) work climate, and (3) supports and infrastructure. The number and range of factors vary across frameworks, but two are specifically included in each framework: (1) understanding of the perceived need for the program or practice within the community (and organization) to benefit the population served, and (2) clear organizational leadership and responsibility for implementing the program or practice.

The differences across the frameworks may be attributed, in part, to the different purposes and goals of each and the related literature from which they draw. For example, the Greenhalgh et al. (2004) framework is the most comprehensive, drawing on implementation findings from nearly 500 studies, but primarily from the field of health service delivery. Organizational factors unique to the Greenhalgh et al. (2004) framework include (1) good managerial relations that, with overall leadership, risk-taking climate, and use of data, create an environment receptive to change; and (2) the size and structure of an organization that can make it better prepared to assimilate new innovations. The CFIR builds on Greenhalgh et al. (2004); while it shares many factors, it also specifies aspects of the "inner setting" that supports implementation. For example, the CFIR discusses the importance of a learning climate that values and uses input from a range of staff as well as a climate in which a sense of team or community exists among staff (Damschroder et al., 2009).

Some frameworks are more detailed in defining the organizational factors because they focus on conveying information about how to accomplish (or evaluate) effective implementation. For example, the Metz, Halle, Bartley, and Blasberg (2013) framework that builds from the Fixsen et al. (2005) review specifies the different types of leadership—technical and adaptive—necessary for building capacity to support programs or practices. Durlak and DuPre (2008) and Meyers, Durlak, and Wandersman (2012) specify the need for an accountability plan that lays out tasks and time frames in the implementation process as important to the support of effective program outcomes.

The CFIR points out that organizational factors (or attributes of the inner setting) can be assessed readily through tangible indicators such as policies, procedures, and incentive or reward

[7] Wandersman et al., 2012 is not included in Table III.3.

systems for staff (Damschroder et al., 2009). For example, a learning environment that also allows for risk taking can be reflected in rewards to staff (through performance reviews, promotions, and salary increases) for contributing toward the adoption and implementation of valued practices.

Although all the frameworks signal the importance of organizational factors, they provide no guidance on the unique contribution of one factor over another or how to identify the composition of factors that may prove most effective in supporting positive outcomes. The literature on which the frameworks are based does not provide insight into the level, or potential thresholds, at which factors may be most influential, or in what combination.

Table III.3. Organizational factors in implementation frameworks

Openness to change
Perceived need and benefits of innovation (7)
Ability to integrate new programming by adjusting or developing policies and procedures or reducing administrative barriers (5)
Risk-taking climate supported and encouraged (4)
Learning climate that values and uses input from range of staff (1)
Work climate
Frequent and open communication with feedback loops (5)
Shared decision making (5)
Supportive/positive work climate (4)
Shared goals/vision within organization (4)
Good managerial relations with staff (2)
Sense of team or community among staff (1)
Supports and infrastructure
Leadership and responsibility for implementation (7)
- Technical leadership to provide specific guidance on processes (1)
- Adaptive leadership to solve problems, build consensus, and align practice with mission (1)
Program / practice champion; visionary staff in key positions (6)
Building infrastructure, skills, and motivation (6)
Coordination with other agencies (6)
Qualified support team to work with practitioners; creating an implementation team or task force (5)
Accountability plan for accomplishing specific tasks and timelines (3)
Commitment of resources to support implementation (3)
Size (2)
Structure; functional differentiation (2)

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Note: The number of frameworks that contains each factor is indicated in parentheses.

Wandersman et al., 2012 is not included because it focuses only on capacities that are direct activities to put an innovation into practice.

Contextual factors. Five frameworks incorporate a number of common contextual factors (Table III.4)[8]—the existing theory and research, funding priorities, and policies—all of which can support or inhibit the adoption of specific programs or practices. Data or empirical research clearly identifying the influence of any contextual factor on the implementation of programs or practices is largely nonexistent (Wandersman et al., 2008; Fixsen et al., 2005). Examples of well-documented, successful implementation of medical and mental health programs suggest the interactive nature of all levels of implementation factors, but they cannot isolate the influence of context (Fixsen et al., 2005).

Table III.4. Contextual factors in implementation frameworks

Contextual factors	Greenhalgh et al., 2004	Fixsen et al., 2005	Wandersman et al., 2008	Damschroder et al., 2009	Durlak & DuPre, 2008
Theory and research		X	X	X	X
Funding priorities (federal, state, local)	X	X	X	X	X
Policies: federal or administrative	X	X	X	X	X
Federal and state laws; local ordinances		X		X	
Climate: community readiness to identify and address need; advocates' concerns		X	X	X	
Interests of local consumers		X		X	
Politics: a push toward an innovation or practice (incentives and mandates)	X			X	X
Interorganizational norm-setting and networks	X			X	

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Note: Wandersman et al., 2012, Meyers et al., 2012, and Metz et al., 2013 are not included because they do not focus on contextual factors.

Greenhalgh et al. (2004) identified empirical evidence that the actions of comparable organizations influence adoption of an innovation when the program or practice becomes the norm. Similarly, Damschroder et al. (2009) discuss organizational peer pressure as part of the outer setting that influences implementation. A policy push or external mandate (in policy, often accompanied by funding) also can increase the likelihood of success (Greenhalgh et al., 2004). In ECE, policies and funding at both the federal and state levels that emphasize quality improvement in programs that serve young children are contextual factors that can influence the adoption and implementation of program features or quality initiatives to improve children's experiences.

Durlak and DuPre (2008) suggest that a response to context affects the composition of factors at the practitioner or organizational level that are needed for effective implementation. In this way, the "constellation" of factors that lead to successful implementation may be different

[8] Wandersman et al., 2012, Meyers et al., 2012, and Metz et al., 2013 are not included on Table III.4 because they do not focus on contextual factors.

across contexts. In the current work, for example, a lack of a policy push or funding flow (such as through a QRIS) may not inhibit the implementation of quality innovations or practices if other factors (such as the presence of a champion or the shared vison and mission among administrators or staff) are sufficiently strong.

Implementation activities

Beyond the general capacities needed to create and sustain the infrastructure and environment for implementation, there also are core activities that move implementation from descriptions of what *should* occur to actions and practices that *do* occur. Fixsen et al. (2005) describe what it takes to move from paper implementation to performance implementation, and Greenhalgh et al. (2004) illustrate an implementation continuum that moves from actions to "let it happen, to those that "help it happen," to those that "make it happen" (p.593).

To translate what should be to what is requires behavior change at the individual level. Fixsen et al. (2005) writes (p. 45), "In human services, practitioners are the intervention. Evidence-based programs inform when and how they interact with consumers and stakeholders, but it is the person (the practitioner) who delivers the interventions through his or her words and actions." In social services in general, this change targets the practitioner; in ECE settings in particular, it is primarily the teacher who makes change—or quality—happen. For example, if responsive and stimulating teacher-child interactions are a key feature of high quality ECE, we must understand what needs to happen from an implementation perspective to support these effective interactions. Yet, although programs and practices target practitioners—teachers for this work—Fixsen et al. (2005) emphasize that the supports for implementation cannot be practitioner centered, because practitioners change. For effective services to thrive and be sustained, the support structure must be embedded in a program or developed around a practice so that any qualified practitioner can assume an effective role in service delivery.

The direct support structure for implementation is developed through common activities that translate innovations into practice. Drawing from the frameworks, the team identified five key activities that form the core of effective implementation for any program or practice. They are discussed here and presented in Table III.5 in the order that they typically occur, even when they are iterative:[9] (1) recruitment, hiring and selection of practitioners with the required skills and competencies; (2) selection and use of tools that clearly convey the key concepts, principles, procedures, and practices of an innovation; (3) training that delivers content knowledge to practitioners, (4) technical assistance (TA) or coaching that includes observation and feedback, and (5) a quality assurance (QA) and quality improvement (QI) process.

Table III.5. Implementation activities in implementation frameworks

Implementation activity	Fixsen et al., 2005	Wandersman et al., 2008	Durlak & DuPre, 2008	Meyers et al., 2012	Wandersman et al., 2012	Metz et al., 2013
Staff selection						

[9] Greenhalgh et al., 2004 and Damschroder et al., 2009 are not included on Table III.5.

Implementation activity	Fixsen et al., 2005	Wandersman et al., 2008	Durlak & DuPre, 2008	Meyers et al., 2012	Wandersman et al., 2012	Metz et al., 2013
Recruitment, interviewing, and selection methods to hire practitioners with required skills and competencies	X					X
Tools						
Based on research and developed for end users					X	
Training						
Includes theory, philosophy, values, and competencies	X	X	X	X	X	X
Includes demonstration of skills	X					X
Includes behavior rehearsal to practice skills / receive feedback	X					X
Coaching and technical assistance						
Coaching provision/TA	X	X	X	X	X	X
Coaching delivery plan that specifies where, when, with whom, and why coaching will occur						X
Use of observations by coaches to provide feedback to practitioners	X					X

Implementation activity	Fixsen et al., 2005	Wandersman et al., 2008	Durlak & DuPre, 2008	Meyers et al., 2012	Wandersman et al., 2012	Metz et al., 2013
Quality assurance and quality improvement						
Supervision	X	X		X		X
Transparent staff performance assessments using multiple sources of data, including observation	X					X
Use of positive recognition to improve practitioner performance						X
Data-based decision making; using data to refine organization and practitioner performance	X	X		X	X	X
Feedback mechanism for quality improvement	X			X	X	X

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Note: Greenhalgh et al., 2004 and Damschroder et al., 2009 are not included because they do not focus on activities for implementation.

Together, staff selection, tools, training, coaching, and QA/QI are similar to what Fixsen et al. (2005) identify as core implementation components—the components present among successfully implemented programs and practices. Fixsen et al. (2005) suggest that the core implementation components (what we refer to as implementation activities) are integrated and compensatory, working together to support effective implementation, with the abundance of some compensating for deficiencies in others. Wandersman et al. (2012) recommend that each activity should incorporate and build on the preceding one; for example, training relies on having a tool in place, and coaching relies on some base of training.

Staff selection. Emphasized in Fixsen et al. (2005) and Metz et al. (2013), intentional and well-prescribed processes within an organization are necessary to effectively recruit, interview, and hire qualified staff to implement a program or practice. Successful staff selection is supported by specifying the required skills and abilities in job descriptions, targeting recruitment to find candidates who have the skills sought, developing protocols for interviewing candidates, and having established criteria for making decisions to hire.

Tools. Only the Evidence-Based System for Interventions Support (EBSIS) explicitly discusses the importance of tools (Wandersman, Chien, & Katz, 2012); in other frameworks, this activity is largely implied. Wandersman et al. (2012) draw from the literature, particularly that from the health field, to discuss the role that quality tools—manuals, worksheets, templates, checklists—can play in promoting cost-efficiency and effective outcomes. The presentation of information, based on evidence and developed for end users, supports good outcomes;

misinformation in a poor-quality tool will send practitioners down a path that will be fruitless and potentially detrimental (Wandersman et al., 2012).

A clear example of this activity in the ECE field is the selection of curriculum. Curriculum, as a tool, should be evidence-based to support social and cognitive development in young children. Other tools, often related to the curriculum, can include screenings and child assessments, templates for providing updates to parents about child activities and progress, observational measures for the classroom, and performance reviews for teachers.

Training. All the frameworks incorporate the role of training in supporting implementation, and most discuss the importance that the content of training conveys for theory, philosophy, values, and skill-based competencies of a program or practice. Fixsen et al. (2005) explore the experimental evidence on training effectiveness, drawing primarily on studies conducted in health and education. This review identified three elements of effective training: (1) presenting information to improve knowledge, (2) providing demonstrations of key skills, and (3) providing practice of skills through behavior rehearsals within the training setting (Fixsen et al., 2005).

Limited empirical findings, summarized by Fixsen et al. (2005), suggest other factors that may affect the effectiveness of training and are particularly relevant for the current project. First, for programs and practices in education, it can be difficult to deliver a full complement of training to all teachers because they must be released from time in their classrooms to participate and there may be absences or high turnover (Fixsen et al., 2005). Second, practitioner-level factors (discussed earlier) may interact with the training itself to affect implementation. Fixsen et al. (2005) suggest that training is more productive in translating skills into practice when practitioners want to adopt the new practice (understand its benefits) and feel confident in their ability to deliver it (self-efficacy).

Finally, training is but one more activity in the implementation process for a program or practice, and the process cannot end with training. Reviews of experimental research find that training can produce a modest gain in positive implementation outcomes over tools-only approaches but that training alone does not result in such outcomes (Fixsen et al., 2005; Wandersman et al., 2012). The addition of ongoing consultation, coaching, or TA is the next, and necessary, implementation activity.

Coaching and technical assistance. Each implementation framework in Table III.5 incorporates coaching or TA. Wandersman et al. (2012) highlight the importance of TA in the broadest of terms—hands-on approaches to building an entity's or an individual's capacity for implementation. In other words, TA or coaching can focus on building specific practitioner skills or general capacities (such as leadership or resource development). Applying this concept to ECE settings, coaching or TA may target improving classroom practices among teachers, or TA may be provided to help a director build administrative, management, or staffing capacity to move from one level in a QRIS to another.

Empirical evidence indicates the importance of coaching and TA for effective implementation, but little information exists to help specify coaching and TA approaches in dosage, mode, or what a coach should do and say (Fixsen et al., 2005; Wandersman et al., 2012). Wandersman et al. (2012) find that there is a growing evidence base for some key dimensions of

coaching. Ongoing coaching and TA provide greater benefits to practice than do short-lived or circumstance-limited approaches (Wandersman et al., 2012). However, findings about the most effective dosage, or number of hours of TA or coaching, are mixed or inconclusive (Fixsen et al., 2005; Wandersman et al., 2012). On-site TA provides improved opportunities for the demonstration of skills (compared to telephone or email-based approaches), and proactive and individualized approaches can build capacity across different practitioners and organizations more equitably than TA provided only in response to requests (Wandersman et al., 2012).

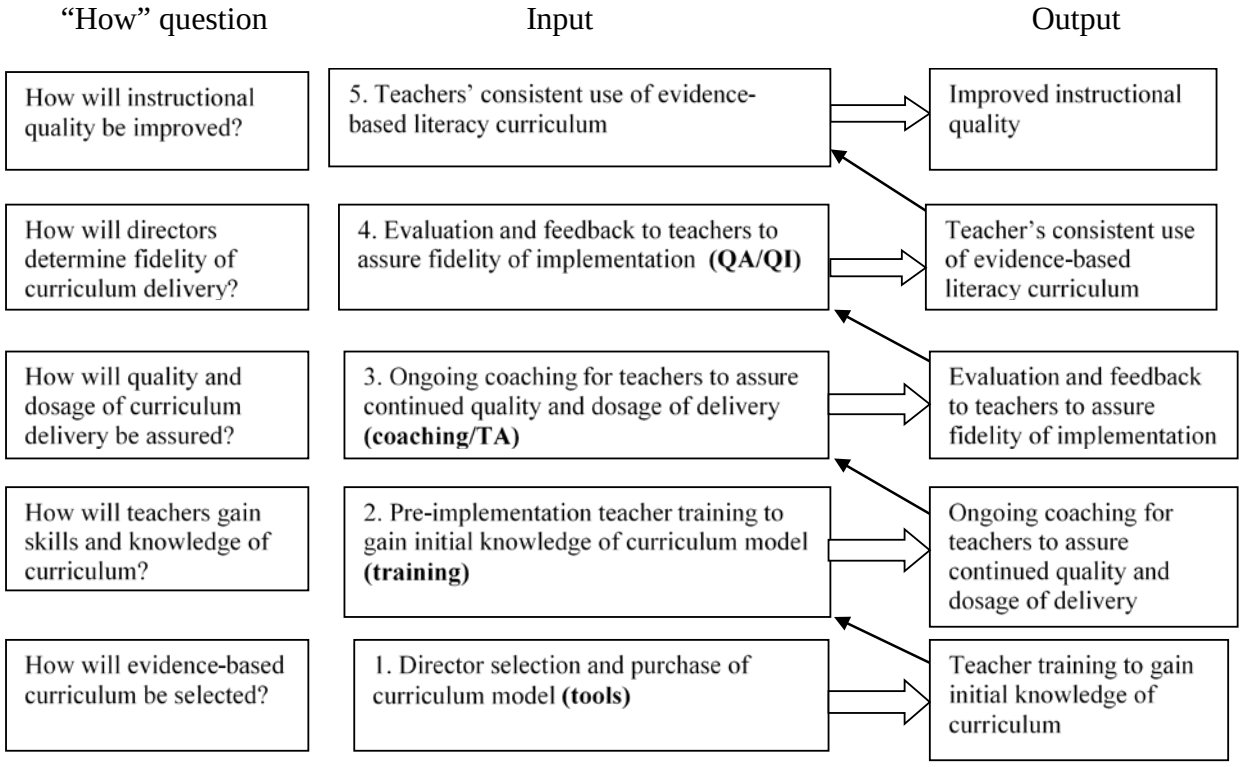
Quality assurance and quality improvement. Implementation of a program or practice is not a linear process; rather, it is iterative in using information from staff assessment and observation, as well as program-level performance, to promote, ensure, improve, and sustain effective services. Five of the six frameworks incorporate the need for an approach to QA in implementation through such methods of gauging and rewarding individual performance as supervision, using observational data, or providing positive recognition. The five frameworks all focus on the use of data—on performance, fidelity, and outcomes—to inform decision making within the organization; four incorporate the need for a way to provide feedback to practitioners and staff with an eye toward improvement.

Cost ingredients from implementation

The five implementation activities will be important to examine in assessing the capacity to implement quality in ECE programs. Investments in these activities may yield the most benefit toward achieving quality, and they can be readily identifiable as cost ingredients. A way to exemplify this is through use of an implementation science cascading logic model that illustrates the importance of asking "how" in an iterative manner to identify the implementation activities that lead to success (National Implementation Research Network, 2014). A central feature of such a model is that, at each level, the desired output shifts to being the input or activity at the next level.

For example, consider an ECE center that sought to improve instructional process quality through the implementation of a particular evidence-based literacy curriculum. The model in Figure III.1 shows a cascading implementation logic model that outlines five steps required to reach the final desired output of enhanced instructional quality: (1) selection and purchase of an evidence-based curriculum (the tool), (2) pre-implementation training of teachers, (3) continued coaching to support appropriate dosage and quality of implementation, (4) ongoing evaluation and feedback from coaches to teachers to assure fidelity (QA/QI), and (5) consistent use of an evidence-based curriculum.

Figure III.1. Cascading implementation logic model of improved instructional quality



Essential to this project is that each step requires staff time and monetary resources that contribute to the costs of achieving ECE quality. Examining the implementation activities associated with program features will ensure that we measure costs well, by capturing potentially hidden costs of implementation and accounting for costs in the appropriate cost category.

Variations in activities and associated costs, by stages of implementation

Implementation activities and costs may vary across ECE centers that have seemingly similar program features because of variations in the stage of implementation of a feature, or group of features. Implementation of quality takes time and resources, but the level of investments may be different at each stage. While the ECE-ICHQ measures will be based on data collection at a particular point in time, it may be important to capture the stage of implementation of particular program features given the potential differences in activities and related costs at different stages.

There are costs (although possibly relatively small) in an exploration or initial consideration stage; more significant costs associated with the startup of a practice or program; and steady-state costs to support the practice or provide the service on an ongoing basis (Fixsen et al., 2005). Three of the implementation frameworks discuss activities across the different stages of implementation (Fixsen et al., 2005; Durlak & DuPre, 2008; Meyers et al., 2012); and two explicitly name and present different stages or phases (Fixsen et al., 2005; Meyers et al., 2012).

When initially exploring and considering a new program or practice, an organization may conduct formal or informal assessments, such as looking at needs, resources, fit with the organization, or capacity and readiness (Fixsen et al., 2005; Durlak & DuPre, 2008; Meyers et al., 2012). These activities may at first involve just administrators or directors, but they can spread throughout an organization as staff are asked to provide information or support to help with the adoption decisions (Fixsen et al., 2005).

The "installation" stage, (as coined by Fixsen et al. [2005]) can be a time of heavy investment in preparing for and launching a new practice or program. An organization, such as an ECE center, must build the general organizational capacity to support a new practice; this includes securing the necessary space, technology or equipment, or aligning policies and reporting mechanisms. Administrators also need to examine staffing to (1) determine whether existing or new staff are needed to meet the qualifications to deliver the new practice; (2) hire staff if necessary; and (3) train all staff on the new practice or program (Fixsen et al., 2005; Meyers et al., 2012). Before and during initial implementation, there may be costs associated with obtaining external expertise, not only for staff training, but also to advise on implementation structures and supports at an organizational level. Internal teams may be created to guide and support.

The stage of full, or ongoing, implementation represents the steady state in the use of resources to deliver the service or practice, as well as the infrastructure that supports implementation. Providers in this phase would ideally have full (or close to full) staffing in place and have the implementation capacities—training, coaching, QA/QI mechanisms (supervision, evaluation, and feedback)—to support continued proficiency and skill of the practice (Fixsen et al., 2005; Meyers et al., 2012).

To sustain a practice or program, an organization (an ECE center) will need to continue to replace and train practitioners to maintain skill proficiency. It also may need to adjust organizational or implementation capacities (such as training or coaching) in response to changes in funding or program requirements.

Key findings and implications for ECE-ICHQ

The implementation frameworks provide some guidance and challenges to consider in developing implementation measures. The literature converges on common factors that build general organizational capacity to support successful implementation, as well as specific implementation activities such as staff selection, tools, training, coaching, and QA/QI. Therefore, the review provides useful guidance in creating markers of implementation that may clearly vary with costs and, ultimately, the quality of ECE. However, we need to recognize that program features of quality and implementation are not entirely distinct. For example, the literature on features of quality discussed in Chapter 2 and the application of the implementation science literature to ECE both suggest the importance of staff education and qualifications and staff training and professional development to quality – and its implementation. In developing the measures, the team needs to recognize that what a center does to support quality and how it does it are intertwined.

The team faces many decisions as it determines the number, collection, and construction of implementation measures, and this review provides helpful guidance. Implementation is ongoing

and dynamic; therefore, implementation studies often capture the perspectives of many stakeholders and are conducted over an extended period of time. The challenge for the ECE-ICHQ project is to assess the implementation of program features that may support quality in a more static and targeted way. For example, to best capture general capacity constructs (such as self-efficacy of staff or the type and strength of leadership that exists) data collection from multiple sources is required and may be beyond the scope of this work. Also, measures developed from this work can capture how quality is implemented within an ECE setting with a focus on the implementation activities (staff selection, tools, training, coaching, and QA/QI) but may be limited in capturing how well quality is implemented. For example, we can ask about the intentionality of decisions to adopt and purchase validated child assessments or evidence-based curricula; the qualifications of teachers, trainers, and coaches; and the number of training and coaching sessions provided. However, we will not be able to gauge the quality of these activities through conducting review and observation activities over time and through multiple modes.

The implementation science literature suggests that no one composition or level of factors is the key to successful implementation. There are many factors at different levels that can affect the capacity for implementation; it will be challenging to define a common set to assess variations across ECE centers in different contexts. The team will need to start with a broad set of factors common across frameworks and recent studies, particularly at the organizational level, then refine these through the phases of the project.

IV. HOW ARE THE COSTS OF ECE MEASURED, AND WHAT CONTRIBUTES TO VARIATION IN COSTS?

Early studies of costs in ECE were primarily designed to assess the relationship between costs and ECE quality, as discussed further in Chapter V. As such, there was a focus on total costs and less exploration of how total costs break down into specific cost categories. Interest in understanding the composition of ECE costs has grown in recent years. However, consensus about the best measures and methods to use for measuring ECE costs has yet to be achieved. The variety of cost measures and data collection methods used in ECE cost studies to date is in part due to changes made to address lessons learned from each study to the next. Nonetheless, inconsistencies and gaps in the research base remain. This chapter first describes existing cost measures and identifies strengths and potential areas where the ECE-ICHQ measure can fill gaps and provide more consistency across different ECE settings. The chapter then summarizes current research on center characteristics and other contextual factors that contribute to variation in costs.

Using the methods described in Chapter I, we identified and reviewed 30 resources that included information on approaches to measuring costs. The 30 resources were 21 empirical studies, two policy briefs, one design report, and six cost tools (Table IV.1).

Table IV.1. Types of resources reviewed

Types of resources	Number reviewed
Empirical studies	21
Policy briefs	2
Design report	1
Cost tools	6
Total	**30**

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Features of cost studies: Data collection and methods

Most of the studies that involved data collection or analysis of costs (17 of 21) pertained to ECE center-based settings (Table IV.2). These studies described the cost of ECE as currently provided in a particular community or how much it would cost to provide high quality ECE for a particular population. We did not specifically exclude non center-based ECE settings from the search, but no cost studies of home-based settings surfaced. One study used country-level data from 17 countries (Levin & Schwartz, 2012). Ten studies used data from more than one state in the United States. Five of the 10 studies used data from the CQO study. These studies include the primary technical report from the CQO study (Helburn, 1995), as well as four studies that conducted secondary data analysis of that data set (Blau & Mocan, 2002; Blau, 2007; Glantz & Layzer, 2000; Helburn & Howes, 1996). Two studies used data collected from military child care providers in multiple states (U.S. General Accounting Office [GAO], 1999; Zellman & Gates, 2002). The final three multistate studies used state-level data for all or a subset of the 50 states (Barnett & Robin, 2006; Gault, Mitchell, Williams, Dey, & Sorokina, 2008; Levin & Schwartz, 2007). Six studies were conducted within individual states (Belfield & Schwartz, 2007; Marshall et al., 2001, 2004a, 2004b; Pierson et al., 2014; Schwartz & Karoly, 2011). Four of the 21 studies

examined costs in other service settings, including agencies providing home visiting services (Burwick et al., 2014), out-of-school time programs (Grossman, Lind, Hayes, McMaken, & Gersick, 2009), and nursing homes (Hicks et al., 2004; Rantz et al., 2004).[10]

Table IV.2. Settings of empirical cost studies

Study setting	Number of studies
ECE settings	17
More than one country (including the United States)	1
More than one state	10[a]
Individual states	6
California	1
Maine	1
Massachusetts	2
Minnesota	1
New Jersey	1
Other settings	4
Home visiting programs in more than one state	1
Out-of-school-time programs in more than one state	1
Non–hospital-based nursing facility in Missouri	2
Total	**21**

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

[a] Five of the 10 studies used data from the CQO study.

The three papers classified as a policy brief or design report in Table IV.1 also pertain to ECE settings. The policy briefs provide guidance for estimating the costs of providing high quality ECE services (Center for Children's Initiatives [CCI], 2011; Gault et al., 2008). The one design report in the review describes plans to examine costs of developing and implementing coaching initiatives in Head Start programs (Howard & Drummond, 2014).

Data collection methods in cost studies

The specific data collection methods and cost tools used in a study directly influence the accuracy, completeness, and timeliness of the resulting cost information. Data sources and measures also influence whether the results are comparable across settings of different auspices and those that operate in different contexts.

To inform the ECE-ICHQ Multi-Case Study data collection tools and build on what has already been learned about existing cost study tools, the team included information about data sources and methods as part of this review. Eleven of the 21 empirical studies conducted primary data collection and used several data sources. Two studies administered questionnaires to directors, teachers, or program managers to collect information (Burwick et al., 2014; Helburn, 1995). Seven studies reviewed existing documents, such as financial records, Department of Education reports, program budgets, and other center records (Belfield & Schwartz, 2007;

[10] Chapter IV presents findings from eight ECE studies that examined associations between quality and costs.

Marshall et al., 2001, 2004a, 2004b; U.S. General Accounting Office, 1999; Rantz et al., 2004; Pierson et al., 2014). In-person and/or telephone interviews with key personnel such as center directors, financial officers, and care providers informed six studies (Helburn, 1995; Marshall et al., 2001, 2004a, 2004b; Schwartz & Karoly, 2011; Pierson et al., 2014). Given the complexity of cost analysis and the information needed to allocate costs to specific categories, the literature supports the idea that multisource, multimethod data collection is needed to gather credible data for the current measure.

Features of programs examined in cost studies

Table IV.3 shows the extent to which features of ECE centers shown or hypothesized to support quality (as discussed in Chapter II) were considered in the reviewed cost studies. Four of the eight features discussed in Chapter II are not included in this table. Group size and adult-child ratio and staff education are not typically reflected as distinct line items in cost studies although their costs are included in staff compensation. Leadership and administrative practices were also not captured in the cost studies we reviewed, except through compensation costs for directors and other administrative staff. Costs related to curriculum were not explicitly mentioned in any of the cost studies. In addition to the features listed in Table IV.3, many studies also reported costs of facilities and maintenance. It is possible that the costs of certain features are included in calculations but are not explicitly mentioned. Six of the studies did not provide a breakdown of the line items in their cost calculations (as indicated by n.a. on the table) and are thus excluded from the descriptions below.

Staff compensation and benefits. Eighteen studies that provided information about cost components included staffing costs in their calculations (Table IV.3). Some studies accounted for teaching versus administrative staff separately, and a few considered contractual staff in addition to permanent employees. Two studies calculated direct labor costs (for staff who provide care directly to children) and indirect labor costs (for staff who perform functions other than child care in the center) (U.S. General Accounting Office, 1999; Zellman & Gates, 2002). Direct labor costs included time caregivers spent away from the classroom, such as during breaks or while attending training. Indirect labor costs might include costs associated with food service personnel, training and curriculum support staff, center management, program management, receptionists, custodial staff, and administrative staff (Zellman & Gates, 2002). In a study of military child care costs, the GAO (1999) found that direct labor costs accounted for approximately half of total costs and 70 percent of labor costs. Gault et al. (2008) looked specifically at instructional staff costs and categorized staff by education level and compensation level. The study separated teachers with bachelor and associate degrees from those with child development associate (CDA) credentials, and took into account salary differences for staff within the same education level. The authors found this distinction important in estimating how costs vary by quality based on past research that adequate compensation for ECE teachers improves staff retention, draws teachers with better qualifications, and results in higher quality ECE for children (Gault et al., 2008). The study's measure of instructional personnel expenditures also included costs associated with employer-provided benefits for teachers. Costs for administrative and support personnel were considered separately. Another study took a similar approach to measuring classroom staff costs, but delineated personnel costs by job title (for example, teacher, assistant teacher, substitute teacher, director) instead of education level (Schwartz & Karoly, 2011).

Table IV.3. Features of programs examined in empirical cost studies, policy briefs, and design report

Resource	Staff compensation and benefits	Physical environment and materials	Training and professional development	Assessment and evaluation	In-kind donations/ volunteer services	Staff time use
Barnett & Robin, 2006	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Belfield & Schwartz, 2007	X					
Blau & Mocan, 2002	X				X	
Blau, 2007	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Burwick et al., 2014	X	X			X	X
Center for Children's Initiatives, 2011	X	X	X			
Gault et al., 2008	X	X	X	X		
Glantz & Layzer, 2000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Grossman et al., 2009	X	X	X			
Helburn, 1995	X	X	X		X	
Helburn & Howes, 1996	X	X	X		X	
Hicks et al., 2004	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Howard & Drummond, 2014	X	X	X	X		X
Levin & Schwartz, 2007	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Levin & Schwartz, 2012	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Marshall et al., 2001	X	X	X		X	X
Marshall et al., 2004a	X	X	X		X	X
Marshall et al., 2004b	X	X	X		X	X
Pierson et al., 2014	X	X	X		X	
Rantz et al., 2004	X					
Schwartz & Karoly, 2011	X	X	X		X	
Stebbins & Langford, 2006	X	X		X		
U.S. General Accounting Office, 1999	X	X				
Zellman & Gates, 2002	X	X				
Total	**18**	**15**	**11**	**3**	**9**	**2**

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Note: Cells marked with an "X" indicate the feature was examined, and blank cells indicate the feature was not examined. Cells marked with "n.a." indicate "not applicable" because the study did not provide information on individual cost components.

ECE = Early care and education

Physical environment and materials. Fifteen studies considered costs related to materials and supplies (Table IV.3).[11] Although some studies specified costs associated with classroom materials separately from more general supplies in their data collection tools (for example, see Helburn, 1995; Schwartz & Karoly, 2011), these costs are often combined with other nonlabor costs for analytic purposes, because centers allocate a very small percentage of their budgets to supplies in general. For example, Schwartz and Karoly (2011) found that, on average, less than 5 percent of costs were incurred for classroom supplies in their sample of 10 centers.

Training and professional development. Other studies considered the costs associated with in-service training and professional development (Table IV.3). For example, Schwartz and Karoly (2011) asked center directors to report on expenditures related to teaching staff participation in conferences and workshops (fees and transportation), as well as costs related to in-service on-site training. They found that programs spent very little on professional development (1 percent or less of costs) (Schwartz & Karoly, 2011). Other cost studies have found similarly small proportions of costs devoted to training and professional development (Marshall et al., 2001, 2004a, 2004b; Pierson et al., 2014). The cost component of the Head Start Coaching Study is designed to collect data on multiple aspects of coaching initiatives, including salaries of coaches; wages of substitutes to cover coaching time; and the amount of time coaches, teachers, and administrators spend planning for, supporting, and participating in the coaching initiative (Howard & Drummond, 2014).

Assessment and evaluation. We did not find any cost analyses that presented costs related to assessment and evaluation separately. In their estimation of infrastructure costs of quality pre-kindergarten programs, Gault et al. (2008) included costs of technical assistance received by the program, monitoring and quality assurance, and outcome evaluation such as the administration of kindergarten readiness assessments. Similarly, Stebbins et al. (2006) recommended including costs of training and technical assistance, evaluation, and other features necessary to support efficient and effective service delivery.

In-kind donations. Nine studies accounted for the value of in-kind donations and volunteer services in their cost calculations (Table IV.3). For example, Schwartz and Karoly (2011) found that donated services or space accounted for anywhere from 1 to 30 percent of ECE center costs. The CQO study found that, on average, volunteer services accounted for about 2 percent of center costs, donated space accounted for 7 percent of costs, and other donations such as food, equipment and supplies accounted for 1 percent of costs (Helburn, 1995). Capturing contributions is important, regardless of what the centers may actually expend; however, the studies have measured donations in different ways, making comparisons challenging. For example, the CQO study did not apply a market test to the amount and cost of space a center would use if the space were not donated, and it included estimates of foregone wages of staff as donated time in full-cost estimates (Glantz & Layzer, 2000). On the other hand, the Massachusetts and Maine studies did apply a market test to the amount and cost of donated space but did not include foregone wages (Marshall et al., 2001, 2004a, 2004b). Schwartz and Karoly (2011) did not apply a market test because they encountered challenges in obtaining information from programs about what they would have had to pay for the donated services or space.

[11] All the studies included costs associated with rent, maintenance, and utilities in their analysis.

Staff time use. Four studies considered staff time use. Marshall and colleagues in the Massachusetts and Maine studies (Marshall et al., 2001, 2004a, 2004b) used information about staff time use to distinguish between teaching staff and staff who primarily served administrative or other functions. Burwick et al. (2014) collected data on how home visiting program staff allocated their time across program activities in order to allocate costs among program components. As indicated earlier, the Head Start Coaching Study will be collecting data on how much time coaches, teachers, and administrators use for activities related to the coaching initiative (Howard & Drummond, 2014).

Features of cost studies: Analytic approaches

Many of the studies the team reviewed used broad measures of costs (total costs or full costs) in their analysis. Broad measures are unable to distinguish between investments in and possible trade-offs between features of ECE centers to examine costs that may be more or less strongly related to the quality of services.

Results from studies that delineated costs into finer categories indicate that broad measures can mask important differences in cost allocations between centers. For example, the CQO study found no differences in total costs (or in the cost-quality association) between nonprofit and for-profit centers, although for-profit centers invested greater resources in physical space (Helburn & Howes, 1996). Schwartz and Karoly (2011) found that public school-based preschools, nonprofit centers, and Head Start centers spent more per child care hour on labor costs than did for-profit centers. More than half of the difference was due to salaries of on-site, non–classroom-based staff such as curriculum specialists, coaches, health and nutrition staff, and family outreach staff.

A consistent finding across several of the studies is that labor costs account for a large proportion of total costs. Some studies have delved deeper into this cost category by looking at labor costs by levels of education or experience (see, for example, Blau & Mocan, 2002) or by staff type (see, for example, Schwartz & Karoly; Zellman & Gates, 2002), but these indicators lack specificity about what staff are doing with their time. One way to better understand the allocation of labor resources is to collect data on staff time use. Through this strategy, Burwick et al. (2014) found differences in resource allocation by program model and implementing agency type.

Features of existing cost tools

We reviewed six existing cost tools designed for use in a range of settings, including ECE settings and educational programs more broadly, after-school programs, substance abuse treatment programs, and home visiting programs. Table IV.4 summarizes which features of ECE centers shown or hypothesized to support quality (as discussed in Chapter II) were considered in the reviewed cost tools. Five of the tools included staff compensation and benefits, and three included the cost of materials (Table IV.4). Training and professional development, and assessment and evaluation are each included in three of the tools. Two of the tools explicitly considered the value of in-kind donations and volunteer services. Following is a brief description of each:

- The **CBCSE Cost Tool Kit** (Center for Benefit-Cost Studies of Education, 2012) uses the cost-ingredient method, which builds up cost measures based on an assessment of all

resources used to implement a program. The Tool Kit includes an "ingredients" work sheet that lets the user identify program ingredients and assign prices for each. Users may look up prices of commonly used resources in educational programs through the "Database of Educational Resource Prices," which is also part of the Tool Kit. The Tool Kit allows users to calculate full costs, per-participant costs, and costs per unit of an outcome.

- The **Provider Cost of Quality Calculator (PCQC),** found on the National Center on Child Care Quality Improvement website[12], is a tool for estimating costs based on specific inputs identified by a provider. It includes training and professional development costs, as well as the number of additional hours per week a provider spends on quality-related activities. The PCQC allows users to determine the cost of providing services at a particular level of quality (based on licensing or QRIS standards) and to compare estimated costs with estimated revenues to assess sustainability.
- The **Evidence-Based Home Visiting (EBHV) Cost Data Collection Instruments** (Boller et al., 2012), used to calculate costs of early childhood home visiting programs, collect information on staff time use and allow calculation of the amount of time staff members spend in direct contact with families versus time spent on travel, writing up case notes, and other tasks.
- The **QRIS Cost Estimation Model,** found on the National Center on Child Care Quality Improvement website[13], estimates the costs of implementing a QRIS based on user-entered assumptions, including the cost of quality assessment, monitoring, and administration; professional development; technical assistance; financial incentives; communication for public awareness; facility improvements; system evaluation; and data systems and other administration.
- The **Out-of-School Time Cost of Quality Calculator** (Grossman et al., 2009) generates a summary of weekly, annual, hourly, daily, and monthly costs of after-school programs. Users are prompted to enter several program features, including the age of children served by the program, whether the program is a school year or summer program, program auspice and location, and anticipated adult-child ratio.
- The **Substance Abuse Services Cost Analysis Program** (Zarkin, Dunkap, & Homsi, 2004) walks the user through cost and labor modules that derive a number of cost estimates by several components. The main cost categories collected are related to personnel; contracted services; buildings and facilities; depreciation costs; supplies, materials, and minor equipment; and miscellaneous costs.

[12] Accessed May 20, 2015 at https://www.ecequalitycalculator.com/Login.aspx?ReturnUrl=%2f

[13] Accessed May 20, 2015 at https://cemocc.icfwebservices.com/

Table IV.4. Features of programs examined in cost tools

Cost tools	Staff compensation and benefits	Physical environment and materials	Training and professional development	Assessment and evaluation	In-kind donations/ volunteer services	Staff time use
CBCSE Cost Tool Kit	X	X	X	X	X	
Provider Cost of Quality Calculator	X	X	X	X		X
EBHV Cost Data Collection Instruments	X	X			X	X
QRIS Cost Estimation Model			X	X		
Out-of-School Time Cost of Quality Calculator	X					
Substance Abuse Services Cost Analysis Program	X				X	

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.
Note: Cells marked with an "X" indicate the feature was examined, and blank cells indicate the feature was not examined.

ECE = Early care and education

CBCSE = Center for Benefit-Cost Studies of Education

EBHV = Evidence-based home visiting

Do costs vary by contextual factors?

Many attributes of ECE centers may influence the costs of quality. These attributes include the type of organization providing services, the number and characteristics of children served, the comprehensiveness of services offered, and staffing structure. The ECE-ICHQ study aims to understand how ECE center characteristics influence costs in order to create an instrument that will be useful in a variety of settings. The study will target a diverse sample of ECE centers in order to cover a range of characteristics. The measures will be designed to collect relevant information pertaining to these characteristics.

The geographic, political, and fiscal environment in which an ECE center operates may affect the costs of care. The cost of many resources necessary for providing quality child care may differ across regions or between rural and urban areas. States may vary in their government policies and regulations affecting ECE centers, such as licensing standards, child care subsidies, features of the state QRIS, state pre-kindergarten policies, and government support for enhancing ECE infrastructure through professional development or quality initiatives. The ECE-ICHQ study sample will include ECE centers that operate in a range of contexts to capture the broader ECE market and institutional context and explore how much they contribute to differences in costs and quality. Next, we describe characteristics of ECE centers or other human service providers and other contextual factors examined in the studies reviewed and summarize the findings about each.

How are ECE center or provider characteristics associated with costs?

Nearly all the cost studies we reviewed examined how center characteristics are related to costs. Next, we describe the center characteristics examined and the extent to which findings across studies clearly indicate each characteristic's relation to costs:

- **Enrollment level or capacity.** Thirteen studies examined whether a provider's capacity or enrollment level are related to costs (Barnett & Robin, 2006; Belfield & Schwartz, 2007; Burwick et al., 2014; Gault et al., 2008; Grossman et al., 2009; Helburn, 1995; Helburn & Howes, 1996; Levin & Schwartz, 2006; Marshall et al., 2001; Marshall et al., 2004a; Marshall et al, 2004b; Schwartz & Karoly, 2011; Zellman & Gates, 2002). Findings were consistent across the studies that, as a provider serves more children, more staff, materials, and space are required, leading to increased costs. However, costs per child are lower for larger providers due to economies of scale.
- **Hours of operation.** The relationship between costs and hours of operation was examined in 13 studies (Barnett & Robin, 2006; Gault et al., 2008; Grossman et al., 2009; Helburn, 1995; Helburn & Howes, 1996; Levin & Schwartz, 2006; Marshall et al., 2001; Marshall et al., 2004a; Marshall et al, 2004b; Pierson et al., 2014; Rantz et al., 2004; Schwartz & Karoly, 2011; Zellman & Gates, 2002). Results from these studies indicate that providers offering full-day services incur more costs than providers offering half-day services. Similarly, providers that offer services throughout the full calendar year incur more costs that those that operate during the school year only. However, there does not appear to be a linear relationship between hours and days of operation and costs. For example, the cost of a full-day program is not double that of a half-day program (Barnett & Robin, 2006).
- **Staffing structure.** Fourteen studies discussed staffing structure as a key component of costs (Barnett & Robin, 2006; Belfield & Schwartz, 2007; Burwick et al., 2014; Gault et al., 2008; Grossman et al., 2009; Helburn, 1995; Helburn & Howes, 1996; Levin & Schwartz, 2006; Marshall et al., 2001; Marshall et al., 2004a; Marshall et al, 2004b; Schwartz & Karoly, 2011; U.S. GAO, 1999; Zellman & Gates, 2002). The number and type of staff, which are influenced by a provider's capacity, the age of the children being served, and regulations, affect costs directly though the direction of the effect is not entirely clear. Personnel costs are higher when a provider delivers auxiliary services (such as health care, nutrition assistance, or transportation) to cover the costs of additional staff members. Staff with more experience and education earn higher wages, in general, which leads to higher costs. However, higher wages also help to reduce staff turnover and can produce cost savings through improved workforce stability (U.S. GAO, 1999).
- **Ages of children served.** Nine studies considered how costs vary with the age of the children served by different providers (Blau & Mocan, 2002; Blau, 2007; Grossman et al., 2009, Levin & Schwartz, 2012; Marshall et al., 2001; Marshall et al., 2004a; Marshall et al., 2004b; U.S. GAO, 1999; Zellman & Gates, 2002). It is more costly to serve younger children than older children because regulatory standards require more caregivers to be present when serving younger children, resulting in higher personnel costs. This was illustrated in a study of military child care settings (Zellman & Gates, 2002), where the caregiver-to-child ratio was three times larger for preschoolers than for infants. This translated into the average annual cost of providing infant care being almost twice the annual average cost of providing care to a preschool-age child ($12,133 versus $6,594).

- **For-profit status.** Seven studies considered for-profit status in their analysis of costs (Blau & Mocan, 2002; Helburn, 1995; Helburn & Howes, 1996; Marshall et al., 2001; Marshall et al., 2004a; Marshall et al., 2004b; Schwartz & Karoly, 2011). Three of the studies controlled for this status in their cost models but did not describe how costs differed by this characteristic (Marshall et al., 2001; Marshall et al., 2004a; Marshall et al., 2004b). In a study of ECE centers in Minnesota, for-profit centers were found to have the lowest costs compared to nonprofit centers, public school-based centers, and Head Start Centers (Schwartz & Karoly, 2011). Four of the studies analyzed data from the CQO study (Helburn, 1995) and consistently found that total costs did not significantly differ by for-profit status (Blau & Mocan, 2002; Helburn & Howes, 1996). However, analysis of the CQO data did reveal differences in cost allocations by for-profit status. Specifically, nonprofit centers spent significantly more than for-profit centers on labor and food, and for-profit centers spent significantly more than nonprofit centers on facilities and other operating expenses (Helburn & Howes, 1996).
- **Auspice.** Five studies explored the role of auspice (that is, who owns or operates the agency) in their analysis of costs (Burwick et al., 2014; Grossman et al., 2009; Hicks et al., 2004; Pierson et al., 2014; Zellman & Gates, 2002). In one study, private ECE centers serving children from ages 0 to 5 years old had higher per-child hour costs ($11.34 per child hour) than public ECE centers serving similar aged children ($8.62 per child hour) (Schwartz & Karoly, 2011). Zellman and Gates (2002) found that military child care centers operated by the U.S. Department of Defense did not have costs significantly different from those of centers operated by outside contractors. Grossman et al. (2009) found that school-based or school-run out-of-school time programs for elementary school-age children had lower daily per-child costs than similar programs run by and housed in community-based organizations. However, the cost differences were eliminated when hourly per-child costs were examined, because programs run by community-based organizations operate for more hours per day than school-based programs. The remaining two studies did not conduct statistical tests of the relationship between auspice and costs (Hicks et al., 2004; Burwick et al., 2014).
- **Funding sources.** The CQO study looked at the relationship between funding sources and costs. Findings indicate that providers that receive public funding (from federal, state, or local sources) have higher costs than providers that do not receive public funding or receive minimal public funding (Helburn, 1995). The authors speculated that public funding is often tied to higher quality standards, which may be linked to increased costs.

How do other contextual factors affect costs?

The empirical cost studies we reviewed did not examine contextual characteristics as frequently as provider characteristics. Two contextual characteristics were examined in multiple studies:

- **Region or urbanicity.** Ten studies examined how region or urbanicity of the center location was related to the cost of providing care (Barnett & Robin, 2006; Burwick et al., 2014; Helburn, 1995; Helburn & Howes, 1996; Hicks et al., 2004; Grossman et al., 2009; Levin & Schwartz, 2012; Marshall et al., 2001; Marshall et al., 2004b; Zellman & Gates, 2002;). ECE was more costly to provide in urban or suburban areas than in rural areas. In addition,

studies noted that variation in wage rates, birth rates, cost of living, and labor market conditions specific to an area also contribute to differences in cost by region.

- **Licensing and regulations.** Three studies noted that regulations may be linked to increased cost, as providers face higher standards to achieve accreditation and state licensing (Blau, 2007; Marshall et al., 2004; Pierson et al., 2014). For example, using CQO data, Blau (2007) examined the relationship between regulations and cost and concluded that regulations may not always increase the cost of providing care because centers can respond to increased regulations by engaging in substitution among inputs—that is, they compensate for the higher costs of some resources by spending less in other areas. For example, if a provider must hire additional staff to meet stricter adult-child ratio requirements, that provider may respond by reducing staff wages.

Key findings and implications for ECE-ICHQ

Given the complexity of cost analysis and the information needed to allocate costs to specific categories, the literature supports the idea that multisource, multimethod data collection is needed to gather credible data. The extant research on ECE costs also suggests a need for a measure that does not just calculate total costs but also captures differences in how resources are allocated and how costs are connected to the implementation of program features. Understanding how ECE centers allocate resources, particularly towards program features that directly support quality, will require creativity and innovation in data collection as ECE centers are unlikely to track their costs at a level of detail that would facilitate such analysis.

Another next step to take from the existing literature is to look at the decisions that centers make to support what goes on in the classroom that also plays out in costs, and quality. Decisions that affect implementation and costs include staffing structures, the qualifications of staff, how staff use their time, and the professional development opportunities the center provides for staff. Within total costs, centers can make different decisions. A center faced with more stringent adult-child ratio standards may try to control costs by hiring less qualified staff, for example. Without workforce supports such as supervision, training, or coaching in place, that center may experience increased staff turnover, resulting in potentially higher costs and lower quality.

Finally, consideration of center characteristics and contextual factors is key in any examination of the cost-quality relationship in ECE. Therefore, it will be important to capture these factors as the ECE-ICHQ measure is developed to ensure that the tools we develop are sensitive to variation in costs and implementation resulting from them.

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V. HOW IS QUALITY RELATED TO COSTS?

Cost analyses of ECE is challenging because of the varied contexts, auspices, and funding environments in which centers operate. The combined challenge in systematically measuring both costs and quality contributes to an incomplete understanding of the relationship between the two. We have a handful of studies to draw from in understanding how quality is associated with costs in center-based ECE settings. This chapter presents findings from eight studies that bring together quality and cost data. We review the findings, draw lessons from the research, and discuss implications for the ECE-ICHQ project.

What do we know about the relationship between quality and costs in ECE center-based settings?

Research on the association between quality and costs in ECE center-based programs is limited (and is non-existent for home-based settings). However, the existing evidence from the empirical studies we reviewed indicates that a positive relationship exists between cost and quality; higher-quality centers tend to have higher costs (Table V.1).

The first comprehensive investigation of this question was conducted through the Cost, Quality, and Child Outcomes (CQO) study—a study of 401 child care centers (228 infant/toddler classrooms and 521 preschool classrooms) in four states (California, Colorado, Connecticut, and North Carolina) conducted in the mid-90s (Helburn, 1995). The study found that costs were positively associated with quality. On average, a 1-point difference in quality scores on a 7-point scale, as measured by the Environment Rating Scales (ERS), was associated with a 10 percent difference in a center's total variable costs (Helburn, 1995).[14] Alternative analyses that grouped centers in quality intervals of 0 to 2.49, 2.5 to 3.49, 3.5 to 4.49 (average quality), 4.5 to 5.49, and 5.5 and above indicated that the costs of centers in the 4.5 to 5.49 ERS score group were 7.5 percent higher than those in the average range, which corresponds to an additional 12 cents per child per hour.

[14] Quality was measured by the Early Childhood Environment Rating Scale (ECERS) or the Infant/Toddler Environment Rating Scale (ITERS), depending on the age of children in the classroom observed. For each program, one classroom from each age group was randomly selected. Classroom scores were averaged to produce a program-level score.

Table V.1. Summary of studies estimating the relationship between cost and quality in ECE settings

Study and sample	Cost variable	Composition of cost variable	Quality variable	Relationship between cost and quality	Other variables in model
Helburn, 1995 (Cost, Quality, and Child Outcomes study) 401 child care centers serving infants, toddlers, and/or preschoolers in California, Colorado, Connecticut, and North Carolina	Total variable costs (short-run excludes overhead, facilities, and insurance because these are fixed—that is, they do not change with the hours of care provided)	Wage and salary expenditures, nonwage benefits, staff education costs, subcontracting costs, food costs, other operating expenses, and the estimated value of in-kind donations (food, volunteer services, and supplies)	ECERS/ITERS	10 percent difference in cost for every unit difference in ECERS Centers in quality range of 4.5–5.5 have costs that are 7.5 percent higher than the ones in the quality range of 3.5–4.5	Cost inputs: wage rates, total hours per age group, amount of physical space Center characteristics: profit status, chain versus independent center, subsidy receipt (any and more than 50 percent of revenue), auspice (owned and operated by public agency), state
Blau & Mocan, 2002 266 centers serving infants, toddlers, and/or preschoolers in California, Colorado, Connecticut, and North Carolina (secondary analysis of data from the CQO study)[a]	Log total costs	Wage and salary expenditure, nonwage benefits, staff education costs, subcontracting costs, food costs, other operating expenses, estimated value of in-kind donations (food, volunteer services, and supplies), overhead, insurance, and occupancy costs (rent or mortgage, utilities, repair and maintenance)	ECERS/ITERS	6 percent difference in cost for every unit difference in quality	Staff wage rates, total hours, number of classrooms, state
Marshall et al., 2001 90 community-based centers serving preschoolers on a full-day, full-year basis in Massachusetts	Full costs,: excluding value of subsidized space	Nonlabor expenditures (food, occupancy, other); labor expenditures; adjusted for cost of subsidized space and in-kind contributions	Centers grouped based on their ECERS-R scores: < 4.5 = less than good 4.5 to 5.49 = good-minus to good-plus 5.5 and above = better quality	Costs of centers that are “good-minus to good-plus” are 5 to 9 percent higher than “less than good” centers Costs of centers that are “better quality” are 27 percent higher than “less than good” centers	Child hours of care , market wages, rent per square foot, and the local unemployment rate Profit status, enrollment size, inclusion in multiservice organization, participation in Child and Adult Care Food Program, presence of infants and toddlers, NAEYC accreditation

Study and sample	Cost variable	Composition of cost variable	Quality variable	Relationship between cost and quality	Other variables in model
Marshall et al., 2004a 102 full-day, full-year community-based centers serving infants and 104 full-day, full-year community-based centers serving toddlers in Massachusetts	Classroom-level expenditures per child care hour	Expenditures in four broad categories: (1) labor, including salaries, wages, benefits, and payroll taxes; (2) food; (3) occupancy, including rent and mortgage payments, real estate taxes, utilities, and maintenance repairs; and (4) other goods and services, including office supplies, and children's transportation	ITERS scores of at least 4 versus scores less than 4	13 percent higher costs in infant rooms with ITERS scores of at least 4 versus those with scores less than 4 14 percent higher costs in toddler rooms with ITERS scores of at least 4 versus those with scores less than 4	Child hours of care, market wages, rent per square foot, local unemployment rate
Marshall et al., 2004b 90 community-based centers serving preschoolers on a full-day, full-year basis randomly selected from 16 counties in Maine	Full costs: expenditures plus value of in-kind contributions	Nonlabor expenditures (food, occupancy, other); labor expenditures; adjusted for cost of subsidized space and in-kind contributions	ECERS-R scores of 3 or above versus scores below 3	17 percent difference in costs between centers with ECERS scores of 3 and above versus those with scores below 3	Child hours of care, occupancy cost, urban versus rural, for-profit status, enrollment size, inclusion in multiservice organization, presence of infants and toddlers, NAEYC accreditation
Belfield & Schwartz, 2007 Sample of Abbott preschool programs (210 private centers, 535 public from 2003–2007) (6-hour preschool day) from 31 districts in New Jersey	Average cost per child (based on budget statements or expenditures)	No breakdown provided. Costs were based on budget statements or expenditure reports	ECERS scores	2 percent difference in cost for every unit difference in ECERS	Teacher wages Abbott-eligible and non-eligible enrollment, multisite, profit status, district demographics (percentage married, college educated, average income, population)

Study and sample	Cost variable	Composition of cost variable	Quality variable	Relationship between cost and quality	Other variables in model
Levin & Schwartz, 2007 50 states	State per-child expenditures on preschool Average cost per child	No breakdown provided	NIEER quality rating of state preschool program National Association of Child Care Resource and Referral Agencies (NACCRRA) quality scale	A 1-point increase on the 10-point NIEER quality rating scale is associated with a 7 percent increase in spending above the mean expenditure of $3,700 10-point increase on the 150-point NACCRRA quality scale is associated with a 5 percent increase above the average cost of $6,600 per child	None specified

Source: ECE-ICHQ literature review conducted December 2014 through February 2015.

Note: Studies are listed in the same order as presented in the text.

[a] The analytic model used in the study classified staff based on years of education; however, some centers did not have certain types of staff based on this classification. Therefore, the analysis was restricted to centers that used all types of staff. The authors conducted additional analyses to demonstrate that this restriction of the sample was unlikely to have introduced bias in the results.

[b] Authors' calculation based on study-reported results of a $100 difference in cost corresponding to a 0.01 to 0.02 point difference on the ECERS/ITERS.

ECE=Early care and education

Two studies reanalyzed the CQO data. Blau and Mocan (2002) used data from a subsample of 266 centers.[15] Blau and Mocan's cost variable included occupancy (rent or mortgage), insurance, and overhead costs, which were treated as fixed costs in the original analysis. They calculated a 6 percent difference in costs for a 1-unit difference in ERS scores. Glantz and Layzer (2000) used the CQO data to estimate the cost-quality relationship at the classroom level across the study's 401 centers. They argued that center-level analysis is inadequate for examining this question because there is substantial within-center variation in quality. Their analysis (which they noted to be limited because they did not have full access to the data) found that a $100 difference in the annual full per-child cost (that is, the cost of services that includes the value of in-kind donations and foregone earnings) for a classroom was associated with a 0.01 to 0.02 difference in ECERS or ITERS score, depending on the state. This finding suggests that we would expect a $5,000–$10,000 difference in annual per-child costs between classrooms with scores that differ by one rating point.

Four studies examined the relationship between cost and quality using state-specific data. The Massachusetts Cost and Quality Study (Marshall et al., 2001) collected cost and quality data similar to that of the CQO study from 90 community-based centers serving preschoolers in Massachusetts. In their analysis, the researchers compared centers of "less than good" quality (with ERS scores below 4.5) to centers of "good-minus to good-plus" quality (scores of 4.5 to 5.49) and centers with "better quality" (scores of 5.5 and above). They estimated a 5 to 9 percent difference in full per-child hour costs, on average, between the "less than good" centers and the "good-minus to good-plus" centers, but the difference was not statistically significant. The cost difference between "less than good" and "better quality" centers was larger and statistically significant, at 27 percent. A follow-up study of 102 community-based centers serving infants and 104 full-day, full-year community-based centers serving toddlers in Massachusetts revealed that costs were 13 percent higher in infant rooms with ITERS scores of at least 4 versus those with scores less than 4. Similarly, costs were 14 percent higher in toddler rooms with ITERS scores of at least 4 versus those with scores less than 4 (Marshall et al., 2004a). In a similar study conducted using data from centers in Maine, Marshall et al. (2004b) also found a positive association between costs and quality. Unlike the CQO study or the Massachusetts study, however, the centers in this analysis were grouped into two quality categories: (1) those with ECERS scores of 3 and above, and (2) those with scores below 3. Centers with scores of 3 and above had costs that were 17 percent higher than centers of less than minimal quality.

The fourth state-specific study we reviewed explored the cost-quality relationship using data from 745 public and private preschool programs in the Abbott districts in New Jersey (Belfield & Schwartz, 2007). As a program run by the state Department of Education, Abbott preschools are subject to stringent standards in class size, staffing, and other structural features. The average ECERS-R score was 4.93 among private centers and 4.70 among public programs. In contrast, the average ECERS-R score in the CQO study was 4.01 (Helburn, 1995). Belfield and Schwartz estimated a statistically significant 2 percent difference in per-child costs associated with a 1-point difference on the ECERS-R for the Abbott preschool programs. The estimated difference was similar in models fit separately for private and public centers. The authors suggest that this

[15] The study excluded some centers that did not employ certain types of staff. The authors conducted additional analyses to confirm that doing so did not bias the results.

difference is smaller than estimates from the CQO study, likely because the study sample is much more homogeneous and of higher average quality than the CQO sample.

Finally, Levin and Schwartz (2007) used national data to examine the relationship between cost and quality at the state level. They found that states that provided higher quality preschool as measured by the state preschool quality rating scale of the National Institute for Early Education Research (NIEER) spent about 7 percent more than average based on state-reported expenditures. The authors conducted a second set of analysis using a different data set and found a similar result—the average annual cost of preschool was about 5 percent higher in states with more stringent quality standards (based on the NACCRRA quality scale).

Lessons from the research base

Although the studies described above consistently found a positive association between cost and quality, the estimated magnitude of the relationship ranged considerably across studies. Our analysis indicates that the definition and approaches for measuring cost and quality, as well as consideration of center characteristics and other contextual factors, may all contribute to variation in estimates and limit the field's current understanding of the cost-quality relationship in ECE settings (Table V.1). The studies were designed to examine the association between aggregate costs and quality. This was an important first step on which future work can build to delve deeper into the composition and allocation of costs and refine data collection methods. For example, the past studies included only limited examination of how total costs break down into different categories, placed limited attention on within-center variations in cost and quality, and had narrow definitions of quality. Learning from the past work, the ECE-ICHQ project can take steps to address these information gaps. We consider each lesson in more detail next.

Greater understanding of resource allocation within total costs is needed.

All the studies reviewed use a measure of total or full costs in their primary analyses. Yet, some evidence exists that centers at different quality levels allocate resources in ways that are meaningful but that are not captured in comparisons of total or full costs. For example, program accreditation in Maine was more strongly associated with nonlabor costs than with labor costs (Marshall et al., 2004b). Although we might expect accredited centers to have higher labor costs due to employing more highly qualified staff, the authors found that accredited centers actually incurred more administrative and material costs compared to their non-accredited counterparts. These unresolved issues suggest that alternative data collection strategies would be useful. For example, time use data can contribute to a better understanding of resource allocation in centers and can shed light on how labor is allocated toward activities that we expect to be more or less related to the quality of services provided.

Further consideration of within-center variation in cost and quality is necessary.

Past studies have focused on center-level estimates of both cost and quality. Although center-level estimates are useful for research, policy, and practice, careful consideration of how costs and quality vary within centers is important. Considerable variation in ERS scores within centers has been documented (Karoly, Zellman, & Perlman, 2013), suggesting that important information is missed in focusing only on measures of average quality across classrooms. Similarly, as Glantz and Layzer (2000) suggest, there may be important differences in costs between classrooms within centers that should be taken into account. For example, infant and

toddler classrooms incur higher costs than preschool classrooms due to lower child-to-staff ratios and smaller group sizes. At a minimum, it is important to understand the variation in quality and costs among classrooms within centers to better articulate potential limitations of center-level estimates.

The definition of quality may need to be broadened.

The use of the ERS as a quality measure across the studies facilitates comparison of findings to a certain extent, because we can assess how cost differences are associated with a unit change in the ERS scale. However, comparability of magnitudes is limited because studies grouped centers in different ways based on the distribution of scores in the sample and tested the cost-quality relationship using their categorical measure of quality, rather than using the ECERS scores in their original form. In the Massachusetts study, Marshall et al. (2001) created three quality categories. They used two categories in the Maine study (Marshall et al. 2004b). Therefore, we cannot directly compare the estimates from these studies with each other or with the original CQO study, which tested a quality scale broken down into five categories.

A larger point is that, although the ECERS provides a common benchmark of quality, it is challenging to assess the practical importance of the cost-quality relationship estimates produced. For example, the CQO study reports that it would cost an additional 25 cents per hour per child (after adjusting for inflation) to produce an increase from average to good quality for an average center. It is possible to produce similar estimates based on the other studies reviewed here; however, the extant research does not shed much light on how those 25 cents could be spent to produce higher quality services.

Implications for ECE-ICHQ

Past research into the relationship between cost and quality suggests that quality costs more, but it does not shed light on why or in what ways resources may best be directed to support quality. The field needs more specific measures of costs that can map more closely to what is being done within a center to pursue quality. The charge for ECE-ICHQ is to develop cost measures that build on the research base and captures enough detail to examine how costs vary in relation to program features and how those features are implemented. Connecting measures of cost with measures of implementation would help promote an understanding of why costs vary across centers of different quality (or even the same quality) based on the way resources are used to implement program features. Further, the field has identified the tension that exists in trying to examine the relationship between center-level costs and classroom-level quality. Cost measures that can differentiate between costs that support classroom-based practices and those that support program-level features and capacity could be put to better use in specifying the cost to quality relationship.

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VI. CONCLUSIONS, IMPLICATIONS, AND FRAMEWORK FOR THE ECE-ICHQ PROJECT

The ECE-ICHQ project's literature review highlights issues that inform the field of study and help determine the project's next steps. These issues include the challenge of bridging the gap between three research literatures: one focused on assessing the associations between elements of classroom quality and children's outcomes, another the literature on factors that lead to successful implementation, and the last a limited literature on the costs of ECE. In addition, the review revealed other gaps in the literature that will require OPRE and the project team, with input from the technical expert panel (TEP), to identify new measurement constructs and new implementation and cost measures that can be tested and used in later research.

In this chapter, we draw conclusions from the literature review and summarize their implications for the field. Based on this literature review and input from the TEP, the project team created a draft conceptual framework that we present at the end of this chapter. The team will use this framework to guide its approach to the first phase of data collection. The framework is a work in progress. It will be revisited and revised as necessary after the initial data collection and based on the ongoing contributions of the TEP and other stakeholders.

Conclusions and implications for the field

Based on a review of the literature and research syntheses in the areas of ECE quality, implementation science, and costs, the ECE-ICHQ team arrived at five primary conclusions that both inform the field and help determine the next steps in the ECE-ICHQ project.

1. Research reveals some associations between the features of an ECE center and quality, or children's outcomes, but the lack of clear evidence means that ECE-ICHQ data collection must start broad.

The framework for the ECE-ICHQ project needs to correspond to the way ECE quality is defined and measured. If it does, the resulting measures of implementation and cost will help identify the actions and investments that can lead to quality.

The literature on the associations between ECE features and children's outcomes or classroom practices is useful, but still developing. A growing body of evidence on the positive associations between good instruction/teacher-child interactions and children's outcomes has made these interactions a focus in defining high quality ECE, and the interaction between teacher and child is one important way that ECE centers achieve quality. Based on the literature, other program features with the most consistent (albeit modest) positive associations with both classroom practices and children's outcomes are group size and adult-child ratio, staff education and credentials, physical environment and materials, and training and professional development. These features reflect what the ECE center does to support good classroom practices and ultimately enhance children's outcomes. A few studies have also revealed associations between the use of some specific curricula and positive outcomes for children.

In the studies we reviewed, classroom observational tools such as the ERS and CLASS are the tools most commonly used to measure quality. ERS and CLASS provide information about classroom practices, including teacher-child interactions, but the ERS measures the broader

environment and is often regarded as a measure of global quality. These and other currently used measures of classroom quality do not capture information about the specific features of an ECE center that may help that center support or achieve high quality. ECE-ICHQ is poised to fill that gap by focusing on classroom functions and implementation activities in support of quality features that are not measured by these tools.

The growing emphasis on improving the quality of ECE has sparked the development of program-level definitions of quality and measurement frameworks that provide actionable markers or indicators of progress. For example, QRIS standards, NAEYC accreditation, and other quality assessments often include program-level features but also include other, little-researched features that have been endorsed by experts as important in sustaining quality—such as assessment and evaluation, and leadership and administrative practices. As the ECE field moves toward greater professionalization of the workforce and breaking down of key program features, practice leaders and policymakers are including in their quality assessments the constructs and measures they view as central to good management. For example, the Early Head Start-Child Care Partnerships program (EHS-CCP) requires a level of collaboration and coordination between agencies on shared services that has not been well studied (Office of Head Start, 2014). Few of these emerging constructs have been examined empirically and separately from other features in the extant literature.

The ECE-ICHQ measures will add value by offering a deeper look into the variation in how ECE centers implement program features and in their capacity to support the kind of implementation that may be driving differences in quality. This information is not currently captured by or understood through existing measures. The findings of the project will expand the field's understanding of what programs do with the resources they have (staff time, materials, funds) in the areas that are viewed as important to support quality.

2. Little research has been done to reveal the associations between implementation factors, program features, and quality.

Implementation science identifies a broad set of factors that support the infrastructure and environment necessary for successful program implementation. However, the key factors or "active ingredients" are difficult to identify, because they cannot be studied separately as predictors of ECE quality or of children's outcomes.

As noted, the focus on classroom quality in the ECE field, along with correspondingly less attention paid to the factors that support quality at the program level, may cause us to miss important variations in how programs can achieve quality. Implementation science can inform a measurement approach that assesses (1) the general capacity of ECE centers to create the infrastructure and environment in which successful implementation may take place, and (2) the core activities that determine how a feature is implemented. In this way, program features can be assessed by the factors that go into making them happen and by the activities that are needed to implement any feature, or combination of features, in ways that are most likely to achieve higher quality. However, we also need to recognize that program features and implementation are not entirely distinct. For example, from the quality literature, we identified training and professional development as a program feature that is associated with children's outcomes, while from the implementation literature we identified training is an implementation activity that can support a range of features within an ECE center.

Viewing all this through the lens of implementation science can broaden our approach, allowing us to assess the many possible combinations (and interactions) of organizational factors, program features, and implementation activities that play a role in attaining high quality. With this approach, we acknowledge the many different things that ECE centers can do to achieve quality, and the approach will allow the field to better identify combinations that work and, potentially, advance the effort to isolate the effects of key factors (to the extent that enough programs could be assessed to allow testing of specific hypotheses).

3. The state and community context can influence the implementation (and pursuit) of quality, as well as its cost.

A review of the literature in implementation science reveals the importance placed on the role of context in influencing what the ECE center may need to support quality effectively. For example, in a state with no funding or policy push to promote quality, such as through QRIS or professional development offerings and registries, an ECE center may need to have particularly strong leaders and access to resources in comparison with an ECE center in a state where the QRIS bears some of the cost of improving quality. This is also true of the costs associated with supporting quality; costs may be higher in ECE centers where outside resources are limited. In documenting costs at the ECE center level, it is important to consider the influence of the role played by states and municipalities in addressing ECE quality (for example, with financial support or technical assistance).

4. Current measurement of the cost-to-quality relationship provides little direction for those who wish to invest in quality.

Despite the positive cost-quality associations of the CQO study (Helburn, 1995; Helburn & Howes, 1996), little research has been done in the past 20 years to help dissect costs in order to guide better investments in quality. Understanding the association between costs and quality would help program directors and policymakers as they seek to invest in quality improvement or assess the trade-offs of increasing or reducing investments in expensive features or activities.

All of the reviewed studies that correlated costs with quality at the ECE center (or classroom) level used aggregate measures that may not capture underlying variations—variations that may be central to understanding the impact of investments in quality. First, costs were typically examined in total or by broad categories such as labor and non-labor or direct and indirect. This approach limits the potential to understand how shifts or increases in costs that are tied to ECE center functions or features could be reallocated to improve quality. For example, the CQO study researchers suggest that it costs the average center an additional 25 cents per hour per child (after adjusting for inflation) to achieve good quality, but it is not possible to discern whether those 25 cents would be spent most wisely on increasing staff credentials or on promoting more assessments of children, for example.

On the other side of the equation is the measurement of quality. Researchers in all of the reviewed studies that produced estimates of the cost-quality association at the center or classroom level used the ERS (ECERS or ITERS) to measure quality. As a measure of global quality, the ERS cannot break down the role of different features and how they are implemented, nor can it capture the general organizational capacity that helps determine the quality of an ECE

center. As a result, information about the relationship between cost and quality is not useful for identifying features, capacities, or implementation activities that may improve quality outcomes.

Past research has also revealed the challenge that arises when costs are measured at the program level and quality is measured at the classroom level. It is difficult to base assumptions on measures that are not aligned. In only one study, researchers examined cost-quality associations at the classroom level. Findings from this study suggest that classroom-level differences in costs are associated with differences in quality (Glantz & Layzer, 2000). Differences in both quality and costs within a center may indicate that the organization does not have the capacity to support consistent implementation—to standardize the practices it uses to hire and retain qualified staff, to supervise and support staff consistently, and to provide training and TA systematically to teachers in every classroom.

5. The gaps in measurement that we identified in the literature review reveal the need to align measures of implementation and cost to inform the direction of any efforts to improve quality.

The field needs more knowledge about what an ECE center needs to do to offer better quality. Specifically, the literature review reveals a need for disaggregated measures that can allow researchers to better assess how an ECE center functions and allocates resources in ways that may support quality. Given the many combinations of program features, organizational factors, and implementation activities that may be important to determining the center's quality, the field needs finer measures that can better capture the different mechanisms and paths that may lead to quality improvement.

This review also identifies the absence of a conceptual link between measurement of costs and quality. Research has identified some program features that are associated with quality and children's outcomes; experts have endorsed others. However, the field has not yet fully incorporated this knowledge in ways that facilitate calculating costs of specific program features or functions that we might expect to be associated with quality improvement. The field is also constrained by the current measurement of quality (through observational tools) that, importantly, is focused on what happens inside the classroom but cannot assess what it takes at the center level to support or produce the classroom environment or the interactions that take place in the classroom.

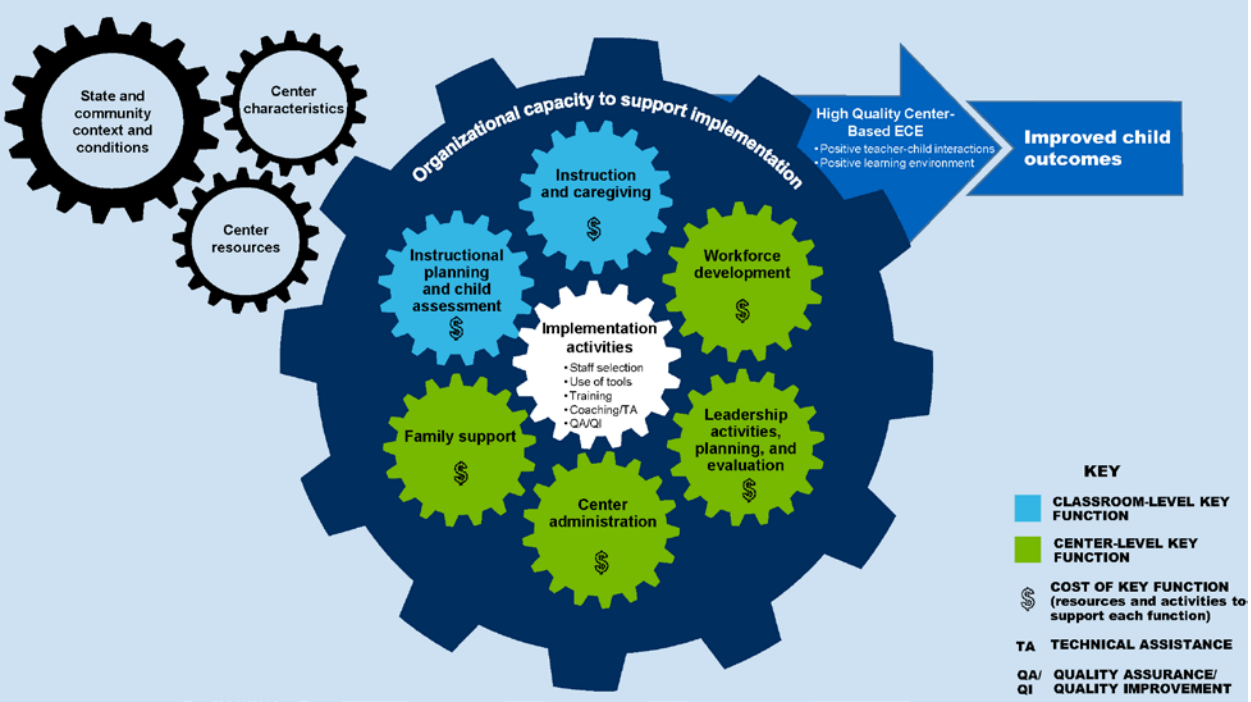
The alignment of implementation and cost measures, potentially for the program features or key functions of an ECE center, could create a parallel structure that aids in understanding what an ECE center does and how, as well as how much it costs. These disaggregated measures could allow an exploration of the relationship between implementation, costs, and quality that has been difficult to pursue in the past. For example, measures that produce cost estimates assigned to specific functions of an ECE center can dissect how resources are allocated within a center. Examining the variations between ECE centers in how they make this allocation can reveal differences in implementation, organizational capacity, context, and available resources that may make a difference in the manner and extent to which quality is achieved.

A draft conceptual framework for the ECE-ICHQ project

The resulting ECE-ICHQ instrument needs to align cost and implementation measures so as to identify the variations that make a difference in quality. Doing so will produce information that can help center-based ECE providers make use of limited funds to invest in quality and help state administrators and policymakers direct resources (financial or technical assistance) in ways that build the capacity to implement quality and promote activities that support quality.

The ECE-ICHQ project has a unique charge and an opportunity to bring together different literatures and ways of conceptualizing ECE quality, implementation, and costs. The project team, together with OPRE and a TEP, developed a draft conceptual framework that will guide the approach to data collection and measurement development. The findings from this review led us to consider key functions that take place in ECE centers of all types (including community-based centers, Head Start programs, and public pre-kindergarten). These are functions (1) for which cost estimates can be produced and (2) that encompass the features identified by research or endorsed by experts as associated with quality (Figure IV.1). Information that is collected about program implementation and costs can be organized by these key functions.

Figure VI.1. Conceptual framework for assessing the implementation and cost of high quality early care and education (ECE-ICHQ)



The premise of the ECE-ICHQ project is that high quality early care and education should give all children the social, emotional, and cognitive skills they need before they enter school, and help close the achievement gap for low-income, disadvantaged children. However, ECE centers vary in their investments in and capacities to implement key functions in ways that promote quality. The elements of high quality and improved outcomes for children are included on the right side of the framework to connect the measurement work to the intended goals of ECE centers.

Although it is outside the project's scope to measure the observed quality of ECE that is being provided, this framework shows that we will be measuring how classroom- and program-level functions are carried out in pursuit of high quality. Because particular classroom- and program-level functions in themselves may not be sufficient to ensure quality, we have separated these features from the "High Quality Center-Based ECE" portion of the framework. We broadly define "High Quality Center-Based ECE" in the framework as positive teacher-child interactions and a positive learning environment. Findings from the literature review and discussions with the TEP suggest that a program with particular features in place has *greater potential* to provide high quality ECE.

In the draft framework, we present in one figure the key functions of an ECE center, what those functions cost, and how they are driven by a number of elements that influence whether and how a center can achieve high quality and improve children's outcomes. We elected to depict various elements of the framework as gears because they drive how the center operates to achieve quality. The blue and green gears in the middle represent the key functions that we expect to find in all ECE centers *may* contribute to quality, depending on how they are implemented. However, we expect the relative role of each function (and size of the circles) to vary from one ECE center to the next. The way each ECE center carries out each function is driven by: (1) the implementation activities that support the functions (the gear in the middle), (2) the organizational capacity in which they operate (the large gear that holds them), and (3) the resources and characteristics of the ECE center, as well as the state and community context (the three gears located to the left of the large gear).

There was consensus among the TEP that it is not only important to measure the costs of the full package or bundle of features that may determine the quality within a program, but also to describe how those costs may vary based on the composition of individual elements within the bundle. The TEP saw value in distinguishing categories (of quality or costs) between those at the classroom level and those at the program level. We use "key functions" to reflect tasks that all ECE centers engage in and for which there are clear ways to measure implementation and costs. To put it simply, "functions" are what ECE centers *do.* Across ECE centers, programs devote their time and activities to these functions.

To identify these functions, the ECE-ICHQ team used findings from the literature review and "cross-walked" cost and quality categories as defined within several sources in the review, including the QRIS Compendium (Tout et al., 2010) and the Program Administration Scales (Talan & Bloom, 2004). The team identified six key functions of ECE centers that take place at the classroom or program level. These key functions are mutually exclusive but complementary; they are essential to any ECE center, but on their own they are not enough to deliver high quality ECE. All these functions contribute to the program's cost, as indicated by the dollar signs in each circle. Two functions—instructional planning and child assessment, and instruction and caregiving—take place at the classroom level (indicated by the color blue in the circles). The other four functions are at the program level (indicated by the color green).

We show the general capacity of an ECE center to support implementation by placing the key functions within the large, outer gear of organizational capacity. Five core activities were identified through the literature as common to successfully implemented programs (staff selection, use of tools, training, coaching/technical assistance, and quality assurance/quality

improvement). We placed these in the gear at the center of the key functions to represent that these activities support the execution of the key functions.

ECE centers vary in their resources, characteristics, and the communities and states in which they operate. Center characteristics and resources, as well as the actions and characteristics of the state and community, help drive the implementation and costs of key functions. These three elements are the three gears on the left side of the framework.

The framework includes dollar signs in the key function circles and not in its other pieces, such as implementation activities or community and state context and conditions, to signify the level at which we will produce and present cost measures. The costs of each key function will reflect the scope of the implementation activities, as well as other elements, that drive that function.

Next steps

A phased approach to data collection in the Multi-Case Study will enable us to refine our definitions of key functions (as cost categories and for examining implementation activities) as well as to develop the items to be studied for the entire range of elements identified by this review as important to the measurement framework. These elements include the context in which the ECE center operates, the characteristics of the center (such as the ages of children served, funding sources, enrollment, etc.), and the center's organizational capacity, program features, and implementation activities. An iterative refinement process in each of the three phases will ensure that the resulting data collection tools and measures are useful to their intended audiences. The development process this project follows could inform similar future work focused on home-based settings but the measures produced through this project will not be applicable in family child care and home-based settings given substantial differences in structure and implementation of services in those settings compared to centers.

Together, the ECE-ICHQ implementation and cost measures should advance the field in its understanding of how center-based ECE programs invest in quality. The ECE-ICHQ measures will be field-tested for consistency and reliability in measurement across constructs and users. Once developed and tested, the ECE-ICHQ measures could be validated with a measure (or measures) of quality to ensure they do indeed capture variations in implementation and costs that are meaningful in explaining differences in quality.

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APPENDIX A

INITIAL LIST OF RESOURCES FOR THE LITERATURE REVIEW

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Table A.1. Preliminary list of ECE quality and implementation science resources

Research Area and Resources
ECE Quality (excluding cost studies)
Barnett, W. S. (2011). Effectiveness of Early Educational Intervention. *Science*, *333,* 975-978.
Boller, K., Tarrant, K., & Schaack, D. D. (2014). Early care and education quality improvement: A typology of intervention approaches. OPRE Research Brief #2014-36. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.
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Yoshikawa, H., Weiland, C., Brooks-Gunn, J., Burchinal, M., Espinosa, L., Gormley, W. … Zaslow, M. J. (2013). Investing in our future: The evidence base on preschool education. New York: Foundation for Child Development and Ann Arbor, MI: Society for Research in Child Development.
Zaslow, M., Anderson, R., Redd, Z., Wessel, J. Tarullo, L., & Burchinal, M. (2010). Quality dosage, thresholds, and features in early childhood settings: A review of the literature, OPRE 2011-5. Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.
Implementation Science
Durlak, J. A., & Dupre, E. P. (2008). Implementation matters: A review of research on the influence of implementation on program outcomes and the factors affecting the implementation. *American Journal of Community Psychology, 41*, 327–350.
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Wandersman, A., Duffy, J., Flaspohler, P., Noonan, R., Lubell, K., Stillman, L. & Saul, J. (2008). Bridging the gap between prevention research and practice: The interactive systems framework for dissemination and implementation. *American journal of community psychology*, *41*(3-4), 171-181.

Table A.2. Preliminary list of cost studies, resources related to cost analysis, and existing cost measures and tools

Research Area and Resources
Cost Analysis and Cost Studies
Blau, D. (2001). The child care problem: An economic analysis. New York: Russell Sage Foundation.
Burwick, A., Zaveri, H., Shang, L., Boller, K., Daro, D., & Strong, D. (2014). Costs of early childhood home visiting: An analysis of programs implemented in the Supporting Evidence-Based Home Visiting to Prevent Child Maltreatment Initiative. Princeton, NJ: Mathematica Policy Research.
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QRIS Cost Estimation Model (Office of Child Care, http://www.acf.hhs.gov/programs/occ/resource/qris-cost-estimation-model-and-resource-guide)
Provider Cost of Quality calculator (Office of Child Care, https://www.ecequalitycalculator.com/)
After School Program Cost Calculator (The Wallace Foundation, http://www.wallacefoundation.org/cost-of-quality/pages/default.aspx)
Cost Tool Kit (Center for Benefit-Cost Studies in Education, http://cbcse.org/cost-resources/)
Substance Abuse Services Cost Analysis Program (https://www.rti.org/page.cfm?objectid=7E6095C8-AE6E-4568-874839C81FAD414B)
Cost Data Collection Instruments for the Evidence-Based Home Visiting to Prevent Child Maltreatment Cross-Site Evaluation (http://supportingebhv.org/crossite)

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