

CHILD OUTCOME MEASURES IN THE STUDY OF CHILD CARE QUALITY

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This article assesses whether there are methodological problems with child outcome measures that may contribute to the small associations between child care quality and child outcomes found in the literature. Outcome measures used in 65 studies of child care quality published between 1979 and December 2005 were examined, taking the previous review by Vandell and Wolfe (2000) as the starting point. Serious methodological problems were not pervasive for child outcome measures. However, methodological concerns were most prevalent among measures of socioemotional development. Furthermore, psychometric information on outcome measures was often missing from published reports, and health outcomes and approaches to learning were infrequently studied. Future research should address alignment issues between aspects of quality and the specific child outcomes chosen for study.

Keywords: *child care quality; child outcome measures; methodological issues*

AUTHORS' NOTE: *The preparation of this article was made possible by the generous support of the National Institute of Child Health and Human Development (NICHD) through the Family and Child Well-Being Research Network, Grant 1U01 HD37558. Early versions of this article were presented at the meetings of the Association for Public Policy Analysis and Management and at the Child Care Bureau of the U.S. Department of Health and Human Services, and the authors gratefully acknowledge feedback from these presentations that helped to shape the final article. The authors also thank Doug Besharov for his helpful feedback on multiple drafts of the article, as well as comments from the other authors of this special edition. The authors are grateful to Michelle McNamara for extensive help with the references and tables for this article. Julia Calkins has completed a master's in education and is currently an elementary school teacher. Lindsay Pitzer is currently at Purdue University.*

EVALUATION REVIEW, Vol. 30 No. 5, October 2006 577-610

DOI: 10.1177/0193841X06291529

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Much of the current discussion about how to strengthen the study of child care quality focuses on the independent variables in the equation: the measures of child care quality (see Layzer and Goodson 2006 [this issue]). Concerns include (a) the appropriateness of existing measures for studying quality in care provided by kith and kin, (b) the degree to which measures focusing on quality in the classroom or group may miss the extent of stimulation or support received by an individual child, and (c) whether existing measures of child care quality require that certain features of the child care environment, such as outdoor play space, be present when external constraints may make this impossible (e.g., in dangerous inner-city neighborhoods). Other concerns include the need to attend more carefully to sample representativeness and attrition, especially the need to move toward experimental designs to study the effects of quality on child outcomes (see Duncan and Gibson-Davis 2006 [this issue]).

This article extends the focus of the discussion to the dependent variables in the equation: the child outcome variables. Lamb (1998) raised the possibility that “noise” in the outcomes side of the equation—not only in the study design and measurement of quality—may contribute to an underassessment of the association between child care quality and child outcomes:

There is vast (and often poorly specified) variability within and among studies with respect to the actual care arrangements, the amount of care received, the age at which it began, the number and types of changes in the patterns of care, *and the ways outcomes were assessed* [italics added]. Even when the same outcomes are assessed, variations in the ages of assessment and enrollment, *means of quantification* [italics added], and the composition and selection of comparison groups often preclude more than tentative conclusions about specific care arrangements. (P. 115)

To extend the discussion of research on child care quality to focus on the child outcome measures, this article addresses three specific questions:

1. Are studies covering the aspects of development that are important to consider in relation to child care quality? At the level of broad domains of development, are certain aspects of development of potential importance either missed or studied only in a limited manner?
2. To what extent is there a lack of agreement across studies in the specific constructs that are studied within the broad domains of development (Lamb 1998)? Is it difficult to relate findings across studies because the same or similar constructs are often not considered?
3. Are there methodological concerns about the child outcome measures included in studies of child care quality? Are such concerns concentrated in measures of particular domains of development?

To address these questions, we used as our starting point the set of studies from the comprehensive review of the child care quality literature by Vandell and Wolfe (2000). This review summarizes, among other things, the evidence from 45 studies examining the association between variation in child care quality and child outcomes (with the child outcomes measured either concurrently or longitudinally). We used the tables provided by Vandell and Wolfe to identify the studies completed between 1979 and the preparation of their review. We then sought additional studies published through December 2005, extending the set of studies considered here to 65.¹

We reviewed the child outcome measures included in each of the 65 studies, particularly (a) the broad domains of development that the child outcome measures addressed and (b) the specific constructs considered within each domain. We also identified any concerns pertaining to the reliability and validity of the child outcome measures.

Our review found a strong emphasis on children's socioemotional development, language development, and cognition and general knowledge in relation to variation in child care quality in this literature. But there was limited consideration of health outcomes and such motivational aspects of learning (i.e., "approaches to learning") as task persistence or enthusiasm. Our review also found, at the construct level, a lack of agreement about what the important aspects of children's socioemotional development are, specifically within positive social development. The studies examined a wide range of constructs, and limited replication occurred across studies. We also found a greater prevalence of issues with the reliability and validity of child outcome measures in socioemotional development than in other domains of development. We discuss (a) the possible implications of these patterns in research that finds associations between child care quality and child outcomes and (b) potential steps to strengthen this research.

THE DOMAINS OF CHILD DEVELOPMENT

Determining whether the research on child care quality is focusing on important aspects of children's development requires a framework. One possible rubric is the research on school readiness. It is reasonable to assume that one goal of high-quality child care is to provide a strong foundation for children's positive early adjustment to and academic progress in school. Indeed, some studies of child care quality make this assumption explicit by using assessments labeled as measures of "school readiness" (e.g., National Institute of Child Health and Human Development [NICHD] Early Child Care

placed the outcome in the separate category for language development and early literacy.

Table 1 provides a summary of the school readiness domains addressed by the child outcomes in the 65 studies. Many studies focused on multiple domains of children's development, but only 1 (Howes and Smith 1995) focused on all five domains simultaneously. Across all 65 studies, the greatest number (52 studies, or 80%) included measures of children's socioemotional development. A substantial number focused on cognition and general knowledge (35 studies, or 54%) and on language development and early literacy (33 studies, or 51%). Together, nearly two thirds of the studies focused on either language and early literacy or cognition and general knowledge, indicating a substantial focus in these areas. The studies provided less emphasis on approaches to learning (considered in 25% of the studies) and minimal focus on physical well-being and motor development (5%).

The very limited focus on physical well-being and motor development was unexpected, given that components directly related to the physical development of children are included in one of the most widely used sets of measures of child care quality across these studies, the Early Childhood Environment Rating Scale (ECERS) (Harms and Clifford 1980) and ECERS-R (Harms, Clifford, and Cryer 1998) and the variants of this measure for infants and toddlers in center care (Infant/Toddler Environment Rating Scale; Harms, Cryer, and Clifford 1990) and for children in family child care (Family Day Care Rating Scale, Harms and Clifford 1989). For example, the ECERS-R includes a rating of meals and snacks with elements concerning nutritional value, sanitary conditions, and accommodations for children with food allergies. Its rating of space for gross motor play includes elements pertaining to the availability of outdoor or indoor space for play, the safety of the space, and whether the space has surfaces permitting different types of play. Another rating pertains to adequacy of supervision of gross motor activities to protect children's health and safety. Ratings focus explicitly on health practices (e.g., whether the center has written rules regarding what to do if a child gets sick, isolation of a child with a contagious illness, and readmission of a child after an illness) and safety practices (e.g., whether procedures are in place for emergency evacuation, whether staff are trained in first aid and CPR, and whether hazards exist in the outdoor play space).

It is not the case that, in general, the research on child development in child care has failed to focus on health and safety. However, this research tends to focus on differences in health status between children who do or do not participate in child care of particular types and to various extents

(text continues on p. 586)

TABLE 1: Coverage of School Readiness Domains of Child Development

Citation	Physical Well-Being and Motor Development				Social and Emotional Development	Language Development	Approaches Toward Learning	Cognition and General Knowledge
	Physical Well-Being and Motor Development	Social and Emotional Development	Language Development	Approaches Toward Learning				
Blau (1999)		✓	✓		✓			✓
Broberg, Hwang, Lamb, and Bookstein (1990)		✓	✓					
Broberg, Wessels, Lamb, and Hwang (1997)		✓	✓		✓			✓
Burchinal, Peisner-Feinberg, et al. (2000)		✓	✓		✓			✓
Burchinal et al. (1996)					✓			✓
Burchinal, Roberts, et al. (2000)					✓			✓
Campbell et al. (2001)								✓
Chin-Quee and Scarr (1994)					✓			✓
Clarke-Stewart et al. (2002)					✓			✓
Deater-Deckard, Pinkerton, and Scarr (1996)					✓			✓
Dunn (1993)							✓	✓
Dunn, Beach, and Kontos (1994)								✓
Elicker, Forthner-Wood, and Noppe (1999)					✓			✓
Field (1991) Study 1					✓			✓
Field (1991) Study 2	✓				✓			✓
Goelman (1988)								✓
Hagekull and Bohlin (1995)					✓			✓
Hausfather et al. (1997)					✓			✓

Hestenes, Kontos, and Bryan (1993)	✓			
Holloway and Reichhart-Erickson (1988)	✓			
Howes (1988)	✓		✓	
Howes (1990)	✓	✓		
Howes (1997) Study 1	✓			✓
Howes (1997) Study 2	✓			✓
Howes and Olenick (1986)	✓			
Howes, Phillips, and Whitebook (1992)	✓			
Howes and Smith (1995)	✓	✓		✓
Howes and Stewart (1987)	✓			✓
Jacobs and White (1994)	✓	✓		✓
Kontos (1991)	✓	✓		✓
Kontos and Wilcox-Herzog (1997)	✓			✓
Loeb et al. (2004)	✓			✓
McCartney (1984)	✓			✓
McCartney et al. (1985)	✓		✓	
McCartney et al. (1997)	✓			✓
National Institute of Child Health and Human Development (NICHD)	✓			
Early Child Care Research Network (1998)	✓			
NICHD Early Child Care Research Network (1999a)	✓			✓
NICHD Early Child Care Research Network (1999b)	✓			

(continued)

TABLE 1 (continued)

<i>Citation</i>	<i>Physical Well-Being and Motor Development</i>	<i>Social and Emotional Development</i>	<i>Language Development</i>	<i>Approaches Toward Learning</i>	<i>Cognition and General Knowledge</i>
NICHD Early Child Care Research Network (2000)			✓		✓
NICHD Early Child Care Research Network (2001a)		✓			
NICHD Early Child Care Research Network (2001b)		✓			✓
NICHD Early Child Care Research Network (2002)		✓			
NICHD Early Child Care Research Network (2003a)		✓		✓	✓
NICHD Early Child Care Research Network (2003b)			✓		✓
NICHD Early Child Care Research Network (2003c)					
NICHD Early Child Care Research Network (2003d)		✓	✓	✓	✓
Research Network (2005)		✓	✓	✓	✓
Peisner-Feinberg and Burchinal (1997)		✓	✓	✓	✓
Peisner-Feinberg et al. (1999)		✓	✓	✓	✓
Peisner-Feinberg et al. (2001)		✓	✓	✓	✓

Phillips, McCartney, and Scarr (1987)	✓				✓	
Pianta (2004)						✓
Pierrehumbert et al. (1996)	✓				✓	
Pierrehumbert et al. (2002)	✓				✓	
Poe, Burchinal, and Roberts (2004)	✓				✓	
Ruopp et al. (1979)					✓	
Sagi et al. (2002)	✓				✓	
Schliecker, White, and Jacobs (1991)					✓	
Spieker et al. (2003)					✓	
Vandell, Henderson, and Wilson (1988)					✓	
Vernon-Feagans, Emanuel, and Blood (1997)					✓	
Vernon-Feagans and Manlove (2005)					✓	
Volling and Feagans (1995)					✓	
Votruba-Drzal, Coley, and Chase-Lansdale (2004)					✓	
Weigel, Martin, and Bennett (2005)					✓	
Total studies with a focus on each domain	3	52	33	16	35	

(Alexander et al. 1990; Hildensheim, Hoffman, and Overpeck 1999; Hurwitz et al. 1991; Nafstad et al. 1999; NICHD Early Child Care Research Network 2001b; Wald, Guerra, and Byers 1991; Youngblut 1999). That is, the gap is specifically with respect to whether health outcomes vary in relation to variations in child care quality.

That prevalent measures of child care quality emphasize health and safety practices, nutrition, and opportunities for motor development, yet studies of child care quality focus minimally on physical well-being outcomes, raises the question of whether this literature lacks implicit or explicit logic models. Such models provide a theory linking inputs or resources (e.g., the physical space, furnishings, and equipment in child care) to program activities (e.g., the provision of child care within the setting), outputs (e.g., children's participation in the setting) and outcomes (e.g., children's development as related to the child care environment; see Clarke et al. forthcoming).

On further consideration, however, we think the child care quality literature has a clear and prevalent logic model, but one that is broad rather than specific. That is, rather than hypothesizing that specific types of inputs (e.g., health and safety practices in care) are related to specific outcomes (e.g., children's health outcomes), the logic model posits that "structural" aspects of child care quality (e.g., group size, ratio, and caregiver education) are linked to "process" aspects of quality (e.g., the tone and extent of caregiver-child interaction), which in turn predicts children's developmental outcomes (see reviews by Lamb 1998; NRC and IOM 2000; Vandell and Wolfe 2000).

A paper by the NICHD Early Child Care Research Network (2002) is the first to examine all of the linkages in this model empirically through structural equation modeling (though see an earlier examination across all these linkages using path analysis by Howes, Phillips, and Whitbook 1992). However, a substantial body of research has examined different parts of the model (for example, that structural features of quality are related to process quality and separately that aspects of process quality are related to child outcomes) (see Vandell and Wolfe 2000; Smolensky and Gootman 2003).

It is much less common in the research literature to see predictions that specific types of inputs in child care foster specific types of child outcomes. Exceptions include studies of language or literacy stimulation in relation to children's language development (see, e.g., Dunn, Beach, and Kontos 1994) and studies of positive caregiver engagement with the child and child positive affect in child care or the child's attachment to the caregiver (see, e.g. Elicker, Fortner-Wood, and Noppe 1999; Hestenes, Kontos, and Bryan 1993; Howes, Phillips, and Whitebook 1992).

McCartney (1984) noted the need to explore the possibility that specific aspects of child care quality would be more closely tied to child outcomes than summary scores of quality. McCartney cautioned against separating out the most relevant subscales of the ECERS to examine their relation specifically to children's language development, because she found that the subscales of the ECERS were highly intercorrelated. She did, however, find that specific components from another measure of quality, the Day Care Environment Interview, were related to child language development, whereas others were not, and that the related measures (e.g., low noise levels in the classroom) could be hypothesized to be meaningfully related to opportunities for growth in language.

What emerges from this examination of the broad dimensions of child development that have been examined in the research on child care quality is (a) a strong focus on some aspects of development (especially socioemotional, language, and cognitive development) but limited focus on other important dimensions (particularly approaches to learning and health), (b) a tendency to focus on broad rather than on specific models of how quality is linked to child outcomes, and (c) a tendency to focus on summary measures of child care quality rather than specific aspects of care that could be examined in relation to the most closely related child outcomes.

CONSTRUCTS WITHIN THE DOMAINS OF SCHOOL READINESS

Lamb's (1998) review of the child care quality research cautioned about a lack of correspondence across studies in how aspects of child development were operationalized in terms of specific constructs examined and the measures used to examine them. He noted that this inconsistency was a barrier to discerning consistent patterns of findings across studies regarding the associations between quality and child outcomes.

We examined whether this issue was a problem for the measures within specific domains of development or whether it occurred across all five school readiness domains. For each of the 65 studies, we delineated the specific constructs examined within domains of development. We defined "construct" empirically, through examination of the discrete child outcome variables that were actually included in data analyses. For example, in a study by Kontos and Wilcox-Herzog (1997), the constructs were "competence with peers" within the domain of socioemotional development and "competence with objects" within the domain of cognition and general

knowledge. Often multiple constructs were included in analyses from a single measure of development (e.g., when analyses focused separately on ratings of aggression and anxiety from the Preschool Behavior Questionnaire [Behar and Stringfield 1974] in the work of Phillips, McCartney, and Scarr [1987]). We also looked for patterns of use at the level of measures rather than constructs, asking whether particular measures were frequently relied on within domains or whether little overlap occurred in the use of measures across studies.

Table 2 details the constructs and measures used in the studies reviewed (Table 2 may be found online as supplemental data at <http://erx.sagepub.com/content/vol30/issue5>). It indicates that a number of specific constructs recur across studies within the domain of children's language development, including "receptive and expressive language" and "verbal intelligence or ability." Looking at the studies from the perspective of measures used rather than constructs, the 33 studies that considered language development used 22 different measures. The measure used most often was the Peabody Picture Vocabulary Test-Revised (Dunn and Dunn 1981), which was used in 13 studies, followed by the subtests of the Woodcock-Johnson-Revised (Woodcock and Johnson 1990a, 1990b), especially the Letter-Word Identification subtest, which was used 10 times. Most studies used standardized, published measures, but several used original assessment methods, such as coding target children's speech during observations of their classroom interactions.

In the domain of cognition and general knowledge, "mental development or intelligence," and "early math ability" recur as constructs. Across the 35 studies that focused on this domain, 21 different assessments were used. The subtests of the Woodcock-Johnson-Revised (Woodcock and Johnson 1990a, 1990b) were used in 11 studies, with the Applied Problems subtest used most often. The Bayley Scales of Infant Development (Bayley 1969, 1993) were also used frequently (7 studies). Other measures used fairly frequently were the Bracken Basic Concept Scale (Psychological Corporation 1998) and the Preschool Inventory (Caldwell 1970). As in the domain of language development, several studies used direct observations of children's activities, with a measure of Play with Objects used most often (Rubenstein and Howes 1979).

By contrast, the list of constructs in the area of children's socioemotional development is long, and only some overlap occurs across studies, generally regarding "behavior problems." The list of constructs analyzed for positive socioemotional development includes "secure attachment" to mother or child care teacher or provider, "emotional expressiveness," "emotional well-being," "impulse control," "easy versus difficult temperament," "attractiveness," "playfulness," "popularity," "leadership," "sociability," "social competence,"

“social awareness,” “self-esteem,” “considerateness,” “interactions with peers,” “positive peer play,” “peer relationships,” “empathy,” “acceptance by peers,” “cooperation,” “compliance,” and “self-regulation.” Even if some of the constructs are seen as closely related (e.g., impulse control and self-regulation), the aspects of positive social and emotional development considered in this set of studies are still quite extensive.

Mirroring the long list of constructs, 57 different measures were used across the 52 studies that focused on the socioemotional domain. The Classroom Behavior Inventory (CBI; Schaefer, Edgerton, and Aaronson 1978) was used in 8 studies and the Child Behavior Checklist (CBCL; Achenbach and Edelbrock 1981; Achenbach, Edelbrock, and Howell 1987) was used in 15 studies. The Social Skills Rating System (Gresham and Elliott 1990) was used 6 times, and the Preschool Behavior Questionnaire (PBQ; Behar and Stringfield 1974) and Student-Teacher Relationship Scale (STRS; Pianta 1992) were each used 5 times. The Adaptive Social Behavior Inventory (ASBI, Hogan, Scott, and Bauer 1992) was used 3 times and the Peer Play Scale (Howes 1980; Howes and Matheson 1992) was used in 6 studies. The other 50 measures were used in only 1 or 2 studies. A number of these were newly developed observational systems (see, for example, measures in Field 1991; Howes, Phillips, and Whitebook 1992; Kontos and Wilcox-Herzog 1997; NICHD Early Child Care Research Network 1998, 2001a; Vandell, Henderson, and Wilson 1988).

In addition to the multiplicity of the socioemotional constructs studied, a further problem with the constructs was the lack of a clear dividing line between measures that reflect reciprocal positive social engagement, and therefore may be seen as indicators that the current child care environment is high-quality, and measures that can be seen as enduring features of the child’s social development. For example, is secure attachment to the child care provider an indicator of a high-quality environment (reflecting positive caregiver–child interactions) or of the child’s social development? Similarly, are playfulness, emotional expressiveness, or conflict negotiation, when measured concurrently with child care quality, simply reflections of a positive reciprocal social environment, or are they outcomes?

Some recent research suggests that future work may provide greater emphasis on particular aspects of positive socioemotional development. The Committee on Integrating the Science of Early Childhood Development highlighted the centrality of children’s ability to regulate their own behavior and expressions of emotion as well as attention (NRC and IOM 2000). Social and emotional self-regulation may be fostered by positive caregiving environments, such as high-quality child care, but it may be undermined by unresponsive care. Moreover, social and emotional self-regulation may be

particularly important as a child enters school, when the ability to control behavior and the expression of emotion becomes more salient. Thus, it may be valuable to consider how child care of varying quality contributes to self-regulation and, by extension, readiness for school. Much activity among researchers involves considering how best to measure self-regulation as a construct (Kochanska, Murray, and Harlan 2000; Kochanska, Coy, and Murray 2001; McCabe et al. 2000; Murray and Kochanska 2002; Pittman, Li-Grining, and Chase-Lansdale 2002; Roid and Miller 1997). Whereas some studies of child care quality have considered self-regulation (see, e.g., Howes 1990), we would anticipate a stronger focus on this specific aspect of positive social development in future studies and, we hope, greater ability to relate findings across studies through measurement of this construct.

Few of the studies we reviewed focused on constructs in the domains of health and physical development or approaches to learning. For health and physical development, three studies examined "activity level." As for approaches to learning, constructs included "task orientation," "work/study habits," "interest," "attention," and "creativity." Given the few studies that focused on these aspects of development, we did not pursue recurrence of particular measures within these domains.

In sum, we found that lack of agreement as to the most important constructs to examine is particularly apparent in the study of positive aspects of children's social development and that few constructs are examined at all for health and physical development and approaches to learning. Further progress may come from the recent focus on social and emotional self-regulation as a central construct in children's positive socioemotional development and work on developing measures of self-regulation.

METHODOLOGICAL CONCERNS WITH CHILD OUTCOME MEASURES

Following a preliminary reading of this set of studies, we identified 10 methodological concerns involving child outcome measures in child care quality research. Once we were confident of the definition of each methodological concern, we returned to every article and rated the child outcome measures included for the presence or absence of each concern. Although our examination of Question 2, above, focused both on constructs (e.g., externalizing behavior problems, internalizing behavior problems, and hyperactivity) and on measures, our rating of methodological concerns focused on measures (e.g., the CBCL) because methodological concerns generally pertained to

measures and the way they were described or administered, rather than to constructs. The research team discussed methodological concerns for each measure and coded them by consensus. We then summarized the data by number of studies focusing on a domain of development with none of the methodological concerns and the number of studies focusing on a domain of development in which any of the measures used had a particular methodological concern.

We underscore that our goal in identifying methodological concerns was not to identify particular studies that had methodological problems but rather to point out recurring concerns with measures (as reported on in these studies) within broad domains of child development. We especially wanted to note where the measurement of child outcomes could be strengthened. Accordingly, our summary focuses on the prevalence of methodological concerns within the five broad domains of development. We asked whether methodological concerns were more prevalent for measures within a particular domain and which concerns occurred with some frequency.

The ten methodological concerns were as follows:

1. ambiguity as to whether the measure reflected an aspect of quality or a child outcome (an issue touched on also with respect to constructs above);
2. absence of information about reliability for a measure that is not standardized or established;²
3. absence of information about validity for a measure that is not standardized or established;
4. use of a measure in a culture other than the one for which it was developed, with no reliability or validity data presented for the culture;
5. modification of a measure, with no reliability or validity information presented for the modification;
6. questionable adequacy of reliability for a measure;
7. questionable adequacy of validity for a measure;
8. lack of detail or specificity about the content of a measure in the paper's description of it;
9. no empirical basis given for how a composite score was created; and
10. unclear relation of part or all of the content of a measure to what the measure purported to be examining.

Table 3 provides an overview of the prevalence of each methodological concern by domain of child development studied. Note that a particular study could have generated more than one methodological concern; the numbers in the table do not reflect individual measures with these concerns but rather the number of studies that contained any measures with Methodological Concerns 1 through 10. We limit our discussion below to

TABLE 3: Methodological Concerns, by Domain of Child Development

Methodological Concerns	Physical				Cognition and General Knowledge
	Well-Being and Motor Development	Social and Emotional Development	Language Development	Approaches Toward Learning	
Total studies with a focus on each domain	3	52	33	16	35
Studies focusing on each domain with no methodological concerns	0	15	21	7	20
Studies focusing on each domain in which measure(s) had the following methodological issues:					
1. Ambiguity in whether the measure is an aspect of quality or a child outcome (within this study, not across studies)	0	4	0	0	0
2. No reliability information provided and not a standardized or established ^a measure	1	6	2	2	2
3. No validity information provided and not a standardized or established measure	2	17	4	2	4
4. Measure is used in a different culture, with no reliability or validity data for that culture	1	4	2	2	4
5. A modification of a measure is used, with no reliability and/or validity data for this modification	1	14	0	3	2

6. Adequacy of reliability can be questioned	0	3	1	0	0
7. Adequacy of validity can be questioned	0	2	1	0	0
8. Detail or specificity is lacking about content of the measure	0	9	5	1	7
9. Composite score used without empirical basis	0	3	0	0	0
10. Part or all of content of measure is not clearly related to what the measure purports to be examining	0	0	1	3	1

a. "Established" means there is a reference to original psychometric work.

the three domains of child development studied most frequently in the child care quality research: (1) socioemotional development, (2) language and literacy, and (3) cognition and general knowledge.

Of the 52 studies focusing on socioemotional development, we found at least one methodological concern in nearly three quarters (71%). The most frequently occurring concerns were failure to provide validity information for a measure that was not standardized or established (Concern 3), modification of an existing measure without presenting information regarding reliability or validity for the modification (Concern 5) or failure to provide reliability information for a measure that was not standardized or established (Concern 2), and a lack of detail or specificity about the content of a measure (Concern 8). Measures within this domain rarely had more serious methodological concerns, such as questionable adequacy of reliability or validity (Concerns 6 and 7). When reliability or validity information was not provided, it is not clear whether it was due to failure to convey available information or a lack of such information. Moreover, it is not clear in these instances whether information about reliability or validity would have indicated a problem.

Methodological concerns for measures of language and early literacy occurred in just over a third (36%) of the studies examining this domain. Compared to other domains, a higher proportion of the measures used in this domain were established measures developed with reference to a standardization sample. The most frequently occurring concerns in this domain were absence of validity information about a measure that was not standardized or established and insufficient detail about the content of a measure (Concerns 3 and 8). Although these methodological concerns likely limit researchers' ability to relate findings across studies in a meaningful way, it is not clear whether the lack of information reflects deeper problems with the measure or simply a failure to convey information that would indicate strong measure characteristics.

Finally, at least one methodological concern was present in fewer than half of the studies focusing on the domain of cognition and general knowledge (43%). Here again, a higher proportion of the measures were well established or standardized measures with extensive psychometric work reported. The most frequently occurring methodological problem for measures in this domain was, again, a lack of detail or specificity provided about the content of a measure (Concern 8).

Overall, what emerges is that the methodological problems present in this area of research often have to do with limited reporting of reliability and validity or of the content of a measure. Whereas we do not see serious and pervasive problems with inadequate reliability or validity, the lack of reporting of psychometric information on so many measures, particularly in

the domain of socioemotional development, may mask underlying problems with the strength of the measures in some instances. We see a need for more consistent reporting of measure characteristics so that researchers can gauge the strength of the measures and more clearly relate the content of measures across studies.

The wide range of constructs of positive social development and the prevalence of methodological issues in the measures within this domain are likely linked. Rather than relying on well-established or extensively validated measures, researchers focusing on this domain more often developed new measures to address the aspects of development in which they were interested. New measures may, in turn, have less extensive documentation of such psychometric properties as validity. Dual and highly interrelated needs exist in the measurement of children's positive socioemotional development in the research on child care quality: (a) a need for further discussion of the specific aspects of development that are likely to be linked to variations in quality (perhaps leading to a winnowing the large list of "candidates" now in the literature); and (b) a need for careful measures development, with documentation of reliability and validity, for the highest priority constructs.

RECOMMENDATIONS

Research has shown consistent yet small associations between child care quality and child outcomes (Lamb 1998; NRC and IOM 2000; Vandell and Wolfe 2000). Lamb's (1998) review raises the possibility that there are impediments to the accurate assessment of the strength of this association because of a variety of methodological issues, including problems in the measurement of child outcomes. What does our review suggest about this possibility?

Improve reporting of psychometric properties of child outcome measures. We did not find evidence that serious methodological problems are pervasive for the child outcome measures used in the research on child care quality. Few of the studies we reviewed raised concerns about inadequate reliability or validity in measures. Yet it was fairly common that information about reliability and validity of outcome measures was lacking in published articles. It is impossible to assess how often the absent information, had it been provided, would have raised concerns about the psychometric characteristics of the measures. A recommendation for strengthening the research on child care quality is simply to improve the reporting of measures'

characteristics on the dependent variable side of the equation to help ensure that all measures of child outcomes have the desired psychometric properties. Well-documented psychometric properties would make it possible to examine the strength of the association between child care quality and child outcomes for outcomes of greater and lesser reliability and validity within a particular domain of development.

Improve alignment of measures of child care quality and child outcomes.

Interestingly, the problems that we have identified have more to do with the degree of correspondence, or alignment of variables, both within and across studies than with the characteristics of the child outcome variables themselves. Within studies, we have identified a lack of alignment between the content of frequently used measures of child care quality and the specific child outcomes considered. Across studies, there appears to be lack of alignment in the constructs measured, especially in the area of socioemotional development.

Within studies, we found that frequently used measures of child care quality contain substantial content on health and safety practices in child care as well as information concerning opportunities for fine and gross motor activities. Yet studies have focused only minimally on child health outcomes or motor development in relation to variations in quality. Similarly, frequently used measures of quality focus on such features as the structuring of the child care environment to permit creative activities and exploration (e.g., through dramatic play, art, and music) and to minimize interruptions to sustained activities (e.g., "space is arranged so most activities are not interrupted" in the Early Childhood Environment Rating Scales-Revised; Harms, Clifford, and Cryer 1998). Yet there is little attention in child care quality research to studying such aspects of approaches to learning as task persistence, creativity, or exploration.

In a survey of kindergarten teachers (National Center for Education Statistics 1993), when asked to rate how important each of 15 qualities were for children's readiness for kindergarten, the teachers gave the highest priority to the child's physical well-being (e.g., "the child is physically healthy, rested, well-nourished"), the child's ability to communicate (e.g., the child "communicates needs, wants, and thoughts verbally") and approaches to learning (e.g., the child "is enthusiastic and curious in approaching new activities"). The kindergarten teachers' priorities for school readiness underscore the potential importance of more closely aligning measures of child care quality with child outcomes by expanding the examination of both child health outcomes and approaches to learning.

Use early intervention and other literatures as resources. An important resource for research on child care quality is the related literature on early childhood interventions. When those interventions have included a component aimed at improving child health, the evaluation studies have included detailed child health outcome measures. A noteworthy example is the evaluation of the Infant Health and Development Program (McCarton et al. 1997), which included among its child outcome measures the Child General Health Survey (Landgraf et al. 1993) and the Developmental Test of Visual–Motor Integration (Beery 1989), direct measures of growth, and a health questionnaire.

A possible new direction in the study of child health in relation to child care quality is the measurement of children's cortisol levels. Cortisol is a steroid hormone that is linked to a person's adaptation in social settings as well as his or her response to threatening or stressful events (Tout et al. 1998). The efficient use and regulation of cortisol is an important aspect of physiological functioning. Research suggests that cortisol levels (measured from saliva samples) among toddlers and preschool-age children in child care increase throughout the day, in contrast to findings in the home, where children's cortisol levels decrease throughout the day (Dettling, Gunnar, and Donzella 1999; Tout et al. 1998; Watamura et al. 2003). There is some evidence of variation in cortisol activity with other child behaviors and with the quality of child care at the higher end of the range. Tout et al. (1998) found that cortisol level is positively correlated with externalizing behavior and negatively correlated with internalizing behavior among boys. In addition, Dettling, Gunnar, and Donzella (1999) found that, for both sexes, elevated cortisol level is associated with aggression and poor self-control. Of particular importance, Dettling, Gunnar, and Donzella found that children's cortisol levels over the course of the day in child care are correlated with the amount of stimulation and attention given them by their caregivers. Further work is needed to clarify whether cortisol level should indeed be considered a child outcome in studies of child care quality (and, if so, whether it belongs in the domain of child health) and to extend the examination of cortisol activity to higher risk children and care of lower quality (see discussions in Brotman et al. 2003; Watamura et al. 2003).

Recent national surveys focusing on early childhood development have sought to include measures of approaches to learning. These attempts to capture motivational components of early engagement in learning, however, have not always gone smoothly. Analyses of a nationally representative sample of kindergartners in the Early Childhood Longitudinal Study—Kindergarten Class of 1998–99 found that the data are positively skewed for both parent

and teacher reports of curiosity and enthusiasm for learning among children entering kindergarten (Hair et al. 2003), suggesting that the parent and teacher report measures designed for this study may not yield adequate variability in measurement. In analyses of a sample of low-income families with young children enrolled in the Child Outcomes Study of the National Evaluation of Welfare to Work Strategies, however, researchers were able to find adequate variability in the teacher report measure used to capture approaches to learning for 8- to 10-year-olds (Hamilton et al. 2001). One possibility is that motivational aspects of engagement in learning are more readily measured in older children, who are past a period of initial adaptation to formal schooling.

As noted above, substantial recent effort has gone into the development of measures of both socioemotional and attentional self-regulation (Kochanska, Murray, and Harlan 2000; Kochanska, Coy, and Murray 2001; McCabe et al. 2000; Murray and Kochanska 2002; Pittman, Li-Grining, and Chase-Landsdale 2002; Roid and Miller 1997). However, these measures have permeated studies of early intervention more than studies of child care quality. For example, the evaluation of Early Head Start included measures of child attention and motivation (Fauth and Brady-Smith 2003). The child care quality literature should build on the recent steps in related literatures.

Consider child outcomes in relation to individual experiences. Another concern pertains to the unit of analysis. Studies of children's development in light of features of the home environment tend to hold constant the unit of analysis in that the parent-child relationship, experience of stimulation and support in the home environment, and child outcomes are all studied at the level of the individual child. Yet studies of child care quality often examine child care quality at the group or classroom level (e.g., studies using the environmental rating scales) but look at child outcomes at the level of the individual child (an important exception is the NICHD Study of Early Child Care). As noted elsewhere in this volume (Layzer and Goodson 2006), studying quality at the classroom or group level may miss important aspects of the individual child's experiences within care (e.g., frequency of direct engagement in verbal interaction with adults). Observations across multiple classrooms might be assumed to result in an estimate of the average child's experience of quality. Yet direct observation of a particular child's experience in the classroom and that child's development would increase precision in examining the linkage between quality and child outcomes.

Delineate important aspects of child socioemotional development. A final issue concerning alignment across studies pertains to the potential to

look across studies and consider how evidence for particular aspects of children's development is accumulating. We concur with Lamb's (1998) concern about a lack of agreement across studies with respect to constructs measured and we find evidence of this problem especially with regard to the measurement of children's positive social development.

It is interesting that the study of children's socioemotional development within this literature showed both the greatest prevalence of methodological issues and lack of alignment across studies in constructs measured. Recent studies encompassing both measures of cognitive development or language and measures of children's socioemotional development show a closer association between child care quality and children's cognitive and language development than between quality and children's socioemotional development (evidence summarized in Vandell and Wolfe 2000). Further work delineating which specific aspects of children's socioemotional development are most important to study in relation to child care quality, along with strengthening the measurement of positive social development, would help clarify whether this pattern in part reflects a difference in the strength of measures in different domains. Such work would also enhance the capacity to look across studies to discern whether consistent patterns of findings are emerging for specific constructs.

CONCLUSION

Clarifying the relation between child care quality and child outcomes will require attention to the measurement of child outcomes as well as the measurement of the environment. We continue to need greater consideration of health and approaches to learning in relation to child care quality and greater clarity as to which aspects of children's positive social development are both important and rigorously measured. In addition to focusing separately on measures of child care quality and child outcomes, this body of research would also benefit from greater consideration of the alignment of the two parts of the equation, namely, moving from implicit logic models of how quality is linked to child outcomes to explicit models and from broad logic models to more differentiated and specific ones. Studies now in the field, such as the Quality Interventions for Early Care and Education (QUINCE) Evaluation, an experimental evaluation focusing on on-site consultation approaches to improving child care quality launched by the Child Care Bureau and the Office of the Assistant Secretary for Planning and Evaluation of the U.S. Department of Health and Human Services, have the potential to strengthen our understanding of which

aspects of children's development change when specific features of child care quality are improved. In addition, the recently funded NICHD grants that are developing new outcome measures for children ages 3 to 5 (RFA-HD-04-026) may help to strengthen measures in several domains, including children's socioemotional development and the attentional aspects of approaches to learning.

NOTES

1. We attempted to access all studies that examined both measures of child care quality and child outcomes published between 1979 and 2005. Although our search for articles beyond the Vandell and Wolf (2000) review was extensive, we may have inadvertently overlooked some relevant papers.

2. "Established" here means there is a reference to original psychometric work.

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