Creating a measurement framework for service coordination in maternal and early childhood home visiting: An evidence-informed, expert process

Allison West*, Anne K. Duggan, Kelsey Gruss, Cynthia S. Minkovitz

Department of Population, Family and Reproductive Health, Johns Hopkins Bloomberg School of Public Health, United States

A B S T R A C T

Home visiting is a preventive service strategy to promote child health and development by providing voluntary services to expectant families and families with young children in their homes. Home visitors provide direct services (such as screening for parenting risks and teaching parenting skills) and link families to needed community resources. Service coordination is a core element of most evidence-based home visiting models and offers potential benefits to families, local organizations, and communities. However, there is no agreed upon framework that recognizes the unique role of home visiting in service coordination. This paper describes the process used to create a measurement framework for service coordination between home visiting programs and other organizations within early childhood systems. The framework was developed using an evidence-informed, modified Delphi process. It is grounded in five key principles: family centeredness; equity; adaptability; an interdisciplinary perspective; and a focus on population health and well-being. The framework includes a logic model and 37 indicators to assess the strength of the implementation system, activities, and outcomes that theory and prior research suggest support successful service coordination. The framework may be used to support needs assessment, monitoring, quality improvement, and research around service coordination in home visiting.

1. Introduction

Home visiting is a preventive service strategy to promote child health and development by providing voluntary services to expectant families and families with young children in their homes (HRSA, 2017). The primary objectives of home visiting are to improve child outcomes by building supports and reducing stressors that effect parenting. Although the roots of home visiting in the US extend back to the late 1800's (Minkovitz, O'Neill, & Duggan, 2016), services have expanded in the past decade due, in large part, to the establishment in 2010 of the Federal Maternal, Infant and Early Childhood Home Visiting Program (MIECHV). MIECHV awardees – states and territories – are to prioritize families living in at-risk communities and to devote the majority of funds to implement evidence-based home visiting models (Adirim & Supplee, 2013). Currently, 20 home visiting models have been designated as evidence-based following a rigorous review of the research literature (Sama-Miller et al., 2017). In FY 2016, MIECHV provided services to 160,000 parents and children in 50 states, the District of Columbia and 5 territories (HRSA, 2017). Home visiting services in many communities also are supported by additional federal, state, and local public and private initiatives.

Evidence-based home visiting models provide an array of services that vary by program model, family needs, and available local resources. Home visiting programs often target families with multiple, complex challenges including poverty, poor maternal or child health, substance use, domestic violence, and child maltreatment (Adirim & Supplee, 2013). Services vary by model but typically include screening for developmental delays, substance use, poor mental health, and family violence; providing health and parenting education; and linking families with needed goods and services (USHHS, 2017). High risk families often require services that are beyond the scope of what home visiting programs offer; thus, referrals and linkages to other service providers are essential to achieving positive family outcomes. As a result, families enrolled in home visiting are often involved with an array of providers across multiple sectors such early care and education; family support; income assistance and services to address basic needs; physical and oral health; mental and behavioral health; employment training and education; child protection; and early intervention (Goldberg, Greenstone, Colon, Fauth, & Mingo, 2016).

Service coordination is a core element of most evidence-based home visiting models (USHHS, 2017). *Service coordination* refers to the deliberate organization of activities between two or more organizations to

* Corresponding author at: Department of Population, Family, & Reproductive Health, Johns Hopkins University Bloomberg School of Public Health, 615 N. Wolfe Street, E4140, Baltimore, MD 21205, United States.
E-mail address: awest25@jhu.edu (A. West).

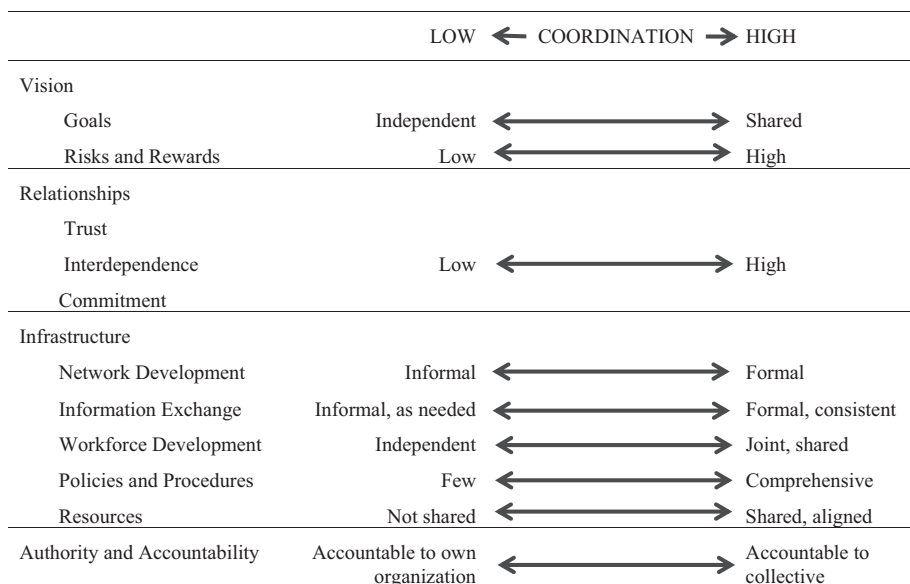|	LOW ← COORDINATION → HIGH		
Vision			
Goals	Independent	←→	Shared
Risks and Rewards	Low	←→	High
Relationships			
Trust			
Interdependence	Low	←→	High
Commitment			
Infrastructure			
Network Development	Informal	←→	Formal
Information Exchange	Informal, as needed	←→	Formal, consistent
Workforce Development	Independent	←→	Joint, shared
Policies and Procedures	Few	←→	Comprehensive
Resources	Not shared	←→	Shared, aligned
Authority and Accountability	Accountable to own organization	←→	Accountable to collective

Fig. 1. Coordination as continuum.
Note. Adapted from Collins & Marshall (2006).

facilitate, in partnership with the family, the delivery of the right services in the right setting at the right time. Service coordination is more complex and more difficult to achieve than simple referral of a family from one service to another. Coordination implies purposeful efforts of organizations delivering services across settings and over time to improve client care. It entails shared goals, delegated responsibility, accountability, communication, aligned resources, and the exchange of information (AHRQ, 2014; IOM, 2012). Service coordination is not an all-or-nothing phenomenon; rather, it occurs along a continuum (Fig. 1). Coordination is high when partners share a vision; have trusting, interdependent and committed relationships; have a solid infrastructure; and have sufficient authority and accountability to all partners.

Service coordination has many potential benefits for families, home visiting programs, other agencies and community-based organizations, and early childhood systems. Linkage of families with needed services has been shown to strengthen family engagement in home visiting, for example (Duggan, Burrell, Crowne, et al., 2015). Integration of home visiting and family-centered medical homes has been shown to improve understanding and retention of anticipatory guidance, adherence to recommended schedules for well-child visits and immunizations, and satisfaction with care (Tschudy, Tommey, & Cheng, 2013). In South Carolina, home visiting service coordination with patient-centered medical homes led to increased access to both health care and home visiting services, consistent messaging across providers, and better care and coordination for children and families (Sides & Baggett, 2015). Other potential benefits of coordination between home visiting and health care providers include sharing results from assessments; facilitation of referrals to each other and to community resources; and mutual reinforcement of advice and anticipatory guidance. In addition, home visiting programs can share results of home-based assessments of living conditions, safety, and parenting risks, such as maternal depression, with health care providers (Toomey & Cheng, 2013). As a result of enhanced coordination, organizations may experience an increase in appropriate and timely referrals and feedback from other providers. Communities may benefit from increased awareness of early childhood services and family needs and stronger relationships across organizations and service sectors. Over time, these benefits may contribute to greater efficiency of service delivery; equity in health, development and life course trajectories; and population health.

Despite numerous perceived benefits, home visiting's coordination

with other services often falls short of what is intended. Studies have shown that visitors often fail to identify and refer mothers who would benefit from community services for parenting risks, such as poor maternal mental health, substance use and partner violence (Duggan et al., 2004; Duggan et al., 2015). Duggan et al. (2004) suggested that such failures reflect inadequate implementation systems to support coordination; they noted lack of standardized assessments, inadequate training of home visitors and supervisors, and lack of formal referral arrangements with other community providers, for example. Moreover, when home visiting programs succeed in improving access to other services, such as pediatric primary care, there is little evidence of further coordination with such services (AHRQ, 2014; Gustin et al., 2014).

Prior research suggests that there is substantial *unintended* variation in home visiting referral and coordination practices, that is, variation that is explained more by community, organization, or staff features than by family needs and interests (Duggan, Caldera, Rodriguez, Burrell, & Crowne, 2007). Furthermore, home visiting activities required by national models and the MIECHV program, such as required screenings, may duplicate activities of other providers and send mixed messages to families if services are not aligned. All duplication is not bad; however, duplication that is unintended and uncoordinated may squander resources such as staff time and effort and generate frustration among families and providers.

Coordination must be considered within a much broader context. For example, federal and state economic and regulatory conditions may influence coordination funding, service availability, and family eligibility criteria for home visiting and other programs within the early childhood system (Hodges, Israel, Ferreira, & Mazza, 2007). To supplement MIECHV funding and expand home visiting services for eligible families, several states leverage funds from Medicaid, Temporary Assistance for Needy Families (TANF), philanthropic organizations, and other sources. Policy and program changes that limit or restrict funding for specific activities can have far-reaching implications for coordinated systems of care.

Moreover, home visiting is only one component of the comprehensive early childhood system of care. As in other complex systems, relations among multi-level inputs, activities, and outcomes are dynamic and nonlinear, with changes in one part of the system leading to changes in other parts (Best, 2011). These changes may be favorable, as in the case of positive feedback from families about experiences with one provider leading to more eligible families being referred to that

provider. Alternately, changes may be unfavorable, such as when program eligibility criteria become more restrictive, limiting access to services for families in need. Home visiting and other child- and family-serving organizations must have the requisite structures and activities to support coordination of services within this complex and changing environment.

Service coordination is currently a high priority for home visiting; it is one of six required benchmark areas named in the MIECHV program's authorizing legislation and one of four focal areas for MIECHV Innovations awards sponsored by the Health Resources and Services Administration of the Department of Health and Human Services (HRSA, 2016). We know of no frameworks or measurement instruments that address the unique role of home visiting in service coordination across agencies and sectors, however. Similar efforts in other fields have focused on understanding and assessing barriers and facilitators to collaboration (Hicks, Larson, Nelson, Olds, & Johnston, 2008; Kania & Kramer, 2011). One existing framework addresses broad community systems development (Coffman, 2007). Other existing models focus on coordination of services within a specific sector, such as health (AHRQ, 2014; ANA, 2013), or between two sectors, such as substance abuse treatment and child welfare agencies (Children & Family Futures, 2011). Specific tools focus on the depth of collaborative relationships (Frey, Lohmeier, Lee, & Tollefson, 2006) or the quality of partnerships (Mattessich, Murray-Close, & Monsey, 2001). Although these tools are useful in considering the contextual influences of coordination, home visiting lacks an agreed upon framework for service coordination, including specific indicators to measure its achievement.

This paper describes the process used to develop a measurement framework for service coordination between local home visiting programs and other entities within early childhood systems. The project addresses important needs in home visiting research, policy, and practice within the early childhood system of care. First, it addresses the need for a shared conceptual understanding of what it takes to achieve coordinated service delivery in the context of home visiting. Second, it provides a coordination framework and indicators to advance the field by supporting stakeholders in carrying out home visiting needs assessment, monitoring, quality improvement, evaluation, and research.

2. Method

2.1. Overview

Following Mangione-Smith, Schiff, and Dougherty (2011), we developed the measurement framework and corresponding indicators for coordination using a modified Delphi method. The Delphi method is a structured decision-making technique that incorporates scientific use of expert opinion (Dalkey, Brown, & Cochran, 1969; Fink, Kosecoff, Chassin, & Brook, 1984). Key characteristics of the Delphi method include: a) use of a panel of experts for obtaining data, b) anonymity of panel members' responses, c) two or more rounds of questionnaires or surveys to gather information or opinion from panel members, d) a controlled feedback process, and f) identification of patterns of agreement (Boulkedid, Abdoul, Loustau, Siboy, & Alberti, 2012; Hasson, Keeny, & McKenna, 2000; Landeta, 2006).

We modified the traditional Delphi method to include one face-to-face meeting of the experts. Because individual panelists were from multiple sectors and disciplines, meeting face-to-face encouraged sharing and understanding of diverse perspectives. We believed this was particularly important for a project to promote service coordination among these sectors.

2.2. Establishment of the expert panel

We solicited recommendations from key stakeholders and national leaders with expertise in home visiting, service coordination, and early

childhood systems. Nominees included 33 representatives from service sectors including health, social services, and early care and education. Twenty-seven of 33 individuals who were invited agreed to participate; two resigned after the initial kick-off meeting. The final panel of 25 experts represented the full range of stakeholders – organizations representing families, federal home visiting program state administrators, organizations responsible for developing quality metrics, researchers, early childhood systems experts, coordination experts, professional groups, and project sponsors.

In February 2016, we invited panelists to participate in a one-hour interactive webinar to orient them to the project. To increase participation, panelists were offered two different opportunities to participate in the webinar. The dual purpose of the webinars was to give an overview of the project objectives and process and to solicit panelists' perspectives regarding the reference list and draft conceptual framework. We implemented a five-step iterative decision-making process for revising and finalizing the framework and corresponding indicators.

2.3. Step 1: first draft of the framework

In conceptualizing the framework, we drew from existing frameworks and models of coordination in health, social services, and early care and education. We conducted a review of peer-reviewed and grey literatures to identify existing frameworks for service coordination across these service sectors. We identified over 40 models and frameworks for coordination. These models and frameworks varied in terms of whether they focused on practice or measurement, the target audience, whether they were theoretically or empirically derived. They also varied in the extent to which they focused on coordinating activities between two entities or on collaborations within and between much larger systems of care (Appendix). We also drew from ecological and systems theories and theories of organizational context and behavior and implementation science.

The first draft of the framework was presented as a logic model with inputs, outputs, and outcomes. We conceptualized service coordination as a process influenced by complex interactions among participants and factors at multiple levels. Inputs were organized in three domains: community and family context, organizational context, and home visiting program implementation system. The implementation system refers to factors that implementation science has shown to influence service delivery such as leadership, workforce competency, and data systems that support decision making (Fixsen, Blasé, Naoom, & Duda, 2013). We proposed activities and outcomes that we drew or adapted from models and frameworks for coordination in related service sectors (Appendix).

2.4. Step 2: first round of scoring

We emailed a draft of the proposed conceptual framework to the expert panelists in March 2016. The framework consisted of a narrative and logic model. We provided citations for sources from which we drew elements of the draft framework. After reviewing all materials, panelists completed nine Likert-type items (1 = *not at all* to 4 = *very much*) to indicate the extent to which the framework: 1) identified key concepts, 2) highlighted relationships among key constructs, 3) built on existing frameworks, 4) generated hypotheses to promote understanding of coordination, 5) included concepts that could be operationally defined and measured, 6) included short and long-term outcomes, 7) was conceptually clear, 8) was visually pleasing, and 9) was concise while covering key factors. Two open-ended questions elicited suggestions for improvement to the logic model and to the framework overall.

2.5. Step 3: second draft of framework

We used panelist feedback to inform revisions to the draft framework. In the second draft we added 72 measurable indicators for

Table 1
Criteria for evaluating indicators.

Dimension	Criteria
Importance	*A service coordination indicator is important if it meets one or more of the following:*
	A. Is applicable across MIECHV-funded home visiting (HV) programs
	B. Supports monitoring, evaluation, research, OR quality improvement related to coordination
	C. Assesses an aspect of coordination for which there are known disparities
	D. Contributes to a final set of measures that represent a balanced portfolio across the domains of interest (implementation system, activities, & outcomes)
Validity	*A service coordination indicator is valid if:*
	A. It corresponds to the real world and measures what it intends to measure
	B. Scientific evidence or, where evidence is insufficient, expert consensus supports the stated relationship between:
	• *Implementation system and activities* (e.g., there is a strong likelihood that policies and procedures for communication promote increased accountability)
	• *Implementation system and outcomes* (e.g., there is strong likelihood that policies and procedures for communication lead to increased timely services and decreased unmet needs)
	• *Activities and outcomes* (e.g., there is strong likelihood that increase in number of warm hand-offs leads to increased family engagement)
	C. Home visiting programs are responsible for the implementation system, activities, and outcomes. The indicators are under the control of the HV organization (or local implementing agency), HV program manager, supervisor, and/or home visitor.
Feasibility	*A service coordination indicator is feasible if:*
	A. The information is likely to be found in available data sources (e.g., HV policies or procedures manual, management information systems, or surveys of staff or families) or could routinely be collected by HV programs without undue burden to the program or clients.
	B. Estimates of adherence to the measures are likely to be reliable and unbiased. Reliability is the degree to which the measure is free from random error. Thus, the measure produces similar results under similar conditions, or when rated by multiple people.

coordination. Consistent with the Donabedian (1982) model of health services quality, we focused on indicators of the implementation system (structures), activities (processes), and outcomes hypothesized to support service coordination. The indicators were drawn or adapted from existing lists of indicators for service coordination across multiple service sectors (Appendix).

2.6. Step 4: second round of scoring

We distributed a revised draft of the framework to expert panelists via email in May, 2016. We also provided a summary of panel feedback from the two webinars and a list of the 72 draft indicators with the source of each indicator identified. We asked panelists to score each indicator on three criteria: importance, validity, and feasibility (Table 1). Panelists scored the indicators on a 5-point Likert scale (1 = *not important/valid/feasible*, 5 = *highly important/valid/feasible*). Panelists were given the option to use web-based or paper forms for scoring.

For each indicator scored in Round 2, we calculated the means and distributions of scores on each of the three criteria. Decisions to keep, discard, or discuss indicators after Round 2 were based on predetermined decision rules (Table 2). We retained 24 indicators with mean scores greater than or equal to 4 for Importance and Validity. We retained for discussion 31 indicators with mean scores greater than or equal to 4 for Importance and between 3 and 4 for Validity. We discarded 15 indicators that did not meet these criteria.

We ultimately chose not to use Feasibility as a criterion for deciding whether to keep or discard indicators, for two reasons. First, experts were drawn from multiple service sectors and thus had varying levels of knowledge of relevant data sources in home visiting on which to base judgments about feasibility. Second, we intended for indicators to be used by a range of stakeholders and felt that feasibility would vary across users and contexts.

Table 2
Decision rules for keeping, discussing, or discarding indicators.

Decision	Importance	Validity
Keep	Mean score ≥ 4	Mean score ≥ 4
Discuss	Mean score ≥ 4	Mean score < 4 and ≥ 3
Discard	Mean score < 4	Mean score < 3

2.7. Step 5: discussion and final round of scoring

Panelists convened for a one-day in-person meeting in June 2016. The primary purpose of the meeting was to move toward convergence of opinion regarding the framework, and in particular the 31 indicators for which there was only partial agreement. There were four key objectives of the meeting: 1) review the results from the second round of scoring 2) discuss the 31 indicators for which there was partial agreement, 3) re-score the 31 indicators after discussion, and 4) identify issues needing further attention. In preparation for the meeting, we emailed each panelist a de-identified summary of data from the second round of scoring and a revised list of indicators. To make the best use of meeting time, we limited discussion to ten minutes per indicator and focused on two criteria: Importance and Validity. Panelists were provided paper forms on which to re-score each indicator using the same 5-point scale as in Round 2. Space was given for panelists to submit comments about each indicator.

2.8. Refinements to framework and indicators

The project team refined the framework using quantitative data and panelists' verbal and written feedback from both rounds of scoring. In the interest of clarity, consistency, and parsimony, we also incorporated minor wording and grammatical changes. The discarding of some indicators after scoring led to removal of one subdomain within the implementation system and two from within the activities domain. Another major revision involved re-conceptualizing short- and long-term outcomes as short-term *program* outcomes, short-term *systems* outcomes, and long-term outcomes. Major revisions were reviewed by the Expert Panel.

3. Results

There were three rounds of scoring. Eighteen experts participated in the first round (72%), 20 participated in the second round (80%), and 20 participated in the third round (80%). Fourteen experts fully participated in all the three rounds of scoring (56%), five participated in two rounds (20%), and six participated in one round (24%).

Ratings in the first round were high, indicating general agreement with the draft framework (Table 3). Highest scores were given for *identifies key concepts* and *summarizes and integrates existing knowledge*. Lowest scores were given for *generates hypotheses that promote*

Table 3
Framework assessment from first round of scoring (N = 18).

Item	Mean (SD)
To what extent does the framework	
Identify key concepts related to coordination in early childhood systems?	3.8 (0.8)
Highlight relationships among key constructs?	3.0 (0.9)
Summarize and integrate existing knowledge?	3.7 (0.4)
Generate hypotheses that promote understanding of coordination?	3.0 (0.8)
Include concepts that can be operationally defined and measured?	3.2 (0.9)
Include short and longer term outcomes?	3.5 (0.8)
To what extent is the framework	
Conceptually clear?	3.0 (1.0)
Visually pleasing?	3.2 (1.0)
Concise while covering key factors?	3.2 (0.8)

Note: All items have possible range of 1–4.

understanding and *conceptual clarity*. Feedback from open-ended questions focused on the need to be more specific in defining the purpose of the framework, including intended uses and users, and in defining how the framework was to reflect, complement, or add to related efforts to enhance coordination in home visiting (e.g., MIECHV benchmarks). Other suggestions included the need to clearly define key concepts such as coordination and equity, to acknowledge the role of history among organizations as a factor that can promote or impede coordination, to assign accountability for each indicator, and to recognize the bi-directional nature of coordination. Panelists also suggested that the framework be specific yet adaptable to meet the unique needs of families and home visiting programs.

The final framework is presented as a set of guiding principles (Table 4) and logic model comprised of inputs, outputs, and outcomes that are specific to service coordination (Fig. 2). Table 5 describes subdomains, specific indicators, and potential data sources within each domain.

The final framework includes 12 indicators within five subdomains of the implementation system: 1) staff with designated roles; 2) staff training; 3) staff supervision and coaching; 4) data systems to support decision-making; and 5) policies and procedures to guide communication between home visiting programs and other agencies. Each subdomain contains two or three indicators.

The framework includes 20 indicators of **activities** within seven subdomains: 1) establish roles across organizations; 2) assess family strengths and needs; 3) create a goal plan; 4) facilitate communication and referrals; 5) monitor, follow-up, and respond to change; 6) support self-management of goals; and 7) align services with population needs and community resources. Each subdomain has one to five indicators.

The framework includes five indicators of **short-term, program-level outcomes** within three subdomains: 1) increased family satisfaction and engagement; 2) increased referrals to home visiting programs; and 3) increased feedback to community providers. Each subdomain has one to three indicators.

Finally, the framework contains four feedback loops, recognizing that changes in one part of the system may lead to changes in other parts. Achievement of activities and short- and long-term outcomes indicators may effect change within the broader community and organizational context. For example, increased family satisfaction and feedback to community providers may lead to an increase in positive attitudes regarding service coordination.

4. Discussion

Using a modified Delphi process, we leveraged expertise across multiple service sectors to develop a framework to measure specific indicators of service coordination. This transparent, evidence-informed process led to the identification of a parsimonious set of indicators for three domains for effective service coordination: a) implementation system, b) activities, and c) short-term program outcomes. The final set of 38 indicators is intended to be applicable across all early childhood home visiting programs and models, and available for adaptation by other programs and organizations within early childhood systems.

This project is a step toward enhancing service coordination between local home visiting programs and other providers within systems of care. We envision several potential uses for the framework, which was designed to support generation of knowledge, needs assessment, monitoring, evaluation, quality improvement, and research. The framework and indicators may be most useful within the context of a comprehensive continuous quality improvement (CQI) system. Home visiting programs might begin the CQI process by selecting two or three indicators of greatest importance to their own intended outcomes, participants, and services. Once achieved, programs could "retire" the indicators and select new ones for improvement.

We further intend the framework to facilitate research to test theory-based linkages and causal associations among coordination structures, processes, and outcomes. Two new federal home visiting initiatives offer unique opportunities to further this work. In 2016, HRSA awarded over 17 million dollars to nine entities in 13 states to support innovations to strengthen the federal home visiting program; three of these projects focus on service coordination. In 2017, HRSA funded a new research and development platform to advance the national home visiting research agenda. The platform will focus on using "precision home visiting" to distill the active ingredients of effective home visiting programs and to determine what works for whom and under what circumstances. Service coordination is one of the top ten
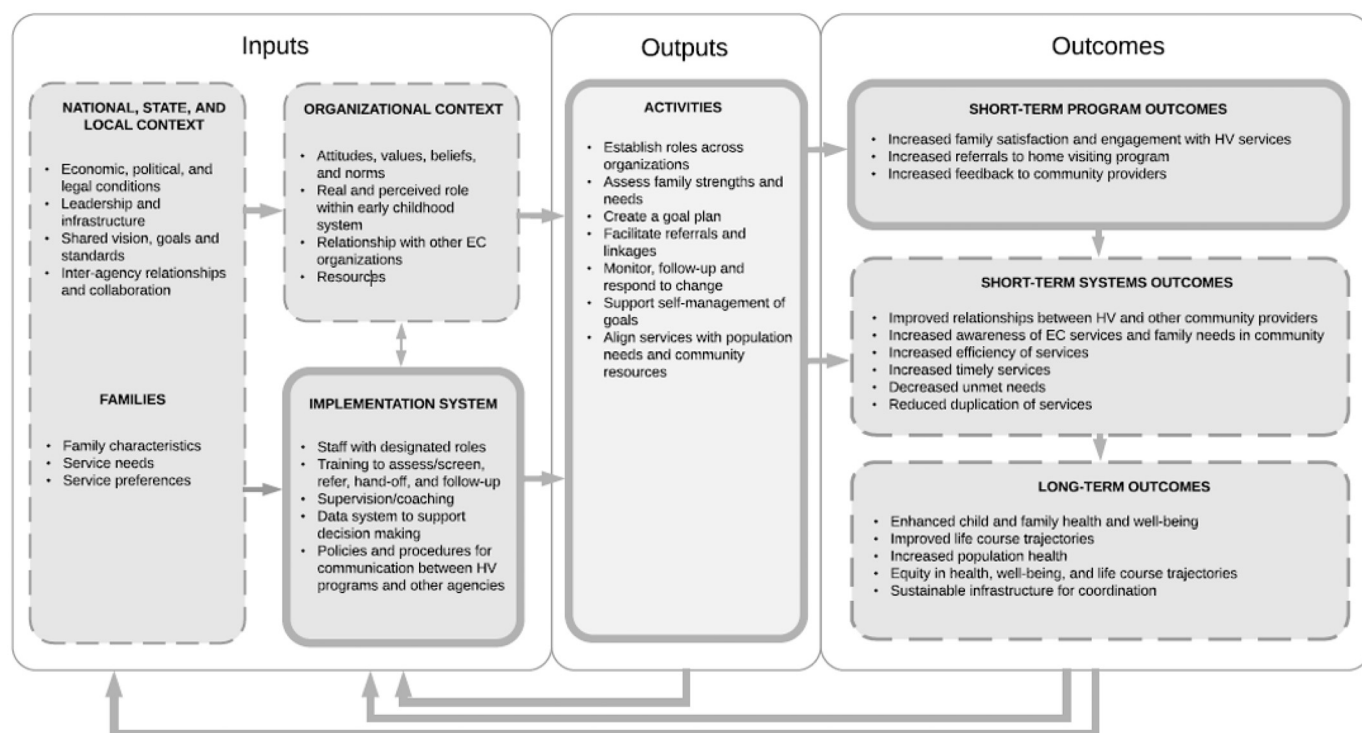
Table 4
Guiding Principles for the Measurement Framework for Service Coordination.

Principle	Operationalization
Family-centeredness	Families' strengths, needs, and preferences drive service planning and decision-making. Services are individualized, culturally responsive, and reflective of participants' needs, strengths, and preferences.
Equity	HV programs, together with other providers, help remove barriers and facilitate access to services for families in need so that they can reach their full potential.
Adaptability	Providers, organizations and systems are prepared to meet the changing needs of families, communities and society.
An interdisciplinary perspective	Providers, organizations, and systems acknowledge, learn from and capitalize on strengths of varied service sectors.
Focus on population health and well-being	The early childhood system emphasizes promotion, prevention, early identification and response to identified family and community needs.

Note. Adapted from ANA (2013); Antonelli, McAllister, and Popp (2009); Best et al. (2003); Bruns et al. (2004); NQF (2014); Nebelkopf and Wright (2011); Stroul, Blau, and Friedman (2010); & Valentijin, Schepman, Opheij, and Bruijnzeels (2013).

Fig. 2. Measurement framework for service coordination.

research priorities.

Finally, it is our hope that the framework will stimulate further integration of home visiting programs into early childhood systems in local communities. The development of state home visiting programs and their engagement in diverse early childhood initiatives such as those supported by Project LAUNCH and HRSA-supported efforts through MIECHV may lead to innovative strategies to promote service coordination. Some states, such as Illinois, have used MIECHV funds to develop resources for facilitating connections between home visiting and pediatric primary care (Illinois AAP, n.d.), while others, such as South Carolina, have chosen to co-locate home visiting and primary care (Sides & Baggett, 2015).

The modified Delphi process engaged experts from diverse fields and with diverse perspectives in constructive dialogue around service coordination. We identified panelists who were motivated to participate and whose expertise would contribute to the theme being studied (Landeta, 2006). Some panelists brought expertise in macro-level systems thinking, whereas others were more focused on micro-interactions between providers. The resulting framework represents the culmination of these ideas tailored for the field of home visiting.

The process was not without challenges. Although the intent was to develop a pragmatic framework with measurable indicators for use by home visiting programs, the importance of broader context cannot be ignored. The panel struggled with how to acknowledge broader structural, political, social, and economic factors that influence service coordination but that are difficult to measure and are not under the direct purview of local home visiting programs. Ultimately, we decided to include a broad overview of these factors in the logic model.

Although panelists stated that it was important to include only indicators under the direct control of home visiting programs, they recognized that motivation and capacity of other community service providers to coordinate with home visiting also influences outcomes. In

this sense, the framework is somewhat "one-sided" in its approach. Recognizing the critical importance of shared accountability for promoting coordination in the early childhood system, we developed a set of systems-level short-term outcomes. Because these outcomes are not under the sole purview of home visiting programs, a broken line demarcates this subdomain. Relatedly, we moved two family short-term outcomes that were not under the sole purview of home visiting programs (decreased unmet need, reduced duplication of services) into the newly identified set of systems-level short-term outcomes. These outcomes require collaboration among multiple community partners.

An important point of discussion among panelists focused on whether all indicators were relevant for coordinating services around sensitive challenges such as mental health, substance use, and domestic violence. Families often need, want, and expect help addressing these challenges (Duggan et al., 2004; Krysik, LeCroy, & Ashford, 2008; Paris & Dubus, 2005), yet concerns about privacy and safety may limit the amount of information that can and should be shared. Home visiting staff must follow professional practice guidelines in these situations. Similarly, as emphasized in the guiding principles and framework, decisions regarding when and with whom to share information must always be made in partnership with the family.

At least two features of home visiting make it challenging to reach consensus on a vision of coordination for the field. First, home visiting models and local programs are aligned with varied service sectors, including health services, human and social services, child welfare services, and early education services. Second, a focus on coordination as a core element of home visiting may represent a paradigm shift from current ways of thinking about home visiting models. Some home visiting staff may resist shifting focus away from direct practice. Further research is needed to measure outcomes associated with coordination activities and to enhance our increasing our understanding of distinct and synergistic elements of home visiting.

Table 5
Indicators of service coordination.

Implementation system		
Factor and defintion	#	Indicator
Staff with designated roles *Staff are provided clear expectations and accountability. Staff include home visitors, supervisors, program managers, directors, and others employed at the organization.*	I-1	Job descriptions clearly define expectations and accountability for assessment, screening, referral, linkage, and follow through. [1,7]
	I-2	Formal policy clearly defines WHO is responsible for assessment, screening, referral, linkage, and follow through.[10, 14]
Training to assess, screen, refer, link, and follow-through *Staff receive instruction regarding assessment, screening, referral, linkage and follow-up.*	I-3	Formal policy clearly defines the timing and scope of training for HV staff around assessment, screening, referral, linkage, and follow through.[1, 7, 10]
	I-4	Formal training for HV staff focuses on assessment, screening, referral, linkage, and follow-through with other service providers.[1, 7]
	I-5	HV staff are competent in using a family-centered approach when coordinating services with families with diverse background, strengths, and needs. [15]
Supervision/coaching *Oversight is readily available and of high quality.*	I-6	Supervisors support and monitor staff around assessment, screening, referral, linkage, and follow through.[1,2, 7]
	I-7	HV staff use supervision or coaching data regarding assessment, referrals, linkages, and follow-through to drive improvements in processes.[2,8]
Data system to support decision-making *Information and reporting systems inform continuous quality improvement regarding home visiting services. Information is collected regarding coordination to support improvement in policy, practice, and programs.*	I-8	Formal policy clearly defines accountability for measurement, reporting, and reviewing outcomes for coordination in the management information systems.[8, 10]
	I-9	Management information systems maintain data specific to screening, referral, linkage and follow through.[8]
	I-10	HV staff use a data system to inform decisions regarding coordinating services for families.[8]
Policies and procedures for communication between HV programs and other agencies *Formal policies or procedures specify the intended nature of communication (content, mode, frequency of interactions) between agencies.*	I-11	Formal agreements or memoranda of understanding support communication between HV programs and other agencies.[5, 14]
	I-12	Formal policy clearly defines the primacy of the family in deciding what and with whom information is shared.[14]
Activities		
Activity and defintion	#	Indicator
Establish roles across organizations. *Clear expectations delineate WHO is responsible for WHAT services or aspects of services, including service coordination.*	A-1	HV staff understand the roles of other community providers with regard to serving families.[1, 7, 9]
Assess family strengths and needs *Determine the family's strengths and needs in areas including but not limited to physical, emotional, social, psychological, and spiritual health and well-being as well as need for education, employment, peer support.*	A-2	Families participate in a comprehensive assessment of strengths and needs.[2,9]
	A-3	Family assessment includes consideration of both formal and informal supports (professional, friends, and relatives).[15]
	A-4	HV staff screen families/children for [XX] with a standardized tool.[2]
Create a goal plan *In partnership with the family, establish and maintain a goal plan that outlines the family's short- and long- term goals and steps to achieve them.*	A-5	Families have a goal plan.[1, 5, 7]
	A-6	Goal plans have clearly specified family-centered goals for home visiting.[1, 2, 7]
	A-7	Goal plans clearly document that family preferences were incorporated.[9, 13]
	A-8	Goal plans incorporate families' formal and informal supports (professionals, friends, and relatives).[14]
Facilitate referrals and linkages *Facilitate referrals and linkages by sharing pertinent information with families and providers.*	A-9	Family agreement for exchange of information about [XX] screening results is documented in record.[3]
	A-10	HV staff offer a referral to families with a positive screen for [XX] who are not already in services.[4]
	A-11	HV staff provide referral information specific to [XX] to families with positive screens for [XX].[6]
	A-12	HV staff provide key information to the family about the referral (such as logistics, nature of services provided).[7, 12]
	A-13	HV staff provide pertinent information about the family to the community provider at the time of the referral (e.g., reason for referral; family needs and preferences).[5, 7, 12]
	A-14	HV staff provide a warm-hand-off to families who receive referrals to community organizations (this refers to connecting a caregiver with a provider in real time, in person or by phone).
Monitor, follow-up and respond to change *In partnership with the family, HV staff assess progress toward service and service coordination goals on a regular basis.*	A-15	Home visiting staff follow up with families who received referrals to learn about the family's understanding and next steps.
	A-16	Home visiting staff follow up with families who received but did not complete referrals to learn why referral was not completed.[15]
	A-17	Home visitors review the goal plan monthly with families and update as needed.[13, 14]
Support self-management of goals *Tailor education and support to align with families' capacity for and preferences about involvement in their own care and to promote empowerment, self-efficacy, and engagement.*	A-18	Home visitors use specific strategies (e.g., coaching, motivational interviewing) to promote self-care, progress toward goals, and self-sufficiency.[12]
Align services with population needs and community resources *In partnership with other community organizations, adapt services to meet changing population needs and availability of other community resources.*	A-19	HV staff are actively engaged in community discussions regarding the evolving needs of the community, gaps in services, and the capacity to serve all families in need of services.[1, 7, 9, 11]
	A-20	HV staff participate in community health planning activities.
Short-term program outcomes		
Outcome and defintion	#	Indicator

Table 5 (*continued*)

Implementation system		
Factor and defintion	#	Indicator
Increased family satisfaction and engagement with HV services	OF-1	Families receive all of the expected home visits each month. [1,4,7,12]
Families are report satisfaction and demonstrate increased participation and	OF-2	Families report satisfaction with HV services. [1,7,12]
engagement in services.	OF-3	Families remain enrolled in HV for recommended time period. [1,7,12]
Increased referrals to home visiting program	OO-4	Number of referrals of families meeting eligibility requirements within a 6 month period. [5]
HV programs receive appropriate referrals from community organizations.		
Increased feedback to community providers	OO-5	HV programs give feedback about family progress to community providers.
HV programs share feedback with community providers regarding HV services families receive and progress toward achieving goals		

Note. XX refers to maternal depression, intimate partner violence, maternal substance use, or child development delay.
Note. Indicators were adapted from the following sources: 1) ANA (2013); 2) Antonelli et al. (2009); 3) French and Scholle (2010); 4) Mackrain (2016); 5) JBA (2014); 6) HRSA (2016); 7) McDonald et al. (2014); 8) NIRN (2015); 9) NQF (2014); 10) PEW Charitable Trusts (2015); 11) Preskill, Parkhurst, and Splansky Juster (n.d.); 12) Schultz, Pineda, Lonhart, Davies, and McDonald (2013); 13) Singer et al. (2011); 14) Snyder, Lawrence, and Dodge (2012); 15) Proposed by Expert Panel.

A measurement framework for service coordination in home visiting is critical in understanding, assessing, and strengthening the capacity of local programs to link vulnerable families with needed services and in strengthening the role of home visiting within the early childhood system of care.

Declarations of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https:// doi.org/10.1016/j.childyouth.2018.04.037.

References

Adirim, T., & Supplee, L. (2013). Overview of the federal home visiting program. *Pediatrics, 132*(2), S59–S64. http://dx.doi.org/10.1542/peds.2013-1021C.

Agency for Healthcare Research and Quality (AHRQ) (2014). Care coordination measures Atlas update. Rockville, MD. Retrieved July 17, 2017, from http://www.ahrq.gov/professionals/prevention-chroniccare/improve/coordination/atlas2014.

American Nurses Association (2013). Framework for measuring nurses' contributions to care coordination. Retrieved February 7, 2016, from http://www.nursingworld.org/Framework-for-Measuring-Nurses-Contributions-to-Care-Coordination.

Antonelli, R. C., McAllister, J. W., & Popp, J. (2009, May). Making care coordination a critical component of the pediatric health system: A multidisciplinary framework. Retrieved February 3, 2016, from http://www.lpfch.org/sites/default/files/care_coordination_a_multidisciplinary_framework.pdf.

Best, A. (2011). Systems thinking and health promotion. *American Journal of Health Promotion, 25*(4), (eix-ex) https://doi.org/10.4278/ajhp.25.4.eix.

Best, A., Stokols, D., Green, L. W., Leischow, S., Holmes, B., & Buchholz, K. (2003). An integrative framework for community partnering to translate theory into effective promotion strategy. *American Journal of Health Promotion, 18*(2), 168–176.

Boulkedid, R., Abdoul, H., Loustau, M., Siboy, O., & Alberti, C. (2012). Using and reporting the Delphi methods of selecting healthcare quality indicators: A systematic review. *PLoS One, 6*(6), 1–9. http://dx.doi.org/10.1371/journal.pone.0020476.

Bruns, E. J., Walker, J. S., Adams, J., Miles, P., Osher, T., Rast, J., & VanDenBerg, J. (2004). Ten principles of the wraparound process. Retrieved February 3, 2016, from *National wraparound Initiative, research and training center on family support and children's mental health*Portland State University. web site http://nwi.pdx.edu/pdf/WalkerNWITenPrincWAProcess.pdf.

Children and Family Futures (2011). The collaborative practice model for family recovery. *Safety and stability. Irvine, CA: Author*.

Coffman, J. (2007). A framework for evaluating systems initiatives. Retrieved from http://www.buildinitiative.org/Portals/0/Uploads/Documents/Framework%20for%20Evaluating%20Systems%20Initiatives.pdf.

Collins, J., & Marshall, A. (2006). Collaboration between system of care communities and the child welfare system: Create ideas for how to make it work. Retrieved July 12, 2017, from http://www.choicesccs.org/knowledge-center/collaboration-between-system-of-care-communities-and-the-child-welfare-system-creative-ideas-for-how-to-make-it-work.

Dalkey, N. C., Brown, B. B., & Cochran, S. (1969). *The Delphi method: An experimental study of group opinion. Vol. 3.* Retrieved July 10, 2017, from http://www.acove.com/content/dam/rand/pubs/research_memoranda/2005/RM5888.pdf.

Donabedian, A. (1982). Explorations in quality assessment and monitoring. *The criteria and standards of quality. Vol. II.* Ann Arbor, MI: Health Administration Press.

Duggan, A., Burrell, L., Crowne, S. S., et al. (2015). Evaluation of evidence-based home visiting in New Jersey: Early family engagement and services in home visiting. *Division of family and community services: Early childhood services.* Trenton, NJ: New Jersey Department of Children and Families.

Duggan, A. K., Caldera, D., Rodriguez, K., Burrell, L., & Crowne, S. (2007). Impact of a statewide home visiting program to prevent child abuse. *Child Abuse & Neglect, 31*(8), 801–827.

Duggan, A. K., Fuddy, L., Burrell, L., Higman, S., McFarlane, E., Windham, A., & Sia, C. (2004). Randomized trial of a statewide home visiting program to prevent child abuse: Impact in reducing parental risk factors. *Child Abuse & Neglect, 28*(6), 623–643.

Fink, A., Kosecoff, J., Chassin, M., & Brook, R. H. (1984). Consensus methods: Characteristics and guidelines for use. *American Journal of Public Health, 74*(9), 979–983.

Fixsen, D., Blasé, K., Naoom, S., & Duda, M. (2013). Implementation drivers: Assessing best practices. Retrieved May 20, 2016, from *National implementation science network*. web site at http://implementation.fpg.unc.edu/sites/implementation.fpg.unc.edu/files/NIRN-ImplementationDriversAssessingBestPractices.pdf.

French, J. B., & Scholle, S. H. (2010, November). Measuring care coordination for children at risk of developmental delay: Challenges and opportunities. Retrieved from https://www.ncqa.org/Portals/0/Publications/Resource%20Library/Issue%20Briefs/Measuring%20Care%20Coordination%20Issue%20Brief.pdf.

Frey, B. B., Lohmeier, J. H., Lee, S. W., & Tollefson, N. (2006). Measuring collaboration among grant partners. *American Journal of Evaluation, 27*(3), 383–392.

Goldberg, J., Greenstone, J., Colon, M., Fauth, R., & Mingo, M. V. (2016). Getting to the warm hand-off: A study of home visitor referral activities. *Presented at the 2017 collaborative science of home visiting meeting, Crystal City, VA.*

Gustin, S., Hellman, D., Scott, L., Ojo, K., Burrell, L., Cluxton-Keller, F., & Duggan, A. (2014). Referrals to community resources: Linking research and practice in New Jersey. *Presented at head start's 12th National Research Conference on early childhood, Washington, DC.*

Hasson, F., Keeny, S., & McKenna, H. (2000). Research guidelines for the Delphi survey technique. *Journal of Advanced Nursing: Methodological Issues in Nursing Research, 34*(4), 1008–1015.

Health Resources and Services Administration (HRSA) (2016). The maternal, infant, and early childhood home visiting program. *Form 2: Performance system and outcome measures.* Last retrieved on July 11, 2017, from https://mchb.hrsa.gov/sites/default/files/mchb/MaternalChildHealthInitiatives/HomeVisiting/performanceresources/form2benchmark.pdf.

Health Resources and Services Administration (HRSA) (2017). Maternal, infant, and early childhood home visiting program national program brief. Retrieved on July 11, 2017, from https://mchb.hrsa.gov/sites/default/files/mchb/MaternalChildHealthInitiatives/HomeVisiting/pdf/programbrief.pdf.

Hicks, D., Larson, C., Nelson, C., Olds, D. L., & Johnston, E. (2008). The influence of collaboration on program outcomes: The Colorado nurse—family partnership. *Evaluation Review, 32*(5), 453–477.

Hodges, S., Israel, N., Ferreira, K., & Mazza, J. (2007, February). Critcal factors in system of care implementation (Issue Brief No. 2). Retrieved from http://rtckids.fmhi.usf.edu/rtcpubs/study02/issueBrief2.pdf.

Illinois Chapter of the American Academy of Pediatrics (n.d.) Home visiting. Accessed August 10, 2017, from http://illinoisaap.org/home-visiting/

IOM (Institute of Medicine) (2012). *Public health: Exploring integration to improve population health.* Washington, DC: The National Academies Press.

James Bell Associates (JBA) (2014). The maternal, infant, and early childhood home visiting (MIECHV) program: Benchmark measures selected by grantees. *Report of the design options for home visiting evaluation (DOHVE).* Last retrieved July 17, 2017 from http://www.jbassoc.com/ReportsPublications/508_compliant%20PDF_Benchmark%20measures.pdf.

Kania, J., & Kramer, M. (2011, Winter). Collective impact. *Stanford social innovation review.* Retrieved March 18, 2016, from https://ssir.org/images/articles/2011_WI_Feature_Kania.pdf.

Krysik, J., LeCroy, C. W., & Ashford, J. B. (2008). Participants' perceptions of healthy families: A home visitation program to prevent child abuse and neglect. *Children and Youth Services Review, 30*(1), 45–61.

Landeta, J. (2006). Current validity of the Delphi method in social sciences. *Technological forecasting and social change, 73*(5), 467–482.

Mackrain, M. (2016). *Refined HV CoIIN AIMS, measures and operational definitions.* Washington, DC: Educational Development Center, Inc.

Mangione-Smith, R., Schiff, J., & Dougherty, D. (2011). Identifying children's health care quality measures for Medicaid & CHIP: An evidence-informed, publicly transparent expert process. *Academic Pediatrics, 11*, S11–S21. http://dx.doi.org/10.1016/j.acap.2010.11.003.

Mattessich, P., Murray-Close, M., & Monsey, B. (2001). *Wilder collaboration factors inventory.* St. Paul, MN: Wilder Research.

McDonald, K. M., Schultz, E., Albin, L., Pineda, N., Lonhart, J., Sundarm, W., ... Davis, S. (2014). *Care coordination atlas: Version 4 (AHRQ publication no. 14-0037-EF).* Rockville, MD: Agency for Healthcare Research and Quality.

Minkovitz, C. S., O'Neill, K. M., & Duggan, A. K. (2016). Home visiting: A service strategy to reduce poverty and mitigate its consequences. *Academic Pediatrics, 16*(3), S105–S111. http://dx.doi.org/10.1016/j.acap.2016.01.005.

National Implementation Research Network (2015). Implementation drivers: Assessing best practices. Retrieved February 25, 2016, from the NIRN web site at http://implementation.fpg.unc.edu/resources/implementation-drivers-assessing-best-practices.

National Quality Forum (2014). Priority setting for healthcare performance measurement: Addressing performance measure gaps in care coordination. Retrieved March 7, 2017 from https://www.qualityforum.org/Publications/2014/08/Priority_Setting_for_Healthcare_Performance_Measurement_Addressing_Performance_Measure_Gaps_in_Care_Coordination.aspx.

Nebelkopf, E., & Wright, S. (2011). Holistic system of care: A ten-year perspective. *Journal of Psychoactive Drugs, 43*(4), 302–308.

Paris, R., & Dubus, N. (2005). Staying connected while nurturing an infant: A challenge of new motherhood. *Family Relations, 54*(1), 72–83.

Pew Charitable Trusts (2015, October). Using data to measure performance: A new framework for assessing effectiveness of home visiting. Retrieved March 8, 2017, from http://www.pewtrusts.org/en/research-and-analysis/reports/2015/10/using-data-to-measure-performance-of-home-visiting.

Preskill, H., Parkhurst, M., & Splansky Juster, J. (n.d.) Guide to evaluating collective impact. Supplement: Sample questions, outcomes, and indicators. Retrieved February 7, 2017 from http://www.fsg.org/publications/guide-evaluating-collective-impact#download-area

Sama-Miller, E., Akers, L., Mraz-Esposito, A., Zukiewicz, M., Avellar, S., Paulsell, D., & Del Grosso, P. (2017). *Home visiting evidence of effectiveness review: Executive summary.* Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.

Schultz, E. M., Pineda, N., Lonhart, J., Davies, S. M., & McDonald, K. M. (2013). A systematic review of the care coordination measurement landscape. *BMC Health Services Research, 13*(119), http://dx.doi.org/10.1186/1472-6963-13-119.

Sides, K., & Baggett, S. (2015). Coordinating comprehensive healthcare with home visits for new families: A case study of home visitation integration with the family-centered medical home at Carolina health centers. Retrieved June 6, 2017, from https://firstfocus.org/resources/report/coordinating-comprehensive-healthcare-with-home-visits-for-new-families-a-case-study-of-home-visitation-integration-with-the-family-centered-medical-home-at-carolina-health-centers.

Singer, S. J., Burgers, J., Friedberg, M., Rosenthal, M. B., Leape, L., & Schneider, E. (2011). Defining and measuring integrated patient care: Promoting the next frontier in health care delivery. *Medical Care Research and Review, 68*(1), 112–127.

Snyder, E. H., Lawrence, N., & Dodge, K. A. (2012). The impact of system of care support in adherence to wraparound principles in Child and Family Teams in child welfare in North Carolina. *Children and Youth Services Review, 34*, 639–647.

Stroul, B., Blau, G., & Friedman, R. (2010). *Updating the system of care concept and philosophy.* Washington, DC: Georgetown University Center for Child and Human Development, National Technical Assistance Center for Children's Mental Health.

Toomey, S. L., & Cheng, T. L. (2013). Home visiting and the family-centered medical home: Synergistic services to promote child health. *Academic Pediatrics, 13*(1), 3–5. http://dx.doi.org/10.1016/j.acap.2012.11.001.

Tschudy, M., Tommey, S., & Cheng, T. (2013). Merging systems: Integrating home visitation and the family-centered medical home. *Pediatrics, 132*(2), S74–S81. http://dx.doi.org/10.1542/peds.2013-1021E.

U.S. Department of Health and Human Services (2017). Home visiting. Retrieved June 22, 2017, from https://mchb.hrsa.gov/maternal-child-health-initiatives/home-visiting-overview.

Valentijin, P. P., Schepman, S. M., Opheij, W., & Bruijnzeels, M. A. (2013). Understanding integrated care: A comprehensive conceptual framework based on the integrative functions of primary care. *International Journal of Integrated Care, 13*, 1–12.