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Women's empowerment and nutritional outcomes of children under five in low, lower-middle, and upper-middle income countries: A systematic review

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By

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An abstract of
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Abstract

Women's empowerment and nutritional outcomes of children under five in low, lower-middle, and upper-middle income countries: A systematic review

By Lauren Bardin

Objective: Approximately 6.9 million children under the age of five die each year, of which, an estimated 53% of deaths are associated with malnutrition. Disproportionately affected are those from low and middle-income countries. While global prevalence of stunting and wasting decreased over the past ten years, it has increased in sub-Saharan Africa and some areas of Asia. Further barriers exist to child health outcomes when the mother or caregiver is disempowered and ill-equipped to provide appropriate care. Motivated by the need for continued research on how nutrition-sensitive approaches can be incorporated into nutrition-specific interventions, this systematic review assessed the relationship between women's agency (a component of empowerment) and nutritional outcomes of children younger than five in low, lower-middle, and upper-middle income countries as identified in current literature.

Methods: A systematic search of peer-reviewed, population-based literature was conducted in five electronic databases: Embase, PubMed, SocIndex, Web of Science, and Women's Studies International. Studies that evaluated the association between women's agency, defined through women's decision-making and freedom of movement, and nutritional outcomes of children under five, defined by anthropometric assessment, were included for review. A total of 1,818 abstracts were screened for inclusion and ten studies met our final inclusion and exclusion criteria.

Results: Of the ten included studies, two were from the sub-Saharan Africa, two from Latin America and the Caribbean, and six from Southeast Asia regions. Eight of the ten included studies determined components of women's agency were associated with nutritional outcomes of children under five, with decision-making most frequently associated with nutritional outcomes.

Conclusions: Nine of the ten studies defined agency through the term 'autonomy' however, not one used the same items or methods to create this variable. Inconsistency in functional definitions and measurements of agency emphasizes a fragmented interpretation of what agency actually is. While the development community is promoting women's empowerment as a means to improve nutritional outcomes, this indicates a need for the community to adopt a consistent definition to ensure clarity in approaches. Additional research is needed to address the inconsistent findings and better identify the association between agency and nutrition.

Keywords: Women's empowerment, women's agency, child nutrition, under-5 nutrition, systematic review

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List of Acronyms

HAZ – Height-for-age z-score

LAZ – Length-for-age z-score

SUN – Scaling up Nutrition movement

UNICEF – United Nations Children’s Fund

USAID – United States Agency for International Development

WAZ – Weight-for-age z-score

WHO – World Health Organization

WHZ – Weight-for-height z-score

WLZ – Weight-for-length z-score

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Chapter 1. Introduction

1.1 Introduction and rationale

It is estimated that 19 million preschool age children, mostly from sub-Saharan Africa and Southeast Asia, are suffering from severe wasting (WHO 2013). The consequences of malnutrition can be life-long, having profound impacts on a child's ability to learn, grow, and enter the workforce (Gratham-McGregor *et al.* 2007; Walker *et al.* 2007; Gibson 2005). The period between birth and two years, dubbed the 'window of opportunity', is an especially critical stage of growth, as insufficient food intake means a deprivation of energy necessary for development (Clinton 2010). Repercussions can be irreversible. Similarly, poor nutrition can weaken a child's immune system and increase susceptibility to dying from common illnesses like pneumonia, diarrhea, and malaria (Caulfield *et al.* 2006). It is estimated that, per year, malnutrition is associated with 53 percent of the 6.9 million deaths of children under five worldwide (UNICEF 2013a; Rice *et al.* 2000; Guerrent *et al.* 2008).

Included in Millennium Development Goals (MDG) one, two, three, four, five, and six, the last decade has been marked by an increased prioritization of nutrition interventions by the global development community (Lancet 2008; Lancet 2013; World Bank 2006). It is now recognized that malnutrition needs to be tackled through both nutrition-specific and nutrition-sensitive interventions (World Bank 2006). In other words, interventions that target the direct needs of the individual, like dietary diversification and micronutrient supplementation, should be

complimented by interventions that address other underlying determinants, like women's empowerment. The health of mother and her dependent child are intricately linked. Reliance on a mother to provide food, healthcare, and support is especially profound amongst children younger than five. Thus, restrictions of her rights affect both mother and child.

1.2 Problem statement

The number of global death and disability adjusted life years (DALYs) in children less than five attributed to stunting, severe wasting, and intrauterine growth restriction constitutes the largest percentage of any risk factor in this age group (Black *et al.* 2008). Disproportionately affected are those from low and middle-income countries (Ezzati *et al.* 2002). While prevalence of stunting and wasting decreased over the past ten years, it has increased in sub-Saharan Africa and some areas of Asia because of the simultaneous interaction with infectious diseases (Ezzati *et al.* 2002; Lancet 2008; Lancet 2013).

Further barriers exist to child health outcomes when the mother or caregiver is disempowered and ill-equipped to provide appropriate care (Engle 1999). A recent study found that, in 18 of the 30 countries assessed, more than half of women reported having no say in household decisions (UN Women 2011). As primary caregivers, mothers have significant control over factors critical for child well-being, including food preparation and storage, feeding practices, psychosocial care, hygiene and health practices, and newborn care (Engle, Menon, & Haddad 1999). Restrictions on a mother's participation in household decision-making may inhibit

the quality of care the child receives and negatively impact the child's growth and development.

1.3 Purpose and objectives

The purpose of this systematic review is to identify, describe, and analyze available evidence that explores the relationship between women's agency, as defined by her participation in household decisions and freedom of movement, and the nutritional outcomes of children under five years of age. A close look at methodology employed by studies and identified outcomes will provide an increased understanding for how practitioners can replicate or improve future research and incorporate critical programmatic components to empower the women and improve the nutritional outcomes of her child.

1.4 Research goals

This research seeks to achieve the following goals:

1. Compare the methodologies used to define, measure, and analyze women's agency and nutrition to identify best practices for how future research can be implemented and interventions targeted.
2. Identify and analyze existing research to determine whether women's involvement in decision-making and freedom of movement is associated with the nutritional outcomes of children under five.
3. Explore elements of women's agency that are associated with nutritional outcomes and assess patterns across sub-groups (e.g., geographic region, location of residence, age group, gender).

1.5 Significance statement

The results of this project will inform programmatic development of nutrition-sensitive interventions. Increased understanding of how underlying social constructs, like women's empowerment, impact a child's nutritional status will provide insight on how nutrition-specific interventions can incorporate nutrition-sensitive elements. As expressed by Kabeer (1999), women's empowerment is a process composed of separate, but interdependent components—resources and agency—that together, influence desired outcomes. Current literature predominantly focuses on how resources alone impact child nutritional outcomes. Given the paucity of data looking at the association between agency and nutritional outcomes, our research chose to intentionally focus on agency alone. Exploration of functional definitions, measurements, and methods for analysis of women's agency will contribute to future efforts to understand how it impacts nutritional outcomes and whether this impact varies by sub-group.

1.6 Definition of terms

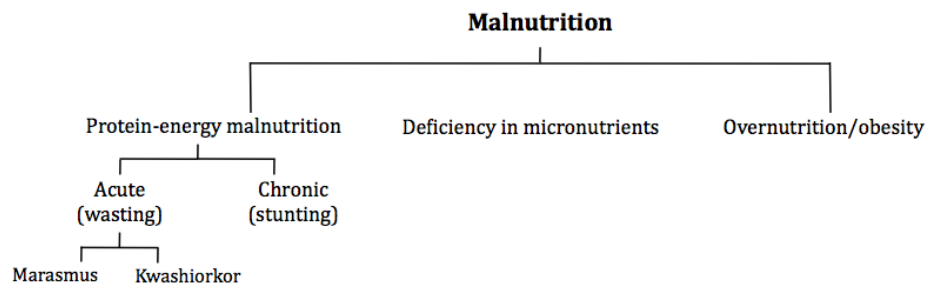
Anthropometry is the measurement of body parameters to indicate nutritional status. Weight, age, and height (or if an infant is younger than 12 months, recumbent length) measurements are then interpreted using reference curves that compare these scores to the expected growth patterns for the average child at their age in the population. There are two reference curves: 1) CDC/NCHS and 2) WHO 2005 (see definitions). An individual is then classified as malnourished using z-scores, percentiles, and percent median. If a Z-score value is greater than -2 and less than 2, the individual's nutritional status is 'adequate'; if a z-score is less than -2 but greater than -3 the individual is classified as moderately malnourished; and, if a z-score is less

than -3 the individual is classified as severely malnourished.

Body mass index (BMI) is body weight in kilograms divided by height in meters squared (kg/m^2). A BMI greater than 25 is classified as overweight and a BMI lower than 18.5 is classified as 'thinness'. Both a high and low BMI are considered inadequate.

Malnutrition is a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate bodily performance processes such as growth, pregnancy, lactation, physical work, and resisting and recovering from disease. There are three principle constituents to malnutrition 1) protein-energy malnutrition, 2) deficiency in micronutrients, and 3) overnutrition/obesity. Undernutrition is comprised of the first two items (protein-energy malnutrition and deficiency in micronutrients). Anthropometric assessment reflects protein-energy malnutrition, so for the purposes of this paper, we will be discussing malnutrition in this way.

Classification of malnutrition in children



NCHS/CDC growth reference curve (National Center for Health Statistics/US. Centers for Disease Control and Prevention) is based on a sample of bottle-fed children from the United States of European ancestry, collected during the 1960s and 1970s. This reference curve was later adopted by the World Health Organization and is also seen written as NCHS/WHO.

Undernutrition is a term to reflect protein-energy malnutrition and deficiency in micronutrients.

Underweight refers to a low weight-for-age; that is, two z-scores below the population reference curve for weight-for-age. It implies stunting or wasting and is an indicator of undernutrition.

Stunting indicates a failure to reach linear growth potential because of inadequate nutrition or poor health. It implies long-term undernutrition and poor health, measured as height-for-age (or length) two z-scores below the population reference curve. For children under 12 months, recumbent length is used instead of height.

Wasting refers to acute weight loss and is indicated by a low weight-for-age. Weight (in kilograms) divided by height (in meters squared) that is two z-scores below the population reference curve. It describes a recent or current severe process leading to significant weight loss, usually a consequence of acute starvation or severe disease. Commonly used as an indicator of undernutrition among children; especially useful in emergency situations such as famine (Lancet 2008).

WHO reference population is a growth chart derived from a combination of the United States NCHS pooled growth data, and the WHO Multicentre Growth Reference Study (MGRS) from Brazil, Ghana, Norway, India, Oman, and the United States.

Z-score is the deviation of an individual's value from the median value of a reference population, divided by the standard deviation of the reference population.

Chapter 2: Comprehensive Review of the Literature

2.1 Nutrition interventions

Historically, program efforts to tackle malnutrition focused on the provision of services or food and tended to the proximate causes, like one's diet and health status (Casanovas *et al.* 2013; IFPRI 2011; WHO 2013). A reflection of the development field at this time, nutrition programs in the mid-to-late twentieth century were frequently part of an emergency response targeting areas of famine through provision of food and clinical attention (Gibson 2005; WHO 2013). However, over time, increased recognition has been given to the fact that food security is not the only cause of malnutrition. For instance, research looking at food secure regions with increased food production rates *and* very high prevalence of malnutrition in both Ethiopia and Tanzania, confirms, not that food supplies are irrelevant, but that other factors, such as maternal knowledge, maternal empowerment, caring and feeding practices for young children, access to health services, and water and sanitation have important roles to play (Shakir 2006).

In 1990, the United Nations Children's Fund (UNICEF) introduced a conceptual framework to guide the analysis of the causes of nutrition in a given context. Development of this framework was in part motivated by the realization that comprehension of the nature of the 'nutrition problem' had drastically changed over time, and in light of this change, there was great diversity in understandings across sectors, agencies, and disciplines which negatively contributed to fragmented and often contradictory actions at national and international levels (UNICEF 1990).

The framework demonstrated a public shift in how nutrition was previously viewed and suggested that child survival, growth, and development was influenced by immediate, underlying, and basic causes (UNICEF 1990). The immediate causes listed were inadequate dietary intake and infectious disease; the underlying causes being household food security, health care and a health environment, and child care; and the basic causes formal and non-formal institutions, political, and ideological superstructure, economic structure, and potential resources (UNICEF 1990).

In the context of this framework, malnutrition is viewed as one important *manifestation* of a larger problem. As such, the goal is not only to eliminate the manifestation (malnutrition) but also the development problem itself. This is not to diminish the importance of malnutrition and the child, but only to be clear that the way in which these manifestations are addressed is also important. From this perspective, an intervention focusing just on an immediate cause of malnutrition, like distribution of plumpy'nut alone, would be regarded as doing little to address the root causes which lie in the larger development problem. The 1990 UNICEF framework acts as the foundational construct within the international nutrition community and has helped foster discussion on the multifaceted approaches needed to address malnutrition.

This initial framework has been built upon to reflect an increasing number of determinants research has identified from the individual to the global levels (Lancet 2013; Casanovas *et al.* 2013; UNICEF 2013b). The most recent iteration, which appeared in the 2013 Lancet Series on Maternal and Child Nutrition, went as far as to identify the strategies to target malnutrition at all levels (Lancet 2013; Black *et al.*

2013). Suggested interventions to address basic determinants, like politics and governance, include the creation of advocacy strategies, leadership programs, and horizontal and vertical coordination; to address underlying determinants, like feeding and caregiving resources, suggested interventions include classroom education, agriculture and food security, and focus on women's empowerment; lastly, suggested interventions to target immediate causes of malnutrition include maternal dietary supplementation, disease prevention and management, and micronutrient supplementation and fortification (Black *et al.* 2013).

As primary caregivers, mothers have significant control over factors critical for child well-being, including food preparation and storage, feeding practices, psychosocial care, hygiene and health practices, and newborn care (Engle, Menon, & Haddad 1999). Research shows positive associations between increases in women's empowerment and improved nutrition outcomes and, conversely, that actions leading to women's *disempowerment* can result in adverse nutritional impacts for women themselves and their children (Bhagowalia *et al.* 2012; Quisumbing & Maluccio 2003; Smith & Haddad 2000). Given this critical weight of influence, governments, multilateral organizations, and non-governmental organizations alike have almost unanimously adopted strategies that advocate empowerment of the woman as a mean to improving child nutrition (Cassanovas *et al.* 2013; Clinton 2010; Engle 1999; Engle, Menon, & Haddad 1999; FAO 2011; FTF 2011; Guerrant *et al.* 2008; Lancet 2008; Lancet 2013; Malapit *et al.* 2013; Moursund & Kravdal 2003; Narayan 2002; Sraboni *et al.* 2013; UNICEF 1990; UNICEF 2013a; UNICEF 2013b; UNDP 2008; UNFPA 2007; USAID 2008; World Bank 2006).

2.2 Defining women's empowerment

Though promotion of women's empowerment has become a mainstream component to development discourse, how it is measured and functionally defined across organizations varies greatly. In fact, one study conducted by the Oxford Poverty and Human Development Initiative (OPHI) identified 32 different definitions for the term, and the list was by no means exhaustive (Ibrahim & Alkire 2007). Arising in part from the nuances involved in this abstract concept, translating objectives into concrete interventions and outcomes remains a challenge.

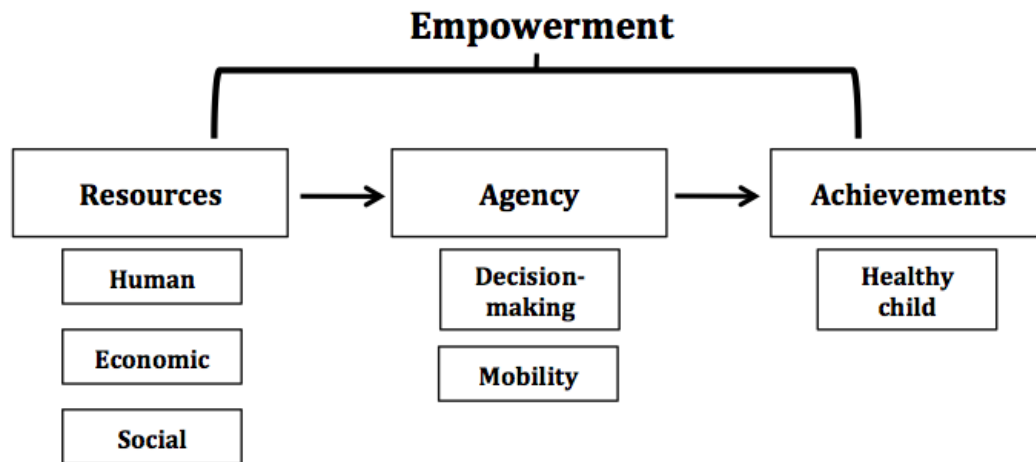
Conceptualized in terms of economic power, some understand the provision and increased ownership of goods through, for instance, micro-credit initiatives or development of women-run cooperatives, to achieve empowerment (Mason 1984; Narayan 2001; UNFPA 2007). Others view educational attainment to be the best indicator of a woman being empowered (Caldwell 1979; ICPD 1995; Kristof & WuDunn 2010; Adhikari & Sawangdee 2011). In the United States, the popular Half the Sky movement reflects this understanding and prescribes a list of three ways to empower women worldwide: 1) make girls smarter; 2) support a woman's business; and 3) keep a girl in school (Kristof & WuDunn 2010).

While all of these are necessary, possession of human, economic, and social resources does not necessarily mean equal ability to access or exercise these. In rural Gambia for instance, researchers found that health and nutrition education targeting the mother was not enough in itself (Mwangome *et al.* 2010). Other

factors like equality in household decision-making, presence or absence of support networks, and alternative explanatory models of malnutrition were identified as the main factors that would determine the ability of a mother to practice what she was learning about child health and nutrition (Mwangome *et al.* 2010).

Kabeer attempts to bridge these definitions and argues measures of objective status through proxy indicators like education or employment do not fully account for a woman's sense of empowerment (Kabeer 1999). Further, possession of human, economic, and social resources does not necessarily mean equal ability to access or exercise these. Whether a woman has the freedom to exercise this knowledge is as Kabeer outlines, a completely separate construct called agency (Kabeer 1999). Her proposed framework recognizes empowerment has three, interdependent yet, separate domains: resources, agency, and achievements (Kabeer 1999). Empowerment as she says, is a process that involves change from a condition of disempowerment and denial of choice to one of collective empowerment (Kabeer 1999).

Figure 1. Naila Kabeer's Framework for Empowerment, Interpreted for the Context of this Systematic Review (1999)



We have adapted this framework to the context of our study (Figure 1) to visually represent the process by which a woman's resources and agency *together* contribute to achievements. Figure 1 presents this framework in a linear manner for the sake of simplicity, however, this directionality is not always the case. As indicated in Figure 1, agency has been operationalized as 'decision-making' and 'freedom of movement' for the purposes of this study. These reflect an individual's 'power within', or ability to bring motivation and purpose to an activity (Kabeer 1999).

2.3 Relationship between women's empowerment and nutrition

While at a conceptual level, these two components of empowerment – one focusing on resources the other on agency – are complementary, in practice, it is

often difficult to disentangle the two, particularly while operationalizing these for empirical research. Thus, an overt focus on empowerment through resources alone has established a strong evidence-base confirming the association with resources, like a mother's socio-economic status, participation in the work force, and educational attainment, and the nutrition achievements of her children (Allendorf 2007; Bhutta *et al.* 2008; Caldwell 1979; Engle 1999; Frost, Forste, & Haas; FTF 2011; Malapit *et al.* 2013; Mason 1984). However, there is a paucity of data focusing specifically on the relationship between women's agency and nutritional outcomes of children under five.

Since 2004, the non-governmental organization (NGO) CARE and the government of Bangladesh have been implementing the largest non-emergency U.S. Agency for International Development (USAID) food security program in the world (CARE 2013). This program combined elements of economic capacity building, food production, maternal and child health and nutrition, and women's empowerment. In a matter of four years, child stunting due to undernutrition plummeted 28 percent, despite natural disasters and spikes in food prices occurring during the same time frame (CARE 2013). Results of the first phase of this program (2004-2010) identified women's empowerment as the 'game-changer' that produced the greatest independent impact on the outcomes (CARE 2013). Women who participated in empowerment interventions to help them fight harassment and expand their decision-making over household spending and food consumption were less likely to have stunted children than women who received only nutrition interventions, like regular food rations (CARE 2013).

Findings from CARE reinforce the potential impact women's agency can have on a child's nutritional status. Thus, as other programs, like those within the Scaling up Nutrition (SUN) movement, continue to expand, it is important to better understand the mechanisms of this process. Identification of how other studies have witnessed women's agency to impact a child's nutrition will allow programs to better target areas of need and known impact.

Chapter 3. Manuscript

Women's empowerment and nutritional outcomes of children under five in low, lower-middle, and upper-middle income countries: A systematic review

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Student Contribution

This manuscript will be submitted for publication with multiple authors as follows: Lauren Bardin, MPH Candidate, Kristin VanderEnde, MSN, CNM, PhD, Sara Thorpe, MPH Candidate, Courtney Peters, MPH Candidate, Kathryn Yount, PhD. The authors worked collaboratively throughout the duration of this project. As the research lead, Lauren Bardin made significant contributions during all phases of the project including research, analysis, and manuscript development.

Research

- 1) Authored protocol to guide systematic review
- 2) Identified and refined search terms and strategy through series of pilot tests
- 3) Developed and refined inclusion/exclusion criteria to identify relevant literature yielded from primary search on electronic databases
- 4) Conducted secondary works cited, key author, and reverse work cited search then reapplied inclusion/exclusion criteria to this new pool of literature to identify 10 for inclusion

Data Extraction and Analysis

- 5) Modified and pilot tested data extraction and quality assessment tools to extract all required data from 10 included articles
- 6) Input data into Microsoft Excel and Word tables for analysis and presentation of findings
- 7) Revision of these tables to ensure data was conveyed in appropriate manner

Manuscript construction

- 8) Wrote all sections of the manuscript

- 9) Created and adapted tables and figures
- 10) Edited and revised numerous drafts of the manuscript based upon feedback from advisor, committee member, and research team

Abstract

Objective: Approximately 6.9 million children under the age of five die each year, of which, an estimated 53% of deaths are associated with malnutrition. Disproportionately affected are those from low and middle-income countries. While global prevalence of stunting and wasting decreased over the past ten years, it has increased in sub-Saharan Africa and some areas of Asia. Further barriers exist to child health outcomes when the mother or caregiver is disempowered and ill-equipped to provide appropriate care. Motivated by the need for continued research on how nutrition-sensitive approaches can be incorporated into nutrition-specific interventions, this systematic review assessed the relationship between women's agency (a component of empowerment) and nutritional outcomes of children younger than five in low, lower-middle, and upper-middle income countries as identified in current literature.

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Conclusions: Nine of the 10 studies defined agency through the term 'autonomy' however, not 1 used the same items or methods to create this variable. Inconsistency in functional definitions and measurements of agency emphasizes a fragmented interpretation of what agency actually is. While the development community is promoting women's empowerment as a means to improve nutritional outcomes, this indicates a need for the community to adopt a consistent definition to ensure clarity in approaches. Additional research is needed to address the inconsistent findings and better identify the association between agency and nutrition.

Keywords: Women's empowerment, women's agency, child nutrition, under-5 nutrition, systematic review

3.1 Introduction

Approximately 6.9 million children under the age of five die each year, of which, an estimated 53% of deaths are associated with malnutrition (UNICEF 2013; Rice *et al.* 2000; Guerrent *et al.* 2008). Greater still is the number who lives with these deficiencies and their consequences (USAID 2008). The negative impact on their health and well-being is substantial and the repercussions are lifelong. The period of life from conception to two years of age is an especially critical time that lays the foundation for lifelong health, learning, and productivity. In the early months and years, the body's organs, physiological processes, and brain structure are being developed. Poor nutrition and health during this time hinders physical and cognitive development and can have profound impacts on a child's ability to learn, grow, and enter the workforce (Grantham-McGregor *et al.* 2007; Walker *et al.* 2007). Similarly, it can weaken a child's immune system and increase the risk of dying from common illnesses like pneumonia, diarrhea, and malaria. The high prevalence of malnutrition can also shape a populace's long-term health, stability, and prosperity (Victora *et al.* 2008). Reduced intellectual capacity undermines investments in education and perpetuates cycles of poverty. Evidence shows that a reduction in malnutrition can increase a country's GDP by at least two to three percent annually (UNICEF 2011). It is a substantial barrier to a nation's economic progress and improved standards of living.

Stunting and wasting begin in early childhood and are usually caused by diets that do not provide sufficient nutrients and by high rates of infectious diseases (*Lancet* 2008). Stunting, or a chronic restriction of vertical growth indicated by a low weight-for-age, indicates chronic malnutrition and has long-term health implications, like cognitive delays (*Lancet* 2008). Of an estimated 178 million children younger than five years who are stunted, 160 million (90%) live in just 36 countries and make up 46% of the 348 million children in those countries (Black *et al.* 2008; UNDP 2008). Wasting, as defined by a low weight-for-height, reflects acute weight loss and is usually caused by diets that do not provide sufficient nutrients and high rates of infectious disease (*Lancet* 2008). About 55 million children are wasted and of whom, 19 million have severe wasting or severe acute malnutrition (*Lancet* 2008; Bhutta *et al.* 2008; Franzo & Pronyk 2011).

Historically, program efforts to tackle malnutrition focused on the provision of services or food and tended to the proximate causes of malnutrition, like one's diet and health status (IFPRI 2011; WHO 2013; Casanovas *et al.* 2013). While important, a growing body of research now recognizes that nutritional outcomes are determined by a complex interaction among preconditions, including dietary intake and health status; household food security, caring capacity, access to adequate health services; and a health environment – all of which are reinforced by deeper social, economic, and political processes that drive and enable them (Bhutta *et al.* 2008; Franzo & Pronyk 2011; Grantham-McGregor *et al.* 2007; Malapit *et al.* 2013; Rice *et al.* 2000; UNICEF 2013).

Women's empowerment and nutritional status of children under five

The health and survival of children is influenced by patterns of family interaction. The realm of influence is especially pronounced amongst children under age five, as they have not yet enrolled in school and typically spend the majority of their time at home. Given this weight of exposure, women's empowerment is frequently identified as a possible pathway to improve a child's nutrition.

While the promotion of women's empowerment is widespread, great debate exists on how this is actually accomplished. Conceptualized most frequently in terms of economic power and access to, and control of, resources (Bose 2011; Mason 1984; Narayan 2002; Sen 1990), some understand the provision and increased ownership of goods to be a means to empowering and enabling a woman. Along this vein, others perceive educational attainment to be the best indicator of a woman being empowered (Caldwell 1979). The discourse is also dominated by the term 'autonomy' and arguments that women with higher autonomy are more able to make better decisions for themselves and children (Moursand & Kravdal, 2003).

In Naila Kabeer's (1999) overarching framework, she argues that measures of objective status through proxy indicators, like education or employment, do not account for a woman's sense of empowerment (Kabeer 1999). Possession of human, economic, and social resources does not necessarily mean equal ability to access or use these. Whether she has the freedom to exercise attained knowledge, is as she outlines, a completely separate domain. In rural Gambia for instance, researchers found that health and nutrition education targeting the mother was not enough in itself (Mwangome *et al.* 2010). Other factors like equality in household decision-making and the presence or absence of support networks were identified as dominant factors that would determine a mother's ability to practice what she was learning (Mwangome *et al.* 2010). Recognizing these nuances, Kabeer contends that empowerment is a process involving change from a condition of disempowerment and denial of choice to one of collective empowerment. Thus, we have adopted Kabeer's framework, which recognizes empowerment has three, interdependent yet, separate domains: resources, agency, and achievements (Kabeer 1999) and focus on how agency, or a woman's ability to act upon her resources, is related to her achievements, in this case, having a well-nourished child.

Current Research Gaps

Evidence highlights the biological, environmental, and socioeconomic risk factors for child malnutrition, however, research on the influence of other aspects of the social environment is nascent. More distal determinants, like maternal empowerment, are acknowledged predictors of child health. Yet, the difficulty in measuring these constructs exposes a need to develop an evidence base. Major gaps exist in the evidence available for nutrition-sensitive interventions, and, as reinforced by Lancet's 2013 Maternal and Child Nutrition series, there is a need to fill these empirical gaps.

To this end, we conducted this systematic review to synthesize the available evidence, identify gaps in research, and understand the relationship between women's empowerment and child nutrition.

3.2 Materials and Methods

Search strategy

We performed a systematic search of the literature using identical keywords, Boolean terms, and punctuation in five electronic databases: Embase, PubMed, SocIndex, Web of

Science, and Women's Studies International. These databases house literature from a myriad of disciplines, follow rigorous screening procedures, exhibit international diversity, and display sophisticated search functions. The list of keywords in Table 1 was formulated through research and refined through a series of pilot tests.¹

Inclusion and exclusion criteria

Included in our review are population-based studies from low and middle-income countries (as defined by the World Bank) published in peer-reviewed journals between the dates of January 1, 1970 and October 1, 2013. Studies that investigate, or include within their measures of exposure, women's agency and its relationship to child malnutrition were included in this review. No restrictions were placed on a mother's age, however, we chose to limit the inclusion of children to under five years because during this period the household is typically the primary location for meals. Studies of infant nutrition during the neonatal period (birth to 28 days) were excluded due to differing variables that affect nutrition in this stage.

The exposure included women's agency, measured through decision-making and freedom of mobility in accordance to the previously mentioned framework by Kabeer (1999), but excluded gender attitudes and intimate partner violence, as they are believed to be independent variables (VanderEnde *et al.* 2012). The outcome, malnutrition, included studies that used anthropometric assessment to define an individual as underweight, stunted, or wasted. 'Underweight' is determined through a low weight-for-age score, that arises from gaining insufficient weight relative to age, or losing weight (WHO 1995; Gibson 2005). A low height-for-age score indicates stunted growth from chronic malnutrition and can be used as an index of past nutritional or health status (Gibson 2005). Wasting is defined through a low weight-for-height score and indicates acute malnutrition (Gibson 2005). Recumbent length may be used in place of height for children under 12 months, and studies that opted for its use were not excluded from review (Gibson 2005).

No exclusion criteria was placed on study type, though, we chose to exclude articles assessing the interplay of HIV/AIDS, women's agency, and nutritional status because the scope was so large and would warrant a systematic review in itself. Only studies published in English were included due to a lack of expertise available for translation. Table 2 provides a complete list of inclusion and exclusion criteria and their justifications.

Assessment of study eligibility

Using these search terms and databases, 457 articles were identified for further review. Duplicate articles were removed and the remaining 411 articles underwent two subsequent rounds of screening – first of titles and abstracts (LB) and second of the full-text of articles (LB and ST). Two coders (LB and ST) randomly selected ten percent of the articles to pilot test inclusion and exclusion criteria. Minor discrepancies were resolved in this phase and, from there, the two researchers (LB and ST) independently conducted full-text reviews of the articles. Agreement between the reviewers was high and disagreements worked out through discussion. In total, seven articles were included from this stage.

¹ When available, indexing terms attached to key words by PubMed (MeSH) and Embase (Emtree) were used to enhance the search.

From these seven articles, secondary search strategies were employed. In total, 1,361 additional articles were collected through reference lists, other articles that cited the article, and other studies published by key authors. This second pool of studies underwent the same screening process and another three articles were identified for inclusion. The most common reason for exclusion was that a study looked at a woman's resources (e.g. employment status or income level) and not her agency.

Synthesis of data and quality assessment

In total, ten studies met the inclusion criteria for this systematic review. One reviewer (LB) extracted data from the articles and input them into a data extraction tool. This tool was modeled after the Cochrane Review suggested format and adjusted for relevance after pilot testing it on two included articles (CHMG 2007).

As part of this process, we assessed each study using the 22-item STROBE Checklist for Cross Sectional Studies (STROBE 2007). These guidelines allowed us to quantify whether a study fulfilled the suggested elements for reporting observational research. However, we recognize the limitations of the tool in that it allows us to check for completion but not necessarily gauge the quality of each component.

From the collection tools, data were input into Microsoft Excel spreadsheets and Word tables for manipulation and manual analysis. Meta-analysis was not feasible due to the heterogeneous nature of the studies in terms of both exposures and outcomes, so a narrative approach was used for data synthesis.

3.3 Results

Overview of included studies

Of the ten included studies, data from 333,443 participants were available for interpretive analysis. Included is one longitudinal randomized behavioral intervention (Shroff *et al.* 2011), one mixed-methods cross-sectional study (Sethuraman, Lansdown, & Sullivan 2006), three cross-sectional studies based on primary data (Brunson, Shell-Duncan, & Steele 2009; Bégin, Frongillo, & Delisle 1999; Mashal *et al.* 2008), and five cross-sectional studies based on secondary data – three from the Demographic Health Survey (DHS) (Rahman *et al.* 2012; Frost, Forste, & Haas 2004; Heaton & Forste 2007) and two from India's National Family Health Survey (NFHS) (Shroff *et al.* 2009; Bose 2011). Sample sizes ranged from 162 to 286,231 participants with a median sample size of 3,394 participants. Descriptive characteristics of all included studies are housed in Table 3.

The data in this body of literature spanned ten countries, half of which are classified as low-income, three as lower-middle income, and two as upper-middle income.² Two studies focused on nationally representative data from the Latin America and Caribbean region, one focused on Bolivia (Frost, Forste, & Haas 2004) and the other a multi-country study looked at Bolivia, Colombia, Haiti, Nicaragua, and Peru (Heaton & Forste 2007). The majority of included studies (60%) were conducted in Southeast Asia with four from different regions in India (Bose 2011; Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2009; Shroff *et al.* 2011), one in Bangladesh (Rahman *et al.* 2012), and one in Afghanistan (Mashal *et al.* 2008).

² As defined by the World Bank country and lending group classifications.

The final two studies were conducted in sub-Saharan Africa: one in rural Kenya (Brunson, Shell-Duncan, & Steele 2009) and the other rural Chad (Bégin, Frongillo, & Delisle 1999). The majority of these studies (80%) were published between 2005 and 2013, but based on data collected between 1995 and 2000 (60%) (Bégin, Frongillo, & Delisle 1999; Brunson *et al.* 2009; Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2009; Frost, Forste, & Haas 2004; Heaton & Forste 2007). Three studies analyze data using multivariate logistic regression analysis (Sethuraman, Lansdown, & Sullivan 2006; Mashal *et al.* 2008; Rahman *et al.* 2012), two through hierarchical linear modeling (Brunson, Shell-Duncan, & Steele 2009; Bose 2011), one through stepwise multiple regression (Bégin, Frongillo, & Delisle 1999), one through ordinary least squares regression (Heaton & Forste 2007), one logistic regression (Frost, Forste, & Haas 2004), one logistic regression generalized least squares model (Shroff *et al.* 2011), and one through a weighted logistic regression approach (Shroff *et al.* 2009).

Overall, elements of women's agency were associated with better nutritional status in eight of the ten studies included (Brunson, Shell-Duncan, & Steele 2009; Bégin, Frongillo, & Delisle 1999; Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2009; Shroff *et al.* 2011; Mashal *et al.* 2008; Rahman *et al.* 2012; Heaton & Forste 2007).

Metrics used for women's empowerment

The authors of all studies viewed empowerment as a multi-dimensional construct and almost unanimously (90%) define agency through the term 'autonomy'. Great variation, however, exists in how these constructs were measured and defined. Table 4 provides an aggregated list of questions and response categories used amongst all studies to measure the component of empowerment this systematic review is interested in – agency – and categorizes indicators based on the two most frequently used sub-domains: decision-making and freedom of movement. Three studies included intimate partner violence in their measures of agency; however, these variables were excluded from analysis because they did not meet the outlined inclusion criteria (Shroff *et al.* 2009; Shroff *et al.* 2011; Sethuraman, Lansdown, & Sullivan 2006).

The most emphasis was placed on decision-making. Included in all studies, our review found consensus regarding the *use* of decision-making, but variation exists in how authors *defined* the variable. Overall, 24 unique items were used to create this variable. Most common were questions regarding who made the final decision on everyday household purchases (n=6), whether to seek healthcare when the child is sick (n=6), whether to seek healthcare when the respondent is sick (n=6), and visits to family or friends (n=5). Less common were culturally specific questions used, for instance, in Kenya regarding who makes the final decision to bleed or slaughter animals (n=1) or more contentious household decisions, like how to spend money earned by the respondent's husband (n=1).

The authors of five studies – one from Bangladesh, two from sub-Saharan Africa, and two from the Latin America and Caribbean region – measured agency through decision-making items alone (Brunson, Shell-Duncan, & Steele 2009; Bégin, Frongillo, & Delisle 1998; Rahman *et al.* 2012; Frost, Forste, & Haas 2004; Heaton & Forste 2007). Differences in measurement were especially clear in these studies, as three were based on DHS data yet identify different questions from the survey to be indicative of decision-making. In Bolivia, the decision-making variable was a three-question summative index valuing the number of family-planning decisions a woman was involved in (Frost, Forste, & Haas 2004) whereas a

more robust, five question scale was used in Bangladesh and the Latin America and Caribbean multi-country study to assess maternal and joint decision-making regarding health care for respondent and child, large purchases, everyday household purchases, food to be cooked each day, and visits to relatives is used in the Latin America and Caribbean multi-country study and in Bangladesh (Heaton & Forste 2007; Rahman *et al.* 2012). A culturally specific questionnaire was used to define decision-making in both studies conducted in sub-Saharan Africa that included anywhere from six (Bégin, Frongillo, & Delisle 1998) to eleven (Brunson, Shell-Duncan, & Steele 2007) questions. In Chad, this questionnaire was comparable to other studies with questions regarding who made the decision to purchase medicine for sick children or to buy or sell jewelry. In Kenya however, a qualitative arm of the study identified the need for more unique set of questions (Brunson, Shell-Duncan, & Steele 2009). Therefore, questions regarding who made the decision to buy or sell animals, to slaughter animals for meat, or to bleed animals were added to the more traditional set of decision-making items, like who made the decision to seek healthcare when a child is sick, to create a decision-making index more applicable to the pastoralist society their study was conducted in (Brunson, Shell-Duncan, & Steele 2009).

A woman's freedom of movement was measured as a construct of agency in five of the ten studies. Eight unique items were identified with questions regarding her freedom to shop at the local market (n=4), visit the health facility on her own (n=3), and visit family and friends alone (n=3) being the most frequently used. Three studies measure women's agency through a combination of decision-making and mobility variables (Sethuraman, Lansdown, & Sullivan 2006; Bose 2011; Mashal *et al.* 2008). While some decision-making and freedom of movement items, like a woman's ability to visit family, appear to be identical, one is measuring whether a mother needs permission for mobility and the other her actual mobility. This variable was always used alongside decision-making, no study measured agency through freedom of movement alone. Overall, a woman's freedom of movement was positively associated with child growth outcomes in four of the five studies in which it was used (Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2009; Shroff *et al.* 2011; Mashal *et al.* 2008).

Metrics used to measure nutritional status

The authors of included studies disagreed on what aspect of nutrition (chronic or acute) would be affected by lack of women's agency and incidentally analyzed the relationship with differing anthropometric indicators. Only half of the studies assessed the association of agency with all three anthropometric indicators – stunting, wasting, and underweight (Rahman *et al.* 2012; Mashal *et al.* 2008; Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2009; Shroff *et al.* 2011). The authors of three studies argued that lack of maternal agency would, in fact, manifest as chronic malnutrition, or stunting, and thus only included height-for-age as an outcome (Frost, Forste, & Haas 2004; Heaton & Forste 2007; Bégin, Frongillo, & Delisle 1999). Whereas Brunson, Shell-Duncan, and Steele argued that because their exposure variables captured current levels of agency, the analysis should instead focus on children's current nutritional status, best shown through the weight-for-height z-score (Brunson, Shell-Duncan, & Steele 2009). They agreed that women's agency likely had long-term implications on children's nutrition and growth, however, using measures of women's agency collected in the *present* as predictors of children's nutrition in the distant *past* was non-sensical (as shown through height-for-age).

Overall, four studies, all conducted in Southeast Asia, used the new World Health Organization 2005 growth standards (Shroff *et al.* 2011; Bose 2011; Mashal *et al.* 2008; Rahman *et al.* 2012) and six the CDC/NCHS reference population to define a child as wasted, stunted, or underweight (Bégin, Frongillo, & Delisle 1999; Brunson, Shell-Duncan, & Steele 2009; Shroff *et al.* 2009; Sethuraman, Lansdown, & Sullivan 2006; Frost, Forste, & Haas 2005; Heaton & Forste 2007).

Relationship between women's empowerment and underweight (WAZ <-2)

Five studies, all conducted in Southeast Asia, analyzed whether women's agency was associated with a child being underweight (Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2011; Bose 2011; Rahman *et al.* 2012; Mashal *et al.* 2008). Decision-making variables were marginally associated with a child's weight-for-age z-score in one of these studies and significantly and positively associated in two of the five (Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2011; Mashal *et al.* 2008; Rahman *et al.* 2012), and a woman's freedom of movement was significantly positively associated with a child's weight-for-age score in one of four studies it was used in (Sethuraman, Lansdown, & Sullivan 2006).

Two studies from India and one from Afghanistan determined a woman's involvement in household decision-making was associated with a child's better weight-for-age score (Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2011; Mashal *et al.* 2008). Both studies in India defined decision-making through questions regarding who made the decisions for food purchase and consumption, health care, and family-planning (Sethuraman, Lansdown & Sullivan 2006; Shroff *et al.* 2011). These studies concluded that for every unit increase in maternal decision-making involvement, the weight-for-age z-score for children 6 to 24 months and children 3 to 5 months increased anywhere from 0.10 ($\beta=0.10$; $p<0.05$) (Sethuraman, Lansdown, & Sullivan 2006) to 0.17 points ($\beta=0.17$, 95% CI: 0.04,0.30; $p<0.05$) (Shroff *et al.* 2011). In Afghanistan, decision-making was defined solely through a mother's ability to seek healthcare when her child was sick but still determined that, if a mother was able to do so, her child was 46% (aOR=1.46; 95% CI: 1.00, 2.14) more likely to be well-nourished (Mashal *et al.* 2008).

Four studies assessed whether a woman's freedom of movement was a significant predictor of a child's weight-for-age score (Sethuraman, Lansdown, & Sullivan 2006; Bose 2011; Shroff *et al.* 2011; Mashal *et al.* 2008). The most frequently used items were whether a woman was able to shop within the village (n=3), go to the health facility (n=3), visit family and friends (n=2), or go to the fields (n=2) on her own. Only one study determined that a mother's ability to travel to these areas on her own was positively associated with weight-for-age score (Sethuraman, Lansdown, & Sullivan 2006). These three items were significant even when controlling for known intermediate and underlying causes of malnutrition like maternal weight, maternal hemoglobin, child hemoglobin, missed immunizations, energy-dense foods, nutrient-dense foods, water and sanitation, maternal employment and income, food insecurity, and health decisions ($\beta=0.09$; $p<0.01$) (Sethuraman, Lansdown, & Sullivan 2006).

Relationship between women's empowerment and stunting (HAZ z-score)

Eight studies included height-for-age measures when reporting child nutrition status. Of these, seven assessed whether agency influences a child's height-for-age score and six found elements of agency to be significant predictors of whether or not a child under five years

was stunted – one in Chad, one Afghanistan, two in India, and one study that included five countries from Latin America and the Caribbean. Four studies measured outcomes for a cohort of children from birth to five years (Mashal *et al.* 2008; Rahman *et al.* 2012; Froste, Forste, & Haas 2004; Heaton & Forste 2007), one for children less than 36 months (Shroff *et al.* 2009), one for children between 12 to 71 months (Bégin, Frongillo, & Delisle 1999), and one for infants between 3 to 5 months (Shroff *et al.* 2011).

Decision-making variables that gauged a woman's direct impact on decisions regarding her child's health were most frequently associated with a child's height-for-age score. A woman who decided the age for weaning, introduction of solid foods, and the types of food that should be given was consistently associated with better height-for-age in the two studies it appeared (Bégin, Frongillo, & Delisle 1999; Shroff '11). Studies conducted in India, Afghanistan, and Nicaragua determined that a mother or couple who jointly decided whether healthcare should be sought when a child is sick were more likely to have a child who was not stunted (Shroff *et al.* 2011; Mashal *et al.* 2008; Heaton & Forste 2007). In Afghanistan, this relationship was strengthened when a mother also had the freedom of mobility to travel to the health facility (Mashal *et al.* 2008). The relationship between a woman's decision to seek healthcare for *herself* and stunting however, was inconsistent, and only found to be significant in one of three studies that used it (Heaton & Forste 2007).

Interesting to note is the multi-country study conducted by Heaton & Forste on Bolivia, Colombia, Haiti, Peru, and Nicaragua. Their study included two decision-making variables – one for a mother who had *sole* decision-making rights and one for a couple that indicated *joint* decision-making rights. Both these variables were constructed out of five decision-making items [DM 3,5,11,12,21](Table 4) regarding decisions of what should be cooked each day, whether a woman could seek healthcare for herself, make purchases for daily household needs, make major household purchases, or visit family or friends. Four additional questions [DM 4,7,17,24](Table 4) were used in Nicaragua regarding decisions of childcare and family planning. The difference in the joint and sole decision-making variables was only in the response option, otherwise, this was assessed using the same set of questions. Overall, sole and joint decision-making significantly and positively influenced a child's height-for-age in both Nicaragua and Peru. In Bolivia, Colombia, and Haiti however, these variables were in fact negatively associated with a child's height-for-age.

Relationship between women's empowerment and wasting (WHZ z score <-2)

Four studies analyze the relationship of agency and a child's nutritional status as defined by their weight-for-height (or length) score (Brunson, Shell-Duncan, & Steele 2009; Shroff *et al.* 2011; Mashal *et al.* 2008; Rahman *et al.* 2012). Three of the four studies found elements of agency to be significant, positive predictors of a child's weight-for-height score (Brunson, Shell-Duncan, & Steele 2009; Shroff *et al.* 2011; Rahman *et al.* 2012). Amongst these articles, anywhere from 2 to 40 questions were used to measure women's agency.

Three studies identified decision-making variables to be positively associated with a child's weight-for-height, though, no one decision-making item was associated with nutritional status more than another (Brunson, Shell-Duncan, & Steele 2009; Shoff *et al.* 2011; Rahman *et al.* 2012). Two studies using six of the same decision-making items [DM1, 4, 5, 6, 9, 14](Table 4) found that they were positively associated with the weight-for-height scores (or weight-for-length) amongst children 3 to 5 months and 3 to 10 years, however, found

these were not amongst children 0 to 35 months (Brunson, Shell-Duncan, & Steele 2009; Shroff *et al.* 2011).

Freedom of movement was positively associated with weight-for-height z-scores in one of the two studies that included it in analysis (Shroff *et al.* 2011; Mashal *et al.* 2008). Where one defined it through only one item – a mother’s ability to seek health care for her child alone in Afghanistan – the other, conducted in India, constructed a variable out of all eight mobility items (Table 4). Shroff and colleagues create a freedom of mobility variable out of eight questions gauging a woman’s general ability to travel on her own (able to visit fields, local health center, market, community center in village, home of relatives or friends in the village, temple, next village, a nearby fair) and determined that a woman’s inability to travel to these places freely was negatively associated with the weight-for-length z-score of children between 3 to 5 months ($n=1,200$; $\beta= -0.20$; 95% CI: $-0.34, -0.06$; $p<0.05$) after controlling for mother’s age, education, BMI, working status, child’s age, parity, caste schedule, family structure, and child’s birth weight, indicating that maternal freedom of movement mediates a child’s nutritional status (Shroff *et al.* 2011).

3.4 Discussion

This study sought to determine the relationship between women’s agency, defined by her participation in family decision-making and freedom of movement, and the nutritional outcomes of children under five years of age. Of the 1,818 abstracts collected for review, a total of ten studies met our inclusion criteria. Elements of agency were significantly associated with nutritional outcomes in eight of the ten studies, with a woman’s involvement in decision-making more frequently associated with positive nutrition outcomes than freedom of movement. Inconsistent measures of agency produced varying results by indicator and ultimately call attention to the need for the nutrition community to operationalize a definition of agency to ensure more appropriate measurements and accurate interpretation of what outcomes are really showing.

Inconsistent definitions and metrics

A simple, yet profound, finding was that nine of the ten studies used the term ‘autonomy’ to denote agency, but not one used the same set of items to measure it. This concordance in terminology but discordance in functional definitions highlights a fragmented understanding of agency and possible risk for findings to be misinterpreted.

The term autonomy generally refers to an individual’s ability to do something alone. Brunson, Shell-Duncan, and Steele (2009) reinforced this and defined it as the ability to make decisions on one’s own, to control one’s own body, and to determine how resources will be used, without needing to consult with or ask permission from another person. Characterized in this way, decisions made solely by the women were valued as the highest expression of agency, and respondents were not provided an option to indicate a decision was made together with their spouse. Instead, women were asked whether decisions were made by: 1) their husband or husbands family solely, 2) husband primarily, 3) respondent primarily, or 4) respondent solely (Brunson, Shell-Duncan, & Steele 2009). Defined in this manner, they concluded that ‘high levels of autonomy’, or the more decisions a woman made on her own, significantly predicted whether older children (3 to 10 years) were

wasted, though not amongst younger children (0 to 35 months) (Brunson, Shell-Duncan, & Steele 2009).

Given the tendency towards communal living in the countries where the included studies take place, we question whether women view *complete* autonomy as a desired state. Motivated by this same question, analysis by Heaton and Forste gives attention to aspects of couple interaction and their influence on child health outcomes in Bolivia, Colombia, Haiti, Peru, and Nicaragua (Heaton & Forste 2007). Their findings indicated that maternal input on household decisions was associated with child mortality rates about one third lower compared to households where husbands or other household members make decisions (Heaton & Forste 2007). Similarly, joint-decisions on family planning were associated with better height-for-age and lower child mortality in Nicaragua and Peru (Heaton & Forste 2007). Thus, indicating that joint-decision making in the household can have positive benefits to child health and reaffirming why the term 'autonomy' may not be best affiliated with our understanding of empowerment as a collective aspect of power, not just an individual one (Kabeer 1999).

Across all studies, these were the only two studies that measured decision-making in this way. All others (n=8) placed the same value on a woman who made a decision on her own or jointly with her husband. Thus, the inconsistent associations found in both studies between sole and joint decision-making identify the need for additional research to discern whether measures of independence or of interdependence are more appropriate (Heckert & Fabric 2013).

Women's agency and nutritional status

This body of research demonstrates considerably low levels of maternal agency across all geographic regions – from India, where as few as 16.5% of women indicated they were involved in deciding what food should be purchased for the family (Sethuraman, Lansdown, & Sullivan 2006), to Nicaragua, where only 10.1% of women reported involvement in deciding whether the child visited the doctor (Heaton & Forste 2007), to Afghanistan, where 79.1% of women indicated permission was needed to go to the health center for their child (Mashal *et al.* 2008). Commonly employed nutrition interventions, like dietary diversification or home-based micronutrient supplementation, generally target the mother, as children under five are dependent on her for food. Yet, such findings emphasize a significant barrier to the success of these programs and encourage use of more comprehensive indicators of agency so programs are not falsely assuming women have the capacity to implement the changes they promote.

Eight of the ten included studies show that increased levels of women's agency are associated with better nutritional outcomes, especially when women are involved in decision-making. Across all regions, women's involvement in household decisions directly related to food and childcare were more frequently associated with better nutritional outcomes than more indirect measurements of decision-making, like the decision on whether to buy or sell jewelry or decision-making about the mother herself. Thus, the lack of association with this indicator juxtaposed with the association of other, more direct indicators, suggests that such studies may erroneously classify a woman as empowered or disempowered, and subsequently underestimate the effect agency has on child nutrition. If women's empowerment is not accurately measured, research can underestimate the true impact it has on a child's well-being, emphasizing the importance of this work.

While inconsistency was noted amongst the relationship of specific decision-making and freedom of movement items and nutritional outcomes, broadly speaking, low levels of maternal agency were associated with a child experiencing both acute and chronic malnutrition. Amongst women with higher levels of agency, a positive and significant relationship was established in three of the five studies that included weight-for-age (underweight), six of the seven that included height-for-age (stunting), and four of the four that included weight-for-height (wasting). While prevalence of stunting and wasting typically require different interventions, the association across all three nutrition indicators emphasizes that maternal agency is a constant, underlying element to childhood well-being and should be understood as a necessary component to all nutrition interventions. Though, the more frequent association between involvement in decision-making than freedom of movement indicates that nutrition programs should exercise caution when implementing any intervention, especially those that distribute items like grains or sprinkles, at a household level as unequal participation in household decisions may negatively impact the effectiveness of the program.

Surprisingly, two studies found that in some cases, women's agency was negatively associated with a child's nutritional status (Shroff *et al.* 2011; Heaton & Forste 2007). Heaton & Forste's multi-country analysis found that, while women's involvement in decision-making positively influence height-for-age in Nicaragua and Peru, it was negatively associated in Bolivia, Colombia, and Haiti. The authors of this study conjectured that this relationship was reflective of inadequate indicators that only looked at women's involvement in decisions about themselves, not the child. In India, Shroff and colleagues found an inverse relation between mother's freedom of movement and her infant's (3 to 5 months) weight-for-length z-score (Shroff *et al.* 2011). Mothers with greater freedom to go places without permission had children with greater length only if the infant was on the lower end of the birth weight distribution, but overall, the mothers with higher mobility autonomy had children with lower weight-for-length [MB1-8](Table 4) (Shroff *et al.* 2011). One hypothesis is that, because a weight-for-length z-score below -2 indicates prevalence of starvation or infectious disease, greater freedom of mobility could also mean the child has greater exposure to pathogens and is more likely to be infected.

No other study assessed the relationship between weight-for-height (or weight-for-length) and a mobility score, so there is no other direct comparison between this finding and findings of others. Though, two other studies in India found a positive relationship between freedom of mobility and height-for-age and weight-for-age (Shroff *et al.* 2009; Sethuraman, Lansdown, & Sullivan 2006), one in Kenya did find decision-making to only be associated with better weight-for-height outcomes amongst children older than 35 months (Brunson, Shell-Duncan, & Steele 2009). This lack of a significant relationship between women's decision-making and the younger children is not entirely surprising. Some, if not all, of the younger children in their sample received a significant portion of their nutrition from breast milk. This means that they were somewhat buffered against moderate changes in the food supplies of their household and that they were less likely to benefit from their mothers being able to provide additional food. So when measuring current nutritional status through the weight-for-height indicator, any indication of chronic malnutrition may not be accounted for. More research is needed to determine the relationship between maternal agency and whether it affects children differently based upon their age.

The complexities of women's empowerment and nutrition

Women within and across societies are not all the same. By virtue of these differences, 'empowerment' differs by culture and the role of the community should not be overlooked (Sraboni, Malapit, Quisumbing, & Ahmed 2013). Since empowerment has different meanings in different contexts, a behavior that signifies empowerment in one setting may indicate something else in another. For example, going to the market may signify empowerment in Afghanistan, but not in Bolivia. Even in one particular setting, the ways in which empowerment is manifested are likely to change over time, as social norms change. On one hand, findings from this systematic review suggest that the association between women's agency and child's nutritional outcomes vary according to the local environmental and socioeconomic conditions. In Bolivia and India for instance, two studies determined community level variables were at times more consistent and stronger than the individual-level characteristics (Bose 2011; Frost, Forste, & Haas 2004). On the other hand, an interesting finding was that when included studies created their own, contextually specific questionnaire to measure women's agency, irrespective of location, items determined to be relevant to that particular context were more similar to one another than items used by studies that analyzed secondary data sources. No consistent relationship was seen between specific indicators and outcomes; however, variations in functional definitions and statistical methods to analyze the relationship may contribute to this.

Debate exists on whether women's agency should be measured well using context-specific indicators or if a more global set of indicators should be adopted for means of comparability. A promising attempt to teeter these fine lines and create a flexible, yet global set of indicators is witnessed in the Feed the Future initiatives Women's Empowerment in Agriculture Index (WEAI) (FTF 2011). Produced by USAID, the International Food Policy Research Institute (IFPRI), and the Oxford Poverty and Human Development Initiative (OPHI), this index was constructed using the Alkire Foster Method, and measures empowerment in accordance to Kabeer's framework (FTF 2011). Pilot tests conducted in regions of Bangladesh and Ghana for instance, found that different dimensions of empowerment have different implications for nutrition based upon context and gender. While women's limited role in household decision-making was associated with child nutritional outcomes in Nepal, in Ghana, they were strongly related to infant and young child feeding outcomes, but weakly associated to nutritional status (FTF 2011; Malapit *et al.* 2013; Sraboni *et al.* 2013). Pilot tests have shown that the multi-dimensional measurements espoused in this index are able to sensitively pick up on contextual differences while still providing valid and comparable measurements needed for program prioritization.

While we do not negate the role context plays, these commonalities provide evidence to the specificity of domains used to measure agency and that it is in fact possible to develop a set of global indicators to define it. However, as Kabeer (1999) remind us: "Statistical' perspectives on decision-making, however, should be remembered for what they are: simple windows on complex realities" (Kabeer 1999) and results be interpreted through a culturally sensitive lens.

Limitations and implications for future research

This review highlights limitations in the current literature and points to recommendations for future research. The most constraining of which, is that nine of the ten included articles base their studies on data from cross-sectional surveys. Women's empowerment and

nutritional status are variables that evolve over a period of time. However, cross-sectional surveys provide data on a defined population at a particular point in time. Given the complexities of women's empowerment and nutritional status, variation may exist between true prevalence and what this snapshot establishes. Therefore, it is advised that, wherever possible, future research be longitudinal or prospective in nature, comparable to the study conducted by Shroff and colleagues (Shroff *et al.* 2011).

Further, five of these studies are based on secondary data sources and constrained to a set of preexisting questions to measure agency. The ability of DHS questions to fully capture relevant aspects of women's empowerment has been called to question (Heckert & Fabric 2013). Researchers included in our sample echo these sentiments and address the shortcomings of DHS and NFHS questions (Shroff *et al.* 2009; Frost, Forste, & Haas 2007). For instance, Frost, Forste, and Heaton were limited to a series of 3 DHS questions about family planning and felt their results may be different if better measures existed (Frost, Forste, & Haas 2007). The NFHS was critiqued for including questions relevant to women's own health rather than the children's health (Shroff *et al.* 2009).

Studies that utilized their own tools and included decision-making indicators regarding purchase of food (n=4) and when to wean and introduce solid foods (n=2) provided more specific and sensitive measurements of the direct impact a mother's lack of decision-making may have on a child's nutritional status (Brunson, Shell-Duncan, & Steele 2009; Bégin, Frongillo, & Delisle 1998; Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2011). Whereas indirect proxy indicators, like a woman's ability to buy or sell jewelry (n=3), were less frequently associated with a child's nutritional status (Bégin, Frongillo, & Delisle 1998; Shroff *et al.* 2009; Shroff *et al.* 2011). The variations in indicators used, limitations acknowledged by researchers towards secondary data sources, and inconsistent conclusions based upon statistical analysis warrant further exploration solely looking at the metrics employed by various organizations and what ones have been shown to be the most effective in capturing constructs of agency.

Lastly, our review presents results from studies published in peer-review journals only. Given the increased attention development practitioners are giving to incorporating women's empowerment into nutrition interventions, it is believed that a more comprehensive systematic review, inclusive of grey literature, would yield an increased number of studies relevant to our research question.

3.5 Conclusion

The results of our study provide empirical evidence to the relationship between women's agency and the nutritional outcomes of children under five. Inconsistency of definitions and tools to measure agency highlight that, although experts perceive women's empowerment as a necessary pathway to improve current levels of malnutrition, interpretation of this messaging varies. A fragmented understanding of agency is witnessed through consistent use of overarching terms like 'autonomy' and 'empowerment' but inconsistent interpretation and functional measurement, raising concern for misinterpretation of findings and the potential underestimation of the impact agency has on nutritional outcomes. Further research will need to be conducted to expand this evidence base and better identify whether different variables of agency have differing effects on child nutrition. Agreement on common definitions and tools for measurement may be a positive next step for researchers to conduct such an examination, as this will increase the

comparability of findings and provide policy makers with a stronger evidence-base. Promise exists in the new Women's Empowerment in Agriculture Index and its progress should be monitored to discern if its use can be expanded to all sectors, and not just agriculture.

Association between agency and nutrition, irrespective of location and age at when outcomes were assessed, support our recommendation to incorporate components of empowerment in nutritional interventions. Further, implementation of common tools that measure more sensitive aspects of women's agency, like the Women's Empowerment in Agriculture Index, in a standardized manner may in fact find that current findings actually underestimate the true relationship between agency and child nutrition. Overall, results of this systematic review affirm the relevance a woman's freedom of mobility and decision-making rights to health outcomes of her children. As the global community continues to strive to improve the nutritional status of children under five, this review lends evidentiary support to the need for interventions to not overlook individual-level components and the role they play in nutritional outcomes.

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Conflicts of interest

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TABLES and FIGURES

Table 1. Search terms for identifying role of maternal agency on the nutritional status of children under 5 years of age

Exposure		Outcome
("Womens agency" OR		("Infant and young child feeding" OR
"Womens empowerment" OR		Infant growth OR
"Womens autonomy" OR		Child growth OR
"Womens decision making" OR		Infant nutrition OR
"Womens freedom of movement" OR		Child nutrition OR
"Womens status" OR	AND	Infant nutritional status OR
"Maternal agency" OR		Child nutritional status)
"Maternal empowerment" OR		
"Maternal autonomy" OR		
"Maternal decision making" OR		
"Maternal freedom of movement" OR		
"Maternal status" OR		
"Gender equality")		
		NOT HIV OR AIDS

Figure 2. Identification and assessment of studies for inclusion in the systematic review

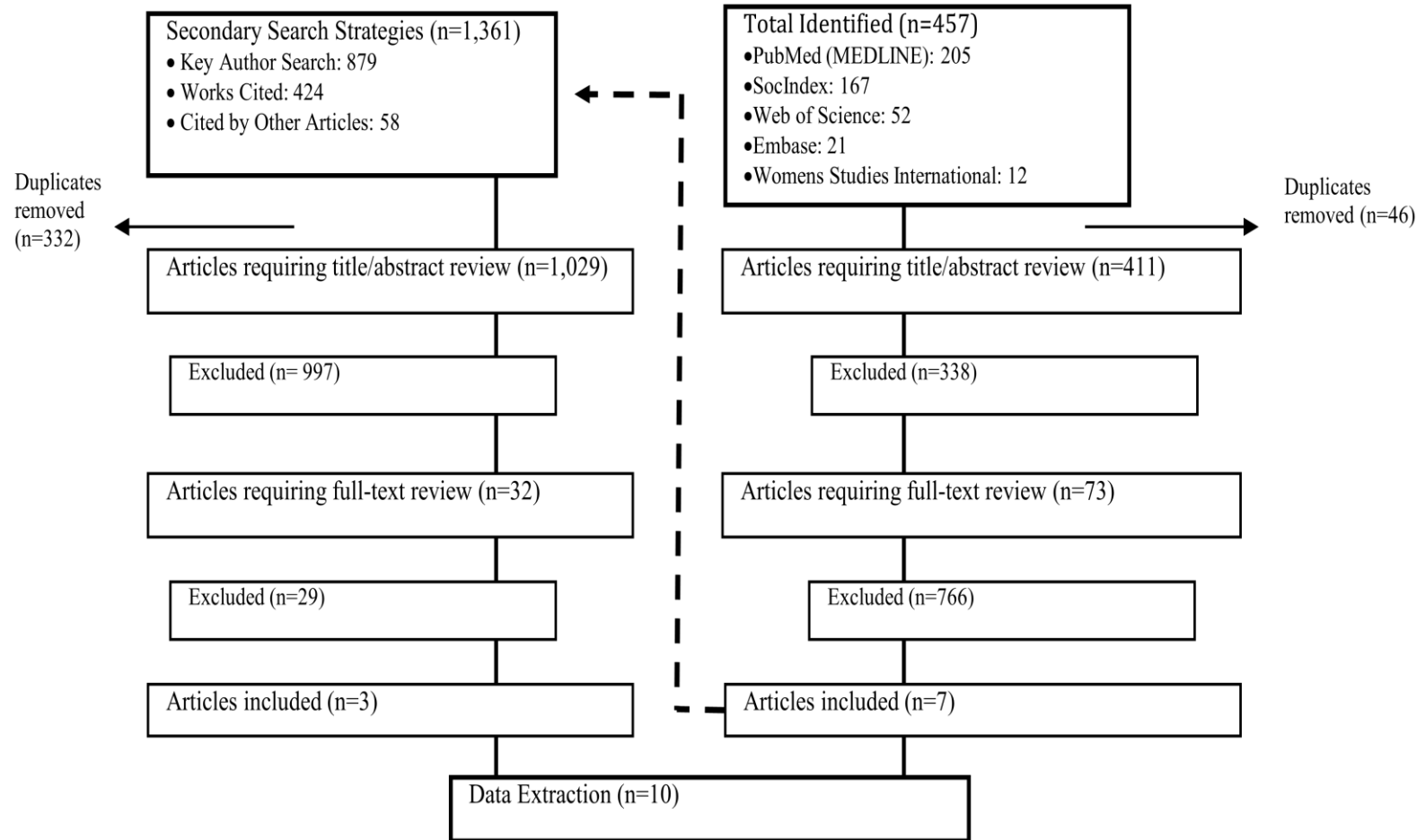


Table 2. Criteria for Inclusion and Exclusion of Literature

	<i>Included</i>	<i>Excluded</i>	<i>Rationale</i>
Literature Type	Peer-reviewed journals	Non-peer reviewed	Such literature has undergone review by a panel of subject area experts and publication in a peer-reviewed journal offers a minimum threshold for quality control.
Publication Date	01 Jan 1970 – 01 Sept 2013	Publications before or after these dates	Nutritional assessment was introduced in clinical medicine during the 1970s. ¹ Similarly the African economic crisis of the 1970s brought food security initiatives to the forefront of development. ²
Geographic Location	Low and Middle Income Countries (LMIC) ³	High income countries	LMIC were chosen for comparability of results and because of the higher burden of under nutrition in these countries.
Language	English	All other languages	Primary reviewer is fluent in English only.
Study Type	Quantitative, Qualitative, & Mixed-Methods	N/A	Given the dearth of data on nutrition-sensitive interventions that address the underlying determinants of child nutrition, qualitative data will provide a holistic and more comprehensive understanding of how a woman's level of agency can influence her child's nutritional status.
Sampling Methods	Population-based	Not population based	To better understand population-level outcomes.
Age	Women of all ages & children under 5	Children older than 5 and neonates ⁴	The nutritional status of children older than 5 and neonates is affected by a host of other determinants warranting an entirely new systematic review.
Exposure Measure	Agency: decision-making, mobility, empowerment	Enabling resources	The framework for inclusion was informed by Kabeer's Framework (1999).
Outcome Measure	Anthropometric measurements	Nutritional assessment without anthropometric assessment	For comparability of results. Literature will not be excluded based upon the reference population utilized to classify such statuses.
Analysis	Multivariate minimum	Less than multivariate	Control measurement within or between groups must be utilized to account for any confounding variables.

¹ Gibson, Rosalind S (2005). *Principles of Nutritional Assessment, 2nd Edition*. Oxford University Press, New York (2005).

² Heidhues F et al (2004).

³ Low and Middle Income countries as defined by the World Bank list of economies at the time the article was published. This includes lower-income, lower-middle and upper-middle income countries.

⁴ Neonatal period defined as birth to 28 days of life.

Table 3. Characteristics of Included Studies (N=10)

<i>Characteristic</i>	<i>No. of Studies</i>	<i>% of Studies</i>	<i>Citation</i>
Year Published			
1995-2000	1	10%	Bégin, Frongillo, & Delisle 1999
2000-2005	1	10%	Frost, Forste, & Haas 2005
2005-2010	5	50%	Brunson, Shell-Duncan, & Steele 2009; Sethuraman, Lansdown, & Sullivan 2006; Shroff <i>et al.</i> 2009; Mashal <i>et al.</i> 2008; Heaton & Forste 2007
2010- Sept. 2013	3	30%	Bose 2011; Shroff <i>et al.</i> 2011; Rahman <i>et al.</i> 2012
Geographic Region			
Latin America & the Caribbean	2	20%	Frost, Forste, & Haas 2005; Heaton & Forste 2007
Southeast Asia	6	60%	Sethuraman, Lansdown, & Sullivan 2006; Shroff <i>et al.</i> 2009; Bose 2011; Shroff <i>et al.</i> 2011; Mashal <i>et al.</i> 2008; Rahman <i>et al.</i> 2012
Sub-Saharan Africa	2	20%	Brunson, Shell-Duncan, & Steele 2009; Bégin, Frongillo, & Delisle 1999
Distribution of Countries¹			
<i>Low income:</i> Afghanistan, Bangladesh, Haiti, Chad, Kenya	5	50%	Mashal <i>et al.</i> 2008; Rahman <i>et al.</i> 2012; Heaton & Forste 2007; Bégin, Frongillo, & Delisle 1998; Brunson, Shell-Duncan, & Steele 2009
<i>Lower-middle income:</i> Bolivia, India, Nicaragua	3	30%	Heaton & Forste 2007; Sethuraman, Lansdown, & Sullivan 2006; Shroff <i>et al.</i> 2009; Bose 2011; Shroff <i>et al.</i> 2011
<i>Upper-middle income:</i> Colombia, Peru	2	20%	Heaton & Forste 2007
Study Type			
Longitudinal randomized behavioral intervention	1	10%	Shroff <i>et al.</i> 2011
Mixed-methods cross-sectional study	1	10%	Sethuraman, Lansdown, & Sullivan 2006
Cross-sectional survey based on primary data	3	30%	Brunson, Shell-Duncan, & Steele 2009; Bégin, Frongillo, & Delisle 1999; Mashal <i>et al.</i> 2008
Cross-sectional survey based on secondary data	5	50%	Rahman <i>et al.</i> 2012; Frost, Forste, & Haas 2005; Heaton & Forste 2007; Shroff <i>et al.</i> 2009; Bose 2011
Data Source			
Primary	5	50%	Bégin, Frongillo, & Delisle 1999; Sethuraman, Lansdown, & Sullivan 2006; Brunson, Shell-Duncan, & Steele 2009; Shroff <i>et al.</i> 2011; Mashal <i>et al.</i> 2008
Demographic Health Surveys (DHS)	3	30%	Rahman <i>et al.</i> 2012; Frost, Forste, & Haas 2005; Heaton & Forste 2007
National Family Health Surveys (NFHS)	2	20%	Shroff <i>et al.</i> 2009; Bose 2011
Domains of Agency Measured			
Mobility only	0	-	-
Decision-making only	5	50%	Brunson, Shell-Duncan, & Steele 2009; Bégin, Frongillo, & Delisle 1999; Rahman <i>et al.</i> 2012; Heaton & Forste 2007; Frost, Forste, & Haas 2004
Decision-making and mobility	5	50%	Sethuraman, Lansdown, & Sullivan 2006; Shroff <i>et al.</i> 2009; Bose 2011; Shroff <i>et al.</i> 2011; Mashal <i>et al.</i> 2008
Nutrition Measures Analyzed with Agency			
Underweight (WAZ) only	1	10%	Bose 2011

Stunting (HAZ) only	3	30%	Bégin, Frongillo, & Delisle 1999; Frost, Forste, & Haas 2005; Heaton & Forste 2007
Wasting (WHZ) only	1	10%	Brunson, Shell-Duncan, & Steele 2009
More than one	5	50%	Sethuraman, Lansdown, & Sullivan 2006; Shroff <i>et al.</i> 2009; Shroff <i>et al.</i> 2011; Mashal <i>et al.</i> 2008; Rahman <i>et al.</i> 2012
Reference Population Used			
NCHS/WHO	6	60%	Bégin, Frongillo, & Delisle 1999; Brunson, Shell-Duncan, & Steele 2009; Shroff <i>et al.</i> 2009; Sethuraman, Lansdown, & Sullivan 2006; Frost, Forste, & Haas 2005; Heaton & Forste 2007
WHO 2005	4	40%	Shroff <i>et al.</i> 2011; Bose 2011; Mashal <i>et al.</i> 2008; Rahman <i>et al.</i> 2012
Age Range of Children			
Under 6 months	1	10%	Shroff <i>et al.</i> 2011
Under 36 months	3	30%	Sethuraman, Lansdown, & Sullivan 2006; Shroff <i>et al.</i> 2009; Brunson, Shell-Duncan, & Seteele 2009
Under 5 years	5	50%	Brunson, Shell-Duncan, & Steele 2009; Mashal <i>et al.</i> 2008; Bose 2011; Rahman <i>et al.</i> 2012; Frost, Forste, & Haas 2005; Heaton & Forste 2007
Between 12 – 71 months	1	10%	Bégin, Frongillo, & Delisle 1999

¹ Economic status as defined by World Bank Country and Lending groups.

Table 4. Indicators and response categories used to measure agency¹	
Indicators for Agency by Sub-Domain	Response Items
Decision-making	
<i>The decision to:</i>	
DM1 Purchase food	RC1 Dichotomous (yes/no)
DM2 Decide the age for weaning and introduction of solid foods, types of food given	RC2 Others in household; jointly with others in household; respondent
DM3 Decide what food should be cooked each day	RC3 Husband or husbands family solely responsible; husband primarily responsible; respondent primarily responsible; respondent solely responsible
DM4 Seek health care when a child is sick	RC4 Dichotomous (high autonomy/low autonomy)
DM5 Seek health care for yourself	RC5 Dichotomous (woman had no final say/women had final say or joint decision)
DM6 Purchase medicine for sick children	RC6 Index for number of aspects women involved in for decision-making (range 0, few to 5, many elements)
DM7 Whether a child attends school	
DM8 Allow you to work for wages	
DM9 Spend the money you earn	
DM10 Spend the money your husband earns	
DM11 Make purchases for daily household needs	
DM12 Make major household purchases	
DM13 Buy or sell jewelry	
DM14 Make the decision to buy or sell animals	
DM15 Make the decision to slaughter animals for meat	
DM16 Bleed animals	
DM17 Adopt use of contraceptives	
DM18 Have children	
DM19 Get married dependently of others	
DM20 Make major household decisions	
DM21 Visit family or friends	
DM22 Invite guests to your home	
DM23 Have child immunized	
DM24 How child is disciplined	
Mobility	
<i>Freedom of movement to:</i>	
MB1 Shop alone within the village/local market	RC1a Dichotomous (yes/no)
MB2 Visit family or friends	RC2a Always, some of the time, never
MB3 Go to health facility	RC3a Never allowed to go, sometimes when I choose to, always when I choose to
MB4 Go outside the village/community	RC4a Dichotomous (high autonomy/low autonomy)
MB5 Go to the fields	RC5a Allowed to go alone, has to go with someone else, not allowed to go at all
MB6 Go to the community fair	

MB7 Go to community center

MB8 Go to Temple

¹Measurement items and response categories have been summarized from their original wording for comparability and brevity.

Table 5. The association between women's agency and nutritional outcomes of children under five years (N=10)

Citation Date	Study Type & Data Source	Age when Outcome Measured	Nutritional Outcome ¹	Sample Size			Term for agency	Agency Measure & Response Items	Agency Measurement Instrument	Type of Analysis	Outcomes ^{2,3}
				Mother	Child	Total					
Kenya (rural)											
Brunson, Shell-Duncan, & Steele 2009	Cross-sectional, Primary data	0 to 10 years	WHZ, using NCHS/WHO reference	n=435	n=934	N=1,369	Autonomy	DM1, 4, 5, 6, 7, 9, 10, 14, 15, 16, 17 RC3, 7	Principal component analysis; autonomy variable based on who makes decision [low aut=1/ high aut=4]	Hierarchical linear modeling	0-35 mo (n=306) (ref: high): $\beta = -0.11$, $p=0.63$ Standard Error (SE): 0.21 3-10 years (n=628) (ref: high): $\beta = 0.23$, $p=0.04$ SE: 0.11
Chad (rural)											
Bégin, Frongillo, & Delisle 1998	Cross-sectional, Primary data	12 to 71 mo.	HAZ, using NCHS/WHO reference	n=64	n=98	N=162	Autonomy	DM1,2,6,9,11,13 RC1	Unidimensional dichotomous	Ordinary least squares (OLS) regression Stepwise multiple regression	OLS: DM for household food expenditures (ref: mother has influence): $r^2=0.20$; $p=0.025$ Stepwise: DM for child feeding (ref: mother has influence): $\beta=0.55$; SE: 0.27; $p=0.043$ * other variables not included in multiple regression model
India (rural; urban & rural; nationally representative; rural respectively)											
Sethuraman, Lansdown, & Sullivan 2006	Mixed methods cross-sectional, Primary data	6 to 24 mo.	WAZ, using NCHS/WHO reference ⁴	n=820	n=820	N=1,640	Empowerment: Decision-making & freedom of movement	DM1,4,5,8,17,18,19,20 RC1 MB1,2,5 RC1	Unidimensional dichotomous	Bivariate regression analysis Multivariate regression analysis	DM: Mother's position in household & involvement in DM (ref: low): $\beta=0.08$; $t=2.55$; $p<0.05$ MB: Woman travels alone within village: $\beta=0.09$; $t=2.78$; $p<0.01$
Shroff <i>et al.</i> 2009	Cross-sectional, DHS, NFHS-2 2000	Under 3 years	HAZ, using CDC/NCHS reference ⁵	n=821	n=821	N=1,642	Autonomy	DM3,5,9,11,13,21 RC1 MB1,2	Unidimensional dichotomous: recoded so low score=	Weighted logistic regression	DM: Allowed to have money set aside to use for discretionary purpose (ref: no): aOR=0.74; 95% CI: 0.54, 0.98; $p<0.05$

							RC1a	high autonomy & high score=low autonomy		MB: Permission needed to go to market & HAZ (ref: needs permission): aOR=0.59; 95% CI: 0.38, 0.93; p<0.05	
Bose 2011	Cross-sectional DHS, NFHS-3 (05-06)	Under 5 years	WAZ, malnutrition ⁶ , using WHO 2005 growth standards	n=124,385	n=161,846	N=286,231	Autonomy	DM5, 11, 12, 21 RC2 MB1, 3, 4 RC5a	Summative continuous index (0-14, high=high autonomy) using principal component analysis	Hierarchical linear modeling (HLM)	Girl children Autonomy: $\beta=-0.003$; SE: 0.005; NS Boy children Autonomy: $\beta=-0.003$; SE: 0.006; NS <i>* p-values not reported</i>
Shroff <i>et al.</i> 2011	Longitudinal randomized behavioral intervention, Primary data	3 to 5 mo.	WAZ, LAZ, WLZ, using WHO 2005 growth standards	n=600	n=600	N=1,200	Autonomy	DM1,2,4, 5,6,8,9,1	Reduced 47 items into 7 variables using confirmatory factor analysis	Logistic regression generalized least squares (GLS) models	Financial autonomy (n=465) WAZ: $\beta= -0.010$; 95% CI: -0.104, 0.097; NS WLZ: $\beta= -0.039$; 95% CI: -0.34, -0.06 LAZ: $\beta= 0.033$; 95% CI: -0.06, 0.12; NS Mobility autonomy (n=465) WAZ: $\beta= -0.028$; 95% CI: -0.14, 0.09; NS WLZ: $\beta= -0.202$; 95% CI: -0.34, -0.06; p<0.05 LAZ: $\beta=0.147$; 95% CI: 0.05, 0.25; p<0.05 Mobility (n=465) WAZ: $\beta= -0.042$; 95% CI: -0.14, 0.06; NS WLZ: $\beta= -0.064$; 95% CI: -0.19, 0.06; NS LAZ: $\beta= -0.001$; 95% CI: -0.09, 0.09; NS Household DM (n=465) WAZ: $\beta= 0.167$; 95% CI: 0.04, 0.30; p<0.05 WLZ: $\beta= 0.263$; 95% CI: 0.11, 0.42; p<0.05 LAZ: $\beta= -0.056$; 95% CI:
							Household decision-making	1,12,13,14,21,22,23			
							Decisions regarding child care	RC2			
							Mobility autonomy	MB1-8 RC2a, RC3a			
							Actual mobility	Financial autonomy: DM RC2			
							Financial autonomy	Household DM: DM1, 4, 5, 6, 8, 9, 11, 12, 13, 14, 21, 22 RC2			
							Childcare DM:	DM2, 4, 23 RC2			
							Mobility				

autonomy: MB
 Mobility: MB1, 2, 3, 4, 5, 6, 7, 8
 RC3a

-0.17, 0.06; NS

Childcare DM (n=465)
 WAZ: $\beta = -0.06$; 95% CI: -0.04, 0.17; NS
 WLZ: $\beta = -0.006$; 95% CI: 0.11, 0.42; NS
 LAZ: $\beta = -0.097$; 95% CI: 0.01, 0.19; $p < 0.05$

* *p-values not reported when results were not significant*

Afghanistan (urban & rural)											
Mashal <i>et al.</i> 2008	Cross-sectional, Primary data	Under 5 years	WAZ, HAZ, WHZ using WHO 2005 growth standards	n=1,327	n=2,474	N=3,801	Autonomy	DM4 RC1 MB3 RC1a, RC5a	Multidimensional dichotomous (yes/no); Methods to combine not stated	Multivariate logistic regression	Lack of maternal autonomy & WHZ: aOR=1.67; 95% CI: 1.00, 2.81 Lack of maternal autonomy & HAZ: aOR=1.38; 95% CI: 1.01, 1.90; $p < 0.05$ Lack of maternal autonomy & WAZ: aOR=1.46; 95% CI: 1.00, 2.14
Bangladesh (nationally representative)											
Rahman <i>et al.</i> 2012	Cross-sectional, DHS, '07 ⁷	Under 5 years	WAZ, HAZ, WHZ, using WHO 2005 growth standards	n=1,851	n=1,851	N=3,702	Decision-making autonomy	DM4, 5, 11, 12, 21 RC5, 6	Categorical DM index (1=low; 5=high)	Multivariate logistic regression	No. of aspects of DM & HAZ (ref: 0 aspects) 1 aspect: aOR=0.33; 95% CI: 0.15, 0.71; $p < 0.05$ 2 aspects: aOR=0.97; 95% CI: 0.36, 1.23 3 aspects: aOR=1.07; 95% CI: 0.67, 1.71 4 aspects: aOR=0.75; 95% CI: 0.47, 1.19 5 aspects: aOR=0.94; 95% CI: 0.61, 1.45 No. of aspects of DM & WAZ (ref: 0 aspects): 1 aspect: aOR=0.71; 95% CI: 0.39, 1.32 2 aspects: aOR=1.18; 95% CI: 0.72, 1.92 3 aspects: aOR=0.97; 95% CI: .60, 1.57 4 aspects: aOR=0.74; 95% CI: 0.47, 1.19 5 aspects: aOR=0.95;

											95% CI: 0.62, 1.45
											No. of aspects of DM & WHZ (ref: 0 aspects):
											1 aspect: aOR=0.33;
											95% CI: 0.15, 0.71
											2 aspects: aOR=0.85;
											95% CI: 0.40, 1.80
											3 aspects: aOR=0.93;
											95% CI: 0.53, 1.65
											4 aspects: aOR=0.68;
											95% CI: 0.37, 1.25
											5 aspects: aOR=0.94;
											95% CI: 0.55, 1.58
Bolivia (nationally representative)											
Frost, Forste, & Haas 2004	Cross-sectional survey DHS, '98	Under 5 years	HAZ (di: above/below), using NCHS/WHO reference	n=5,562	n=5,562	N=11,124	Autonomy	DM17, RC1	Additive index using principal component analysis (range 0-4)	Logistic regression	Autonomy & HAZ (ref: low): $\beta = -0.05$; SE: 0.03; NS
											* <i>p-value not reported</i>
Multi-Country: Bolivia, Colombia, Haiti, Nicaragua, Peru (nationally representative)											
Heaton & Forste 2007	Multi-country cross-sectional DHS, Bolivia 2003, Colombia 2000, Haiti 2000, Nicaragua 97/98, Peru 2000	Under 5 years	HAZ, using NCHS/WHO reference	Not provided	Not provided	Bolivia: N=8,027 Colombia: N=3,086 Haiti: N=1,869 Nicar: N=4,792 Peru: N=4,798	Joint DM & Autonomous DM	Bolivia, Colombia, Haiti, Peru: DM3, 5, 11, 12, 21, RC1, 5 Nicaragua <i>items listed above and:</i> DM4, 7, 17, 24, RC1, 5	Responses summed and averaged to create joint DM & autonomous DM variables (range 0=no final say to 1=final say to all 5 questions)	Ordinary Least Squares Regression	Ref: husband has final say <u>Bolivia</u> Autonomy DM: $\beta = -10.9$; NS Joint DM: $\beta = -16.2$; $p < 0.05$ <u>Colombia</u> Autonomy: $\beta = -27.1$; $p < 0.05$ Joint DM: $\beta = -3.7$; NS <u>Haiti</u> Autonomy: $\beta = -35.6$; $p < 0.05$ Joint DM: $\beta = -23.9$; NS <u>Nicaragua</u> Autonomy: $\beta = 32.1$; $p < 0.05$ Joint DM: $\beta = 49.2$; $p < 0.05$ <u>Peru</u> Autonomy: $\beta = 45.6$; $p < 0.05$ Joint DM: $\beta = 15.8$; $p < 0.05$

- 1 WAZ, weight-for-age z-score for underweight. HAZ, height-for-age and LAZ, length-for-age z-score for stunting. WHZ, weight-for-height and WLZ, weight-for-length z-score for wasting. Recumbent length may be used instead of height for children under 12 months of age. Unless specified, analyzed as continuous variables.
- 2 Inferred p-values from reported confidence intervals for Rahman *et al.* and Mashal *et al.* Where 95% confidence did not include 1, $p < 0.05$.
- 3 Reported results rounded to the nearest hundredth.
- 4 All 3 anthropometrics are collected, but only WAZ included in analysis.

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- 5 All 3 anthropometrics collected, but only HAZ included in analysis.
 - 6 Malnutrition is a dichotomous variable that is coded 1 for malnutrition and 0 for well-nourished children.
 - 7 Only ever married women ages 15-49 are eligible to participate in the Bangladesh DHS.

Chapter 4. Conclusion and Policy Implications

This study sought to determine the relationship between women's agency, defined by her participation in family decision-making and freedom of movement, and the nutritional outcomes of children under five years of age. Of the 1,818 abstracts collected for review, a total of ten studies met our inclusion criteria. Elements of agency were significantly associated with nutritional outcomes in eight of the ten studies, with a woman's involvement in decision-making more frequently significantly associated with nutrition outcomes than freedom of movement. Though nine of the ten studies defined agency through the term 'autonomy', not one study used the same items to measure it, methods to create variables, or statistical methods to analyze the relationship between the two. Similar disagreement was noted amongst authors' understanding of how agency was associated with nutritional outcomes. Some argued it would be associated with acute malnutrition and subsequently only analyzed the relationship between agency and wasting whereas others felt measures of chronic malnutrition, or stunting, would be influenced and only analyzed the relationship between those two variables.

Discrepancies in definitions and methods witnessed amongst every layer of the empirical research come at a point when the nutrition community is almost unanimously recognizing women's empowerment as a critical pathway to improve current levels of child malnutrition. Divergence between what programs say is needed – women's empowerment – and what this construct is actually conceptualized to be highlights an urgent need for the adoption of a consistent definition of empowerment and its domains within the nutrition field. This in itself

would help bridge the gaps between the currently fragmented perspectives of what empowerment is and enable more appropriate interpretation of findings and recommendations.

With so many organizations promoting women's empowerment as a mechanism to improve childhood malnutrition, practitioners need more information on *how* this can be accomplished. While there is no one size fits all approach, especially to such multi-dimensional concepts like women's empowerment and malnutrition, the absence of policies or specific guidelines increases the risk of programs misunderstanding what constitutes a woman as empowered and possibly implementing contradicting programs to 'empower' (in accordance to their definition) women. In pursuance of the World Health Organization (WHO) guidelines, a systematic review of evidence must be conducted prior to making any policy change (WHO 2013). The 2013 Lancet Series on Maternal and Child Nutrition draws attention to this process and identifies the need for continued research on how nutrition-sensitive approaches can be incorporated into nutrition-specific interventions (Lancet 2013).

The results of this systematic review provide empirical evidence to the relationship between women's agency and nutritional outcomes of children under five, but the lack of comparability inhibits any clear articulation of specific relationships or trends across the association of agency and nutrition amongst indicators, geographic location, nutritional outcome, or age group. Only when a more conclusive set of research exists can a more robust systematic review be conducted and policy change be accomplished.

The Women's Empowerment in Agriculture Index developed by the Feed the Future partners is a newly developed index to measure empowerment as we understand it through Kabeer's framework and holds promise for this field. Further implementation and distribution of its findings will provide additional insight as to whether a global set of indicators can be used. We recommend that not just the agriculture sector, but the nutrition community at large adopts Kabeer's framework which recognizes empowerment as a process, composed of three interdependent, yet separate, domains: resources, agency, and achievements (Kabeer 1999). Our study deviates from the majority of available studies that define empowerment through resources have on nutrition outcomes, and contends that agency, or a woman's ability to act upon her resources, is also related to her achievements, in this case, having a well-nourished child.

At a conceptual level, these two components of empowerment – one focusing on resources the other on agency – are complementary, but in practice, it is often difficult to disentangle the two, particularly while operationalizing these for empirical research. However, programmatic interventions targeting childhood malnutrition hinge on the involvement of the mother. Programs targeting the interaction of infectious disease and malnutrition, like the mass distribution of Vitamin A and deworming pills, require a mother's freedom of movement to travel to community-based distribution sites. More expansive programs, like the management of severe acute malnutrition (SAM), are even more reliant on a woman's agency. While resources, like money to pay for transportation to the health facility, for treatment, and even the availability of health facilities are

important components to obtaining this healthcare, six included studies identified a mother's involvement in decision-making to seek healthcare for her child was positively and significantly associated with a child's nutritional outcomes, three of which determining this to be associated with prevalence of stunting, which is what a SAM intervention would be focusing on.

SAM guidelines call for programs to teach mothers how to look after her child during the rehabilitation process, prepare appropriate foods for intensive feeding, know how to make appropriate toys and play with a child, know how to give home treatment for diarrhea, fever, and acute respirator infections, and know how recognize signs that mean she must seek medical assistance (UNICEF 2013b). Again, while possession of resources (e.g. time to take away from work and participate in classes to learn these tactics, money to buy the food, etc.) are critical means to achieve these services, it also requires a woman has for instance, a say in what food should be provided to children. If the mother does not have decision-making rights within the household or freedom of movement to get the food or toys, restrictions on a mother's agency may inhibit the quality of care the child receives and negatively impact the child's growth and development.

Understanding empowerment through Kabeer's framework allows one to identify the critical weight of influence women's agency can have on nutritional outcomes. However, what this association is exactly, is hindered by inconsistent interpretations of agency, functional definitions, and methods for analyzing its relationship to health outcomes. The results of our study provide empirical evidence to the relationship between women's agency and the nutritional outcomes

of children under five. Inconsistency of definitions and tools to measure agency highlight that, although experts perceive women's empowerment as a necessary pathway to improve current levels of malnutrition, interpretation of this messaging varies.

A fragmented understanding of agency is witnessed through consistent use of overarching terms like 'autonomy' and 'empowerment' but inconsistent interpretation and functional measurement, raising concern for misinterpretation of findings and the potential underestimation of the impact agency has on nutritional outcomes. Further research will need to be conducted to expand this evidence base, better identify whether different variables of agency have differing effects on child nutrition, and develop a more expansive systematic review for the WHO to establish demonstrable policy recommendations off of. Agreement on common definitions and tools for measurement may be a positive next step for researchers to conduct such an examination, as this will increase the comparability of findings and provide policy makers with a stronger evidence-base. Promise exists in the new Women's Empowerment in Agriculture Index and its progress should be monitored to discern if its use can be expanded to all sectors, and not just agriculture.

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Appendix 1. Data Extraction and Quality Assessment Tool

DATA EXTRACTION ³			
			Year
REF ID		Reviewer, Date	
Author(s)			
Journal/Source			
Country of origin			Region
WHO country classification	<input type="checkbox"/> Low income <input type="checkbox"/> Lower-middle income <input type="checkbox"/> Upper-middle income		
Organization responsible			
Year(s) Data Collection took place:			
Data source	Primary data collection <input type="checkbox"/> / DHS <input type="checkbox"/> / Secondary (<i>if yes, specify</i>) <input type="checkbox"/>		
	<i>If primary: Dates of recruitment</i>		
Study type	Quantitative <input type="checkbox"/> / Qualitative <input type="checkbox"/> / Mixed Methods <input type="checkbox"/>		
Notes / Short description of objective & research questions			
STUDY DESIGN BASICS			
Theoretical framework	There is an explicitly stated or implicitly identified theoretical framework or frame of reference? No <input type="checkbox"/> / Yes (<i>explain</i>) <input type="checkbox"/>		
Agency explicitly described in framework?	No <input type="checkbox"/> / Yes (<i>explain description and terminology</i>) <input type="checkbox"/>		
Theoretical relationship between agency and nutritional outcomes described in framework?	No <input type="checkbox"/> / Yes (<i>explain</i>) <input type="checkbox"/>		
Summary: Metrics for			

³ Data extraction template modeled after Cochrane Review suggested format and adjusted for relevance to our study (CHMG 2007).

empowerment	
Metrics for nutritional outcomes (<i>specify reference population used to determine anthropometrics</i>)	
Other variables assessed	
Inclusion & Exclusion Criteria	
Outcomes assessed	
Other outcomes assessed	
Confounders	(Were confounders mentioned? A priori / a posteriori? Which? List confounders mentioned and number controlled for here)
STUDY CHARACTERISTICS	
Sample size	
Response Rate	
Sample population	
Sample design	Randomized <input type="checkbox"/> / Recruited <input type="checkbox"/> / Other (<i>specify</i>) <input type="checkbox"/>
Recruitment method	
Setting	Rural <input type="checkbox"/> / Urban <input type="checkbox"/> / Rural & Urban <input type="checkbox"/> Other (<i>specify</i>) <input type="checkbox"/>
Location of study (<i>national or sub-national, specify</i>)	
Data Collection methods	(Nutritional assessment conducted at household level? School-based? Paper-based survey? Etc. Identify and explain)
Funding	
Number of groups	
Flow diagram?	
Primary study aims	
Additional study aims	
Outcomes	Statistically significant for primary end-point: Yes <input type="checkbox"/> / No <input type="checkbox"/> / Enter p-value: Statistically significant for secondary end-point:

	Yes <input type="checkbox"/> / No <input type="checkbox"/> / Enter p-value:		
	If outcome was NOT statistically significant, explain:		
Additional comments?			
CHARACTERISTICS OF STUDY PARTICIPANTS			
	Mothers	Children	Notes
Overall comments			
Sample size: <i>Overall</i>			
Age			
Mean			
Median			
Range			
Descriptive characteristics (ethnicity, gender, etc.)			
EXPOSURE & OUTCOMES			
Exposure			
Definition of exposure & indicator used			
Definition 2			
Definition 3			
Outcome			
Definition of outcome & indicator used			
Timing of data collection periods & tools used			
Statistics			
Length of time outcomes measured after initiation of intervention			
Identified limitations			
Recommendations			
Conclusions			
STATISTICAL APPENDIX			

Type of analysis	Primary <input type="checkbox"/> / Secondary <input type="checkbox"/> / Other (specify) <input type="checkbox"/>	
Design effects controlled?	Yes <input type="checkbox"/> / No <input type="checkbox"/> / Other (specify) <input type="checkbox"/>	
Tests used (list)		
Independent variable		
Dependent variable(s)		
Explanatory variable(s)		
Associations Assessed (list)		
Multivariate ratios for exposure/ outcome of interest	Explanation	
	Model 1	
	Model 2	
	Model 3	
	Model 4	
	Additional Models	
Multivariate ratios for exposure/ outcome of interest (if more than 1 outcome)	Explanation	
	Model 1	
	Model 2	
	Model 3	
	Model 4	
	Additional Models	
Additional outcomes assessed		
CONCLUSIONS		
Identified limitations		
Recommendations		
Conclusions		

QUALITY ASSESSMENT (see corresponding checklist)⁴	
Number of items fulfilled: Title and abstract	
Introduction	

⁴ STROBE Statement (2007).

Methods	
Results	
Discussion and Other	
Systematic Sampling	Yes <input type="checkbox"/> / No <input type="checkbox"/>
If systematic, probability-based?	Yes <input type="checkbox"/> / No <input type="checkbox"/>
Sample size	Reported: No <input type="checkbox"/> / Yes <input type="checkbox"/> <i>If yes, size:</i>
Response rate	
Control for confounding?	No <input type="checkbox"/> / Yes <i>If yes, how many confounders?:</i>
Complex sample design accounted for?	Yes <input type="checkbox"/> / No <input type="checkbox"/>
Other sample design factors accounted for?	N/A <input type="checkbox"/> / Yes <input type="checkbox"/> / No <input type="checkbox"/>
Total number of items fulfilled from STROBE Checklist ⁵	
Notes	

⁵ To be considered “fulfilled”, every component of the category must have a “Yes” or N/A, (e.g., “Statistical Methods” (part of the larger “Methods”) has five components (a-e), and only receives a point if all are fulfilled).

Appendix 2. Sample data analysis tool

Compendium of indicators identified across all ten studies to define women's agency, the studies that used them, and whether the study identified the indicator to be a statistically, significantly predictor of a child's nutritional outcome (as defined by underweight, stunting, or wasting) (n=10) ¹																																																		
Study No.	Underweight (WAZ)										Stunting (HAZ)										Wasting (WHZ)										Overall																			
	1	2	3	4	5	6	7	8	9	10	Total Sig.	Total Used	% Sig.	1	2	3	4	5	6	7	8	9	10 ²	Total Sig.	Total Used	% Sig.	1 ³	2	3	4	5	6	7	8	9	10	Total Sig.	Total Used	% Sig.	Total Sig.	Total Used	% Sig.								
Decision-making																																																		
Purchase food [D1]		+									1	1	100												1	2	50	+/-																2	3	100	4	6	66.7	
Decide age for weaning, intro of solid foods, types of food given [D2]						-					0	1	0	+											2	2	100																		0	1	0	2	4	50
Decide what food should be cooked each day [D3]											0														7	11	63.6	+/-																	0			7	11	63.6
Seek healthcare when child is sick [D4]		+				-	-	-			1	4	25												4	4	100	+/-																	3	5	60	8	13	61.5
Seek healthcare for yourself [D5]		+				+					2	3	66.7												7	12	58.3	+/-																	3	4	75	12	19	63.2
Purchase medicine for sick children [D6]									+		1	1	100												0	2	0	+/-																2	3	67	1	3	33.3	
Whether a child attends school [D7]											0														2	2	100	+/-																	1	2	50	3	4	75
Allow you to work for wages [D8]		+				+					2	2	100												0	1	0																	1	1	100	3	4	75	
Spend the money you earn [D9]						+					1	1	100												0	2	0	+/-																2	3	67	3	6	50	
Spend the money your husband earns [D10]											0														0			+/-																1	2	50	1	2	50	
Purchases for daily household needs [D11]						-					0	2	0												7	11	63.6																		2	2	100	9	15	60
Major household purchases [D12]						-	+				1	3	33.3												7	12	58.3	+/-																	2	2	100	10	17	58.8
Buy or sell jewelry [D13]						+					1	1	100												0	3	0																		1	1	100	2	5	40
Make the decision to buy or sell animals [D14]						+					1	1	100												0	1	0	+/-																2	3	67	3	5	60	
Decision to slaughter animals for meat [D15]											0														0			+/-																1	2	50	1	2	50	
Bleed animals [D16]											0														0			+/-																1	2	50	1	2	50	
Use contraceptives [D17]		+									1	1	100												2	3	66.7	+/-																	1	2	50	4	6	66.7
Have children [D18]		+									1	1	100												0	1	0																		0			1	2	50
Get married dependently of others [D19]		+									1	1	100												0																				0			1	1	100
Make major household decisions [D20]		+									1	1	100												0																				0			1	1	100

If the box is not shaded green, red, or orange, then this means the indicator was not used. Row and column totals provide the total number of studies that found an indicator significant, the total number of studies that used that indicator, and the proportion of studies that determined it to be significant per health outcome, per domain of agency (decision-making or mobility), and per study.

A footnote explains the results identified for the two studies that found conflicting results in detail. Study number 10 is a multi-country study that includes two sets of decision-making variables per study – sole decision-making and joint decision-making – valued in the row and column totals as 1 each. Although this is one study and all other studies are valued as 1 in the row and column totals, the differing results by country and by variable per indicator were better represented as 1 each, compared to other studies that only had 1 country and 1 variable per indicator. So for example, the indicator D3 was significant in Nicaragua when a couple made the decision together, so this was counted as one, and it was found significant in Nicaragua when the woman made the decision herself, so this is also counted as one, and so on. Similarly, study number 1 conducted 2 sets of analysis per indicator – one on the nutritional outcomes per children 0 to 35 months and one on the nutritional outcomes per children 3 to 10 years. Results differed by analysis (significant amongst older children, not amongst younger), so we valued this as 2 (one per variable) in the row and column totals.