# 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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## 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.

**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. Ultimately, 10 studies were included for review.

**Results:** Of the 10 included studies, 2 were from the sub-Saharan Africa region, 2 from Latin America and the Caribbean, and 6 from Southeast Asia. Eight of the 10 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 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. The association between a woman's decision-making and freedom of movement show that these are relevant components of agency that should not be overlooked by nutrition interventions. 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

## 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 nutritional 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 health, learning, and productivity. In the early months and years, the body's organs, physiological processes, and brain structure are being developed. Poor nutrition 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. It is a substantial barrier to a nation's economic progress and improved standards of living. In fact, one study shows that a reduction in malnutrition can increase a country's GDP by at least two to three percent annually (UNICEF 2011).

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; UNDPI 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 nutritional status.

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 fully account for a woman's sense of empowerment (Kabeer 1999). *Possession of* human, economic, and social resources do not necessarily mean *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 dominate 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 and is a process comprised of three, interdependent, yet separate domains: resources, agency, and achievements (Kabeer 1999). Considering Kabeer's framework alongside current discourse and empirical evidence, we have adopted her framework of empowerment for this systematic review.

### *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 has produced a body of evidence focused on how resources alone impact nutritional outcomes. 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 a systematic review that focuses on agency alone to synthesize the available evidence, identify gaps in research, and better understand the relationship between agency and child nutrition.

## 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.

## 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.*

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

2011), one in Bangladesh (Rahman *et al.* 2012), and one in Afghanistan (Mashal *et al.* 2008). 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 leas 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; β= -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).

## 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 & Fabic 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 & Fabic 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.

## 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 it's 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

None declared.

## References for Manuscript


1. Bégin F, Frongillo E.A., & Delisle H (Mar 1999). Caregiver behaviors and resources influence child height-for-age in rural Chad. *Journal of Nutrition*, Vol.129 (3): 680-686.
2. Bhutta Z *et al.* (2008). Maternal and Child Undernutrition 3: What works? Interventions for maternal and child undernutrition and survival. *Maternal and Child Undernutrition Study Group*. *Lancet* 2008; 371: 417-40. Available from: http://download.thelancet.com/pdfs/journals/lancet/PIIS0140673607616936.pdf
3. Black, Allen, Bhutta, Caulfield, de Onis, Ezzati Mathers, & Rivera (2008). Maternal and child undernutrition: global and regional exposures and health consequences. *The Lancet* 2008; 371: 243-60.
4. Bose S (Sept 2011). The effect of women's status and community on the gender differential in children's nutrition in India. *Journal of biosocial science*. Vol. 43(5): 513-533.
5. Brunson E.K., Shell-Duncan B, & Steele M (Jan-Feb 2009). Women's Autonomy and its Relationship to Children's Nutrition Among the Rendille of Northern Kenya. *American Journal of Human Biology* Vol. 21(1): 55-64 Jan-Feb 2009.
6. Caldwell J (1979). Education as a factor in mortality decline: An examination of Nigerian data. *Population Studies*, 33, 395-413.
7. Casanovas et al. (2013). Multi-sectoral interventions for healthy growth. *Maternal and Child Nutrition* (2013), 9 (Suppl. 2), pp. 46-57. PDF available from: http://onlinelibrary.wiley.com/store/10.1111/mcn.12082/asset/mcn12082.pdf;jsessionid=E1E802544961D5AB053EB760C7D7D3CD.f01t01?v=1&t=hswgk5nb&s=3bfc9534f4db1000e51a74ea9548598c250a3d7c
8. CHMG (2007). *Cochrane Review Systematic Review on "Intervention X in Patients Y"*. Produced by Cochrane Review. PDF available from: http://chmg.cochrane.org/sites/chmg.cochrane.org/files/uploads/Template-Data%20Extraction-CHMG.pdf.
9. Grantham-McGregor *et al.* and the International Child Development Steering Group (2007). 'Developmental potential in the first 5 years for children in developing countries.' *The Lancet* 369: 60-70. 2007.
10. Franzo & Pronyk (2011). A review of global progress toward the Millennium Development Goal 1 Hunger Target. *Food and Nutrition Bulletin*, vol. 32, no. 2, 2011.
11. Frost M, Forste R, & Haas D (2005). Maternal education and child nutritional status in Bolivia: finding the links. *Social Science & Medicine* Vol.60 (2): 395-407.
12. Guerrant R, Oriá R, Moore S, Oriá M, & Aldo L (Sept. 2008). Malnutrition as an enteric infectious disease with long-term effects on child development. *Nutr Rev.* Sept 2008; 66(9): 487-505.
13. Gibson R (2005). *Principles of Nutritional Assessment, Second Edition*, Oxford University Press, Inc. New York, New York.
14. Heaton T & Forste R (2008). Domestic Violence, Couple Interaction and Children's Health in Latin America. *Journal of Family Violence* Vol.23 (3): 183-193.
15. Heckert & Fabic (Sept 2013). Improving Data Concerning Women's Empowerment in Sub-Saharan Africa. *Studies in Family Planning*, 44(3): 319-344, September 2013.
16. Kabeer N (1999). Resources, Agency, Achievements: Reflections on the Measurement of Women's Empowerment. *Development and Change* Vol. 30(3): 435-464. PDF available from: http://onlinelibrary.wiley.com.proxy.library.emory.edu/doi/10.1111/1467-7660.00125/pdf
17. *Lancet* (Jan 2008). Maternal and Child Undernutrition Series. *The Lancet*, Launched in London, UK, January 16, 2008. Available from: http://www.thelancet.com/series/maternal-and-child-undernutrition
18. *Lancet* (Jun 2013). The Lancet Series on Maternal and Child Nutrition. *The Lancet*, Published 6 June 2013. Available from: http://www.thelancet.com/series/maternal-and-child-nutrition

19. Malapit, Kadiyala, Quisumbing, Cunningham, & Tyagi (Dec. 2013). Women's Empowerment in Agriculture, Production Diversity, and Nutrition: Evidence from Nepal. *International Food Policy Research Institute***,** Washington, D.C. IFPRI Discussion Paper 01313. PDF available from: http://www.ifpri.org/sites/default/files/publications/ifpridp01313.pdf
20. Mashal T, Takano T, Nakamura K, Kizuki M, Hemat S, Watanabe M, & Seino K (2008). Factors associated with the health and nutritional status of children under 5 years of age in Afghanistan: Family behavior related to women and past experience of war-related hardships. *BMC Public Health*. 8 Article Number: 301.
21. Mason K.O. (1984). *The Status of Women: A Review of its Relationship to Fertility and Mortality.* Rockefeller Foundation, New York.
22. Moursund A & Kravdal Ø (2003). Individual and community effects of women's education and autonomy on contraceptive use in India. *Population Studies* 57:285-302.
23. Mwangome M, Prentice A, Plugge E, & Nweneka C (Apr 2010). Determinants of Appropriate Child Health and Nutrition Practices among Women in Rural Gambia. *Journal of Health, Population and Nutrition.* April 2010; Vol. 28(2): 167-172.
24. Narayan D (2002). Empowerment and Poverty Reduction. Washington, D.C., World Bank.
25. Rahman M, Poudel K, Yasuoka J, Otsuka K, Yoshikawa K, & Jimba M (2012). Maternal Exposure to Intimate Partner Violence and the Risk of Undernutrition Among Children Younger Than 5 Years in Bangladesh. *American Journal of Public Health.* Vol. 102(7): 1336-1345.
26. Rice A, Sacco L, Hyder A, & Black R (2000). Malnutrition as an underlying cause of childhood deaths associated with infectious diseases in developing countries. *Bulletin of the World Health Organization,* 2000, 78: 1207-1221. PDF available from: http://www.who.int/bulletin/archives/78%2810%291207.pdf
27. Sen A.K. (1990). Gender and cooperative conflicts. In Tinker, I. (ed.) *Persistent Inequalities.* Oxford University Press, New York, p. 123-149.
28. Sethuraman K, Lansdown R, & Sullivan K (2006). Women's empowerment and domestic violence: The role of sociocultural determinants in maternal and child undernutrition in tribal and rural communities in South India. *Food and Nutrition Bulletin.* Vol. 27 (2): 128-143.
29. Shroff M, Griffiths P, Adair L, Suchindran C, & Bentley M (2009). Maternal autonomy is inversely related to child stunting in Andhra Pradesh, India. *Maternal and Child Nutrition*. Vol. 5(1): 64-74.
30. Shroff M, Griffiths P, Suchindran C, Nagalla B, Vazir S, & Bentley ME (2011). Does maternal autonomy influence feeding practices and infant growth in rural India? *Social Science and Medicine*. Vol. 73(3): 447-455.
31. Sraboni, Malapit, Quisumbing, & Ahmed (Oct 2013). Women's Empowerment in Agriculture: What Role for Food Security in Bangladesh? *International Food Policy Research Institute*, Washington, D.C. IFPRI Discussion Paper 01297. PDF available from: http://www.ifpri.org/sites/default/files/publications/ifpridp01297.pdf
32. STROBE (Oct/Nov 2007). Checklist for cross-sectional studies. PDF available from: http://www.strobe-statement.org/fileadmin/Strobe/uploads/checklists/STROBE_checklist_v4_cross-sectional.pdf.
33. United Nations Children Fund [UNICEF] [2011]. Statistics and Monitoring: SOWC 2005-2011. Available from: http://www.unicef.org/statistics/index_step2.php?sid=b1adb7d4cd5d48010520cf75d504f6e1
34. United Nations Children Fund [UNICEF] (2013). Report 2013: Levels & Trends in Child Mortality. *Estimates Developed by the UN Inter-agency Group for Child Mortality Estimation.* PDF available from: http://www.childinfo.org/files/Child_Mortality_Report_2013.pdf
35. U.S. Agency for International Development [USAID] (2008). *Investing in the future: A united call to action on vitamin and mineral deficiencies: Global Report 2009*.

36. United Nations Department of Public Information [UNDPI] (2008). *United Nations Goal 1: Eradicate extreme poverty and hunger. Fact Sheet.* UN Department of Public Information – DPI/2640 A/Rev.1 New York, 2008.
37. VanderEnde K, Yount K, Dynes M, & Sibley L (Jun 2012). Community-level correlates of intimate partner violence against women globally: A systematic review. *Social Science & Medicine*, Vol. 75 (2012): 1143-1155.
38. Victora *et al.* for the Maternal and Child Undernutrition Study Group (2008). 'Maternal and child undernutrition: consequences for adult health and human capital'. *The Lancet* 371: 340-57 2008.
39. Walker *et al.* and the International Child Development Steering Group. *The Lancet* 369: 145-57. 2007.
40. World Health Organization [WHO] (1995). Physical Status: The Use and interpretation of anthropometric indicators of nutritional status. *Bulletin of the World Health Organization* 64: 929-941.
41. World Health Organization [WHO] (2013). Use of systematic reviews of the evidence in public health nutrition. *Proceedings of an informal consultation held 18 October 2011 in Geneva, Switzerland.* Geneva: World Health Organization; 2013. Available from: http://apps.who.int/iris/bitstream/10665/85792/1/978924150638_eng.pdf?ua=1

# 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 |

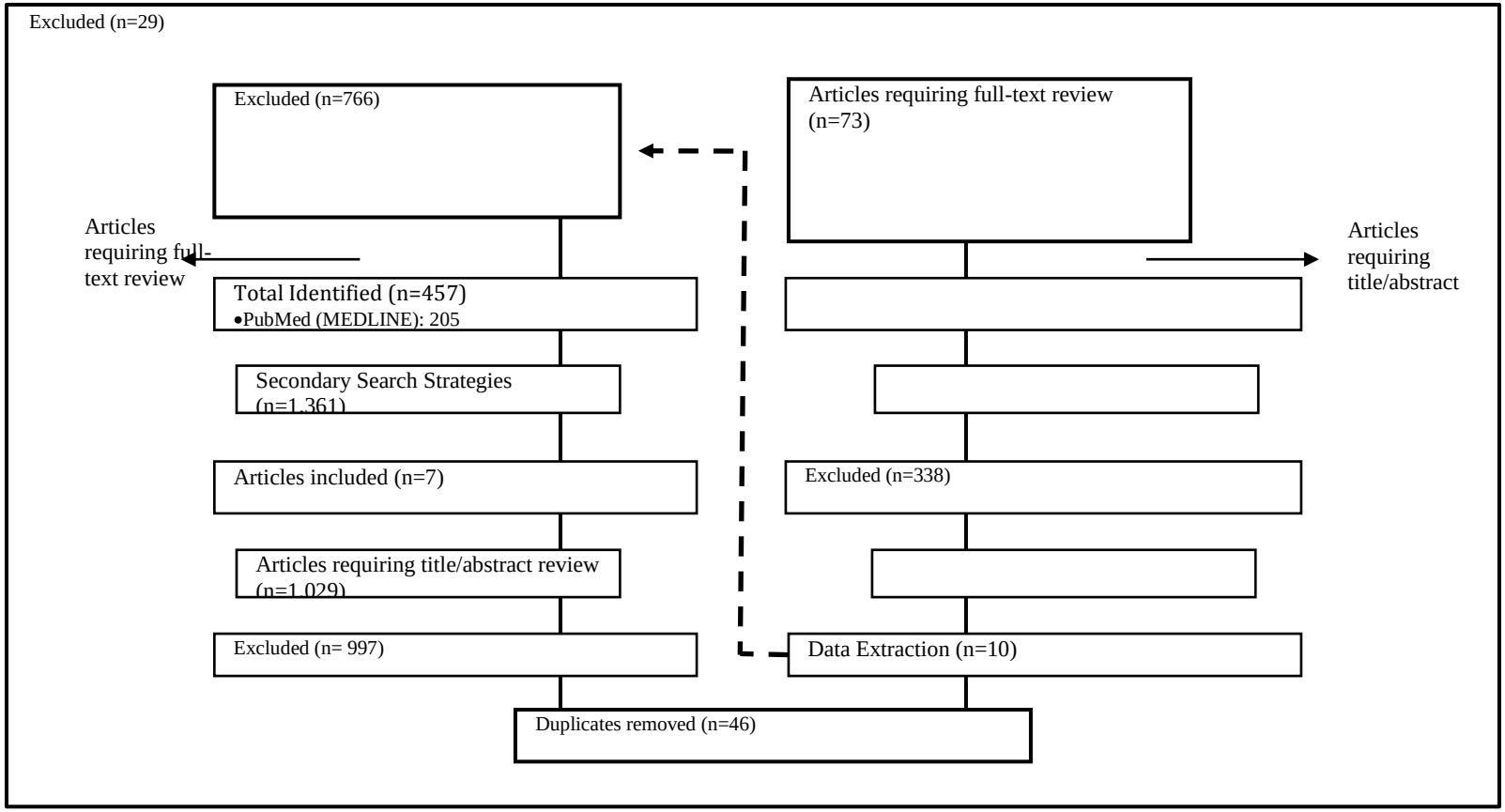
Excluded (n=29)
Excluded (n=766)
Articles requiring full-text review (n=73)
Articles requiring full-text review
Articles requiring title/abstract
Total Identified (n=457)
•PubMed (MEDLINE): 205
Secondary Search Strategies (n=1,361)
Articles included (n=7)
Excluded (n=338)
Articles requiring title/abstract review (n=1,029)
Excluded (n= 997)
Data Extraction (n=10)
Duplicates removed (n=46)

**Table 2. Criteria for Inclusion and Exclusion of Literature**

| | *Included* | *Excluded* | *Rationale* |
|---|---|---|---|
| **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)**

| *Characteristic* | *No. of Studies* | *% of Studies* | *Citation* |
|---|---|---|---|
| **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 *et al.* 2009; Mashal *et al.* 2008; Heaton & Forste 2007 |
| 2010- Sept. 2013 | 3 | 30% | Bose 2011; Shroff *et al.* 2011; Rahman *et al.* 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 *et al.* 2009; Bose 2011; Shroff *et al.* 2011; Mashal *et al.* 2008; Rahman *et al.* 2012 |
| Sub-Saharan Africa | 2 | 20% | Brunson, Shell-Duncan, & Steele 2009; Bégin, Frongillo, & Delisle 1999 |
| **Distribution of Countries[1]** | | | |
| *Low income:* Afghanistan, Bangladesh, Haiti, Chad, Kenya | 5 | 50% | Mashal *et al.* 2008; Rahman *et al.* 2012; Heaton & Forste 2007; Bégin, Frongillo, & Delisle 1998; Brunson, Shell-Duncan, & Steele 2009 |
| *Lower-middle income:* Bolivia, India, Nicaragua | 3 | 30% | Heaton & Forste 2007; Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2009; Bose 2011; Shroff *et al.* 2011 |
| *Upper-middle income*: Colombia, Peru | 2 | 20% | Heaton & Forste 2007 |
| **Study Type** | | | |
| Longitudinal randomized behavioral intervention | 1 | 10% | Shroff *et al.* 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 *et al.* 2008 |
| Cross-sectional survey based on secondary data | 5 | 50% | Rahman *et al.* 2012; Frost, Forste, & Haas 2005; Heaton & Forste 2007; Shroff *et al.* 2009; Bose 2011 |
| **Data Source** | | | |
| Primary | 5 | 50% | Bégin, Frongillo, & Delisle 1999; Sethuraman, Lansdown, & Sullivan 2006; Brunson, Shell-Duncan, & Steele 2009; Shroff *et al.* 2011; Mashal *et al.* 2008 |
| Demographic Health Surveys (DHS) | 3 | 30% | Rahman *et al.* 2012; Frost, Forste, & Haas 2005; Heaton & Forste 2007 |
| National Family Health Surveys (NFHS) | 2 | 20% | Shroff *et al.* 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 *et al.* 2012; Heaton & Forste 2007; Frost, Forste, & Haas 2004 |
| Decision-making and mobility | 5 | 50% | Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2009; Bose 2011; Shroff *et al.* 2011; Mashal *et al.* 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 *et al.* 2009; Shroff *et al.* 2011; Mashal *et al.* 2008; Rahman *et al.* 2012 |
| **Reference Population Used** | | | |
| NCHS/WHO | 6 | 60% | Bégin, Frongillo, & Delisle 1999; Brunson, Shell-Duncan, & Steele 2009; Shroff *et al.* 2009; Sethuraman, Lansdown, & Sullivan 2006; Frost, Forste, & Haas 2005; Heaton & Forste 2007 |
| WHO 2005 | 4 | 40% | Shroff *et al.* 2011; Bose 2011; Mashal *et al.* 2008; Rahman *et al.* 2012 |
| **Age Range of Children** | | | |
| Under 6 months | 1 | 10% | Shroff *et al.* 2011 |
| Under 36 months | 3 | 30% | Sethuraman, Lansdown, & Sullivan 2006; Shroff *et al.* 2009; Brunson, Shell-Duncan, & Seteele 2009 |
| Under 5 years | 5 | 50% | Brunson, Shell-Duncan, & Steele 2009; Mashal *et al.* 2008; Bose 2011; Rahman *et al.* 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 agency[1]**

| Indicators for Agency by Sub-Domain | | Response Items | |
|---|---|---|---|
| ***Decision-making*** | | | |
| *The decision to:* | | | |
| **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*** | | | |
| *Freedom of movement to:* | | | |
| **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 | | |

[1]Measurement 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, | Principal component analysis; autonomy variable based on | Hierarchical linear modeling | 0-35 mo (n=306) (ref: high): β= -0.11, p=0.63 Standard Error (SE): |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 15, 16, 17 RC3, 7 | who makes decision [low aut=1/ high aut=4] | | 0.21<br><br>3-10 years (n=628) (ref: high):<br>β= 0.23, p=0.04<br>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 | DM 1,2, 6,9, 11, 13<br><br>RC 1 | Unidimensional dichotomous | Ordinary least squares (OLS) regression<br><br>Stepwise multiple regression | OLS: DM for household food expenditures (ref: mother has influence): $r^3$=0.20; p=0.025<br><br>Stepwise: DM for child feeding (ref: mother has influence): β=0.55; SE: 0.27; p=0.043<br>** 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<br>MB1, 2,5 RC1 | Unidimensional dichotomous | Bivariate regression analysis<br><br>Multivariate regression analysis | DM: Mother's position in household & involvement in DM (ref: low): β=0.08; t=2.55; p<0.05<br><br>MB: Woman travels alone within village: β=0.09; t=2.78; p<0.01 |
| Shroff *et al.* 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<br>MB1, 2 RC1a | Unidimensional dichotomous: recoded so low score= high autonomy & high score=low autonomy | 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<br><br>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<br><br>MB1, 3, 4 RC5a | Summative continuous index (0-14, high=high autonomy) using principal component analysis | Hierarchical linear modeling (HLM) | Girl children Autonomy: β=-0.003; SE: 0.005; NS<br><br>Boy children Autonomy: β=-0.003; SE: 0.006; NS<br>** p-values not reported* |
| Shroff *et al*. 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<br><br>Household decision-making<br><br>Decisions regardin | DM1, 2,4,5, 6,8,9, 11,12 ,13,14 ,21, 22,23 RC2<br><br>MB1-8 | Reduced 47 items into 7 variables using confirmatory factor analysis | Logistic regression generalized least squares (GLS) models | Financial autonomy (n=465)<br>WAZ: β= -0.010; 95% CI: -0.104, 0.097; NS<br>WLZ: β= -0.039; 95% CI: -0.34, -0.06<br>LAZ: β= 0.033; |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | g child care | RC2a, RC3a | | | 95% CI: -0.06, 0.12; NS<br><br>Mobility autonomy (n=465)<br>WAZ: β= -0.028; 95% CI: -0.14, 0.09; NS<br>WLZ: β= -0.202; 95% CI: -0.34, -0.06; p<0.05<br>LAZ: β=0.147; 95% CI: 0.05, 0.25; p<0.05<br><br>Mobility (n=465)<br>WAZ: β= -0.042; 95% CI: -0.14, 0.06; NS<br>WLZ: β= -0.064; 95% CI: -0.19, 0.06; NS<br>LAZ: β= -0.001; 95% CI: -0.09, 0.09; NS<br><br>Household DM (n=465)<br>WAZ: β= 0.167; 95% CI: 0.04, 0.30; p<0.05<br>WLZ: β= 0.263; 95% CI: 0.11, 0.42; p<0.05<br>LAZ: β= -0.056; 95% CI: -0.17, 0.06; NS<br><br>Childcare DM (n=465)<br>WAZ: β= -0.06; 95% CI: -0.04, 0.17; NS<br>WLZ: β= -0.006; 95% CI: 0.11, 0.42; NS<br>LAZ: β= -0.097; 95% CI: 0.01, 0.19; p<0.05<br><br>* *p-values not reported when results were not significant* |
| | | | | | | | Mobility autonomy<br><br>Actual mobility<br><br>Financial autonomy | Financial autonomy: DM RC2<br><br>Household DM: DM1, 4, 5, 6, 8, 9, 11, 12, 13, 14, 21, 22 RC2<br><br>Child care DM: DM2, 4, 23 RC2<br><br>Mobility autonomy: MB<br><br>Mobility: MB1, 2, 3, 4, 5, 6, 7, 8 RC3a | | | |
| **Afghanistan** (urban & rural) | | | | | | | | | | | |
| Mashal *et al.* 2008 | Cross-sectional, Prima | Under 5 years | WAZ, HAZ, WHZ using | n=1,327 | n=2,474 | N=3,801 | Autonomy | DM4 RC1<br><br>MB3 | Multidimensional dichotomous (yes/no); | Multivariate logistic regression | Lack of maternal autonomy & WHZ: aOR=1.67; 95% CI: 1.00, |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ry data | | WHO 2005 growth standards | | | | | RC1a, RC5a | Methods to combine not stated | | 2.81<br>Lack of maternal autonomy & HAZ: aOR=1.38;<br>95% CI: 1.01, 1.90; p<0.05<br>Lack of maternal autonomy & WAZ: aOR=1.46;<br>95% CI: 1.00, 2.14 |
| **Bangladesh** (nationally representative) | | | | | | | | | | | |
| Rahman *et al.* 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)<br>1 aspect: aOR=0.33; 95% CI:<br>0.15, 0.71; p<0.05<br>2 aspects: aOR=0.97; 95% CI:<br>0.36, 1.23<br>3 aspects: aOR=1.07; 95% CI:<br>0.67, 1.71<br>4 aspects: aOR=0.75; 95% CI:<br>0.47, 1.19<br>5 aspects: aOR=0.94; 95% CI:<br>0.61, 1.45<br>No. of aspects of DM & WAZ (ref: 0 aspects):<br>1 aspect: aOR=0.71; 95% CI:<br>0.39, 1.32<br>2 aspects: aOR=1.18; 95% CI:<br>0.72, 1.92<br>3 aspects: aOR=0.97; 95% CI:<br>.60, 1.57<br>4 aspects: aOR=0.74; 95% CI:<br>0.47, 1.19<br>5 aspects: aOR=0.95; 95% CI:<br>0.62, 1.45<br>No. of aspects of DM & WHZ (ref: 0 aspects):<br>1 aspect: aOR=0.33; 95% CI:<br>0.15, 0.71<br>2 aspects: aOR=0.85; 95% CI:<br>0.40, 1.80<br>3 aspects: aOR=0.93; 95% CI:<br>0.53, 1.65<br>4 aspects: aOR=0.68; 95% CI:<br>0.37, 1.25<br>5 aspects: aOR=0.94; 95% CI:<br>0.55, 1.58 |
| **Bolivia** (nationally representative) | | | | | | | | | | | |
| Frost, Forste, & Haas 2004 | Cross-sectional survey | Under 5 years | HAZ (di: above/ below), using NCHS/ WHO | n=5,562 | n=5,562 | N=11,124 | Autonomy | DM17, 18 RC1 | Additive index using principal component | Logistic regression | Autonomy & HAZ (ref: low): β= -0.05; SE: 0.03; NS<br><br>** p-value not reported* |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | DHS, '98 | | reference | | | | | | analysis (range 0-4) | | |
| **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*ite ms listed above and:* 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<br>Bolivia<br>Autonomy DM: β=-10.9; NS<br>Joint DM: β= -16.2; p<0.05<br><br>Colombia<br>Autonomy: β= -27.1; p<0.05<br>Joint DM: β= -3.7; NS<br><br>Haiti<br>Autonomy: β= -35.6; p<0.05<br>Joint DM: β= -23.9; NS<br><br>Nicaragua<br>Autonomy: β= 32.1; p<0.05<br>Joint DM: β= 49.2; p<0.05<br><br>Peru<br>Autonomy: β= 45.6; p<0.05<br>Joint DM: β= 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.

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.