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ASSOCIATIONS BETWEEN WOMEN'S AUTONOMY AND WOMEN'S EXPERIENCE OF DOMESTIC VIOLENCE WITH CHILDREN'S NUTRITIONAL STATUS

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ABSTRACT

A mother's social context plays an important role in determining the health and well-being of her children. Constructs such as low maternal autonomy and experience of domestic violence not only compromise the health and well-being of women, but also can lead to adverse health outcomes for children. A systematic review of the literature was conducted summarizing the literature on maternal autonomy's relationship to children's nutritional status. Findings of the review strongly suggest that raising maternal autonomy is an important goal for improving children's nutritional status. Additionally, a secondary analysis was performed using data from a 2005 national survey of Colombia, in which measures of maternal decision-making autonomy were associated with child feeding practices such as child age at introduction to complementary foods and the number of precautions (such as washing hands and utensils) that mother took during food preparation using generalized linear models. In addition, when mothers both experienced domestic violence and had low decision-making autonomy, the combination of these risk factors was associated with poor child feeding practices. There was an interaction between maternal autonomy and experience of domestic violence on child age at introduction to complementary feeding, breastfeeding duration, and likelihood of child anemia. Overall, findings from the review of the literature and the secondary data analysis presented here are important for policy-setting and for directing future research examining maternal autonomy, domestic violence, and their implications for the health and well-being of children.

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Chapter 1. Associations between Women's Autonomy and Child Nutritional Status: A Review of the Literature

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ABSTRACT.—Around the world, many women continue to experience low levels of autonomy. Recent literature has reported that the health consequences of low maternal autonomy extend beyond mothers and translate into health consequences for their children, and may be an important causal factor in child malnutrition. This review summarizes the current knowledge of the relationship between maternal autonomy and children's nutritional status (defined as any measure that reflects the nutritional state of the body, such as birth weight or anthropometric scores) and child feeding practices. The review also includes both discussion of the limitations found in the literature and directions for future research. A systematic review of the literature was conducted. Results of the studies included in the review strongly suggest that raising maternal autonomy is an important goal for improving children's nutritional status, yet gaps in the current knowledge exist, further confounded by issues with how autonomy is measured and limitations of cross-cultural comparability. A thorough understanding of the consequences of restricting women's autonomy will inform programs and policy worldwide, and speed progress towards both empowering women and alleviating the global burden of child malnutrition.

Introduction

Women's autonomy is defined in different ways in the literature, but refers to a woman's ability to have control or influence over choices that affect herself and her family within her own particular context. This includes a woman's ability to influence decisions involving family, finances and expenditures, work, social outings, healthcare, travel, family planning, and childcare, along with others. Recently, interest has been growing regarding how social constructs such as women's autonomy may be implicated in child malnutrition. Although largely a preventable condition, child malnutrition is estimated to affect one third of children in developing countries and is responsible for one third of under-five childhood deaths worldwide (UNICEF & WHO 2011). One underlying factor in child malnutrition is lack of appropriate care for women and children (UNICEF 1998). Care is important for child nutritional status as it comprises "measures and behaviors that translate available food and health resources into child growth and development" (UNICEF 1998). It is widely acknowledged that mothers play a vital role in determining the nutritional status of their children. As primary caregivers, mothers have significant control over factors critical for child well-being, including food preparation and storage, feeding practices, psycho-social care, hygiene and health practices, and newborn care (Engle et al. 1999). Women's autonomy has received increased attention in this respect because a mother's degree of autonomy at the household level may impact her ability to make decisions in the best interest of her children or may limit her ability to divert household resources to her children. When mothers have control over income they tend to divert more towards health- and nutrition-related expenditures than men (e.g. Caldwell 1986; Thomas 1997; Quisumbing & Maluccio 2000; Quisumbing & Maluccio 2003). Furthermore, an increase in women's autonomy is sometimes associated with a decrease in child mortality (Boehmer & Williamson 1996; Hossain et al. 2007).

Women's autonomy is also an important aspect of care for women. Women with greater autonomy tend to be more likely to use contraception, have longer birth intervals, are less likely to have unintended pregnancies, and have smaller families (e.g. Balk 1994; Morgan & Niraula 1995; Upadhyay & Hindin 2005; DeRose & Ezeh 2009; Abada & Tenkorang 2012; Rahman 2012). Additionally, they are more likely to seek healthcare and use prenatal care, and have less risk for depression and anxiety disorders (Bloom et al. 2001; Patel *et al.* 2006; Hadley et al. 2010; Woldemicael & Tenkorang 2010; Qadir *et al.* 2011; Hou & Ma 2013). In many parts of

the world, women continue to experience very low levels of autonomy. According to the United Nations (UN), using data from 2004-2009, in 18 out of 30 developing countries from Africa, Asia, Latin America and the Caribbean more than half of the women reported having no say in everyday household decisions like making large household purchases, purchases for daily needs, visits to family or relatives, or decisions regarding their own health care (UN Women 2011).

Promoting gender equality and women's empowerment is one of the eight established Millennium Development Goals set by the UN in the year 2000. Yet substantial progress still remains to be made towards empowering women around the world before the goal date of 2015 (United Nations 2013). While increasing women's autonomy is an important goal in and of itself for ensuring human rights, a growing body of literature recognizes that women's autonomy has far-reaching impacts for the health and wellbeing of the community and the family, and is essential for reducing child malnutrition worldwide.

The aim of this literature review is to summarize the current evidence of the impact of maternal autonomy on child nutritional status, as well as to highlight some of the critical gaps in the literature. Overall, current evidence indicates that higher maternal autonomy is associated with benefits for child nutritional status. However, limitations exist because autonomy is measured differently from one study to the next, its association with child nutritional status differs based on which dimension of autonomy is measured, cultural contexts are not readily comparable, and maternal autonomy is sometimes negatively associated with child nutritional status. Following the review of the literature, important areas of focus for future research will be highlighted. Also included is some discussion on the limitations relating to current autonomy measurements as found in the identified studies, such as the issue of joint decision-making, questions of validity, and problems of cross-cultural comparability.

Search strategy employed in the literature review

To identify articles relevant to the literature review question, "how does maternal autonomy affect child nutritional status?," searches were conducted systematically in Medline and Web of Science. In Medline, both a combination of MeSH terms (personal autonomy, child nutritional status) and free terms were used initially, followed by searches using only free terms. Searches using only free terms were found to be the most fruitful, so this became the focus of the search strategy. Key terms related to both autonomy and child nutritional status were identified

(Table 1) and logically connected using Boolean operators in each database along with terms related to mothers (maternal, women, woman, female, mother) and children (child, children, infant). Searches were not limited in any database except in Medline by species (human) and field (title/abstract). No restrictions were made on child age, although child age was typically less than five years in the identified studies, with a few studies additionally including older children up to 13 years of age. Additional searches were conducted of the grey literature using Google Scholar, and relevant articles were included in the review as these make a substantial contribution to the current understanding of the relationship between maternal autonomy and child nutritional status. Following the identification of relevant articles using the search strategy, the references of all identified articles were searched by hand to locate additional relevant publications.

Inclusion Criteria:

Relevant articles were identified using the following two criteria:

1) Maternal autonomy or a closely related construct is a measured predictor of interest.
2) Child nutritional status is a measured outcome of interest.

All predictors related to autonomy, such as women's status or empowerment, were included in the review for a comprehensive view of this topic. However, only direct measurements of maternal autonomy at the household level were included for review (as opposed to women's autonomy at the societal level). All child nutritional outcomes were of interest and included in the review (anthropometric scores, birth weight, breastfeeding, and complementary feeding).

Results

Overview of studies included for analysis

Twenty-two studies published from 1990 to 2011 were included for review. All studies were from developing countries, with ten investigating south Asia (six from India), eight Africa, and one Latin America. Additionally, three studies compared multiple countries from different continents. Table 2 provides a summary of all significant results of final regression models found in the literature on the impact of maternal autonomy on child nutritional status. These findings illustrate that maternal autonomy tends to be positively associated with child nutritional status, yet also show that autonomy is measured differently from one study to the next, tends to have

inconsistent findings, sometimes is negatively associated with child nutritional status, and differs across context. With a few exceptions, most of the studies measuring the relationship between maternal autonomy and child nutritional status can be roughly divided into two groups based on whether different dimensions of autonomy are combined into one composite score, or whether each is analyzed as a separate independent variable. For the purpose of this review, the studies that analyze each dimension separately (or only measure one dimension) and the studies that use a composite score for autonomy will be discussed separately. All findings are reported as significant ($p \leq 0.05$), or as marginally significant ($p \leq 0.10$). Because the way autonomy is defined and measured is critical to the study of its impacts on health outcomes, this review first examines the definitions and measurement of autonomy in the identified studies, and also highlights qualitative literature demonstrating the complexity of autonomy measurement.

Definitions of women's autonomy

There has been a fair amount of discussion in the literature on how autonomy should be defined. Autonomy is considered a multidimensional construct, consisting of dimensions such as the ability to make purchases and control resources, the ability to make decisions about healthcare or childcare, and the experience of domestic violence (Agarwala & Lynch 2006). All of these dimensions of autonomy are related and purported to measure the same underlying construct, yet women can have high autonomy in one dimension and very little autonomy in another. For example, a woman may have some control over daily household expenditures but little say in large household purchases, or a woman may be able to make decisions about her and her children's healthcare but may be disempowered by her experience of domestic violence. Because no standard definition of autonomy has been accepted, many studies define autonomy operationally in distinct ways. This is true in the literature describing the effect of women's autonomy on various child health outcomes, including children's nutritional status.

Of the studies using child nutritional status as an outcome measure, each uses different dimensions to comprise the autonomy construct. For example, one recent study defined autonomy specifically in relation to decisions made on mobility, finances, and healthcare (Chakraborty & Anderson 2011). Radebe et al. (1996) measured autonomy as a woman's ability to make decisions without permission from a male relative on "what to grow, what to sell, when to seek health care for her children and choices about family planning." Shroff et al. (2011)

defined autonomy as "7 dimensions in which women make decisions and control resources within the family," expanding the definition of autonomy to include more decision-making dimensions like "household decision-making autonomy, child-related decision-making autonomy, financial control and access (financial autonomy), decisions regarding mobility (mobility autonomy), freedom of movement (mobility), acceptance of domestic violence, and experience of domestic violence." To select dimensions for study, some researchers rely on qualitative work to choose dimensions that are culturally appropriate, while many others select dimensions based on previous research or what is available in survey data. In a few recent cases, statistical considerations were used to narrow which dimensions to include in analysis. For example, Chakraborty and Anderson (2011) used principal component analysis to select dimensions most relevant to their outcome of interest. Shroff et al. (2011) used predetermined dimensions, and used confirmatory factor analysis to determine which questions should comprise each dimension. The variability in which dimensions are included in analyses limits comparability across studies, as will be discussed further (see "Composite score for autonomy").

This review uses the term "autonomy" because it commonly refers to women's agency at the household level. However, similar constructs such as women's empowerment and women's status are frequently used alongside, interchangeably or in the stead of women's autonomy (Basu & Koolwal 2005). The terms status or empowerment are typically defined in broader and more comprehensive ways than is autonomy. Status, for instance, is often defined at multiple levels rather than just the household level. In a cross-country study by Smith et al. (2003), status was defined as "women's power relative to men in the households, communities and nations in which they live." This study measured women's decision-making power at the household level as well as gender equality at the societal level. A study by Desai and Johnson (2005) used a definition developed by early researchers (Dixon-Mueller 1978; Mason 1986), who define women's status as women's "access to and control over material resources […] and social resources […] within the family, in the community, and in the society at large," although they contend that this broader construct can be represented by data gathered at the household level. On the other hand, empowerment is sometimes distinguished from autonomy and status as a process rather than a static state (Malhotra et al. 2002; Basu & Koolwal 2005; Mullany et al. 2005). However, empowerment is also frequently considered a condition (Dixon-Mueller 1978; Basu & Koolwal 2005). Other more comprehensive discussions of the definitions of the terms empowerment,

status, and autonomy exist in the literature (e.g. Mason & Smith 2000; Malhotra et al. 2002; Smith et al. 2003; Basu & Koolwal 2005; Brunson et al. 2009).

In general, autonomy, status, and empowerment are all related constructs sometimes used interchangeably and defined in similar but distinct ways in the literature. The lack of a clear definition for these terms is considered problematic by some (Sethuraman et al. 2006; Brunson et al. 2009), but not all. For instance, Smith et al. (2003) argues that it does not pose a problem as long as researchers clarify what is meant by the terms they are using. In addition to these constructs, other terms were included for this review such as women's social power (Simon et al. 2002), or bargaining power (Patel et al. 2007). Such terms have distinct meanings but are highly related to autonomy and of interest.

Measuring women's autonomy

Many comprehensive discussions on how to conceptualize and measure autonomy exist (e.g. Kabeer 1999; Agarwala & Lynch 2006). Because a woman's agency or ability to make important decisions reflects her autonomy, one way of operationalizing autonomy is to directly measure a women's ability to make common household decisions. The most frequently employed method of measuring autonomy in the identified literature is to use survey data, such as data from Demographic and Health Surveys (DHS), which question women on who in the household makes decisions on a number of differing dimensions of autonomy such as what to cook, daily household purchases, large household purchases, or other common dimensions of household decision-making. Similar to survey data used in many studies of women's autonomy, in DHS, mothers report who has the final say on various household decisions, and can answer that they themselves have the final say, their partners have the final say, the decision is made jointly, or someone else has the final say. Using these answers, women are typically rated as having high (woman has the final say), intermediate (decision is made jointly) or low (woman has no say) autonomy.

However, alternative methods of measuring women's autonomy are also employed in the identified literature. In a society in which women are almost universally subject to men, Doan and Bisharat (1990) used women's position in the household (whether head/co-head or subject to a mother-in-law or other relative) as a measure of autonomy. On the other hand, Simon et al. (2002) used a mother's felt control and passivity/helplessness to represent women's social

power. Smith et al. (2003) measured women's status by whether the mother works for cash income, her age at first marriage, the percent difference in the mother and her partner's age, and the difference in the mother and her partner's years of education. Smith et al. (2003) employed these measures because variables giving direct evidence of women's status were not available in all the countries being tested, but validated the variables for the countries in which direct measurements of decision-making power were available and found a strong, positive correlation.

To assign an autonomy score to a given woman in the identified studies, researchers either make a composite score that includes various dimensions of autonomy, or they may analyze each question or dimension separately. It is unclear that one method of measurement is preferred over the other by researchers, and there is no indication that one leads to clearer conclusions than the other. This difference in measurement limits comparability among studies and, ultimately, limits this field's ability to make strong conclusions or recommendations for programs. Agarwala and Lynch (2006) advocate using a composite score for autonomy since analyzing dimensions separately dilutes the available research (due to multicollinearity between dimensions) and undermines the theory that autonomy is comprised of separate dimensions that represent one underlying construct. On the other hand, many dimensions comprise autonomy, and the relationship of some dimensions with child health outcomes may be obscured when combined with others in a single analysis. In a recent study, Shroff et al. (2011) separately related each dimension of autonomy to child health outcomes, hypothesizing that each may influence child health differently. Among the studies that measure dimensions of autonomy separately, differing associations with child health are found. Of additional importance is the finding that the correlates of women's decision-making autonomy over any one decision differ from the correlates of decision-making autonomy over other decisions (Kishor & Subaiya 2008). Issues of validity resulting from autonomy measurements will be discussed further (see "Validity").

Qualitative research on autonomy

The discussion above illustrates how complex and challenging it is to measure autonomy. Qualitative literature exploring gender relations clearly highlights the social complexity that can surround women's decision-making. For example, levels of autonomy are highly culturally-dependent and vary even within a particular region. One qualitative study found that in the

Mysore region of Karnataka, India, tribal women had higher rates of autonomy than rural women of the same region due to different cultural norms (Sethuraman et al. 2006). Levels of autonomy in a particular context can also vary greatly with time, so that measures that are appropriate at one time may not be appropriate at another (Malhotra et al. 2002). Additionally, the availability of resources must be taken into account. Autonomy involves the ability to control resources, yet poverty also limits women's access to resources. Furthermore, mismanagement of money by women or their husbands can also have important implications. For example, one early qualitative study of women in rural Yemen found that household management of finances made a substantial difference in child health outcomes. One woman had considerable financial autonomy but tended to use it to buy soft drinks, decorations, and jewelry and her household was frequently in debt, exemplifying that while women may be more likely to divert resources to children this is not necessarily always the case (Myntti 1993). This study also highlighted the importance of social support and maternal psychological well-being to child health outcomes. Women whose children had better health outcomes tended to have supportive relationships with neighbors and family, accepted assistance when needed, and valued hard work, while women with poor child health outcomes were more likely to be isolated and refuse assistance, tended to have conflict or poor relationships in general with their husbands and families, and tended to be more fatalistic (Myntti 1993). A mother's social support and her personal characteristics and values likely have a large influence on decision-making. To add another level of complexity, feminist literature documents that women can internalize cultural norms and accept low status as inevitable and thus, a woman's own perceptions of her autonomy may not be accurate (Malhotra et al. 2002). Overall, qualitative literature highlights many of the nuances in gender relations which are difficult to capture in operationalized measurements of autonomy, and which must be taken into consideration when interpreting results. On the other hand, a qualitative study from India examining the influence of maternal autonomy on child feeding practices suggested that women with more financial autonomy and autonomy over child-related decisions were more likely to feed their babies colostrum rather than discarding it (Shroff 2007). Thus, there is some support in the qualitative literature for a direct improvement in child care practices when women's autonomy is increased.

Much of the qualitative research that focuses on women's autonomy or empowerment comes from South Asia (Malhotra et al. 2002). Survey questions from Demographic and Health

Surveys (DHS) that measure women's empowerment were selected to be cross-culturally relevant but were based mainly on knowledge of empowerment in the South Asian context (Schatz & Williams 2011). How these variables reflect empowerment in other contexts has not yet been thoroughly explored. In fact, there is a surprising dearth of research qualitatively examining dimensions of women's household decision-making autonomy in various cultural contexts. This is important, as certain questions can have different implications in different contexts, or may not be useful indicators of autonomy in some cultures. Some literature on women's empowerment suggests that to accurately measure empowerment, some exploratory, qualitative research must first occur and questions should first be tailored to each specific context (Hashemi et al. 1996; Malhotra et al. 2002). While practical difficulty may sometimes limit researchers' ability to apply this level of rigor, several of the reviewed studies did make efforts to measure autonomy in culturally-relevant ways.

Joint decision-making

An important difference in autonomy measurements among the studies under review is whether they include joint-decision making (when a woman reports that she and her husband make a decision together as opposed to the woman having the final say on the decision) as indicating a woman has lower of autonomy in the household. For example, Brunson et al. (2009) emphasized that autonomy should be defined as the ability to make a decision with complete independence from any other person. In this study, women who had the final say on various household decisions were scored as having greatest autonomy, while women who made decisions jointly with their husbands were scored as having less autonomy (Brunson et al. 2009). This type of scoring is commonly employed in the identified studies. In contrast, both Heaton and Forste (2008) and Patel et al. (2007) measured joint decision-making as a separate variable. The rationale behind this is twofold: 1) the father's involvement may benefit child development and 2) joint decision-making has been associated with reduced rates of domestic violence and lower rates of child mortality (Kishor & Johnson 2004; Heaton & Forste 2008). Issues of validity related to joint decision-making will be discussed further (see "Validity").

Socio-demographic characteristics of women with low autonomy

Although many of the reviewed studies did not report differences in socio-demographic characteristics based on autonomy status, some characteristics of women with low autonomy can be distinguished from studies which do report these differences. Women with low autonomy consistently tend to be younger (Doan & Bisharat 1990; Sethuraman et al. 2006; Chakraborty & Anderson 2011) and have lower socio-economic status (Simon et al. 2002; Chakraborty & Anderson 2011). Chakraborty & Anderson (2011) reported that women with less autonomy were more likely to have no education, and similarly, Simon et al. (2002) found women with more felt control tended to be more educated. Doan and Bisharat (1990) reported that women with lower autonomy were actually more likely to be highly educated, but this was likely because highly educated women also tended to be younger in this culture, and younger women were more likely to be subject to their mother-in-law. In other studies, women with lower autonomy tended to have lower weight and BMI (Sethuraman et al. 2006; Chakraborty & Anderson 2011). Additionally, Sethuraman et al. (2006) found that women with low autonomy were more likely to be from rural rather than tribal communities. Women with more felt control tended to be more likely to have participated in a credit rotation scheme, have a husband in a skilled occupation, and have a supportive mother-in-law (Simon et al 2002). Furthermore, Chakraborty and Anderson (2011) reported that women with low autonomy were more likely to be unemployed, followers of Islam, from male-headed households, daughter-in-laws of household head (or other relative other than wife), and from Northeast and Eastern regions of India as compared to Central and Southern regions.

Studies separating the dimensions of autonomy (n=11)

Table 3 summarizes the relationship of commonly-measured dimensions of women's autonomy with child nutritional status. Dimensions are included in the table only if they were found to significantly affect child nutritional status in at least one of the identified studies separating the dimensions of autonomy. Table 3 illustrates that different dimensions of autonomy affect child nutritional status inconsistently, with many found to have non-significant associations with child nutritional status approximately equally as often as significant associations. Any apparent trends should be interpreted with caution due to the small number of studies, differences in measurement, and limitations in comparability, also keeping in mind that

the number of times each dimension is measured impacts the number of times it will be found to be significant. Even so, some general dimensions of autonomy do stand out as being relevant to children's nutritional status more frequently than others. Each will be explained and discussed briefly.

Child feeding/child care autonomy

"Child feeding/child care autonomy" is considered as any question measuring whether the mother has autonomy in decisions regarding the care and feeding of children. When mothers have autonomy over child feeding and child care, they may be more likely to follow recommended feeding practices (Shroff 2007) or provide more appropriate care. Questions used to measure this dimension vary from study to study. Bégin et al. 1997 and Bégin et al. 1999 (notably, using the same dataset) found that greater maternal influence over child feeding decisions in rural Chad was associated with improvement in child height-for-age. This relationship was found in the context of food scarcity and widespread child malnutrition, and thus maternal influence over feeding decisions may have been especially important in this context (Bégin et al. 1997; Begin et al. 1999). Other studies have suggested that maternal autonomy may be especially important in situations of resource scarcity (Brunson et al. 2009). While two other studies measured some aspect of the relationship of maternal autonomy with child feeding or care on child nutritional status, no other significant associations were found: Merchant and Udipi (1997) examined the association of intrahousehold food allocation and decisions regarding breastfeeding and weaning on child growth with no significant results, and Roushdy (2004) measured the association of decision-making related to children on child height-for-age with no significant results. A study by Shroff et al. (2011) also measured child-related decision-making and found it to be associated with improved child nutritional status, but the two questions measuring this dimension were whether the mother had autonomy over infant immunizations and what to do if the child falls sick. For this reason, this finding was instead considered part of healthcare autonomy. Additionally, somewhat related to maternal control over child feeding is maternal control over food decisions in general. Several studies investigated aspects of maternal autonomy over food decisions, with no significant results: Basu and Koolwal (2005) examined the association of who decides what to cook with whether or not the youngest child has anemia, Sethuraman et al. (2006) studied the association of maternal control over food supply with child weight-for-age, and Ross-Suits (2010) examined the association of maternal

autonomy over food to be cooked each day with child stunting, wasting and underweight. The preponderance of non-significant results suggests that maternal influence over child care and child feeding (or food-decisions in general) may be a weak measure of autonomy. Women are often expected to be sole caretakers of children, and in the same vein, food preparation is often considered a woman's responsibility in many cultures. Having control over childcare decisions and food-related decisions would be a poor representation of autonomy if a woman is exercising her expected role in the household. In fact, a question concerning women's control over food to be cooked was included in the DHS questionnaire with the assumption that women's autonomy over this aspect of household decision-making would be the norm, and women not in control of this aspect of decision-making would be unusual (Kishor & Subaiya 2008). More insight is needed as to what maternal control over childcare represents in specific situations and contexts, and likely autonomy over food decisions should not be considered a measure of autonomy.

Healthcare autonomy

Among the studies included for review, women's autonomy over healthcare, either for herself or for her children, is the dimension most consistently associated with children's nutritional status. When women control their own healthcare, they may have more access to important services such as prenatal care. Additionally, when women have control over decisions regarding healthcare they may be quicker to seek healthcare during periods of illness both for themselves and their children, despite potential cost. Of the three studies measuring female autonomy over child healthcare, all found significant associations with child nutritional status. Merchant and Udipi (1997) found that mothers with less autonomy over their children's medical treatment during an illness were significantly more likely to have children in the negative-deviant growth category. Mashal et al. (2008) defined women's autonomy as whether the mother could bring her children to see a doctor without her partner's permission and whether she needed to be accompanied while bringing children to a health facility, and found maternal healthcare autonomy to be significantly associated with decreased incidence of child stunting. Shroff et al. (2011), as mentioned previously, combined two questions in measuring child-care decision-making: whether a mother decided on whether to immunize the infant and on what to do when an infant became sick. Child-care decision-making was associated with better child length-for-age scores (Shroff et al. 2011).

Three studies also evaluated whether female control over their own healthcare had a significant association with child nutritional status, and all found significant results. Ross-Suits (2010) found maternal autonomy in choosing her own healthcare to be significantly associated with better child height-for-age scores, and Dancer and Rammohan (2009) similarly found that maternal control over healthcare was significantly associated with improved child height-for-age scores, although only marginally. Conversely, Dancer and Rammohan (2009) measured the relationship of various problems mothers may encounter in getting to a medical facility with child nutritional status and found contradictory results. Mothers reporting that it was "a small problem" or that it was "not a problem" to get to a medical facility for themselves due to available transport had children with marginally better height-for-age scores, yet children were more likely to be stunted. Similarly, mothers with no problems or only small problems getting to a medical facility for themselves due to their willingness to go alone had children with better weight-for-height scores. However, mothers having "a big problem" getting to a medical facility for themselves due to the distance had children with better weight-for-height scores. All of these results were only significant for male children when genders were analyzed separately. The reason for these contradictory findings is unclear. However, using the degree of problems women experience in getting to a medical facility to define autonomy is unusual, with no other identified study using such measures. Based on the information provided, it is uncertain how women would interpret whether they were experiencing "big problems" or "small problems," and also uncertain what other resources women may be able to access if they are experiencing problems in any of the areas (such as distance to health facility). Finally, Basu and Koolwal (2005) found that a mother's ability to make decisions about her own healthcare marginally increased the odds that her youngest child would not have anemia.

In general, all studies measuring maternal autonomy over healthcare-related decisions find significant associations (although not necessarily for every outcome measure), with the exception of the study by Dancer and Rammohan (2009), which used an unusual measure of healthcare autonomy. Taken together, the consistency with which maternal autonomy over health care decisions is found to be positively associated with child nutritional status is suggestive that this may be an especially important factor in determining child nutrition outcomes. While speculative, it is possible that when women are able to independently bring children to medical

facilities and have autonomy over healthcare-related decisions, their children have better health and can avoid the known cyclic relationship between disease and compromised nutritional status.

Mobility/social autonomy

The mobility/social autonomy dimension considered any question or group of questions which measured a mother's freedom of movement through her ability to independently travel to various places, attend social events or visit family and friends. Restrictions of a woman's freedom of movement may limit her ability to obtain resources, such as from the market, and can limit her ability to receive advice or support from friends and family. Seven of the eleven studies measured mobility autonomy, and of these, four found significant relationships. Merchant and Udipi (1997) found that in Bombay mothers with less autonomy over social decisions such as outings and attendance at different social functions were more likely to have children in the negative-deviant growth category. Sethuraman et al. (2006) found that women's mobility within the village had a positive association with her child's weight-for-age. Similarly, Shroff et al. (2009) found that not needing permission to go to the market decreased the likelihood that a child would be stunted. Shroff et al. (2011) found mixed results for mobility autonomy. While high mobility autonomy was associated with lower weight-for-age scores, it was associated with higher length-for-age scores. In this study, mobility autonomy interacted with child birth weight, with mobility autonomy being more important for improving length-for-age scores in children with lower birth weights (Shroff et al. 2011). No significant associations for mobility autonomy were found in three studies: Roushdy 2004, Basu and Koolwal 2005, and Ross-suits 2010. Overall, while some studies report that mobility autonomy positively influences children's growth and nutrition, this finding is not consistent in the literature. Mobility autonomy appears to have important implications for child nutrition, but its effect likely varies by situation and context, or based on how the variable is defined.

Financial autonomy

Financial autonomy was considered to be any question or group of questions giving evidence of women's control over financial resources. This type of control can allow women to divert resources to children, thus improving child grown and nutrition. A fairly wide range of questions regarding income, finances, and purchases was included in this category. Five of the identified studies (out of the nine that analyzed some aspect of financial autonomy) found significant associations of financial autonomy with child nutritional status, but with mixed

results. Basu and Koolwal (2005) found that increasing the amount of maternal contribution to the family income from almost none to less than half significantly decreased the odds that her child would have anemia. However, no significant association was seen for mothers being able to use money as they wished, or if mothers were able to make decisions about major household purchases (Basu & Koolwal 2005). Shroff et al. (2009) found that women able to set aside money for personal use had children who were significantly less likely to be stunted. In another study testing several different dimensions of autonomy, only maternal financial autonomy (whether mothers were able to independently make various household financial decisions) was significantly associated with increasing the likelihood of exclusive breastfeeding at 3-5 months of age (Shroff et al. 2011). However, in this study financial independence was not associated with any other child nutritional outcome, including weight-for-age, length-for-age, and weight-for-length. On the other hand, comparing the upper and lower quartiles of children's weight-for-age, Sethuraman et al. (2006) found that maternal income and employment had a negative association with child nutritional status, increasing the risk of children having low weight-for-age scores. However, this main effect was not significant in a model that included an interaction term for maternal employment and food insecurity. Sethuraman et al. (2006) explained this interaction by speculating that mothers from poorer households with greater food insecurity may be more likely to be employed, which would explain the negative relationship sometimes seen with maternal employment (Abbi et al. 1991; Kishor & Parasuraman 1998). Other mixed results for financial autonomy were reported by Dancer and Rammohan (2009), who found a marginally significant negative association with children's weight-for-height when mothers had the final say on large household purchases, but a positive association when mothers had the final say on making purchases for daily needs, and both of these findings were only significant for male children. Additionally, four studies found no association of financial autonomy with child nutritional status. According to Bégin et al. (1999), whether mothers earned and controlled their own income or were involved in household health and food expenditures had no association with child height-for-age. Roushdy (2004) found no association of a mother's control over household cash allocation with children's height-for-age scores. Merchant and Udipi (1997), measuring financial independence as whether the mother had control over income, found no association with child growth. Finally, in a study by Ross-Suits (2010), there was no association between mothers having the final say on large household purchases or financial independence (including

control over income) and child stunting, wasting, and underweight. Overall, maternal financial autonomy does appear to influence child nutritional status in the literature frequently enough to be of interest, yet consistent results are not seen. The reason for inconsistencies in findings is not clear and may be due to differences in measurement or context, or the broad range of questions on financial decisions which was included under this dimension. The mixed findings underscore the need for a more thorough understanding of the different factors at play influencing women's autonomy measures.

Maternal disbelief in legitimacy of domestic violence

Women's opinion of the legitimacy of domestic violence is typically measured by questioning women on whether they feel domestic violence is justified in various circumstances (such as if a woman neglected children or cheated on her husband). Women who believe domestic violence is at times legitimate may have accepted such cultural norms or violence as inevitable. Thus, they are considered inherently disempowered, although they may not realize this fact themselves. Five studies measured the association of women's opinion of the legitimacy of domestic violence with child nutritional status, and of these, one found a relationship. Basu and Koolwal (2005) found that when mothers did not view domestic violence as ever justifiable, their youngest child was significantly more likely to be non-anemic. In contrast, Roushdy (2004) measured women's opinion of domestic violence and found no association with child height-for-age. Similarly, Shroff et al. measured women's attitude toward domestic violence and found no association with child stunting (2009). In another study, Shroff et al. (2011) reported no association between women's acceptance of domestic violence and any measure of child nutritional status, including weight-for-age, length-for-age, weight-for-length, and exclusive breastfeeding at 3-5 months of age. Ross-Suits similarly asked whether mothers felt domestic violence was ever justifiable and found no significant association with child stunting, wasting, or underweight (2010). Women's opinion of domestic violence stands out as a dimension of autonomy that frequently has non-significant associations with child nutritional status. Agarwala and Lynch (2006) examined the relatedness of autonomy dimensions using survey data from India and Pakistan and found that while most commonly measured dimensions of autonomy were moderately correlated, perceived legitimacy of domestic violence did not correlate well with other dimensions of autonomy. For this reason, they argued that women's opinion of the

legitimacy of domestic violence should not be included in autonomy measurements as it may reflect education, or some social factor other than autonomy (Agarwala & Lynch 2006).

Maternal experience of domestic violence

Women's experience of domestic violence is commonly included as a dimension of autonomy because violence can severely restrict women's freedom and choices, but it is also studied as a separate construct. Four of the identified studies examined the relationship of women's experience of domestic violence with child nutrition. Of these, two measured domestic violence as a dimension of women's autonomy, and two measured domestic violence as a separate construct alongside autonomy. Of the four studies, three reported significant associations. Sethuraman et al. (2006) found that mothers who had experienced psychological abuse or sexual coercion were significantly more likely to have children in the lower quartile of weight-for-age. Heaton and Forste found that across five Latin American countries, women's experience of domestic violence had a significant negative association with child height-for-age in Bolivia and Haiti, but not in Colombia, Peru, or Nicaragua (2008). Roushdy (2004) found that maternal experience of domestic violence was significantly associated with higher likelihood that daughters would be stunted, but did not affect male children. However, Shroff et al. (2011) measured women's experience of domestic violence and found no significant association with any aspect of child nutritional status, including weight-for-age, length-for-age, weight-for-length, and exclusive breastfeeding at 3-5 months. Studies that exclusively focused on domestic violence in the home but that did not consider it a dimension of women's autonomy were not included in this review. However, a growing body of literature recognizes the negative impact of domestic violence on child nutritional status (e.g. Sobkoviak et al. 2012; Yount et al. 2011). Pulling in results from this body of literature, it seems clear that domestic violence has important negative effects on child nutrition, both indirectly through maternal stress, mental health, behavioral risks, physical health and malnutrition as well as through stress experienced by the child, possible impairment of mother's ability to breastfeed and in general compromising the mother's ability to care for the child (Yount et al. 2011). What may be less clear is how the experience of domestic violence relates to female autonomy. The reasons for inconsistent findings among the reviewed literature are unclear, although again, context and issues related to measurement are probably important factors.

General maternal involvement in household decision-making

The final dimension of autonomy commonly found in the identified studies is general household decision-making, which was measured through various questions about who makes decisions at the household level. Three studies included general household decision-making as a dimension of autonomy, and two of these found significant results. Sethuraman et al. (2006) examined whether women were "involved in major household decisions" and found that higher maternal decision-making and position in the household was significantly associated with improved child weight-for-age scores. Shroff et al. (2011) used questions such as who makes decisions on "what gifts to give when relatives marry," "whether or not you should work outside the home," and "obtaining healthcare for yourself," along with others, and found that higher maternal household decision-making autonomy was associated with significantly higher weight-for-age and weight-for-length scores in children. However, Shroff et al. (2009) found no significant association for general household decision-making with child stunting. The fact that this dimension is used by a small number of studies and is subsumed in other dimensions (such as decisions on obtaining healthcare for self) again exemplifies the difficulty in comparison that can arise from the various definitions and measurements of autonomy seen in the literature.

Studies using a composite score for autonomy (n= 11)

Eleven of the identified studies used a composite score to represent autonomy. While results of these studies generally lend support to autonomy having a positive influence on child nutritional status, some mixed results are still seen. Using a composite score for autonomy, clear significant associations were found by Radebe et al. (1996) on children's weight-for-age, and also by Chakraborty and Anderson (2011) on children's birth weight. Brunson et al. (2009) similarly found a strong significant association of women's autonomy on children's weight-for-height, but only for children over 36 months of age, and when tested individually in 5 different regions of Northern Kenya, only remained significant for one region, Korr, which of the 5 regions studied, had especially poor conditions and the highest rates of child wasting. Bose (2011) found significant positive associations of women's autonomy with three different child feeding practices; higher maternal autonomy was related to longer duration of breastfeeding, a higher likelihood that the child received supplemental milk products, and a higher likelihood of receiving supplemental meat, fish, or eggs. Additionally, maternal autonomy was associated with

lower likelihood that female children would be malnourished (Bose 2011). On the other hand, Patel et al. (2007) reported a negative finding for increased maternal power. Shared power, mother power, and father power were measured separately, and Patel et al. (2007) found that shared power was associated with higher child BMI, and when measured separately, this was true for both male and female children. However, mother power had a negative association with child BMI. Patel et al. (2007) thus suggest that increasing the bargaining power of mothers does not always improve child nutritional status, and that encouraging cooperation and communication between partners within the household may be preferable.

Three of the studies using composite autonomy scores compared results across different countries and all reported mixed findings. Desai and Johnson (2005) found significant positive associations of women's autonomy with child height-for-age in India and marginally in Mali, but had a significant negative association in Malawi and marginally in Haiti, while no association was reported for Benin, Uganda, Zimbabwe, Egypt, Nepal, Colombia, Nicaragua, or Peru. Heaton and Forste (2008) similarly reported a significant negative association of women's autonomy with child height-for-age in Haiti (with no significant associations in Colombia, Peru, Nicaragua and Bolivia). Similar to Patel et al. (2007), in this study autonomy was calculated by separating women's autonomy from joint decision-making. Along with autonomy, joint decision-making had independent, mixed associations with child nutritional status; increased joint decision-making had a negative association with child height-for-age scores in Boliva, but a positive association in Nicaragua (Heaton & Forste 2008). Smith et al. (2003) is by far the most comprehensive study carried out on the relationship of autonomy and child nutritional status, examining various child nutritional outcomes in 36 countries in Asia, Africa, and Latin America. Measuring autonomy across all countries, a significant positive association was found overall on child weight-for-age. Briefly, women's autonomy was found to have a positive association with child weight-for-age in three out of four countries in Asia, six out of 23 countries in Africa, and two out of nine countries in Latin America/Caribbean. Significant negative associations were also found in one country in Africa and one country in Latin America. In general, increases in women's autonomy tended to be negatively associated with breastfeeding measures (particularly duration) but increased the likelihood that a child 6-12 months old had received complementary foods, increased the times per day the child was offered foods and increased the quality of foods the child did receive (Smith et al. 2003). One other study, Maffioli et al. (2009), compared a

composite score of women's autonomy across five countries in South Asia and Africa on child stunting, and found no significant associations, although women's status (measured using the differences between a mother and her partner's education and occupation) had a marginally significant association with child stunting in India. Potential trends in findings based on context will be discussed later (see "Regional Differences").

Two studies used unique measures of women's autonomy. In an early study by Doan and Bisharat (1990) carried out in Amman, Jordan, autonomy was measured based on whether mothers were the heads of household or whether they were subject to other relatives, such as their mother-in-law. In this culture, women rarely if ever have final say in household decisions and are almost universally subject to men. Thus, typical survey questions would have little meaning in this context. However, women may have relatively more or less autonomy based on their position in the household (specifically, whether or not they are subject to their mother-in-law). Increasing maternal autonomy by not being subject to other relatives in the household is associated with significant benefits for children's weight-for-age scores (Doan & Bisharat 1990). However, it is difficult to separate whether the benefit to children is due to the mother's increase in autonomy or the diminished influence of the mother-in-law, a factor which may be independently associated with children's nutritional status (Aubel 2012; Reid et al. 2010). On the other hand, Simon et al. (2002) scored women's social power based on survey data measuring felt control and passivity/helplessness. Women who were more passive were marginally more likely to have children who were wasted and stunted while women who had higher felt control were marginally more likely to have children in the normal range for weight-for-height.

Overall, studies using a composite score of women's autonomy support the hypothesis that increasing women's autonomy has a positive effect on children's nutritional status. However, there are inconsistencies among findings that warrant further attention. It is difficult to pinpoint causes of these inconsistencies, partly due to differences in autonomy measurement. For example, each study includes different dimensions in calculating an overall autonomy score. It is possible that some studies find no significant results or fewer significant results based on which autonomy dimensions are included in the score. Chakraborty and Anderson (2011) used principal component analysis to select the dimensions for inclusion in the composite score, which may have contributed to the strong significant association they reported. Interestingly, the dimensions finally selected into the study were whether the mother had the final say on her own healthcare,

daily household purchases, large household purchases, and visits to relatives, which covers many of the dimensions that tended to most often have significant results when analyzed separately. Additionally, regional differences in women's autonomy likely play an important role in the mixed results seen in this group, as will be discussed further (see "Regional Differences").

Outcome measures

The most typical outcome measures used in the studies included in this review were the WHO growth scores weight-for-height (wasting), height-for-age (stunting), and weight-for-age (underweight). Weight-for-height is considered to represent current malnutrition, height-for-age a measure of long-term malnutrition, and weight-for-age a combination of the two. Another limit to comparability among the identified studies is that frequently only one of these measures is used in analyses. Only four of the identified studies assessed all three growth outcomes (Smith et al. 2003; Mashal et al. 2008; Ross-Suits 2010; Shroff et al. 2011), and two others included both weight-for-height and height-for-age (Simon et al. 2002; Dancer et al. 2008). Among studies evaluating all three nutritional outcomes, significant results were often found for one, but not others. This suggests the possibility that studies could have found additional significant results if more measures had been included. In addition, no patterns can be discerned in the results based on the outcomes used. However, height-for-age scores (as well as stunting) do stand out as most often reflecting significant results for the healthcare-related dimension of autonomy. Mashal et al. (2008) included wasting, stunting, and underweight and found that lack of maternal autonomy (as measured by whether the mother would bring the child to see a doctor alone and without permission) was significantly associated with increased likelihood of child stunting. Dancer and Rammohan (2009), Ross-Suits (2010), and Shroff et al. (2011) all found positive associations of increases in women's healthcare autonomy using specifically child height-for-age scores as outcome measures. One possible explanation is that stunting is most likely to occur during the rapid period of growth in the first two years of childhood, and young children are also especially vulnerable to disease. These first few years are a sensitive time period when access to healthcare is important in preventing malnutrition, and children's healthcare may be improved when mothers have the autonomy to make healthcare-related decisions. However, as Brunson et al. (2009) point out, one limitation in these measurements is that stunting is a long-term measure of nutritional status, and autonomy measurements taken at the time of the survey may not

accurately reflect the mother's autonomy during the period of time in which the stunting occurred. Some studies have noted that in many cultures women's autonomy tends to increase with age and with the birth of children, especially sons (Hindin 2000; Acharya et al. 2010). However, in a more comprehensive study of changes in women's autonomy over their life course in India, Lee-Rife (2010) found that many of the women actually experienced decreased autonomy with age, although autonomy levels immediately following marriage were highly correlated with autonomy levels many years later.

A few studies also examined the association of women's autonomy on child feeding practices. Shroff et al. (2011) measured the association of dimensions of Indian women's autonomy on exclusive breastfeeding (EBF) at 3-5 months of age, and found that increased financial autonomy was positively associated with EBF. Similarly, Bose (2011) found that higher maternal autonomy was associated with longer breastfeeding duration in Bolivia. However, Smith et al. (2003) found a clearly negative association of maternal autonomy with breastfeeding measures across Asia, Africa, and Latin America. While maternal decision-making was associated with increased likelihood of initiating breastfeeding in South Asia, it was associated with decreased likelihood of EBF at 0-4 months of age in South Asia, increased chances the child received something from a bottle in the past 24 hours in both South Asia and Sub Saharan Africa, and shorter breastfeeding duration in South Asia, Sub Saharan Africa, and Latin America. The reason for these differences is unclear.

Complementary feeding was a measured outcome in two studies. Bose (2011) found that higher maternal autonomy was associated with higher likelihood that in the last 24 hours children received supplemental milk products, and supplemental meat, fish, or eggs. Smith et al. (2003) also found a positive association of maternal autonomy and child complementary feeding, with increases in a woman's decision-making power increasing the chances that a 6-12 month old child would have received complementary food in South Asia and Sub-Saharan Africa, increasing the chances that a child older than 6 months would have received high-quality complementary food in the past 24 hours in South Asia, and increasing the number of times a child older than 6 months eats per day in South Asia, Sub-Saharan Africa and Latin America/Caribbean. Based on these two studies, it appears that higher women's autonomy generally has a positive association with complementary feeding practices.

Due to the possible differences in maternal autonomy's impact on breastfeeding and complementary feeding, there may be a differential impact of maternal autonomy on children of different ages. However, only one of the identified studies looked at outcomes of different age-groups separately to compare children receiving mainly breast milk to children receiving complementary foods. Brunson et al. (2009) found that higher maternal autonomy was related to better child weight-for-height for children over 36 months of age but made no difference for younger children. Brunson et al. (2009) noted that in this culture, children up to 36 months of age tend to meet most of their caloric needs through breast milk. Thus, there is some support in the literature for a differential effect of women's autonomy based on child age.

Regional differences

As mentioned previously, of the studies included in this review, ten were based in South Asia (with six from India), seven Africa, and one Latin America. Additionally, four studies compared results across countries. Women's autonomy may vary greatly across cultural contexts because women may be empowered in certain dimensions but oppressed in others, and this may be especially true across countries and even regions (and likely even varies from household to household.) For this reason, measurements of autonomy across different cultural contexts may pose problems. Little research has been done to determine whether typical autonomy measurements are valid across different cultural contexts, and studies which do compare contexts suggest that in fact, autonomy measurements do not appear to be valid across different communities (see "Validity" below). Thus, comparing results across countries is questionable at best. To measure autonomy in different countries and regions, the studies identified for review took varying approaches. Some researchers created culturally specific autonomy indexes after carrying out qualitative research, while other studies used standard survey data to measure autonomy, often from DHS, which was designed to make cross-country comparison possible. There are advantages and disadvantages to each approach. In creating a culturally specific survey, the autonomy measurement may be more valid, but less easily comparable to other studies. Using DHS data, the measurements are readily comparable, but this may be misleading as the survey questions may have different implications for autonomy in different countries. All four studies comparing the relationship of women's autonomy and child nutrition across countries made use of DHS data as a way to standardize the autonomy measurement (Smith et al.

2003; Desai & Johnson 2005; Heaton & Forste 2008; Maffioli et al. 2009) and there appears to be some clear regional trends in the findings.

South Asia

Women's autonomy has been a topic of particular interest in South Asia. Child malnutrition rates are higher in India and South Asia than Africa, a fact which cannot be explained by economic or political conditions (Ramalingaswami et al. 1996). Recent estimates show that prevalence of child underweight is much higher in South Asia compared to Sub-Saharan Africa (31% of children are underweight in South Asia, 21% in Sub-Saharan Africa) as well as child wasting (15% of children are wasted in South Asia, 9% in Sub-Saharan Africa) (Unicef & WHO 2011). Furthermore, based on estimates from 1998-2004, the highest rates of low birth weight are found in South Asia, with recent estimates of 31% of infants born with low birth-weight in South Asia, while 14% of infants in Sub-Saharan Africa are born with low birth-weight (UNICEF 2006). Notably, 40% of all low birth-weight babies in the developing world come from India (UNICEF 2006). High prevalence of low birth-weight infants is highly suggestive of poor conditions of the mother. The Asian enigma hypothesis ignited interest in women's autonomy by theorizing that the reason for the high rates of child malnutrition in South Asia are the high rates of inequality between men and women (Ramalingaswami et al. 1996). Thus many of the studies exploring the association of women's autonomy with child nutrition focus on South Asia and India in particular.

While in recent years India has continued to make progress both in improving conditions for women and decreasing rates of child malnutrition, substantial progress remains to be made on both fronts. The clearest significant findings of the relationship between women's autonomy and child nutritional status are invariably centered in Asia, and typically in India, which is particularly clear in cross-country analyses. Out of the 12 developing countries assessed by Desai and Johnson (2005), only in India did women's decision-making have a strong significant association with child height-for-age, although no significant results were seen for Nepal. Smith et al. (2003) measured the association of women's status with a number of child nutritional outcomes in 36 countries across Asia, Latin America and Sub-Saharan Africa and invariably found the most strongly significant results in South Asia. The association of women's decision-making power with child weight-for-age was strongly significant in India, Nepal, and Pakistan, but not Bangladesh. The other study comparing women's autonomy across 5 countries in Asia

and Africa (Maffioli et al. 2009) found no significant relation of mothers' decisional autonomy with child nutritional status in any country, while mothers' relative status was a marginally significant predictor of child stunting only in India, although Maffioli et al. (2009) noted that this could be due to the larger sample size for this country.

Overall, the most consistently positive associations between women's autonomy and child nutritional status are focused in South Asia. This may be due to lower rates of women's autonomy in this region compared to other regions. However, as mentioned previously, most of the qualitative literature exploring women's empowerment was carried out in South Asia. It is possible that consistent results are found in this region because the autonomy measurements often used are most culturally relevant for South Asia.

Africa

Somewhat less significant findings and more mixed results are reported for Africa. Smith et al. (2003) found significant positive associations of women's autonomy with child weight-for-age in six African countries: strong associations for Chad, Mozambique, Nigeria, and Namibia, and marginal associations for Cameroon and Niger. No significant associations were reported for 16 other African countries. Smith et al (2003) also found a negative association of maternal autonomy on child nutritional status in Ghana. In Mali, women's autonomy was significantly associated with improved child nutritional status as investigated by Desai and Johnson (2005), but did not reach significance in a study by Smith et al. (2003). Desai and Johnson (2005) also found a negative association of women's autonomy with child height-for-age in Malawi.

The degree of inequality between men and women varies across African countries, which could account for some of the mixed results. On the other hand, among the identified studies focusing on individual African countries and not doing cross-country comparisons, autonomy measurements are more likely to be culturally specific and a more consistent positive association with child nutritional status is generally found. Among these studies, increases in maternal autonomy were positively associated with improvements in children's nutritional status in Zimbabwe (Radebe et al. 1996), Chad (Bégin et al. 1997; Bégin et al. 1999), Mali (Simon et al. 2002), Egypt (Roushdy 2004), Kenya (Brunson et al. 2009) and Tanzania (Ross-Suits 2010). The significant findings amongst studies using more culturally-specific autonomy measurements suggest that culturally-specific questionnaires may be more appropriate to derive measures of women's autonomy in Africa. Overall, the literature suggests that increasing women's autonomy

in Africa would benefit child nutritional status, a conclusion that is especially apparent when culturally-specific measurements are utilized. Mixed findings in cross-country comparisons suggest that more research is needed to clarify how autonomy functions in the African context

Latin America/Caribbean

The most mixed and least significant results were reported for Latin America/Caribbean. Smith et al. (2003) measured women's status in nine countries from Latin America/Caribbean and found significant positive associations with child weight-for-age in Peru, and a marginally positive association in the Dominican Republic, as well a marginally negative association with child weight-for-age in Brazil. No association was reported for Paraguay, Bolivia, Guatemala, Haiti, Colombia, or Nicaragua. Desai and Johnson (2005) measured women's autonomy in four Latin American countries and only found a marginal negative association with child height-for-age in Haiti (with no association found for Colombia, Nicaragua, and Peru). Heaton and Forste (2008) measured women's decision-making across five Latin American countries and found again, only a negative association with child height-for-age in Haiti but no association reported for Colombia, Peru, Nicaragua or Bolivia. On the other hand, joint decision-making was measured separately and had a negative association with child height-for-age in Bolivia but a positive association in Nicaragua (Heaton & Forste 2008). Patel et al. (2007) also separately measured the relationship of mother bargaining power, father bargaining power, and shared bargaining power with child BMI in Bolivia and found that increased shared power was associated with higher child BMI, while higher mother power was associated with lower child BMI. Latin America generally has higher levels of women's autonomy than developing countries in South Asia and Sub-Saharan Africa, and also a lower prevalence of child malnutrition. It is possible that increasing maternal autonomy when autonomy is already high does not improve child nutrition, or could even have a negative effect. Women with high autonomy may be less likely to breastfeed (Smith et al. 2003), or it is possible increases in autonomy could mean more time spent away from children, such as may occur if women seek employment. Smith et al. (2003) found that in Latin America, child wasting decreased with increasing maternal autonomy when maternal autonomy was low, but it increased with increases in maternal autonomy when mothers already reported a high level of autonomy. Another possible explanation for the negative relationship sometimes seen in Latin America is that higher autonomy could result in more domestic violence and thus have a negative effect on child nutrition (Koenig et al. 2003;

D'Oliveira et al.. 2009). On the other hand, no Latin American study was identified that used a questionnaire based on qualitative research to measure the relationship of women's autonomy and child nutritional status. It is likely that many of the standard questions used to measure women's autonomy have different meanings or effects in this context. More research is needed to further clarify the relationship between women's autonomy and child nutritional status in Latin America (see "Future Research").

Validity of autonomy measurements

An important consideration is whether or not survey measurements of autonomy at the household level are valid. From the identified studies, four major questions concern the validity of autonomy measurements:

1. If we understand autonomy to represent true freedom or agency on the part of the woman to make important decisions for herself as well as her children, are the dimensions frequently used to measure autonomy a valid representation of this construct?

Autonomy may not be accurately represented by some of the frequently-used dimensions. For example, as previously mentioned, opinion of domestic violence has been found to poorly correlate with experience of domestic violence and other dimensions of autonomy (Agarwala & Lynch 2006). In the identified studies, few found significant associations between opinion of domestic violence and child nutritional status. Furthermore, conceptual problems may exist with the dimensions used to represent autonomy. Consider for example one commonly used question: whether a woman has the final say on decisions regarding daily household purchases. It is possible that in some cases, a woman's control over this aspect of household decision-making may not represent autonomy on the part of the woman but rather a responsibility that she is obligated to fulfill. Rather than representing freedom or agency on her part, these purchases could represent a responsibility that she would not have willingly taken control over and a lack of social support, or yet another aspect of her daily life she needs to take care of in her limited time or with limited resources. This distinction was also explored by Basu and Koolwal (2005), who separated leisure from responsibility in their measurement of autonomy. Along with typical dimensions of autonomy directly related to child care and household tasks, they measured leisure variables, such as whether a woman reads the newspaper or spends time listening to the radio, and they found that newspaper reading by mothers is significantly associated with children not

having anemia. It is questionable whether the time a woman spends in leisure activities represents an improved measure of autonomy over the typically-used questions, but leisure variables may have other important implications in terms of care for mothers, possibly reflecting that the mother has time to rest and is not overburdened with responsibility, which may result in improved care for children. However, it is clear that more care needs to be taken to understand what is being measured by each dimension of autonomy. Literature may show that mothers' control over various household dimensions improves child nutrition, but it remains questionable whether this control is a true reflection of autonomy. Several studies have shown that when women are heads of households with males absent, this results in nutritional benefits for children (Kennedy & Peters 1992; Johnson & Rogers 1993; Pryer et al. 2004) although the opposite has also been found (Haidar & Kogi-Makau 2009). This suggests that women having control of household decisions results in benefits for children, yet female-headed households also tend to be more impoverished (Kennedy & Peters 1992; Haidar & Kogi-Makau 2009) and it is likely that many women do not freely choose to lack the support of a male partner unless an abusive or conflict-ridden relationship is a concern. If children benefit when women have increased responsibility for childcare and household decisions this is certainly of interest, but perhaps should not be labeled "autonomy."

2. When assigning women a score for their level of autonomy, is it appropriate to consider joint decision-making as representative of lower autonomy?

Another problem may exist in the extent to which measurements of autonomy should emphasize a woman's complete independence from others. Most studies to date regard women who have the final say on decisions as having the highest level of autonomy, and women who share decisions with their husbands as having less autonomy. As discussed previously, Heaton and Forste (2008) found support that both female autonomy and joint decision-making have independent associations with children's nutritional status. Similarly, Patel et al. (2007) separately measured mother power, father power, and shared power and found that shared decision-making had a positive association with children's nutritional status. Other recent studies suggest that joint decision-making is preferable to male- or female-dominated decision-making. For example, higher rates of women's autonomy were associated with lower likelihood of her partner accompanying her to antenatal care, while joint decision-making led to higher involvement of the husband in antenatal care, and increased planning and discussion between

women and their partners regarding health (Mullany et al. 2005). Also, couples that make joint-decisions regarding reproductive issues are more likely to use contraception (Feyisetan 2000). A comprehensive study by Kishor and Subaiya (2008) measuring the correlates of different dimensions of women's empowerment concluded that joint decision-making and female-dominated decision-making were unique variables, with correlates varying depending on the specific decision being made. This study clearly demonstrates that combining joint decision-making and independent decision-making as one undifferentiated variable is not appropriate (Kishor & Subaiya 2008). Results from these studies make a compelling case for measuring joint-decision as a separate variable, and bring into question the validity of autonomy measurements as they have been conceived to date.

3. Is autonomy differentiated from social support in measured constructs?

Social support is frequently found to result in improved child health outcomes (Crnic et al. 1983; Kana'Iaupuni 2005; Elsenbruch et al. 2007). It is difficult to discern from survey data when the involvement of partners or others in important decision-making processes could be considered social support, or when it is oppressive and leads to loss of desired individual autonomy. In fact, women are enmeshed in social networks and rarely make decisions in complete isolation from other persons. Theoretically, different scenarios are possible which could result in a woman having more decisional power: a woman may be more authoritarian than her husband and as a result take control of decisions, she may have a respectful relationship with her partner which results in her having more say over decisions, or she may have a partner unwilling to support the family or one who delegates responsibilities to her that she would prefer not to have. Clearly a number of explanations are possible, and the likelihood of different scenarios may be culturally dependent. When women have the final say on a decision because a partner is uninvolved, this could represent a lack of social support yet would be rated as greater autonomy. But, if a woman makes decisions jointly, this could represent greater social support yet would be rated as lower autonomy in many studies.

4. Is the typical mode of measuring women's autonomy valid across different cultural contexts?

There is evidence that certain types of survey questions for measuring autonomy, used in many of the studies included for review, are not valid cross-culturally. Comparing results from 23 communities across five countries, Ghuman et al. (2006) demonstrated that women and their

partners respond markedly differently to survey questions measuring the wives' autonomy. Importantly, the difference between the answers of husbands and wives varied unpredictably from one community to the next, and a considerable amount of random error existed in answers to the survey questions that also appeared to differ based on context. Furthermore, men and women appeared to understand the survey questions differently based on context (Ghuman et al. 2006). Another interesting finding of this study is that in four out of the five countries, while higher levels of women's autonomy as reported by women were associated with lower child mortality, higher levels of women's autonomy as reported by men were associated with higher child mortality. Ghuman et al. (2006) concluded that the husbands' and wives' reports of women's autonomy may differ based on their past experiences of child mortality. In other words, after the death of a child, women may be more likely to claim to have low autonomy to pass blame on to the husband, while husbands may be more likely to claim their wives have greater autonomy to pass the blame for previous child deaths onto their wives (although Ghuman et al. [2006] concluded that women's responses were more reliable as they fit better with theory and previous research).

Comparing responses to DHS survey data across 23 different developing countries, Kishor and Subaiya (2008) found that several of the typically-measured decisions used to represent women's autonomy had different correlates based on context. Another comparative study found that, using data from Pakistan and India, even a small change in context resulted in large changes in measurement error and variances among the commonly employed dimensions of autonomy (Agarwala & Lynch 2006). These authors contend that weighting each dimension of autonomy and accounting for measurement-error will result in more accurate measurements of autonomy, but acknowledge that more work needs to be done to understand how larger shifts in context affect autonomy measurements. On the other hand, Ghuman et al. (2006) conclude that in order to validly measure autonomy, qualitative research should be done to ensure that survey questions are more culturally-specific, while also acknowledging the need to generalize findings across different contexts (which is important to establish policy and inform public health initiatives). Similarly, Kishor and Subaiya (2003) emphasize that "theory and context" must determine which autonomy measures will be used for each setting, and that "there is a need to be very specific" about what is being measured.

Future research

Based on this review, the following areas are recommended as the focus for future research:

1. The effect of women's autonomy on child nutritional status should be compared across age groups. Brunson et al. (2009) found a significant association of women's autonomy on child nutrition only for children over 36 months of age, and represents the only identified study which compares the differential relationship of women's autonomy with children in different age groups. This difference could be regional, due to variations in autonomy measurements, or it is possible that a child's transition from breastfeeding to complementary feeding and eventual dependence on solid foods could mediate the effect of women's autonomy on child nutrition. As discussed previously, Smith et al. (2003) found that women with greater status were less likely to breastfeed in Asia, Africa, and Latin America, with the strongest negative associations seen in India. This finding could explain why increasing women's autonomy could have a differing impact on the nutritional status of younger children. More studies are needed to investigate how women's autonomy impacts children at varying age groups.
2. In light of research demonstrating that women's autonomy can change over time or with reproductive events such as abortion or pregnancy (Lee-Rife 2010), longitudinal research should be conducted to understand how changes in autonomy over the life course can affect children's nutritional status. Future research could begin to explore how varying levels of women's autonomy impact children at different developmental stages, and how autonomy relates to women's perceived self-efficacy in their role as mothers.
3. This review suggests that some dimensions of autonomy may be more salient to child nutritional status than others. Specifically, healthcare autonomy seems to most often result in significant benefits for child nutrition, while opinion of domestic violence is the least frequently significant. However, more research is needed to clarify whether different dimensions do have differing impacts on child nutrition. Currently the number of studies measuring separate dimensions of autonomy is fairly limited making any trend tenuous. In addition, dimensions are measured differently, and some dimensions are simply measured more than others. However, a clearer understanding of which dimensions of autonomy are most important for improving child nutritional status could be useful for public policy. While

maternal autonomy is highly important as a matter of women's rights rather than just a matter of child outcomes, increasing our understanding of which dimensions of autonomy are important for child nutritional status could allow programs to focus on these crucial areas while continuing to work to improve female autonomy in general.

4. Future research should improve our understanding of how autonomy impacts different child outcomes. An increased understanding of all three WHO child growth outcomes (weight-for-age, weight-for-height, and height-for-age) would be helpful, especially as studies which measure all three outcomes often find significant results for some measurements of child malnutrition but not others. This review has suggested that healthcare autonomy seems to frequently be related to child height-for-age in the identified studies. Measuring all three nutritional outcomes would improve comparability among studies and ensure that important associations of autonomy on child nutritional status are not missed, although sometimes practical considerations make including all of these measures difficult. Other child nutritional outcomes should be explored further as well, specifically breastfeeding in light of the current mixed findings, as well as birth weight, complementary feeding and obesity.
5. The literature supports that the impact of women's autonomy on child nutrition may differ across regions, as has been discussed previously. Research is needed to clarify how autonomy functions differently in different cultural contexts, and to increase our understanding on how to allow comparison of specific findings with other contexts (or to determine to what extent such comparisons are possible). Specifically, in-depth qualitative research would aid our understanding of how autonomy varies with situation and context.
6. More research is needed to determine whether autonomy measures are valid (as discussed previously) and resolve the problems with validity or possibly suggest alternative ways to directly measure autonomy. Along this line, more studies are needed looking at the differences between joint decision-making and male or female-dominant decision-making, and their differing impacts on child nutrition.
7. Although generally the literature supports that increases in women's autonomy have a positive impact on child nutritional status, there is still considerable variation around these findings, with many studies reporting non-significant and sometimes negative associations. In order to clarify the reason for inconsistent findings, more studies are needed to clarify the mechanisms by which autonomy can positively impact child nutrition to inform programs

and policy and to aid in the design of interventions (see Future Research #8). Mechanisms by which women's autonomy can negatively impact child nutrition should also be investigated in light of some of the reported findings, like the fact that autonomy can negatively affect breastfeeding (Smith et al. 2003).

8. Future research should expand beyond cross-sectional studies to show causality, possibly by employing intervention studies to find practical ways to improve women's autonomy and how such an improvement can affect child health and nutrition outcomes.

Conclusion

In general, women's autonomy tends to be associated with improvement in children's nutritional status. However, this relationship is also obscured by differences in how researchers measure autonomy and uncertainty in the validity of the definition and measurement of autonomy. Additionally, different dimensions of autonomy may have differing impacts on children's nutritional status. While improving women's overall status in developing countries is an important long-term goal, understanding which dimensions of autonomy result in the most health benefits for women and children could help focus public health interventions on improving the most important aspects of women's autonomy as immediate goals. This could be especially helpful given that improvements in women's autonomy have been found to sometimes result in increased rates of domestic violence (Koenig et al.. 2003; D'Oliveira et al. 2009) although the opposite is also true (Sabarwal et al. 2012). Similarly, increasing women's decision-making autonomy has been associated with increased blood pressure and depression, possibly due to disagreement and increased conflict between partners (Hadley et al. 2010). Rather than trying to increase women's autonomy in all dimensions, focusing on particular aspects of women's autonomy such as increasing women's ability to make healthcare decisions for themselves and their children might help avoid some of the negative impacts resulting from shifting power within households (although to date, there is no data showing that increasing autonomy in only one dimension would not result in any negative effects). Joint decision-making has also been found to decrease rates of domestic violence (Kishor & Johnson 2004; Heaton & Forste 2008), thus increasing true (partner-supported) joint-decision making is another possible focus for public health interventions because this type of decision-making could empower women while avoiding domestic violence (Hindin et al. 2008). Involving and educating men in

health-related decisions may benefit women's autonomy and health while possibly minimizing disagreement and conflict between partners or spouses (Feyisetan 2000; Mullany et al. 2005). Regional differences in women's autonomy are also apparent, and understanding how autonomy has differing impacts across regions will lend additional focus and insight to public health interventions.

This review has sought to summarize the current extent of knowledge on the relationship between women's autonomy and children's nutritional status, as well as to focus future research. When women are disempowered in society, negative health consequences extend beyond women to children, thus affecting all of society. Increasing our knowledge of how women's autonomy impacts child nutritional status will hopefully add impetus and insight to public health interventions in developing nations, speeding progress towards accomplishing many of the Millennium Development Goals for both women and children.

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The authors declare that they have no conflicts of interest.

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Tables

Table 1. Predictor and outcome terms used in the literature review search stragety

Objective: How does maternal autonomy affect child nutritional status?	
Predictor Terms: • Autonomy • Women's status • Empowerment • Decision-making • Social power • Women's position • Women's rights	**Outcome Terms:** • Nutrition • Malnutrition • Feeding • Breastfeeding • Birth weight • Complementary feeding • Stunting • Wasting • Underweight • Weight • Height

Table 2. Significant associations between maternal autonomy and child nutritional status

Author(s) & year of publication	Region	Sample Size (after exclusion)	How autonomy is measured	Outcome type	Results/Findings
Doan & Bisharat 1990	Jordan	n=736 children from 0 to 36 months	Mothers that are heads or co-heads of households are considered to have high autonomy, while mothers that are daughter-in-law to heads of households are considered to have low autonomy.	Weight-for-age	Less maternal autonomy associated with lower child weight-for-age Z-score (WAZ), whether or not other relatives are present ($F=6.49^{***}$). R^2 for the whole model = 0.07.
Radebe et al. 1996	Mazowe District of Zimbabwe	n= 327 children between 6 months to 5 years of age	Decision-making power measured based on whether mother can make decisions without a male relative on what to sell and grow, when to obtain health care for children, and family planning.	Weight-for-age	Mothers on communal lands with less decision-making power have children more likely to be malnourished ($OR=2.86^{**}$).
Bégin et al. 1997	Rural Chad	n= 16 infants and 98 children 12-71 months	Mothers questioned on whether they influence what foods their children are given.	Height-for-age	1. Maternal influence associated with higher child height-for-age Z-score (HAZ) ($\beta=1.61^{***}$). 2. Maternal influence results in higher HAZ for younger children but not older children ($\beta=-0.264^{*}$).
Merchant & Udipi 1997	Bombay	n= 150 infants	Decision-making power measured using four categories: household decisions, financial decisions, decisions regarding self, and social decisions.	Three categories of child growth (weight and height): positive deviants,	1. Less maternal autonomy for child medical treatment decisions during periods of illness results in greater likelihood children are in negative-deviant growth category ($p\leq0.05$). Measure of association not reported. 2. Less maternal autonomy for social decisions results in greater likelihood

Author(s) & year of publication	Region	Sample Size (after exclusion)	How autonomy is measured	Outcome type	Results/Findings
				median growers, and negative deviants.	children are in negative-deviant growth category ($p \leq 0.01$). Measure of association not reported.
Bégin et al. 1999	Chad	n=98 children between 12 to 71 months of age	Autonomy measured based on earned money and control of income, involvement in decisions on household food and health expenditures and child feeding, and whether other family members participated in these decisions.	Height-for-age	Maternal influence over child feeding decisions associated with marginally higher height-for-age scores ($\beta=0.53$*). R^2 for all caregiver-related variables = 0.36.
Simon et al. 2002	Mali	n= 402 children under 5 years of age and 261 mothers	Mother's felt control and passivity/helplessness was measured using a 20 item questionnaire.	Weight-for-height (wasting) and height-for-age (stunting).	1. Higher maternal score for passivity/helplessness marginally associated with greater likelihood that children are wasted ($\beta=0.216$*) and stunted ($\beta=0.175$*) 2. Higher maternal score for felt control associated with greater likelihood that children are stunted ($\beta= -0.359$*) while no relationship seen for height-for-age scores.
Smith et al. 2003	Data from thirty-six countries in South Asia(SA), Sub-Saharan Africa (SSA), and Latin	n=117,242 children under 3 years old and 105,567 women	Mother's relative power within the household measured by making a single index from four different factors, including whether mother works for cash income, mother's age at first marriage, percent difference in the mother and her partner's age, and the difference in the	Height-for-age and stunting, weight-for-height and wasting, and weight-for-age and under-weight.	1. Across all 36 countries, higher decision-making power is positively associated with child WAZ ($\beta=0.012$***) 2. In SA, SSA, and LAC, higher maternal power positively associated with child's growth including WAZ ($\beta=0.0156$*** for SA; $\beta=0.0046$*** for SSA) HAZ ($\beta=0.0140$*** for SA; $\beta=0.0034$*** for SSA), and weight-for-height Z-score (WHZ) ($\beta=0.0094$*** SA; $\beta=0.0039$*** for

Author(s) & year of publication	Region	Sample Size (after exclusion)	How autonomy is measured	Outcome type	Results/Findings
	America/Caribbean (LAC)		mother and her partner's years of education.		SSA; β= 0.0143 for LAC). 3. In SA, women's power decreases likelihood that her child will be underweight (OR=0.976***), stunted (OR=0.980***) and wasted (OR=0.986***). In SSA, increased power decreases likelihood of child being underweight (OR=0.994***), stunted (OR=0.994**), and wasted (OR=0.992***). In LAC, increased power decreases chances of child being stunted (OR=0.995*) and wasted (OR=0.989*). 4. In SA, out of 4 countries, all but Bangladesh showed associations between power and child WAZ. In SSA, out of 23 countries, 6 showed associations between women's power and child WAZ, while 1 country (Ghana) showed a negative association. In LAC, out of 9 countries, 2 showed associations between women's power and child WAZ, while1 country (Brazil) showed a negative association between women's power and child WAZ. 8. Increased decision-making power associated with increased breastfeeding initiation, decreased exclusive breastfeeding, decreased breastfeeding duration, increased bottle-feeding, increased chances that a 6-12 month old child received complementary foods, and increased eating events for children older

Author(s) & year of publication	Region	Sample Size (after exclusion)	How autonomy is measured	Outcome type	Results/Findings
					than 6 months. Results varied in a region-specific manner.
Roushdy 2004	Egypt	n= 3,286 women with children under 5 years old	Women's decision-making measured using 4 dimensions: mobility, opinion of domestic violence, control of household cash allocation & child care decisions. Experience of domestic violence also measured.	Height-for-age	1. Mother's experience of domestic violence associated with lower HAZ for their daughters (β= 0.138*).
Basu & Koolwal 2005	India	n= 4,408 ever-married women giving birth in the past 5 years	Self-indulgent autonomy measured as age, age difference with partner, reads magazine/ listens to radio, decisions on visits with family/friends, decisions on own health care, ability to use money, & opinion of wife-beating. Responsibility measured as input to earnings, permission to go to market, & decisions on food and major purchases.	Whether or not youngest child has anemia	1. When mother's ability to make decisions about own health care increases from joint decision-making to making decision alone, it increases the odds that her youngest child will not have anemia (OR=2.0866*). 2. Odds of not having anemia increase if child's mothers contributes less than half of total family income compared to mothers contributing almost none of family income (OR=0.2097**). 3. Odds of not having anemia increase if mother reads newspaper (OR=4.2934**) and doesn't think domestic violence ever justifiable (OR=1.6908**)

Author(s) & year of publication	Region	Sample Size (after exclusion)	How autonomy is measured	Outcome type	Results/Findings
Desai & Johnson 2005	Benín, Malawi, Mali, Uganda, Zimbabwe Egypt, India, Nepal, Haiti, Colombia, Nicaragua & Peru	n= typically between 5,000-8,000 house-holds	Women's decision-making measured as whether women have final say in health care, making large household purchases, household purchases for daily needs, and visits to family or relatives.	Height-for-age	Out of 12 countries, women's decision-making was associated with higher children's height-for-age for two countries, India (β= 9.27***) and Mali (β= 7.64*). However, women's decision-making associated with lower children's HAZ in two countries, Haiti (β= -8.06*) and Malawi (β=-10.9***).
Sethuraman et al. 2006	South India	n= 820 mother-child dyads, with children between 6-24 months of age	Women's empowerment measured as mobility within village, control over food supply, current employment and income, position in household and involvement in decision-making, previous employment, family type and mobility around the village, women's decisions, experience of psychological abuse and sexual coercion, and distance from natal home.	Weight-for-age	1. The empowerment variables positively associated with child WAZ were mother's position in household and involvement in decision-making (β= 0.08*** for model I, β= 0.09** for model II) and mother's mobility (β= 0.10*** for model II). Maternal employment and income associated with lower child WAZ for model I (β= -0.12***), but was no longer significant after including an interaction term between maternal employment and food insecurity in final model II. 2. Comparing the upper and lower quartiles of children's WAZ, both maternal income and employment (OR= 2.168***) and psychological abuse and sexual coercion (OR= 1.429**) increases the risk of children having low WAZ.

Author(s) & year of publication	Region	Sample Size (after exclusion)	How autonomy is measured	Outcome type	Results/Findings
Patel et al. 2007	Bolivian Amazon	221 households with 659 children between 2-13 years of age	Household power was measured by questioning both mothers and fathers one question: "Who decides what to buy at the market or what food to cook?"	Child BMI	1. Increased shared power associated with higher child BMI (β=0.034**; R^2=0.128) 2. Higher bargaining power of mother associated with lower child BMI (β=-0.030*** R^2=0.1786).
Heaton & Forste 2008	Latin America (Colombia Peru, Haiti, Nicaragua and Bolivia)	Sample size not given. Data taken for children ≤5 years of age	Decision-making measured using five questions on who makes final decisions regarding health care, large household purchases, everyday household purchases, visits to relatives, and food to be cooked daily.	Height-for-age	1. Violence associated with lower child HAZ in Bolivia (β= -23.3) and Haiti (β= -81.4). No p-value reported. 2. Higher scores for maternal autonomy was associated with lower child HAZ scores in Haiti (β= -35.0). No p-value reported. 3. Joint decision-making of the parents associated with lower child HAZ in Bolivia (β= -16.2) but higher child HAZ in Nicaragua (β= 28.5). No p-value reported.
Mashal et al. 2008	Afghanistan	n=2474 children under 5 years old from 1327 house-holds.	Maternal autonomy measured using questions on whether mother has permission from the head of the household to bring the child to see a doctor, and whether it was required that mothers have an accompanying person to visit a health facility with the child.	Emaciation (wasting), linear growth retardation (stunting), and under-weight	Lack of maternal autonomy increases the chances of linear growth retardation (stunting) (OR: 1.38; 95% confidence interval: 1.01-1.90).

Author(s) & year of publication	Region	Sample Size (after exclusion)	How autonomy is measured	Outcome type	Results/Findings
Brunson et al. 2009	Northern Kenya	n=435 women with 934 children between 0-10 years old.	Maternal autonomy was measured with a culture-specific questionnaire consisting of 11 questions: 3 questions on money and food, 3 on livestock, and 5 on medical care, birth control and schooling.	Weight-for-height	1. Maternal autonomy was associated with higher WHZ for children over 36 months of age (β= 0.23**) but no relationship was seen for children under 36 months of age. 2. Out of the five regions tested in Kenya, women's autonomy was only a positive predictor of child WHZ for children over 36 months of age in Korr ($p<0.02$; $R^2=0.17$).
Shroff et al. 2009	Andhra Pradesh, India	n=821 mothers and oldest children less than 36 months of age.	Maternal autonomy is measured based on decision-making power, freedom of movement, financial autonomy, and attitude towards domestic violence.	Stunting	Increased likelihood of child stunting was associated with both whether a woman needed permission to go to market (OR= 0.593**) and whether a woman was allowed to set aside money for personal use (OR=0.731**).
Dancer & Rammohan 2009	rural Nepal	n=4,360 rural children between 6-59 months of age	Maternal autonomy was measured through seven questions including whether the mother has the final say on her own health care, on making large household purchases, and on making purchases for daily needs, as well as whether getting medical help for herself is a problem due to needing permission to go, a problem because of the distance to the health facility, a problem because of taking transport, or	Stunting and wasting	1. Mothers reporting more problems taking transport to get medical help for themselves was associated with significantly lower child HAZ (β= -0.127*). Mothers having the final say on their own health care associated with higher child HAZ (β= 0.139*). Mothers having problems going to a medical facility for themselves due to not wanting to go alone had a negative association with their children's WHZ (β= -0.063**). Mothers who had more problems getting medical help for self (unable to take transport) have children less likely to not be stunted (OR= 0.829**). 2. Mothers having problems getting to a

Author(s) & year of publication	Region	Sample Size (after exclusion)	How autonomy is measured	Outcome type	Results/Findings
			a problem because she is unable to go alone.		medical facility due to the distance associated with higher child WHZ (β=0.090**). 5. Mothers having final say on making large household purchases associated with children having lower WHZ (β= -0.088*). Mothers having the final say on making purchases for daily needs associated with children having better WHZ (β= 0.087**). 8. When analyzed separately by gender, all the above results were only significant with male children. 5. Mothers who have the final say on their own health care have children more likely to not be stunted (OR=1.284*) and this held for both male children and female children when analyzed separately.
Maffioli et al. 2009	India, Bangladesh Burkina Faso, Ethiopia, and Ghana	India- n=26,309 Bangladesh- n= 3,565 Ghana- n=1,900 Ethiopia- n=2,873 Burkina Faso- n=5,565 (All children between 1-5 years of age)	Decisional autonomy measured based on mother's participation in decisions on healthcare, purchases, visits to relatives, and food to be cooked. Women categorized as having more, intermediate, or less autonomy. Wife's relative status to husband measured as differences between wife and husband's education and difference in prestige of the	Stunting	1. A mother's decisional autonomy is not correlated with the probability of her children being stunted in any of the five countries. 2. Mothers' low relative status compared with their husband is associated with increased child stunting only in India (OR=1.367**).

Author(s) & year of publication	Region	Sample Size (after exclusion)	How autonomy is measured	Outcome type	Results/Findings
			occupations. Low status assigned if both of mother's variables were lower than husband, higher status if both variables were higher than the husband's, or medium status for other situations.		
Ross-Suits 2010	Tanzania	n=6,101 women between 15-45 years who have children between 0-59 months	Decision-making power measured based on final say on own healthcare, large purchases, visits to family, and food to be cooked. Also measured if mother felt violence was justified in various circumstances and financial independence	Stunting, wasting, and under-weight.	A mother's autonomy in choosing her own health care was associated with improved HAZ. All other autonomy variables were insignificant (OR=.857**).
Bose 2011	India	124,385 women and their children less than 5 years old	Women's autonomy is measured based on decisions about own healthcare, major household purchases, purchases for daily needs, and visiting family or relatives, and whether the woman is allowed to go to the market, the health facility, or places outside the community/village alone.	Duration of breast-feeding, whether child had milk in past 24 hrs, meat, fish, or eggs in past 24 hrs, & if child is mal-nourished)	1. Increase in mother's autonomy is associated with increases in the duration of breastfeeding (β=0.154***), and increases in the likelihood that the child received both supplemental milk products (β=0.030***) and supplemental meat, fish or eggs (β=0.057***). 2. Maternal autonomy and child sex interact significantly to affect child malnutrition, with female children less likely to be malnourished if their mother has higher autonomy (β=0.029**).

Author(s) & year of publication	Region	Sample Size (after exclusion)	How autonomy is measured	Outcome type	Results/Findings
Shroff et al. 2011	Andhra Pradesh, India	n=600 mother-infant dyads, with infants between 3-15 months of age	Maternal autonomy was measured using a 47-item questionnaire covering 7 dimensions of autonomy including household decision-making, child-related decision-making, financial independence, permission for mobility, actual mobility, acceptance of domestic violence, and experience of domestic violence. With the exception of experience of domestic violence, all items were weighted with some removed to improve fit, and a composite score created for each dimension of autonomy.	Weight-for-age, length-for-age, weight-for-length, and exclusive breastfeeding at 3-5 months of age.	1. Maternal financial autonomy is significantly associated with exclusive breastfeeding at 3-5 months of age (OR = 1.23**). 2. A high score for maternal mobility autonomy associated with lower WHZ (β= -0.202**). 3. A high score for maternal household decision making is associated with significantly higher scores for WAZ and HAZ (β=0.167**). 4. High scores for both maternal mobility autonomy (β=0.141**) and child care decisions (β=0.10**) is associated with higher HAZ. 5. An interaction between child birth weight and maternal mobility autonomy indicates that for low birth-weight infants, maternal mobility autonomy had a positive association with infant's HAZ (β= -0.143**) while no relationship was seen for infants with higher birth weights.

Author(s) & year of publication	Region	Sample Size (after exclusion)	How autonomy is measured	Outcome type	Results/Findings
Chakraborty & Anderson 2011	India	n=14,407 mother-child dyads for measured birth weight n=33,881 mother-child dyads for maternal perception of birth weight. All children <5 years old.	Maternal autonomy was measured based on whether or not the mother had the final say on her own healthcare, the final say on making large household purchases, the final say on making purchases for daily needs, and the final say on visits to family or relatives. Autonomy scores were split into three categories: high, medium, and low autonomy.	Low birth weight (<2500.0 g)	Low maternal autonomy increased the likelihood of low birth weight infant (OR=1.28***). There was no significant influence for a medium autonomy score.

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 3. Summary of the effects of different commonly-measured domains of women's autonomy on child nutritional status in the literature

	Child feeding/child care autonomy	Maternal healthcare autonomy	Child healthcare autonomy	Mobility/social autonomy	Financial autonomy	Maternal disbelief in legitimacy of domestic violence	Less maternal experience of domestic violence	General maternal involvement in household decision-making
Begin et al. 1997	IMPROVE	-	-	-	-	-	-	-
Merchant and Udipi 1997	NS	-	IMPROVE	IMPROVE	NS	-	-	-
Begin et al. 1999	IMPROVE	-	-	-	NS	-	-	-
Roushdy 2004	NS	-	-	NS	NS	NS	IMPROVE	-
Basu and Koolwal 2005	-	IMPROVE	-	NS	IMPROVE	IMPROVE	-	-
Sethuraman et al. 2006	-	-	-	IMPROVE	MIXED	-	IMPROVE	IMPROVE
Heaton and Forste 2008	-	-	-	-	-	-	IMPROVE	-
Mashal et al. 2008	-	-	IMPROVE	-	-	-	-	-
Shroff et al. 2009	-	-	-	IMPROVE	IMPROVE	NS	-	NS
Dancer and Rammohan 2009	-	IMPROVE	-	-	MIXED	-	-	-
Ross-suits 2010	-	IMPROVE	-	NS	NS	NS	-	-
Shroff et al. 2011	-	-	IMPROVE	MIXED	IMPROVE	NS	NS	IMPROVE

***Boxes are labeled "IMPROVE" if study found a positive association of the domain with a measure of child nutritional status, "MIXED" if mixed results were found, "NS" if no significant results were found, and "-" if domain was not measured.**

Chapter 2. Associations of Maternal Decision-Making Autonomy and Domestic Violence with Childhood Anemia and Child Feeding Practices in Colombia

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ABSTRACT.— Maternal decision-making autonomy and experience of intimate partner violence (IPV) influence a mother's ability to care for her children and may impact her children's nutritional status. A growing body of cross-sectional research indicates that empowering women can positively influence child growth, possibly through child feeding practices. However, this is understudied in Latin America, and mixed results have sometimes been found in this context. The objective of this study was to explore the associations of child feeding practices with maternal autonomy and IPV in Colombia. We hypothesized that less maternal autonomy and increased IPV would be associated with decreased breastfeeding duration, increased likelihood of children having anemia, and negatively associated with other measures of child feeding practices. A secondary analysis was performed using data from a 2005 national survey of Colombia measuring associations of maternal decision-making and maternal experience of domestic violence with child feeding practices (breastfeeding duration, age of introduction of complementary foods, whether complementary foods were introduced between 4-6 months of age, hygienic precautions taken during child feeding, and child anemia.) Only married/cohabitating women were included in the analysis, along with last-born singleton children less than 5 years of age. Associations were measured using generalized linear models. Maternal decision-making autonomy was conceptualized using various household-level decisions such as who makes the final decision on large household purchases (the woman, her partner, someone else, or a joint decision with her partner or someone else). IPV was measured as the number of control issues present (such as the woman's partner limiting her contact with family or friends), whether there was ever any emotional domestic violence, and a score for the number of types of physical domestic violence the mother had ever experienced. In the final adjusted models, when a woman's partner had the final say on social visits or when women made decisions jointly with their partners regarding their own healthcare this was associated with fewer precautions taken during food preparation (OR = 0.74 ± 0.11** and OR= 0.80 ± .092**, respectively). On the other hand, when a woman made decisions jointly with her partner regarding daily purchases, this was associated with lower liklihood that her child had anemia (OR= 0.56 ± 0.13**). Additionally, there were several significant interactions between domestic violence and decision-making in their associations with child feeding and anemia outcomes. When women experienced domestic violence and had low rates of decision-making autonomy this was associated with earlier introduction of complementary foods, lower likelihood of

breastfeeding duration continuing beyond 12 months and greater likelihood of children having anemia. Understanding the relationships between child feeding practices and child health with maternal autonomy and IPV is important for planning interventions and setting policy to improve child feeding practices and prevent child malnutrition worldwide.

Introduction

Malnutrition is implicated in 45% of under-five childhood deaths worldwide (UNICEF 2013). Infants and young children are at high risk for malnutrition due to the high caloric and nutrient requirements needed to support growth and development. Malnourished children are more likely to experience impaired growth and cognitive deficits, leading to a lifelong increased risk of morbidity and mortality. Many Latin American countries continue to have high rates of child malnutrition, although generally lower than developing countries in South Asia and Africa. In Colombia, in 2004-2005, 12% of children were estimated to be stunted, 7% were underweight, and 1% were wasted (Colombia Demographic and Health Survey 2005). Recently, prevalence of under-nutrition in Colombian children has persistently declined while the prevalence of overweight has increased (UN Human Development Report 2013). On the other hand, very high rates of anemia have been reported among Colombian children. In 2005, 27% of children in Colombia between 2-4 years of age were found to have anemia, while among children under the age of two, rates of anemia were found to be as high as 53% (Colombia Demographic and Health Survey 2005)

Child care practices are an important determinant of child nutritional status (UNICEF 1998), and also represent modifiable behaviors that could be practical targets for intervention. Child feeding practices are known to be important determinants of whether or not children will become malnourished; in fact, inappropriate child feeding practices are thought to be linked to 1/3rd of all cases of child malnutrition (WHO 2006). Inappropriate child feeding practices include short duration or absence of breastfeeding, lack of exclusive breastfeeding in young children, early or late introduction of complementary foods, and introduction of poor-quality complementary foods (such as those with low nutrient density). As the primary caregivers, mothers have considerable influence over the quality of child feeding, including both breastfeeding as well as complementary feeding practices. However, social and environmental factors can either enhance or limit a woman's ability to breastfeed and to appropriately introduce complementary foods during the early critical years. One of the underlying causes of child malnutrition is lack of appropriate care for women (UNICEF 1998). Recently, interest has been growing in the role a mother's social situation plays in determining her children's health and nutritional status. A mother's decision-making autonomy and her experience of domestic

violence are two social factors that may greatly enhance or limit a woman's ability to provide quality care for her children.

Maternal autonomy

Worldwide, many women continue to face low levels of autonomy. Colombian women have a comparatively higher status than women in many developing countries; for example, women have the same ownership rights as men, have a growing representation in the workforce, and go to school at approximately equal rates as men (Social Institutions & Gender Index 2012). However, Colombian women face a relatively high maternal mortality rate compared to other Latin American countries; 92 women die of pregnancy-related causes for every 100,000 births, whereas the maternal mortality rate for Mexico is 50 and the average for all Latin American countries is 74 (Human Development Report 2013). Additionally, relatively low rates of decision-making autonomy for Colombian women were reported in 2008 for some dimensions of autonomy; when asked whether they had the final say on various household decisions, 65% of women reported having the final say on their own healthcare, 40% on purchases for daily needs, 28% on visits to family and friends, and only 18% on large purchases (Heaton and Forste 2008).

As reported in Chapter 1, low maternal autonomy results in health consequences for mothers (Carlson et al. 2014). When women have higher levels of autonomy they are more likely to use contraception, have less unintended pregnancies and are more likely to use prenatal care, have longer birth intervals, and have smaller families (Abada and Tenkorang 2012, Rahman 2012, DeRose and Ezeh 2010, Upadhyay and Hindin 2005, Morgan and Niraula1995, Balk 1994, Hou and Ma 2012, Woldemicael and Tenkorang 2010, Bloom et al. 2001). Additionally, they may have less risk for depression and anxiety disorders (Qadir et al 2011, Hadley et al. 2010, & Patel et al. 2006). Many of these health outcomes for women have an important impact on the health and nutritional status of children. In addition, with higher levels of autonomy mothers may be better able to make decisions in the interest of their children and to allocate household resources to children. For example, research suggests that mothers tend to divert more income towards health- and nutrition-related expenditures than men (e.g. Caldwell 1986, Quisumbing and Maluccio 1999, 2003, Thomas 1997).

Most research examining the relationship between maternal autonomy and child nutrition has found that women's autonomy tends to be associated with improved measures of

child nutritional status (Carlson et al., 2014). However, in general, the associations between women's autonomy and child nutritional status have been studied the least in Latin America, and the most mixed results are found in this context (Carlson et al., 2014). It is uncertain why mixed results are more frequently found in the Latin American context. Possible explanations for this were previously discussed in Chapter 1 (Carlson et al. 2014). Briefly, it has been suggested that women's autonomy is most influential in improving child nutritional status when resources are scarce, as women are then able to direct more resources towards children (Brunson et al. 2009). On the other hand, women with high autonomy may be less likely to breastfeed (Smith et al. 2003), or increases in autonomy could result in more time spent away from children, which could lead to negative associations between maternal autonomy and measures of child nutritional status. Some evidence has been found supporting this theory; Smith et al. (2003) found that across nine Latin American countries child wasting *decreased* with increasing maternal autonomy when maternal autonomy was already low but *increased* with increasing maternal autonomy when autonomy was high. However, a fairly high level of autonomy had to be achieved before a negative impact on child nutritional status occurred, and Smith et al. (2003) concluded that child nutritional status should benefit overall by increases in maternal autonomy in Latin America.

Another possible explanation for the mixed or negative relationship between maternal autonomy and child nutritional status sometimes found in Latin America is that higher autonomy could result in more domestic violence and thus have a negative effect on child nutrition (Koenig et al. 2003, d'Oliveira et al. 2009, Weitzman 2014) as discussed later (see "The Relationship between Domestic Violence and Autonomy"). Domestic violence has important negative effects on child nutrition, both indirectly through compromising maternal health and well-being, as well as directly through stress experienced by the child and compromising the mother's ability to care for the child (Yount et al. 2011). In general, the effect of maternal experience of domestic violence on child nutritional status is understudied, and findings have been mixed (Yount et al. 2011). Few studies have explored this relationship in the Latin-American context. In a case-control study from Rio de Janeiro, higher scores of parental conflict were linked with severe and acute malnutrition in children (Hasselman and Reichenheim 2006). Another study found a marginal association of domestic violence with child stunting in Honduras (Rico et al. 2011).

Maternal experience of domestic violence

Domestic violence (also intimate partner violence or IPV) is often divided into three categories: emotional domestic violence, physical domestic violence, and sexual abuse. However, all are highly related and many victims of domestic violence often experience all categories (Friedemann-Sánchez and Lovatón 2012). In Latin America, more than 50% of women will experience violence within their family (Gaviria 2013). Nationally, Colombia has a long history of conflict and violence, which continues today. Additionally, Colombian culture has been traditionally influenced by the concept of machismo, which emphasizes male dominance and authority (Heaton and Forste 2008, Jones and Ferguson 2009). This may in part contribute to the very high prevalence of violence within families; rates of IPV in Colombia are among the highest in the world, and among Latin American countries Colombia is second only to Peru in IPV prevalence (Friedemann-Sánchez and Lovatón 2012). Although physical abuse is often the focus of research, some studies report higher levels of distress among women experiencing emotional abuse as compared to physical abuse (Mechanic, Weaver and Resick 2008, Friedemann-Sánchez and Lovatón 2012). Multiple adverse effects have been reported for Colombian women experiencing domestic violence: 66% of abused women experienced a physical health problem, over half reported feeling worthless, a quarter experienced suicidal thoughts, and among women abused during pregnancy, 10% experienced a miscarriage (Friedemann-Sánchez and Lovatón 2012).

Joint decision-making

The distinction between joint decision-making versus female- or male- dominant decision-making was previously discussed in Chapter 1 (Carlson et al. 2014). Briefly, joint decision-making, or when women and their partners share decisions, is frequently considered to reflect a condition in which women have somewhat less autonomy than when women make decisions independently. However, it is difficult to determine whether sharing power represents a state of lowered individual autonomy or a state of greater social support. Measuring joint decision-making as a separate category from female- or male-dominant decision-making may be more appropriate as some evidence suggests that joint decision-making may reflect greater support or involvement from a woman's partner and has been associated with decreased rates of

domestic violence (Kishor and Johnson 2004, Flake and Forste 2006, Heaton and Forste 2008, Friedemann-Sánchez and Lovatón 2012). Couples making joint decisions regarding reproductive issues may be more likely to use contraception (Feyisetan 2000). Additionally, Mullany et al. (2005) found that women with higher levels of autonomy were less likely to have their partners accompany them to antenatal care visits, while women with higher scores of joint decision-making were more likely to experience partner involvement during prenatal healthcare (Mullany et al. 2005). Other researchers have concluded that joint decision-making and female-dominant decision-making do not represent differing levels of autonomy but are rather different variables with different correlates (Kishor and Subaiya 2003), adding further evidence that it is not appropriate to measure joint decision-making as an intermediate level of a continuous women's autonomy variable. Few studies have measured joint decision-making as a predictor of child nutritional status in the Latin American context, and among these, mixed results were found (Heaton and Forste 2008, Patel et al. 2007.)

The relationship between domestic violence and autonomy

Domestic violence and autonomy are related in complex ways as both domestic violence and autonomy involve power relations within families. The experience of domestic violence can disempower women, and it has been theorized that domestic violence may be used by the male partner to gain bargaining power (Jones and Ferguson 2009). Higher levels of autonomy are sometimes associated with increased rates of domestic violence (Koenig et al. 2003, d'Oliveira et al. 2009, Weitzman 2014), possibly due to shifting balance of power within the household, although increased autonomy has also been found to have a protective effect against domestic violence (Sabarwal et al. 2012). Increased women's autonomy has been reported to be associated with increased maternal blood pressure and depression, possibly due to disagreement and conflict between partners (Hadley et al. 2010). Conversely, another study reported that increased autonomy was associated with lowered risk of common mental health disorders among women (Patel et al. 2006). In the 2005 DHS survey, Colombian women were less likely to experience violence when they reported making decisions jointly with their partners, while women were more likely to experience violence if either partner dominated decision-making or if partners split decision-making (Friedemann-Sánchez and Lovatón 2012). To date, evidence of

the relationship between domestic violence and autonomy remains mixed and the relationship between these two factors is not well understood.

Study objective

The primary objectives of these analyses were 1) to determine how domestic violence and autonomy variables are related in this population and 2) to understand how different measures of decision-making and domestic violence are associated with child feeding and anemia outcomes. A more detailed explanation of how each outcome and predictor variable is constructed is described below (see "Methods").

Hypotheses:

1. Compared to other types of decision-making, joint decision-making was hypothesized to be associated with improved child feeding practices including increased likelihood of breastfeeding initiation, longer breastfeeding duration, more timely introduction of complementary foods, increased number of precautions taken during food preparation, and will be associated with lower likelihood of children having anemia.
2. Both maternal experience of domestic violence and male-dominant decision-making was hypothesized to be negatively associated with all child feeding practices, and associated with increased rates of childhood anemia compared to both joint decision-making and female-dominant decision-making.
3. Maternal decision-making autonomy and maternal experience of domestic violence was hypothesized to interact so that increased maternal influence in decision-making would have a positive association with child feeding practices with no maternal experience of domestic violence, but no association would be seen when women experienced domestic violence.

Significance:

This study contributes to the literature by addressing the following gaps in the current understanding:

1. This study investigates the relationship of maternal autonomy and experience of domestic violence in Colombia. Research regarding the relationship between both

maternal autonomy and maternal experience of domestic violence with child nutritional status is understudied in the Latin-American context.

2. In measurements of decision-making autonomy, women who make decision jointly with their partners are typically considered to have lower autonomy than women who make decisions independently, although evidence suggests that joint decision-making does not simply represent lower autonomy but may be a separate construct. This study contributes to the literature by considering joint decision-making as a separate category.
3. Many studies have considered the association of maternal autonomy with child growth, but few have measured the association of maternal autonomy with child feeding practices or the effect of domestic violence on child feeding practices. This study considers child feeding practices as a primary outcome, specifically using measures of breastfeeding and complementary feeding. Understanding the association among autonomy and domestic violence on child feeding practices will help elucidate the mechanism for how these constructs can impact child nutritional status.
4. Currently, no research has explored how autonomy and domestic violence may interact to affect child nutritional status. However, if women experience increased rates of domestic violence with greater decision-making autonomy, then increasing autonomy will likely not be associated with positive nutritional outcomes. Increased maternal decision-making autonomy may only positively impact children's nutritional status when domestic violence is not present. This study contributes by testing these interactions on the outcome measures of interest.
5. Few studies have considered how maternal autonomy may impact children at different ages and developmental stages, which may be important as some evidence suggests that maternal autonomy may have a negative association with measures of breastfeeding, but a positive association with measures of complementary feeding (Smith et al. 2003). This study will contribute by utilizing measures of both breastfeeding and complementary feeding to examine possible differential associations.

Methods

Data

Data was taken from The National Survey of Nutritional Status in Colombia 2005 (ENSIN 2005), which surveys 37,211 households from 32 departments and the capital city of Colombia. 11,062 mothers were interviewed, and information was collected for 14,597 children under the age of 5. The ENSIN 2005 was collected by Profamilia, a Colombian nonprofit organization, and was carried out alongside the National Demographic and Health Survey (DHS). In order to approximate departmental-, subregional-, regional-, and/or national-level estimates of specific nutrition problems among individuals 0–64 y, subsamples were randomly drawn. Eligible women from each household were interviewed and information was collected on women's decision-making autonomy and experience of domestic violence, breastfeeding and child feeding practices, as well as other personal and demographic information. To assess whether or not a child had anemia, venous blood was taken from preschool-age children. Detailed information regarding survey methods is reported in the Colombia Demographic and Health Survey (2005).

Statistical Analyses

Descriptive statistics were used to describe demographic characteristics of the study sample, as well as the demographic characteristics of the excluded population. Additionally, to understand how domestic violence and autonomy variables were inter-related, multivariable regression analyses were employed to investigate associations between autonomy and domestic violence variables, using whether women had experienced each type of domestic violence as binary outcome variables and decision-making autonomy variables as predictors, along with salient demographic information (socio-economic status, maternal age, maternal education, and marital status).

To address the main study objectives and hypotheses, the associations between decision-making autonomy and domestic violence as predictors and child feeding practices and anemia as outcome variables were tested using linear or logistic regression models (depending on type of outcome variable), taking into account complex survey design (svy command in Stata). Analysis proceeded in three steps. First, all relationships between single predictors and outcome variables were tested using bivariate regression models to examine their overall association when not

accounting for other covariates (for example, decision-making on large household purchases was tested as a predictor of anemia, age at introduction of complementary foods, breastfeeding duration, and precautions in food preparation). Second, the significance of interactions between each type of domestic violence and each autonomy variable was tested for each outcome. Interactions were tested for all the outcome measures using multivariable regression models including the appropriate covariates. Because of the large number of possible interactions, three adjusted models were used to test whether interactions were significant for each outcome: one testing interactions between decision-making autonomy and control issues, a second testing interactions between decision-making autonomy and emotional domestic violence, and a third testing interactions between decision-making autonomy and physical domestic violence. Thus, for 5 outcomes a total of 15 adjusted models were used to test interactions. Significance of interaction terms in the adjusted interaction models was assessed using F-tests to determine whether the interaction taken as a whole was significantly associated with the child feeding or anemia outcomes. All significant interactions ($p \leq 0.05$) were included in final models. Third, all autonomy and domestic violence variables were combined into one model for each outcome along with covariates and interaction terms previously selected. However, non-significant interactions ($p \leq 0.05$ for any level) in the final adjusted model were removed. For final models, significant associations were defined as $p \leq 0.05$. Finally, similar models for breastfeeding and complementary feeding outcomes explored potential differential effects when limiting the sample to children ≤ 2 years of age rather than ≤ 5 years. Detailed information regarding the construction of outcome variables and predictor variables is given below. Data from ENSIN 2005 was analyzed using STATA 12 (StataCorp 2011).

Issues with dataset

The dataset used in the present study had issues which could not be resolved before the completion of this thesis. Out of 25,850 respondents, information was missing for 11,229. This missing data could not be explained by researchers in Colombia who merged the dataset. However, responses to several of the variables of interest closely match results reported in Colombia's 2005 DHS final report so the missing values may not necessarily signify a problem—survey participants were eligible for parts but not all of the components of the DHS/ENSIN. For example, rates of domestic violence reported in 2005 DHS final report match

rates in this dataset: in both datasets, 33% of women report being pushed or shaken and 9% report being hit, while 8% report being hit with a weapon according the 2005 DHS final report and 7% in the analyzed dataset. Similarly, 97% of women are reported to have initiated breastfeeding in the 2005 DHS final report, while in the analyzed dataset this figure is 96.3%. The results reported here should be interpreted with caution until issues with the dataset are resolved. However, given the comparability of the statistics cited above, it is likely that these results will not differ greatly from final results in a confirmed/corrected dataset.

Exclusion criteria

Only married or cohabitating women were included for analysis. In addition, only singleton children less than 5 years of age and who were currently alive were included, and only the last-born child of each woman if multiple children were present in the home. Additional analyses explored whether differential associations were found when the sample was limited to children less than 2 years of age for complementary feeding and breastfeeding outcomes, as reporting errors may have increased with the passage of time.

Control variables

In order to determine important potential covariates of breastfeeding and child feeding outcomes, a systematic search of the literature was conducted to identify recent review articles (within the past 10 years) assessing correlates of breastfeeding and complementary feeding practices. Additional information regarding the search strategy used for these searches and the articles selected is reported in Table 4. An additional search was conducted to identify potential covariates of hygienic precautions taken during food preparation, but no review articles were identified specific to this outcome. Because this outcome is related to complementary feeding practices, the same covariates as for complementary feeding practices were applied to this outcome. An additional potential covariate reflecting whether a household had access to piped water was included because it was hypothesized this could be an important determinant of whether hygienic precautions (such as washing hands and washing utensils) were practiced. All of the covariates thus identified were compiled and used to develop conceptual frameworks of potential covariates related to each outcome (see Figure 1 and Figure 2). A previous study examined the predictors of anemia in Colombian children using ENSIN 2005 (Kordas et al.,

unpublished data) and thus all correlates found to be significant predictors in this previous analysis were considered as potential covariates in regressions in which anemia was the outcome of interest, including environmental factors, mother-related factors, and child-related factors (see Figure 3).

Many of the potential covariates identified as relevant correlates of breastfeeding and complementary feeding practices were not available in the dataset and could not be included in analyses. When possible, proxy variables were used. For example, whether or not a mother smoked cigarettes during pregnancy was used as a proxy for postnatal tobacco use. The number of antenatal visits mothers reported served as a proxy for postnatal information and advice from healthcare providers. Additional limitations were encountered as some of the identified potential covariates were present in the dataset but did not measure the time period of interest. For example, mothers reported whether they currently worked, but not whether they worked while breastfeeding or during the time period when complementary foods were introduced. Variables not meaningful to the time period of interest and which were not hypothesized to be meaningful proxies of what was occurring during the time period of interest were not included in analyses. Along with these limitations, additional covariates were not used due to low response rates, such as variables measuring whether a mother felt worthless or thought of committing suicide, which were determined to be proxies for maternal depression. Finally, any variable thought to be a potential mediator of the relationship between decision-making autonomy or domestic violence and outcomes of interest were excluded from consideration as potential covariates. For example, although iron deficiency is an important determinant of whether a child has anemia, iron deficiency could potentially mediate the relationship between child anemia and low maternal autonomy or experience of domestic violence, so including this variable as a covariate could obscure this relationship.

In order to determine which covariates to retain in final models, bivariate regression models were used to measure associations between individual covariates and outcome variables. Covariates that had significant or nearly significant ($p \leq 0.10$) associations with the outcome measures were retained. However, strong evidence in the literature was found for certain covariates of complementary feeding including socioeconomic status, maternal age, maternal education, maternal tobacco use, and information and advice from healthcare providers (Wijndaele et al. 2009). For this reason, it was determined in advance that these variables would

be forced into final complementary feeding models regardless of the strength of association found in bivariate regression models. Although none of the identified review articles included information regarding whether strong evidence was found for certain correlates of breastfeeding compared to others, it was hypothesized in advance that socioeconomic status, maternal age, and maternal education would be highly relevant and thus these were also forced into final breastfeeding models regardless of whether an association was found in bivariate regression models. Socio-economic status of respondents was approximated using a SISBEN (System for the Selection of Beneficiaries of Social Programs) score, which is an indicator commonly used in Colombia to approximate households' economic status, with 1 representing the lowest economic position and 4-6 representing the highest economic positions. SISBEN scoring is based on household characteristics, consumption of goods, income, and human capital (Vélez Castaño & Deutsch 1998). There were no correlations ≥ 0.60 between covariates, so no covariates were omitted due to collinearity. The highest correlation found among covariates was between birth order and maternal age (Spearman's rank correlation= 0.572).

Maternal decision-making autonomy measures

All available questions on decision-making from ENSIN that measured both joint decision-making and female- or partner-dominated decision-making were considered in comprising maternal decision-making autonomy. Six of the available variables met this criterion: 1) who makes decisions about contraception use, 2) who decides how to spend money, 3) who has the final say on large household purchases, 4) who has the final say on making household purchases for daily needs, 5) who has the final say on visits to family or relatives, 6) who decides on food to be cooked daily and 7) who has the final say on the mother's own healthcare. Because there was a high number of missing responses present among variables measuring who makes decisions about contraception use (n=11,621 available) and who decides how to spend money (n=8,605 available) compared to other autonomy variables (n >14,000 available), these variables were excluded from final models, leaving a total of five autonomy variables. For each question, the female respondent could reply that she makes the decision, she makes the decision jointly with her husband or partner, her husband or partner makes the decision alone, she makes the decision with someone besides her husband/partner, someone else makes the decision, or the decision was not made/not applicable. The small number of

participants (n= 21–462 out of >14,000 respondents) who responded that the "decision was not made" or "not applicable" were not included in analyses. "Female-dominated decision-making," "partner-dominated decision-making," "joint decision-making with partner", "joint decision-making with someone else", and "someone else makes decision" were measured as separate categories for each question. Female-dominated decision-making served as the reference for comparison in bivariate and multivariable regression analyses.

Although some studies combine autonomy variables using an additive scale or factor analysis, it was decided to measure each autonomy variable separately in order to accomplish the study's aims of investigating how different types of decision-making autonomy influence child feeding outcomes and anemia. Prematurely combining autonomy variables could dilute potential associations between autonomy predictors and outcomes if specific autonomy variables have differential associations with the outcome of interest. Additionally, in order to employ factor analysis, responses to "who makes the final decision" must be ranked numerically. For example, Chakraborty & Anderson (2011) gave "woman makes the final decision" a score of 1, "joint decision-making" a score of 2, "woman makes decision with someone other than husband" a score of 3, "husband makes decisions alone" a score of 4, "someone else makes decisions" a score of 5, and "other" a score of 6. However, such rankings may not be appropriate, as discussed previously. Instead, the possible responses to "who makes the final decision" are probably best treated as categorical data. Additionally, no qualitative research has yet been done in Colombia to explore how decision-making autonomy variables employed in DHS are interpreted by respondents or whether they are meaningful in this context. Because some autonomy variables appear to be dissimilar from others from a theoretical standpoint, combining variables may not be appropriate. For example, who makes decisions on food to cook every day versus who makes decisions about large household purchases may have very different implications in terms of representing the construct "women's autonomy." However, internal consistency of the autonomy variables was measured, yielding Cronbach's alpha of 0.7056, which shows good internal consistency, although one variable, "who has the final say on decisions regarding woman's own healthcare" had moderately low correlations with the other autonomy variables and removing this variable slightly increased the Cronbach's alpha value (see Table 5). Results suggest that most autonomy variables are measuring the same underlying construct. Even so, there is little confidence that in the Colombian context the

underlying construct represents "autonomy" and it is uncertain whether these variables would influence child feeding outcomes and anemia in the same direction.

Maternal experience of domestic violence measures

Domestic violence was measured using variables related to types of domestic violence experienced between a woman and her partner, or intimate partner violence (IPV). Physical domestic violence was measured as an additive composite score reflecting the number of types of physical domestic violence a woman had ever experienced with her partner, with a possible range of 0-7. Possible types of physical domestic violence a woman could report included whether her partner or spouse ever 1) slapped or twisted her arm, 2) tried to strangle or burn her, 3) punched her with fist or something harmful, 4) pushed her, shook her or threw something, 5) threatened her with knife/gun or other weapon, 6) attacked her with knife/gun or other weapon, or 7) bit her. To each type of physical domestic violence women could respond 1) no, 2) yes, in the last year, or 3) yes, before last year. For analysis, the categories "yes, in the last year" and "yes, before last year" were collapsed, and women were assigned a score of "1" for each type of domestic violence ever experienced and a score of "0" for each type not experienced, so that each respondent's score reflects the number of types of violence ever experienced. Considering both past and present experiences of domestic violence is relevant because child feeding measures reflect both past and present maternal behaviors. For example, since the sample includes all children under 5, initiation and duration of breastfeeding and timing of complementary feeding may reflect child feeding behaviors from several years past. Additionally, past experiences of domestic violence may still reflect characteristics of women's present relationship with her partner and may continue to influence present behavior. Although some types of domestic violence are clearly of greater severity than others, Colombian women who have experienced more severe forms of domestic violence are more likely to have also experienced the less severe forms. For instance, women with lower composite scores for domestic violence were more likely to have reported that their partner pushed, shook, or threw something as opposed to a more severe form of physical domestic violence, while women who reported being attacked with a knife/gun or other weapon are more likely to have a higher overall score (Table 6). Thus, an additive score for types of domestic violence reported accurately reflects the severity of IPV experienced.

Moderate to strong correlations were found among different types of physical domestic violence (Table 7). Internal consistency of domestic violence variables was also assessed, showing good internal consistency (alpha=0.733, Table 4). Whether women reported being bit showed moderately low correlations with other domestic violence variables, and removing this variable improved Cronbach's alpha very slightly (Table 8). This variable was retained in the additive score. Along with physical domestic violence, a composite score for the number of control issues present in the relationship was also utilized as a measure of IPV. Respondents reported whether their partner exhibited eight different controlling behaviors, including whether partner 1) accused her of unfaithfulness 2) tried to limit her contact with family 3) insisted on knowing where she is 4) doesn't trust her with money 5) ignores her 6) doesn't count on her or take her into consideration for family reunions 7) didn't consult her for important family decisions and 8) did not permit her to meet her girlfriends. Possible answers for each question included (similar to responses for physical domestic violence) 1) no, 2) yes, in the last year, or 3) yes, before last year. The categories "yes, in the last year" and "yes, before last year" were again collapsed, and women were assigned a score of "1" for each positive response and a score of "0" for each negative response. Scores were summed to reflect the total number of control issues ever present in the relationship, with a possible range of 0-8. Spearman's rank was used to measure the correlations among control issues, showing again low to moderate correlations (Table 9). Cronbach's alpha was employed to measure internal consistency among control variables, showing good internal consistency (alpha=0.745, Table 10). Internal consistency was not improved by removing any of the items. In addition to physical domestic violence and control issues, emotional domestic violence was measured as a dichotomous variable indicating whether or not the woman ever experienced any emotional violence (yes or no.)

Physical domestic violence, control issues, and emotional domestic violence were chosen as predictors because they were available in the ENSIN dataset and were hypothesized to be influential for mother's child feeding behaviors, as well as potentially related to autonomy. IPV, as mentioned previously, has been demonstrated to have different dimensions that may have differential effects (Friedemann-Sánchez and Lovatón 2012). Another dimension of IPV, sexual domestic violence, was available in the ENSIN dataset but was not included in the analysis. This decision was made to limit the scope of the study. However, sexual domestic

violence likely has important implications for the well-being of women and children and is an important topic for future study.

Outcomes: breastfeeding, complementary feeding, and anemia

Breastfeeding duration is not normally distributed in the ENSIN 2005 dataset and shows an excess number of responses every three months, probably reflecting the tendency of women to round total breastfeeding duration to memorable time intervals (3 months, 6 months, 9 months, 12 months, etc.) First, breastfeeding duration was collapsed into three month intervals (0-3 months, 4-6 months, 7-9 months, etc.) and an ordinal logistic regression model was used to fit the ordinal nature of the outcome. However, the final ordinal logistic regression models violated the proportional odds assumption (for example, an increase in breastfeeding duration from 0-3 months to 4-6 months may not have been equivalent to moving from 4-6 months to 6-9 months, and so on). For this reason, associations were instead measured using logistic regression. Breastfeeding duration was collapsed into two categories using the median duration of breastfeeding, which in the sample is 12 months. Women who reported below average breastfeeding durations (<12 months) were assigned a score of 0, while women who reported breastfeeding average or greater than average durations (≥ 12 months) were assigned a score of 1.

Three outcome variables were used to measure complementary feeding practices: the child's age at which complementary feeding began, whether or not complementary feeding practices began when the child was between 4-6 months of age, and whether fewer (0-1) or more (2-3) precautions were taken by women during food preparation for child feeding. First, two variables were used to construct a new variable measuring the child's age at introduction to any non-liquid food: the child's age at introduction to semi-solid foods, and the child's age at introduction to solid foods (both measured in months). Whichever type of food was introduced first was considered the age at which complementary feeding began. Age at introduction to complementary foods was normally distributed and associations were measured using regression. Next, a second variable was constructed capturing whether or not a child began complementary feeding within the appropriate age range of 4-6 months (yes or no). For this outcome, associations were measured with a logistic regression. Finally, an additive score was created to assess the number of precautions taken during food preparation, with possible

precautions including whether the mother washes her hands before preparing food, whether utensils are cleaned prior to food preparation, and whether or not utensils were cleaned and boiled (thus, possible scores range from 0-3). Ordinal logistic regression was again attempted to measure associations with the number of precautions taken during child feeding. However, this model also violated the proportional odds assumption, so categories were collapsed so that women who took 0-1 precautions were assigned a score of 0, while women who took 2-3 precautions were assigned a score of 1, and then logistic regression was employed to measure associations.

Last, whether or not the child has anemia was considered as a dichotomous variable, with anemia being defined as altitude-adjusted hemoglobin <11g/dL (WHO 2011), and was analyzed using logistic regression. This outcome was measured along with other child feeding outcomes due to the high prevalence of childhood anemia in Colombia.

Results

Sample characteristics

After limiting the study sample based on exclusion criteria, 8,277 mother-child dyads were included for analysis. Chi-square tests were used to determine whether the study sample differed significantly from the excluded sample. Sample characteristics are summarized and differences between included and excluded samples are described in Table 11. The majority of the study population had a SISBEN score of 1 or 2, while 26.6% (± 1.0% SE) of respondents had a SISBEN score of 3, and 3.5 ± 0.5% of respondents had a score of 4-6. The study population was spread over six different regions in Colombia, including Atlántica, Oriental, Central, Pacífica, Bogotá, and National Territories, with the majority of respondents (69.8 ± 1.1%) living in urban areas. Mothers' age ranged from 13-49, with the majority (55.1 ± 0.8%) falling between 19-29 years of age. About half of mothers (54.2 ± 0.8%) had a normal BMI between 18.5 and 25, while 1.5± 0.3% of mothers were undernourished (BMI <18.5), 29.9 ± 0.7% were overweight (BMI ≥ 25) and 11.4 ± 0.5% were obese (BMI ≥ 30). 3.22 ± 0.3% of mothers reported receiving no type of education, while most mothers received primary (32.3 ± 0.8%) or secondary school education (49.8 ± 0.9%) and somewhat less received higher education (14.7 ± 0.7%).

Differences between the included and excluded population were calculated using Chi-square tests for categorical variables and t-tests for continuous variables. Tests were performed

treating the included and excluded groups as analyzable samples. The excluded women differed significantly from the study sample in all demographic characteristics (see Table 11). Larger percentages of the excluded population had low SISBEN scores, rural residence, younger maternal age, normal maternal BMI, and lower maternal education, probably reflecting the characteristics of women whose last child passed away or who are raising children without a cohabitating partner.

Only 2.2 ± 0.7% of mothers in the study sample reported not initiating breastfeeding. The majority of mothers (35.7 ± 0.8%) in the sample reported they are currently breastfeeding, while 21.8 ± 0.7% reported having breastfed for 0-6 months, 17.8 ± 0.6% from 7-12 months, 9.9 ± 0.4% from 13-18 months, 8.0 ± 0.4% from 19-24 months, and 4.6 ± 0.4% more than 24 months. Most mothers introduced complementary foods within the recommended range (59.7 ± 1.0% while 22.6 ± 0.9% introduced complementary foods before this range and 17.7 ± 0.8% introduced complementary foods after. 13.9 ± 0.7% of mothers reported taking no precautions during food preparation (washing hands, washing utensils, boiling utensils), while 26.8 ± 0.8% took one precaution, 39.4 ± 1.0% took two precautions, and 19.9 ± 0.8% took all three. A large percent of children (32.8 ± 0.2%) were anemic.

Despite the differences in the demographic characteristics of excluded participants, in terms of child feeding practices and childhood anemia, the excluded sample differed from the included sample only in breastfeeding duration, with fewer women currently breastfeeding and more reporting lower breastfeeding durations. Again, these differences were calculated using Chi-square tests for categorical variables and t-tests for continuous variables and treating the included and excluded groups as analyzable samples.

Rates of decision-making autonomy

Marital status and rates of decision-making autonomy are reported in Table 12. The majority of women in the study sample (68.1 ± 0.9%) lived with their partners, while only 31.9 ± 0.9% were married. For all decision-making questions, there was a wide variance in who tended to have the final say on a decision. For example, most women made the final decision regarding their own healthcare (75.8 ± 0.7%), daily purchases (41.8 ± 0.8%) and regarding food cooked daily (71.6 ± 0.7%). On the other hand, most women made decisions jointly with their partners regarding large purchases (49.3 ± 0.8%), and social visits (53.8 ± 0.8%). Men did not have the

final say most of the time on any decision-making question, but most frequently had the final say on large purchases (21.8 ± 0.63%) followed by daily purchases (15.0 ± 0.6%) and rarely had the final say on food cooked daily (3.15 ± 0.3%). In general, few women reported making any decision jointly with someone besides their partner or that someone else made a decision entirely on their behalf, although in both cases this was most common for decisions regarding food cooked daily.

Prevalence of domestic violence

Fairly high rates of IPV were reported in the study sample. 20.5 ± 0.6% of women reported experiencing emotional domestic violence at some time with their partners. Scores for the number of control issues present and number of types of domestic violence reported with partners is depicted graphically in Figure 4. The majority of women (61.1 ± 0.8%) reported some type of control issue present in their relationship with their partner. About one third (33.0 ± 0.8%) of women reported experiencing at least one type of physical domestic violence from their partners.

Associations between domestic violence and decision-making autonomy variables

Associations of domestic violence with decision-making autonomy variables as well as several salient demographic variables (SISBEN scores, maternal education, maternal age, and marital status) are reported in Table 13. SISBEN scores were not significantly associated with whether women reported experiencing any type of domestic violence. Similarly, maternal education level was not significantly associated with whether women experienced any type of IPV, although there was with a tendency for women with higher education levels to be marginally less likely to experience emotional violence and control issues. Increasing maternal age was associated with less likelihood that women would experience emotional domestic violence. On the other hand, women who lived with their partners without being married were significantly more likely to experience emotional domestic violence, physical domestic violence, and control issues compared with women who were married.

Compared with women having the final say, joint decision-making was associated with less experience of domestic violence for several of the decision-making variables. When women reported making decisions jointly with their partners regarding social visits, they were less likely

to report experiencing emotional IPV, physical IPV, or control issues. Similarly, making decisions jointly regarding large household purchases was associated with less emotional IPV and control issues, while making decisions jointly regarding women's own healthcare was associated with less emotional and physical IPV.

Mixed associations were seen when women reported their partners have the final say on various decisions compared with women who had the final say. When partners had the final say on food cooked daily, women were much more likely to report experiencing emotional IPV. Similarly, when partners had the final say on decisions regarding social visits, women were more likely to report physical domestic violence. However, when partners made the final decision regarding women's own healthcare, women were less likely to report experiencing any type of domestic violence (emotional, physical, or control issues.)

Unadjusted bivariate associations between potential covariates with child feeding and anemia outcomes

Unadjusted bivariate relationships between potential covariates and complementary feeding outcomes are reported in Table 14. As previously discussed, all covariates associated or marginally associated with outcomes ($p \leq 0.10$) were included in final models, along with covariates predetermined to be relevant and therefore forced into models. All complementary feeding outcomes (including child age at introduction to complementary foods, whether complementary foods were introduced between 4-6 months of age, and whether 0-1 versus 2-3 precautions were taken during child feeding) were associated with region, urban vs. rural residence, SISBEN scores, and marital status. Child birth order, maternal education, and number of antenatal visits were significant predictors of both whether complementary foods were introduced between 4-6 months of age and the number of precautions taken during food preparation. Breastfeeding duration and whether the mother smoked cigarettes during pregnancy were related to age at introduction to complementary feeding and precautions taken during child feeding. Maternal age and access to piped water was related to the number of precautions taken during child feeding. No significant unadjusted relationships were found between any complementary feeding outcomes and child sex, child birth weight, current pregnancy of mother, or maternal BMI

Unadjusted bivariate relationships between potential covariates and breastfeeding duration are reported in Table 15. Breastfeeding duration significantly varied based on region. Greater likelihood of breastfeeding duration continuing ≥ 12 months was associated with rural residence, lower SISBEN scores, later child birth order, increased maternal age, and delivering a child at home vs. at the hospital. Higher birth weight was also marginally associated with greater likelihood of longer breastfeeding duration. Lower likelihood of breastfeeding past 12 months was associated with the child being delivered by cesarean section, greater number of antenatal visits, and whether the mother visited a doctor in the past year.

Additionally, unadjusted bivariate relationships between potential covariates and anemia are reported in Table 16. The likelihood of children having anemia varied by region. Additionally, whether a child had anemia was associated with rural residence, lower SISBEN score, more children under five residing in the same household, larger household size, and a greater total number of children born to the mother. Additionally, whether a child had anemia was associated with younger maternal age, younger maternal age at marriage, cohabitation with partner without being married, less maternal education, and no health insurance. Furthermore, not having a toilet, piped water, or a sewer connection was associated with a child having anemia, as well as not being currently breastfed and younger child age. Finally, an elevated CRP measure was marginally associated with greater likelihood that a child would have been diagnosed as anemic.

Unadjusted bivariate associations between domestic violence and autonomy predictors with child feeding and child anemia outcomes

In unadjusted bivariate regression models, experience of domestic violence tended to have a negative impact on child feeding practices (Tables 17-18). When mothers experienced emotional domestic violence this was associated with later introduction of complementary foods and lower likelihood that foods were introduced between 4-6 months of age. When mothers experienced more control issues with their partners, they were less likely to introduce complementary foods between 4-6 months and more likely to take fewer precautions during food preparation.

When women's partners had the final say on various decisions this tended to have a negative associations with child feeding practices in unadjusted bivariate regression models.

Women were less likely to introduce complementary foods between 4-6 months of age and less likely to take more precautions during child feeding when their partners had the final say on social visits, daily purchases, or women's own healthcare compared with women having the final say on these decisions. When men had the final say on what food is cooked daily, women were less likely to take multiple precautions during child feeding.

Joint decision-making tended to show mixed results in unadjusted models. Women were more likely to introduce foods within the 4-6 month range when they made decisions jointly with their partners on social visits compared with women who had final say on these decisions. On the other hand, women were less likely to take multiple precautions during child feeding when they made decisions jointly with their partner regarding their own healthcare, but were more likely to breastfeed past 12 months. Additionally, joint decision-making regarding daily purchases was associated with a lower likelihood of the woman's child having anemia compared with women having the final say on daily purchases.

When someone besides a woman or her partner had the final say about her healthcare, she was significantly less likely to take multiple precautions during child feeding. When a woman made decisions jointly with someone besides her partner regarding food cooked daily this was associated with introducing complementary foods later. When a woman made decisions regarding daily purchases jointly with someone besides her partner she was less likely to breastfeed past 12 months. When someone else besides a woman or her partner made the final decision regarding a woman's healthcare or large purchases, her children were more likely to be anemic.

Significant interactions between decision-making autonomy and domestic violence variables

As mentioned previously, interactions were tested using 15 adjusted models which explored all potential interactions between decision-making autonomy and each type of domestic violence. Interactions with significant F-tests ($p \leq 0.05$) were included in final models. For the outcome age at introduction to complementary feeding, there were significant interactions between decision-making regarding social visits and emotional domestic violence ($F_{4, 3059} = 3.82^{***}$), and between decisions regarding women's own health care and control issues ($F_{4, 3059} = 2.42^{**}$). However, the interaction between decisions regarding women's own health care and control issues had no significant levels in the final model and the F-test of the interaction was no

longer significant ($F_{4, 3059}$= 2.35*) and so this interaction was removed. There were no significant interactions between decision-making autonomy and domestic violence predictors for whether food was introduced from 4-6 months or for the number of precautions taken during food preparation, so no interaction terms were included in these final models.

For the outcome measuring whether breastfeeding duration continued past 12 months, interactions were found between who has the final say on decisions regarding woman's own healthcare and physical domestic violence ($F_{4, 3088}$= 2.43**), who has the final say on daily purchases and emotional domestic violence ($F_{4, 3088}$= 12.91***), and who has the final say on large purchases and emotional domestic violence ($F_{4, 3088}$= 24.92***) in the interaction models. Both interactions had significant levels in the final model and were retained. However, because interaction terms no longer had significant F-tests in the final model, a main effects model excluding interaction terms was also included for purposes of comparison.

Finally, for the outcome measuring whether the child had anemia, interactions were found between who has the final say on decisions regarding the woman's own healthcare and emotional domestic violence ($F_{3, 2774}$= 4.14***), and who has the final say on food cooked daily and emotional domestic violence ($F_{4, 2773}$= 2.99**). In the final model, both interactions had significant levels and were retained, although the interaction between who has the final say on the woman's own healthcare and emotional domestic violence had only a marginally significant F-test ($F_{(3, 2773)}$ = 2.44*).

Final adjusted model—Predictors of child age at introduction to complementary feeding

Predictors of child age at introduction to complementary feeding are summarized in Table 19. No domestic violence or decision-making variables significantly predicted child age at introduction to complementary feeding. However, decision-making regarding social visits interacted with emotional domestic violence, and this interaction was statistically significant. When mothers experienced emotional domestic violence and their partners had the final say on decisions regarding social visits or they made these decisions jointly with someone besides their partners this was associated with earlier introduction of complementary foods compared to women who had the final say on these decisions.

Several covariates remained significantly associated with child age at introduction to complementary feeding in the final adjusted model. Region was significantly associated with

child age at introduction to complementary feeding, with mothers tending to introduce foods ealier in Atlántica compared to all other regions. SISBEN score also was associated with child age at introduction to complementary feeding. The greatest difference was found between mothers with high SISBEN scores: mothers with a SISBEN score of 3 tend to introduce foods earlier, while mothers with a SISBEN score of 4-6 tend to introduce complementary foods later. Additionally, maternal report of smoking during pregnancy was associated with earlier introduction of complementary foods (β=-0.57 ± 0.28, p= 0.043).

Final adjusted model—whether child had complementary foods introduced at 4-6 months of age

Predictors of whether food was introduced within an appropriate range (4-6 months) are summarized in Table 20. No decision-making autonomy or domestic violence variable was associated with whether complementary food was introduced to children within an appropriate age range. However, several covariates remained associated with whether foods were introduced within the appropriate range. Overall, SISBEN scores were significantly associated with whether foods were introduced between 4-6 months. A SISBEN score of 4-6 was associated with greater likelihood of introducing foods within an appropriate range compared to women with a SISBEN score of 1. Maternal education was also overall a significant predictor of introducing complementary foods between 4-6 months. Women having education beyond secondary school was associated with greater likelihood of introducing foods within an appropriate range compared to women with no schooling.

Final adjusted model—Predictors of whether 0-1 vs. 2-3 precautions were taken during food preparation

Predictors of child age at introduction to complementary feeding are summarized in Table 21. No domestic violence variables were significantly associated with the number of precautions taken during child feeding, although emotional domestic violence was marginally associated with more precautions taken during food preparation. Two decision-making autonomy variables were significant in the final model. Women who made decisions jointly with their partners on decisions regarding their own healthcare were more likely to take fewer precautions compared to women who made these decisions independently. Additionally, compared to women

having the final say, having one's partner make the final decision on social visits is associated with significantly fewer precautions taken during food preparation.

Several covariates remained significantly associated with whether 0-1 vs. 2-3 precautions were taken during food preparation in the final model. Region is strongly associated with the number of precautions taken during child feeding. Living in all regions except the Central region is associated with greater likelihood of taking fewer precautions during food preparation compared to Atlántica. Additionally, SISBEN scores are significantly associated with the number of precautions taken during food preparation. Having a SISBEN score of 3 or 4 is associated with greater likelihood of taking more precautions during child feeding compared to a SISBEN score of 1. Education is also strongly associated with precautions taken during food preparation. Having a higher education level is associated with taking more precautions during child feeding compared with women who have no education.

Final adjusted model—Predictors of whether breastfeeding duration continued ≥ 12 months

Predictors of whether breastfeeding duration continues ≥ 12 months are summarized in Table 22. Three interaction terms were significantly associated with breastfeeding duration. When women experienced emotional domestic violence and their partners made the final decision about the women's healthcare, this was associated with lower likelihood that women would breastfeed past 12 months. Similarly, when women experienced more physical domestic violence and their partners made the final decision regarding daily purchases, this was also associated with lower likelihood that women would breastfeed ≥ 12 months. On the other hand, when women experienced emotional domestic violence but made decisions jointly with their partners regarding daily purchases, this was associated with greater likelihood that breastfeeding duration would continue ≥ 12 months. Compared to this model, when no interaction terms are included in the final model there are no significant associations between breastfeeding duration and any decision-making autonomy or domestic violence variable (see Table 23).

Several covariates remained significantly associated with breastfeeding duration in the final model. Breastfeeding duration varied based on region. Living in rural areas was associated with greater likelihood that breastfeeding duration continued ≥ 12 months. Additionally, SISBEN scores were significantly associated with breastfeeding duration. Women with higher SISBEN scores were less likely to breastfeed ≥ 12 months; compared to the women with the

lowest SISBEN scores, women with SISBEN scores of 4 were 80% less likely to breastfeed ≥ 12 months. Older maternal age was associated with a slightly increased likelihood that breastfeeding would continue ≥12 months. Finally, a child having higher birth weight was associated with greater likelihood that they would be breastfed ≥ 12 months. Covariate associations did not vary when interaction terms were excluded from the final model.

Final adjusted model—Predictors of likelihood children have anemia

Predictors of whether a child has anemia are summarized in Table 24. Two interactions between decision-making autonomy and domestic violence predictors were significant for childhood anemia. First, when women experienced emotional domestic violence, making decisions jointly with their partners regarding their own healthcare was associated with more than a 4-fold increase in child anemia. Conversely, when women did not experience emotional domestic violence, decreased likelihood of anemia was found when a woman's partner had the final say on decisions regarding a woman's own healthcare. Second, when women experienced emotional domestic violence and someone else had the final say on what food is cooked daily, this was associated with a lower likelihood their child would have anemia, while joint decision-making was also associated with a marginally lower likelihood of childhood anemia. Finally, one additional decision-making autonomy variable was significantly associated with likelihood of whether a child had anemia; when women made decisions jointly with their partners regarding daily purchases, this was associated with a reduction in child anemia.

Several covariates were associated with whether children had anemia in the final adjusted model. Child anemia varied significantly by region. Additionally, lower likelihood of a child having anemia is associated with having a toilet in the household, higher SISBEN score, older maternal age, and older child age.

Sensitivity analyses—Limiting sample to children less than two years of age

As mentioned previously, sensitivity analyses were conducted for all child feeding outcomes in order to test how limiting the sample to children ≤ 2 years of age (rather than ≤ 5 years) could potentially alter the results. Some significant associations were gained or lost when the sample was limited to children ≤ 2 years of age, but confidence intervals typically became wider when the sample was limited to only include younger children.

For the outcome measuring child age at introduction to complementary feeding, no significant associations were either gained or lost among decision-making autonomy or domestic violence outcomes. In both regressions, emotional domestic violence interacted with decisions regarding social visits to be associated with child age of introduction to complementary foods. Two levels of this interaction were significant, including when women's partner had the final say on social visits and when women made decisions jointly with another person. For both levels, the β coefficient was lower and the confidence intervals were wider when the sample was limited to children less than 2 years of age. On the other hand, for the outcome measuring whether complementary foods were introduced between 4-6 months of age, one significant association was gained; joint decision-making regarding social visits was significantly associated with greater likelihood that complementary foods would be introduced between 4-6 months (OR=1.32 ± .17, p=0.022). However, although a significant association was found, the confidence interval was again wider when the sample was limited to children less than 2 years of age. For the third outcome measuring whether 0-1 vs. 2-3 precautions were taken during child feeding, a previously significant association between joint-decision-making regarding women's own healthcare and whether multiple precautions are taken during child feeding became only marginally significant, while on the other hand, a significant association was gained, with women who make decisions jointly with a person other than their partner regarding daily purchases associated with greater likelihood multiple precautions were taken during child feeding (OR=2.53 ± 1.12, p=0.037). Again, for both the association gained and lost confidence intervals became wider. Finally, for the outcome "whether breastfeeding duration continued ≥ 12 months," the significant association found in the interaction between who makes decisions regarding women's own healthcare and emotional domestic violence is lost. On the other hand, regarding the interaction between who makes decisions on daily purchases and score for physical domestic violence, the joint decision-making level that was previously marginally significant became significant (OR = 0.500 ± .13, p=0.008) while the level "partner makes the final decisions" became non-significant. Again, in all cases confidence intervals widened when the sample was limited to children ≤ 2.

Discussion

The primary of objectives of this study was to 1) determine how domestic violence and autonomy variables were related in this population and 2) understand how different measures of decision-making and domestic violence were associated with child feeding and anemia outcomes. Overall, domestic violence and autonomy variables were significantly associated and also signifcantly interacted to be associated with child feeding practices and anemia. Additionally, although many domestic violence and decision-making autonomy variables were not associated with child feeding or child anemia outcomes in the final adjusted models, those associations that were found generally aligned with the study's hypotheses. Analyses also are suggestive that decisions regarding women's healthcare autonomy differ from other decision-making variables in potentially important ways. Each of these points will be discussed further in the sections that follow.

Sensitivity analyses

Sensitivity analyses were conducted to understand whether there may have been a difference in analyses that limited the study sample to children less than 2 years of age, compared to analyses that included children less than 5 years of age. While researchers frequently include children of less than 5 years of age in measures of child feeding practices, this may not be appropriate if women cannot accurately recall breastfeeding duration or timing of introduction of complementary foods (recall bias). However, limiting the sample to children less than two did not result in more significant associations between predictors and outcomes, and it tended to result in wider confidence intervals, decreasing the precision of the results. The wider confidence intervals may simply reflect smaller sample sizes—however, if women of younger children more accurately recalled child feeding practices compared to women of children > 2 years of age, some precision might have been gained when the sample was limited. Additionally, information regarding women with longer breastfeeding duration was lost (more than 6% of the sample breastfed for longer than 24 months.) Thus, limiting the sample to children less than 2 did not appear to result in any advantages in regression analyses. This supports the inclusion of all children under 5 for measures of child feeding practices.

Decision-making autonomy

This study hypothesized that compared to women having the final say on various household decisions, joint decision-making would be associated with improved measures of child feeding practices and lowered likelihood of anemia. However, there were only two significant associations with joint decision-making, and mixed results were found. When women made decisions regarding daily purchases jointly with their partners this was associated with lower likelihood of child anemia. On the other hand, when women made decisions jointly with their partners regarding their own healthcare this was associated with fewer precautions taken during food preparation. However, who makes decisions regarding the women's healthcare may have differing implications compared to other variables (see "Decision-making autonomy regarding women's healthcare").

It was additionally hypothesized that compared to women having the final say on various household decisions, a woman's partner having the final say would be associated with less ideal child feeding practices and greater likelihood of child anemia. Only one association was found. When a woman's partner had the final say on social visits this was associated with fewer precautions taken during food preparation. This supported the hypothesis that male-dominant decision-making would be associated with poor child feeding practices.

In conclusion, across the five final adjusted models (testing a total of 20 different decision-making autonomy variables) significant associations were found with three decision-making variables. Thus, most of the decision-making variables were not significant predictors in the final adjusted models. This is in line with previous research, which has tended to find many nonsignificant associations between women's decision-making autonomy and children's health and nutritional status (Carlson et al. 2014). It is still worth noting, however, that across the population, more significant associations were found in unadjusted bivariate analyses, and these associations mainly supported the study's hypotheses; for example, when partners had the final say on certain household decisions, this was associated with lower likelihood that complementary foods would be introduced within an ideal range and associated with fewer precautions taken during child feeding, whereas joint decision-making on certain decisions was associated with greater likelihood of introducing food between 4-6 months of age, greater likelihood of breastfeeding duration continuing $\geq$ 12 months, and lower likelihood of child anemia. The only exception to the positive associations found with joint decision-making was that in both unadjusted and adjusted models women were less likely to take more precautions

during child feeding when they made decisions jointly with their partners regarding their own healthcare. Although most of these associations were not supported in final adjusted analyses, the consistent direction of these relationships gives additional support to the hypothesized relationship between different types of decision-making (although for some variables they may be non-causally related.)

Domestic violence

It was hypothesized that experience of domestic violence would be associated with poorer child feeding practices and with greater liklihood of anemia. Among the five final adjusted models (with a total of 11 domestic violence variables tested) no associations were found. Significant associations were only found between domestic violence variables and child health or nutritional outcomes when interactions with decision-making variables were taken into account (see "Associations and interactions between domestic violence and decision-making autonomy" below). However, it is again worth noting that across the population, bivariate unadjusted associations between domestic violence predictors and child nutrition and health outcomes supported overall that maternal experience of domestic violence may be associated with poor child feeding practices, including later introduction of complementary foods, less liklihood that foods would be introduced within the 4-6 month range and fewer precautions taken during food preparation. All significant unadjusted associations were seen with emotional domestic violence or control issues, while no unadjusted associations were found between child feeding outcomes and physical domestic violence. Additionally, no unadjusted relationships were found between any type of domestic violence outcome and breastfeeding duration or likelihood of children having anemia.

Associations and interactions between domestic violence and decision-making autonomy variables

Associations were explored between domestic violence and autonomy variables, and these associations supported the findings of previous research (Kishor and Johnson 2004, Flake and Forste 2006, Heaton and Forste 2008, Friedemann-Sánchez and Lovatón 2012) showing that joint-decision-making is associated with less domestic violence. Adjusting for socio-economic status, maternal education, maternal age, and marital status, joint decision-making between a

woman and her partner regarding social visits, large household purchases, and women's own healthcare was associated with less experience of domestic violence (emotional domestic violence, physical domestic violence, or control issues) compared with women having the final say on these decisions.

On the other hand, men having the final say on food cooked daily or decisions regarding social visits was associated with higher likelihood that women reported experiencing domestic violence (emotional, physical, or control issues) compared to women who had the final say on these decisions. While previous research suggests that both women having the final say on decisions or men having the final say on decisions can lead to increased experience of domestic violence, these associations suggest that male-dominant decision-making may also be related to increased experience of domestic violence compared to women having the final say on decisions in this context. The one exception to these trends was the finding that male-dominant decision-making regarding women's own healthcare is actually associated with less reported emotional violence, physical domestic violence, and control issues. These associations were unexpected. However, it is possible that healthcare autonomy decision-making has different implications compared to other types of decision-making (see "Health-care decision-making autonomy" below). Additionally, decision-making regarding daily purchases was the only decision-making variable that had no significant associations with the likelihood of experiencing domestic violence.

Decision-making autonomy and domestic violence were hypothesized to interact such that a woman having the final say on various decisions would be associated with improved child feeding practice and a lower likelihood of her children having anemia when she did not experience any domestic violence, but these benefits would disappear if mothers experienced domestic violence. This hypothesis was based on previous findings that higher levels of women's autonomy may put women at higher risk of experiencing domestic violence (Koenig et al. 2003, d'Oliveira et al. 2009, Weitzman 2014). However, as mentioned previously, male-dominant decision-making was associated with greater likelihood of women experiencing domestic violence in this context compared with women having the final say. The significant interaction terms instead suggest that when women have the final say on various decisions or make decisions jointly with their partners, this may diminish some of the negative associations between experience of domestic violence and child feeding practices or anemia that occur when

partners have the final say on decision-making. Additionally, emotional violence in particular often interacted with decision-making autonomy in its association with child feeding practices. Across all five final adjusted models, six significant interactions were found between domestic violence and decision-making autonomy variables, and of these, five were specifically emotional domestic violence.

Among significant interactions, when women both experienced domestic violence and their partners had the final say on certain decisions, this tended to be associated with less ideal child feeding practices. For example, emotional domestic violence interacted with decisions regarding social visits such that women experiencing emotional domestic violence was associated with earlier introduction of complementary foods when their partners had the final say on decisions regarding social visits compared to when women had the final say (although it is uncertain whether this would in fact result in inappropriately timed introduction of complementary foods.) Additionally, emotional domestic violence interacted with who had the final say on decisions regarding women's healthcare; when a woman's partner had the final say on this decision, experiencing emotional domestic violence was associated with lower likelihood that breastfeeding duration continued ≥ 12 months. A negative association between a woman's partner having the final say on decisions regarding daily purchases and the likelihood of breastfeeding continuing ≥ 12 months was also found when women experienced physical domestic violence. Again, one interpretation of these interactions is that there are potential negative consequences for child feeding practices and child likelihood of anemia when women both lack autonomy and experience domestic violence.

On the other hand, mixed associations were found regarding interactions between joint decision-making and emotional domestic violence. For example, an interaction was found between who made decisions regarding daily purchases and emotional domestic violence, so that when women experienced emotional domestic violence, their partners having the final say on daily purchase decisions was associated with a more than two-fold greater likelihood that breastfeeding duration would continue ≥ 12 months. Additionally, the likelihood that children would have anemia was marginally lower when women who had experienced emotional domestic violence made decisions jointly regarding food cooked daily compared with women having the final say on this decision. In contrast, women who experienced emotional domestic violence and made decisions jointly regarding their own healthcare had a more than four-fold

greater likelihood that their children had anemia compared with women having the final say on these decisions.

Breastfeeding versus age at introduction to complementary foods

One of the aims of this study was to assess whether decision-making autonomy was differentially associated with breastfeeding practices versus complementary feeding practices, as increasing autonomy has sometimes been associated with reduced breastfeeding duration (Smith et al. 2003). No clear differential associations could be found between these two different outcomes (in part because few associations were found in general). However, it is important to note that women with higher SISBEN scores were less likely to breastfeed past 12 months and there was no association between breastfeeding duration and women's level of education. On the other hand, women with higher SISBEN scores and higher levels of education were more likely to introduce complementary foods within the appropriate range and more likely to take multiple precautions during child feeding.

Health-care decision-making autonomy

Conceptually, it seems most appropriate for women to have the final say on decisions regarding their own healthcare, and this was the norm for Colombian women (75.8 ± 0.7% of women had the final say on this decision).Thus, it may be that joint decision-making can be beneficial, but in terms of a woman's own healthcare joint decision-making may be indicative of a controlling relationship. In Chapter 1 of this thesis, it was suggested that healthcare autonomy seemed to stand out as being more often related to children's health and nutrition compared to other decision-making variables (Carlson et al. 2014). Decisions regarding women's healthcare did not stand out as being more likely to be associated with any of the child feeding or child anemia outcomes in these analyses. However, healthcare autonomy appeared to possibly have different implications compared to other types of decision-making variables. For example, decision-making regarding women's healthcare had low item-rest correlation with other decision-making variables, assessed using a Cronbach's alpha test. Removing the variable "who has the final say on women's healthcare" improved Cronbach's alpha test value, although the test value was still high when it was included.

Additionally, for most decision-making variables, when men had the final say on decisions this was associated with increased domestic violence while joint decision-making was associated with decreased domestic violence. However, all male involvement in decisions regarding women's own healthcare was associated with decreased domestic violence (whether a woman's partner had the final say on women's healthcare or these decisions were made jointly) including lower likelihood of emotional domestic violence, physical domestic violence, and control issues. If decisions regarding women's own healthcare are in fact especially representative of autonomy compared to other types of decision-making, then the associations with lower experience of domestic violence could suggest that increased autonomy could lead to more domestic violence in the Colombian context, as has been found elsewhere (Koenig et al. 2003, d'Oliveira et al. 2009, Weitzman 2014).

Although male involvement in women's own healthcare led to decreased domestic violence, it also tended to be associated with poorer child feeding outcomes. When women made decisions jointly with their partners regarding their own healthcare they took fewer precautions during food preparation. Additionally, as mentioned in the previous section, decision-making regarding women's healthcare interacted with emotional domestic violence in its association with both breastfeeding duration and likelihood of child anemia. In both cases, experience of emotional domestic violence was associated with worse outcomes when women did not have the final say on their own healthcare (less likelihood of breastfeeding $\geq$ 12 months and greater likelihood that their child had anemia), regardless of whether the decision was made jointly or by the woman's partner. On the other hand, when women did not experience emotional domestic violence and their partners had the final say on decisions regarding their own healthcare, this was associated with a decreased likelihood of children having anemia.

One explanation for these interactions is the distinction between social support and lack of autonomy. A supportive male involvement in women's healthcare could be beneficial, but controlling male involvement in women's healthcare could be especially indicative of low autonomy. It is possible that differentiating between women who do and do not experience emotional domestic violence could be a way to distinguish between women experiencing helpful involvement as opposed to women experiencing a loss of freedom or a controlling relationship. This, however, is speculative. It is also possible that the combinantion of low autonomy and emotional domestic violence may simply represent a double burden leading to adverse outcomes.

To truly understand the significance of these associations and to answer these questions with any confidence, qualitative research is required.

Conclusion

Several key points can be drawn from this study which warrant further investigation. First, no other study has yet explored interactions between domestic violence and autonomy variables. A salient finding is that emotional domestic violence and decision-making autonomy frequently interact with each other in their associations with certain child feeding practices, specifically child age at introduction to complementary foods and breastfeeding duration, as well as likelihood of child anemia. This is an important finding, particularly as emotional domestic violence may be given less attention compared to physical domestic violence. Yet, research suggests that emotional domestic violence may be especially devastating for women (Mechanic, Weaver and Resick 2008, Friedemann-Sánchez and Lovatón 2012). While additional research is needed to draw firm conclusions, these findings suggest that emotional domestic violence is related to decision-making autonomy and the combination of women experiencing emotional domestic violence and lack of decision-making autonomy may have particularly negative consequences for child feeding practices and child health. On the other hand, when women have more control over decisions, experience of domestic violence may be less likely to lead to negative outcomes regarding child care practices. Future research will be important in supporting and clarifying this relationship.

Another important finding of this study is that joint decision-making was associated with less reported domestic violence compared to male- or female-dominant decision-making (as found by Friedemann-Sánchez and Lovatón 2012)and was sometimes associated with improved child feeding practices (although not for decisions regarding women's own healthcare). It remains uncertain whether joint decision-making could lead to a more balanced division of power and prevent domestic violence or whether it simply is a reflection of a more supportive or egalitarian relationship. Findings of this study should discourage use of joint decision-making as representing less autonomy than women having the final say on decisions in future research.

Finally, who has the final say on decisions regarding women's own healthcare is highlighted as potentially having different implications compared to other types of decision-making autonomy.

Strengths and limitations

This study is innovative in that it explored interactions between autonomy and domestic violence and compared these to unique outcome measures (child feeding practices and child anemia.) Additionally, the relationship of decision-making autonomy and domestic violence with child feeding and child health has been understudied, particularly in the Latin American context. Finally, these analyses should be helpful both to inform policy and direct future research regarding both women's autonomy and domestic violence and the implications these have for the health and well-being of women and children.

However, this study is exploratory in nature and has several important limitations. The number of analyses done in this study increased the potential of finding spurious results. However, analyzing several different outcomes also allowed for comparisons across models. For instance, the frequency with which emotional domestic violence interacted with decision-making autonomy variables increased the confidence that the interaction was not spurious. Along with the number of analyses done, this study is limited by being cross-sectional in nature and is unable to show causalility or directionality. Furthermore, because this was a secondary data analysis, survey questions were not designed to answer this study's aims and some important information was lacking. Particularly, although breastfeeding duration was measured, the survey questions did not provide information on whether breastfeeding was exclusive. Additionally, some potentially important covariates were not measured, or did not refer to the time period of interest. Along with this, because the data presented here relied on self report of mothers and dealt with some sensitive issues, there is potential for both recall bias, social desirability bias, or possibly other types of cognitive bias. Finally, it is again important to note that some concerns still exist regarding the integrity of the dataset used for these analyses. While there is reason to think results will not change dramatically once these analyses are conducted using a corrected dataset (due to the comparability of some findings from this dataset with the Colombian 2005 DHS final report), these findings must be viewed cautiously until the concerns regarding the dataset are resolved.

Integration and Future Research

In Chapter 1 of this thesis, many points for future research were considered. A few of these points were addressed in the current study—for example, in Chapter 1, it was suggested

that joint decision-making should be measured as a separate type of autonomy rather than intermediate between female-dominant and male-dominant decision-making. In this study, joint decision-making was treated as a separate category and found to be associated with decreased domestic violence and potentially beneficial for child well-being, supporting the recommendation that joint decision-making should be measured as a separate construct. Future research should explore further how shared power in households can affect household dynamics and child care practices. Second, unique outcomes were also explored as recommended in Chapter 1, and overall the analyses supported that freedom from domestic violence and higher decision-making autonomy are associated with improved child feeding practices and lower likelihood of children having anemia, although it is unclear whether these could be mechanisms leading to improved nutritional status of children. Third, a reccommendation was made to explore autonomy further in the Latin American context, and the current analyses provide information regarding the associations of child nutritional outcomes with decision-making variables in Colombia. However, many of the points of future research highlighted in the review remain unaswered and are given further impetus through some of the findings of this study.

The validity of methods of measuring women's autonomy was brought into question in Chapter 1. In previous research, some studies have used factor analysis to measure decision-making autonomy, some studies have employed additive scales, while others measured associations with each autonomy variable separately. When autonomy variables are considered categorical in nature and are analyzed separately, this leads to a large number of predictor variables (one multi-category variable for each measure of autonomy), numerous potential associations, and an increased likelihood of spurious results, which is an important limitation of this study. However, studies that employ factor analysis or additive scales assume that the levels of autonomy variables are ordinal in nature such that women having the final say on decisions is scored as highest autonomy, followed by women making decisions jointly, and then men having the final say on decisions. There is strong evidence that conceptually this is incorrect. Therefore, despite its limitations, measuring autonomy variables separately in the present study allowed a more accurate characterization of the impacts of different types of decision-making autonomy in a conceptually sound manner. As was highlighed in Chapter 1, developing valid methods for scoring women's degree of autonomy is an important direction for future research. This may

involve finding different variables to represent autonomy than the decision-making variables currently used.

Along with a need for valid autonomy measures, this study also adds to the conclusions of Chapter 1 that there is a need for qualitative research to explore how different dimensions of autonomy may have different implications, again pointing to healthcare autonomy as a potential target for further investigation. Additionally, there is a need to understand how autonomy may act differently in different contexts, how it may change over time, and how interventions could be developed to increase autonomy while decreasing domestic violence. Finally, Chapter 1 of this thesis discussed how increasing autonomy may result in increased domestic violence. Results of these analyses support that domestic violence and autonomy are associated and also interact, which should be taken into account in future studies. Additionally, emotional domestic violence in particular is understudied but may have important implications for the health and well-being of women and children and should be a focus for future research. Continued efforts to improve study methods and to further explore the nuanced relationships between autonomy, domestic violence and children's health promise to play an important role in understanding and preventing child malnutrition worldwide.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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Tables and Figures

Table 4. Methods used to identify covariates

Outcome	Search Strategy	Date Conducted	Results	Articles selected
Breastfeeding Duration	(breastfeeding) AND (determinants OR correlate* OR covariate* OR predictor*), limited to reviews, last 10 years, human	12/12/2013	192	1. Whalen B. & Cramton R. (2010) Overcoming barriers to breastfeeding continuation and exclusivity. *Current Opinion in Pediatrics* **22**, 655–663. 2. Tarrant R. C. & Kearney J.M. (2008) Review of breastfeeding practices in Ireland. *Proceedings of the Nutrition Society* **67**, 371–380. 3. Schlickau J.M. & Wilson M.E. (2005) Breastfeeding as health-promoting behaviour for Hispanic women: literature review. *Journal of Advanced Nursing* **52**, 200–210. 4. Spencer B.S. & Grassly J.S. (2013) African American Women and Breastfeeding: An Integrative Literature Review. *Health Care for Women International* **34**, 607-625.
Complementary feeding practices	(complementary feeding OR weaning) AND (determinants OR correlate* OR covariate* OR predictor*), limited to reviews, last 10 years, human	12/17/2013	124	1. Wijndaele K., Lakshman R., Landsbaugh J.R., Ong K.K., & Ogilvie D. (2009) Determinants of early weaning and use of unmodified cow's milk in infants: a systematic review. *Journal of the American Dietetic Association* **109**, 2017-28. 2. Nasreddine L., Zeidan M.N., Naja F., & Hwalla N. (2012) Complementary feeding in the MENA region: practices and challenges. *Nutrition, Metabolism, and Cardiovascular Diseases* **22**,793-798.

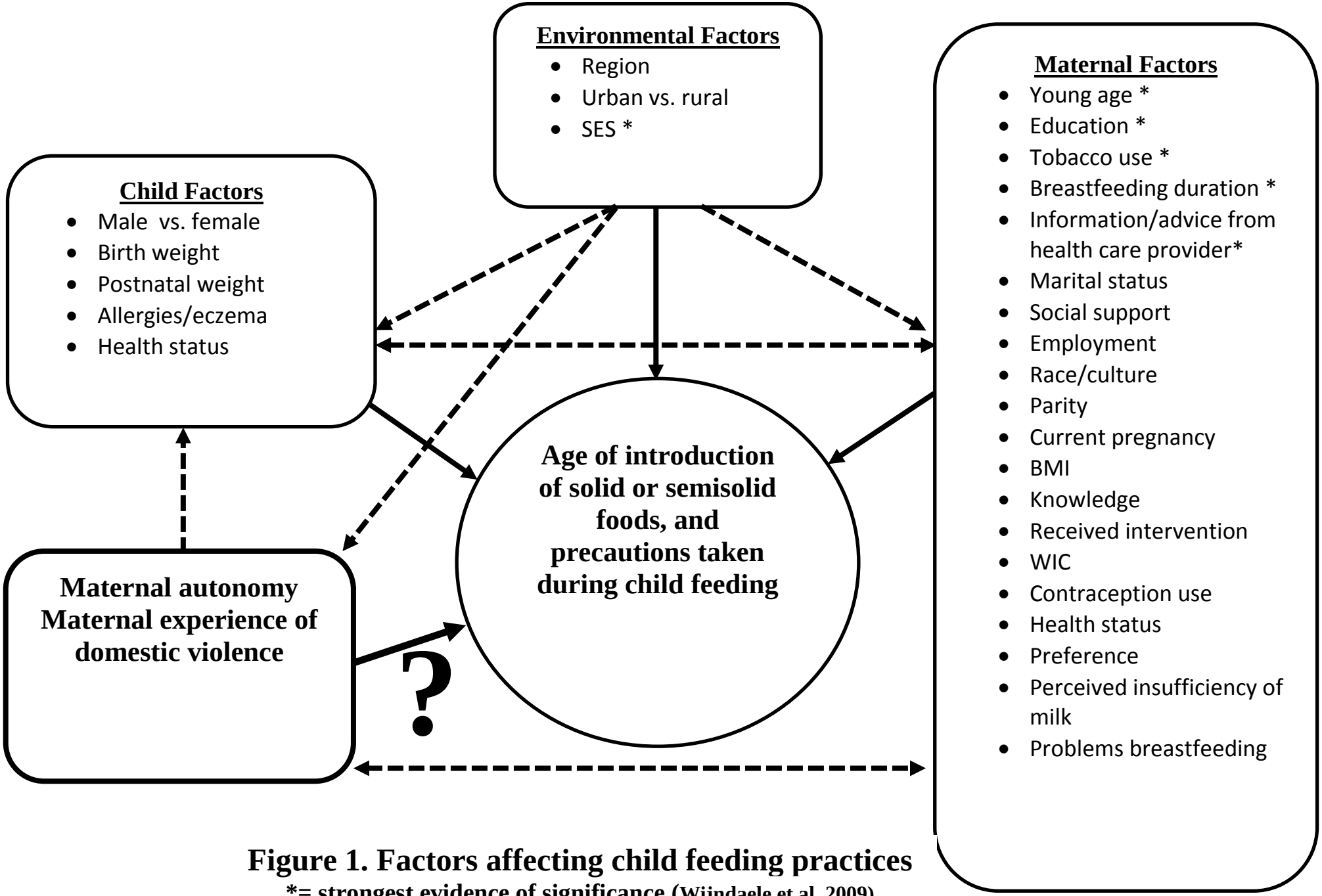


Figure 1. Factors affecting child feeding practices

***= strongest evidence of significance (Wijndaele et al. 2009)**

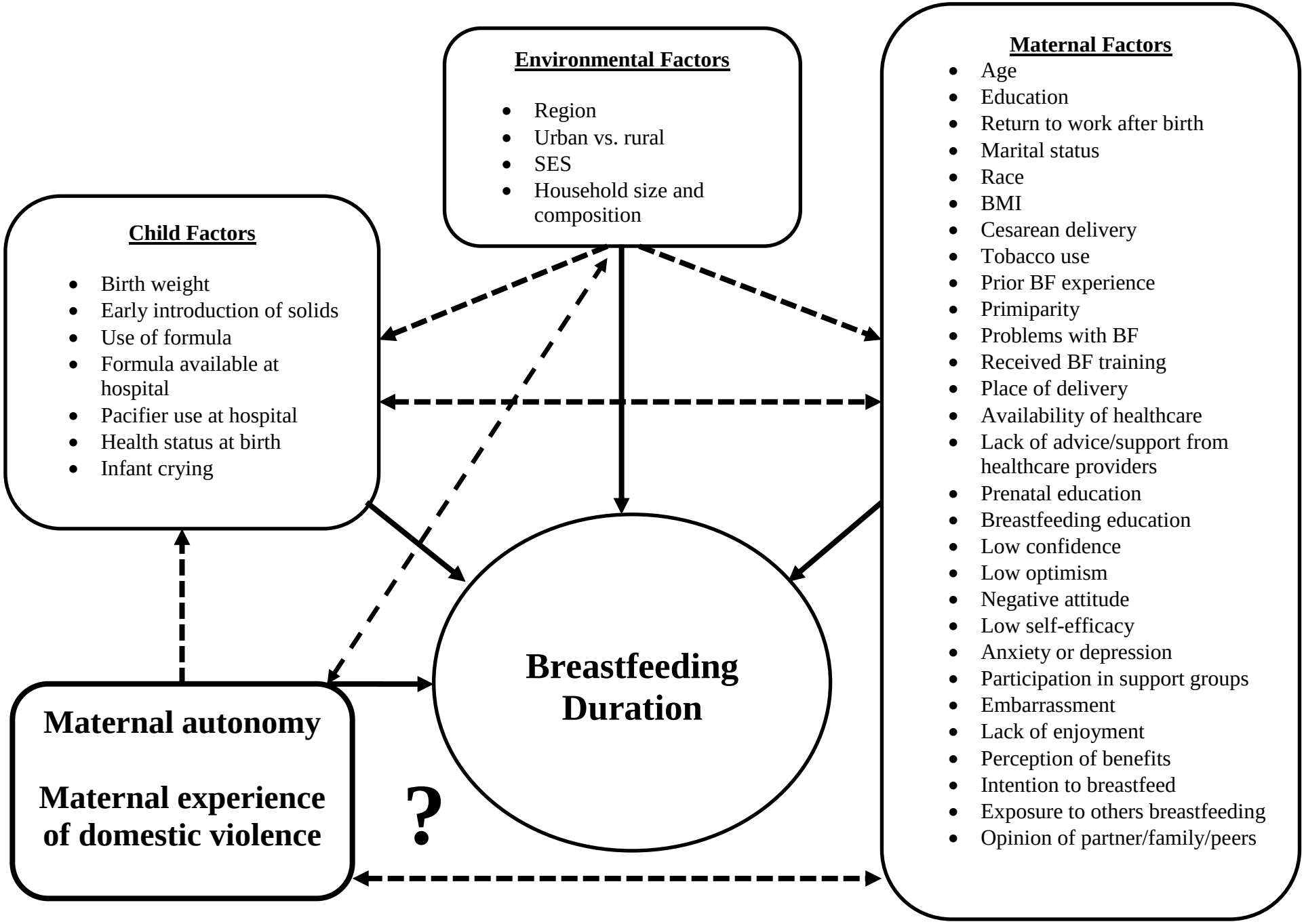


Figure 2. Factors affecting breastfeeding duration

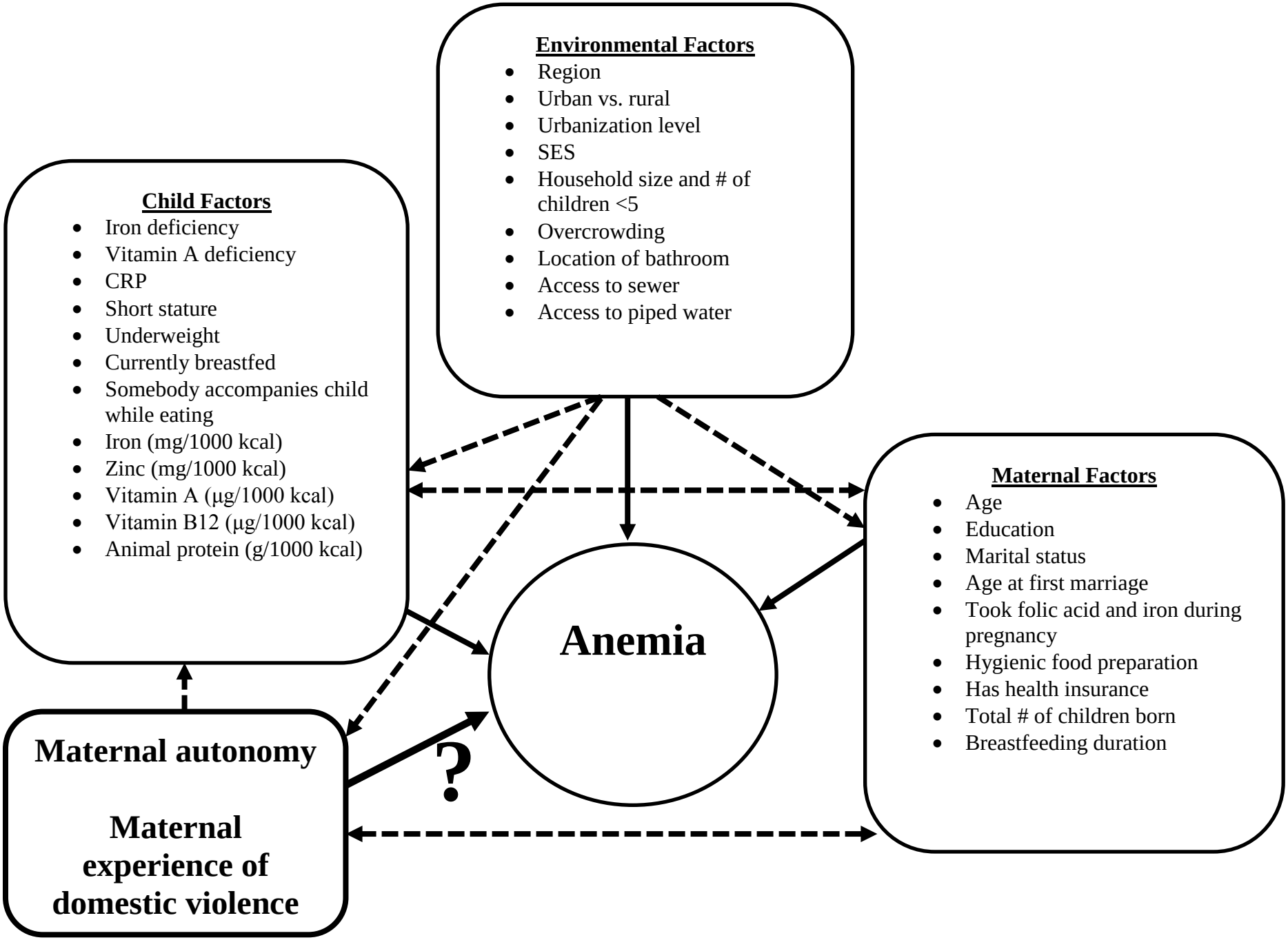


Figure 3. Factors affecting childhood anemia

Table 5: Cronbach's alpha test of decisional autonomy variables

Item—who makes decisions regarding:	Observations	Sign	Item-test correlation	Item-rest correlation	Average interitem covariance	Alpha
Woman's own healthcare	8265	+	0.4894	0.2748	.4249302	0.7201
Large purchases	8239	+	0.7904	0.6301	.2609135	0.5844
Daily purchases	8264	+	0.8168	0.6514	.2361613	0.5682
Visits to family/friends	8051	+	0.5735	0.3640	.3882384	0.6952
Food to cook daily	8243	+	0.7001	0.4311	.3066282	0.6815
Test scale					.3235184	0.7056

Table 6: Frequency tables comparing composite physical domestic violence score (dv) and responses of woman as to whether they experienced specific types of physical domestic violence

Partner ever pushed, shook, or threw something				**Partner ever attacked with knife/gun**			
Physical domestic violence score	**No**	**Yes**	**Total**	**Physical domestic violence score**	**No**	**Yes**	**Total**
0	5,387	0	5,387	**0**	5,387	0	5,387
1	330	567	897	**1**	895	2	897
2	49	1,034	1,083	**2**	1,080	3	1,083
3	12	361	373	**3**	367	6	373
4	4	175	179	**4**	147	32	179
5	3	100	102	**5**	48	55	102
6	1	54	55	**6**	8	47	55
7	0	12	12	**7**	0	12	12
Total:	5786	2303	8,089	**Total:**	7,932	157	8,089

Table 7: Spearman's rank correlations among different types of physical domestic violence experienced by female respondents from partner

	Pushed, shook, or threw something	Slapped or twisted arm	Punched with fist or object	Strangled or burned	Threatened with knife/gun	Attacked with knife gun	Bit
Pushed, shook, or threw something	1.0000						
Slapped or twisted arm	0.6835	1.0000					
Punched with fist or object	0.3579	0.4100	1.0000				
Strangled or burned	0.2762	0.2890	0.3242	1.0000			
Threatened with knife/gun	0.2995	0.3353	0.4296	0.3450	1.0000		
Attacked with knife gun	0.1992	0.2282	0.3592	0.2696	0.5808	1.0000	
Bit	0.1968	0.1980	0.2237	0.2236	0.1786	0.1724	1.0000

Table 8: Cronbach's alpha test for types of physical domestic violence experienced by female respondents from partner

Item	Observations	Sign	Item-test correlation	Item-rest correlation	Average interitem covariance	alpha
Pushed, shook, or threw something	8089	+	0.8115	0.6075	.0154651	0.6712
Slapped or twisted arm	8089	+	0.8284	0.6501	.0150195	0.6490
Punched with fist or object	8089	+	0.6609	0.5227	.022675	0.6873
Strangled or burned	8089	+	0.5296	0.4094	.0263203	0.7152
Threatened with knife/gun	8089	+	0.6174	0.4960	.0243953	0.6983
Attacked with knife gun	8089	+	0.4936	0.4023	.027761	0.7226
Bit	8089	+	0.3845	0.2791	.0289275	0.7353
Test Scale					.0229377	0.7334

Table 9: Spearman's rank correlations between different types of control issues

	Accuses of unfaithfulness	Does not permit to meet girlfriends	Limits contact with family	Insists on knowing where she is	Doesn't trust with money	Ignores	Doesn't count on her/ take into consideration for family reunions	Does not consult for important family decisions
Accuses of unfaithfulness	1.0000							
Does not permit to meet girlfriends	0.4305	1.0000						
Limits contact with family	0.3198	0.4369	1.0000					
Insists on knowing where she is	0.3990	0.4841	0.3678	1.0000				
Doesn't trust with money	0.2568	0.3099	0.2969	0.3525	1.0000			
Ignores	0.3061	0.3103	0.2786	0.3007	0.2895	1.0000		
Doesn't count on her/ take into consideration for family reunions	0.1540	0.1398	0.1687	0.0991	0.1231	0.1930	1.0000	
Does not consult for important family decisions	0.1457	0.1370	0.1696	0.0986	0.1221	0.1818	0.5759	1.0000

Table 10: Cronbach's alpha values for different types of control issues

Item	Observations	Sign	Item-test correlation	Average item-rest correlation	Interitem covariance	alpha
Accuses of unfaithfulness	8089	+	0.6438	0.4859	.041106	0.7088
Does not permit to meet girlfriends	8089	+	0.6917	0.5488	.0392966	0.6959
Limits contact with family	8089	+	0.6174	0.4889	.043769	0.7114
Insists on knowing where she is	8089	+	0.6766	0.5081	.0389343	0.7040
Doesn't trust with money	8089	+	0.5701	0.4161	.0446233	0.7225
Ignores	8089	+	0.6214	0.4383	.041364	0.7195
Doesn't count on her/ take into consideration for family reunions	8089	+	0.4836	0.3135	.0475796	0.7401
Does not consult for important family decisions	8089	+	0.4702	0.3168	.0483808	0.7385
Test scale					.0431317	0.7446

Table 11. Characteristics of respondents included for analysis and differences between the included and excluded samples

Predictors & Whether significantly different from excluded sample	Level	n (unadjusted for population weights)	% ± SE (adjusted for population weights)
SISBEN* **	1	3,162	30.9 ±0.89
	2	3,166	39.0 ± 0.97
	3	1,772	26.6 ± 0.96
	4	177	3.5 ± 0.47
Region**			
	Atlántica	2,451	24.4 ± 0.61
	Oriental	1,191	18.5 ± 0.68
	Central	1,716	22.6 ± 0.70
	Pacífica	1,194	16.7 ± 0.58
	Bogotá	336	16.4 ± 0.73
	National Territories	919	1.40 ± 0.10
Residence* **	Urban	5,796	69.8 ± 1.12
	Rural	2,481	30.2 ± 1.12
Maternal Age* **	≤18	406	4.31 ± 0.29
	19-29	4,571	55.1 ± 0.82
	30-39	2,788	33.9 ± 0.77
	≥40	512	6.72 ± 0.44
Maternal BMI* **	<18.5	350	3.5 ± 0.31
	≥18.5 and <25	4,221	54.2 ± 0.81
	≥25 and <30	2,394	29.9 ± 0.73
	≥30	966	11.4 ± 0.52
Maternal Education* **	No school	299	3.22 ± 0.26
	Primary	2,777	32.3 ± 0.81
	Secondary	4,039	49.8 ± 0.86
	Higher	1,162	14.7 ± 0.66
Breastfeeding duration* **	No breastfeeding	196	2.36 ± 0.23
	0-6 months	1,597	21.8 ± 0.69
	7-12 months	1,451	17.8 ± 0.61
	13-18 months	870	9.89 ± 0.43
	19-24 months	252	7.97 ± 0.40
	>24 months	144	4.56 ± 0.35
	Still breastfeeding	1,071	35.7 ± 0.75
Child age of introduction to	0-3 months	1,154	22.6 ± 0.86

complementary feeding			
	4-6 months	2,765	59.7 ± 1.01
	6-9 months	698	14.6 ± 0.76
	9-12 months	153	2.87 ± 0.32
	>12 months	11	0.21 ± 0.00
Number of precautions taken during food preparation			
	None	843	13.9 ± 0.65
	1	1,535	26.8 ± 0.81
	2	2,199	39.4 ± 0.95
	3	1,083	19.9 ± 0.77
Child Anemia	Yes	904	32.8 ± 0.15
	No	1,656	67.2 ± 0.15

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

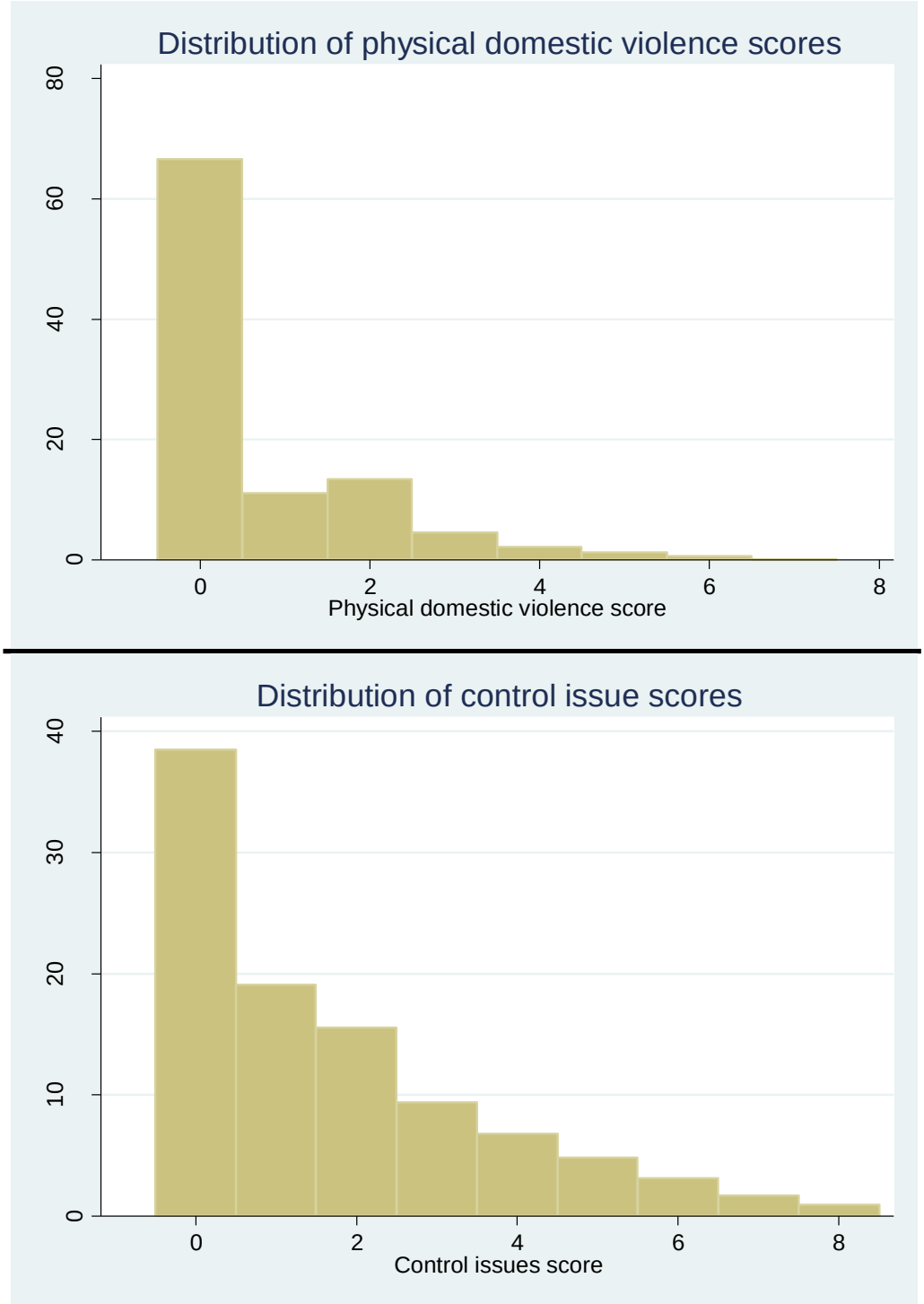
Exclusion criteria: Women are excluded if they are not married or cohabitating with a partner and children are excluded if they are not singleton, last born children or if they are deceased. Differences between included and excluded groups are calculated treating the populations as analyzable samples

Table 12. Summary of sample characteristics for marital status, emotional domestic violence, and decision-making autonomy

Predictor	Level	Included sample **%** ± SE
Marital Status	Married	31.9 ± 0.86
	Living together	68.1 ± 0.86
Decisions on own healthcare	Woman makes final decision	75.8 ± 0.70
	Decision made jointly between woman and partner	13.8 ± 0.54
	Partner makes final decision	8.30 0.40
	Woman makes decision jointly with someone else	0.74 ± 0.12
	Someone else makes decision	1.39 ± 0.16
Decisions on large purchases	Woman makes final decision	21.1 ± 0.66
	Decision made jointly between woman and partner	49.3 ± 0.84
	Partner makes final decision	21.8 ± 0.63
	Woman makes decision jointly with someone else	2.34 ± 0.23
	Someone else makes decision	5.39 ± 0.34
Decisions on daily purchases	Woman makes final decision	41.8 ± 0.82
	Decision made jointly between woman and partner	35.0 ± 0.78
	Partner makes final decision	15.0 ± 0.55
	Woman makes decision jointly with someone else	2.68 ± 0.25
	Someone else makes decision	5.47 ± 0.33
Decisions on social visits	Woman makes final decision	29.8 ± 0.73
	Decision made jointly between woman and partner	53.8 ± 0.82
	Partner makes final decision	11.1 ± 0.48
	Woman makes decision jointly with someone else	3.32 ± 0.29
	Someone else makes	1.97 ± 0.27

	decision	
Decisions on food cooked daily	Woman makes final decision	71.6 ± 0.73
	Decision made jointly between woman and partner	12.7 ± 0.52
	Partner makes final decision	3.15 ± 0.26
	Woman makes decision jointly with someone else	5.42 ± 0.35
	Someone else makes decision	7.14 ± 0.42

Figure 4. Distribution of number of types of physical domestic violence and number of control issues in the sample population



*Distributions are unadjusted for sample weights

Table 13. Associations of types of domestic violence with demographic variables and who has the final say on various household decisions

Predictor	Any emotional domestic violence (OR±SE)	Any control issues (OR±SE)	Any physical domestic violence (OR±SE)
SISBEN			
1	Reference	Reference	Reference
2	1.04 ± .09	1.05 ± .08	1.04 ± .08
3	.90± .11	.87 ± .09	.86 ± .09
4	.82 ± .30	.82 ± .20	.78 ± .21
Married vs. living together	1.75 ± .17***	1.37 ± .10***	1.34 ± .11***
Mother's age	.99 ± .01**	1.00 ± .01	1.00 ± .01
Mother's education level			
No Education	Reference	Reference	Reference
Primary	1.22 ± .23	.75 ± .15	1.25 ± .22
Secondary	.94 ± .18	.70 ± .15*	1.28 ± .23
Higher	.65 ± .15*	.78 ± .18	.81 ± .17
Decisions on own healthcare:			
Woman makes final decision	Reference	Reference	Reference
Decision made jointly between woman and partner	.70 ± .08***	.85 ± .08*	.79 ± .08**
Partner makes final decision	.60 ± .09***	.78 ± .10**	.71 ± .09***
Woman makes decision jointly with someone else	.39 ± .20*	.42 ± .16**	.53 ± .21
Someone else makes decision	.97 ± .29	.93 ± .24	.74 ± .22
Decisions on large purchases:			
Woman makes final decision	Reference	Reference	Reference
Decision made jointly between woman and partner	.67 ± .08***	.68 ± .08***	.84 ± .09
Partner makes final decision	.91 ± .12	.95 ± .11	.91 ± .11
Woman makes decision jointly with someone else	.77 ± .26	1.32 ±.41	1.23 ±.35
Someone else makes decision	.71 ± .18	.92 ± .22	1.14 ± .29
Decisions on daily purchases:			
Woman makes final decision	Reference	Reference	Reference
Decision made jointly between woman and partner	1.05 ± .12	.98 ± .10	.95 ± .10
Partner makes final decision	1.17 ± .14	1.13 ± .13	1.04 ± .12
Woman makes decision	.98 ± .30	.74 ± .21	.90 ± .26

jointly with someone else			
Someone else makes decision	1.12 ± .28	.78 ± .19	.72 ± .18
Decisions on social visits:			
Woman makes final decision	Reference	Reference	Reference
Decision made jointly between woman and partner	.65 ± .06***	.78 ± .07***	.80 ± .07***
Partner makes final decision	1.14 ± .14	1.08 ± .14	1.29 ±.15**
Woman makes decision jointly with someone else	.87 ± .21	.93 ± .19	.73 ± .15
Someone else makes decision	.77 ± .30	1.63 ± .47*	1.05 ± .35
Decisions on food cooked daily:			
Woman makes final decision	Reference	Reference	Reference
Decision made jointly between woman and partner	1.10 ± .14	1.05 ±.11	.90 ± .10
Partner makes final decision	1.77 ± .34***	1.29 ± .29	1.29 ± .24
Woman makes decision jointly with someone else	.88 ± .19	.92 ± .15	.59 ± .12***
Someone else makes decision	1.16 ± .22	1.14 ± .19	.93 ± .16

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 14. Unadjusted associations between potential covariates and complementary feeding outcomes

Predictor	Child age (in months) at introduction to complementary foods (β±SE)	Whether complementary foods were introduced between 4-6 months of age (OR±SE)	0-1 versus 2-3 hygienic precautions taken during child feeding (OR±SE)
Region:			
Atlántica	Reference	Reference	Reference
Oriental	.82 ± .12***	1.41 ± .16***	.76 ± .08***
Central	.46 ± .11***	1.06 ± .11	1.13 ± .11
Pacífica	1.00 ± .12***	1.37 ± .16***	.73 ± .08 ***
Bogotá	.91 ± .17***	1.16 ± .19	.96 ± .14
National Territories	.83 ± .16***	1.27 ± .18*	.93 ± .14
Urban vs. Rural	.04 ± .09***	.76 ± .06***	.70 ± .06***
SISBEN:			
1	Reference	Reference	Reference
2	.33 ± .10***	1.20 ± .11**	1.30 ± .11***
3	.17 ± .11	1.82 ± .20***	1.84 ± .19***
4	.73 ± .18***	5.47 ± 1.86***	3.31 ± .99***
Child sex (reference = male)	.01 ± .08	.88 ± .07	.94 ± .070
Birth order	-.003 ± .03	.90 ±.02***	.92 ± .02***
Birth weight	-.03 ± .08	1.02 ± .08	.92 ± .075
Maternal age	.01 ± .01*	1.01 ± .01	1.01 ± .01**
Maternal education:			
No education	Reference	Reference	Reference
Primary	.28 ± .27	1.16 ± .25	2.39 ± .49***
Secondary	.19 ± .26	1.81 ±.38***	3.17 ± .64***
Higher	.45 ± .27*	2.87 ± .67***	5.72 ± 1.31***
Whether mother smoked cigarettes during pregnancy	-.59 ± .27**	.95 ± .23	.58 ± .13**
Number of antenatal visits	.02 ± .02	1.06 ± .02***	1.08 ± .014***
Current pregnancy	.22 ± .14	1.07 ± .18	1.12 ± .19
Married vs. living together	-.27 ± .09***	.75 ± .07***	.72 ± .062***
Maternal BMI	.02 ± .01*	1.01 ± .01	.99 ± .01
Breastfeeding Duration (months)	.05 ± .01***	1.00 ± .01	.98 ± .01**
Access to piped water (reference= no access)	-	-	1.54 ± .15***

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 15. Unadjusted associations between potential covariates and whether child was breastfed ≥ 12 months

Predictor	Level	Whether breastfeeding was continued ≥12 months (OR±SE)
Region:	Atlántica	Reference
	Oriental	1.02 ± .12
	Central	.65 ± .06***
	Pacífica	1.32 ± .16**
	Bogotá	.67 ± .10***
	National Territories	1.20 ± .151
Urban vs. Rural		1.72 ± .14***
SISBEN:	1	Reference
	2	.71 ± .06***
	3	.49 ± .05***
	4	.21 ± .07***
Number of children in household under 5 years of age		.98 ± .06
Child sex (reference = male)		1.14 ± .09
Birth order		1.13 ± .03***
Birth weight		1.16 ± .09*
Maternal age		1.01 ± .01**
Maternal education:	No education	Reference
	Primary	1.05 ± .22
	Secondary	.77 ± .17
	Higher	.48 ± .11***
Whether mother smoked cigarettes during pregnancy		.79 ± .18
Number of antenatal visits		.96 ± .01***
Married vs. living together		1.01 ± .09
Maternal BMI		1.014 ± .01
Whether delivered by cesarean		.80 ± .07***
Delivery at home vs. hospital/clinic/other		.49 ± .06***

Early introduction to solids (before 4 months)	.67 ± .09***
Whether visited doctor in last year	.66 ± .07***
Whether has health insurance	.91 ± .08
Whether received breastfeeding training	1.05 ± .09

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 16. Unadjusted associations between potential covariates and likelihood of children having anemia

Predictors	Level	Whether child has anemia (OR±SE)
Region:	Atlántica	reference
	Oriental	.28 ± .05***
	Central	.32 ± .05***
	Pacífica	.49 ± .09***
	Bogotá	.62 ± .16**
	National Territories	.57 ± .10***
Urban vs. Rural		1.34 ± .19**
Urbanization level		1.10 ± .07
SISBEN:	1	reference
	2	.51 ± .07***
	3	.41 ± .07***
	4	.43 ± .28
Number of children in household under 5 years of age		1.63 ± .14***
Number of members in the household		1.11 ± .03***
Maternal age at marriage		.95 ± .01***
Maternal age		.97± .01***
Maternal education:	No education	reference
	Primary	.64 ± .22
	Secondary	.55 ± .19*
	Higher	.42 ± .16**
Total number children ever born to mother		1.10 ± .04***
Whether child is currently breastfed		2.32 ± .34***
Married vs. living together		1.71 ± .22***
Whether household has piped water		.55 ± .09***
Whether household has a toilet		.36 ± .07***
Whether household is connected to a sewer		.55 ± .08***
Whether child's CRP was elevated		1.59 ± .43*
Child age		.95 ± .01***
Whether has health insurance		.65 ± .08***

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 17. Unadjusted associations between predictors and complementary feeding outcomes

Predictor	Decision-making	Child age (in months) at introduction to complementary foods (β±SE)	Likelihood that complementary foods were introduced between 4-6 months of age (OR±SE)	0-1 versus 2-3 hygienic precautions taken during child feeding (OR±SE)
Physical domestic violence score	-	-.014 ± .04	.94 ± .03*	.94 ± .03*
Emotional domestic violence	-	-.25 ± .10**	.73 ± .07***	1.00 ± .09
Number of control issues	-	.02 ± .02	.95 ± .02**	.95 ± .02**
Decisions on own healthcare	Woman makes final decision	Reference	Reference	Reference
	Decision made jointly between woman and partner	.06 ± .12	.91 ± .10	.80 ± .08**
	Partner makes final decision	-.21 ± .16	.69 ± .09***	.64 ± .08***
	Woman makes decision jointly with someone else	-.16 ± .40	1.29 ± .53	1.05 ± .40
	Someone else makes decision	-.18 ± .37	.65 ± .19	.44 ± .11***
Decisions on large purchases	Woman makes final decision	Reference	Reference	Reference
	Decision made jointly between woman and partner	.15 ± .10	1.02 ± .11	1.00 ± .10
	Partner makes final decision	.15 ± .10	.74 ± .09*	.82 ± .09*
	Woman makes decision jointly with someone else	-.32 ± .26	.96 ± .26	1.02 ± .28
	Someone else makes decision	-.04 ± .16	1.01 ± .18	.73 ± .12
Decisions on daily purchases	Woman makes final decision	Reference	Reference	Reference
	Decision made jointly between woman and partner	.17 ± .09	1.05 ± .10	1.08 ± .10
	Partner makes final decision	.06 ± .14*	.66 ± .08***	.78 ± .08**

	Woman makes decision jointly with someone else	-.13 ± .23	.73 ± .17	1.24 ± .31
	Someone else makes decision	.02 ± .15	1.01 ± .17	.83 ± .12
Decisions on social visits	Woman makes final decision	Reference	Reference	Reference
	Decision made jointly between woman and partner	.08 ± .10	1.26 ± .12**	1.14 ± .10
	Partner makes final decision	-.10 ± .15	.72 ± .09***	.61 ± .08***
	Woman makes decision jointly with someone else	-.35 ± .24	.93 ± .21	1.19 ± .28
	Someone else makes decision	-.16 ± .28	1.68 ± .58	.74 ± .23
Decisions on food cooked daily	Woman makes final decision	Reference	Reference	Reference
	Decision made jointly between woman and partner	-.11 ± .12	1.09 ± .14	1.07 ± .12
	Partner makes final decision	-.02 ± .28	.66 ± .14*	.52 ± .10***
	Woman makes decision jointly with someone else	-.41 ± .16***	1.13 ± .18	.96 ± .13
	Someone else makes decision	-.12 ± .14	1.03 ± .17	.93 ± .13

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 18. Unadjusted associations between predictors and likelihood that children were breastfed ≥ 12 months or have anemia

Predictor		Whether breastfeeding continued ≥ 12 months (OR±SE)	Whether child has anemia (OR±SE)
Number of types of physical domestic violence experienced		1.01 ± .03	.98 ± .05
Emotional domestic violence		.85 ± .08*	1.05 ± .15
Number of control issues		.99 ± .02	.99 ± .03
Decisions on own healthcare:	Woman makes final decision	Reference	Reference
	Decision made jointly between woman and partner	1.36 ± .15***	1.18 ± .19
	Partner makes final decision	1.18 ± .16	.78 ± .15
	Woman makes decision jointly with someone else	.90 ± .39	.72 ± .43
	Someone else makes decision	1.09 ± .34	2.65 ± 1.24**
Decisions on large purchases:	Woman makes final decision	Reference	Reference
	Decision made jointly between woman and partner	.96 ± .10	.80 ± .13
	Partner makes final decision	1.00 ± .12	1.10 ± .20
	Woman makes decision jointly with someone else	.63 ± .16*	1.33 ± .50
	Someone else makes decision	.90 ± .17	1.86 ± .53**
Decisions on daily purchases:	Woman makes final decision	Reference	Reference
	Decision made jointly between woman and partner	1.04 ± .10	.70 ± .10**
	Partner makes final decision	1.12 ± .13	.88 ± .16
	Woman makes decision jointly with someone else	.58 ± .13 **	1.03 ± .33
	Someone else makes decision	1.02 ± .17	1.60 ± .41*
Decisions on social visits:	Woman makes final decision	Reference	Reference
	Decision made jointly between woman and partner	.98 ± .09	1.14 ± .16
	Partner makes final decision	1.21 ± .16	1.31 ± .26
	Woman makes decision jointly with someone else	.69 ± .16	.54 ± .21
	Someone else makes decision	.77 ± .27	1.84 ± .84

Decisions on food cooked daily:	Woman makes final decision	Reference	Reference
	Decision made jointly between woman and partner	.91 ± .11	1.09 ± .19
	Partner makes final decision	1.14 ± .26	1.53 ± .55
	Woman makes decision jointly with someone else	.90 ± .16	1.16 ± .28
	Someone else makes decision	.69 ± .11	1.34 ± .41

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 19. Predictors of child age (in months) at introduction to complementary foods-- Final adjusted model

Predictors	level	(β±SE)	F statistic for categorical variables
Decisions on social visits	Woman makes final decision	reference	$F_{(4, 3059)} = 1.50$
	Decision made jointly between woman and partner	-.05 ± .13	
	Partner makes final decision	.28 ± .19	
	Woman makes decision jointly with someone else	-.19 ± .31	
	Someone else makes decision	-.55 ± .40	
Emotional domestic violence	-	-.25 ± .19	-
Decisions on social visits X emotional domestic violence	Woman makes final decision	reference	$F_{(4, 3059)} = 6.07$***
	Decision made jointly between woman and partner	.24 ± .22	
	Partner makes final decision	-.86 ± .32***	
	Woman makes decision jointly with someone else	-1.24 ± .53**	
	Someone else makes decision	.89 ± .57	
Number of types of physical violence experienced	-	-.004 ± .043	-
Number of control issues	-	.04 ± .03	-
Decisions on own healthcare	Woman makes final decision	reference	$F_{(4, 3059)} = 0.81$
	Decision made jointly between woman and partner	.10 ± .13	-
	Partner makes final decision	-.16 ± .16	-
	Woman makes decision jointly with someone else	.11 ± .39	-
	Someone else makes decision	.42 ± .39	-
Decisions on large purchases	Woman makes final decision	reference	$F_{(4, 3059)} = 0.77$
	Decision made jointly between woman and partner	-.04 ± .13	-
	Partner makes final decision	.03 ± .16	-
	Woman makes decision jointly with someone else	-.58 ± .36	-
	Someone else makes decision	-.06 ± .27	-
Decisions on daily purchases	Woman makes final decision	reference	$F_{(4, 3059)} = 1.13$

	Decision made jointly between woman and partner	.07 ± .12	-
	Partner makes final decision	.10 ± .17	-
	Woman makes decision jointly with someone else	.49 ± .32	-
	Someone else makes decision	.46 ± .24*	
Decisions on food cooked daily	Woman makes final decision	reference	$F_{(4, 3059)} = 1.71$
	Decision made jointly between woman and partner	-.20 ± .12*	
	Partner makes final decision	.16 ± .27	
	Woman makes decision jointly with someone else	-.36 ± .19	
	Someone else makes decision	-.14 ± .18*	
Region:	Atlántica	reference	$F_{(5, 3058)} = 17.26$***
	Oriental	.80 ± .13***	-
	Central	.40 ± .11***	-
	Pacífica	.96 ± .13***	-
	Bogotá	.91 ± .19***	-
	National Territories	.83 ± .17***	-
Urban vs. Rural		.09 ± .10	-
SISBEN:	1	reference	$F_{(3, 3060)} = 3.56$**
	2	.10 ± .11	-
	3	-.15 ± .13	-
	4	.43 ± .23*	-
Maternal age		.01 ± .01	-
Maternal education:	No education	reference	$F_{(3, 3060)} = 1.83$
	Primary	.10 ± .26	-
	Secondary	.05 ± .26	-
	Higher	.33 ± .29	-
Whether mother smoked cigarettes during pregnancy		-.57 ± .29**	-
Married vs. living together		-.16 ± .10*	-
Maternal BMI		.01 ± .01	-

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 20. Predictors of whether food was introduced within an appropriate range (4-6 months)—Final adjusted model

Predictors	level	(β±SE)	F statistic for categorical variables
Number of types of physical violence experienced	-	1.01 ± .04	-
Emotional domestic violence	-	.86 ± .10	-
Number of control issues	-	.99 ± .03	-
Decisions on own healthcare	Woman makes final decision	reference	$F_{(4, 3075)}$= 0.31
	Decision made jointly between woman and partner	.95 ± .11	
	Partner makes final decision	1.01 ± .17	
	Woman makes decision jointly with someone else	1.28 ± .52	
	Someone else makes decision	.76± .27	
Decisions on large purchases	Woman makes final decision	reference	$F_{(4, 3075)}$= 0.75
	Decision made jointly between woman and partner	.86 ± .11	
	Partner makes final decision	.88 ± .12	
	Woman makes decision jointly with someone else	1.24 ± .48	
	Someone else makes decision	1.23 ± .35	
Decisions on daily purchases	Woman makes final decision	reference	$F_{(4, 3075)}$=1.13
	Decision made jointly between woman and partner	1.06 ± .12	
	Partner makes final decision	.91 ± .13	
	Woman makes decision jointly with someone else	.52 ± .18*	
	Someone else makes decision	.89 ± .25	
Decisions on social visits	Woman makes final decision	reference	$F_{(4, 3075)}$= 1.38
	Decision made jointly between woman and partner	1.18 ± .13	
	Partner makes final decision	.94 ± .13	
	Woman makes decision jointly with someone else	.92 ± .22	
	Someone else makes decision	1.66 ± .67	
Decisions on food cooked daily	Woman makes final decision	reference	$F_{(4, 3075)}$= 0.21

	Decision made jointly between woman and partner	.95 ± .13	
	Partner makes final decision	.95 ± .23	
	Woman makes decision jointly with someone else	1.15 ± .24	
	Someone else makes decision	.95 ± .19	
Region:	Atlántica	reference	$F_{(5, 3074)}$ =1.91*
	Oriental	1.42 ± .18***	
	Central	1.05 ± .12	
	Pacífica	1.22 ± .14	
	Bogotá	1.07 ± .18	
	National Territories	1.20 ± .19	
Urban vs. Rural		1.04 ± .10	
SISBEN:	1	reference	$F_{(3, 3076)}$ = 4.68***
	2	.94 ± .10	
	3	1.23 ± .17	
	4	3.08 ± 1.11***	
Maternal age		1.00± .01	
Maternal education:	No education	reference	$F_{(3, 3076)}$ = 5.49***
	Primary	1.06 ± .240	-
	Secondary	1.53 ± .37*	-
	Higher	1.84 ± .52**	-
Whether mother smoked cigarettes during pregnancy		1.28 ± .36	-
Married vs. living together		.92 ± .091	-
Birth Order		.97 ± .032	-
Number of antenatal visits		1.01 ± .016	

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 21. Predictors of whether 0-1 versus 2-3 hygienic precautions were taken during food preparation-- Final adjusted model

Predictors	level	(OR±SE)	F statistic for categorical variables
Number of types of physical violence experienced	-	.99 ± .04	-
Emotional domestic violence	-	1.25 ± .15*	-
Number of control issues	-	.98 ± .03	-
Decisions on own healthcare	Woman makes final decision	reference	$F_{(4, 3129)} = 1.95$*
	Decision made jointly between woman and partner	.80 ± .09**	-
	Partner makes final decision	.87 ± .13	-
	Woman makes decision jointly with someone else	1.28 ± .52	-
	Someone else makes decision	.60 ± .17*	-
Decisions on large purchases	Woman makes final decision	reference	$F_{(4, 3129)} = 0.93$
	Decision made jointly between woman and partner	.87 ± .11	-
	Partner makes final decision	.97 ± .14	-
	Woman makes decision jointly with someone else	.57 ± .22	-
	Someone else makes decision	.67 ± .19	-
Decisions on daily purchases	Woman makes final decision	reference	$F_{(4, 3129)} = 1.08$
	Decision made jointly between woman and partner	1.14 ± .13	-
	Partner makes final decision	1.14 ± .15	-
	Woman makes decision jointly with someone else	1.93 ± .77	-
	Someone else makes	1.39 ± .38	-

	decision		
Decisions on social visits	Woman makes final decision	reference	$F_{(4, 3129)} = 2.81$**
	Decision made jointly between woman and partner	1.15 ± .12	-
	Partner makes final decision	.74 ± .11**	-
	Woman makes decision jointly with someone else	1.22 ± .29	-
	Someone else makes decision	.94 ± .32	-
Decisions on food cooked daily	Woman makes final decision	reference	$F_{(4, 3129)} = 0.64$
	Decision made jointly between woman and partner	.99 ± .12	-
	Partner makes final decision	.70 ± .16	-
	Woman makes decision jointly with someone else	.94 ± .19	-
	Someone else makes decision	.95 ± .18	
Region:	Atlántica	reference	$F_{(5, 3128)} = 6.74$***
	Oriental	.61 ± .07***	-
	Central	1.01 ± .11	-
	Pacífica	.63 ± .07***	-
	Bogotá	.67 ± .10**	-
	National Territories	.75 ± .13*	-
Urban vs. Rural		.95 ± .10	-
SISBEN:	1	reference	$F_{(3, 3130)} = 2.61$**
	2	1.10 ± .11	-
	3	1.34 ± .17**	-
	4	1.85 ± .58**	-
Maternal age		1.02 ± .01**	-
Maternal education:	No education	Reference	$F_{(3, 3130)} = 5.27$***
	Primary	2.00 ± .46***	-
	Secondary	2.33 ± .55***	-
	Higher	2.90 ± .80***	-

Whether mother smoked cigarettes during pregnancy		.82 ± .21	-
Married vs. living together		.89 ± .09	-
Birth Order		.96 ± .03	-
Number of antenatal visits		1.02 ± .02	-
Access to piped water		1.07 ± .12	-

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 22. Predictors of whether breastfeeding continued ≥ 12 months—Main effects model

Predictors	level	(OR±SE)	F statistic for categorical variables
Number of types of physical violence experienced		1.01 ± .05	-
Emotional domestic violence		.81 ± .11	-
Number of control issues		1.00 ± .03	-
Decisions on own healthcare			$F_{(4, 3088)} = 0.86$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	1.06 ±.16	-
	Partner makes final decision	.72 ± .15	-
	Woman makes decision jointly with someone else	1.47 ± .85	-
	Someone else makes decision	1.12 ± .56	-
Decisions on large purchases			$F_{(4, 3088)} = 0.16$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	.88 ± .15	-
	Partner makes final decision	.90± .16	-
	Woman makes decision jointly with someone else	.99 ± .43	-
	Someone else makes decision	1.02± .44	-
Decisions on daily purchases			$F_{(4, 3088)} = 0.60$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	1.00 ± .14	-
	Partner makes final decision	.93 ± .17	-
	Woman makes decision jointly with someone else	.59 ± .25	-
	Someone else makes decision	1.10 ± .41	-
Decisions on social visits			$F_{(4, 3088)} = 1.01$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	1.04 ± .14	-
	Partner makes final decision	1.06 ± .21	-
	Woman makes decision jointly with	.64 ± .20	-

	someone else		
	Someone else makes decision	.49 ± .26	-
Decisions on food cooked daily			$F_{(4, 3088)} = 0.77$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	1.06 ± .16	-
	Partner makes final decision	1.11 ± .37	-
	Woman makes decision jointly with someone else	1.53 ± .43	-
	Someone else makes decision	.92 ± .22	-
Region:	Atlántica	reference	$F_{(5, 3087)} = 5.82$***
	Oriental	1.15 ± .16	-
	Central	.74 ± .10**	-
	Pacífica	1.53 ± .22***	-
	Bogotá	1.04 ± .19	-
	National Territories	1.44 ± .24**	-
Urban vs. rural residence		1.46 ± .17***	-
SISBEN:	1	reference	$F_{(3, 3089)} = 1.47$
	2	.76 ± .09**	-
	3	.59 ± .09***	-
	4	.20± .08***	-
Maternal age		1.02 ± .01**	-
Maternal education:	No education	reference	$F_{(3, 3089)} = 8.07$***
	Primary	1.29 ± .47	-
	Secondary	1.31 ± .49	-
	Higher	.97 ± .39	-
Birth weight		1.20 ± .10**	-
Birth order		1.00 ± .05	-
Number of antenatal visits		.99 ± .02	-
Delivery at home vs. hospital/clinic/other		.86 ± .21	-
Whether mother delivered by cesarean		.98 ± .11	-
Whether visited doctor within the past year		.79 ± .11	-

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 23. Predictors of whether breastfeeding continued ≥ 12 months—Final adjusted model

Predictors	level	(OR±SE)	F statistic for categorical variables
Emotional domestic violence		.61 ± .12**	-
Decisions on own healthcare			$F_{(4, 3088)} = 0.54$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	1.03 ± .17	-
	Partner makes final decision	.91 ± .22	-
	Woman makes decision jointly with someone else	2.29 ± 1.42	-
	Someone else makes decision	.85 ± .53	-
Decisions on woman's own healthcare X emotional domestic violence			$F_{(3, 3089)} = 2.23$*
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	1.43 ± .55	-
	Partner makes final decision	.37 ± .17**	-
	Woman makes decision jointly with someone else	dropped—predicts outcome perfectly	-
	Someone else makes decision	2.20 ± 2.17	-
Decisions on daily purchases			$F_{(4, 3088)} = 0.17$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	1.00 ± .15	-
	Partner makes final decision	1.01 ± .22	-
	Woman makes decision jointly with someone else	.72 ± .32	-
	Someone else makes decision	1.03 ± .41	-
Number of types of physical violence experienced		1.12 ± .08	-
Decisions on daily purchases X emotional domestic violence			$F_{(4, 3088)} = 1.78$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	2.19 ± .68**	-
	Partner makes final decision	1.57 ± .58	-
	Woman makes decision jointly with someone else	.74 ± .88	-
	Someone else makes decision	.91 ± .60	-

Decisions on daily purchases X physical domestic violence score			$F_{(4,\ 3088)} = 2.22^{*}$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	.81 ± .09*	-
	Partner makes final decision	.79 ± .09 **	-
	Woman makes decision jointly with someone else	.52 ± .23	-
	Someone else makes decision	1.13 ± .23	-
Number of control issues		1.00 ± .03	-
Decisions on large purchases			$F_{(\ 4,\ 3088)} = 0.21$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	.89 ± .15	-
	Partner makes final decision	.89 ± .16	-
	Woman makes decision jointly with someone else	1.01 ± .45	-
	Someone else makes decision	1.16 ± .50	-
Decisions on social visits			$F_{(\ 4,\ 3088)} = 1.21$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	1.01 ± .13	-
	Partner makes final decision	1.11 ± .23	-
	Woman makes decision jointly with someone else	.60 ± .19	-
	Someone else makes decision	.48 ± .25	-
Decisions on food cooked daily	Woman makes final decision	reference	$F_{(\ 4,\ 3088)} = 0.89$
	Decision made jointly between woman and partner	1.07 ± .16	-
	Partner makes final decision	1.20 ± .42	-
	Woman makes decision jointly with someone else	1.54 ± .43	-
	Someone else makes decision	.89 ± .21	-
Region:	Atlántica	reference	$F_{(\ 5,\ 3087)} = 5.97^{***}$
	Oriental	1.16 ± .17	-
	Central	.75 ± .10**	-
	Pacífica	1.56 ± .22***	-
	Bogotá	1.06 ± .20	-
	National Territories	1.52 ± .27**	-
Urban vs. rural residence		1.46 ± .17***	-
SISBEN:	1	reference	$F_{(3,\ 3089)} = 8.76^{***}$
	2	.75 ± .09**	-
	3	.58 ± .09***	-

	4	.20 ± .07***	-
Maternal age		1.02 ± .01**	-
Maternal education:	No education	reference	$F_{(3, 3089)} = 1.27$
	Primary	1.21 ± .45	-
	Secondary	1.24 ± .46	-
	Higher	.93 ± .37	-
Birth weight		1.21 ± .10**	-
Birth order		1.00 ± .05	-
Number of antenatal visits		.99 ± .02	-
Delivery at home vs. hospital/clinic/other		.85 ± .21	-
Whether mother delivered by cesarean		1.00 ± .11	-
Whether visited doctor within the past year		.80 ± .11	-

***p≤ 0.10 **p≤ 0.05 ***p≤ 0.001**

Table 24. Predictors of likelihood that children have anemia—Final adjusted model

Predictors	level	(OR±SE)	F statistic for categorical variables
Decisions on own healthcare			$F_{(4,\ 2773)} = 4.12$***
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	.74 ± .21	-
	Partner makes final decision	.32 ± .10***	-
	Woman makes decision jointly with someone else	.23 ± .21	-
	Someone else makes decision	1.00 ± 1.08	-
Emotional domestic violence		.73 ± .19	-
Decisions on woman's own healthcare X emotional domestic violence			$F_{(3,\ 2773)} = 2.44$*
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	4.09 ± 2.33**	-
	Partner makes final decision	.75 ± .49	-
	Woman makes decision jointly with someone else	1 (empty)	-
	Someone else makes decision	.48 ± .74	-
Decisions on food cooked daily			$F_{(3,\ 2773)} = 0.57$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	1.33 ± .36	-
	Partner makes final decision	.73 ± .77	-
	Woman makes decision jointly with someone else	.86 ± .39	-
	Someone else makes decision	1.65 ± .96	-
Decisions on food cooked daily X emotional domestic violence			$F_{(4,\ 2773)} = 3.74$***
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	.40 ± .21*	-
	Partner makes final decision	6.81 ± 8.53	-
	Woman makes decision jointly with someone else	.56 ± .41	-
	Someone else makes decision	.13 ±.11**	-
Number of control issues		.97 ± .05	-

Physical domestic violence score		.97 ± .07	
Decisions on large purchases			$F_{(4,\ 2773)} = 0.30$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	.97 ±.25	-
	Partner makes final decision	1.02 ± .27	-
	Woman makes decision jointly with someone else	2.05 ± 1.58	-
	Someone else makes decision	1.78 ±1.46	-
Decisions on daily purchases			$F_{(4,\ 2773)} = 1.60$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	.56 ± .13**	-
	Partner makes final decision	.80 ± .21	-
	Woman makes decision jointly with someone else	.95 ± .58	-
	Someone else makes decision	.65 ± .56	-
Decisions on social visits			$F_{(4,\ 2773)} = 1.35$
	Woman makes final decision	reference	
	Decision made jointly between woman and partner	1.32 ± .27	-
	Partner makes final decision	1.06 ± .31	-
	Woman makes decision jointly with someone else	.30 ± .21*	-
	Someone else makes decision	.81 ± .55	-
Region:			$F_{(5,\ 2772)} = 7.88$***
	Atlántica	reference	
	Oriental	.26 ± .07***	-
	Central	.37 ± .09***	-
	Pacífica	.70 ± .17	-
	Bogotá	.88 ±.30	-
	National Territories	.44 ± .11***	-
Urban vs. Rural residence		.66 ± .15*	
Number of members in the household		1.08 ± .05*	
Number of children under 5		1.01 ± .15	
Whether household has access to sewer		.70 ±.16	
Whether household has		1.33 ± .34	

access to piped water			
Whether or not household has a toilet		.52 ±.16**	
Whether has health insurance		.79 ± .13	
SISBEN:	1	reference	$F_{(3,\ 2774)} = 1.90$
	2	.68 ± .13**	-
	3	.94 ± .24	-
	4	1.46 ± .82	-
Maternal age		.96 ± .02**	-
Maternal education:	No education	Reference	$F_{(\ 3,\ 2774)} = 0.85$
	Primary	1.51 ± .67	-
	Secondary	1.26 ± .59	-
	Higher	.94 ± .51	-
Total number children mother has:		1.14 ± .08*	
Whether mother is currently breastfeeding:		1.51 ± .32*	
Child age		.96 ± .01***	
Married vs. Living together		1.18 ± .22	-
Whether CRP is elevated		1.76 ± .54*	-