

## **The Women's Empowerment in Nutrition Index**

**Sudha Narayanan, Erin Lentz, Marzia Fontana, Anuradha De, and Bharati Kulkarni**



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## **Abstract**

*Rural women face many obstacles that thwart their well-being. Policies that seek to empower them, for example, by improving livelihood opportunities, often do not translate into improvements in other areas, notably in their nutritional status. Indeed, many existing measures of women's empowerment have ambiguous associations with indicators of nutritional status. This is likely because existing operationalizations of empowerment often focus on aspects that are somewhat distal from factors that influence nutrition. In this paper, we present an index that aims to measure women's empowerment in the realm of nutrition. We define nutritional empowerment as the process by which individuals acquire the capacity to be well fed and healthy, in a context where this capacity was previously denied to them. Our index draws on theory and multi-site formative research from South Asia and captures multiple dimensions of empowerment spanning domains that influence nutritional outcomes. We construct this index using data from two sites in India and validate it by estimating two nutritional outcomes, body mass index (BMI) and anaemia, as a function of the index. We find that our index is significantly associated with these outcomes, indicating that in rural South Asia, the women's empowerment in nutrition index can assist researchers to understand the nutritional status of women and their families.*

**Keywords:** gender, rural, nutrition, South Asia, empowerment

**JEL Code:** J16, D63, I00

# The Women's Empowerment in Nutrition Index<sup>1</sup>

*Sudha Narayanan, Erin Lentz, Marzia Fontana, Anuradha De, and Bharati Kulkarni<sup>2</sup>*

## Abstract

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## **The Women's Empowerment in Nutrition Index**

### **1. Introduction**

Poor rural women's lives are characterized – more so than rural men's – by a multiplicity of tasks and responsibilities. This is a reflection and consequence of “women's work” including both productive and reproductive (care) activities while men's work tends to focus primarily on production (FAO-IFAD-ILO 2010). As noted in a UN World Survey on the Role of Women in Development (UN Women 2014), governments and donors increasingly target women as important agents for promoting sustainable food production, enhancing household food security and protecting the environment. But if projects are designed without due consideration to the interdependencies and conflicts between women's productive and reproductive roles, the norms that govern these roles and the consequences for women's overall work burden, gender inequalities may intensify. Further, even projects leading to empowering experiences in one area of a woman's life (e.g., a greater say in agricultural production decisions or the opportunities to do paid work) do not automatically translate into her greater capacity to make choices and transform power relations in another area of her life (e.g. entitlement to an adequate and nutritious diet).

This potential disjunction is particularly important in the context of current efforts that aim to empower women economically on the one hand and secure their nutritional wellbeing on the other (UN Women, 2018). In fact, studies that measure empowerment in different areas suggest that the linkage between economic empowerment and nutritional wellbeing are complex, particularly in rural contexts (Kennedy, 1994; Kadiyala et al. 2014). For example, recent analyses aiming to establish the relationship between women's empowerment in agriculture (WEAI) and nutrition-related variables (such as per capita calorie availability, dietary diversity and adult BMI) find mixed evidence in both West Africa and South Asia (Malapit and Quisumbing 2014 for Ghana; Sraboni et al. 2014 for Bangladesh; Malapit et al. 2015 for Nepal). Such findings highlight the need for a complementary set of measures and indicators that more explicitly captures the pathways leading to women's empowerment in nutrition. Thus, if improving

nutritional wellbeing and the empowerment of women are both goals, it is crucial not only to identify and address the constraints women face in securing nutrition but also to determine how women can attain better nutritional outcomes through processes that support the expansion of meaningful choice for women (Kabeer 1999).

To this end, we present an index, the Women's Empowerment in Nutrition Index (WENI), that aims to measure empowerment in nutrition. We define nutritional empowerment as the process by which individuals acquire the capacity to be well fed and healthy, in a context where this capacity was previously denied to them (Narayanan et al. 2017). This process entails acquiring knowledge about, and a say over, nutritional and health practices; gaining access to and control over intake of adequate and nutritious food; and being able to draw support from both family and other institutions to secure and maintain an adequate diet and health.

The WENI is a multidimensional index that draws on and brings together two streams of literature – drivers of nutrition and empowerment – and multi-site formative research from rural South Asia. We apply this index to data from two sites in India to understand the role of empowerment in nutritional outcomes – both to assess the extent to which individuals are empowered but also to identify those who are disempowered. The paper demonstrates the use of this index to generate measures of disempowerment at the individual and community levels that help understand obstacles in attaining desirable nutritional status.

Our index differs from other empowerment measures in several conceptual ways. First, it focuses on empowerment in nutrition – an outcome – rather than livelihoods defined around agriculture/livestock (e.g., Alkire et al. 2013; Galie et al. 2018). Second, it is concerned about women's empowerment in nutrition in general, including the nutritional empowerment of rural women whose households are not engaged in agriculture, who belong to landless households, whose families rely on common pool resources, and/ or who rely on remittances. It is common for rural households to pursue pluri-activities

and in many rural communities, links to agriculture are indirect (e.g., coastal, forest and pastoral communities and those who have caste-based occupations). Further, our approach does not assume empowerment in one area (e.g., empowerment relative to production decisions) will translate to another (e.g., nutrition) and recognizes that empowerment is a complex, multifactoral process (Kabeer 1999; Robeyns 2003). We attempt to capture different aspects of empowerment, including agency, resources, and achievements. Many empowerment measures tend to focus on agency, with less emphasis on other aspects (Donald, et al, 2017; Meinzen-Dick, 2018). However, in the context of nutrition, having agency is not enough to guarantee nutritional empowerment. Knowledge and broad institutional resources are necessary for women to achieve their adequate nutritional status. For example, Lentz et al. (under review) find that in rural Odisha, women describe advocating for access to social protection schemes to which they are entitled. These schemes could support nutritional outcomes for themselves and their families. Yet, local authorities remained unresponsive, contributing to women's food and nutritional insecurity and disempowerment.. Our effort is therefore to explicitly incorporate relevant resources as well as norms shaping the terms of access to such resources, (Kabeer 1999; Robeyns 2003; Alkire et al. 2013). Finally, we also shift the focus away from children to women and other household members. Literature on child malnutrition strongly suggests that women's empowerment influences children's nutritional status and that child nutritional status itself is often positively associated with maternal BMI (Pratley 2016). Yet, it is not clear what aspects of women's empowerment matter for women's own nutritional status; or whether men or women (both those in the reproductive age group and those who are not) face different barriers. We hope that the WENI offers a way to address some of these issues.

Our paper is organized in eight sections. In Section 2, we elaborate on the concept of nutritional empowerment. We then discuss the rationale for an index to assess nutritional empowerment and discuss the steps involved in constructing the WENI (Section 3). After a brief description of the survey that forms the basis for our illustration of the WENI (Section 4), we discuss the findings (Section 5). In Section 6, we assess the ability of the WENI to predict nutritional outcomes. We also examine the sensitivity to

alternative assumptions and approaches to measurement to ensure its robustness (Section 7). Section 8 concludes the paper with a discussion on how to and how not to use the WENI and possible future work.

## **2. Conceptualizing nutritional empowerment**

We believe women's nutritional statuses matter in their own right and our index of nutritional empowerment focuses on women themselves, rather than their children.<sup>3</sup> While our effort aims to measure women's empowerment in nutrition (WEN), the concept of nutritional empowerment has been developed more generally for any individual. Our particular interest is to examine revealed gender disparity in nutritional empowerment via comparisons between men and women, or among women of different age groups.

We identify four dimensions of nutritional empowerment. We begin with Naila Kabeer's (1999) dimensions of empowerment: resources, agency, and achievements. We also single out knowledge as distinct fourth dimension. Because we are interested in better tracing the barriers women face to making strategic life choices, we aim to disentangle lack of knowledge about material and social resources and how best to use these versus actual lack of such resources. Within resources, we consider material and social resources as well as the terms and norms that define access to them. We understand agency as including intrinsic, individual and collective agency (Kabeer, 1999). We define achievements as nutritional outcomes. Knowledge, resources and agency constitute the dimensions of empowerment we seek to capture, while achievements are the nutritional outcomes we care about.

We consider three main domains as particularly relevant for nutritional empowerment – food, health, and institutions. These are consistent with the UNICEF approach (1999) to understanding child malnutrition, which is relevant also for adult malnutrition. Our domain of institutions encompasses

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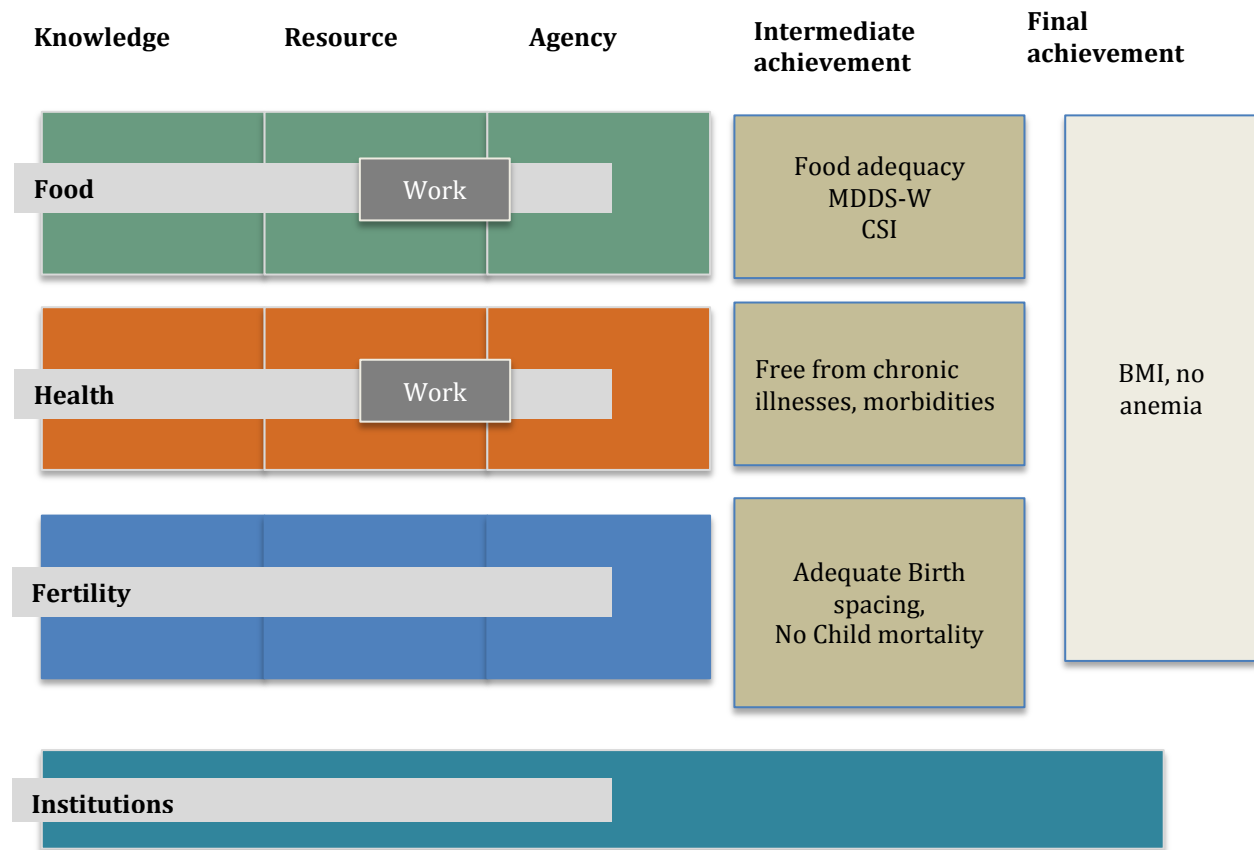
<sup>3</sup> While women might be well fed and healthy without their agency having led to it, for example, where food and other material resources are abundant and easily available, we are especially concerned about situations of scarcity and deprivation. In these situations, a woman's knowledge and capacity to act to secure food might make a difference to her nutritional status, particularly in the face of strong discriminatory gender norms. It therefore matters if nutritional outcomes reflect a meaningful choice or not.

UNICEF's underlying causes; food and health domains capture UNICEF's intermediate causes. We exclude childcare practices, which are less relevant for able-bodied adults. Across each domain, we consider knowledge, resources and agency. We also highlight paid and unpaid work as a crosscutting factor that feeds into both food and health domains. Work provides either direct access to food (as with those engaged in cultivation and animal husbandry) or resources that can help support adequate and quality diets. Work also entails energy expenditure and potential exposure to health hazards. Therefore, quality of work is also a crucial health input, with poor working conditions becoming a “negative” resource. Including paid and unpaid work, rather than focussing on a specific livelihood (e.g., agriculture or livestock) expands the usability of our index, making it relevant for all rural populations rather than those involved in a specific form of work. We introduce another sub-domain, fertility, which is potentially a critical aspect of nutritional empowerment for women of reproductive age (between 15 and 49).. Findings and comparisons regarding the role of fertility in nutritional empowerment are limited to women of reproductive age. We capture the norms and cultural practices that shape food and health domains, such as the order of eating within a household, within those domains,. However, we also include a separate domain of broader institutions, referring to legal rules, legal pluralism, and societal and community norms likely to indirectly influence nutritional empowerment.

The WEN Grid (Figure 1) reflects each of these domains and dimensions and . forms the basis for operationalizing our survey (Table 1). For an individual there are indicators associated with seven domain-dimensions of nutritional empowerment and for women of reproductive age there are ten domain-dimensions. Each D-D can be scored based on the proportion of D-D-specific indicators in which an individual is deemed to be empowered, which yields a nutritional empowerment scorecard for an individual. The scorecard helps identify the D-Ds where there are most obstacles at both individual and community levels. Aggregating these D-D scores into the WEN index provides us with a comprehensive measure to gauge progress of communities with respect to nutritional empowerment.



**Figure 1: The WEN Grid and its domain-dimensions**



### *Why an Index*

Operationalizing a measure of nutritional empowerment that correlates with nutritional status involves two formidable challenges. First, measuring empowerment is far from straightforward (Kabeer 1999; Robeyns 2003; Gates 2014). As Kabeer (1999) has argued, some indicators that are intended to capture empowerment fail to do so. There is also a view that it is not always desirable or easy to quantify what is essentially a complex process. At the same time, a rich tradition of empirical quantitative work has generated as many as 121 unique indicators of empowerment in the context of studying its influence on nutritional outcomes (Pratley 2016). Most of these measures of empowerment are confined to representing aspects for which secondary data are available and do not specifically capture empowerment in the realm of nutrition.

A second challenge is the wide range of factors that collectively influence nutritional status. The effort of identifying precise relationships between empowerment and nutritional outcomes becomes complicated very quickly. In such situations, indices can be valuable tools to understand concepts that are complex and multidimensional. Despite their recognized limitations, notably the loss of detail (Meinzen-Dick 2013), and questions of how to aggregate and weight factors (Alkire and Foster 2011; Alkire et al. 2012), indices remain useful ways to aggregate and communicate findings to initiate policy dialogue and discussion.

Notwithstanding the challenges inherent in measuring empowerment, we believe that the conceptualization of nutritional empowerment itself and the attempt to measure it can (a) clarify our ways of thinking about the socio-economic contexts that shape nutrition outcomes, differently or not, for women and men, (b) serve as a basis or tool for diagnosing the weakest domain/dimensions of nutritional disempowerment via the scorecard and decompositions of the index itself (described later), and (c) (hence) support efforts of policy makers to address critical gaps in order to promote nutritional security and health, specifically of women. In what follows, we describe how to construct the index, identify relevant factors and compute aggregate sample-level indicators of nutritional disempowerment in the community.

### **3. Constructing the Index**

Our approach is to identify indicators to quantify elements for each D-D in the WEN grid (Table 1). We then score each domain-dimension to gauge the fraction of total indicators in which an individual is empowered within the D-D, to obtain a scorecard of nutritional empowerment. This scorecard is the basis for constructing an index but is itself of value to identify D-Ds where an individual is least empowered. We then aggregate these scores into an index. The primary purpose of the WENI is to gauge the extent of empowerment specifically in the domain of nutrition; but the WENI is also constructed to be predictive of nutritional status, and we validate this feature of WENI later. The predictive power of the index is only

true on average, i.e. it isn't true that every individual who is more empowered will also have a higher nutritional status.

To construct the WENI, we draw on literature on the construction of Multidimensional Poverty Indices (MPI) (Alkire et al. 2015). As with the MPI, the central tasks of constructing the WENI involve: (1) defining a set of relevant indicators, (2) defining an empowerment cut-off normatively for each indicator; individuals below that value are disempowered for that indicator (3) creating new binary indicators that assigns individuals above the cutoff a value of 1 (indicating being empowered in that indicator) and assigns a 0 to those below the cutoff, (4) assigning a weight to each new binary indicator, and computing empowerment scores for each D-D, (5) constructing an empowerment index by aggregating across the scores (weighted or not) for each D-D, and (6) setting a threshold for the overall index such that if the person has a score below the threshold, the person is considered nutritionally disempowered.<sup>4</sup> (7) compute the proportion of the sample who are disempowered and the intensity of disempowerment.

Several steps involve normative judgements, especially the choice of weighting systems and the threshold (Alkire et al. 2015). Our thresholds represent aspirational levels but from a policy perspective could be set to pragmatic goals attainable in the short/medium term.

The MPI approach to index construction offers several aspects useful for policymaking and evaluation. First, the MPI approach satisfies subgroup decomposability (Alkire, et al. 2015). In the WENI, subgroup decomposability ensures that the empowerment level in a society is equivalent to the population-weighted sum of subgroup empowerment levels. Further, the MPI approach also allows us to break down the WENI by domain and dimension. This offers a useful policy diagnostic tool to identify

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<sup>4</sup> In the typical MPI, deprivations are counted to identify those that are multidimensionally poor/deprived. In the WENI we count the achievements. While the approach is different they are equivalent in the sense that for MPI the minimum cut-off in the MPI is the threshold of deprivations and in the case of WENI, the threshold we use, represents the maximum achievements so that those below the threshold are regarded as nutritionally disempowered.

disempowerment by dimension and or domain of empowerment. This approach can be combined with the D-D specific scores to examine where an individual, community, or target group fares worst. This use of WEN constituent indicators as a diagnostic comprises the “scorecard approach” and can be applied even without aggregating the scores into the WENI (discussed further in Narayanan et al. 2017). The WENI measures also satisfy dimensional monotonicity. When an individual moves from being disempowered to empowered in particular dimensions or domains, overall empowerment levels on the aggregate increases. This is quite useful for tracking empowerment as a process, especially given that empowerment can occur in different domains at different rates (Kabeer 1999). It would also help uncover the interdependence of the domains and dimensions such that an intervention in one domain-dimension might empower the beneficiary in another domain or dimension.

The index aims to capture enduring changes in nutritional empowerment rather than temporary fluctuations, although it accounts for seasonal variations that can contribute to nutritional empowerment. For example, one potential indicator captures whether paid work opportunities are available throughout the year. If such opportunities for continuous employment emerged and replaced seasonal work, the index would capture this positive change.

### *3.1. Identifying Relevant Indicators*

The first four steps of computing the WEN index include: identifying which indicators are relevant, determining indicator-specific empowerment cutoffs, generating binary indicators from these variables, and aggregating these within the D-D by applying a set of weights.

. The survey we use to illustrate WENI (henceforth the WENI Survey, described below) includes questions on each D-D and on ultimate achievements. Our measures of achievements are haemoglobin levels and BMI, both indicators of nutritional status for adults; other measures may be appropriate in other contexts. Table 1 shows the main themes and several candidate indicators could populate each domain-dimension. For each indicator or theme, our survey included multiple approaches to capturing

the indicator. How one measures each indicator and which questions from a cluster of potential questions best captures a theme could vary by context. For example, to capture norms around eating, we ask questions ascertaining whether the family members eat together. Another alternative is to ask if the individual has the freedom to choose when to eat or to ask how frequently the individual eats last.

Our indicators are thus derived from a cluster of survey questions, each potentially a good construct of the theme we wish to capture. However, we do not prescribe specific questions, which would depend on the context and the sub-population studied. In the selection of questions, there are a few principles useful to consider. We took care to ensure that some indicators are free from gender specificities, so that the question asked is as relevant for men, as it is for women of different age groups. As with any index, it is challenging to use and interpret indicators reflecting processes that may generate multiple effects with opposite signs. For example, doing paid work can facilitate nutritional empowerment as a source of income but can undermine it when it involves disproportionate energy expenditure. We made an attempt to capture all of the different aspects of such variables. Further, several indicators can be measured at either the individual or household level. To reduce the survey burden, several indicators were measured at the household level (i.e., access to toilets, and drinking water), although we acknowledge that measures at the individual level will better capture the drivers of intra-household variation in nutritional empowerment. Other indicators are subjective assessments and as such inherit the problems associated with most subjective measures. For example, rather than an elaborate time-use survey we opted to get the respondent's perception of their leisure time, in order to reduce survey burden. These remain caveats. We note also that it is simpler to construct the index from questions where conflicting or inconsistent responses are less likely; pre-testing survey questions and adequate enumerator training can reduce this issue. For more information on selecting questions to generate the indicators, see the supplementary appendix.

From the rich set of variables collected as part of the WENI Survey, where appropriate, we use the variable as asked while , in other cases, we combine survey questions to generate indicators. We

convert each indicator in each D-D into a binary variable. For binary variables, 1 represents empowerment and 0 represents disempowerment. For continuous and ordered variables (i.e., Likert-scale), higher values indicate greater indicator-level empowerment. For simplicity, we define an indicator-specific threshold of 0.5, for all continuous indicators, such that a person scoring above that value for a specific question is deemed to be empowered (and assigned 1) when transforming these into binary indicators. Policymakers and practitioners with interest in specific indicators may wish to adjust thresholds (Alkire et al. 2015). The complete dataset from the WENI Survey includes 128 indicators derived from 281 variables. When including the fertility domain for WEN women, there are 158 indicators derived from 356 variables. We denote this full set of potential WEN Grid indicators as  $F$ .

One issue common to most indices is that each respondent must have an associated value for each indicator in order to be included in the computation of the index. Yet, as is the case with many indices, some WEN survey questions are not applicable to all respondents. We use normative judgements to code these “Not Applicable” (NA) values as empowering or disempowering to retain these individuals in our index. For example, questions regarding conditions of paid work are applicable to only those who access paid work. For an indicator on energy intensity of work, we code “NA” as empowering because not doing paid work is equivalent to saying that there was no energy expenditure on paid work. This sometimes has the effect of masking significant differences in responses across individuals, and is a limitation of indices more broadly. The score relative to energy expenditure of a woman not doing paid work could be still low (i.e. ‘disempowering’) if her not doing paid work is more than offset by long hours, or intensive, unpaid domestic work” or similar. In the current version we are able to address this in a limited way, treating support for domestic and care work as a positive resource. Table 2 provides values for key indicators, and indicators how NA responses influence such values.

From the full set of potential empowerment indicators,  $F$ , we identify a shorter list of indicators,  $S$ , that feeds into WENI. Within each domain-dimension, we first use factor analysis, a data reduction technique that aims to identify latent factors related to a larger number of variables. The value of factor

analysis is that it helps identify which subset of indicators to include, such that the indicators are not correlated with one another. It also helps select specific formulations and constructs of indicators that “best” represents each D-D. We conduct a factor analysis separately for WENI woman, spouse and mother in law and within each D-D. We choose those variables whose eigenvalues (a measure of total variation accounted for by each factor) are over 2, with factor loadings over 0.4 (Acock, 2011).<sup>5</sup> We call this smaller set of indicators  $S$ ;  $S$  is a subset of  $F$ . As a consistency check, we compute the tetrachoric/polychoric correlations of elements of  $F$  with those variables that were discarded (i.e., that are part of  $F$  but not of  $S$ ) to ensure that the factor analysis did not drop variables that might be uncorrelated with those in  $S$  and might be relevant. In the section on sensitivity analysis and validation, we discuss results using other factor loadings. In each D-D, ten or less indicators met the factor analysis selection criterion. A benefit of having a maximum of ten indicators in each D-D is that it helps to ensure that WENI is parsimonious and tractable.

We then apply a normative lens to the indicators identified through factor analysis, the set  $S$ , to ensure the WENI stays anchored to our conceptualization of nutritional empowerment. This involves grouping some variables, checking for redundancies, and including some indicators that factor analysis might have not captured. One example is water and sanitation. While the factor analysis results suggest that these indicators do not appear relevant in the context of our study, we include them nevertheless to reflect evidence that WASH practices and resources often matter for nutrition in many contexts (Headey et al. 2015). We denote this final subset of indicators as  $I$ .  $I$  is the basis of WENI and contains 40 indicators derived. Including the fertility domain, the total number of indicators is 50. Table 2 lists the specific measures included in  $I$ . The indicators within each D-D in Table 2 represent a substantive theme or aspect of empowerment that might matter for nutrition.

### 3.2. *Identification of disempowerment*

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<sup>5</sup> Costello and Osborne (2015) recommend 0.3.

Having identified the set of relevant indicators, we then compute the score for each D-D. Each score is the ratio of indicators an individual is empowered in to the total number of indicators within that D-D. This set of D-D specific scores allows us to generate a scorecard of nutritional empowerment based on the WEN Grid. The WENI builds on this scorecard using a counting approach. For each D-D we establish thresholds below which people are considered nutritionally disempowered. We set the cut off for each domain-dimension at 0.5. If there are  $n$  indicators representing a domain-dimension, then an individual is considered empowered in that D-D if the individual scores at least  $n/2$  for that D-D.

We then aggregate these D-D-specific empowerment indicators over the 7 domain-dimensions (10 for WENI women of reproductive age). A simple count of the number of domain-dimensions in which an individual is empowered is divided by the total number of domain-dimensions (i.e., 7 or 10) to obtain WENI. In computing the WENI, we assign equal weights to each domain-dimension. We do so because we believe that empowerment involves having knowledge, access to resources and supportive structural conditions as well as agency to act upon the knowledge and utilize the resources, across all the domains. The WENI ranges from 0 to 1. A person who is completely nutritionally disempowered scores 0 and someone who is fully empowered scores 1. The former is disempowered in all 7 (or 10) domain-dimensions and the latter is empowered in all. An individual who is nutritionally empowered is thus empowered in each domain-dimension, which means that (s)he is empowered in at least half the domain-dimension-specific indicators for each domain-dimension.

The implication of first weighting D-D specific indicators equally within the D-D and then aggregating over seven (or ten) D-Ds again with equal weights is that each indicator in D-Ds with fewer indicators get a disproportionately higher weight. For example, if there are three indicators for Food-Knowledge, each indicator is given  $1/3$  weight for the D-D specific score. In the aggregate WENI, each Food-Knowledge indicator gets a weight of  $1/21$  because each of the 7 domain-dimensions get a weight of  $1/7$ . Food-Resource, on the other hand, has 5 indicators, implying that each Food-Resource indicator



would hence get a weight of  $1/35$ . A benefit of this approach is that it ensures that the ranking is not driven overwhelmingly by the number of indicators in each domain-dimensions.

We then use a cut-off of 0.5 on the total nutritional empowerment index. Those with a WENI below 0.5 are considered nutritionally disempowered. For the WENI to be a reliable measure of nutritional empowerment, it should rank individuals similarly whether one uses  $F$ ,  $S$  or  $I$ . In the section on sensitivity, we show that this is the case and the rank order is maintained.

Many indices, such as the WEAI (Alkire et al. 2013), include gender parity as a component of the index. We do not. Gender parity cannot often be reduced to spousal parity in the context of complex family structures and it is challenging in a household survey to capture the disparities between men and women in a meaningful way. We also believe that in resource-constrained settings, where deprivations are pervasive, it is not clear what gender parity implies when both men and the women are deeply - if not equally - deprived. We therefore restrict ourselves to measures of individual empowerment and a comparison of WENI across these two groups is the only sense in which we can capture or understand intra-household disparities.

#### **4. The Survey**

We use a fit-for-purpose survey (henceforth, the WENI survey) that measures the variables represented in each domain-dimension in the WEN Grid. The WENI survey resamples women from 26 villages in Odisha and Bihar who were previously surveyed under the 2014-2016 Systematic for Promoting Appropriate National Dynamism for Agriculture and Nutrition (SPANDAN) project. See the supplementary appendix for more information on sampling. By resampling SPANDAN interviewees, we can draw on SPANDAN's baseline demographic information (e.g., caste and prior fertility information), decreasing the survey burden for our respondents. Women in our sample had at least one child under age seven, and are identified as WENI women. Among households with a husband present, every other husband of WENI women was interviewed. The same sampling procedure was used for households with

mothers-in-law, but in general there were fewer mothers-in-law than husbands. Our sample included 522 WENI women, 290 husbands and 161 mothers in law. We caution that this sample is not representative at administrative levels higher than the village level and is representative only of households with a child below the age of 7 years. We do not report village names to maintain respondent anonymity. Thus, the purpose of the survey is to operationalize and validate the concept of nutritional empowerment.

The survey was conducted in February to April 2018, using two teams of trained enumerators. When possible, interviews with WENI women, mothers-in-law, and spouses were conducted simultaneously and in private, to enable WENI women to speak frankly.<sup>6</sup> The Institutional Review Board of National Institute of Nutrition, India reviewed survey protocols. Enumerators received training on ethical research practices and requesting informed consent. Survey length for the WENI woman was about 75 minutes; for other household members it was about 40 minutes. As compensation for the time the household spent on the survey, we offered a kilogram of cooking oil, valued at Rs. 100.

The survey collected information on each domain-dimension of the WEN index for each respondent in order to compute her or his WEN score. We obtained the weight and height for each interviewee to compute body mass index (BMI); low BMIs in adults indicate undernutrition. We also collected dried blood spot (DBS) samples from the WENI women to test hemoglobin (Hb) levels; low Hb indicates anemia, a micronutrient deficiency. BMI and anemia are the ultimate achievements against which we internally validate the index. Additional details on the survey and on steps taken with respondents with low hemoglobin levels are in the supplementary materials.

Within the sample, we find rates of undernutrition and anemia are consistent with levels in the respective states as per the National Family Health Survey 2015-16 (Table 3). A quarter of our sample was underweight; 65% had mild anemia or worse and 39% had moderate anemia or worse. About 47%

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<sup>6</sup> 56 of 454 WENI women were interviewed in presence of someone. For 68 cases, we do not have this information.

reported that they had been sick the month prior to the survey and 22% suffered from one or more chronic illnesses. There are stark gender differences; on average, women fare worse than men.

## 5. Results

We first use WENI to identify which communities or social categories are nutritionally disempowered overall. We then consider the specific domains and dimensions where individuals are systematically disempowered, decomposing the WENI itself and using the scorecard of the WEN Grid to complement the analysis.

### 5.1 *Who is disempowered?*

We first calculate the prevalence of nutritional disempowerment equivalent to the Headcount Ratio  $H$ .  $H$  is the proportion of those nutritionally disempowered divided by the entire sample. We also compute the intensity of nutritional disempowerment  $In$  for the entire sample, which is the percentage of deprivations suffered by each individual (i.e., the percent of domain-dimensions where an individual is disempowered). We also present these by sub-groups - mothers-in-law, spouses, and WENI women, by state.

In many resource-constrained contexts, some households might be systematically more intensely disempowered than others, which is the depth of disempowerment,  $G$ . From a policy perspective in particular, it is useful to identify how far below the cutoff those who are nutritionally disempowered are.

This is computed as  $G = \frac{\sum_{i \in ND} |c_i - \bar{c}|}{n}$ .

We then generate a set of measures ( $M_\alpha$ ) that sheds light on the nature and extent of nutritional disempowerment for communities. The adjusted headcount ratio ( $M_0$ ) combines the head count and intensity of nutritional disempowerment, computed as  $M_0 = H \times In$ . It allows us to understand how, even with the same headcount ratio, communities might still differ in the intensity of nutritional disempowerment. The adjusted gap ( $M_1$ ), measures the depth of the extent of nutritional disempowerment, which captures how far below the cut off a community is on average. This measure

combines incidence, intensity and depth and is computed as  $M_1 = H \times I_n \times G$ . The higher the value of each of these metrics, the greater the nutritional disempowerment.

Distributions of the Index appear comparable across states (Figure 2) but are significantly different for WENI women, their spouses and mothers-in-law. Overall, as expected, the distribution of the index for male spouses is centred right of that for the WENI women. Mothers-in-law, on average, have lower scores than for either of the other two groups (Figure 2). Stochastic dominance tests show that the distribution of WENI for male spouses first order dominates those of WENI women and their Mothers-in-law.<sup>7</sup> Kolomogorov-Smirnov tests for equality of distributions of WENI too suggest that WENI scores male spouses is statistically significantly different from those for WENI women.

Using the WENI cut-off of 0.5, we find that 66% of individuals in the sample are nutritionally disempowered. A gender-wise comparison suggests a stark difference between men and women (Figure 2 and Figure 3). Both overall and within each state, twice as many women are disempowered compared to men. The gap is larger in Odisha than for Bihar. In Odisha, about 29 percent of male spouses are disempowered, but 79 percent of WEN women are. The rates of nutritionally disempowered mothers-in-law are worse than the rates for WEN women. Among mothers-in-law, 89% in Odisha and 81% in Bihar are nutritionally disempowered, compared with 79% and 75% respectively for the WENI women. In the estimations for WEN women that includes fertility, we also find that differences in the headcount ratio and intensity of nutritional disempowerment between Bihar and Odisha are small.<sup>8</sup>

The difference between genders is starker when one factors in the intensity of disempowerment and the disempowerment gap. Whereas the headcount ratio suggests women are a little more than twice as likely to be disempowered as men, the adjusted headcount ratio that takes into account intensity of disempowerment, suggests that the WEN women are three times as more likely to be disempowered

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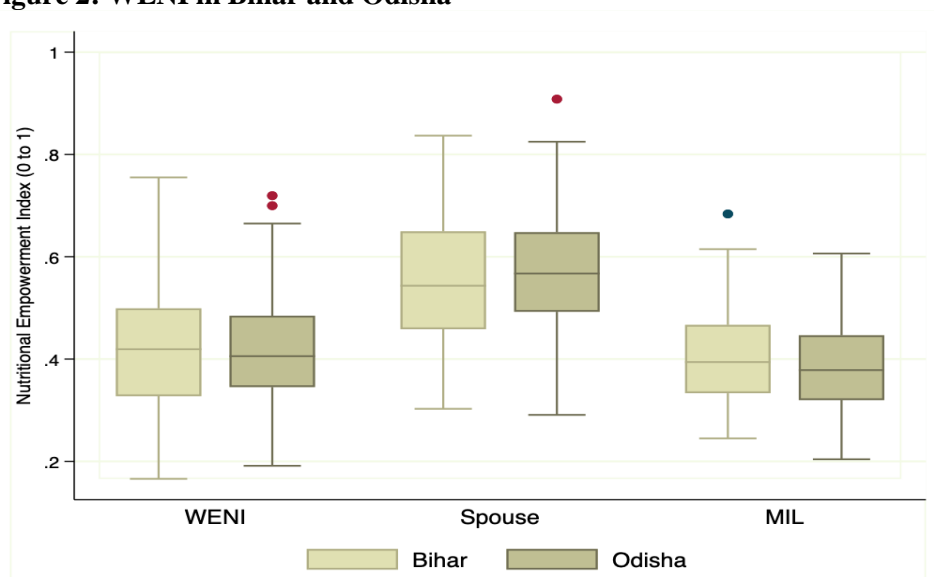
<sup>7</sup> The relationship between WENI women and their mothers-in-law is indeterminate – there is neither first order nor second order dominance.

<sup>8</sup> We note that while the intensity of disempowerment is lower for WENI women when the fertility domain is included compared to results from the pooled approach. However, these scores are not directly comparable because two different sets of indicators were used to generate the scores.

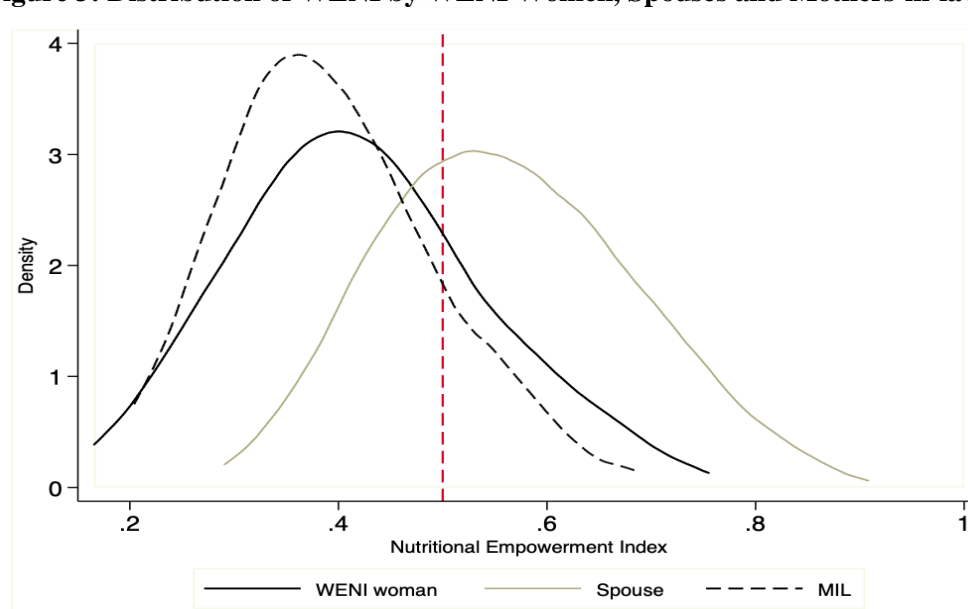
(Table 4). In other words, women are more likely than men not only to face obstacles in more domain-dimensions but also to fall short of D-D specific thresholds. Nutritionally disempowered women thus have a longer distance to “catch-up” than do nutritionally disempowered men.

While many men are more nutritionally empowered than women, they too continue to face obstacles on many domains and dimensions. In some cases, they are far below the threshold. Thus, gender disparity in empowerment prevails in contexts of more general and widespread deprivation.

**Figure 2: WENI in Bihar and Odisha**



**Figure 3: Distribution of WENI by WENI Women, Spouses and Mothers-in-law**



Note: The Kolmogorov-Smirnov statistic for equality of distribution of male spouse vis-à-vis WENI women is 0.4887 and MIL is 0.6148, both statistically significant at the 1% level.

## 5.2 *Which domains and dimensions require policy attention?*

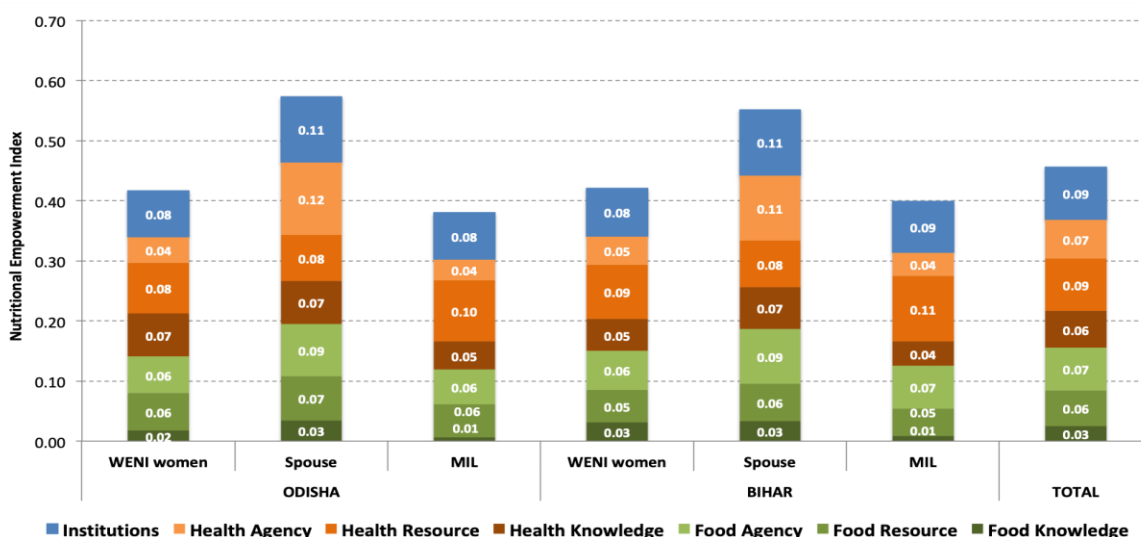
Because of its decomposability, WENI can support identification of where the rates of disempowerment are the highest. The WEN scorecard helps identify which aspects of nutritional empowerment are weakest for which groups and which D-Ds most contribute to average nutritional empowerment scores (Figure 4 and Figure 5). Most of the differences in the nutritional empowerment index between men and WENI women reflect differences in the health agency D-D and institutions domain (Figure 4). Health agency includes indicators such as the ability to go alone to a health center, and the ability to make a decision alone about one's own health (Table 2). The institutions domain includes indicators for freedom of movement, participation in the public sphere, access to information. In almost all of the component indicators in the institutions domain, men fare way better than the either WENI women or mothers-in-law. For example, men are more likely to be in control over their own health decisions and can visit the medical facility alone without having to seek permission (See Table 2).

The two groups of women in our sample also offer interesting contrasts. The difference between WENI women and mothers-in-law comes additionally from the dimension of knowledge, be it food or health. Younger women seem to have more knowledge than their mothers-in-law and perhaps also of agency, notably in the domain of health. Yet, mothers-in-law have greater health resources at their disposal. They are able to get assistance in household chores if they are ill, and they are more likely to be satisfied with the level of assistance they get regarding chores (Figure 4 and Table 5).

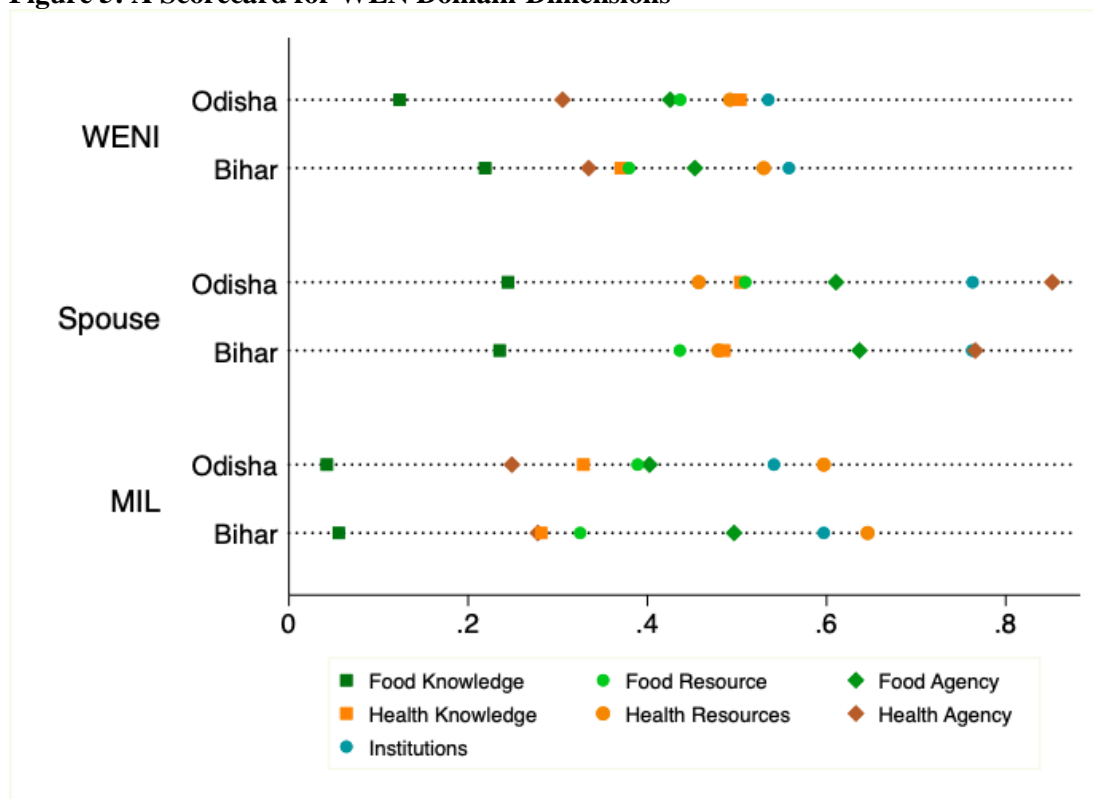
If one wants to understand which domain-dimensions are weak and are the obstacles to better nutritional empowerment, the scorecard is useful (Figure 4; Table 5). The low mean empowerment scores for the knowledge dimensions suggest that knowledge may be a particular barrier to nutritional empowerment. Across states and groups surveyed, the scores are fairly low, particularly for mothers-in-law. Regarding work, we find that men do substantially more paid work and disproportionately report poorer working conditions and backbreaking work. Women in contrast report more domestic and care

work and getting less support in undertaking such work (Table 2). For program evaluation purposes, baseline and endline WEN scores could show how changes in specific indicators or specific dimension-domains influence nutritional empowerment.

**Figure 4: Contribution of Each Domain-Dimensions to the Nutritional Empowerment Index**



**Figure 5: A Scorecard for WEN Domain-Dimensions**



## 6. Validation

We now examine the WENI's prediction of nutritional outcomes. While we care about nutritional empowerment in its own right, we also care about nutritional achievements. Given the indicators' normative basis for inclusion, not all will necessarily have a predictive relationship with nutritional achievements. Thus, we aim to ensure that the indicators,  $I$ , that constitute WENI are collectively able to explain a significant proportion of the variability in BMI and anemia.

Figure 6 graphs WENI against BMI; WENI is positively correlated with BMI for the entire sample and for most subgroups, suggesting that higher nutritional empowerment is plausibly associated with better BMI.<sup>9</sup> A similar pattern is apparent for haemoglobin levels (Figure 7). Table 6 presents results for t-tests of equality of mean nutritional outcomes and of equality of proportions with adequate nutritional status by empowerment status. In both cases, we reject the null of no difference. As a more robust approach, we estimate a series of regression equations to evaluate the extent of variation in BMI or haemoglobin levels that the WENI explains. We estimate the following linear models:

$$BMI_i = \alpha_0 + \beta_0 WENI_i + \varepsilon_i$$

$$Hb_i = \gamma_0 + \delta_0 WENI_i + \varepsilon_i$$

$$Pr(BMI \geq 25)_i = \alpha_1 + \beta_1 WENI_i + \varepsilon_i$$

$$Pr(Hb \geq \text{group-specific WHO threshold}^{10})_i = \gamma_1 + \delta_1 WENI_i + \varepsilon_i$$

Our outcome variables are the continuous (and binary) nutritional outcome measures of BMI and haemoglobin levels for individual  $i$ . We estimate least squares models for both, i.e. linear probability models for the binary outcome variables, with robust standard errors (Table 7). We note that BMI should

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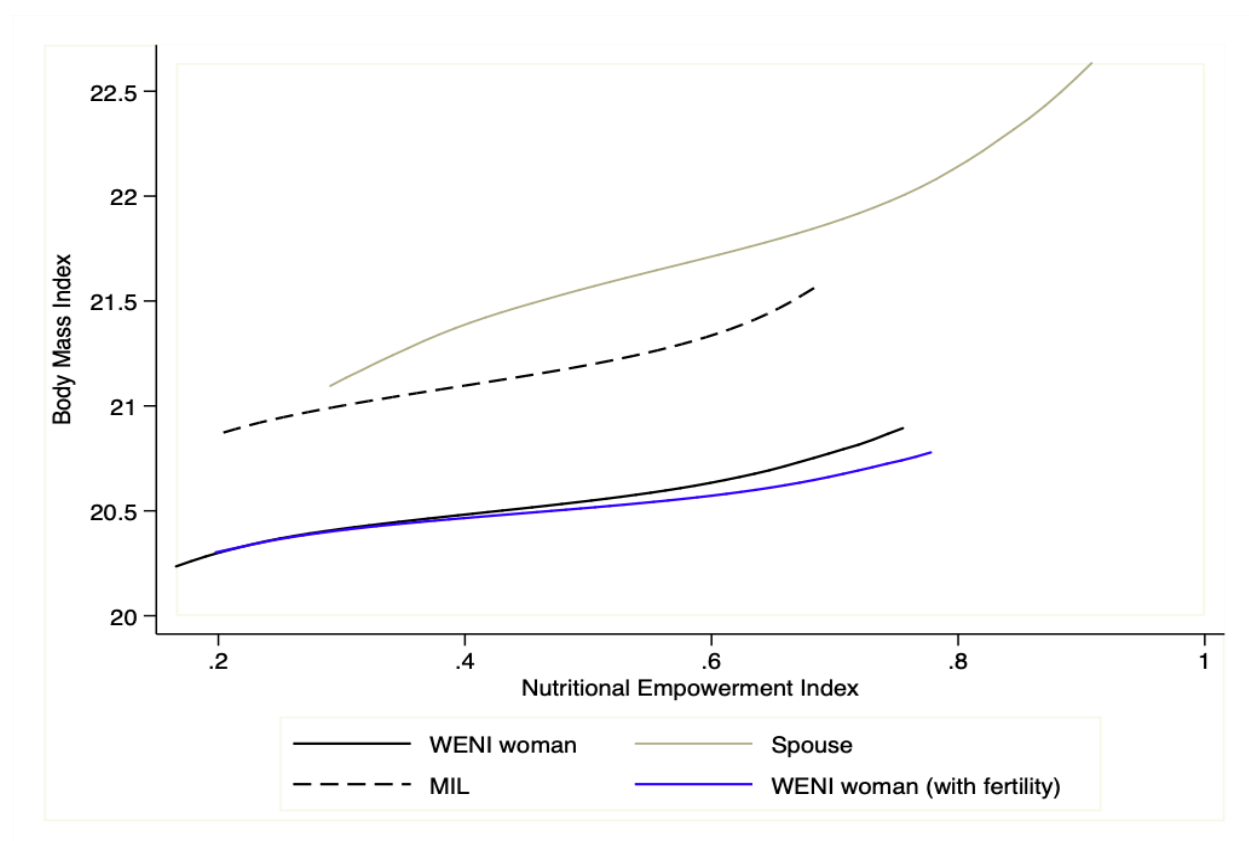
<sup>9</sup> Since the sub-groups are fairly small, the results at the sub-group level needs to be interpreted with caution. We only present results for which we have a large sample.

<sup>10</sup> We use the World Health Organization (WHO)'s thresholds for specific age groups and gender and physiological status (pregnant/nursing). For men it is 130 g/l, pregnant women, it is 110 g/l, non-pregnant women 120 g/l



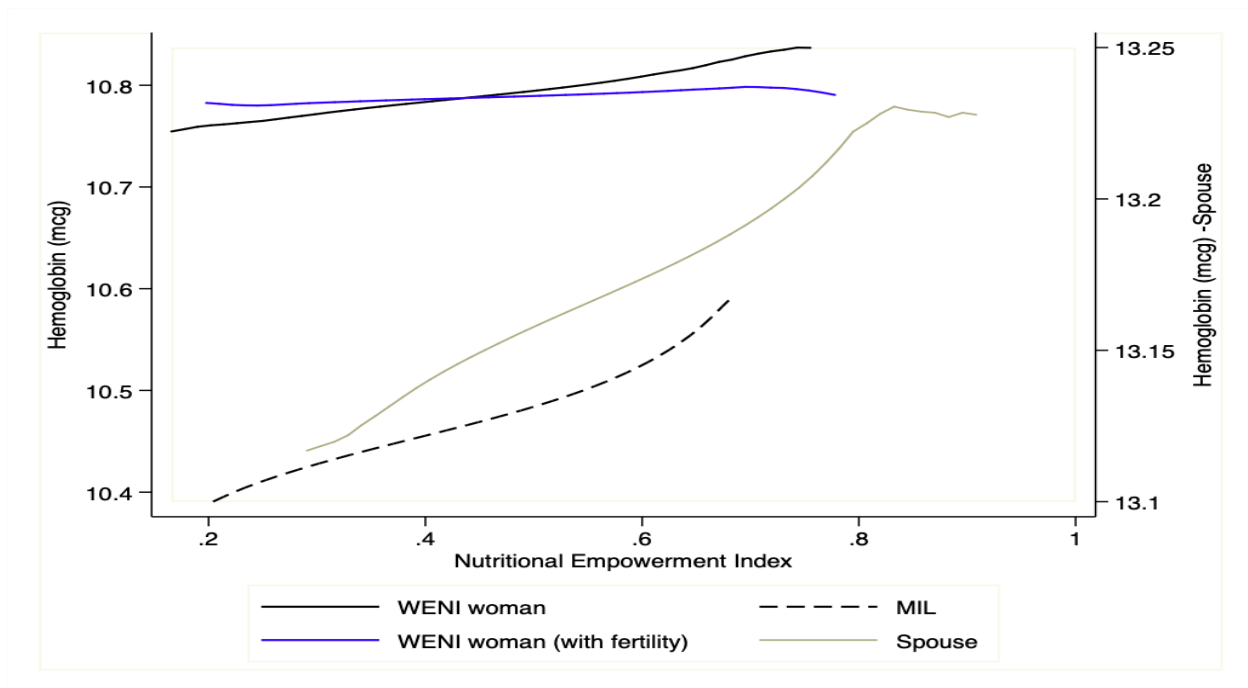
not be interpreted for pregnant women. and exclude them from all models. We exclude household and individual level controls, because systematic differences in household socio-economic status are captured adequately, if not fully, by the WEN Grid. However, including a vector of controls such as house type, roofing material, number of rooms in the house, religion, caste, age, and household wealth index of the respondent does not alter the results (these are available with the authors).

**Figure 6: The Relationship between WENI and BMI**



Note: These are local polynomial regressions; confidence intervals have not been plotted here.

**Figure 7: The Relationship between WENI and Haemoglobin levels**



Note: These are local polynomial regressions; confidence intervals have not been plotted here.

## 7. Sensitivity analysis

First, we apply sensitivity checks regarding indicator selection. As described above, the indicators in the different domain-dimensions of nutritional empowerment have a normative basis for inclusion. While the complete set of indicators is most informative, several indicators are highly correlated with one another and the need to collect many indicators can be a barrier to the uptake of WENI. For these two reasons, the final subset of indicators,  $I$ , were derived using factor analysis. There is not a definitive factor loading cut-off for identifying a subset of indicators for a given domain-dimension factor. For this reason, we test an alternative factor-loading cutoff of at least 0.63, based on recommendations made by Tabachnick and Fidell (2007). Variables were included based on this cutoff conditional on their eigenvalues being greater than 1 and cumulative variance adding to unity. At the aggregate level, the WENI slightly changes and the rank order is preserved.

Second, to evaluate the sensitive of the WENI to indicator selection, we vary indicators within domain-dimensions. Our survey collected a variety of similar indicators. Each indicator could be an equally appropriate or suitable indicator from a normative perspective. We select one indicator from among a group of highly correlated indicators within a D-D, and compute WENI; we then compute WENI for a different indicator from that same group of correlated indicators. Here too, the WENI seems to vary slightly but the rank order is highly correlated across the alternatives.<sup>11</sup>

Third, we assess the sensitivity of the empowerment index to selection of the threshold above which individuals are considered nutritionally empowered. In this paper we used a threshold of 0.5. Without applications of WEN in other contexts, we do not yet know whether identifying universal thresholds is appropriate. In resource-constrained settings, too high a threshold renders everyone disempowered. A threshold too low would make everyone empowered – making measures such as the headcount ratio and comparisons between groups or communities on that basis meaningless. One recommendation is to set the threshold to reflect aspirations, for example, by drawing on policy or programmatic goals (Alkire, et al. 2015). Alternatively, thresholds could also draw on finding from representative survey data; a threshold to separate the nutritionally empowered or disempowered could be endogenous and computed based on whether it produces systematic differences in nutritional outcomes/status between those that are empowered and those that are not.

We find that our threshold of 0.5 accurately reflects differences in nutritional status for BMI. For haemoglobin levels, however, fitting a linear relationship between empowerment using a threshold of 0.5 and hemoglobin levels, did not yield statistically significant coefficients for the binary variable representing nutritional empowerment. Increasing the threshold by 0.05 at a time, the classification of those empowered and disempowered becomes significant statistically at 0.75 (Appendix 3). This suggests that policies that aim to empower communities nutritionally need to recognize that marginal improvements in measured nutritional empowerment might not necessarily be associated with significant

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<sup>11</sup> We do not test the threshold for individual indicators in this paper.

improvements in anemia. Indeed, calorie-protein adequacy may be enough for improving BMI whereas improving anemia requires wider micronutrient adequacy and access to health care. If a goal is to improve anemia status via nutritional empowerment, the aspirational threshold needs to be higher than the threshold to achieve BMI improvements.

Fourth, we confirm that the list of indicators, *I*, used in the construction of WENI performs comparably well with the full set of indicators (*F*) and that identified via factor analysis (*S*) on two counts. First, *I* produces a rank order of individual nutritional empowerment scores similar to that produced by *F* and *S*. We then compute the rank correlation of these the rank orderings. We use Kendall's tau-b to address the issue of ties in ranking. The rank correlations by scores suggest that rank orders are maintained. Second, we compute rank correlation for each domain-dimension scores as a robustness check and find that the ranking of individuals within each domain-dimension is also preserved going from *F* to *S* to *I* (Table 8).

To gauge the sensitivity and consequences of paring down the set of indicators that constitute the index, we estimate three separate equations using the entire set of indicators in *F*, *S*, and *I*. Table 9 shows the R-squared, which is the proportion of total variation in the outcomes that are explained by the model, for the sets *F*, *S* and *I*, for WEN women, spouses, and mothers-in-law. We run two versions of the model, one without controls and the other with household and individual level controls, including house type, roofing material, number of rooms in the house, religion, caste, age, and household wealth index of the respondent. Not surprisingly, we find that the R-squared declines as we move from *F* to *S* to *I*. Nonetheless, the total variation in BMI explained by the models using the *I* list of 40 indicators (with and without controls) is 13 and 10 percent respectively for BMI and 37 and 42 percent for haemoglobin. In terms of sub-groups, the figures for with controls and without are 14 and 19 percent for WENI women, to 24 and 30 percent for spouses, to 32 and 42 percent for mothers-in-law. For haemoglobin levels, we are able to explain 8 and 19 percent for WENI women, 16 and 30 percent for spouses and 39 and 54 percent for mothers-in-law, for with controls and without respectively. Despite the reduction in R-squared using the smallest set of WENI indicators, the WEN models using *I* indicators still outperform existing models

relating empowerment measures and nutritional outcomes, indicating that the WEN grid variables are predictive of nutritional status.<sup>12</sup>

## **8. Conclusion**

Undernutrition rates among adults, and in particular women, in South Asia remain stubbornly high. The WEN grid can provide insights into the domain-dimensions that contribute to gaps in nutritional empowerment that impede improvements in nutritional outcomes. While recognizing that empowerment is a process and the pathways to empowerment are ridden with obstacles, the WEN grid can be a useful policy tool. When used as a scorecard, it allows examining the dimensions of empowerment and domains of nutrition that are likely to be the weak links and require policy attention. As an index, it provides a comprehensive measure of nutritional empowerment that permits comparison across socio-demographic groups, across administrative units or over time. As such, it allows policymakers and practitioners to check progress relative to milestones on the path to nutritional empowerment.

Efforts to design nutrition sensitive projects and policies might facilitate empowerment in one area, for example agriculture, but, may not translate into empowerment of women in the realm of nutrition. The WENI can potentially help gauge the nutrition sensitivity of such interventions. WENI is also designed to be applicable for all rural households, including those not engaged in agriculture, allowing for a more comprehensive understanding of the specific barriers and opportunities that rural women and their families face. Further, many programs that aim to inform and educate women on nutritional issues presume women have power over allocation of resources and social practices are conducive to favorable nutritional status, equally for all household member. WENI could offer a systematic way to understand if these assumptions are correct.

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<sup>12</sup> As with other indices, the WENI too entails some loss of detail and trades off explanatory and predictive power for parsimony. These tradeoffs limit the extent to which WENI can be simplified. With adequate validation, there is scope to abridge WENI for a leaner version.

WENI is a summary measure but „, like all indices, is also a statistical benchmark that represents many complex and interdependent factors; it is therefore akin to an “information platform” (Alkire, et al., 2013). Indeed, the WENI is not an end in itself but is best used as a heuristic device; it is important to look beyond and behind the WENI to uncover and identify obstacles to nutritional empowerment that deserve programmatic or policy attention. For this reason we do not advocate any comparisons across communities and groups that relies exclusively on the WENI. Nor do we advocate using it to define eligibility criteria for program participation.

The WENI presented here has been validated in two sites in India. We caution that the indicators that ideally represent the component themes in WENI and their thresholds for empowerment may differ in other contexts.. Nonetheless, the WENI is intentionally broad and aims to offer a complete articulation of factors influencing nutritional empowerment.. The WEN grid allows for considerable latitude in choosing specific indicators. There are many ways to capture key aspects of each domain dimension and retaining this flexibility allows the WENI to be adapted to specific contexts. Future research will utilize data from outside of South Asia to test whether the indicators identified for rural South Asia have salience in other contexts.

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**Table 1: Themes in the WEN Grid**

<b>Food knowledge (n= 2)</b>	<b>Food resource (n=9)</b>	<b>Food agency (n=6)</b>
Knowledge of calcium Knowledge of iodine	(1) <u>Participation in income generating activities</u> Does paid work as employee Participation in non-agricultural household enterprise Participation in agriculture and allied activities (2) <u>Access to support and to assets</u> Aid for crop and livestock production. Financial support for business Access to food aid schemes and employment schemes Asset owned by individual (3) <u>Eating norms</u> No imposed dietary restrictions Eating order (all eat together)	(1) <u>Say in productive activities</u> Say in cultivation decisions Say in kitchen garden production Say in major/minor decisions related to household enterprise (2) <u>Control /say in income and expenditure</u> Say in rent or sale of own assets Say in expenditure of own contribution to income Say in purchasing food items
<b>Health knowledge (n=3)</b>	<b>Health resource (n=5)</b>	<b>Health agency (n=3)</b>
Knowledge of anemia Knowledge of ORS Knowledge of malaria	(1) <u>Work/energy expenditure and working conditions</u> Does no activity, paid or unpaid, which is back breaking or heavy Does no activity paid or unpaid, with risk of injury or risk of major health problem (2) <u>Support in work</u> Has help with domestic and care work; does not undertake care work (3) <u>Support when ill and health seeking</u> Not ill in past 30 days (chronic or otherwise) or sought treatment when ill Has help for housework when ill (4) <u>Access to improved water, sanitation and smoke free kitchen</u>	Can go alone to health centre when required Does not need to take permission for going to health centre Takes decisions on own health
<b>Institution (n=7)</b>		
Membership: Member or non-membership of groups out of their own volition Access to information about government schemes Intimate partner violence: Does not experience physical abuse or gets family support when experiencing physical abuse. Freedom of movement: Has visited bank/post office unaccompanied/can visit family alone No risk of sexual harassment in paid/other work Veil use: Does not practice burkha Public/civic engagement: Participated in rally/protests/petition/Comfort speaking in public		
<b>Fertility knowledge (n=2)</b>	<b>Fertility resource (n=5)</b>	<b>Fertility agency (n=4)</b>
Knowledge of menstrual cycle and pregnancy Knowledge of need of different diets during pregnancy	Ability to secure an adequate, appropriate and diverse diet during pregnancy Did not undertake heavy physical activity after 8th month of pregnancy Did not do heavy physical activity for at least a month after delivery Received support in housework during pregnancy At least one antenatal and postnatal care facility of good quality accessible and affordable	Has a say in use/not use of contraceptive Has a say in the choice of facility for delivery Has a say in total no of children Has a say in spacing of children

**Table 2: Summary Statistics of Nutritional Empowerment Indicators**

Domain Dimension (Number of indicators)		Description of the indicator	Odisha			Bihar			Total
			WENI Woman	Spouse	Mother- in-law	WENI Woman	Spouse	Mother- in-law	
FOOD									
Food Knowledge (2)	1	Knowledge of foods rich in calcium	6.2	8.9	1.4	14.8	13.2	4.4	9.8
	2	Knowledge that iodized salt is a key source of iodine	18.5	40.0	7.0	29.0	33.8	6.7	25.1
Food Resources (9)	1	Does market work as employee, for wages or salary, in cash or kind	32.6	76.3	22.5	36.0	63.6	18.9	42.5
	2	Has at least three distinct types of food resources available via participation in the following: ruminants, poultry, fishing, aquaculture, kitchen gardens	48.5	37.0	39.4	56.9	58.3	55.6	51.0
	3	At least 50% of village reports its acceptable for women to work in village	96.5	98.5	97.2	100	100	100	98.8
	4	Owns land in his or her own individual capacity	20.7	21.5	21.1	3.7	16.6	11.1	14.1
	5	Household members eat together	43.2	56.3	39.4	9.8	4.0	7.8	25.1
	6	Has diverse sources of income (at least 3 of 5, from the following: paid work, own account family enterprise, agriculture, transfers, remittances)	7.1	10.4	5.6	18.2	30.5	20.0	15.7
	7	Own account worker/contributing family worker in agriculture or non-agriculture family enterprise	67.8	61.5	49.3	63.0	84.1	56.7	65.6
	8	Is eligible to access state food subsidies and workfare program	57.3	61.5	64.8	22.6	27.8	25.6	40.3
		<i>-Proportion of households who have a ration card</i>	84.6	83	84.5	76.4	76.8	81.1	80.3
		<i>-Proportion of households who have a job card</i>	65.6	72.6	76.1	27	32.5	30	47.1
	9	Financial support for either business or agriculture	24.2	21.5	11.3	50.5	22.5	20.0	30.3
Food Agency (7)	1	Decision to undertake or not undertake paid work own	37.9	86.7	76.1	45.5	72.2	85.6	59.5
	2	Has no dietary restrictions not of his/her own volition and can give these up if he/she wishes	22.5	51.1	28.2	14.8	26.5	18.9	24.8
		<i>-Proportion who have no dietary restrictions</i>	10.1	30.37	16.9	4.04	11.3	5.6	11.3
	3	The earnings from an asset owned by the respondent has not been used without his/her consent	21.6	57.8	47.9	15.2	21.2	23.3	26.7
	4	At least some say in kitchen garden decisions and/or cultivation	35.2	46.7	32.4	36.7	52.3	47.8	40.9
	5	At least some say in major or minor own account family enterprise decisions	10.6	20.0	5.6	6.7	30.5	1.1	12.6
	6	Has independent source of cash (earned, transfers or remittances) and has some control over how to use it	74.9	90.4	59.2	92.6	99.3	91.1	86.6
	7	Has a say in how his/her contribution to family income is to be spent	38.3	90.4	28.2	36.0	86.1	26.7	50.5

HEALTH								
Health Knowledge (3)	1	Can recognize if someone has anaemia	19.4	14.1	8.5	35.0	39.1	26.7
	2	Aware of what ORS is for and when to administer it	68.3	68.1	47.9	29.6	43.7	23.3
	3	Aware of how malaria is transmitted	63.4	68.9	42.3	46.5	62.9	31.1
Health Resources (9)	1	Has no chronic illness in the past year or illness in the past month; or has either but sought health care	85.5	94.8	88.7	93.6	96.7	95.6
		- <i>Proportion who did not have any illness in the past one month</i>	41.8	28.9	39.4	60.6	42.4	57.8
		- <i>Proportion who were unwell in the past one month</i>	58.2	71.1	60.6	39.4	57.6	42.2
		- <i>Proportion with chronic illness in the past one year</i>	15	14.1	49.3	19.9	19.2	45.6
	2	At most one type of paid work undertaken	89	80	94.4	91.9	74.2	96.7
		- <i>Proportion who <u>does not</u> undertake paid work</i>	67.4	23.7	77.5	63.9	36.4	81.1
		- <i>Proportion who does one type of paid work</i>	22.0	56.3	16.9	28	37.8	15.6
	3	Very satisfied with the time available to visit friends and family or living with them	12.8	42.2	42.3	16.2	25.8	32.2
		- <i>Proportion who lives with their family</i>	4.8	97	8.5	2.4	79.5	6.7
	4	Does no productive work (whether paid or unpaid) activity that is back breaking or heavy	66.5	23.7	74.6	62.6	35.8	81.1
		- <i>Proportion of those who do paid work</i>	32.6	76.3	22.5	36.1	63.6	18.9
		• <i>Proportion of the above who says the work is heavy or back breaking</i>	87.8	97.1	93.8	92.5	88.5	100
		- <i>Proportion of those who work in family owned non-agricultural enterprises</i>	14.1	20	7	7.4	31.3	1.1
		• <i>Proportion of the above who says the work is heavy or back breaking</i>	68.8	33.3	60	59	34	0
	5	At least somewhat satisfied with help in domestic & care work	76.7	100	98.6	89.9	100	97.8
	6	Gets assistance in domestic and care work' when ill	80.6	94.8	84.5	77.1	90.7	100
	7	Household has access to improved water, improved toilets & a well ventilated cooking area	14.5	17.8	22.5	39.1	39.7	47.8
		- <i>Household has access to improved water</i>	75.3	74.8	80.3	98	98.7	97.8
		- <i>Household has access to improved sanitation</i>	33.5	39.3	42.3	42.1	41.7	50
		- <i>Household has access to ventilated cooking area</i>	50.2	51.9	54.9	92.9	95.4	94.4
	8	Productive work (paid or hh enterprise) <= 8 hours	81.1	52.6	90.1	86.5	48.3	95.6
	9	Faces no risk of injury or major health problem in any activity	50.7	14.8	59.2	44.4	17.2	58.9
Health Agency	1	Can visit the health facility alone if needed	35.7	95.6	23.9	54.9	98.0	30.0
	2	No expectation to seek permission from the family before visiting health	38.3	69.6	42.3	26.6	84.8	43.3

(3)		facility							
	3	Can make decision on own health	17.6	90.4	8.5	18.9	47.0	10.0	31.3
INSTITUTIONS									
Institutions (7)	1	Can become a member of any group out of his/her own accord	13.7	30.4	25.4	20.5	17.9	37.8	21.8
	2	Never uses a veil	22.0	100	14.1	2.4	100	7.8	37.1
	3	Has a mobile phone and receives information on government schemes	15.4	12.6	5.6	24.6	29.1	3.3	18.1
	4	Does not experience domestic violence or experiences domestic violence but has support	78.0	93.3	81.7	91.2	95.4	95.6	88.8
		- <i>Proportion who does not experience domestic violence</i>	62.6	92.6	77.5	66	91.4	93.3	76
	5	Has freedom to visit bank, post office, or family alone	54.6	99.3	56.3	69.0	100	75.6	74.4
	6	Does not experience sexual harassment in any activity, paid or unpaid	99.6	100	98.6	96.3	94.0	98.9	97.6
	7	Civic Engagement: Has participated in at least one activity in the last five years (petition, protest, public meetings, representation to government officials, voted in elections)	91.2	98.5	97.2	86.5	97.4	98.9	92.9
FERTILITY DOMAIN									
Fertility knowledge (2)	1	Has knowledge of menstrual cycle & likelihood of pregnancy	4.9			12.3			9.1
	2	Is aware that pregnant women have different dietary needs	76.4			91.1			84.7
Fertility Resources (5)	1	Cash or in-kind assistance from Govt. during pregnancy	93.3			68.3			79.2
	2	Did not undertake heavy physical activity after 8th month of pregnancy	11.1			9.6			10.2
	4	Received at least a fair bit of support from family during pregnancy	43.6			44.1			23.7
	5	Has access to natal care facility of good quality & very affordable	93.8			71.4			43.8
	6	Had adequate and diverse diet during last pregnancy	19.8			8.4			7.2
Fertility Agency (3)	1	Place of delivery decided based on respondent's preference	89.3			75.8			81.7
	2	Has at least some say in total number of children	49.8			64.8			58.3
	3	Has at least some say in spacing between children	67.0			74.4			38.4

Note: The figures reported by WENI, Spouse and MIL are not comparable even when the indicator is measured at the household level, since not all spouses and MILs were interviewed.

**Table 3: Health and Nutritional Outcomes in the Sample**

	<b>Odisha</b>			<b>Bihar</b>			<b>All</b>
	<b>WENI</b>	<b>Spouses</b>	<b>MIL</b>	<b>WENI</b>	<b>Spouses</b>	<b>MIL</b>	<b>Total</b>
<b>Nutritional status</b>							
Mean body mass index (BMI)	21	22	21	20	21	21	21
Underweight (%)	31	16	22	29	14	30	25
Mean haemoglobin levels (mcg)	11	13	10	11	13	11	11
Mild anemia (%)	26	36	10	23	32	20	26
Moderate anemia (%)	54	8	61	43	5	42	36
Severe anemia (%)	3	1	13	4	1	1	3
Mild anemia or worse (%)	82	44	83	71	37	63	65
Moderate anemia or worse (%)	56	9	73	48	5	43	39
<b>Health outcomes</b>							
Unwell in the past month (%)	42	29	39	61	42	58	47
Suffering from chronic illness in past 12 months (%)	15	15	49	20	19	46	22

**Table 4: WENI, Headcount Ratio and Other Measures**

-	POOLED Without Fertility Domain							Only WENI Women (with fertility)		
	Odisha			Bihar			All	Odisha	Bihar	All
	WENI	Spouses	MIL	WENI	Spouses	MIL				
Nutritional Empowerment Index	0.417	0.574	0.380	0.421	0.552	0.399	0.457	0.450	0.454	0.452
Head count ratio of nutritionally disempowered (%)	79	29	89	75	40	81	66	70	69	69
Intensity of disempowerment	0.603	0.432	0.649	0.615	0.479	0.607	0.567	0.304	0.313	0.309
Gap in Empowerment score	0.125	0.046	0.140	0.133	0.067	0.137	0.110	0.103	0.102	0.102
Adjusted Headcount Ratio (%)	48	13	58	46	19	49	39	21	22	21
Adjusted Gap	0.059	0.006	0.081	0.062	0.013	0.067	0.048	0.022	0.022	0.022

Note: The nutritional empowerment index is the proportion of total domain-dimensions in which an individual is deemed empowered. Head Count Ratio (HCR) is the percentage of those classified as nutritionally empowered – i.e., if their nutritional empowerment index is greater than or equal to 0.5. This would mean that the individual is deemed empowered in at least 50% of the seven domain-dimensions that constitute WENI and 10 domain dimensions for WENI women.

**Table 5: Domain and Dimension-wise Disempowerment Headcount Ratio**

		Odisha			Bihar			All
		WENI Women	Spouses	Mothers in law	WENI Women	Spouses	Mothers in law	
<b>Domain (in %)</b>	<b>Food</b>	78	48	80	79	53	88	71
	<b>Health</b>	37	17	31	39	33	29	33
	<b>Institution</b>	40	0	39	33	0	19	24
	<b>Fertility</b>	28			34			63
<b>Dimensions (in %)</b>	<b>Knowledge</b>	77	62	90	74	62	84	73
	<b>Resource</b>	36	33	13	31	42	12	31
	<b>Agency</b>	64	7	70	60	3	57	45
	<b>Knowledge (incl Fertility)</b>	75			72			86
	<b>Resource (incl Fertility)</b>	44			55			73
	<b>Agency (incl Fertility)</b>	58			53			76

Note: All refers to a weighted average of the headcount ratio for both the states of Bihar and Odisha

**Table 6: Empowerment Status and Outcomes: Validity Tests**

	Disempowered		Empowered		Difference	T / Z statistic	p-value
	Mean /Proportion	N	Mean /Proportion	N			
<i>Test of Equality of Means</i>							
BMI	20.35	608	22.08	320	-1.74	-7.04	0
Hb levels	11.06	578	12.23	296	-1.17	-8.63	0
<i>Test of Equality of Proportions</i>							
Normal BMI	0.7	608	0.83	320	-0.14	-4.6	0
No anemia	0.25	578	0.42	296	-0.17	-5.25	0



**Table 7: The Relationship Between Nutritional Empowerment and Status (Full Sample & WENI Women only)**

Variables	BMI		Normal BMI(=1)		Hb levels		Anemia (=1)	
Nutritionally empowered (=1)	1.617*** (5.73)		0.330*** (2.99)		0.204 (1.56)		0.102 (0.96)	
Nutritional empowerment index		7.113*** (6.67)		1.569*** (3.67)		1.118** (2.21)		0.660 (1.59)
Spouse (=1)	0.409 (1.37)	0.106 (0.34)	0.446*** (3.60)	0.371*** (2.87)	2.271*** (15.13)	2.203*** (14.04)	0.914*** (7.96)	0.868*** (7.27)
Mother-in-law (=1)	0.197 (0.29)	0.455 (0.67)	0.284 (1.17)	0.352 (1.44)	-0.274 (-0.92)	-0.224 (-0.75)	0.005 (0.02)	0.035 (0.14)
Age (completed years)	0.017 (0.92)	0.012 (0.61)	-0.005 (-0.68)	-0.006 (-0.90)	-0.002 (-0.30)	-0.003 (-0.44)	-0.004 (-0.59)	-0.005 (-0.69)
Constant	19.588*** (33.79)	17.149*** (25.25)	0.560*** (2.60)	0.025 (0.10)	10.843*** (45.56)	10.455*** (35.11)	-0.708*** (-3.36)	-0.942*** (-3.63)
<b>N</b>	<b>928</b>	<b>928</b>	<b>928</b>	<b>928</b>	<b>874</b>	<b>874</b>	<b>874</b>	<b>874</b>
R-squared	0.058	0.069			0.324	0.326		
Adjusted R-squared	0.054	0.065			0.321	0.323		
<b>WENI Women Only</b>								
Nutritionally empowered (=1)	1.414*** (3.79)		0.350*** (2.65)		-0.022 (-0.14)		0.024 (0.17)	
Nutritional empowerment index		4.478*** (2.81)		0.808 (1.40)		0.274 (0.35)		-0.055 (-0.09)
Age (completed years)	0.033 (1.01)	0.035 (1.12)	0.003 (0.24)	0.004 (0.36)	-0.001 (-0.11)	-0.002 (-0.17)	-0.003 (-0.27)	-0.003 (-0.25)
Constant	19.064*** (19.86)	17.398*** (15.88)	0.306 (0.87)	0.003 (0.01)	10.862*** (33.64)	10.751*** (24.66)	-0.725** (-2.28)	-0.699* (-1.77)
<b>N</b>	<b>494</b>	<b>494</b>	<b>494</b>	<b>494</b>	<b>474</b>	<b>474</b>	<b>474</b>	<b>474</b>
R-squared	0.0403	0.0233			0.0003	0.0001		
Adjusted R-squared			0.0122	0.0039			0.0002	0.0001

**Table 8: Comparison of the Full Set of WEN Grid Variables with Indicators Included in the Index**

		<b>WENI Women</b>		<b>Pooled</b>	
		<b>From F to S</b>	<b>From S to I</b>	<b>From F to S</b>	<b>From S to I</b>
3.1.a	Food Knowledge	1.00	1.00	1.00	1.00
3.1.b	Food Resource	0.65	0.63	0.60	0.59
3.1.c	Food Agency	0.51	0.63	0.49	0.63
3.1.d	Health Knowledge	1.00	1.00	1.00	1.00
3.1.e	Health Resource	0.48	0.35	0.41	0.34
3.1.f	Health Agency	0.43	0.80	0.58	0.86
3.1.g	Fertility Knowledge (only WEN)	1.00	1.00		
3.1.h	Fertility Resource (only WEN)	0.54	0.38		
3.1.i	Fertility Agency (only WEN)	0.76	0.83		
3.1.j	Institutions	0.57	0.52	0.61	0.59
<b>3.2</b>	<b><i>Food Domain</i></b>	<b>0.58</b>	<b>0.70</b>	<b>0.55</b>	<b>0.67</b>
<b>3.3</b>	<b><i>Health Domain</i></b>	<b>0.55</b>	<b>0.44</b>	<b>0.52</b>	<b>0.47</b>
<b>3.4</b>	<b><i>Fertility Domain (only WEN)</i></b>	<b>0.56</b>	<b>0.61</b>		
<b>3.5</b>	<b><i>Knowledge Dimension</i></b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>
<b>3.6</b>	<b><i>Resource Dimension</i></b>	<b>0.48</b>	<b>0.39</b>	<b>0.39</b>	<b>0.25</b>
<b>3.7</b>	<b><i>Agency Dimension</i></b>	<b>0.54</b>	<b>0.74</b>	<b>0.49</b>	<b>0.74</b>
<b>3.8</b>	<b>Overall WEN grid</b>	<b>0.58</b>	<b>0.60</b>	<b>0.55</b>	<b>0.62</b>

Note: The number of indicators for WEN women is greater than the number of pooled indicators because the pooled indicators exclude fertility questions.

**Table 9: R-squared from regressing BMI and Haemoglobin Levels on F, S and I**

	F		S		I	
	Controls	No controls	Controls	No controls	Controls	No controls
<b>Least squares for BMI and haemoglobin levels</b>						
<b>BMI</b>						
All	0.20	0.26	0.12	0.18	0.10	0.13
WENI Women	0.39	0.36	0.25	0.21	0.19	0.14
Spouses	0.68	0.61	0.35	0.32	0.30	0.24
MIL	-	0.91	0.47	0.32	0.42	0.32
<b>Haemoglobin</b>						
All	0.52	0.50	0.43	0.38	0.42	0.37
WENI Women	0.41	0.34	0.24	0.15	0.19	0.08
Spouses	0.72	0.66	0.41	0.24	0.30	0.16
MIL	-	0.99	0.57	0.42	0.54	0.39
<b>Linear probability models for binary outcomes</b>						
<b>Normal BMI</b>						
All	0.20	0.18	0.12	0.10	0.10	0.07
WENI Women	0.29	0.27	0.14	0.11	0.10	0.07
Spouses	0.59	0.50	0.25	0.19	0.23	0.13
MIL	-	0.89	0.44	0.32	0.39	0.28
<b>No anemia</b>						
All	0.36	0.32	0.27	0.21	0.24	0.18
WENI Women	0.40	0.34	0.22	0.14	0.16	0.07
Spouses	0.69	0.65	0.37	0.27	0.29	0.21
MIL	-	0.97	0.54	0.43	0.52	0.39

\* Note the total number of observations for these regressions under set F is only marginally higher than the parameters estimated and the R-squared should therefore be interpreted with caution. For this reason, results for the Mother in law are not reported for F. In addition to WEN grid elements, “Controls” regressions include other household and individual level controls. These are house type, roofing material, number of rooms in the house, physiological status, religion, caste, age and household wealth index of the respondent.

## Online Supplementary Materials

### *Appendix 1: Construction of indicators*

The indicators within each domain-dimension in Table 1 represent a substantive theme or aspect of empowerment that might matter for nutrition, but do not prescribe specific questions, which would depend on the context and the sub population studied. On the one hand, the WENI allows flexibility in choice of indicators depending on the context and researcher, programmatic or participant priorities. For example, in the context of freedom of movement, where most women have such freedoms – for example, to visit family, the market or a bank, or the ability to drive a vehicle might represent greater empowerment. Another illustration of contextual specificity pertains to decisions around cultivation and kitchen gardens. These are more relevant for agrarian communities and own land or homesteads. In contrast, where markets dominate as the most important source of food, how much say the individual has in procuring, processing and cooking might matter more. On the other hand, one might simply want to use a uniform set of indicators across contexts to both enable comparisons.

In any index, it is challenging to capture indicators that have complex or ambivalent values. Yet, to construct the index, it is necessary to assign cut-offs indicating whether responses are empowering or disempowering for each specific indicator. For example, women's access to paid work can increase both their access to resources and enhance agency within the household. At the same time, if such work is hazardous or poorly paid, it might be harmful as well. Similarly, many individuals in resource constrained settings take up multiple jobs. While this strategy helps smooth earnings over time, it also might indicate poor quality, fragile jobs that might reduce leisure or increase stress. We attempt to capture both aspects in WENI. Access to paid work and participating in plural activities is an indicator for Food Resource, but having at most one type of paid work is deemed an empowering Health Resource.

The coding of responses to some indicators as empowering or disempowering are more open to debate. For example, our indicator capturing Intimate Partner Violence (IPV) assign to women a score of 1 if they do not face domestic violence at all or if they do they have support to cope with it. One could argue that the former is the better measure of empowerment and it is incorrect to admit the possibility that women who experience IPV are deemed empowered just because they have support. In the WENI presented here, we chose both forms of the indicator as candidates, but only one of them emerged relevant in the data reduction exercise.

We also constructed indicators to be free from gender specificities in order to ensure direct comparability and scale equivalence across genders. On the use of veil for example, we ask both men and women this question, even though this question is not applicable to men. Similarly, in most contexts

women are the majority of IPV victims. We, however, ask men for sources of domestic conflict, drivers of these conflicts and incidence of violence against them. We found a few cases where men experienced violence within the household.

Our formative research in Bangladesh and India suggests that state support could significantly influence the ability of women to access resources. The index does a modest job of capturing the full extent of support the state. The WENI captures explicitly government schemes to provide work and in-kind rations to the poor, assistance to pregnant women. Household access to water, toilets and sanitation, do not reflect the specific role of the state but could reflect public investments in these areas. Similarly, health and nutritional knowledge could be a consequence of government interventions. The extent to which state role in forwarding nutritional empowerment is captured depends on the research question.

Many indicators in WENI are captured at the household level (access to toilets, water, etc.) that can be better captured at the individual level. Other indicators are subjective assessments and as such inherit the problems associated with most subjective measures. These choices might not be ideal, but we chose these to reduce the burden of interviews on the respondents.

Thus overall, while WENI's candidate themes and indicators are meant to capture comprehensively our conceptualization of nutritional empowerment, we do not define a list of indicators that are appropriate for all contexts. Nor is there a perfect approach to capture these that also allows us to minimize the burden of surveys for the respondents. An index based on this is sure to be sensitive to the inclusion and exclusion of variables, as also to forms in which the question is administered and the cut-offs used. We discuss findings regarding indicator selection in the section on robustness checks.

## ***Appendix 2: The WENI Survey***

The SPANDAN survey was funded by the Bill and Melinda Gates Foundation and was conducted collaboratively by the Indira Gandhi Institute for Development Research, Mumbai India and the National Institute of Nutrition, Hyderabad, India. For more information on SPANDAN's coverage, questionnaires, and sampling procedures, see: <http://www.spandan-india.org/Survey/Survey.aspx>. SPANDAN surveyed members of households that included a mother of at least one child under the age of 5. We drew our sample of WENI women from the same set of SPANDAN mothers. Thus, the sampled WENI women had at least one child age seven or under, with the exception of a few WENI women whose children had died.

We selected each of the districts covered in the SPANDAN survey. These districts were originally randomly selected from each of nine agro-climatic zones as identified by Government of India's National Agricultural Resource Program. Within SPANDAN's selected districts, we drew a subsample of one SPANDAN surveyed block in each district. Within each of the blocks, we randomly selected a SPANDAN surveyed village that had been interviewed during SPANDAN's Round 1 and we randomly selected a SPANDAN surveyed village that had been interviewed during SPANDAN's Round 2. In total, the WENI sample was drawn from 9 districts (5 in Odisha, 4 in Bihar), 9 blocks, and 18 villages. Within the sample villages, our goal was to interview all previously surveyed mothers in SPANDAN households. Due to attrition, we were unable to interview 21.5% of women. Reasons for attrition include non-availability of the WENI women due to work, hospital visits, attending weddings, and visiting to parents. In a few cases, either the woman declined to be interviewed or her family did not give her permission to be interviewed. In a few other cases the woman was deceased or mentally or physically unwell.

To compensate for the attrition and due to the small number of SPANDAN households within each village, we interviewed women who were surveyed by SPANDAN in another SPANDAN village in the same block. In all, we covered 26 villages, as opposed to the original 18, choosing 8 additional villages to expand the households covered. To capture the relative disparities within households, we sampled SPANDAN households where WENI Women lived with her male spouse and or her mother-in-law. If the woman interviewed in the SPANDAN survey was not available, the entire household was skipped. If the husband or mother-in-law was selected to be interviewed but was unavailable, the WENI Woman was interviewed and the mother-in-law or husband was interviewed in the next selected household. In nine SPANDAN households (eight in Bihar and one in Odisha), there were had two mothers with children under age five. The WENI Survey interviewed whoever was listed first on the SPANDAN household roster, and interviewed the second mother only if the first was unavailable. If this

household had split after the SPANDAN survey such that the two mothers were now part of separate households, then both were interviewed.

### *Dried blood spot samples*

The dried blood spot samples were processed at the laboratory facilities at the National Institute of Nutrition (NIN, Hyderabad, India). A qualified practitioner provided respondents information on their height, weight and dried blood spot test result. For respondents with low hemoglobin levels, the practitioner also provided advice on the treatment of anemia, including advising those with severe anaemia to visit the nearest public health centre as soon as possible. We also provided the answers to the nutritional knowledge questions asked in the survey.

**Appendix Table 1: Distribution of the Sample**

	Agro climatic Zone	District and State	Block (Villages)	Number of respondents ( Number for whom Haemoglobin was measured)		
				WENI women	Spouses	Mothers in law
1	Northern Plateau	Mayurbhanj, Odisha	Baripada (2), Khunta(1)	67 (64)	41 (36)	21 (18)
2	Coastal Zone	Kendrapara, Odisha	Patkura (2), Mahakalapada (1)	57 (55)	30 (30)	28 (25)
3	Central Table Land	Anugul, Odisha	Athamalik (2), Talcher Sadar (1)	31 (29)	24 (22)	6 (6)
4	Eastern Ghats	Rayagada, Odisha	Muniguda (1), Ambdala (1), Padmapur (1)	37 (34)	17 (17)	6 (6)
5	Western Undulating	Nuapada, Odisha	Boden (2), Jonk (1)	35 (35)	24 (23)	10 (10)
6	North-East Alluvial Plains	Purnia, Bihar	Dagarua (1), Banmakhi (2)	141 (138)	77 (72)	40 (34)
7	North-West Alluvial Plains	Sitamarhi, Bihar	Charaut (2), Pupri (1)	51 (46)	23 (22)	16 (16)
8	South Bihar Alluvial Plains (a)	Jamui, Bihar	Jamui (2), Lakshmipur (1)	82 (77)	43 (36)	25 (21)
9	South Bihar Alluvial Plains (b)	Rohtas, Bihar	Tilothu (1), Akhori Gola (1)	21 (19)	11 (10)	9 (8)

**Appendix 3: Sensitivity to thresholds and outcome measures**

This table presents the coefficient of WENI under different cutoffs. Some windows have sparse observations or have coefficients of 0 and are not reported. Full results are available with the authors.

<b>Threshold</b>	<b>BMI</b>	<b>Normal weight (=1)</b>	<b>Hb level</b>	<b>No anemia (=1)</b>
<b>0.5</b>	1.546***	0.095***	0.211*	0.109
<b>0.55</b>	1.617***	0.080**	0.167	0.095
<b>0.6</b>	1.469***	0.041	0.071	0.106
<b>0.65</b>	1.283***	0.061	0.148	0.214
<b>0.65</b>	2.154***	0.045	0.318	0.263
<b>0.7</b>	0.987	0.172***	0.526*	-
<b>0.75</b>	2.304	0.156***	0.466**	0.755**
<b>0.8</b>	6.182***	0.146***	0.338***	-



