

ASSOCIATION OF BASIC MATERNAL FACTORS AND MATERNAL AUTONOMY WITH
MALNOURISHMENT AMONG CHILDREN 6-36 MONTHS OLD IN AN URBAN SLUM IN BANGALORE,
INDIA
FOR THE MD WITH DISTINCTION IN GLOBAL HEALTH THESIS

by

SINDHU SUDANAGUNTA

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ABSTRACT

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The University of Texas Southwestern Medical Center, 2016
Supervising Professor: Courtney Baldrige, M.D.

Background: Child malnutrition is a significant problem in many developing countries with much of the burden falling on economically and historically underprivileged societies. Chronic undernutrition leads to decreased height for age (stunting) and contributes to reduced intellectual capacity, morbidity, and mortality. Acute undernutrition results in decreased weight for height (wasting) and can decrease a child's reserve for fighting illnesses and thriving. Recent attention on psychosocial dynamics has encouraged researchers to focus on maternal factors and its effect on child malnourishment.

Objective: Maternal autonomy – the freedom and ability to control the resources available to the mother to care for her child – are likely important factors influencing child health outcomes, especially in an economically disadvantaged, culturally segregated slum society.

Methods: To examine this relationship in an urban slum in Karnataka, India, a cross-sectional observational study was conducted on 199 mother-child dyads. Anthropometric measurements were collected from children between 6-36 months of age. A 34 question survey uncovering issues of basic maternal factors, decision-making abilities, and domestic violence was administered to the mothers.

Results: Stunting was present in 32% of children (7.5% were severely stunted) and wasting was present in 23% (6.5% were severely wasted). Logistic regression models were used to test association between maternal factors and risk of having stunted or wasted children. Number of people in the household and mother's education were significantly associated with stunting. This breakdown shows that both maternal education and more members in the household were independently protective against stunting. The only maternal autonomy factor significantly associated with stunting and wasting was her ability to decide on major household purchases. The correlation, however, is inverse between stunting and wasting. Mothers who were more autonomous in this scenario were more likely to have children who were wasted, but less likely to have children who were stunted.

Conclusion: In the psychosocial context of an urban slum in Karnataka, India, maternal autonomy poses an interesting inverse relationship between stunting and wasting suggesting the need for more research on this topic.

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ABBREVIATIONS

BBH: Bangalore Baptist Hospital

DJ Halli: Devara Jeevanahalli

HAZ: Height for age

MDG: Millennium Development Goals

SD: Standard Deviation

SES: Socioeconomic Status

UNICEF: United Nations International Children's Emergency Fund

WHO: World Health Organization

WHZ: Weight for height

CHAPTER 1

INTRODUCTION

Children are in a phase of life with constant growth and development requiring adequate caloric, protein, and micronutrient intake. It has been shown many times over that nutritional inadequacy results in growth faltering leading to decreased height for age (stunting) and decreased weight for height (wasting). It is also linked to higher rates of mortality, decreased ability to cope with illnesses, and lower intellectual capacity¹.

Chronic undernutrition leads to stunting which is an irreversible form of decreased capacity for physical and cognitive growth. Recent data published by UNICEF suggest that over half of the world's stunted children are in Asia and about one third in Africa². As of 2013, a devastating 38% of children under 5 years old were stunted in South Asia. However, interventions have been successful in the past decade. Globally, the prevalence of stunting in children has decreased from one in three to one in four between the 2000 and 2013³. Though malnourishment among children is steadily declining in India, it is still asymmetrically prevalent among urban slum children. Its effects further exacerbate the short-term morbidity and mortality of these children as well as the potential for long-term well-being, SES growth, and ability to contribute to society.

Recent data on the first 1,000 days of life (from conception, through pregnancy, to the child's 2nd birthday) is changing the focus on nutrition. It has been shown that stunting is irreversible after the age of two leading to suboptimal health and growth⁴. Due to this new knowledge, the World Health Assembly has dedicated itself to decreasing stunting by 40 percent by 2025 in children under the age of 5⁵.

Studies done over the past few decades have tried to elucidate the major factors that

impact child malnutrition. This research has identified two correlated categories: biological and social factors. Biological factors include gender of the child, birth order, and genetic potential where as social factors include parental education level, SES status, women's rights, etc⁶.

Maternal factors have been studied many times over in regards to their effects on child malnourishment. Maternal age and maternal education level seems to be of highest correlation to nutrition. A study by Mittal et al. reported that "mother's age showed highly significant ($P = 0.001$) effect on the prevalence of undernutrition, i.e. where mother's age was <20 years, the prevalence was 75.0% as compared to 32.2% where mother's age was >30 years". They also reported that "prevalence of undernutrition was 60.9% where mother was illiterate and it was only 21.2% where education level was more than high school"⁷.

Recent studies have been focusing on psychosocial factors that may impact nutritional status of children. One such interesting factor is the role of maternal autonomy on childhood undernutrition. In these studies, maternal autonomy is defined as the freedom and independence a mother has in asserting control over the resources within her household. These studies have shown a positive correlation with the mother's access to education and freedom to travel to the nutritional states of their children³.

Though India is advancing economically, public health changes are lagging due to unequal social, educational, and economical burden. The first step in addressing these issues is to understand the particular socio-cultural infrastructure plaguing progress in slum areas. For this reason, the following hypothesis were tested:

1. Previously studied maternal factors (age, number of children, educational level, etc.) will be differently correlated to child malnourishment in Bangalore slums given the distinctly different psychosocial factors interwoven in this society.
2. Higher levels of maternal autonomy will lead to lower level of stunting and wasting in children.
3. Maternal autonomy will be more correlated to child malnourishment than other maternal factors.

CHAPTER 2

REVIEW OF LITERATURE

A report by UNICEF published in 2013 described that one-third of the world's undernourished children are in India³. Though progress is being made towards reducing child malnourishment, a 2010 report by UNICEF showed that this progress was uneven. It was reported that “the prevalence of underweight in children below five years in the richest 20 per cent of the households decreased from 37 per cent in 1992 to 25 per cent in 2006, whereas the corresponding reduction in the poorest 20 per cent households was negligible, from 64 per cent to 61 per cent⁹.”

The long term implications of malnourishment have been studied many times over. A report by Maternal and Child Undernutrition Study Group reviewed longitudinal cohort studies from five developing countries (India, Philippines, South Africa, Brazil, and Guatemala) which followed children into adulthood. The study concluded that stunted children were more likely to be short in stature as adults and have reduced lean body mass. A remarkable association was also found with less schooling, decreased intellectual capacity, reduced economic productivity, and lower offspring birthweights. The study concluded that damage to growth in childhood leads to permanent impairment in adulthood and can affect future generations¹⁰. Addressing causes of malnourishment would have valuable health, educational, and economic benefits.

An anthropometric study was conducted in children in the slums of Mumbai by Sushmita Das et al. They argued for the importance of a “window of vulnerability” within which interventions must be focused. It was felt by these researchers that the current practices by Child Development Services in India begin too late in the child's life so they were pushing for focus on younger age-groups¹¹. The United Nations in India agreed with this work. Their works showed

that a child's genetic potential can be attained if proper nutrition is provided within the first 1,000 day window which begins at conception and extends to the child's second birthday. It was reported that the prevalence of stunting reached a peak around 18-24 months after which interventions had minimal effect⁴.

A study done in Punjab, India on children ages 1-5 years found that 38.8% were underweight. The breakdown was such that "26.76% had Grade-I malnutrition, whereas 7.47%, 3.32% and 0.83% had Grade II, III and IV malnutrition, respectively." It was also noted that chances of being underweight decreased as the mothers age increased (75% underweight if mother was younger than 20 years old and 32.32% were underweight if the mother was older than 30). Maternal education was found to be protective against their child's malnourishment as well. The results showed that children of illiterate mothers were malnourished 60.9% of the time, while 21.2% of children were malnourished when they had mothers with a greater than high school level of education⁷.

Studies in developing countries on maternal status and decision-making power showed a significant positive effect on stunting and wasting. Women with lower status had less control over resource allocation, decreased access to information, and poorer mental health. It was understood from the study that the quality of care a women received at home impacted the quality of care she provided to her child. The researchers estimated that if women and men had equal status, the under-three underweight percentage would drop by 13 points (equivalent to 13.4 million fewer malnourished children)¹².

A study done in Andhra Pradesh, India by Sharoff et al. tried to assess maternal autonomy and its relation to child stunting. Autonomy was studied in four dimensions-- decision making,

financial autonomy, permission to travel, and attitude towards domestic violence. It was found that women with higher autonomy were significantly less likely to have stunted children even with SES and maternal education held constant. The two dimensions that seemed the most prevalent were the access to money and freedom to travel¹³. These studies show that focus on women's equality via shifting social norms and policy change would dramatically improve a woman's nutritional status as well as her child's.

CHAPTER 3

STATEMENT OF PURPOSE

The World Health Organization (WHO) estimates that 45% of deaths in children under 5 are caused by nutrition-related factors¹⁴. High prevalence of childhood mortality is the reason 5 of the 8 Millennium Development Goals by the United Nations are dedicated to children's health and nutrition⁹. Maternal autonomy is a part of the solution to addressing this tragedy because the ability of a mother to provide care for her child ultimately depends upon the care she receives.

The site chosen for this study is uniquely isolated from the rest of Bangalore, India which has seen tremendous growth and westernization with its recent technology boom. Census from 2011 indicates that Devara Jeevanahalli (DJ Halli) covers 1.4 square kilometers and has 8,941 households with a total population of 42,135¹⁵. This area is religiously and economically segregated enclave consisting predominantly of underprivileged Muslim families and small businesses.

Though studies have been conducted indicating a correlation between maternal factors, including maternal autonomy, with malnourishment in children, it was our opinion that the results would be significantly different in an economically disadvantaged, culturally segregated society.

CHAPTER 4

METHODS

4.1 Design

A cross-sectional observational study was conducted in DJ Halli, an urban slum in Bangalore, Karnataka, India. Mothers of infants between 6 and 36 months of age residing in DJ Halli were eligible to participate in the study. The study was conducted in January and February of 2016. Ethical approval was obtained from the Institutional Review Board at Bangalore Baptist Hospital. The study was conducted with the assistance of physicians and leadership in Bangalore Baptist Hospital's (BBH) Community Health Department.

4.2 Setting

DJ Halli was chosen because a BBH community health clinic is situated in this area and social workers are familiar with its layout and inhabitants. DJ Halli is religiously segregated from its surrounding colonies as a majority of the inhabitants in this slum are Muslim. This is in contrast to a largely Hindu population which occupies Bangalore.

For this study, a slum is defined as an area characterized by overcrowding, lack of proper light, ventilation, sanitation, or a combination of these factors leading to a decline in safety, health, or morale of the residents. Photographs of DJ Halli are presented as Figures 1, 2, and 3.

4.3 Sample Size

Estimating the prevalence of stunting to be 35% with a 93% confidence interval, and 7% precision, the sample size came out to be 153. However, a total of 200 surveys were collected. One data point was discarded because age was improperly recorded during the interviewing process. This left 199 samples for the study. Anthropometric data (height and weight) were collected first before survey questions were asked to avoid potential skewing of data.

4.4 Materials

Weights for infants who were unable to stand were measured on a Docbel Braun Baby Classic scale with a precision of 100g. The scale was calibrated before every measurement. Weights for children who could stand independently were measured with an electronic Elder weighting scale which a precision of 100g. Children were asked to stand still over the center of the scale facing forward with head up, arms loosely hanging by their sides, and palms facing their thighs. All weights were measured on a completely unclothed child. Heights for infants less than 80cm were measured on an IndoSurgicals Infantometer. The infants laid supine on the Infantometer with the crown of the head against the board at 0cm and back of the head at the base of the board. Heights were measured to the nearest 0.1cm at the sole of the right foot with leg were outstretched and foot at 90° angle to leg. Height for infants greater than 80cm were measured standing with back against a wall. They were asked to stand with the back of both feet, buttocks, shoulder blades, and back of head touching the wall. Figures 4 and 5 demonstrate these techniques.

4.5 Procedure

An initial pilot study was conducted in January 2016 to get exposure to the slum, its occupants, their culture, SES, and general living conditions. From these two weeks, the study objectives were derived. The investigator was accompanied daily by a social worker who was familiar with the area and spoke Hindi, Urdu, Kannada, Telugu, and English. A week prior to the study, the social worker was trained in asking the survey questions uniformly in all languages.

Streets were selected at random in DJ Halli and consecutive households were visited by foot in search of eligible mothers and children. Households in which the mother was not present

were skipped. Six such occasions occurred because the mother was at work. When a household included more than one eligible child (age between 6-36 months), a child was picked at random for inclusion in the study to ensure that clustering was not occurring within households.

Exclusion criteria were applied to households which did not speak Hindi, Urdu, Tamil, Telugu, or Kannada, children with limb deformities or known developmental disorders, or mothers currently diagnosed with a psychiatric condition.

Each of the participants were shown a copy of the consent form and were asked if they would like to participate. The de-identified nature of the study was explained. They were informed that they could decline participation with no repercussions. They were also informed that they can choose to stop the interview at any point, and their answers would be erased and not used for the study. Doing so would also not have any negative repercussions. A written consent was obtained from each participating mother prior to data collection.

The child's height and naked weights were measured at the start of the interview. Ages for the children were determined from a birth certificate when available. When documentation was not presented, mothers were asked to recall the date of birth. When month was remembered but not date, the fifteenth of the respective month was chosen. Surveys were administered via the translator who was trained for a week to ensure uniformity of survey administration. Mothers were interviewed alone in a room to ensure confidentiality. The survey administered is available in Table 1. Maternal autonomy survey questions regarding decision making power was taken from a "Household Decision-Making Scale" and questions about domestic violence were taken from a "Domestic Violence Screening Tool"^{16,17}.

While the study was underway, the investigators decided to collect data on average monthly income and religion from the mothers. Because this decision was made in the middle of the study, data is only available for 119 subjects regarding these factors.

4.6 Statistical analysis

The SAS package, version 9.3 was used for the statistical analyses. Nutritional status of the children were classified based on the following categories:

1. Wasting is caused by acute undernutrition and is also called low weight for height (WHZ). Children with Z-scores for WHZ < -2 were considered wasted while those with WHZ < -3 were regarded as severely wasted¹⁸.
2. Stunting is caused by chronic undernutrition and is also called low height for age (HAZ). Children with Z-scores for HAZ < -2 were considered stunted while those with WHZ < -3 were regarded as severely wasted¹⁸.

The statistical analyses included frequency distributions for all the categorical measurements such as occupation, education of mother, literacy, gender, etc. Means and standard deviations were calculated for the numerical measurements such as age, number of children, weight of child in kg, height of child in cm, etc.

Relationships between pairs of categorical variables were assessed utilizing Chi-Square contingency table analysis: stunted: yes vs no was related to other categorical variables as was wasted: yes vs. no. P values of 0.05 or less were considered a statistically significant relationship while values of 0.05 to 0.10 were considered of borderline significance.

Relationships were assessed for the z-score for wasting with all other numerical values using Pearson correlation coefficients as was the z-score for stunting. P values of 0.05 or less indicated a linear correlation of the specific pair of measurements.

Stepwise logistic regression analysis was utilized in two separate models: one for prediction of wasting and the other of stunting. Possible predictors included demographic factors such as maternal age, age at birth of first child and surveyed child, mother's education and occupation. The child's gender was considered along with the created variables for mother's control of diet, feeding, daily and major purchases. The p value for entry into the model was 0.10 and the model fit was assessed utilizing the Hosmer Lemeshow technique.

CHAPTER 5

RESULTS

Overall, 200 mothers with children between the ages of 6-36 months were surveyed for this study but only 199 samples were included in the study due to inaccurate recording on one occasion. On average, the mothers were 22 years old, received a secondary education (>8th grade), religiously identified as Muslim, were unemployed, and were married with two children. Table 2 presents the descriptive statistics for the mother.

Average age for the children was 18 months and both genders were represented equally (female: 51.76%). The average Z-score for weight for height (wasting) was -1.29; the average Z-score for height for age (stunting) was -1.41. There was no significant undernutrition based gender discrepancy as seen in Table 3. Stunting was present in 32% of children (7.5% were severely stunted) and wasting was present in 23% (6.5% were severely wasted).

Results from the maternal autonomy survey showed that the mothers were in control of the child's diet, and they were in charge of feeding them (70.9% and 89.5%, respectively). However, the mothers reported decreased autonomy in their decision-making abilities regarding daily household needs, major household purchases, and freedom to travel (47.7%, 44.8%, and 15% respectively). Twenty five percent of mothers disclosed that they are victims of domestic abuse, while 15% reported being hurt or frightened so badly that they feared for their lives. The descriptive statistics for maternal autonomy is presented in Table 4.

Bivariate association of malnutrition and basic maternal factors is presented in Table 5; association with maternal autonomy is presented in Table 6. Maternal education had a trend towards significance with stunting and wasting ($p < 0.10$), with lower rates of stunting and wasting among children with mothers who had at least secondary level (>8th grade) education. Number

of antenatal doctor check-ups was also noted to have a trend towards significance with stunting but not wasting; mothers who sought medical care >3 times during pregnancy were more likely to have children who are normal height for age. When it came to maternal autonomy, there was statically significant association between maternal input with major household purchases and both stunting and wasting ($p<0.05$). The correlation, however, is inverse between stunting and wasting. Mothers who were more autonomous in this scenario were more likely to have children who were wasted, but less likely to have children who were stunted.

A logistic regression analysis can be found in Table 7. The basic maternal factors significantly associated with stunting were number of people in household and the mother's education level. This breakdown shows that more members in the household or higher level of maternal education were protective against stunting. The only maternal autonomy factor significantly associated with stunting and wasting was her ability to decide on major household purchases. As noted earlier, however, the relationship between this factor and stunting and wasting is inverse.

CHAPTER 6

DISCUSSION

Child malnutrition around the world contributes to decreased quality of life and potentially even mortality. Recent work in child undernutrition has focused on psychosocial factors affecting the mothers because they are the primary caretakers in developing countries. Maternal autonomy and decision-making power, in particular, have been found to be significant predictors for stunting in children^{6, 7, 8, 12}.

Qualitative interviews done during the pilot study encouraged the investigators to focus on maternal autonomy as a possible culprit leading to child malnutrition. Traditionally, young women (late teens to early twenties) have an arranged marriage and are sent to their in-laws home, or if her husband can afford it, a new home of their own. After marriage, there is family (husband, mother-in-law, her own mother) and societal pressure on her to produce children. Also, in DJ Halli's culturally conservative environment, a newly married woman typically does not have the freedom to travel beyond the confines of her own home or street. However, a woman with a child can leave home to go to the market, with her child in tow. Due to societal expectations and a limit on her freedom to travel, the mothers reported that they were willing to have a child immediately after marriage.

Postpartum practices vary significantly between cultures and even within them in India. However, since DJ Halli is a predominantly Muslim slum, it was observed that some practices are common. For example, it is customary for a new mother to go to her parents' home with her newborn for the first 40 days. After a month and a half, the mother returns to her husband's home at which point there is a celebration of her arrival and their "first night" as a couple is redone. The mothers describe that this practice is to encourage the woman to have children in

succession.

During the qualitative analysis, many women confided their domestic violence issues to the social worker. This was surprising to the investigators because the normative behavior in this culture is to not reveal such private family issues. Approximately a quarter of the woman acknowledged domestic violence in their marriage when directly asked, but it is the belief of the investigators that the true rate is likely higher given the aforementioned norm of concealment of family issues in this culture.

Some context based on observation by the investigators should be provided for the basic maternal factors. Though a minority, a demonstrable percent of households consist of extended families, usually the child's paternal grandparents. Observation during the interviewing process in these homes reveal that the paternal grandfather is head of the household, while the paternal grandmother controls minor household issues including child rearing practices. In these households, maternal autonomy is suspected to be lower.

Most of the mothers are fairly well-educated with approximately 50% of them having achieved secondary schooling (>8th grade education). However, much of this education is from Quran School with no formal English, Science, or Math courses. Despite the high levels of education, only 11% of women work. This work is usually as a housemaid, at the local incense factory, or peeling garlic for restaurants. Even with these jobs, women do not make enough money to be financially independent.

When looking at the data for the children, it is promising to see that there is no gender discrepancy in malnutrition. However, the practices observed in some household would suggest otherwise. It was noted when the investigators conducted surveys during lunch time, that the

male children would sit down to eat first and that they would be given large quantities of white rice and some curry (usually a stew-like dish with potatoes, peas, and minimal lentils or meat pieces). When the male child was finished, the female child would sit at the same plate, but would only be given white rice and small amounts of curry, if any at all. It was then the female child's responsibility to clean up at the end of the meal. This anecdotally suggests gender discrepancies when children are older, but this practice was not specifically assessed in each household so conclusions cannot be made.

No basic maternal factors showed a statistically significant correlation with child malnourishment. However, maternal education and number of antenatal visits showed a trend towards significance. The correlation between maternal education with stunting and wasting has been shown in many other studies and makes intuitive sense. The more educated the mother is, the more likely she is to seek and understand resources directing her towards proper care for her child. Also, there is likely a correlation between mother's education and father's education, occupation, and dispensable income resulting in more resources for their child. However, this relationship was not confirmed during this study in this population.

Number of antenatal visits showed a trend towards significance with stunting but not with wasting. While it is true that antenatal visits are necessary for monitoring of fetus growth and maternal well-being leading to healthier newborns, it is unlikely to be the only reason for this correlation. Mothers who did not attend at least 3 antenatal visits might not have done so for many reasons which include, but are not limited to the following: lack of resources (money, transportation, time, freedom to travel), uneducated or improperly educated regarding pregnancy and child rearing, decreased health seeking behavior, etc. It is possible that these

factors would lead to malnourishment.

The likelihood estimates showed that maternal education and greater number of people in the household were protective against stunting. Increased education, as discussed above, has been shown to be protective in many studies. Number of members in a household could also shelter the child against chronic malnourishment, because the mother would have assistance with her daily responsibilities leaving her with more time to care for her child. It is also possible that in an extended family, the mother gets input from more experienced, older relatives (usually mothers-in-law) who could guide her towards better care for her child.

Interestingly, our analysis showed a contrasting relationship between mother's decision making ability regarding major household purchases with stunting and wasting. The data shows that if a mother has increased autonomy in this sense, her child is less likely to be stunted but more likely to be wasted.

When attempting to make sense of this finding, some clarifications should first be considered. When the mother was asked about her decision-making abilities, no timeframe was given. She was not asked if there was a recent change in her role within her family. Also, it is suspected by the investigators that maternal autonomy, in this regard, has a bimodal peak between high and low SES. This may be because in less educated and lower earning families, husbands are increasingly reliant on their wife's input to make ends meet and make major household decisions.

Since wasting is acute malnourishment, it is conceivable that an acute downturn in a family's socioeconomic fortune would coincide with increased maternal autonomy and the child's wasting (without the chronic malnourishment associated with stunting). However, this is only a

proposition and more work needs to be done to better understand this relationship.

6.1 Limitations

This study of maternal autonomy was limited by a number of factors. The cross-sectional nature of the study limits the ability to draw conclusions about how these maternal factors evolve over time, which would be helpful in understanding their effect on the natural history of chronic childhood undernutrition in this population. Also, this study could have benefited from a more complete qualitative analysis of the psychosocial factors at play in this community as it is possible that important cultural practices were missed. For example, it was realized half way into the study that monthly income would be vital in understanding maternal autonomy and child malnutrition. However, most women were not aware of their husband's monthly income. They were able to state how much their husband makes per day, and how many days he works a week. This allowed the investigator to calculate monthly income. However, even further into the study it was discovered that the wife does not have access to her husband's income. She is given a daily "allowance" which does not necessarily correlate to the income. Given these gaps in data collection, it is difficult to reliably use the income data collected as a predictor of child malnutrition.

Since this study was conducted as a survey, it relies on self-reported information and is vulnerable to recall bias. This, for example, could affect data for domestic violence or how long a child was breast fed, respectively. Additionally, this was a cross-sectional analysis with no long-term follow-up so it can only establish correlation and not causation.

Another limitation of this study is that it does not include male perspective. While this is a study on maternal autonomy, it would be valuable to understand male perception of this issue as

suggested by studies done by Ghuman et al¹⁹.

CHAPTER 7

LIST OF TABELS

Table 1:

1. How old is surveyed child?
2. How old are you currently?
3. How old were you at the birth of your first child?
4. How old were you at the birth of your surveyed child?
5. How many children do you currently?
6. What is the age gap between surveyed child and whichever child is closest in age?
7. How many people are in your household?
8. Does your household consist of a nuclear or extended family?
9. What is your current marital status?
10. Do you have a job, and if so, how many hours did you work in a week?
11. Which grade in school did you complete?
12. Are you literate (in any language)?
13. Where was child delivered?
14. How many ante-natal doctor visits did you attend?
15. After delivery, when was the surveyed child first breast fed?
16. How long did you exclusively breast fed your child (no complementary foods)?
17. What was the first complimentary food introduced?
18. When did the child start drinking alternative sources of milk?
19. How was the milk diluted?
20. When were you taught to initiate complementary foods for your child?
21. How many months was the child when solid food was initiated?
22. Were specific foods avoided? If so, why?
23. Who feeds the child?*
24. Who controls the child's diet?*
25. Who usually makes decisions about making purchases for daily household needs?*^D
26. Who usually makes decisions about making major household purchases?*^D
27. Who usually makes decisions about visits to family or relatives?*^D
28. Imagine that when your child is 10 years old and they either weigh 10kg less or are 10cm shorter than other children. Which scenario worry you the most?
29. Rank these in the order of most importance to you when your child is 20 years old: education, earning capacity, health.
30. Do you think your child is healthy for their age?
31. Do you think your child is tall enough for their age?
32. Do you think your child weighs enough for their age?
33. Have you ever been threatened, hit, punched, slapped or injured by your husband?*^A
34. Have you ever been hurt or frightened so badly by your husband that you were in fear for your life?*

* Maternal autonomy screening questions

^D Questions taken from "Household Decision-Making Scale"

^A Questions taken from "Domestic Violence Screening Tool"

Table 2: Baseline characteristic of mothers with children between 6-36 months

Characteristics	Mean	Min	Max
Maternal age (years)	23.7	18	36
Maternal age at birth of first child (years)	19.36	13	30
Maternal age at birth of surveyed child (years)	22.05	16	33
Age gap between children (months)	29.06	10	138
Family structure			
Number of children	2	1	7
Number of members in household	5	3	16
Income			
Average monthly income per household (Rupees)	8,878.42	1,000	30,000
Average monthly income per capita (Rupees)	2,101.31	171	1,000
Exclusive breast feeding for child (months)	5.09	0	18
	n	Percentage	
Family structure			
Nuclear family household	141	70.85	
Extended family household	58	29.15	
Marital status			
Married	199	100	
Single, divorced, widowed	0	0	
Maternal occupation			
No occupation	178	89.45	
Works <20 hours per week	8	4.02	
Works >20 hours per week	13	6.53	
Education level			
Uneducated	20	10.05	
Basic (1-7)	82	41.20	
Secondary (8+)	97	48.74	
Religion			
Muslim	106	89.08	
Hindu	11	9.24	
Christian	2	1.68	
Location of delivery			
At home with no assistance from community midwife	7	3.52	
At home with assistance community midwife	6	3.02	
At a hospital	186	93.47	

Table 3: Baseline characteristics of children between 6-36 months

Characteristics	n	Percentage
Gender		
Male	96	48.24
Female	103	51.76
Age (months)		
6-11	47	24.12
12-17	59	29.65
18-23	40	20.10
24-29	31	15.58
30-36	22	11.06
Stunting (Z-score)		31.66
Normal (SD > -1.99)	136	68.34
Stunted (SD < -2)	48	24.12
Severely stunted (SD < -3)	15	7.54
Wasting (Z-score)		22.61
Normal (SD > -1.99)	154	77.39
Wasted (SD < -2)	32	16.08
Severely wasted (SD < -3)	13	6.53

	Average
Age (months)	18.16
Wasting (Z-score)	-1.29
Female wasting	-1.23
Male wasting	-1.33
Stunting (Z-score)	-1.41
Female stunting	-1.42
Male stunting	-1.40

Table 4 Descriptive statistics of maternal autonomy

Characteristics	n	Percentage
Who feeds the child		
Mother alone or mother and father	178	89.45
Father alone or someone else	21	10.55
Controls the child's diet		
Mother alone or mother and father	141	70.85
Father alone or someone else	58	29.15
Decisions about daily household purchases		
Mother alone or mother and father	95	47.74
Father alone or someone else	104	52.26
Decisions about major household purchases		
Mother alone or mother and father	89	44.75
Father alone or someone else	110	55.28
Decisions about visits to family members		
Mother alone or mother and father	30	15.08
Father alone or someone else	169	84.92
Domestic violence		
Absent	148	74.37
Present	51	25.62
Fear of life threatening domestic violence		
Absent	168	84.42
Present	31	15.58

Table 5 Relationship between maternal factors and child malnourishment

Maternal factor	n (mothers)	Wasting		Stunting	
		% Children wasted	P-value	% Children stunted	P-value
Family structure			0.677 ^c		0.327 ^c
Nuclear	141	23.40		34.75	
Extended	58	20.69		27.59	
Education			0.094 ^{*c}		0.086 ^{*c}
0-7 th standard	102	27.45		38.24	
>8 th standard	97	17.53		26.80	
Employment			0.789 ^f		0.575 ^c
Unemployed	178	23.03		32.02	
Employed	21	19.05		38.09	
Number of antenatal doctor visits			0.130 ^f		0.090 ^{*f}
0-2 visits	6	50.00		66.67	
>3 visits	193	21.76		31.61	
Location of delivery			0.496 ^f		0.093 ^c
Home delivery	13	30.77		53.84	
Hospital delivery	186	22.04		31.18	
Milk:water dilution ratio			0.369 ^f		0.216 ^f
Not diluted	4	0		0	
Diluted >2:1 (milk:water)	120	22.5		32.5	
Awareness of when to initiate complimentary foods			0.168 ^c		0.086 ^c
No awareness	102	18.63		38.24	
Proper awareness	97	26.80		26.80	

* Trend towards significance, P-value <0.10

^c Chi-Square contingency analysis

^f Fisher's Exact test

Table 6 Relationship between maternal autonomy and child malnourishment

Maternal Factors	n (mothers)	Wasting		Stunting	
		% Children wasted	P-value	% Children stunted	P-value
Feeds child			0.214 ^c		0.6725 ^c
Mother alone or mother and father	178	21.35		33.15	
Father alone or someone else	21	33.33		28.57	
Controls child's diet			0.742 ^c		0.518 ^c
Mother alone or mother and father	141	21.99		34.04	
Father alone or someone else	58	24.14		29.31	
Decisions about daily household purchases			0.870 ^c		0.539 ^c
Mother alone or mother and father	95	22.11		30.53	
Father alone or someone else	104	23.08		34.62	
Decisions about major household purchases			0.019** ^c		0.002** ^c
Mother alone or mother and father	89	30.34		21.35	
Father alone or someone else	110	16.36		41.82	
Decisions about visiting family members			0.919 ^c		0.109* ^c
Mother alone or mother and father	30	23.33		20.00	
Mother alone or mother and father	169	22.49		34.91	
Domestic Violence			0.836 ^c		0.237 ^c
Absent	148	22.97		30.41	
Present	51	21.57		39.22	
Fear of life threatening domestic violence			0.996 ^c		0.435
Absent	168	22.62		31.55	
Present	31	22.58		38.71	

* Trend towards significance, P-value <0.10

** Statistically significant, P-value <0.05

^c Chi-Square contingency analysis^f Fisher's Exact test

Table 7 Likelihood estimate for wasting and stunting

Characteristic	Estimate	Confidence Interval
Wasting		
Mother is involved in decisions about major household purchases	2.226	1.130-4.384
Stunting		
Mother is involved in decisions about major household purchases	0.291	0.149-0.568
Number of people in household	0.879	0.594-0.913
Mother's education level	0.291	0.791-0.976

CHAPTER 8
LIST OF FIGURES



Figure 1: Social worker carries an infant scale and survey forms as she walks through the streets of DJ Halli. To her left are houses built with concrete and metal sheets which are typical to this slum. To her right where a small creek once used to flow is the dumping ground for waste and trash burning.



Figure 2: Communal water source located in alleyways where residents gather daily to collect water for their cooking, drinking, cleaning, and bathing needs.



Figure 3: Dirt covered alleyways leading to homes made of concrete and metal sheets. Clothes line the alleyway as they hang to dry. These pathways are prone to flooding with very little rain or problems with the sewage system.



Figure 4: Two year old child demonstrates how weights were obtained for children who were old enough to stand independently.



Figure 5: Height is being measured for a 10-month-old infant using an Infantometer.



Figure 6: Investigator and social worker/translator sit down with a mother and her child to conduct the survey.



Figure 4: Fourteen-month-old severely stunted and wasted child who is unable to sit or support his head on his own. The mother is uneducated, illiterate, and stays at home with this child and her 2 month old. The father sells samosas (an Indian dish) from a stand at the local market. Both parents are unaware of this child's delayed developmental milestones.

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VITAE

Sindhu Sudanagunta (March 3rd 1992 - present) was born and raised in Andhra Pradesh, India and moved to the United States when she was 8 years old. Her father is a Software Programmer, mother is a Geriatrician, and her sister is a college student studying to become a physician. Sindhu graduated from the University of Texas at Dallas with a Magna Cum Laude and Collegium V honors in Neuroscience. Currently, Sindhu is a 4th year medical student at University of Texas Southwestern in Dallas, Texas. She will be continuing her training as a Pediatric resident at Children's Medical Center in Dallas, Texas where she hopes to also pursue her global health interest.

Permanent Address: 2804 Fox Creek Trail
Arlington, TX, 76017