Master's Theses   University of Connecticut Graduate School

5-9-2014

Social and Environmental Risk Factors for Anemia and Malnutrition Among Adolescent Girls in Mumbai, India

Dylan E. Graetz

University of Connecticut, dgraetz@student.uchc.edu

Social and Environmental Risk Factors for Anemia and Malnutrition Among Adolescent Girls in Mumbai, India

Dylan Elizabeth Graetz

B.A., Middlebury College, 2008

A Thesis

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Public Health

At the

University of Connecticut

2014

APPROVAL PAGE

Masters of Public Health Thesis

Social and Environmental Risk Factors for Anemia and Malnutrition Among Adolescent Girls in Mumbai, India

Presented by

Dylan Elizabeth Graetz, B.A.

Major Advisor_____
Stephen L. Schensul

Associate Advisor_____
Judy Lewis

Associate Advisor_____
Jane A. Ungemack

University of Connecticut

2014

Acknowledgements

This work could not have been done without the incredible team in Mumbai, India. Specifically, I would like to thank Vaishali Jadhav and Vaishali Jagtap for their endless patience as they recruited study participants, obtained consent, and translated interviews and survey instruments. I would also like to thank Rajendra Singh for his consistent guidance and problem solving at every step of the India journey. Thank you to Parasnath Verma for his help with the survey instrument, data entry and study materials, and thank you to Prakash Mishra for his data analysis. To the rest of the team in India – thank you for your friendship and continual brainstorming. Thank you to Judy Lewis who showed up in India just in time to help me transition from qualitative to quantitative data collection and for serving on my thesis committee. Thank you also to Dr. Jane Ungemack for serving on my thesis committee and teaching me how to approach public health research and to Joe Burleson for his help with the power calculation and some of the statistical analysis. Thank you to my family and friends for unbelievable support always and tireless hours of listening to me talk about this research. Finally, thank you Dr. Stephen Schensul for introducing me to India and to international public health. Thank you for your guidance and encouragement, for your patience and willingness to let me explore new terrain in adolescence and anemia, and for helping me through every one of the 20,786 hurdles along the way.

Table of Contents

Introduction

This thesis has been written in the form of three publishable papers. The papers all stem from research conducted with a population of adolescent girls in a low-income community in Mumbai, India. While each paper has a unique focus, the study population is the same and there was one qualitative and one quantitative dataset used for all three papers.

Paper 1: *Anemia among Adolescents in a Low-Income Community in Mumbai, India:*

Prevalence, Symptoms and Social Correlates

Introduction

This paper assesses anemia among adolescent girls in a low-income community in Mumbai, India from the perspective of an objective hemoglobin value and the symptoms reported by adolescent girls. In addition, this study examines health as experienced by adolescent girls including symptoms, the treatment sought for symptoms, and the possible connection between symptoms and negative life experiences.

In 2008, the World Health Organization estimated that 1.62 billion people, 24.8% of the world's population, were anemic (Benoist et al., 2008). Causes of anemia include malnutrition, particularly iron and B12 deficiency, genetic causes such as sickle cell disease and thalassemia, and infections such as helminthes and malaria. Consequences of anemia include impaired concentration, attention span and language development, as well as negative effects on cognition, motor skills, intellectual development and overall learning ability (Lokeshwar, Mehta, Mehta, Shelke, Babar, 2011). Anemia can also lead to chronic fatigue, weakness, and body aches, resulting in decreased physical stamina and work efficiency (Lokeshwar et al., 2011). Much of the global anemia burden is concentrated in economically marginal communities in low and middle-income countries (LMICs), particularly in Africa and parts of Asia (Stolzfus, 2003). High-income countries are estimated to have a 9% rate of anemia, while LMICs range between 40-50% (Benoist et al., 2008).

In India, the most recent National Family Health Survey (NFHS; IIPS, 2006) showed a 70-80% prevalence of anemia in children, 56.2% in ever-married women, and 24% in adult men.

The same study looked at adolescents in India and found that in never-married women aged 15-24 the prevalence of anemia was 51.9%, almost at the level of ever-married women (IIPS, 2006). The high rate of anemia among adolescent girls may be related to increased nutritional requirements as they enter puberty, as well as greater loss of blood and iron through menses. In addition to these biologic determinants, the higher rates may reflect the vulnerability of Indian women within society and within the household (Bentley & Griffiths, 2003). Girls in India are frequently withdrawn from school as young adolescents so that they are able to contribute to household maintenance or participate in cash income generating activities within the home. Approximately 45% of Indian women marry below the legal age of 18 (Moore, et al., 2009). For many young Indian women, parents and older siblings may restrict mobility, social interactions, and economic opportunities. Gender inequity in many Indian households may mean that woman eat last and with more limited food availability than males (Suguna & Rani, 2008). In addition, women's healthcare is not prioritized in India and adolescent girls may be limited in their ability to seek treatment for symptoms until they are very severe.

Chronic fatigue and feelings of being weak and tired have been widely reported in India (Bhatia & Cleland, 1995). Women may experience and present to primary care clinics complaining of culturally-based syndromes or groups of symptoms that have been well described in the literature (Hahn & Harris, 2009), including *kamjori*, a syndrome experienced by Indian women that includes a range of complaints such as pain with menses, joint pain, dizziness, loss of appetite and chronic fatigue (Nichter, 1989; Kostick et al., 2010). Women in India who present with fatigue or *kamjori* are often clinically diagnosed with anemia in the absence of laboratory results and treated with iron supplements.

Kamjori has been associated with women's social burdens and pressure, low self-esteem, and gender inequality (Jejeebhoy & Koenig, 2003; Patel & Ooman, 1999; Hahn & Harris, 1999). Chronic fatigue has been associated with psychological factors indicative of gender disadvantage and poor mental health (Patel et al., 2006). Indian women who reported fatigue were more likely to report other physical symptoms associated with negative health and have increased levels of disability (Patel & Kleinman, 2003). Studies examining mental disorders in poor communities have identified insecurity, hopelessness, discrimination, violence and poor physical health as risk factors for depression and somatoform disorders (Patel & Kleinman, 2003). These social and environmental risk factors are particularly important for women (Lund et al., 2010). Thus, while many of the complaints associated with *kamjori* are consistent with symptoms commonly described in anemia, these symptoms may also describe somatoform expressions of a negative life situation and common mental health disorders.

The specific aim of this study was to examine the prevalence of anemia, based on a hemoglobin value, among adolescents as a particularly vulnerable population, in a low-income community in Mumbai, India. In addition, the study sought to explore anemia-like symptoms reported for adolescents seeking treatment. The hypothesis was that there would be only a weak association between objectively defined hemoglobin status and self-reported symptoms and that these symptoms could not be fully addressed by treatment for anemia alone.

Methods

This research was conducted in association with the program, *Research & Intervention in Sexual Health: Theory to Action* (RISHTA, an acronym meaning "relationship" in Hindi and Urdu). This program was a collaboration of the International Center for Research on Women (ICRW), the Tata Institute of Social Sciences (TISS), the Institute for Community Research and

the University of Connecticut Health Center (UCHC). Formative research on married women's risk issues led to the development of a multi-level intervention aimed at preventing HIV/STI among married women in Mumbai, India. This study sought to extend the exploration of married women's health to adolescent girls in the premarital stage.

Study Community

The study community is classified as a "slum" and is located in the northeast portion of Mumbai. The total population of the community is about 600,000, and most of the residents are migrants from Bihar, Uttar Pradesh, West Bengal and Bangladesh. The population is about 80% Muslim, 15% Hindus, and an additional 5% consisting of Buddhists and Christians. The community incorporates "legal" (municipally-recognized) settlements as well as illegal extensions and encroachments. Homes include *kachcha* dwellings, constructed out of plastic, cardboard and other "found materials" and *pucca* houses, constructed out of cement and brick. The average household income is 5,900 INR per month (about 100 US dollars). The size of an average household is 6.2 people, with almost 90% of the homes consisting of a single room.

Qualitative Data Collection

Qualitative data collection began with identifying key informants; women in the community who had access to and frequent interaction with adolescent girls. Twelve informants included social workers associated with various NGOs (4), private school teachers (2), public school teachers (1), training class instructors (1) and healthcare workers (4).

In-depth interviews were conducted with girls and mothers. The girls interviewed were unmarried adolescents aged 13-18 who had reached menarche and lived in the study community. The sampling frame used for these interviews were based on religion (Muslim v. Hindu) and student status (in or out of school). Hindus were oversampled in order to generate an adequate

picture of ethno-religious differences (see Table 1). Interviews were also conducted with a subset

of 12 mothers of the interviewed girls. Three mothers from each of the four sample cells were

interviewed.

Table 1. Sampling grid used for qualitative data

		In-school	**Out-of-school**
Muslim	Girls	5	6
	Mothers	3	3
Hindu	Girls	5	5
	Mothers	3	3

All interviews began with open-ended questions aimed at eliciting a narrative. Additional

questions were used as probes if certain topics or domains were not fully explored. Interviews

were conducted in either Hindi or Marathi (the Maharashtra state language) and recorded with a

digital recorder. The interviews were then translated and transcribed simultaneously.

Quantitative Data Collection

Analysis of the qualitative data was used to re-work the hypotheses and identify variables

for the quantitative survey. The draft survey was pre-tested on 8 adolescent girls. After pre-

testing, the survey was reviewed and questions were reformatted, deleted and added, and the

instrument was retranslated into Hindi. The final survey was administered orally in Hindi to 150

adolescent girls. For 12% of the sample, parts of the survey were further explained in Marathi.

The sample size was chosen expecting a small to medium effect size (r=0.20) and using

generally accepted values for alpha (0.05) and beta (0.20) for a one-tailed analysis. This

calculation yields a power (1 - beta) of 0.80 (80%).

The study community is divided into subsections or "plots." Two separate "plots," representing different subsets of the population, were used for the study sample. One plot was an initially established legal territory that consisted of predominantly *pucca* houses and families with slightly higher average income. The other plot was located on the outskirts of the community, an initially illegal territory that has a combination of *pucca* and *kachcha* homes. Within each plot, a sample of girls was selected based on ethnicity, age and other demographic factors.

In addition to the survey, anthropometric measurements were taken: hemoglobin, height and weight. Three drops of blood were drawn from each girl and a HemoCue (HemoCue worldwide, 2014) was used to assess hemoglobin as a representation of anemia status. The first two drops of blood from the prick were removed to ensure that the sample was based on fresh capillary blood and the third drop was placed in a cuvette for measurement. The HemoCue produces a digital hemoglobin reading within thirty seconds. Studies have demonstrated that the HemoCue provides hemoglobin results that are comparable to results generated by autoanalysers used as the standard method in U.S. hospitals (Srinivasan & Kasturba, 2010). In addition, the WHO and NFHS used the HemoCue machine for their population prevalence studies. Heights (using a tape measure) and weights (using a portable scale) were taken for each adolescent in the survey sample. These measurements were used to calculate body mass index (BMI).

Variables

The initial research model included four broad domains, *Household/Family, Community, Physical Health, Emotional Health*, which were examined in relation to each other and to the dependent variable of anemia. Each domain was further broken down into sub-factors and individual variables on the survey instrument.

Anemia was examined using hemoglobin level as a continuous variable. The raw hemoglobin values were squared to create a variable with an approximately normal distribution.

Symptoms: The domain of physical health included questions about symptoms experienced by the girls and treatment sought for these symptoms. The sample of adolescent girls was asked about 34 different symptoms they might have experienced during the last 3 months. A Principal Components Analysis (PCA) resulted in a three-factor solution of grouped symptoms. One of the factors that emerged consisted of *kamjori*, irregular menses, weakness, fatigue, fainting, *safed pani* (white vaginal discharge), previous worm infection, loss of appetite and menses flow lasting more than 7 days. Many of these symptoms are used clinically as potential indicators of anemia. This factor showed reliability (Cronbach's alpha of 0.704) and was transformed into a scale with a normal distribution (skewness -0.092). When scaled as *"anemia-like symptoms"* the variable ranged from 0 to 8, indicating that there were girls who did not suffer from any of these symptoms (10.8%), and no girls who suffered from all ten of the symptoms. About 30% of girls suffered from at least half of these symptoms.

Community Variables: The domain of community included questions about school, friends, training programs, boys, discrimination, violence, mobility, and societal norms. To investigate girls' perceptions of their community semantic differential scales (Osgood, 1957) using dichotomies such as *"bad v. good," "violent v. peaceful," "dangerous v. safe," "unfriendly v. friendly."* These questions were combined into a scale of "*Community Attitudes*" (Cronbach's alpha 0.756) with a normal distribution.

To explore discrimination in the community girls were asked six different questions in a "*yes*" or "*no*" format *"In your community are girls treated different than boys regarding…"* that asked about food, mobility, household work, education/trainings, work for income and marriage.

The responses to these questions were grouped into a scale (Cronbach's Alpha = 0.849), which was transformed into a dichotomous variable, *"Community-based Gender Discrimination,"*

Household variables: The household domain included individual questions about different members of the household (e.g. mother, father, male siblings, female siblings) as well as factors such as violence, food distribution, and household responsibilities. To explore household-based gender inequity a *"Household discrimination"* scale was created. This was similar to the *"Community Discrimination,"* scale as it combined questions asking girls if they were treated differently from their siblings in relation to various topics (e.g., food distribution, marriage) (Cronbach's alpha of 0.823).

Violence in the home was explored through individual variables that separately explored physical and verbal violence at the hands of mothers, fathers and siblings. These variables were combined to create an overall *"Home violence"* scale (Cronbach's alpha = 0.731) in which lower numbers reflected more violence within the home.

Data Analysis

Qualitative data were analyzed using Atlas.ti, a computer-based, text-search program that allows multiple codes to be searched at the same time, providing the capability of qualitative "testing" of hypotheses. The codes were developed using a tree-diagram method (Schensul & Schensul, 1999).

Quantitative analysis was conducted using SPSS 17.0. Univariate statistics including descriptive statistics such as sample size, means, medians, standard deviations and indices of normality were produced. In order to examine the relationships among variables, bivariate analyses were explored. Depending on the metric, bivariate statistics include T-Test, One-way ANOVA, Chi-Square, and Pearson's "r" correlation.

Consent was obtained from each girl and her mother using forms that were approved by the IRB at the University of Connecticut in December 2011. These forms were translated into written Hindi before use, and occasionally the administrator used additional oral translation into Marathi to clarify for Hindu girls and women. In addition, all girls were provided with a brochure translated into Hindi that explained anemia, what it was and how to treat and prevent it. Surveyed girls were told their anemia status and girls who were found to be anemic were referred to a healthcare provider.
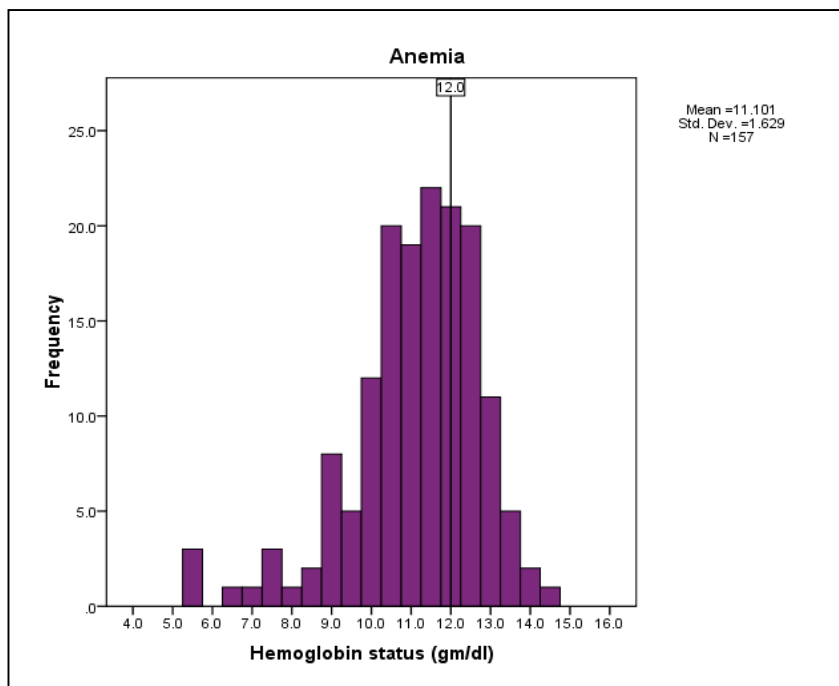
Results

Demographics

The final survey sample was demographically representative of the total community population. Of the survey sample, 77.7% of the girls surveyed were Muslim, 17.2% were Hindu, and 4.5% were Buddhist. The girls ranged in age from 13 to 18, with a mean age of 16.2. Approximately 30% of the girls were aged 13-15, 26.1% of the girls were 16 years old, 20.4% were 17 and 23.6% of girls were 18 years old. About half (47.8%), of the girls resided in the less affluent illegal settlements, and the rest in legal, more stable, areas (46.5%). Of the girls surveyed, 29.3% lived in *"kachcha/semi-pucca"* dwellings, while 70.7% lived in *"pucca"* homes. More than half of the girls (56%) lived in homes with more than 6 family members; 12% lived in households with 10 or more members and 32% of girls lived in houses with 5 or fewer. The vast majority, 96.2% of girls, lived in homes that had two or fewer rooms. There was a wide range in monthly household income. Sixteen percent of girls lived in households where the monthly income was >12,000 INR ($200), 49% lived in households with a monthly income of 6,000-11,999 INR ($100-200) and 35% of girls lived in homes where the monthly income was less than 5,500 INR ($90). Over half of the girls (58.1%,) were enrolled in school at the time of

the interview, 18% were not in school but were working for cash income from home, and 23.9% of girls were neither enrolled in school nor working for income. Only one of the girls interviewed never attended school, and 7.1% did not advance past 5th standard. However, the average standard the girls had completed was 8.6 and 37.8% of girls were in school until at least 10th standard.

Anemia Prevalence

Of the girls surveyed, 47.8% were found to be mildly anemic (Hb of 10.0-11.9 g/dl), 17.9% of girls were found to be moderately anemic (Hb 7.0-9.9 g/dl) and 2.5% of girls were severely anemic (Hb <7.0 g/dl). Overall, the HemoCue results for this sample showed that 68.2% of girls surveyed were in the anemic range. The lowest hemoglobin measured was 5.5 g/dl and the highest was 14.4 g/dl. The mean was 11.1 and the median was 11.3 (Figure 1 depicts anemia prevalence in the community).

Figure 1: Histogram of Anemia Prevalence. *

* Line denotes cut-off for anemia

Table 2 compares the anemia results from the NFHS (IIPS, 2006) from India as a whole and from the sample of slum communities from 6 urban areas in India to the results in the study community.

Table 2

Anemia Prevalence: Overall NFHS Compared to NFHS Slum Sample and Mumbai Population.

Anemia Status	NFHS – India (Age 15-19)	NFHS – Slum (Age 15-21)	Study Population (Age 13-18)
Mild (Hb 10.0-11.9)	39.1%	30.5%	47.8%
Moderate (Hb 7.0-9.9)	14.9%	9.9%	17.9%
Severe (Hb <7.0)	1.7%	1.4%	2.5%
Total (Hb <12.0)	**55.7%**	**34%**	**68.2%**

The results from this study demonstrate a higher overall prevalence of anemia in adolescent girls in this urban community than found in the NFHS. While the sample population used for this study included a slightly younger age range, there is a higher prevalence of anemia in every severity category than indicated by the NFHS

Symptoms

There were nine symptoms included in the symptom scale. Table 3 depicts each symptom included in the anemia scale as well as the frequency of symptoms reported, and the percentage of girls who sought treatment for each symptom.

Table 3

Pseudo-anemic Symptoms and Treatment

Symptom	Girls who experienced symptom	Girls experiencing symptoms who sought treatment
Kamjori	100 (63.7%)	33 (33%)
Fatigue	97 (61.8%)	20 (20.6%)
Weakness/Lack of energy	87 (55.4%)	38 (43.7%)
Loss of appetite	84 (53.5%)	18 (21.4%)
Fainting/Loss of consciousness	84 (53.5%)	9 (10.7%)
Safed Pani	67 (42.7%)	13 (19.4%)
Worms	25 (15.9%)	20 (80%)
Irregular menses	24 (15.3%)	3 (12.5%)
Flow lasting more than 7 days	17 (10.8%)	4 (23.5%)

The most common symptom for which the girls sought treatment was "worms", with 80% of

girls who experienced this symptom seeking care. This may be because worms is considered a

serious condition, however the result may also be skewed by the fact that the girls who sought

treatment would have been given this diagnosis and girls who did not seek treatment might

describe the symptoms of a helminth infection differently. The second most commonly treated

symptom was weakness or lack of energy, but less than half of the girls experiencing this

symptom sought healthcare. For all of the other symptoms included, a third or fewer of the girls

experiencing the symptom sought treatment. The symptoms for which the fewest girls sought

treatment included fainting (10.7%), and irregular menses (12.5%); symptoms that are often

considered very serious in developed countries and communities.

The qualitative data further explored symptoms such as weakness and *kamjori*. Some

girls discussed weakness as a minor problem and explained the home remedies used to overcome

their symptoms:

> *R: "I am very fit"*
> *V: "Do you feel weakness?"*
> *R: "Weakness? Yeah, sometimes I feel weakness…Usually whenever I feel weak or pain I*
> *don't tell my mother or anyone in my home, I just take a painkiller and go to sleep."* (15-
> year-old Muslim schoolgirl)

On the other hand, some girls and mothers talked about how serious their symptoms could get.

They talked about how illness interfered with school and household work, and many of them

described weakness to the point of fainting.

> *R: "I feel my body has become very dull and there is no energy in my body. I don't feel*
> *like doing anything, I just want to sit or lie down. Sometimes my teacher tells me to write*
> *notes and actually my hand is weak and I can't even write."* (15-year-old school-going
> Muslim girl)

> *V: Earlier you said you were feeling "kamjor" so what did you mean?*
> *R: "Whenever I do work, I feel like there is a dark in front of my eyes and I feel very pale.*
> *Then I feel that I'll fall down, I'll faint, and I will die. Those two and three minutes are*

unbearable for me, but after three minutes I come to a normal state." (17-year-old Hindu girl, currently out of school)

When girls and women discussed seeking treatment, some reported that the doctors did not pay much attention:

"R: I went to that doctor…and they told me 'you don't have any major health problems, you just have kamjori'" (15-year-old Hindu girl, currently out of school)

While others said they did receive treatment and described doctors connecting their symptoms to anemia:

R: *"My auntie took me to the hospital and there was a ladies doctor…she gave me an injection and some medicine and told me 'you have to complete this course because you have less blood in your body'"* (16 year-old Muslim girl, currently out of school)

Community Variables:

When describing their community, most of the girls used terms such as "*bad*" or "*not good*" (13 out of 21 girls interviewed explicitly stated this). Factors that contributed to this "bad" environment included violent events in the community, boys who teased and harassed girls in the streets, restrictions placed on the girls' mobility, substance use in the community, and feeling pressure to be "*good girls.*" The quantitative data demonstrated that 21% of girls described their community as *"very bad"* or *"somewhat bad"*, 56.1% of girls described it as *"very"* or *"somewhat violent"*, 32.5% of girls described it as *"very"* or *"somewhat dangerous"* and 26.1% of girls described it as *"very"* or *"somewhat unfriendly.*" When looking at the scaled variable of *Community Attitudes* 41.4% of girls described their community in mostly negative terms.

Girls also discussed the limited role for women in the community and the discrimination that exists between boys and girls surrounding mobility, material goods, food, education and marriage. The girls reported various negative emotions related to their interactions with the community. Three girls expressed anger, three others said they felt fear, and one talked about

crying alone on a regular basis. When surveyed, 58% of girls described discrimination within the community.

Household

In addition, almost half of the girls (9 out of 21) described some form of discrimination at home, and most of this was related to mobility or household work. They said they were more responsible for household work than their male siblings, and more restricted when it came to leaving the house. Almost half of the girls surveyed, 47.8%, described discrimination within the home. Gender was most commonly identified as the basis for discrimination.

Girls also talked about experiencing violence at home, usually because they did not listen or obey their family members, because they did not study or do household work, because they were fighting with siblings, or because they "did something wrong." Quantitative analysis demonstrated that 64.3% of girls reported being the victim of some form of verbal violence within the home, and 78.3% of girls experienced physical violence within the home.

The relationship of hemoglobin level and self-reported anemia-like symptoms

Despite the identification of a trend between hemoglobin level as measured by HemoCue and the scale of *anemia-like symptoms*, there was no significant correlation (r= -0.133, p = 0.098).

The social and environmental variables of community and household perceptions were then examined in relation to hemoglobin level and symptoms. No significant correlations were found between hemoglobin levels and variables examining community perceptions and discrimination in or out of the home.

However, there were significant associations found between symptoms and social variables. Girls who reported more symptoms was more likely to describe her community in

negative terms (r = -0.189, p= 0.017), and more likely to report that girls in the community were treated differently and more negatively than boys (r=-0.187, p = 0.019). Girls who reported more symptoms also reported significantly more discrimination in the home (r = 0.352, p<0.001), as well as more violence in the home (r = -0.256, p =0.018).

Discussion

Almost 70% of adolescent girls in the survey sample had some degree of anemia. This prevalence rate was greater than the results from the NFHS for both India as a whole and for slum communities in six Indian urban areas. This rate suggests that any adolescent girl seeking treatment for any health problem should be assumed to have anemia and treated accordingly.

In addition, the results demonstrated that symptoms such as fatigue and weakness are common in the community, with most of the girls experiencing at least one of the *anemia-like symptoms* over the past three months. However, girls do not often seek treatment for their symptoms. In fact, the only symptom for which more than half of the girls sought treatment was a helminth infection.

When adolescent girls do come to a primary care provider, these anemia-like symptoms are commonly used to diagnose anemia in the absence of laboratory resources for testing hemoglobin. While the rate of anemia in this sample clearly indicates that all girls in the study community should be assumed to have anemia, a treatment focus on anemia is insufficient to address the life issues that are associated with *anemia-like* symptoms.

The results presented here suggest that anemia-like symptoms are reflective of negative experiences at home and in the community, and that these symptoms may indicate a difficult life situation not remediable by a prescription or supplement for low hemoglobin. Adolescent girls who experience more violence and gender inequity the home and the community are likely to

express these life difficulties in the form *anemia-like* symptoms. Anemia treatment alone for this subset of girls will not be sufficient and approaches need to be found to address the psychosocial issues that are the basis for these symptoms.

Healthcare providers in the community must be educated about the connection between symptoms of weakness and fatigue and negative life situations, as well as potential somatoform and mental health disorders. Providers should be encouraged to discuss these issues with their adolescent female patients and look at options for treatment beyond anemia. However, healthcare based solutions are not sufficient as these results demonstrate that many of the girls in the community are not accessing healthcare. These girls, their mothers and families, should be informed about the importance of these symptoms. The community should be provided with information about the potential negative health effects of gender inequity and safety within the community.

Adolescent girls in low-income urban communities must deal with many challenges to their health and well-being. Anemia is clearly a major problem to be addressed in this community, and this paper has shown that a comprehensive psychosocial approach is needed to more fully address the health needs of adolescent girls.

Paper 2: *The Epidemiology and Social Correlates of Anemia among Adolescent Girls in a*

Low-Income Community in Mumbai

Introduction

This paper is based on data drawn from a study that assessed the epidemiology of anemia among adolescent girls in a low-income community in Mumbai India and investigated the social and environmental risk factors for anemia in this community. Anemia, broadly defined as low hemoglobin, is a complex disease with potentially devastating effects (Beniost, McLean, Egli, Cogswell, 2008; Balarajan, Ramakrishnan, Ozaaltin, Shankar, Subramanian, 2011). In addition to chronic fatigue, weakness, decreased work efficiency and impaired concentration (Lokeshwar, Mehta, Mehta, Shelke, Babar, 2011), anemia has been found to be a serious risk factor for maternal and child health. In India, anemia is estimated to be a direct or indirect cause of 26% of maternal deaths, and anemia during pregnancy is associated with increased risk of premature delivery, low birth weight and intrauterine growth retardation; all of which result in increased perinatal mortality (Stolzfus, 2003; Bharati, et al., 2008). As a result of the negative impact of maternal anemia on maternal and child health, much of the focus on anemia has been with young married women who have had or anticipate having children (Bharati, Som, Chakrabarty, Bharati, Pal, 2008).

Less well studied are pre-marital adolescent girls in India, despite their many risk factors and the anticipation of early marriage and pregnancy before their growth period is over (Shobha & Sharada, 2003). The most recent National Family Health Survey (2006) indicated the prevalence of anemia in India to be 51.9% in never married women aged 15-24, almost as high as the prevalence in married women (IIPS, 2006). The fact that many adolescent girls head into

young marriage and conception with high rates of anemia, suggests that the pre-marital period may be an effective intervention point.

The causes of anemia are multifactorial, particularly in India. Internationally, and especially in low-income communities, malnutrition is thought to be one of the main causes of anemia. About half of the anemia seen worldwide is a result of iron-deficiency (Pasricha, Drakesmith, Black, Hipgrave, Biggs, 2013), which has been described as one of the "top ten risk factors contributing to death" (Dubey, 1994). Iron-deficiency is responsible for over 841,000 deaths and over 35 million disability-adjusted life years lost (Stolzfus, 2003). In addition to iron-deficiency, biologic causes of anemia include other forms of malnutrition such as B12 deficiency, genetic causes such as sickle cell disease and thalassemia, and infections such as helminthes and malaria, all of which are present in India. Adolescent girls have increased nutritional requirements as they enter puberty, as well as greater loss of blood and iron through menses, putting them at increased biologic risk for anemia.

In addition to the potential biologic risk factors for anemia, adolescent girls in low income communities are exposed to negative social and environmental factors such as poor housing, patriarchal political economy, religious constraints, gender inequity, and low levels of education, all of which have been associated with varying rates of anemia internationally (Balarajan et al., 2011; Bentley & Griffiths, 2002; Cotta et al., 2011).

Violence has been identified as a specific risk factor for malnutrition and anemia. A biophysiological perspective connects violence and anemia through a stress response (Ackerson & Subramanian, 2008). Domestic violence has been demonstrated to increase psychological stress (Kumar et al., 2005; Kitzman et al., 2003) and correlate with malnutrition among women and children in India (Ackerson & Subramanian, 2008). It has been shown that psychological

stress induced by experiencing or witnessing domestic violence, increases oxidative stress (Epel et al., 2004; Hapuarachchi, Chalmers, Winefeld, Blak-Mortimer, 2003; Irie, Asami, Nagata, Miyata, Kasai, 2001), resulting in free radicals that may damage living tissues (Halliwell, 1994). Oxidative stress may destroy red blood cells prematurely, resulting in a hemolytic anemia (Lang, Lang, Lang, Huber, Wieder, 2006; Sivilotti, 2004). In addition, chronic stress has been linked to long-term reductions of hemoglobin and erythrocytes, possibly because stress interferes with protein synthesis required to create new red blood cells (Mischler et al., 2005).

Because the emphasis has been on biological causes, these cultural and environmental risk factors have not been effectively researched nor have they been targeted as a means of reducing anemia. This study looked broadly at biologic, social and environmental risk factors in an attempt to differentiate why girls are more or less anemic in Mumbai, India where the overall prevalence of anemia is exceptionally high.

Methods

This study was supported by the program, *Research & Intervention in Sexual Health: Theory to Action* (RISHTA, an acronym meaning "relationship" in Hindi and Urdu). This program was a collaborative effort focused on women's risk issues that eventually resulted in a multi-level intervention aimed at preventing HIV/STI among married women in Mumbai, India. By focusing on adolescent girls, this study sought to continue RISHTA's exploration on women's health in the context of their social situation prior to marriage.

Study Community

Research was conducted in a low-income community of approximately 600,000 people in Northeast Mumbai. The inhabitants are predominantly Muslim (approximately 80%); with the remaining mix mostly Hindus, as well as Buddhists and Christians. There are legal settlement

areas with *pucca* (organized) houses, constructed out of cement and brick, as well as illegal extensions and encroachments where homes are often *kachcha* (disorganized) dwellings, constructed out of plastic, cardboard and other "found materials". Household income ranges from approximately 5,500 INR per month ($90) to 12, 000 INR ($200) per month. Most households consist of 6-7 people living in a single room.

Qualitative Data Collection

The first stage of qualitative data collection involved identifying key informants - women in the community who had access to and frequent interaction with adolescent girls. The twelve informants interviewed included social workers, teachers and healthcare workers. These interviews were informal and included open-ended questions investigating the informant's ideas regarding adolescent girls in the community.

The next, more formal, stage of qualitative data collection involved in-depth interviews with unmarried adolescents aged 13-18 who had reached menses and lived in the study community. In order to explore religious stereotypes discussed casually in the community, and in an attempt to capture diversity within each group, the sampling frame used for the interviews was based on religion (Muslim v. Hindu) and educational participation (in or out of school). Hindu girls were oversampled in relation to the community demographics to get a more complete comparative picture (the sampling frame is illustrated in Table 1).

Table 1. Sampling grid used for qualitative data

		In-school	**Out-of-school**
Muslim	Girls	5	6
	Mothers	3	3
Hindu	Girls	5	5
	Mothers	3	3

The qualitative interviews began with open-ended questions aimed at eliciting a narrative based on four large domains including *"Household," "Community," "Physical Health,"* and *"Emotional Health."* If topics required further exploration, additional questions were used as probes. Interviews were conducted in Hindi and Marathi (the Maharashtra state language) and recorded with a digital recorder before being translated and transcribed simultaneously.

Quantitative Data Collection

Qualitative data was analyzed and these results were used to re-work the hypotheses. The qualitative data was formative in identifying variables and shaping the quantitative survey instrument. Once a draft survey was created it was pre-tested on 8 adolescent girls, and then reviewed. After pre-testing, questions were reformatted, deleted and added, and the survey was translated into Hindi. The final survey was administered orally in Hindi to 150 adolescent girls. For about 12% of the girls, certain survey questions were further explained in Marathi.

The sample size for the quantitative data was chosen expecting a small to medium effect size (r=0.20) and using generally accepted values for alpha (0.05) and beta (0.20) for a one-tailed analysis. This calculation yields a power (1 - beta) of 0.80 (80%) and resulted in an *n* of 150 adolescent girls. The girls were sampled using two separate "plots" or subsections of the community. Each subsection represented a slightly different socioeconomic status. One plot was a legal settlement and consisted of mostly *pucca* homes, while the other was an initially illegal territory on the outskirts of the community with a combination of *pucca* and *kachcha* homes. Within each plot, the sample of girls was selected based on representative demographics including age and religion.

In addition to the survey, anthropometric measurements including hemoglobin, height and weight were taken. Hemoglobin was measured using a HemoCue machine (HemoCue

worldwide, 2014) which produces a digital hemoglobin reading within thirty seconds that has been demonstrated to be comparable to results generated by autoanalysers (Srinivasan & Kasturba, 2010). Heights were measured with a tape measure, and weights were measured using a portable scale. These measurements were used to calculate body mass index (BMI).

Variables

In order to examine potential risk factors for anemia, the research model focused on four broad domains, *Household/Family, Community, Physical Health,* and *Emotional Health*. These domains were examined in relation to each other and to the dependent variable, anemia. Each domain was broken down into sub-factors and individual variables, which were specifically investigated on the survey instrument.

Household/Family: Sub-factors under the household domain included each member of the household: mother, father, sibling and extended family members. Various questions were asked about household members in order to explore the dynamic within the home and the girl's relationships with her family members. Other survey items explored meals/food distribution, responsibilities at home, household finances, and expectations household members had for the adolescent's future.

Violence was explored by asking respondents about verbal and physical violence at the hand of each primary member of the household (mother, father, female siblings, male siblings). These questions were structured "*Does your mother/father/sibling…"* and asked ""*slap/twist/push/punch you?*" "*kick/drag/beat you?*" and "*shout at you/use abusive words towards you?*" The first two questions explored different forms of physical violence while the third looked at verbal abuse. The verbal violence and physical violence items were summed and transformed into dichotomous variables differentiating girls who experienced verbal and physical

abuse at home from those that did not. Overall violence in the home was examined by summing all forms of violence (verbal and physical) from all family members: *"Home violence"* (Cronbach's Alpha = 0.731). Finally, because fathers and female siblings emerged as significant violent offenders, another variable was created which looked at whether girls experienced physical violence specifically at the hands of these perpetrators.

Community Variables: The survey explored girls experience and involvement with school, training classes, friends/peers, boys, discrimination, violence, mobility, and societal norms. Respondents were asked about their perceptions of the community using a semantic differential format to describe their community using dichotomies such as *"bad v. good," "violent v. peaceful," "dangerous v. safe," "unfriendly v. friendly."* These questions were combined into a scale of *"Community Attitudes"* (Cronbach's alpha 0.756) with a normal distribution. Respondents were asked how often they were verbally or physically harassed in the community (ranging from *"never"* to *"every time I walk in the street"*). These items were recoded into a dichotomous variable differentiating girls who did or did not experience verbal and physical harassment.

Physical Health: The domain of physical health included questions about symptoms experienced by the girls and treatment sought for these symptoms. Respondents were asked about 34 different symptoms they might have experienced during the last 3 months including potential risk factors for anemia such as *"malaria", "worm infection",* and questions related to their menses. Girls were also asked specifically about the types of food they ate, including green leafy vegetables and meat, which contain a high amount of iron.

Anemia was examined using hemoglobin level as a continuous variable. The raw hemoglobin values were squared to create a variable with an approximately normal distribution.

Data Analysis

Atlas.ti, a computer-based, text-search program was used for qualitative analysis. This program allows multiple codes to be searched at the same time, providing the capability of qualitative "testing" of hypotheses. The codes used for this study were developed using a tree-diagram method (Schensul & Schensul, 1999).

SPSS 17.0 was used for quantitative analysis. Analysis began with univariate statistics including descriptive statistics such as sample size, means, medians, standard deviations and indices of normality. Next, bivariate analyses statistics including T-Test, One-way ANOVA, Chi-Square, and Pearson's "r" were explored using hemoglobin concentration as the dependent variable.

Consent forms approved by the IRB at the University of Connecticut in December 2011 were used to obtain consent from each girl and mother. The consent forms were translated into written Hindi before use, and occasionally the administrator used additional oral translation into Marathi to clarify consent forms for Hindu girls and mothers. In addition, all girls were provided with a brochure in Hindi that explained anemia, as well as how to treat and prevent it. Each girl was told her anemia status and anemic girls were advised to see a healthcare provider in the community.

Results

Demographics

The girls sampled included a diverse group that was demographically representative of the community on a whole. The age range of the girls surveyed was 13 to 18, with a mean age of 16.2. Compared to the 80% Muslim community, 77.7% of the girls surveyed were Muslim, 17.2% were Hindu, and 4.5% were Buddhist. About half (46.5%) of the girls resided legal, more

stable areas and 70.7% lived in *pucca* homes. The other half of the girls lived in the less affluent illegal settlements, and 29.3% lived in "*kachcha/semi-pucca*" dwellings. Only 32% of the girls lived in households comprised of 5 or fewer family members, 56% lived in homes with more than 6 family members, and 12% lived in households with 10 or more members. Household income ranged, with 16% of girls living in households where the monthly income was >12,000 INR ($200), 49% in households with a monthly income of 6,000-11,999 INR ($100-200) and 35% where the monthly income was less than 5,500 INR ($90). Almost all of the girls, 96.2%, lived in homes that had two or fewer rooms. Over half of the girls (58.1%) were enrolled in school at the time of the interview while 18% were not in school but worked at home for income, and the remaining girls (23.9%) were neither enrolled in school nor working for income. The average grade level completed was 8.6. Only one girl interviewed had never attended school, and 7.1% never advanced past 5th standard; 37.8% of girls were in school until at least the 10th standard.

Anemia

There was a higher anemia prevalence found in the adolescent girls in this low-income community than expected based on the results of the NFHS. While the sample population used for this study included a slightly younger age range, there is a higher prevalence of anemia in every severity category than demonstrated by the NFHS (Table 2 compares NFHS data to this study population).

Table 2

Anemia Prevalence: Overall NFHS Compared to NFHS Slum Sample and Mumbai Population.

Anemia Status	NFHS – India (Age 15-19)	NFHS – Slum (Age 15-21)	Study Population (Age 13-18)
Mild (Hb 10.0-11.9)	39.1%	30.5%	47.8%
Moderate (Hb 7.0-9.9)	14.9%	9.9%	17.9%
Severe (Hb <7.0)	1.7%	1.4%	2.5%
Total (Hb <12.0)	55.7%	34%	68.2%

Associated Risk Factors

Demographic and biologic variables were examined as potential risk factors for anemia. There were no significant associations found between demographic factors (e.g. age, religion, household income) and anemia status as defined by HemoCue measurements of hemoglobin. In terms of biologic variables, lower hemoglobin values correlated with longer length of menses (p=0.018), however, no significance was found between hemoglobin and a history of irregular, prolonged, or heavy menses, blood in stools, or vomiting or coughing blood.

Low hemoglobin correlated with a history of "typhoid" diagnosis (p=0.002), but there was no significance found between hemoglobin and a previous diagnosis of a helminthic infection or malaria. It is possible that the correlation found between typhoid and hemoglobin status is due to improper diagnosis within the community. Both typhoid and malaria are characterized by a high fever, and often a diagnosis of one or the other (or both) is made without further testing. Alternatively, while typhoid is not known to cause a bloody diarrhea, the profuse diarrhea caused by this condition may result in decreased absorption of necessary vitamins and minerals and could exacerbate malnutrition and thus anemia.

Food intake was explored to examine the relationship between nutrition and anemia. There is very little meat consumed in the community. The meat consumed most frequently is chicken (82.8% of girls surveyed had at least tasted chicken) which does not have a high concentration of iron, and the meat consumed least frequently is beef, with only 56.7% of girls ever consuming beef. However, there was a significant correlation demonstrating that girls who consumed less beef had lower hemoglobin values (p=0.035). Green vegetables are another good source of both iron and vitamin B12 and are consumed much more frequently in the study community. Almost all of the girls (94.3%) consume green-leafy vegetables, and 19.1% eat them

daily. However, there was no significant correlation between hemoglobin and intake of green vegetables and hemoglobin status. There was also no significant correlation between BMI and hemoglobin.

Due to the lack of correlation between hemoglobin status and biologic or demographic variables, the focus shifted to social and environmental risk factors, and violence emerged as particularly important. In the qualitative interviews girls described violent acts they witnessed in the community. The girls' perceptions varied and there was a group of girls who did not think of their community as quite so violent and were less afraid to travel alone outside. However, in general most girls agreed it was safer to stay inside and none of them felt comfortable walking alone at night. Some girls were particularly fearful and described serious acts of violence that they heard about or witnessed:

> *"This area was very dangerous. Boys used to bring all the dangerous things like sword and knife and everything and used to bring hockey [sticks] too and they had lots of fights there."* (14-year-old Muslim schoolgirl)

> *"They just come with the sword and they cut each other…there was a marriage of a girl and the boys came, some Muslim boys came, and they killed her brother during the ceremony of marriage. So from then onwards I'm very much afraid to go outside, because anything can happen at any time.*" (18-year-old Hindu schoolgirl)

The quantitative data demonstrated that over half of the girls (56.1%) thought their community was very or somewhat violent. Thirty-one percent said that it was somewhat or very peaceful, while 13.4% of girls said it was neither violent nor peaceful. One-third of girls (32.5%) described the community as somewhat or very dangerous, while 63.7% felt it was at least somewhat safe.

Sexual assault and abuse came up in a few of the qualitative interviews, and girls discussed unwanted interactions with boys as a reason to stay off the streets. Two girls talked about rapes that had occurred in their area.

"A few days ago, there is a the bus depot, so near that bus depot one girl was raped." (14-year-old Muslim schoolgirl)

"Some six-year-old girls or 10-year-old girls get raped. We get all this information through television or from newspapers so we heard about these rape cases and all these things so I'm very worried about it." (16-year-old Muslim out-of-school girl)

These girls discussed the fear they felt as a result of the violence and cited it as a major reason they stayed in their homes. Of the girls surveyed, 58% answered yes when asked if they had experienced harassment in the community and 15.9% of girls said boys in the community had touched them. (The prevalence of girls reporting forms of violence in the community is shown in Table 3.)

Table 3		
Girls Reporting Community Violence		
Description of Violence	**Frequency**	**Percent**
Perceive community as very or somewhat violent	88	56.1%
Perceive community as very or somewhat dangerous	52	32.5%
Experienced harassment	91	58%
Experienced physical harassment	24	15.9%

Girls also discussed violence within the home. The survey instrument asked about specific family members and their expressions of either physical or verbal violence. Mothers were the most frequent offenders of every type of violence, and particularly verbal violence. This result is supported by the qualitative interviews in which many girls referred to verbal violence, and mothers were the most frequent "yellers." However, the qualitative data demonstrates that this particular violence ranged in severity and that the verbal violence on the part of the mothers was often in the form of stern reprimands rather than emotional abuse.

"My mother always shouts at me… When I cook the food and I don't pay attention and I watch the TV then she shouts at me because the rice gets burns. Yesterday only I was

cooking rice and it got burned so my mother shouted at me." (15-year-old Muslim schoolgirl)

"We make noise while dancing, that's why she shouts at us." (17-year-old Hindu schoolgirl)

Male siblings were the second most commonly cited source for both types of physical violence, and qualitatively many girls described fighting with their brothers. Fathers were the second most commonly reported perpetrators of verbal violence, however fathers and sisters were the least likely to be cited as perpetrators of physical violence (see table 4).

Table 4				
Types of Violence Inflicted by Core Members of the Household				
	Mother	**Father**	**Female Siblings**	**Male Siblings**
Slap/Twist/Push/Punch	67.1%	27.7%	33.6%	39.3%
Kick/Drag/Beat	21.9%	10.3%	8.7%	12.1%
Shout/Use abusive words	88.4%	60.3%	43.9%	52.5%

*Note: These percentages are out of total girls able to answer the question; girls who did not have certain family members (e.g. no male siblings) were not included in the totals for that question

The violence variables were summed to look generally at girls who reported experiencing any type of physical or verbal violence at home. When examined together, there were actually more girls who reported at least one form of physical violence than verbal violence within the home. Overall, 101 of the 157 girls surveyed (64.3%) reported being the victim of some form of verbal violence in the home, while 78.3% said they experienced some form of physical violence at home (see table 5).

Table 5		
Girls reporting violence at home		
Description of Violence	**Frequency**	**Percent of girls**
Verbal Violence	101	64.3
Physical Violence	123	78.3

In qualitative interviews, many of the girls were hesitant to talk about physical violence directed at them or their siblings, however a few described witnessing abuse at home, and those that did often described their fathers as the most violent perpetrators:

> *"My father used to drink and then come for my mother and physically and verbally abuse her and if my father was abusing her in front of us then my mother feels really bad so we used to go and sit in our neighbor's home and I would start to cry."* (16-year-old Hindu out-of-school girl)

In addition, mothers talked about violence at home, and almost always referred to physical abuse their husbands inflicted upon them.

> *"My husband starts fighting with me…he will start beating me up. Now he doesn't beat me up regularly...but earlier he used to beat me regularly."* (Hindu mother of a girl currently in school)

They referred to this abuse as a common and normal phenomenon.

> *"It happens; husband and wife fight with each other."* (Hindu mother of a girl currently in school)
> *"You know in marriages there are fights and sometimes the husband beats the wife. But it happens everywhere so you know it's no problem.*
>
> *V: Has your husband ever beat you?*
> *R: Yes, so many times but what can I do? It's okay."* (Hindu mother of a girl not currently in school)

Girls also frequently described fighting physically with their siblings, most often their male siblings.

> *V: Okay tell me the relationship between you and your brother and sisters?*

> *R: My younger brother (the older one) he always fights with me. I have a very nice relationship with my younger sister* (17 year-old Hindu schoolgirl)

In general, girls usually described the relationships they had with their sisters as closer than their relationships with brothers.

> *V: I have very good and friendly relationship with my family members. My sister is very close to me and even my mother is very close to me. Whatever is there I share with my mother and my sister. There is nothing that they don't know; they know everything about me.* (18 year-old Hindu schoolgirl)

However, occasionally female siblings were described as angry or aggressive:

> *R: You know, my sister fights with me for each and every small reason…We'll have some argument and then we'll both sit quietly for a while and you know she has a habit of using abusive words and I don't like it.*
>
> *V: So what is your reaction to it?*
>
> *R: I do nothing; I just sit quietly for a while. If I say something she will only start using more abusive words so it is better to keep quiet.* (17 year-old Muslim out-of-school girl)

The quantitative data demonstrated fathers and female siblings as the members of the household least likely to express physical violence against the adolescent girls, and the qualitative interviews supported this as they featured mothers and male siblings much more frequently than fathers and sisters when discussing violence. Fathers and female siblings that were discussed as violent emerged as unusual and particularly aggressive. Violence at the hands of these family members was further explored with quantitative analysis. The questions that asked specifically about physical violence expressed by female siblings and fathers: "*How often do your female siblings [or fathers]…slap/twist/punch/push you*" and "*…kick/drag/beat you?*" were transformed into dichotomous variables and looked at individually in bivariate analysis with the dependent variable of hemoglobin status; all of them demonstrated significant correlations (see Table 6).

Table 6

Physical Violence Inflicted by Father or Female Sibling in Relation to Hemoglobin Status

Variable	F-statistic	*p-value*
Female siblings kick/drag/beat	4.677	0.033
Female siblings slap/twist/punch/push	7.348	0.008
Father kick/drag/beat	10.715	0.001
Father slap/twist/punch/push	6.054	0.015

These variables were then summed to create one variable that looked at physical violence at the hands of either fathers or female siblings. Overall, more than one-third of girls (38.2%) reported being physically abused by their fathers and/or female siblings. In addition, there was a significant relationship between reported abuse at the hands of their fathers or female siblings and lower hemoglobin status (F=4.698, p=0.032). Girls who mentioned physical violence inflicted by their fathers or sisters had a mean hemoglobin concentration of 10.8 g/dl, while the mean hemoglobin concentration of girls who said they did not experience these types of violence was 11.3 g/dl.

Discussion

The overall prevalence of anemia in this community is particularly high, however this study demonstrated very few significant correlations between demographic or biologic risk factors and hemoglobin status. This is important because most previous interventions aimed at reducing anemia prevalence have targeted biologic risk factors. These interventions have focused on helminthes infections, malaria (Kung'u et al., 2009), and nutritional supplementation (Lokeshwar et al., 2011).

The Government of India has been providing supplementation through the National Nutritional Anemia Prophylaxis Programme for over 40 years. This program initially targeted

expected and nursing mothers as well as children 1-5 years old, but has been recently expanded

to include adolescents 11-18 years of age. Unfortunately, evaluations of this program have

demonstrated inadequate and irregular supplies (Vijayaraghavan, Brahmam, Nair, Akbar,

Pralhad Rao, 1990) and the prevalence of anemia remains unacceptably high (Bharati et al.,

2009). Out of the girls surveyed in this study, 37.4% were aware of a supplementation program,

however none of them reported taking supplements unless previously diagnosed with anemia.

Social determinants of health are often overlooked or underemphasized when compared

to biologic risk factors because the biologic connections are more direct, easier to demonstrate,

and potentially altered with simpler interventions. When social and environmental risk factors

were examined, violence, especially within the home, emerged as a particularly relevant risk.

Since violence inflicted by the father specifically correlates with anemia, it is important to look

directly at this relationship. The qualitative data describes some fathers who are less responsible

at home due to alcohol consumption linked to abuse. In the interviews, girls described fathers

who were unable to work because of their addictions. This addiction caused financial stress both

because the father was not generating income, and because of the money required to support his

addiction. There was also a link between addiction and violence, as girls often said their fathers

would return home drunk and beat them or their mothers. Since the men in this community are

the primary providers for the family, it follows that a father who is less capable of supporting and

feeding his family is unable to carry out his traditional role as supporter of household. In

addition, domestic violence has been demonstrated to increase psychological stress (Kumar,

Jeyaseelan, Suresh, Ahuja, 2005; Kitzmann, Gaylord, Holt, Kenny, 2003) and correlate with

malnutrition among women and children in India (Ackerson & Subramanian, 2008).

While the exact mechanism is unknown, the results from this study indicate that adolescent girls who are exposed to particular forms of violence in the home have lower hemoglobin concentrations and are more likely to suffer from anemia. The link between anemia and violence should be further investigated and considered as a basis of intervention.

Home based interventions that encourage a non-violent family life, as well as community interventions aimed at greater security for adolescent females may be required in addition to standard biomedical interventions for effective anemia prevention. At least some of these interventions should specifically target fathers in this community. This is a particularly difficult group to reach as they often have limited interaction with healthcare organizations and NGOs. The most effective intervention points would most likely be religious gatherings or the workplace. The focus of the interventions should be reducing substance abuse, and specifically violence. Men need to be informed about the long-term negative effects their actions have on their families. In addition, interventions should be aimed at empowering girls and strengthening relationships between female siblings. These interventions can take place at schools or through NGOs. Girls in the community are already being taken on retreats to talk about sexual education and other healthcare topics, and violence preventions should be integrated into these activities. These results encourage an approach that broadens our efforts to combat anemia and demonstrates that the social context, and violence prevention in particular, is critical to the health of adolescent girls.

Paper 3: *Body-Image and Dieting among Adolescent Girls in a low Income Community in Mumbai, India*

Introduction

This study seeks to explore concepts of body image and dietary behavior among adolescent girls in a low-income community in Mumbai, India, where there is a high degree of malnutrition and anemia. Body image and eating habits of adolescents have been extensively explored in high-income, resource-rich countries (Hepworth, 1999; Davis & Yager, 1992). Recent literature has begun to examine eating habits in affluent populations of low and middle-income countries (LMICs; Stigler et. al., 2011), with particular emphasis on obesity among middle and upper classes (Chugh & Puri, 2001). However, few studies have examined body image and nutrition among adolescent girls living in resource-poor communities.

The high level of malnutrition and anemia among women living in rural and urban poor communities in LMICs has been well documented (Balarajan, Ramakrishnan, Ozaaltin, Shankar, Subramanian, 2011; Benoist, McLean, Egli, Cogswell, 20008). Malnutrition and its comorbidities have been cited as an extremely important cause of illness and death globally, and malnutrition has been noted to be the single most important risk factor for disease in developing countries (Muller & Krawinkel, 2005).

The World Health Organization (WHO) defines a body mass index (BMI) of less than 18.5 as underweight and a possible indication of malnutrition (WHO, 2014). In India, 41.3% of women aged 15-19 meet this criterion (IIPS, 2006). And the problem of malnutrition in India is not limited to rural areas. The most recent NFHS, conducted from 2005-2006, demonstrates that in urban areas the prevalence of underweight women aged 15-19 was at its very highest, 44%, indicating that young women in the slums may be particularly at risk (IIPS, 2006).

One factor that may be putting adolescents in urban communities at particular risk is the messages they receive through a globalized and national media and access to related technology. Many girls in low-income urban communities now have cell phones. In 2013, there were 893,862 million cell phones in use in India, a number higher than that in the United States and second only to China (World Fact Book, 2014). Privately owned TV stations using cable are increasing exponentially. By 2011, more than 100 million homes had access to cable and satellite television (World Fact Book, 2014).

It has been demonstrated that the media plays an important role in defining "the body beautiful" (Cameron & Ferraro, 2004). "Body image" has been defined as "the mental picture we have of our body's measures, contours and shape; and our feelings related to these characteristics and to our own body" (Gardner, 1996). Body image may include weight and skin color, as well as the behaviors and tools used to alter the image such as diet, cosmetics and clothing. The body image of a heavier woman was seen as an ideal in an earlier historical time. Studies have now shown that the image of beauty projected by current media has changed as models actresses and pageant winners have become thinner and thinner (Byrd-Bredbenner, Murray, Schlussel, 2005).

Historically, it was thought that non-Western populations were protected from the thin ideal (Kayano et al., 2008). In these communities, beauty and status were attributed to individuals with greater amounts of weight, which symbolized affluence, prosperity and fertility (Nasser, 1988; Rucker & Cash, 1992). However, the image of beauty in these populations is changing, it is getting thinner, lighter skinned, and wearing skinny jeans and make- up.

While media access has increased in these slum communities, the average income has shown limited advances, even in the years of high economic growth. The percentage of people living below the poverty line in India has been slowly decreasing (35% in 1999 compared to

50% in 1951), however due to the rapidly growing population, the absolute number of poor in India has actually increased from 164 million in 1951 to 312 million in 1999. Surveys have indicated that in the slums, 40-50% of households live below the poverty line, and another 11% live just above it (Barrett & Beardmore, 2000). In the slum community used for this study, the average household income remains extremely low, with 6-10 family members often living on less than $200 a month. This helps explain why there is still such a high rate of malnutrition in these communities, but raises the question: what happens in a community in which a high degree of malnourishment interacts with increasing access to media providing new body images?

To answer this question, this paper will examine the changing concept of "body-image" and investigate the perceptions and behaviors of adolescent girls in a poor urban community.

Methods

Study Community

Research was conducted in a low-income, "slum", community of 600,000 migrants located in Northeast Mumbai. This community is predominantly Muslim (80%); the remaining residents are Hindus (15%) as well as Christians and Buddhists. Most households in this community range from 5-8 members living in a single room, with an average household income of 5,500 INR ($100 dollars) a month.

Qualitative Data Collection

Semi-structured interviews were conducted with twelve key informants, including social workers associated with NGOs (4), private (2) and public (1) schoolteachers, training class instructors (1) and healthcare workers (4). In-depth interviews were conducted with unmarried adolescent girls aged 13-18 who had reached menarche and lived in the study community. Sampling for the interviews was based on student status (in or out of school) and religion

(Muslim v. Hindu). In order to generate an adequate picture of ethno-religious differences Hindus were oversampled in comparison to community demographics (see Table 1). Similar interviews were conducted with 12 mothers of the interviewed girls. The interviews were conducted in either Hindi or Marathi (the Maharashtra State language) and digitally recorded before being translated and transcribed.

Table 1. Sampling grid used for qualitative data

		In-school	**Out-of-school**
Muslim	Girls	5	6
	Mothers	3	3
Hindu	Girls	5	5
	Mothers	3	3

Quantitative Data Collection

Body-image was discussed during qualitative interviews, and analysis of these interviews was used to re-work the hypotheses and identify variables for the survey instrument. Specifically, dieting was added to the survey instrument based on analysis of qualitative data. The survey was pre-tested on 8 adolescent girls, then reviewed and reformatted, with questions deleted and added. The instrument was translated into Hindi and administered orally in Hindi to 150 adolescent girls. For 12% of the sample (mostly Hindu girls) parts of the survey were further explained in Marathi.

Girls were sampled from two subsections or community "plots" representing different socioeconomic subsets of the population. The sample size chosen was based on a one-tailed analysis with a small to medium effect size (r=0.20) and generally accepted alpha (0.05) and beta (0.20) values. This calculation yields a power (1 - beta) of 0.80 (80%).

In addition to the survey, anthropometric measurements were taken including heights (using a tape measure) and weights (using a portable scale) for each adolescent in the survey sample. These measurements were used to calculate body mass index (BMI).

Key Variables

BMI was calculated and used as a continuous variable. BMI was also re-coded and examined using the WHO categories of *"underweight" "normal"* and *"overweight*."

Media exposure was assessed by asking: *"how often do you read/watch/listen to...newspapers/magazines/movies/TV/radio/internet?"* Answer choices included *"daily"*, *"sometimes", "rarely"* and *"never."* These variables were recoded as dichotomous *"exposure"* variables.

To examine body image and self-perception, girls were asked questions such as *"how healthy do you feel?" "how attractive do you consider yourself?" "how would you describe your body?"* and *"how would you describe your skin color?"* The girls answered these questions on a scale, e.g. *"very unhealthy," "somewhat unhealthy," "neither healthy nor unhealthy," "somewhat healthy,"* or *"very healthy."* The responses to these questions were recoded as dichotomous variables that divided positive and negative attitudes, e.g. *healthy* v. *unhealthy*. Girls were also asked *"yes/no"* questions regarding their use of skin-lightening products and if they dieted or skipped meals to lose weight. In addition there were survey questions asking the girls how often they wore make-up and what clothing they wore when they left the house (*"burqa," "salwar kameez,"* or *"western clothing").*

Data Analysis

Atlas.ti, a computer-based, text-search program was used for qualitative data analysis. This program allows qualitative hypothesis "testing" by searching multiple codes at the same

time. The codes used for this study were developed using a tree-diagram method (Schensul & Schensul, 1999).

Quantitative analysis including univariate statistics and bivariate analysis was accomplished using SPSS 17.0. Descriptive statistics such as sample size, means, medians, standard deviations and indices of normality were initially produced for study variables. Bivariate analyses explored relationships between variables and included T-Test, One-way ANOVA, Chi-Square, and Pearson's "r" depending on the metric.

Consent forms approved by the IRB at the University of Connecticut in December 2011 were used to obtain oral consent from each girl and her mother. These forms were written in English and translated into written Hindi before use. Occasionally the administrator used additional oral translation into Marathi to clarify.

Results

Demographics

The girls surveyed ranged in age from 13-18, with a mean age of 16.2. Over half of the girls (58.1%,) were enrolled in school, 18% were not in school but were working for income from home, and 23.9% of girls were neither enrolled in school nor working for income. Only one of the girls interviewed never attended school, and 7.1% did not advance past 5th standard. However, 37.8% of girls were in school until at least 10th standard. About half (47.8%), of the girls resided in less affluent illegal settlements, and 29.3% lived in "*kachcha/semi-pucca*" dwellings. Other girls (46.5%) lived in more stable areas of the community and 70.7% lived in "*pucca*" homes. Regardless of location or type, most girls (96.2%), lived in houses that had two or fewer rooms. More than half of the girls (56%) lived in households with more than 6 family members and 12% lived in households with 10 or more members. Household income ranged

from 5,500 INR ($90) to >12,000 INR ($200), with 49% of girls living in households where the monthly income was between 6,000 and 11,999 INR ($100-200) a month.

BMI

Body Mass Index (or BMI) is an indicator used to assess an individual's body fat. BMI is calculated using weight in kilograms divided by height in meters squared. The WHO defines a BMI of less than 18.5 as underweight and a possible indication of malnutrition or other health problems (WHO, 2014). A BMI greater than 25 is considered overweight. The WHO recently added additional subcategories at each BMI extreme. These categories include "*severe thinness*" (BMI <16.0), "*moderate thinness*" (16.0-17.0), and "*mild thinness*" (BMI 17.0-18.5), as well as "*overweight*" (BMI 25-30), "*obese class I*" (30-35), "*obese class II*" (35-40) and "*obese class III*" also known as "*morbidly obese*" (BMI >40; WHO, 2014).

The data collected from the most recent 2006 India NFHS demonstrated that in India overall, 46.8% of women were underweight (BMI <18.5), 50.8% of women were a normal weight (BMI 18.5-24.99), and 2.4% of women were overweight or obese. Looking specifically at women living in slum communities in six urban areas, 45.1% of women aged 15-19 were underweight, 49.9% of normal weight, and 4.9% were overweight or obese (IIPS, 2006).

The girls in this study sample belonged to a slightly younger age group (13-18) than those examined through the NFHS, and demonstrated a higher percentage of BMIs at either end of the spectrum. According to the general categories, 51% of girls interviewed would be considered underweight, 43.3% were within the normal range, and 5.1% of girls would be considered overweight or obese based on BMI (see table 2).

Table 2

BMI: Overall NFHS Compared to NFHS Slum Sample and Mumbai Population.

Nutrition Status	NFHS – India (Age 15-19)	NFHS – Slum (Age 15-21)	Study Population (Age 13-18)
Underweight (BMI <18.5)	46.8%	45.1%	51%
Normal (BMI 18.5-24.99)	50.8%	49.9%	43.3%
Overweight (BMI >25)	2.4%	4.9%	5.1%

Using the subcategories for underweight, 16.6% of girls in the study community could be considered severely thin, 12.7% would be considered moderately thin and 21.7% would be considered mildly thin. The mean BMI in the sample of 157 was found to be 19.0 and the median was 18.4. (Figure 1 demonstrates the BMI curve in this community.)

Figure 1: Histogram of BMI. *
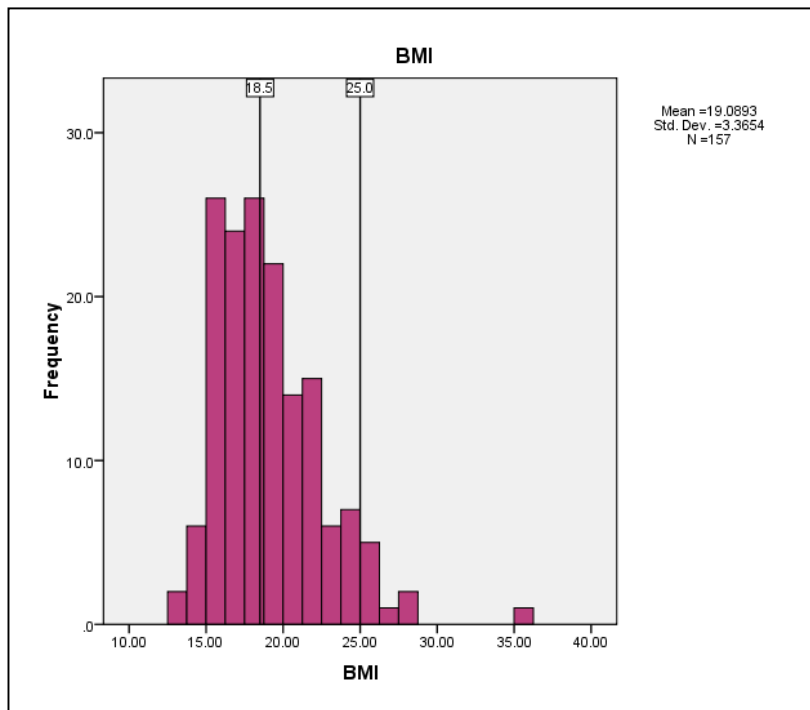
* Lines denote borders of normal range

Media Exposure

The key informants were the first to describe their worries about the increased media exposure in the community. A public school teacher said

"Now the children have the access of media and so if they see something in the television they want they will not listen to anything"

And a 29-year-old English teacher at a private high school agreed,

"They are influenced by all of the images around them and they are trying to take advantage of everything in the atmosphere…it affects them. Their culture, the media, it affects them."

A health worker at an NGO spoke specifically about how the media influenced young girls' body image saying

"Earlier girls were not much self conscious. Now…they will try to look beautiful, they will put some powder, lipstick, and liner. It is all the impact of media. Earlier we didn't have television and all that, now girls easily have access to television…and they want to follow the film stars."

Mothers of teenage girls were also concerned about this impact and one said directly

"If girls will watch serials and movies, then they will acquire bad habits."

When girls themselves were asked about different forms of media exposure, 85.4% (134 girls) said they have a TV in their home, and 70.7% (111 girls) watch TV daily. They described watching "*serials,*" which are similar to soap operas, "*moviesongs,*" which are music videos, and shows that give them beauty tips. One girl said:

"Me and my sister watch on TV, they show some home-made beauty tips for glowing skin, so me and my sister try those things." (17-year-old Hindu girl, not currently in school)

In addition to watching television, 62.4% of girls reported exposure to newspapers, 44.6% listened to the radio, 31.2% looked at magazines, 14% used the Internet, and 13.3% went to the movies.

Body Image and Self-perception

Girls were asked to describe their bodies, and how they felt about their own weight. In qualitative interviews girls described their perception of beauty. One girl said,

"I think I should make my waist level…it should not be bigger, it should be thin." (15-year-old Muslim schoolgirl)

And another said,

"The stomach should be flat…hips should be fat a little bit…the figure looks nice if the breasts are bigger." (17-year-old Hindu schoolgirl)

When asked about their own appearances, 44.6% of surveyed girls said they thought they were unattractive. As they elaborated on the theme of beauty, girls discussed their habits and the efforts they took to try to make themselves more attractive. Some girls talked about using cosmetics and skin-lightening products. One girl said

"I think I should change my life, change myself. I should change my dressing style and my hair and all that. I can't become fair but I use "Fair and Lovely" cream. And I apply powder and all that when I go to college so that my skin will look fairer." (15-year-old Muslim schoolgirl) [Note: *"Fair and Lovely"* is a commercial personal care brand and part of Unilever, a multinational corporation that includes Dove, Pond's, and Vaseline.]

On the other hand, some girls described make-up as "*ugly"* or "*fake."* One girl explained,

"The person who applies lots of make-up, she doesn't look beautiful. She will apply face powder and she will apply cream and she will put kajal in eyes (eye-liner), and she does all these things even if she really needs to go just nearby…. When she doesn't apply make-up she looks so good…she came to meet us she looked even more beautiful that time because she doesn't use any cream or anything." (15-year-old Hindu girl, not in school)

When surveyed, 85.4% of girls (134) reported using make-up at least on occasion, and 12.7% (20 girls) used skin-lightening products.

Girls also discussed how they dressed. Most girls dressed in the traditional salwar kameez (57.5%), which includes a long shirt or tunic and loose pants that are wide at the top and narrow at the ankle. About a third of girls wore the burqa (34.4%), a full-length outer garment worn by women in Islamic traditions in order to cover themselves in public. A few (8.2%) girls said they wore western clothing in the community. One girl explained that her peers

"Wear tight clothes so they can show the shape of their body" (15-year-old Muslim schoolgirl)

And another said

"I like to wear jeans…this is my wish". (16-year-old Muslim girl, out of school)

The concept of body image as it pertains to weight and figure was specifically explored by comparing girls' self-perceptions with calculated BMIs. Survey data showed that in general there was a much higher percentage of girls who thought they were overweight or normal than indicated by the BMIs, and in particular, over half of the girls surveyed were underweight but only about a quarter of girls thought they were underweight. Table 3 illustrates the differences between calculated BMI and self-perceptions.

Table 3

Percentage of Girls in Each BMI-based Weight Classification Compared to Self-perception

Weight Classification	**BMI**	**Self-Image**
Underweight	51%	26.1%
Normal	43.3%	35%
Obese/Overweight	5.1%	38%

Most of the overweight girls correctly perceived themselves as overweight, however the girls who were normal or underweight had very skewed perceptions of themselves. Over half of the girls with BMIs in the normal range perceived themselves as overweight and the majority of underweight girls perceived themselves as either normal or even overweight. Table 4 depicts a crosstabs illustrating how many girls were in each weight category based on BMI compared to self-perceptions.

Table 4

Crosstabs Illustrating Girls in each BMI Category Compared to Their Self-Perceptions

BMI	Girls Perceptions		
	Underweight	**Normal**	**Overweight**
Underweight	27	37	15
% Within BMI	34.2%	46.8%	19%
% Within self-perception	65.9%	67.3%	25%
Normal	13	18	37
% Within BMI	19.1%	26.5%	54.4%
% Within self-perception	31.5%	32.7%	61.7%
Overweight	1	0	8
% Within BMI	11.1%	0.0%	88.9%
% Within self-perception	2.4%	0.0%	13.3%

The mean BMI for girls who did not consider themselves overweight was 17.9, a value that falls in the underweight range, while the mean BMI for girls who considered themselves overweight was 21.1, a value that is considered normal.

In addition to being an indicator of poor self-esteem, the girls' skewed self-perceptions regarding weight led to unhealthy behaviors, as many girls admitted to altering their diet and skipping meals with the intention of losing weight. This topic first emerged during the qualitative interviews. In talking about beauty and "maintaining their figure," one girl was asked

> *"So what do you do to maintain your figure?"*
> And replied: *"I skip my lunch and I remain empty stomach."* (15-year-old Muslim schoolgirl

Another girl said,

> *"Sometimes I skip my food so that I can become thin."* (16-year-old Muslim girl, out of school)

Other girls talked about just eating the *"gravy"* or sauce around the meat and vegetables.

In the quantitative data, 33.1% of girls surveyed reported skipping meals in order to lose weight. There was a significant association between BMI and dieting (F=16.6, df=1, p<0.001), and the mean BMI for girls who said they skipped meals was 20.6, a value that is at the low end of the normal range, while the mean BMI for girls who did not skip meals was 18.4, a value that classifies them as underweight. Of the girls who reported skipping meals, 59.6% considered themselves overweight, however only 11.5% were overweight by objective standards. Half of the girls who diet are within the normal range, and the remaining 38.5% are actually underweight.

Discussion

Malnutrition and anemia continue to be a major problem in low-income communities in India, and many international and national programs are aimed at improving women's health and nutrition (Bharati et al., 2008; Shobha & Sharada, 2003). At the same time, there is increased social access and media exposure in poor urban communities in India, and a new idealized body type has developed that undermines health and nutritional improvement (Byrd-Bredbenner et al., 2005). This combination results in girls in these low resource communities, most of whom are already thin and anemic, comparing themselves to their peers and consistently striving meet a body image standard in line with media trends. In a community where the entire BMI curve is shifted down, women who are underweight have become the new normal, and girls in the normal range perceive themselves to be overweight.

These negative self-perceptions and the high prevalence of dieting pose a real, and relatively new, threat to young girls in this and similar communities. Although it was not possible to directly correlate greater media exposure to an increased desire to be thin, media exposure could certainly be contributing to or confirming the ideal of thin beauty. Adolescent

girls in the study community demonstrate a high degree of media exposure. The girls' limited

mobility keeps them inside for many hours of the day. Girls who are out of school, and even

those in training classes, working in household maintenance or earning cash income in the home

spend many hours watching television and communicating with friends via cell phones. There is

little control over what the girls watch, and they describe enjoying soap operas and music videos,

which feature young Bollywood stars. The body-image endorsed by Bollywood, the Western

media, as well as supported actively by pharmaceutical, cosmetic and apparel industries, may be

impacting how these young women perceive themselves, and in turn how they act and what they

eat.

In the West, the impact of media and body image results in eating disorders that range

from obesity at one end of the spectrum to anorexia and bulimia at the other end. The situation in

the study community is quite different; here there is a high degree of poverty, malnutrition and

anemia, coupled with a desire to be thinner. This "new normal" may lead to unhealthy eating

behaviors, putting young women at risk for even more severe malnutrition.

Urban communities where resources are already low may be particularly at-risk for the

negative body images being portrayed in the media. These are communities where the food

options are limited due to financial constraints and formal education is limited. Girls are not

necessarily aware of healthy eating habits, and even if they are, their families may not have the

resources required to choose healthy options. When they seek to lose weight, the only option is

skipping meals. Recognition of this new trend may require new approaches.

Interventions should not only address proper nutrition and supplementation but must also

counter the image of thin beauty. These efforts should begin with education on healthy weight

and a well-balanced, culturally appropriate diet. The girls in this community, like most

adolescent girls, are highly influenced by their peers. Interventions should be aimed at groups of girls and might include recreational activities that allow them to learn from and support one another. These activities could involve open discussions of concepts of beauty, led by powerful females in the community who might direct girls towards a healthier body image. These interventions could combine discussions of beauty with beauty tips and education about healthy cooking and eating. The women leading these discussions might also use the media to their advantage, focusing on stars with healthier figures, or trends that encourage a variety of shapes and skin-tones.

Adolescence is a vulnerable time, but it is also an important time for intervention, as it is during adolescence that most girls develop the habits they will take with them into adulthood. Change should be made now, before the girls enter the riskier stage of marriage and pregnancy, and while these dangerous ideals are still relatively new and thus less ingrained in adolescent perceptions.

References

1. Ackerson, L. K., & Subramanian, S. V. (2008). Domestic Violence And Chronic Malnutrition Among Women And Children In India. *American Journal of Epidemiology*, *167*(10), 1188-1196.
2. Balarajan, Y., Ramakrishnan, U., Ozaaltin, E., Shankar, A., & Subramanian, S. (2011). Anaemia in low-income and middle-income countries. *Lancet*, *378*(9809), 2123-2135.
3. Barrett, Alison, and Richard Beardmore. "Poverty reduction in India: Towards building successful slum upgrading strategies." *Encyclopedia of Life Support Systems* 1 (2000): 326-333.
4. Benoist, B., McLean, E., Egli, I., & Cogswell, M. (2008). *Worldwide prevalence of anaemia 1993-2005 of WHO Global Database of anaemia*. Geneva: World Health Organization.
5. Bentley, M. E., & Griffiths, P. L. (2003). The burden of anemia among women in India. *European Journal of Clinical Nutrition*, *57*, 52-60.
6. Bharati, P., Som, S., Chakrabarty, S., Bharati, S., & Pal, M. (2008). Prevalence of anemia and its determinants among nonpregnant and pregnant women in India. *Asia-Pacific Journal of Public Health, 20*(4), 347-59.
7. Bhatia, J., & Cleland, J. (1995). Self-reported symptoms of gynecological morbidity and their treatment in south India. *Studies in Family Planning*, *26*(4), 203-216.
8. Brabin, L., & Brabin, B. (1992). The cost of successful adolescent growth and development in girls in relation to iron and vitamin A status. *The American Journal of Clinical Nutrition*, *55*(5), 955-8.
9. Buckshee, K. (1997). Impact of roles of women on health in India. *International Journal of Gynecology and Obstetrics*, *58*(1), 35-42.
10. Byrd-Bredbenner, C., Murray, J., & Schlussel, Y. R. (2005). Temporal Changes in Anthropometric Measurements of Idealized Females and Young Women in General. *Women & Health, 41*(2), 13-30.
11. Cameron, E. M., & Ferraro, F. R. (2004). Body Satisfaction In College Women After Brief Exposure To Magazine Images. *Perceptual And Motor Skills*, *98*(3), 1093-1099.
12. Chugh, R., & Puri, S. (2001). Affluent adolescent girls of Delhi: eating and weight concerns. *British Journal of Nutrition*, *86*(04), 535.
13. Cook, J., Skikne, B., & Baynes, R. (1994). Iron deficiency: the global perspective. *Advances in experimental medicine and biology*, *356*, 219-28.
14. Cotta, R. M., Oliveira, F. D., Magalhaes, K. A., Ribeiro, A. Q., Sant'ana, L. F., Priore, S. E., et al. (2011). Social and biological determinants of iron deficiency anemia. *Cadernos de Saude Publica*, *27*, s309-s320.
15. Davis, C., & Yager, J. (1992). Transcultural aspects of eating disorders: A critical literature review. *Culture, Medicine and Psychiatry*, *16*(3), 377-394.
16. Davis, LM., Schensul, SL., Schensul, JJ., Verma RK., Nastasi, BK., & Singh, R., (in press). Women's empowerment and its differential impact on health in low income communities in Mumbai, India (Global Public Health, 2014)
17. Dubey, A. (1994). Iron deficiency anemia - epidemiology diagnosis and clinical profile. *Nutrition in Children in Developing Countries* (pp. 217-236). New Delhi: BI Publications Pvt Ltd.
18. Epel, E. S., Blackburn, E., Lin, J., Dhabhar, F., Adler, N., Morrow, J., et al. (2004).

Accelerated Telomere Shortening In Response To Life Stress. *Proceedings of the National Academy of Sciences*, *101*(49), 17312-17315.

19. Gardner, R. M. (1996). Methodological issues in assessment of the perceptual component of body image disturbance. *British Journal of Psychology*, *87*(2), 327-337.

20. Gore, F., Bloem, P., Patton, G., Ferguson, J., Joseph, V., Coffey, C., et al. (2011). Global burden of disease in young people aged 10-24 years: a systematic analysis. *The Lancet*, *377*(9783), 2093-2102.

21. Gupta, M., Chaturvedi, S., Chandarana, P., & Johnson, A. (2001). Weight-related body image concerns among 18-24-year-old women in Canada and India: an empirical comparative study. *Journal of Psychosomatic Research*, *50*(4), 193-8.

22. Hahn, R. A., & Harris, K. W. (1999). Sexual risk reduction among married men and women. *Anthropology in public health: bridging differences in culture and society* (pp. 365-393). Oxford: Oxford University Press.

23. Halliwell, B. (1994). Free radicals, antioxidants, and human disease: curiosity, cause, or consequence? *Lancet*, *344*(8924), 721-4.

24. Hapuarachchi, J. R., Chalmers, A. H., Winefield, A. H., & Blake-Mortimer, J. S. (2003). Changes in Clinically Relevant Metabolites with Psychological Stress Parameters. *Behavioral Medicine*, *29*(2), 52-59.

25. Heath, A., Skeaff, C., Williams, S., & Gibson, R. (2001). The role of blood loss and diet in the etiology of mild iron deficiency in premenopausal adult New Zealand women. *Public Health Nutrition*, *4*, 197-206.

26. Hemocue Worldwide. (n.d.). *Hemocue Worldwide*. Retrieved April 10, 2014, from http://www.hemocue.com/

27. Hepworth, J. (1999). *The social construction of anorexia nervosa*. London: Sage Publications.

28. Horton, S., & Ross, J. (2003). The economics of iron deficiency. *Food Policy*, *28*(1), 51-75.

29. Irie, M., Asami, S., Nagata, S., Miyata, M., & Kasai, H. (2001). Relationships between perceived workload, stress and oxidative DNA damage. *International Archives of Occupational and Environmental Health*, *74*(2), 153-157.

30. Jejeebhoy, S. J., & Koenig, M. (2003). The social context of gynecological morbidity: correlates, consequences and health seeking behavior. *Investigating reproductive tract infections and other gynaecological disorders a multidisciplinary research approach* (pp. 30-81). Cambridge, UK.: Cambridge University Press.

31. Johnson, K. (2001). Media and social change: the modernizing influences of television in rural India. *Media, Culture & Society*, *23*(2), 147-169.

32. Kayano, M., Yoshiuchi, K., Al-Adawi, S., Viernes, N., Dorvlo, A., Kumano, H., et al. (2008). Eating attitudes and body dissatisfaction in adolescents: cross-cultural study. *Psychiatry and Clinical Neurosciences*, *62*(1), 17-25.

33. Kitzmann, K. M., Gaylord, N. K., Holt, A. R., & Kenny, E. D. (2003). Child Witnesses To Domestic Violence: A Meta-analytic Review. *Journal of Consulting and Clinical Psychology*, *71*(2), 339-352.

34. Kostick, K. M., Schensul, S. L., Jadhav, K., Singh, R., Bavadekar, A., & Saggurti, N. (2010). Treatment Seeking, Vaginal Discharge and Psychosocial Distress Among Women in Urban Mumbai. *Culture, Medicine, and Psychiatry*, *34*(3), 529-547.

35. Kotecha, P., Nirupam, S., & Karkar, P. D. (2009). Adolescent girls' anaemia control

program me, Gujarat, India. *Indian Journal of Medical Research*, *130*(5), 584-589.

36. Kumar, S., Jeyaseelan, L., Suresh, S., & Ahuja, R. (2005). Domestic violence and its mental health correlates in Indian women. *The British Journal of Psychiatry*, *187*(1), 62-67.

37. Kung'u, J., Wright, V., Haji, H., Ramsan, M., Goodman, D., Tielsch, J., et al. (2009). Adjusting for the acute phase response is essential to interpret iron status indicators among young Zanzibari children prone to chronic malaria and helminth infections. *Journal of Nutrition*, *139*(11), 2124-31.

38. Kung'u, J. K., Goodman, D., Haji, H. J., Ramsan, M., Wright, V. J., Bickle, Q. D., et al. (2009). Early helminth infections are inversely related to anemia, malnutrition, and malaria and are not associated with inflammation in 6-to 23-month-old Zanzibari children. *The American Journal of Tropical Medicine and Hygiene, 81*, 1062-1070.

39. Lang, F., Lang, K. S., Lang, P. A., Huber, S. M., & Wieder, T. (2006). Mechanisms and Significance of Eryptosis. *Antioxidants & Redox Signaling*, *8*(7-8), 1183-1192.

40. Lokeshwar, M. R., Mehta, M., Mehta, N., Shelke, P., & Babar, N. (2011). Prevention of iron deficiency anemia (IDA): how far have we reached? *The Indian Journal of Pediatrics*, *78*(5), 593-602.

41. Lule, E., Rosen, J., Singh, S., Knowles, J., & Behrman, J. (2006). Adolescent Health Programs. *Disease control priorities in developing countries a summary* (pp. 1109-1124). Washington, D.C.: World Bank. (Original work published 1993)

42. Lund, C., Breen, A., Flisher, A. J., Kakuma, R., Corrigall, J., Joska, J. A., et al. (2010). Poverty And Common Mental Disorders In Low And Middle Income Countries: AÂ systematic Review. *Social Science & Medicine*, *71*(3), 517-528.

43. Lund, C., Silva, M. D., Plagerson, S., Cooper, S., Chisholm, D., Das, J., et al. (2011). Poverty and mental disorders: breaking the cycle in low-income and middle-income countries. *The Lancet*, *378*(9801), 1502-1514.

44. Mehra, S., & Agrawal, D. (2004). Adolescent health determinants for pregnancy and child health outcomes among the urban poor. *Indian Pediatrics*, *41*, 137-145.

45. Mischler, K., Fischer, J. E., Zgraggen, L., Kudielka, B. M., Preckel, D., & Kanel, R. V. (2005). The effect of repeated acute mental stress on habituation and recovery responses in hemoconcentration and blood cells in healthy men. *Life Sciences*, *77*(10), 1166-1179.

46. Nasser, M. (1988). Eating Disorders: The Cultural Dimension. *Social Psychiatry and Psychiatric Epidemiology*, *23*(3), 184-187.

47. *National Family Health Survey (NFHS-3), 2005-2006: India*. (2006). Mumbai, India: International Institute for Population Sciences.

48. Nichter, M. (1989). Lay perceptions of medicine: a South Indian case study. *Anthropology and international health: South Asian case studies* (pp. 187-213). Dordrecht, Netherlands: Kluwer Publishers.

49. Osgood, Charles Egerton, George J. Suci, and Percy H. Tannenbaum. *The measurement of meaning*. Urbana: University of Illinois Press, 1957.

50. Pasricha, S., Drakesmith, H., Black, J., Hipgrave, D., & Biggs, B. (2013). Control of iron deficiency anemia in low-and middle-income countries. *Blood*, *121*(14), 2607-17.

51. Patel, V., & Ooman, N. (1999). Mental health matters too: gynecological morbidity and depression in South Asia. *Reproductive Health Matters*, *7*, 30-38.

52. Patel, V., Kirkwood, B., Pednekar, S., Periera, B., Barros, P., & Fernandes, J. (2006). Gender Disadvantage and Reproductive Health Risk Factors for Common Mental

Disorders in Women: A Community Survey in India. *Archives of General Psychiatry*, *63*(4), 404-413.

53. Patel, V., & Kleinman, A. (2003). Poverty and common mental disorders in developing countries. *Bulletin of the World Health Organization, 81*(8), 609-615.

54. Rawat, C., Garg, S., Singh, J., Bhatnagar, M., Chopra, H., & Bajai, S. (2001). Sociodemographic correlates of anemia among adolescent girls in rural district of Meerut. *Indian Journal of Community Medicine, 26*, 173-5.

55. *Risks to Mental Health: An Overview of Vulnerabilities and Risk Factors*. (2012). Geneva, Switzerland: World Health Organization.

56. Rucker, C. E., & Cash, T. F. (1992). Body images, body-size perceptions, and eating behaviors among African-American and white college women. *International Journal of Eating Disorders*, *12*(3), 291-299.

57. Sanchis-Gomar, F., Cortell-Ballester, J., Pareja-Galeano, H., Banfi, G., & Lippi, G. (2012). Hemoglobin point-of-care testing: the HemoCue system. *Journal of Laboratory Automation*, *20*(10), 1-8.

58. Schensul, S. L., Schensul, J. J., & LeCompte, M. D. (1999). *Essential ethnographic methods: observations, interviews, and questionnaires*. Walnut Creek, Calif.: AltaMira Press.

59. Sen, A., & Kanani, S. (2006). Deleterious functional impact of anemia on young adolescent school girls. *Indian Pediatrics*, *43*(3), 219-226.

60. Shobha, S., & Sharada, D. (2003). Efficacy of twice weekly iron supplementation in anemic adolescent girls. *Indian Pediatrics*, *40*(12), 1186-1190.

61. Singhal, A., Cody, M. J., Rogers, E. M., & Sabido, M. (2004). *Entertainment-education and social change history, research, and practice*. Mahwah, N.J.: Lawrence Erlbaum Associates.

62. Sivilotti, M. L. (2004). Oxidant Stress and Haemolysis of the Human Erythrocyte. *Toxicological Reviews*, *23*(3), 169-188.

63. Srinivasan, N. M., & Kasturba, M. P. (2010). Intra-operative point of care haemoglobin estimation: a comparison of three methods. *Sri Lankan Journal of Anaesthesiology*, *18*(1), 15-19.

64. Stigler, M., Arora, M., Dhavan, P., Shrivastav, R., Reddy, K. S., & Perry, C. L. (2011). Weight-related concerns and weight-control behaviors among overweight adolescents in Dehli, India: a cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity*, *8*. Retrieved April 10, 2014, from http://www.ijbnpa.org/content/8/1/9

65. Stolzfus, R., Chwaya, H., Tielsch, J., Schulze, K., Albonico, M., & Savioli, L. (1997). Epidemiology of iron deficiency anemia in Zanzibari schoolchildren: the importance of hookworms. *American Journal of Clinical Nutrition*, *65*(1), 153-9.

66. Stolzfus, R. (2003). Iron deficiency: global prevalence and consequences. *Food Nutrition Bulletin*, *24*, S99-103.

67. Suguna, B., & Rani, G. (2008). Health status of women. *Women welfare and empowerment in India: vision for 21st century* (pp. 111-117). New Delhi: New Century Publications.

68. The world fact book: India. (n.d.). *Central Intelligence Agency*. Retrieved April 8, 2014, from https://www.cia.gov/library/publications/the-world-factbook/geos/in.html

69. Toteja, G., Sing, P., Sarma, U., Gandhi, S., Behl, L., Mukherjee, K., et al. (2006). Prevalence of anemia among pregnant women and adolescent girls in 16 districts of

India. *Food Nutrition Bulletin*, *27*(4), 311-5.

70. WHO: Global Database on Body Mass Index. (n.d.). *WHO: Global Database on Body Mass Index*. Retrieved April 11, 2014, from http://apps.who.int/bmi/index.jsp?introPage=intro_3.html