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The Perception of Maternal Anemia and the Effect of Nutritional Education: A Qualitative Analysis Among Village Mothers in Rural Kumaon, Uk

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SIT Study Abroad

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ABBREVIATIONS

ANC: Antenatal Care

ANM: Auxiliary Nurse Midwife

ASHA: Accredited Social Health Activist

AWC: Anganwadi Center

GLVs: Green Leafy Vegetables

Hb: Hemoglobin

ICDS: Integrated Child Development Services

IFA: Iron and Folic Acid

IMR: Infant Mortality Rate

LBW: Low Birth Weight

MMR: Maternal Mortality Rate

NGO: Non-Governmental Organization

NFHS: National Family Health Survey

NNMB: National Nutrition Monitoring Bureau

NRHM: National Rural Health Mission

PHC: Primary Health Center

INTRODUCTION

Background

Malnutrition is often associated with starving children in developing countries. However, while calorie and protein deficiencies—macronutrient deficiencies—are a cause for concern, micronutrient deficiencies can be equally detrimental and are even more pervasive. The most prevalent micronutrient deficiency is anemia, and the story of anemia in India is particularly grim. India has the largest number of anemic people in the world and severe anemia is the cause of death for an average of 22,000 Indians each year (The Micronutrient Initiative 2006).

Anemia rates are exacerbated for women and even more so for pregnant women. According to the most recent National Family Health Survey conducted in India in 2005-2006 (NFHS III), 55% of Indian women are anemic and 59% of pregnant Indian women are anemic, the highest rate in the world (IIPS 2005-2006). This rate is markedly higher than the average 51% of pregnant women in developing countries who are anemic and drastically higher than the 14% of pregnant women in developed countries who are anemic (Gogoi & Prusty 2013). Such a prevalence of maternal anemia has detrimental implications upon both maternal and child health. Indeed, anemia is the cause of 20% of all maternal deaths in India and an associated cause in 50% of them (MoHFW 2013). Significantly, 80% of all the maternal deaths in Asia attributed to anemia are in India. Maternal anemia also frequently leads to premature births, low birth weights, and peri and neonatal mortality (MoHFW 2013).

Despite its pervasive and severe effects, particularly among pregnant women, anemia has a relatively simple etiology. Anemia is a condition in which a lack of red blood cells causes decreased oxygenation in the body. Poor oxygenation in anemic individuals reduces cognitive performance, immune status, physical capability, and work performance (WHO, UNICEF, & UN Consultation 2001). Many factors can lead to anemia including various micronutrient deficiencies, hemorrhage, and hookworms (MoHFW 2013). One such micronutrient deficiency that causes anemia is a deficiency in the micronutrient iron. Iron deficiency anemia, the most common form of anemia, is particularly dangerous as iron is essential for the synthesis of hemoglobin (Hb), the molecule that transports oxygen through the body. Henceforth, iron deficiency anemia will simply be referred to as "anemia" in the present study.

While anemia has a clear technical definition, the perception of anemia can vary widely and is often an indication of nutritional knowledge. The medical definition of anemia is largely constrained by international and governmental standards. A common definition of anemia in India is often nonexistent. This seems to be particularly true in the case of maternal anemia, as many mothers have severely restricted nutritional knowledge. Nutritional practices are an especially important determinant of anemia, and the pervasiveness of anemia in India is a reflection of poor nutritional knowledge. Moreover, poor knowledge is a direct consequence of poor nutritional education.

The Government of India has tried to combat anemia in India through various interventions, but has not provided sufficient nutritional education. Food-based interventions are the simplest anemia interventions, but apart from an inadequate food supplementation scheme initiated by Integrative Child Development Services (ICDS),

Indian government schemes generally ignore food-based interventions and instead focus on medicinal iron supplementation (Gogoi & Prusty 2013, MoHFW 2013). When India established the National Anemia Prophylaxis Program in 1972 it became the first country to develop a national anemia prevention program (Kalaivani 2009). The program began providing Iron and Folic Acid (IFA) supplements to pregnant women, which are now provided to women in rural areas in accordance with the National Rural Health Mission (NRHM). Under the NRHM, Accredited Social Health Activists (ASHAs) and Auxiliary Nurse Midwives (ANMs) are responsible for providing IFA supplements to women (MoHFW 2013). However, problems of distribution and compliance surround both IFA supplementation and food supplementation schemes. The effectiveness of both schemes is more drastically limited by a lack of accompanying education.

Many Non-Governmental Organizations (NGOs) work to supplement governmental schemes in India, and Aarohi is one such organization striving to improve maternal and child health in rural Kumaon, Uttarakhand. The Maternal Mortality Rate (MMR) is elevated in Uttarakhand to 188 per 100,000 live births, and is further elevated to 353 in Okhalkanda Block of Nainital District, the current area in which Aarohi's Community Health Program works (Aarohi 2013). Aarohi's work to provide supplementary healthcare services and additional training to health workers should reduce the MMR and, concomitantly, rates of maternal anemia. Drawing upon Aarohi's established relationships and current work, the present study looks at the perception of maternal anemia among women in intervention and non-intervention villages.

Objectives

The study explores the perception of maternal nutrition among women and health workers in rural Uttarakhand and how the effort to educate women about nutrition affects such perceptions and, consequently, the effectiveness of anemia interventions. The study firstly looks at the varying conceptions of anemia and the extent of maternal nutritional knowledge. It secondly investigates the nutritional education provided to pregnant women through governmental antenatal care (ANC) and through the intervention of an NGO. The study finally considers how maternal education and the perception of anemia affects the value of governmental interventions.

Field Study Methods

The perception of maternal anemia among village women was determined by means of individual interviews and observations. Interviews were conducted in Bhainsyachana and Okhalkanda Block of Kumaon, Uttarakhand. Villages in both blocks that are future locations of Aarohi health interventions served as baseline villages. Villages in Okhalkanda Block that have already received Aarohi interventions served to illustrate the effect of increased health worker training on nutritional knowledge. In both blocks, interviews were conducted with healthcare workers and mothers. Healthcare workers included ASHAs and ANMs, and mothers included both pregnant mothers and "new mothers," mothers who had given birth within the last year. Half of the mothers were either pregnant with their first child or had just given birth to their first child. Nine pregnant mothers, three new mothers, three ASHAs, and two ANMs were interviewed for a total of seventeen formal interviews. Interviews were conducted largely in Hindi with the assistance of a translator and ranged from 10-20 minutes. A different set of questions

was utilized for mothers and for healthcare workers; all interviews included simple demographic questions and questions pertaining to nutritional practices and knowledge. Questions were only loosely followed to allow for free flowing conversation. Verbal and written consent was obtained for all interviews.

Interviews were primarily held in women's homes as most of the mothers interviewed were found on village walks. Some interviews were conducted at an ANM subcenter in Bhainsyachana Block during a weekly vaccination day where antenatal check-ups of women receiving tetanus vaccines were also observed. Interviews predominantly informed the findings of the study and were utilized in concordance with Aarohi's baseline data, NFHS data, and other secondary literature to make conclusions about the perception of maternal anemia and the effect of nutritional education. In an effort to uphold confidentiality, respondents name have been changed.

Brief Statement of Findings

The study found the nutritional knowledge of women in rural Kumaon to be quite limited. Accordingly, the nutritional education provided to women, albeit slightly increased through the intervention of an NGO, was also observed to be severely limited. The combination of these factors greatly reduced the effectiveness of the government's anemia interventions.

ANEMIA IN KUMAON

Contingent on the context, the definition of anemia can greatly vary. Most conceptions of anemia do not accurately represent the high rates of anemia in India, and particularly in Uttarakhand. Indeed, a more accurate and inclusive definition of anemia could lead to even higher recorded rates of anemia in Uttarakhand and would certainly lead to increased understanding of anemia.

Defining Anemia

The definition of anemia is both an important indicator of its perception and a determinant of its treatment. The present study found the definition of anemia to vary among governmental organizations, health workers, and mothers; concurrently, the understanding of and response to anemia varied among such groups. The most pervasive definition of anemia is likely the definition provided by the World Health Organization (WHO). The WHO defines anemia according to Hb levels due to the link between iron level, hemoglobin synthesis, poor blood oxygenation, and anemia. By the WHO's guidelines, anemia is classified as mild (10.0-10.9 g/dl for pregnant women, 10.0-11.9 g/dl for nonpregnant women), moderate (7.0-9.9 g/dl), and severe (less than 7.0 g/dl) (WHO 2011). India's NFHS III followed the WHO's intervals for anemia severity levels, recording anyone with a Hb level under 11.0 g/dl as anemic (IIPS 2007). According to these standards, 55% of women in India were categorized as anemic. However, the applied definition of anemia in India is not nearly as inclusive.

The governmental definition of anemia utilized in the field of study was quite narrow. In rural India, the government's NRHM standards dictate both the classification and treatment of anemia. The NRHM seems to restrict the categorization of anemia to the WHO's range for severe anemia. A NRHM health record book for pregnant women observed at an ANM subcenter in a rural village reflected this limited definition. On the bottom of the record sheets used to record the Hb levels of pregnant women, an asterisk indicated that Hb levels below 7 g/dl were indicative of anemia and that women with such levels should receive a double dose of IFA supplements (ANM Subcenter, Direct Observation). While this definition is certainly true, it is vastly insufficient. By this definition, only about 2% of the over 55% of anemic women in India would be classified as anemic (IIPS 2007). In India, the label "anemic" is often reserved for severe cases, while anemia is actually quite pervasive and its treatment often only entails simple nutritional changes. The lack of utilization of the term "anemia" only further serves to limit understanding about nutrition; it is especially detrimental when health workers fail to utilize the term and to understand the pertinent implications of anemia.

ANMs and ASHAs interviewed in rural villages had a limited conception of anemia. When asked about the prevalence of anemia in their villages, many health workers, including an ANM and ASHA in Bhainsyachana Block, stated that very few women were anemic (ANM I & ASHA I, Personal Interview). This is rather dubious given that 55% of all Indian women are anemic (IIPS 2007). The low estimation of anemia by health workers is likely related to the limited understanding of anemia observed among health workers. An ASHA Okhalkanda Block had a limited conception of anemia despite being knowledgeable in other regards. When asked about the

prevalence of anemia in her village, the ASHA conceded that most pregnant women in her village were slightly anemic, but that they "aren't that bad, not that bad." She further clarified that most of the women they saw had Hb levels of 9 g/dl or 10 g/dl, despite correctly identifying 11 g/dl, the WHO's cut-off for anemia among pregnant women, as being "normal," (ASHA III, Personal Interview). Many health workers interviewed had similarly limited definitions of anemia, but women in the villages perhaps lacked a definition altogether.

Rural Indian women also seem to largely lack an understanding of anemia. According to the National Nutrition Monitoring Bureau's (NNMB) 2003 Report, a report detailing the nutritional status of women and children in ten Indian states, only 34% of the women surveyed were aware of anemia (NNMB 2003). Similarly, most mothers interviewed did not recognize the term anemia. This lack of recognition extended to mothers receiving regular ANC and to many women who complained of feeling weak. One pregnant woman stated that she felt weak during her pregnancy, clarifying that she always felt weak and that it was "normal." She confirmed that she had never heard of anemia despite having just received an antenatal check-up (Pregnant Mother IV, Personal Interview). Indeed, less than half of the mothers interviewed recognized the term "anemia," event though the majority reported feeling weak. Due to insufficient awareness of anemia, few women understand the correlation between weakness during pregnancy and a lack of iron, a problem often only requiring nutritional changes. As will be expounded later, poor understanding about anemia is attributable to a lack of education; however, it is also indicative of the vast limit of the definition of anemia.

Even the WHO's definition of anemia has limits. The WHO's guidelines are too general to be applied to every population in every nation, particularly when considering vastly different geographical conditions. In fact, a large correlation between Hb levels and altitude has been observed, which is especially relevant to understanding the prevalence of anemia in Uttarakhand. At high altitudes, due to a decrease in the partial pressure of oxygen, there is a drop in blood volume and a subsequent increase in the concentration of Hb molecules (Windsor and Roway 2007). Hb levels are said to increase by .2 g/dl for 1000m of elevation, .8 g/dl for 2000m, and 1.9 g/dl for 3000m (WHO, UNICEF, & UN Consultation 2001). Thus, in the study villages at elevations around 2000 m, tested Hb levels would overestimate Hb levels by nearly 1 g/dl. A study in Bolivia demonstrated the importance of adjusting Hb levels for altitude (Laflamme 2011). In the study of 80 women in El Alto, 17.5% of pregnant women were classified as anemic based upon altitude adjusted Hb levels. Without adjusting for altitude, only 11.39% of the women would have been classified as anemic, missing nearly a third (6.11%) of the anemic women. Furthermore, maternal anemia defined by the altitude adjusted Hb levels had a strong correlation with birth complications, confirming the accuracy and significance of the adjusted levels (Laflamme 2011). Considering altitude adjustments for the Hb levels of women in rural Kumaon, recorded rates would be a significant underestimate and the subsequent additional iron supplementation insufficient.

Given the many confounding definitions of anemia, there is a clear need to better define anemia. A definition of anemia must be set that is both nuanced for diverse populations in varying geographies, but is also restricted enough to be easily dispelled

and vastly understood. Such a definition is an important precedent to the provision of education about anemia.

Rates of Anemia in Rural Kumaon

Before considering nutritional education and the perception of anemia, an understanding of the approximate prevalence of maternal anemia and rates of iron consumption in the study area is helpful. Consistent with national findings, the prevalence of malnutrition and anemia in Uttarakhand is high and climbing. In Uttarakhand, 34% of rural women are classified as too thin (BMI <18.5), and 56.9% of pregnant rural women, 54.7% of all women, are classified as anemic. This percentage is significantly elevated from the 45.6% of women that were classified as anemic in the NFHS II conducted in 1998-99 (IIPS 2007). Rates of malnutrition are further elevated in the backward areas of Okhalkanda and Bhainsyachana Block in rural Kumaon.

Rates of iron consumption are low in rural Kumaon. Anemia is exacerbated in backward areas where iron intake is reduced by low-income levels and the high prices and limited availability of iron-rich foods (India Micronutrient Investment Plan 2006). In rural areas, the general population is said to receive an average of 90% of the Recommended Daily Allowance (RDA) of iron, but those making 0-255 Rs. a month only receive an average of 48% of the RDA of iron (India Micronutrient Investment Plan 2006). Pregnant women consume an even lower percentage of their RDA of 38 mg/day, though they have almost twice the iron needs of other women due to increased blood volume, fetal demands for iron, and blood loss during delivery (NIH 2007). The 2001 NNMB survey recorded the mean iron intake among pregnant women as 14 mg/day with nearly 70% of pregnant women receiving less than half of their RDA of iron daily

(NNMB 2001). Such data is consistent with the high rates of maternal anemia, a result of poor nutritional education.

NUTRITIONAL EDUCATION AND ANEMIA

Education is often a good indication of health status. A correlation between education level and health status can frequently be established. Incidentally, education is also necessary to improve health indicators. Regarding a topic like nutrition that is somewhat harder to conceptualize, education is especially important. Despite additional efforts by NGOs to increase education, maternal nutritional education is vastly lacking in rural Kumaon, correlating with poor nutritional knowledge among pregnant women.

Maternal Nutritional Knowledge

The study found a significant lack of knowledge about nutrition among women interviewed in two blocks of rural Kumaon. Indeed, previous studies depicted a broad lack of nutritional knowledge in the hill region of Uttarakhand. A study similar to the current one was carried out in Bhintal Block of Nainital District in 2011. In the study, the nutritional knowledge of 223 women between 18-45 years old, 41% of whom were malnourished, was assessed. On the multiple-choice nutritional assessment, the average score was 21.3% with 66.3% of women being categorized as having "low" knowledge about nutrition (Upadhyay *et al.* 2011). The limited nutritional knowledge found among women in Nainital District was confirmed in the present study.

Nutritional knowledge was remarkably low among women interviewed. The "nutritional knowledge" of mothers was measured on the basis of responses to open-ended questions about nutrition, recognition of the terms "iron" and "anemia," and understanding of iron supplementation. One of the first interview questions was, "What do you know about nutrition?" The question had quite limited responses, but was still

instructive. Every woman hesitated to answer the question, some failing to respond at all and some asking, "What should I say?" Of those who did respond, many simply stated some of the foods in their diet. The lack of responses to the question was not taken to directly portray the lack of nutritional knowledge of women. Rather, the vast unfamiliarity with the word "poshun," Hindi for "nutrition," seemed to illustrate the informality of nutritional education for women. Even if women were receiving adequate education, they could not identify the information they were receiving as regarding "nutrition." This was the first hint of insufficient maternal knowledge about nutrition and a preview of responses to come.

Following an initial inability to discuss "nutrition," most women were unaware of the aspects of antenatal nutrition and anemia discussed in the interview. To test their understanding of the basics of maternal anemia, women were asked if they recognized the terms "iron" and "anemia." Over half of the mothers surveyed had never heard of iron, though all of the women reported receiving iron supplements during pregnancy. Indeed, of the twelve women receiving iron supplements and the majority consuming them, only four recognized the word "iron." Such lack of knowledge among women actively partaking in nutritionally beneficial practices was alarming. Similarly, as previously noted, less than half of the mothers interviewed were familiar with the term "anemia."

One young pregnant mother in Khansyu village was the picture of a mother who had very limited nutritional knowledge and a consequently increased risk of an unhealthy pregnancy. Priya did not recognize the word "nutrition," did not know why she had a Hb test done, had never heard of anemia or iron, and was not altering her food consumption or resting more during pregnancy. Priya reported feeling dizzy and light-headed during

the seven months of her pregnancy to date, and appeared anemic by her pale pallor, but had not talked to anyone about it (Pregnant Mother VI, Personal Interview). Priya was one of many women with poor nutritional knowledge. Even among women interviewed directly after ANC check-ups, there was a very low understanding about nutrition. This self-selecting group of women receiving ANC should have had the best understanding of nutrition, yet still had poor nutritional knowledge.

To illustrate a broader lack of antenatal knowledge, pregnant women were asked about resting during pregnancy. Many women in rural Uttarakhand engage in farming activities, particularly going "to the field" to perform activities like cutting grass. Women often walk many kilometers with grass bundles on their heads to maintain a supply of feed for their livestock (Supai Village, Direct Observation). Most mothers reported not resting, and a few reported engaging in fieldwork, up to the end of their pregnancy. In fact, one interview was conducted in the field in which a woman was working during her ninth month of pregnancy (Pregnant Mother VIII, Personal Interview). Another pregnant woman stated that she wouldn't rest until the ninth month of her pregnancy (Pregnant Mother II, Personal Interview).

Many women also lacked an understanding of the connection between their health and that of their child's, demonstrating broader limited maternal education. A young pregnant mother of 19, Sneha, understood the need for iron tablets in the context of the health of her fetus, stating that she was taking the tablets as she was told "it'll be good for the child." However, when asked whether her health would affect her child's health, Sneha responded with a resounding, "No, it doesn't affect," (Pregnant Mother V, Personal Interview). On the surface level this demonstrated her misunderstanding of the

purpose of the iron tablets; yet it also demonstrated a fundamental lack of understanding in the connection between maternal health and child health. Sneha failed to understand that she was only bettering her child's health by bettering her own. This was further evident when she stated that she had not been eating any differently during her pregnancy and that she still occasionally went to the field despite being seven months pregnant (Pregnant Mother V, Personal Interview).

Even with sufficient antenatal nutritional knowledge, traditional views can take precedence over the nutritional knowledge of pregnant women. There are many traditional views surrounding nutrition, but the prevalence of traditional views among mothers interviewed was less prominent than expected. Strict traditions regarding pregnancy were reported, though, in one village in Okhalkanda Block. One woman stated that pregnant women should not consume green vegetables, as "it is pain to the child." She further elaborated that women are not supposed to rest after giving birth. However, the woman stated that she did not follow such traditional views during her pregnancy and that she was making sure her pregnant sister-in-law ate green vegetables (Pregnant Mother VIII, Personal Interview). It was also noted that the other pregnant women interviewed in her village stated no such beliefs. Traditional views about nutritional practices were perhaps underrepresented in the study, but are certainly important when considering maternal nutritional knowledge.

While many of the women interviewed were young first-time mothers, limited nutritional knowledge seemed to extend to all mothers regardless of age or number of children. Bimla is an example of a mother in Bhainsyachana Block with little knowledge about nutrition, similar to that of young Priya. Unlike the young first-time mother Priya,

however, Bimla was pregnant with her third child at 29. Bimla's lack of nutritional knowledge was therefore even more shocking because of her age and previous births, and because she was the daughter-in-law of an ASHA living next door. Indeed, Bimla's lack of knowledge was evident despite the ASHA's notable presence during the interview. Bimla revealed that she had not been told about nutrition, did not know what anemia was, and had no idea how the health of a mother affects that of her child. Bimla also reported to be eating less during her pregnancy due to a lack of appetite (Pregnant Mother I, Personal Interview). Bimla's restricted knowledge depicted the lack of nutritional knowledge among pregnant women of all ages and hinted at the ASHA's potentially inadequate dissemination of nutritional information.

Government's Role in Nutritional Education

There is an insufficient emphasis on the education provided to governmental health workers and this translates to an insufficient amount of education provided by such workers to pregnant women. Under the NRHM, ASHAs and ANMs are to provide nutritional education to mothers as a form of ANC (MoHFW 2013). However, ASHAs and ANMs are not provided with adequate education themselves. One ASHA disclosed that, despite having been an ASHA for seven years, she received only one week of training from the government (ASHA I, Personal Interview). Such training is largely insufficient, especially when ASHAs and ANMs are recruited at a young age and lack both the knowledge and confidence to do their jobs well without proper training. One ASHA, speaking on behalf of herself and a fellow ASHA in a nearby village, confided that they were initially "very shy and hesitant as ASHAs" as they were from the same

village as the women they were serving and "felt bad telling women not to do things that [they] did during their pregnancies," (ASHA III, Personal Interview).

Though the healthcare workers interviewed received limited knowledge from the government, they all seemed to highly value their jobs. The workers appeared to take pride in their roles as ASHAs and ANMs. Unfortunately, particularly in Bhainsyachana Block, this pride and desire to perform well seemed to bias their claims. An ANM and an ASHA from the same area reported that women were well educated about nutrition and that there was a very low prevalence of anemia among women (ANM I & ASHA I, Personal Interviews). According to statewide estimations and direct observations, the ANM and ASHA misrepresented the situation, presumably a result of the desire to report good health indicators. This desire to please was further evident when an ANM listened in on an interview with a pregnant woman who had just received an antenatal check-up. When the woman struggled to answer why a blood test was performed, the ANM tried to answer for her and told her the result of her test (Pregnant Mother IV, Personal Interview). The same ANM ensured that all ASHAs were present for immunization day, knowing an NGO group would be coming (Immunization Day, Direct Observation). A desire to please among health workers would be positive if it correlated with a desire to perform well enabled by proper training and education.

The amount of education provided by health workers seemed to be directly correlated with the poor education provided to health workers. India's NFHS III reported a very low percentage of pregnant women receiving nutritional education. Only 10.9% of all pregnant women in India received nutritional education, and only 5.5% in Uttarakhand (IIPS 2007). Most of the women interviewed reported receiving some

nutritional knowledge from the ASHA or ANM but reported information received never extended beyond being told to eating certain foods like green vegetables. As further evidence of the lack of education given to mothers by health workers, many women had an obvious desire for information from the interviewer and awarded agency to the interviewer. For instance, a concerned mother in her tenth month of pregnancy asked the interviewer to calculate her due date because, despite monthly visits to the ANM during pregnancy, she had not been told her due date (Pregnant Mother VII, Personal Interview). Nishi, a 23 year-old first time mother, also received limited antenatal education. Despite being a graduate student and taking iron supplements throughout her pregnancy and while lactating, Nishi did not recognize the word "nutrition" or "iron." Nishi explained that she obtained the iron supplements herself and, when asked if the ANM or ASHA ever gave her supplements, laughed stating, "I've not gotten anything from them," (New Mother I, Personal Interview).

Poor socioeconomic indicators only exacerbate the limited understanding of maternal nutrition and increase the potential influence of the ASHA and ANM. Such realities were exemplified in the backward area of Okhalkanda Block where approximately 31% are in a scheduled caste (SC), 77% married, 37% with no toilets, 24.4% with no schooling, and 13.9% with ten or more years of schooling (Aarohi 2011).

Shreya is an example of an uneducated pregnant mother in Okhalkanda Block receiving poor antenatal nutritional education. Having received no formal schooling and only able to sign her name, Shreya's knowledge was limited by what she was told by the ASHA and ANM. Shreya was compliant with all that she was told during pregnancy, but had never heard of anemia and recalled being told that her most recent Hb test of 9 g/dl

"was good" by the ANM. Shreya further complained about the lack of help she received when recently traveling to and staying the night at a distant Primary Health Center (PHC) with severe labor pains. Shreya was sent home without treatment, information, or her needed refill of iron tablets from the ANM or ASHA (Pregnant Mother IX, Personal Interview). Such instances highlight the limited training of ASHAs and ANMs. Given the large dependence of pregnant and recent mothers on ASHAs and ANMs for nutritional education, there is a huge opportunity for improved education via better-trained health workers.

Aarohi's Role in Nutritional Education

Given the agency awarded to health workers by mothers and their immediate access to pregnant women, there is a large opportunity to increase maternal nutritional knowledge by improving the education of ANMs and ASHAs. Augmenting the pre-existing NRHM governmental scheme through additional trainings and provision of supplies, Aarohi does just that. Aarohi's Community Health Project was initially established in six villages in Ramgarh Block of Nainital district, later extending to 24 villages in Okhalkanda Block as a part of Phase II of the Arogya Project, "Strengthening Self Sustaining Management Systems for Primary Health Care in Rural Uttarakhand." In the 30 intervention villages, the project serves a total population of 12,261 (Aarohi 2012**).** Aarohi is also in the beginning stage of Phase III, which will extend healthcare coverage to another 105 villages in the next five years.

Under the Arogya project, Aarohi aims to improve maternal and child health in remote areas through increased access to supplies, training, and education. Aarohi accomplishes this by forming and strengthening Village Health and Sanitation

Committees (VHSC), ensuring that NRHM services are being carried out, improving the functioning of ANMs, and training various other healthcare workers. Aarohi's work has been quite successful thus far, as evident by increased ANC in Okhalkanda Block. According to Aarohi's baseline report in 2011, only 63% of women who delivered within the past six months reported receiving any ANC, and only 21.2% reported receiving full ANC (three check-ups, 90 IFA supplements, and two tetanus vaccines). After a couple years of intervention in Okhalkanda Block, Aarohi increased ANC coverage to 99% (Aarohi 2013). Of course, ANC coverage is not always indicative of antenatal education.

To investigate the effect of Aarohi's intervention on nutritional education, a comparison study was done between intervention and nonintervention villages. Aarohi had yet to establish health interventions in any villages in Bhainsyachana Block and in some of the villages in Okhalkanda Block. Interviews were conducted with mothers in intervention and nonintervention villages and maternal nutritional education was compared based upon responses. There were small positive changes in intervention villages, but there was no significant correlation between Aarohi's interventions and increased maternal nutritional education.

Women interviewed in Aarohi's established intervention villages had slightly increased nutritional knowledge, likely owing to Aarohi's supplemental training of health workers. A larger percentage of women from intervention villages (80% versus 50% in nonintervention villages) reported being told about nutrition by an ASHA or ANM. Consequently, a larger percentage of women knew about anemia (60% versus 30%) and iron (80% versus 0%) and could explain the purpose of the Hb test (40% versus 0%). Furthermore, there were a couple of mothers with good nutritional education in

intervention villages while all mothers interviewed in nonintervention villages seemed to be significantly lacking nutritional education.

A 20-year old mother, Priti, with a two-year old girl and 5-month baby in Khansyu Village, reported receiving good nutritional education during her pregnancy. Priti recounted that during her pregnancy she was told by the ASHA and ANM to eat green vegetables and lots of dal, received and consumed nutritional packets from the Anganwadi Center (AWC), and was tested for "anemia" to "see what's the weakness." Priti also reported receiving "iron" supplements and talked to her ASHA to receive more supplements when she was feeling weak (New Mother III, Personal Interview). Khansyu Village is one of the Phase II intervention villages in which Aarohi has been working since 2009. Aarohi's additional trainings seemed to have had some positive effects upon antenatal education in intervention villages. Two ASHAs from intervention villages later confirmed this suspicion. Together they spoke of how Aarohi's training had been effective in helping them feel more confident in their work and feel more connected to the villagers. Subsequently, villagers were said to be more open with the ASHAs about problems and called to ask about ANC check-ups. According to the ASHA, such changes were a result of increased education from Aarohi (ASHA III, Personal Interview).

Despite small positive trends in maternal nutritional education in Aarohi's intervention villages, the overall difference was not prominent. The comparison was limited by a small sample size, but the lack of conclusive data was inherently telling. The increased nutritional knowledge of some women in intervention villages certainly pointed to a positive effect of Aarohi's interventions. However, such women were isolated

instances and the overall nutritional knowledge of mothers was still quite low in intervention villages. Thus Aarohi's success in increasing ANC in intervention villages did not directly lead to an increase in nutritional education. The amount of nutritional education provided to women during ANC check-ups perhaps served as a confounding variable disrupting the correlation between ANC rates and maternal nutritional knowledge. Either way, nutritional education awarded to women and healthcare workers alike was vastly insufficient as especially seen through poor maternal knowledge about nutrition.

ANEMIA INTERVENTIONS AND EDUCATION

Under the NRHM and through ICDS services, the government has focused on providing adequate ANC to pregnant women in the past decade. However, such efforts have not decreased the rates of anemia; indeed, there has been no change in national anemia rates since 1986 (Dutta 2013). Furthermore, rates of anemia in Uttarakhand are on the rise. The persistently high rates of anemia are likely due to the insufficient diagnosis of anemia, and the insufficient education accompanying dietary interventions and IFA supplementation.

Hemoglobin Tests

The effectiveness of hemoglobin (Hb) tests among pregnant women is limited by low utilization, inaccurate methods, and poor communication. Firstly, Hb tests, valuable in measuring iron status and diagnosing anemia, are underutilized. Due to the increased implications of anemia in pregnancy, Hb tests are an especially important component of ANC and are to be measured multiple times by the ANM during antenatal check-ups (MoHFW 2013). Unfortunately, many women miss out on this component of ANC, particularly in rural Uttarakhand. From 2005-2006, only about 68% of rural women in Uttarakhand received some form of ANC, and only 44.1% had a blood sample taken during this time (IIPS 2007). Thus a maximum of 44.1% of rural women had a Hb test performed.

As it is, ANMs hold the responsibility for Hb testing. A new ANM in Okhlakanda Block spoke of how important the Hb test was in determining if women are anemic and catalogued the usefulness of the test in Haldwani where she was previously

an ANM. She was frustrated, however, that there was no kit for Hb tests at her new post (ANM II, Personal Interview). The ANM worked in villages that had yet to receive interventions from Aarohi. As a part of Aarohi's Arogya health project, villages in Okhalkanda Block received supplies for Hb tests. To increase Hb testing among all women—including those who do not seek ANC at subcenters, Aarohi enabled ASHAs to do tests in the field by providing both the necessary kits and associated training. An ASHA in one of Aarohi's intervention villages stated that the test kits enabled them to her to perform at least two Hb tests for every pregnant woman and determine which women required additional iron supplementation (ASHA III, Personal Interview). Hb testing in the field by ASHAs could greatly increase the diagnosis of anemia, but requires accurate methods.

Even if the scope of population receiving Hb tests is increased, inaccurate methods still limits the proper diagnosis of anemia. There are numerous methods for the testing of Hb levels, and more accurate ones are constantly being developed. One method approved by the WHO, Sahli's method, involves diluting blood with hydrochloric acid and using a standard for color comparison (Kharkar & Ratnaparkhe 2013). Sahli's method does have room for error, particularly when accounting for biases in color matching. Aarohi uses Sahli's method to test Hb levels at its hospital and trains health workers in intervention villages to use Sahli's method. Unfortunately, Sahli's method may be a bit challenging to carry out in the field. One ASHA who reported being trained by Aarohi to use Salhi's method in the field was initially unable to explain the method, and then revealed that she no longer did Hb tests as she broke the glass blood

siphon in the kit (ASHA III, Personal Interview). However, Sahli's method is still one of the better methods of Hb testing.

In low resource settings, particularly in developing countries, simpler, but less accurate methods of Hb testing are utilized. For instance, color measurement techniques in which blood samples are compared to a color scale, are often used in rural India to measure Hb. Such techniques are imprecise and can be quite biased. During antenatal check-ups at the Bhainsyachana Block ANM subcenter, an ANM utilized the Hemoqwik color scale method to determine Hb levels. The ANM simply pricked each woman's finger and compared the color of the blood drop to the 11 g/dl slot and then the 10 g/dl slot on the color scale every time. She recorded 11 g/dl for almost all of the women, and never recorded a value below 10 g/dl (ANM Subcenter, Direct Observation). Such a consistency in values is improbable and likely due to both the marginal difference in color on the scale for 1 g/dl and the potential bias of the ANM. Indeed, when interviewed the previous day, the ANM reported that Hb values below 10 g/dl are bad, likely biasing her readings (ANM I, Personal Interview). According to WHO standards, 11 g/dl is the low value of normal for pregnant woman and 10-10.9 g/dl is indicative of mild anemia (WHO 2011). For one woman, the ANM quickly compared a drop of her blood to the color scale, marked down 10.5 g/dl, and said, "That's good," (ANM Subcenter, Direct Observation). More important than the ANM's potentially inaccurate readings, however, was the lack of explanation she provided to women about Hb tests.

The usefulness of Hb tests is perhaps most limited by poor accompanying explanations. While all of the mothers interviewed reported receiving Hb tests during their pregnancy, only two knew what the test was for. Even the pregnant mothers who

had just received Hb tests at the ANM subcenter were unable to explain the purpose of the test. When asked why their finger was pricked, none of the women were able to say it was for a Hb test. One of the women thought that the prick was for a sugar test, and the other two had no idea what the purpose of the finger prick was. One woman clarified, "We don't know anything, no one tells," (Pregnant Mother II, Personal Interview). In fact, the ANM did not communicate with women at all while performing Hb tests (ANM Subcenter, Direct Observation). Hb tests become further obsolete if women do not understand the purpose of the test. Thus, in addition to the test being inaccurate and the results of the test being compared to a narrow definition of anemia on the NRHM records, women are unaware of the purpose of the test, completely negating any benefit of the test.

Dietary Interventions

Diet plays an obvious, yet significant role in anemia. Thus, a particular focus must be paid to the overall diet of pregnant women. First and foremost, a diet rich in iron is important for Hb formation and the prevention of anemia. Iron in found in meat, green leafy vegetables, pulses, millets, and cereals (Gopalan *et al.* 1971). However, the body's absorption of iron varies by food source and the absorption of iron from Indian diet sources is particularly low causing the RDA of iron for Indians to be the highest in the world (Expert Group of the ICMR 2009). The consideration of iron absorption is especially important in the context of antenatal nutrition (Expert Group of the ICMR 2009).

Iron absorption in the body varies widely based upon both the food source of the iron and the foods consumed in accordance with the iron source. Indeed, the absorption

of iron from a meal can vary from 1 to 40% pending the iron source and the ratio of foods enhancing the consumption of iron (enhancers) to foods inhibiting the consumption of iron (inhibitors) (WHO, UNICEF, & UN Consultation 2001). Heme iron, from meat sources, is absorbed at a higher rate than non-heme iron from plant sources. For instance, iron in cereal has a 2-5% absorption level while iron in meat or fish has a 10-20% absorption level (Gopalan *et al.* 1971). Enhancers of iron absorption include ascorbic acid and vitamin C, and some fermented and germinated condiments. Inhibitors of iron absorption include the phytates found in cereals, grains, legumes, nuts, and seeds, inositol, calcium, and tannins (WHO, UNICEF, & UN Consultation 2001). Such factors are especially important in India where a large number of vegetarians consume only non-heme iron and where many people consume large quantities of chai. Chai—black tea with milk—has a large quantity of both calcium and tannins, which bind with iron to form insoluble complexes (Ashok & Upadhyaya 2012). Furthermore, fluoride is essential for intestinal iron absorption and many people fail to consume enough fluoride (Dutta 2013). The poor absorption of iron in the Indian diet is even more detrimental for pregnant women who only absorb an average of 8% of the iron they consume (Kalaivani 2009).

The effect of iron absorption and the role of inhibitors and enhancers are important when considering diet, but also when considering the effects of supplementation. While supplementation directly increases the amount of iron in the body, if inhibitors are consumed in concordance with iron supplements, the effectiveness of supplementation is decreased. Thus, it is important that women consume iron supplements with water instead of milk. According to an ASHA in Supai, many women

used to take supplements with milk, but now she actively instructs them not to (ASHA, Personal Interview). Some of the women interviewed in various villages reported consuming the supplements with milk and only one woman reported being told to consume the supplements with water. Furthermore, with increasing doses, the absorption of iron from supplements decreases (NIH 2007). Thus when women are prescribed additional supplementation, it is important to take supplements in multiple spaced doses. However, there was no obvious distribution of such information. While there should certainly be more information about the effect of the diet on supplementation, there should also be a greater focus on diet as a means of intervention for iron-deficiency anemia.

The most natural and sustainable approaches to combatting anemia are food-based. In fact, dietary interventions were set as the top choice for intervention in iron-deficiency during a 2001 international consultation (WHO, UNICEF, & UN Consultation 2001). One obvious food-based approach is the increased provision of iron rich foods like green vegetables and legumes. Green leafy vegetables (GLVs) contain the largest amount of iron and the consumption of GLVs is very important in the prevention and treatment of anemia. According to NFHS III, in Uttarakhand, 42.3% of women consume GLVs daily and 41.8% consume them weekly (IIPS 2007). Among mothers interviewed in Khansyu and Bhainsyachana Block, 100% reported consuming GLVs weekly. No mothers reported consuming them daily. The findings of this study would suggest a largely variable consumption of GLVs based upon seasonal availability and ability to obtain them. Thus, a greater focus on the provision of iron-rich foods to all Indians—especially pregnant women in rural areas—is necessitated. Another valuable food-based

intervention is food fortification with iron (WHO, UNICEF, & UN Consultation 2001). The Integrative Child Development Services (ICDS) scheme to provide supplementary nutrition to pregnant women is an example of such an intervention. However, there are many complications with the current ICDS scheme.

Under the ICDS scheme, pregnant women are to receive supplementary iron-fortified food packets. Initiated in 1975, the ICDS scheme seeks to combat malnutrition among all populations in India via the Public Distribution System, the Midday Meal program for children, the Food for Work program, and the Food and Nutrition Board. Coverage of and funding for the scheme has greatly improved over the past five decades and now nearly the entire country is covered. As a part of the current scheme, pregnant and lactating mothers and adolescent girls are to receive supplemental food in the form of packets of iron-fortified mixed grains. The packets for pregnant women are to be picked up regularly at an Anganwadi Center (AWC). Such supplementation during pregnancy is said to increase the birth weight of a child by 100-150 g and reduce micronutrient deficiencies among women (Ramachandran 2005). However, the scheme has not been especially effective.

Coverage and utilization of the ICDS scheme is reported to be quite low among pregnant women. According to NFHS III, only 20.3% of pregnant women in rural areas received supplementary food packets from an AWC (IIPS 2007). Only half of the mothers interviewed received nutritional packets from an AWC during pregnancy. One of the mothers who failed to receive the packets stated that "no one informed" her about them, despite the AWC workers being her relatives (Pregnant Mother VIII, Personal Interview). A pregnant mother who did receive food packets explained that she only

obtained the nutritional packets once despite living within very close proximity to the AWC, claiming that there was "a lack of it," (Pregnant Mother IX, Personal Interview).

In addition to limited availability of food packets, the ICDS scheme is also limited by noncompliance. Of the interviewed mothers who received supplementary food packets, only a third reported consuming the packets. One pregnant mother reported giving the supplemental food to her children (Pregnant Mother II, Personal Interview) and another reported throwing them out due to their "poor taste," (Pregnant Mother I, Personal Interview). Perhaps better communication about the availability of supplemental food and better education about iron-fortified food supplementation could increase the value of the ICDS food supplementation scheme. As it is, however, the government's provision of supplemental food to pregnant women is chiefly ineffective causing many to focus on supplementation via iron tablets.

IFA Supplementation

While food-based iron supplementation is perhaps healthier and more sustainable, the government's anemia interventions have largely centered on pharmaceutical iron supplementation for years. When the National Anemia Prophylaxis Program was established in 1972, women began receiving Iron and Folic Acid (IFA) supplements to take for 90 consecutive days after their first trimester (Kalaivani 2009). Pregnant women have particularly heightened iron needs during their second and third trimesters and most women—particularly those in developing countries—do not have sufficient iron stores to meet increased iron demands (WHO, UNICEF, & UN Consultation 2001). Iron dosage under the national program was increased in 1992 and a National Nutritional Policy was adopted in 1993 (MoHRD 1993). With this new policy set up under the Ministry of

Women and Child Development (MWCD), IFA supplementation was to be provided for children 0-5 and 6-10, adolescents 10-19, and pregnant and lactating women. Today, pregnant women are to receive a total of 100 supplements during their pregnancy and another 100 tablets post-partum from ANMs and ASHAs under the NRHM (MoHRD 1993). Unfortunately, however, problems of distribution, compliance, and accompanying education make supplementation much less effective.

Insufficient distribution is one major hindrance to the efficacy of iron supplementation. The NFHS III reported that only 58% of pregnant women in rural areas took IFA supplements when pregnant with their last child (IIPS 207). According to Aarohi's Baseline Report of villages in Okhalkanda Block in 2011, only 69% of 177 women who had recently given birth reported receiving IFA supplements during their pregnancy (Aarohi 2011). Okhalkanda Block's PHC had a much higher rate recorded for 2013. According to compiled data from subcenters within Okhalkanda Block, 517 of 631 recorded pregnant women (82%) received 100 IFA tablets from April 2013 to September 2013 (Okhalkanda Subcenter Analysis 2013**)**. This increased rate may have been due to Aarohi's interventions in Okhalkanda Block, but ANC served as a confounding factor. That is, the recorded women were those already receiving ANC; hence only 82% of women reportedly receiving full ANC received IFA supplements. It is clear that IFA supplements are not being properly distributed to all women.

A lack of distribution was not especially obvious in interviews with mothers in Bhainsyachana or Okhalkanda Block. Indeed, all twelve of the mothers interviewed reported receiving supplements. However, according to an ANM in Bhainsyachana Block, distribution was previously an issue, as they received no iron supplements from

the government for three years. Upon demanding the supplements six months prior, they began receiving a regular and sufficient supply (ANM I, Personal Interview). The sampling of mothers was perhaps not representative of the regional and nationwide distribution of iron supplementation. However, the observed compliance of mothers to iron supplementation was perhaps more representative.

Nationally, and in rural Kumaon, many women are not compliant with iron supplementation. According to the NFHS III, only 21.1% of pregnant women in rural areas took IFA supplements for a minimum of 90 days. According to Aarohi's 2001 Baseline Data, only 3.9% of the 177 women surveyed in Okhalkanda Block took 90 or more supplements during their recent pregnancy (Aarohi 2011). Okhalkanda Block's PHC did not have data on IFA compliance. Of the twelve pregnant mothers and recent mothers interviewed in the present study, two mothers reported altogether not consuming the supplements, an 83% compliance rate. However, this rate does not take into account the fact that all twelve women received supplements and does not measure if women were fully compliant with supplementation for 90 days. Taking these factors into consideration, the compliance rate would be much lower. Low compliance to IFA supplementation as hinted at by the present study and recorded by local and national statistics, is largely due to the lack of education provided to women about supplementation.

Noncompliance to iron supplementation among pregnant mothers is a result of poor communication about supplementation and dietary practices. Lack of education given to women about supplements was directly observed when an ANM gave pregnant women 30 IFA supplements at the end of their ANC check-ups without any

accompanying explanation. Three pregnant mothers were interviewed just after receiving a dose of IFA supplements and all three stated that they had not been given information about the supplements and none could explain the purpose of the supplements (Pregnant Mothers II, III, IV, Personal Interviews). One woman clarified that despite receiving and consuming supplements regularly during her last two pregnancies, her only knowledge about supplementation came from other women (Pregnant Mother II, Personal Interview). A pregnant mother in Okhalkanda Block had a similarly limited understanding of supplementation despite remarking upon the effectiveness of her ASHA who always ensured she had IFA tablets. However, the ASHA still did not tell the mother anything about the tablets, and, concomitantly, the mother did not recognize the terms "anemia" or "iron," (Pregnant Mother V, Personal Interview). In these cases, both the women still reported consuming the iron supplements. However, a lack of understanding often leads to a lack of compliance.

Poor communication and education by health workers about iron supplementation leads to noncompliance of pregnant women due to potentially irrational fears, misunderstandings, or simply a lack of resolve. For instance, one particularly reluctant pregnant mother had no understanding of what the supplements were for and consequently took "not even one" of the supplements (Pregnant Mother VIII, Personal Interview). An ASHA in Okhalkanda Block spoke of how she has seen "some women who feel like vomiting even if they just see iron tablets or eat green vegetables," (ASHA II, Personal Interview). Similarly, an ANM in Bhainsyachana Block claimed that some mothers don't take iron tablets because they dislike the taste and say that it makes them constipated (ANM I, Personal Interview). While such factors are not likely the main

cause of noncompliance, there are indeed many side effects like constipation associated with iron supplementation (WHO, UNICEF, & UN Consultation 2001). Indeed, one mother who seldom took her iron supplements during pregnancy complained of feeling dizzy and having headaches after consuming the tablets (New Mother II, Personal Interview). Complaints about side effects can be legitimate, but can also be attributed to other factors and should not dissuade other women from consuming supplements. To prevent this from happening, health workers must be open with women about the side effects associated with supplementation concordant with explaining the merits of supplementation.

Without properly understanding the importance of iron supplementation for their health—and the health of their child—women are apt to be easily dissuaded from taking supplements. Women are largely unaware of the physiological purpose and effect of iron supplementation. Indeed, when asked what iron supplements were for and why they were consuming them, a third of the mothers interviewed said that the iron supplements were "to increase the blood." Even Bimla, the daughter-in-law of an ASHA, stated that the purpose of the supplements was to increase the amount of blood flow (Pregnant Mother I, Personal Interview). The idea that iron increases the amount of blood in the body is a common misconception; indeed, increased blood volume can actually cause anemia by decreasing oxygen concentration. While understanding this detail is not critically important, misconceptions about anemia decrease compliance to supplementation due to irrational fears. Such misunderstandings can be eradicated through increased education by an ASHA or ANM. However, the health workers interviewed seemed unaware of the problem of noncompliance. One ASHA did admit

that very few women in her village knew about anemia. Yet she was quite defeatist claiming that even if they informed women about anemia, women still wouldn't take the supplements. She supposed, "If we tell them, they would listen for some time but then not really care. And even if they take something from us, if I leave from there someone else will come and just say I was faking around," (ASHA II, Personal Interview).

Increased training of health workers may be a valuable approach to increasing understanding of iron supplementation among women. Indeed, there appeared to be slightly increased compliance to and knowledge about supplementation in Aarohi's Phase II intervention villages. An ASHA in an intervention village reported that women previously would not take supplements because they did not have enough information. However, since receiving better training and "books and charts" from Aarohi, the ASHA felt better equipped to explain supplementation to women. The ASHA elaborated that she "would explain it (supplementation) to them and if four, five pregnant women are there [they] would do it together with the charts and books and stuff. This has made a change," (ASHA III, Personal Interview). Such changes are encouraging and further validate the need for better education to be provided to health workers and subsequently to mothers.

CONCLUSIONS

The perception of maternal anemia in rural Kumaon among pregnant women is restricted due to a lack of sufficient nutritional education. Indeed, most women are unable to define anemia, do not know what iron is, and have poor knowledge of proper antenatal nutrition. The perception of anemia among health care workers is similarly restricted, causing the nutritional education provided by governmental workers to be severely lacking, and thus hindering the efficacy of governmental anemia interventions. As seen in Aarohi's intervention villages, NGOs are capable of increasing compliance to governmental anemia interventions and perhaps reducing the occurrence of maternal anemia through adequate supplemental education and training. The study better established the causative link between nutritional education, perceptions of anemia, and compliance to anemia interventions. The study ultimately pointed to a fundamental need for an increased understanding of anemia through nutritional education.

Maternal anemia has intergenerational implications that can only be reduced through widespread education and awareness. Concomitant with its destructive effects on maternal health, anemia has harmful effects on infant and child health causing an increased risk of premature births, of low birth weight (LBW), of peri and neonatal mortality, and of anemia throughout childhood (MoHFW 2013). In India, 28% of children born have a LBW and 78.9% of children are classified as anemic (IIPS 2007). Interestingly, birth outcomes seem to be most strongly linked to anemia in early pregnancy, signifying the importance of pre-pregnancy interventions and nutritional education (Gogoi & Prusty 2013). Thus, while especially pertinent during pregnancy,

nutritional education must extend beyond the context of pregnancy to all young women and even to men, 24% of who are classified as anemic in India (IIPS 2007). The pervasiveness of anemia calls for a broad increase in the understanding of anemia among all age groups and populations. Anemia should be a colloquial term with families working to ensure adequate iron intake on a daily basis, and health workers openly communicating about anemia.

NGOs can be useful in providing increased health education, but NGO interventions are often unsustainable. Indeed, Aarohi's supplementary education seemed initially effective, but decreased in effectiveness as health workers started receiving reduced incentives and fewer trainings due to reduced project funding. Thus, perhaps the best way of expanding the conception of anemia is through education in concordance with governmental ANC, the scope of which is increasing.

Aside from the provision of antenatal education, women's agency is another important factor that must be considered when seeking to improve maternal knowledge and health. Perhaps the only way of ensuring sufficient education of mothers is by empowering women to demand such education. As elucidated through conversations with mothers, many women lack the confidence to demand information from health workers despite a desire for it. However, it is perhaps the scenario of the chicken and the egg. That is, while women need to be empowered to demand maternal education, women are also empowered through maternal education. Women who receive adequate education are more empowered to demand iron supplements, ICDS food packets, and proper ANC. Even still, education and empowerment alone may fall short of eradicating

some social structures. Such factors must be considered when attempting to increase nutritional education and would provide an interesting basis for future research.

To combat maternal anemia in Uttarakhand, and in India at large, the understanding and definition of anemia must be significantly expanded. The government must provide increased education about nutrition to all Indians, with a particular focus on pregnant women. As it is, the perception of maternal anemia in rural Kumaon is severely restricted and certainly a large cause of elevated MMR and IMR. Given the pervasive and destructive effects of maternal anemia, current limited perceptions of anemia are alarming and distressing, and increased education critical.

RECOMMENDATIONS

The present study could be expanded upon through further research of the perception of maternal anemia in both rural Kumaon and throughout India. It would be instructive to see how anemia rates change as the government continues to provide iron supplementation. The effect of women's agency—as alluded to in the conclusion—and traditional views on the perception of maternal health should be further investigated. It would also be interesting to look at the effect of engaging in farming—like many women do in rural Kumaon—on maternal health and on nutritional practices. Additional research should be conducted on the effect of altitude on Hb levels and the need to adjust Hb levels when determining anemia rates.

Other aspects of Aarohi's Health Project could certainly be further evaluated, particularly aspects regarding the sustainability of interventions. Furthermore, the prominence of education in any NGO intervention could make for an interesting study. Aarohi would be a good organization to work with for many studies related to maternal and child health; useful contact information is provided below.

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LIMITATIONS

While the study was able to establish a causative link between nutritional education and the perception of maternal anemia, the study had many limitations. Most notably, the study was limited by a small sample size. The geographical scope of the study was sufficient with interviews conducted in six villages, but the number of interviews conducted in each village was limited. Indeed, only a total of nine pregnant women were interviewed. Pregnant women were hard to find within the villages and, even when a list of pregnant women was obtained, the women were often unavailable. For instance, in Supai there were nine pregnant women recorded, but due to Diwali festivities nearly all of the women were visiting their families during the three days the researcher tried to conduct interviews. In another village with five recorded pregnant women, the ASHA took pregnant women to the PHC with labor pains two consecutive days. Thus, even after a day postponement, three interviews (two pregnant women and the ASHA) were lost. Due to the difficulty in finding pregnant women to interview, the study was expanded to include women who had recently given birth. A late expansion meant that only three such women were interviewed. Limited respondents made it difficult to draw conclusions at times.

In addition to a limited number of respondents, a limited supply of previous healthcare data was found. Despite much searching, promised data was often not to be found. Indeed, after three visits to an ICDS office and over two hours of waiting time in the office, the person in charge of the data never arrived and the data never provided. A similar story occurred at a PHC where, despite an hour and a half at the center and chai

time with a Medical Officer, very limited data was found. Even the data received at an ANM subcenter was in a largely unusable form. Data was seldom compiled into a practical form, and this was even sometimes true at Aarohi. A lack of data made it difficult to ascertain the effectiveness of government interventions and the prevalence of anemia among women interviewed. Accurate Hb levels for many interviewees were not collected due to poor testing methods and record keeping by health workers and by mothers.

Another limiting factor of the study that should be considered in any foreign study is the language and cultural barrier. While the researcher made an attempt to speak some Hindi and utilized a capable translator, much was still likely lost in translation. Notably, the word "nutrition" was largely unrecognized in English or Hindi perhaps pointing to a limited usage of the word in the context of rural Kumaon rather than a limited understanding of nutrition. The translator was also an Aarohi employee perhaps causing some of the conversations regarding Aarohi's interventions to be biased. Furthermore, the researcher's status as a white westerner often affected the responses of respondents. Mothers often seemed to be confused or anxious by the presence of a Westerner in a small rural village and health workers often seemed to be overcome with a desire to portray health situations in a positive light. Such limitations certainly affected the findings of the study, but were not severe enough to make the study's conclusions obsolete.

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Pregnant Mother IV, Personal Interview, 13 Nov. 2013

ANM Subcenter, Direct Observation, 13 Nov. 2013

Okhalkanda Block

ASHA II, Personal Interview, 19 Nov. 2013

New Mother I, Personal Interview, 19 Nov. 2013

ANM II, Personal Interview, 19 Nov. 2013

New Mother II, Personal Interview, 19 Nov. 2013

New Mother III, Personal Interview, 20 Nov. 2013

ASHA III, Personal Interview, 20 Nov. 2013

Pregnant Mother V, Personal Interview, 20 Nov. 2013

Pregnant Mother VI, Personal Interview, 20 Nov. 2013

Pregnant Mother VII, Personal Interview, 21 Nov. 2013

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APPENDIX

Sample Interview Questions: Pregnant Women

Demographics
Age
Family Size/Number of Children
Husband's Job
Literacy/Years of Schooling

Nutritional Knowledge
What do you know about nutrition?
- In what ways/from whom did you learn about nutrition?
- Have you received nutritional information from an ANM or ASHA?

How are you feeling since being pregnant?
- Do you find yourself feeling weak or easily worn out?
- Is weakness and fatigue normal for pregnant women?

Do you know what anemia is?
- What do you know about anemia?

What does your diet consist of?
- Do you feel that you have a balanced diet?
- Are you eating any special or traditional foods during your pregnancy?
- How frequently do you eat green leafy vegetables?

Do you know what iron is?

Are you taking supplements during your pregnancy?
- Where did you get them? Did you take them during your last pregnancies?
- Why are you taking the supplements/what are they for? Do you take them with water or milk?

Do you receive supplementary nutritional packets from an AWC?
- Do you consume the packets?

Have you altered how active you are during your pregnancy?

Does the health of a mother affect her child's health? How?

Have you had any ANC check-ups? How many?
- What did they do during the check-up?

Have you had a blood test during your pregnancy?

What was the test for? Do you remember the result?