Analysis of the Prevalence of Iron-Deficiency Anemia (IDA) and the Intervention for its Reduction in Rural Haryana, India

Introduction

Anemia is currently recognized as one of the most widespread public health concerns globally. Iron-Deficiency Anemia (IDA) is the most common type[1]. In Southeast Asia alone, 65.5% of preschool age children, 48.2% of pregnant women, and 45.7% of non-pregnant women are affected by anemia[2]. Addressing childhood anemia early is essential to avoid abnormalities in cognitive and psychomotor development[3]. Maternal anemia prevention will combat increases in maternal mortality, low birth weight, and preterm delivery[4]. Iron/Folic-Acid (IFA) supplementation programs are generally utilized to address anemia. However, these initiatives are effective only in the short-term due to issues with compliance, accessibility, and delivery systems[1]. To institute a sustainable difference, research has shown that community participation is necessary[1,5,6,7,8]. Thus, the focus of this research is to investigate the methods of sustainably mitigating anemia rates in rural north India through community health worker (also known as health promoter) programs. In Sept. 2013, we led the implementation of an IFA and health promoter system in the village of Charnia, Haryana, India. IFA regimens are typically 90-100 days in length[1]. Therefore, the combined efficacy of IFA and health promoter program will be assessed in Dec. 2013 through follow-up hemoglobin data collection, clinical diagnoses, and surveys. This research will significantly add to anemia studies in rural North India. In addition, [Student A] is writing her Anthropology senior honors thesis on this project, and [Student B] aims to pursue a career in economic development in the future and this project will help him gain the necessary research skills.

Background

Literature Review

Many nutritional deficiencies and diseases are co-morbid with anemia. In India, decreased intake of iron, folate, and vitamin B as well as malaria and parasite worm infestation are linked to high rates of anemia[1]. A 20-50% prevalence of intestinal worms in rural India reduces the bioavailability of iron in the body; children are the most susceptible to these infections, so deworming is often combined with IFA approaches[9]. However, studies have shown that supplementation programs alone are not effective in the long-term for reducing anemia prevalence. Issues frequently arise with the required daily medication adherence, irregular access to the supplementation, and/or side effects from the medication[1,5,6]. Previous studies in rural north India have shown that community participation can significantly improve IFA access and compliance, as well as promote awareness of anemia[7,8]. Further research is necessary to determine the ways IFA programs can be combined with community health worker systems, particularly in rural India.

Target Population and Project RISHI

The population in Charnia mainly consists of brick manufacturing laborers and farmers. Data from 190 household needs assessments conducted in 2012 by Project RISHI (Rural India Social and Health Improvement) members. Project RISHI is the Northwestern organization partnered with Charnia; members travel to the site each year to conduct research and implement initiatives. The needs assessments demonstrated that the brick laborer population was of a lower socioeconomic status than the farming population. Due to this disparity, the brick laborer population is targeted for the IDA intervention. Specifically, the intervention in the brick laboring community of Charnia involves the women of reproductive age (15-49 years), pregnant women, and children of 5-14 years.

Baseline: Initial Implementation of Project (Sept. 2013)

The baseline prevalence of IDA was analyzed in 113 women and children from Charnia's brick laborer community using finger prick hemoglobin measurements, clinical diagnoses, and nutritional surveys. This data indicated an anemia prevalence of 78.8% (Figures 1 and 2). Those who met the standards for anemia (Figure 3) were asked to participate in the pilot study;

those who provided verbal consent were given IFA supplementation (Figure 4). Every child above the age of 5 was given either half or one full tablet of Albendazole (deworming medication) as determined by the supervising physician (each tablet is 400 mg). The sample size consisted of 89 individuals (including both women and children).

In the experimental group (60 randomly selected individuals), two females and one male in the brick laborer community were selected as health promoters based on their commitment and overall understanding of the intervention. Until the completion of the study in Dec. 2013, the health promoters will be responsible for encouraging the anemic individuals in their community to adhere to the regimen of the IFA supplementation. They are expected to follow up with each individual on a weekly basis and record whether medication was taken and if side effects were experienced. The control group does not have a health promoter system.

The study is being conducted with the support of the Northwestern University Feinberg School of Medication and the Postgraduate Institute of Medical Education and Research (PGI) located in Chandigarh, India. IRB approval was received from both Northwestern and PGI prior to the initiation of the project.

Research Objectives (Dec. 2013)

1. Assess IDA prevalence to determine the effect of the IFA supplementation program by collecting subjects' hemoglobin levels and clinical diagnoses of anemia, and comparing this data to the Sept. 2013 baseline.
2. Determine the effect of the health promoter system in reducing anemia by comparing the experimental group's IDA rate to the control group's IDA rate.
3. Conduct surveys to re-assess the subjects' comprehension of nutrition and understand their perceptions regarding the health promoter system.
4. Conduct in-depth interviews with the health promoters to discuss their ability to meet their expectations and determine the ways their roles can be improved and expanded.

Hypothesis: The level of IDA in brick laboring women of reproductive age, pregnant women, and children will decrease more significantly in the experimental as compared to the control population.

Methodology

1. ***Phase 1***

   Research Objectives 1 and 2: Hemoglobin testing, clinical diagnoses (Dec. 15-17)

   STAT-Site Hemoglobin Photometers will be used by trained PGI technicians to perform hemoglobin analysis of the individuals tested in Sept. 2013. After the finger is sterilized with an alcohol swab, one drop of finger stick blood (approximately 12 µl) will be used to determine hemoglobin levels. Clinical diagnoses of anemia will be performed by a PGI physician, who will record symptoms of conjunctiva, tongue, nails, and palm soles; cardiovascular signs; and pregnancy status of the women.

   [Student A]: Will lead this phase of the project by coordinating PGI technicians, assisting with hemoglobin measurements, and recording the data.

   [Student B]: Will obtain informed consent from research subjects.

2. ***Phase 2***

   Research Objective 3: Surveys with research subjects (Dec. 18-20)

   Household surveys will be conducted to collect data regarding consumption of iron-rich foods, accessibility to government programs for IDA, self-reported state of health, worm detection in their children's stools, and overall perceptions regarding anemia and the health promoter system.

   Research Objective 4: Health promoter interviews (Dec. 21-23)

   In-depth interviews will be conducted with the health promoters in Hindi to discuss their ability to improve IFA compliance, their perceptions of their roles, and their ideas for future expansion.

   [Student B] will lead this phase of the project by conducting the surveys/interviews verbally in Hindi and translating the surveys' responses to English for documentation.

[Student A] Will video record the interviews.

3. ***Phase 3***

Research Objectives 1-4: Data analysis (Post-trip)

Microsoft Access and Excel will be used to perform data analysis by comparing the initial and final results to gauge whether a significant reduction in anemia prevalence was achieved. Clinical diagnoses and nutritional survey results will also be compared to the baseline. In addition, the control group's and the experimental group's results will be compared to determine the efficacy of the health promoter system. Moreover, health promoters' collection of data on the subjects' self-reports of health and number of tablets consumed will be analyzed. Wilcoxon rank-sum tests and one-sample Chi Square tests will be utilized as methods of statistical analysis.

[Student A]: Will lead analysis of the hemoglobin and clinical diagnoses data.

[Student B]: Will lead analysis of the surveys and interviews.

Preparation

[Student A]: I have taken several Global Health courses and I am conducting research with Dr. Mamta Swaroop at the Feinberg School of Medication, who is the advisor of this project. In addition, I have taken Anthropology 386 (Research Methods in Human Biology, in which I was trained to assist with hemoglobin fingerpricks), Anthropology 398 (Capstone seminar), Biological Sciences 210 and Organic Chemistry 210 sequences, and Hindi; I will be taking Statistics 202 and Anthropology 399 next quarter. I have also worked in the LaBonne laboratory (Department of Molecular Biosciences), which has provided me with experience in experimental data collection and analysis. As Project RISHI's president and co-founder, I have traveled to Charnia three times so far (Summer 2011, 2012, and 2013) to establish our projects there, including two health camps, needs assessments surveys, and the anemia initiative. Thus, I have experience with surveys, recording data, and Microsoft Access/Excel. Finally, I have maintained contact with the PGI physicians over the past year; we are organizing the trip agenda with their support.

[Student B]**:** At Northwestern so far, I have taken STAT 210 (Introductory Statistics for the Social Sciences) and ECON 281 (Introduction to Applied Econometrics). Both the classes have given me essential data collection and analysis skills, and also made me understand how to conduct an experiment that comprises both an experimental and a control group. Furthermore, I will be taking ECON 381-1 (Applied Econometrics) next quarter, which will enhance my analytical skills. I have also taken BIP 394 (Non-profit Management), which gave me an insight in how to analyze a non-profit organization's operations as well as how to aid the organization in increasing its awareness and outreach. Additionally, I am a fluent speaker in Hindi. As the Director of Initiatives in Project RISHI, I travelled to Charnia this past summer and played an instrumental role in making people understand our project and answering any and all queries and questions. For the past 8 weeks, I have been in regular touch with the health promoters in Charnia to make sure that the project is going as planned.

Conclusion

Through Project RISHI, we aim to use this research to expand the health promoter system in Charnia to address related issues of malnutrition and family planning. [Student A] will also write her Anthropology senior thesis on this project. She will attend medical school at Feinberg next year, and she will continue this research with Dr. Swaroop there. This research will help [Student B] understand how he can play a role in alleviating health issues such as anemia through his education in economics and will continue this research in his pursuit of a higher education in Economic Development.

References

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Appendix: Figures

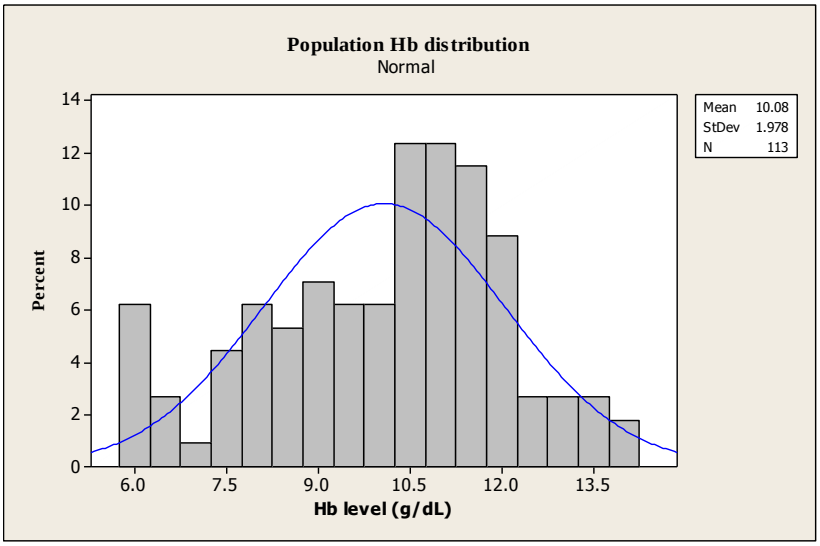

Figure 1. Hemoglobin (Hb, g/L) distribution of all 113 individuals tested in September 2013 (mean Hb level 10.08 g/L).

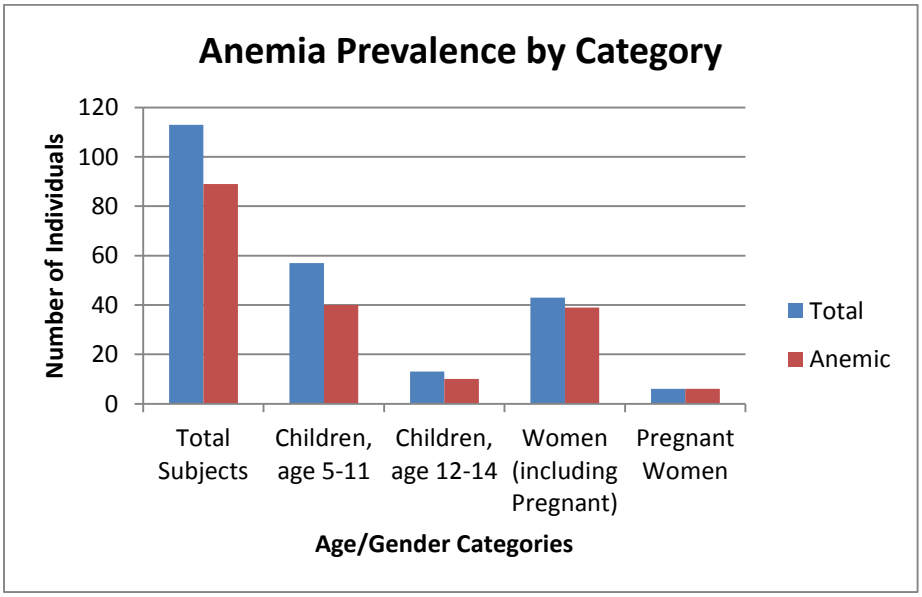

Figure 2. Breakdown of anemia prevalence by age and gender categories.

Age or gender group	Hemoglobin level (g/dL)
Children 6 months to 59 months	11.0
Children 5-11 years	11.5
Children 12-14 years	12.0
Non-pregnant women of reproductive age (15-49 years)	12.0
Pregnant women	11.0
Adult males (above 15 years)	13.0

Figure 3. Hemoglobin levels below which anemia is present in a population[1].

Category	Iron (mg)	Folic Acid (µg)
Child (Age 5-14)	30	
Non-pregnant women of reproductive age (15-49 years)	60	400
Pregnant women	60	400

Figure 4. WHO suggestions for daily IFA dosage[1].