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Factors and Perspectives on Childhood Anemia in Haiti: A Mixed-Methods Study

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Abstract

Objective: The prevalence of childhood anemia in Haiti is among the highest in the world. This study investigated factors associated with childhood anemia, explored knowledge of anemia and perspectives for solutions from community members in the area around Caracol, Haiti.

Methods: We used a mixed-methods design. Participants were children aged 6 months to 14 years, their families, and any community members attending the free clinic between November 12-17, 2017. Quantitative data were collected via a complete record of a patient's key clinical data and medical history taken during a clinic visit, and a subsequent verbal survey with their mothers. We identified risk factors for childhood anemia based on a multi-sectoral framework by USAID, which included biophysical, socioeconomic and environmental factors found in this population. Hemoglobin levels of children were measured using the HemoCue System. Through focus groups, qualitative data on the knowledge of anemia and perspectives of parents and community members were gathered.

Results: This study found a high prevalence of childhood anemia (n=149, 67%-17% mild, 49% moderate, and 1% severe) and an overall low level of understanding of the multiple causes of anemia. Neither children nor maternal factors result in a significant association with childhood anemia. Only the number of bednets in their home was negatively associated with childhood anemia and statistically significant (OR=0.60, 95% CI: 0.37-0.97, p=0.038).

Conclusion: The finding suggests that the distribution of mosquito nets or insecticide-treated bednets can be an extremely effective and easily preventable method in low resource settings such as Haiti, which has not been emphasized in childhood anemia intervention. The finding of the most interest also includes a strong basis of support from community members in terms of commitment and willingness to make changes. A multi-sectoral and community-based approach is critical to solve this intractable problem.

Keywords: Anemia; Children; Haiti; Low resource; Prevention; Multi-sectoral framework; Community-based approach

Introduction

Anemia in children results in lifelong, irreversible deficits in cognitive, behavioral and motor function, even when the anemia is treated [1,2]. These effects can impact quality of life, ability to function fully as a member of society and a loss of human capital [3]. In 2016, the World Health Organization (WHO) reported a global anemia rate for children, 6 to 59 months, of 42%. The prevalence of childhood anemia in Haiti is among the highest in the world. For children of the same age, anemia in Haiti was 58% in 2016 [4].

Multiple risk factors cause childhood anemia [5], although the proportional representation of various types of anemia is not well documented. Besides biophysical and genetic disorders (e.g., sickle-cell, G6PD, or thalassemia), the risk factors most often cited in the literature are low socioeconomic household status, lack of access to healthcare services, inadequate sanitary condition, and a diet with insufficient iron intake [6-12]. Among these risk factors, iron deficiency is the most prevalent determinant of childhood anemia worldwide, as well as in developing countries such as Haiti. Previous studies have shown that the most common cause of childhood anemia in Haiti was iron deficiency anemia [13-15]. Between 2005 and 2015, iron deficiency anemia ranked as the number one cause of disability in Haiti [16].

Reducing childhood anemia in Haiti is a complex issue. Strategic approaches encompass taking multiple steps in improving health behaviors and providing education, as well as addressing resource issues around diet, clean water, soil transmitted helminth precautions, and sanitation. Studies performed in Haitian communities have demonstrated mixed findings on the effectiveness of some recommended strategies. For example, a recent cluster randomized controlled study found that the nutritional intervention (a fortified peanut butter paste, Mamba) was positively associated with reducing anemia among school-aged children in Cap-Haitien, Haiti [8]. A study utilizing Community Health Workers (CHWs)' education of mothers on actions to reduce anemia resulted in a significant improvement in maternal knowledge but no improvement in anemia in rural Haiti [15]. Research conducted in the Central Plateau region assessed the relationship between helicobacter pylori infection and anemia. While a high incidence of seropositivity was found, no association was demonstrated in this particular study. The researchers concluded that the high prevalence of anemia was unrelated to sanitary conditions [17]. Moreover, currently very few studies from the literature have included key stakeholders from the community to help develop solutions to health problems. While such findings do not provide a comprehensive picture, they suggest that factors impacting childhood anemia are multiple and unique among different communities, thus a multi-sectoral and community-based approach is critical to solve this intractable problem among different communities in Haiti.

This study attempts to identify the causes and possible community factors associated with childhood anemia and to identify areas for improved education of the population to prevent anemia in Haitian

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children. A multi-sectoral framework developed by the United States Agency for International Development (USAID) served as the conceptual framework for this study (Figure 1) [5]. We identified risk factors for childhood anemia based on a multi-sectoral framework, which included biophysical, socioeconomic and environmental factors found in this population (described in a later section). Our approach is unique as we paired quantitative analyses (Part 1) with qualitative interviews (Part 2) to assess factors associated with childhood anemia in the five communities (Caracol, Ecam, Limonade, Terrier Rough, and Trou Du Nord) located in the North-East department of Haiti in order to understand perspectives and ideas for solutions from community members.

The specific aims of the study were to 1) determine the prevalence and severity of anemia in children aged 6 months to 14 years attending the free clinic located in Caracol, Haiti, through a complete record of a patient's key clinical data and medical history; 2) evaluate factors affecting anemia prevalence and severity by conducting a supplement survey with the mothers; and 3) understand perspectives and ideas for solutions from community members by holding volunteer focus groups. Aims 1 and 2 were addressed in the quantitative study design (Part 1), while Aim 3 was addressed in the qualitative study design (Part 2).

Methods

We used a mixed-methods design to assess factors associated with childhood anemia and to explore perspectives, understanding and ideas for solutions from community members in Caracol and the four other surrounding communities. Participants were children, their families, and any community members who attended the free clinic from November 12-17, 2017. The clinic was provided as a joint medical mission of the George Washington School of Nursing and Pusan National University Yangsan Hospital in South Korea. This study protocol was approved by the George Washington University Institutional Review Board. Verbal informed consent using translators was obtained from each participant before inclusion in the study.

Part 1: Quantitative study design

Data and study participants: Quantitative data were collected via a complete record of a patient's key clinical data and medical history taken during a clinic visit, and a subsequent verbal survey with their mothers. The researchers conducting the survey interview worked with a local translator. The survey was written in low literacy English with an accompanying version in Haitian Creole, for use by the translator. We focused on children aged 6 months to 14 years. The initial records included 154 child-mother dyads. We excluded 5 children having sickle cell disease, fever (>101°F), diarrhea, bleeding disorder, and/or other chronic disease. A total of 149 child-mother dyads were included in the quantitative study.

Measures: The primary study outcome was anemia. During their clinic visits, hemoglobin levels of children were measured using the HemoCue System. Results were compared with the WHO guidelines [18]. The cut-offs for defining anemia and its severity by age categories were as follows: 6-59 months (mild 10.0-10.9 g/dL; moderate 7.0-9.9 g/dL; severe <7.0 g/dL); 5-11 years (mild 11.0-11.4 g/dL; moderate 8.0-10.9 g/dL; severe <8.0 g/dL); and 12-14 years (mild 11.0-11.9 g/dL; moderate 8.0-10.9 g/dL; severe <8.0 g/dL).

We inquired about risk factors for childhood anemia based on a multi-sectoral framework by USAID, which included biophysical, socioeconomic and environmental factors found in this population (Figure 1) [5]. Age and sex were obtained for all children. Child anthropometric measures of weight and height were taken, and weight-for-age (WAZ) z-scores were calculated using the WHO Child Growth Standards. Underweight was then defined as WAZ < −2.0 standard deviations (SD) [19]. A survey on historical and lifestyle factors was given to mothers was used to collect information regarding child iron-rich foods (such as meats, chicken, fish, or eggs) and Vitamin A sources (such as carrots, green leafy vegetables, pumpkins, squash, yams, or red sweet potatoes) intake, and the length of breastfeeding (≥ 6 months). Per Haiti national protocols, all children aged 0 to 59 months who access the healthcare system in Haiti receive a Road to Health Card (a.k.a. Vaccination Card) [20]. Therefore access to healthcare at least once during infancy or early childhood was assessed by whether a mother reported having a Road to Health Card. Maternal age, education, number of births, and whether or not being anemic when pregnant with this child were assessed. Household and environment information including number of bednets, primary drinking source (water well, river, public pump; tab or faucet inside home; or bottled or potable water), and primary toilet type (open defecation; latrine, share toilet with other households; automatic flush) were also collected.

Statistical analyses: We first examined the prevalence and severity of anemia among children by age categories. Independent samples t-tests (for continuous variables) and ^{2} tests (for categorical variables) were conducted to examine if selected risk factors defined above differed by anemic status (regardless of its severity). Multivariate logistic regression modeling was used to further determine whether risk factors were associated with childhood anemia. All quantitative analyses were performed using the Stata version 13.

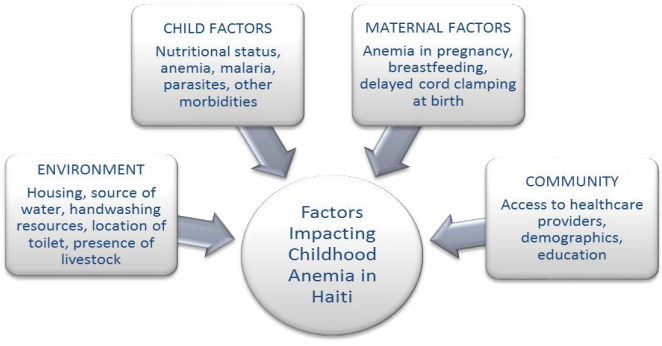

Figure 1: Factors associated with childhood anemia in haiti adapted from usaid. Anemia profile haiti. 2015

USAID = United States Agency for International Development

Part 2: Qualitative study design

This purpose of this study included exploring the perspectives of Haitian people about anemia in children. As such, qualitative inquiry through the use of focus groups was an optimal method for research and analysis. Sample participants were people who lived in the area around Caracol, Haiti who attended the free clinic at the time of the study.

Recruitment to the focus groups was accomplished by inviting clinic patients, at the completion of their visit to the clinic, to take part in a focus group about childhood anemia in Haiti. All patients and their families were invited. A total of 12 focus groups were held with a total of 164 people. The focus groups varied in size from 3 to 20 participants. In the focus groups, data collection was achieved through group discussions. After an introduction, three questions were asked, in sequence, of the groups. 1)" What causes anemia in children?", 2) "What can be done to reduce the number of children with anemia?" and 3) "What is needed to help reduce the number of children with anemia?". After each question, a group discussion followed. The discussions lasted between 15 and 30 minutes. No names were used in the discussions. The investigator spoke English and an interpreter was used to translate English to Haitian Creole and Haitian Creole to English. Focus group sessions were recorded with permission from the participants and later transcribed.

Qualitative analysis was accomplished using the software program Dedoose. Transcripts were reviewed and a content analysis of themes was performed by iterative analysis using preliminary coding, assignation of possible themes and then finalizing key themes and descriptions. Three investigators performed the qualitative analysis and all data were reviewed by at least two researchers (peer debriefing).

Being accountable for personal and professional bias is critical in qualitative research. A number of strategies were used to address this potential. These included employing reflexivity: purposeful and intentional self-reflection while *in the field* (engaged in the research).

Results

Part 1: Quantitative study findings

Prevalence and severity of anemia among children by age group: Figure 2 shows the prevalence and severity of anemia among 149 children by age categories. The overall prevalence of anemia was 67% (17% mild, 49% moderate, and 1% severe). The highest prevalence rate (74%) was observed among children 6 to 59 months of age. Among them, 24% were mildly, 49% were moderately, and 1% were severely anemic.

Risk factors by anemic status: The characteristics of selected risk factors by anemic status (regardless of its severity) are presented in Table 1. Anemic children tended to be underweight (10.87% versus 8.51%) and breastfed for less than 6 months (14.14% versus 8.33%), compared to non-anemic children. Children tended to be slightly more anemic if their mothers were anemic when pregnant (58.70%) than those who were not (56.82%). However, these differences were not statistically significant. The significant differences were found in terms of early access to healthcare and the number of bednets. Children possessing a Road to Health Card tended to be more anemic than those who did not (97.98% versus 89.80%, p=0.027). There was a significant difference in the number of bednets in their home for anemic (mean=0.93, SD=1.29) and non-anemic (mean=1.41, SD=1.84) children (p=0.004).

Risk factors associated with childhood anemia: Table 2 presents the odds ratios (ORs) and 95% confidence intervals (CIs) for childhood anemia from our multivariate logistic regression analysis which controlled for children, maternal and household factors. Neither children nor maternal factors result in a significant association with childhood anemia. Only the number of bednets in their home was negatively associated with childhood anemia and statistically significant at the 0.05 level (OR=0.60, 95% CI: 0.37-0.97, p=0.038).

Part 2: Qualitative study findings

Four themes emerged from the analysis. These were 1) a paradox of knowing, 2) lack of support and resources, 3) no possibility: from oppression to depression and 4) we have the will.

A paradox of knowing: When asked what caused anemia in children, a widely diverse range of answers were given. Present in these statement were clear and authentic expressions of concern for the children. More answers reflected inaccuracies than they did valid explanations for what causes anemia in children. For example, one parent said that "lack of sleep causes anemia". Another participant said that "the sun stresses their blood… you're not supposed to stand in the sun". A majority of the causes that were named were related to nutrition but often lacked accurate information. This included statements like "all vegetables have iron in them", "don't even give one egg to a child"

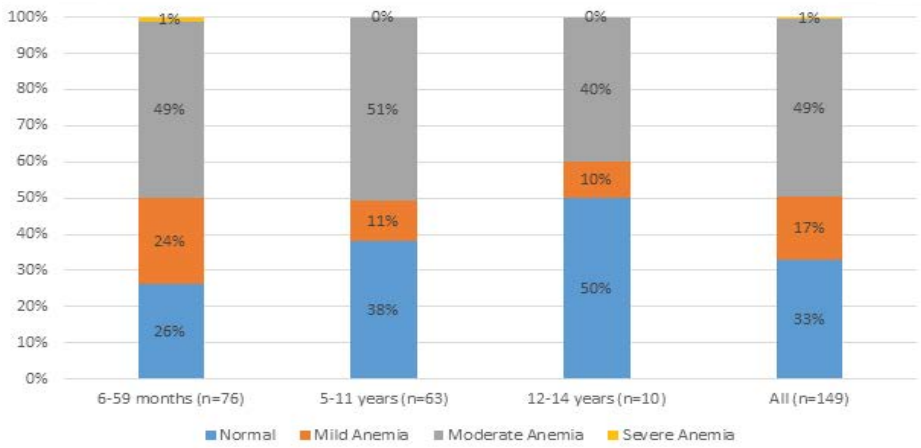

Figure 2: Prevalence And Severity Of Anemia Among Children By Age Group (N=149).

Table 1: Risk Factors By Anemic Status (n=149)[a].

	Normal (n=49)	Anemia (n=100)	Total (n=149)	p-value
Demographic				
Age, %				
6-59 months	40.82	56.00	51.01	0.166
5-11 years	48.98	39.00	42.28	-
12-14 years	10.20	5.00	6.71	-
Sex (n=144), %				
Female	47.92	51.04	50.00	0.724
Male	52.08	48.96	50.00	-
Nutrition				
Underweight[b] (n=139), %				
No	91.49	89.13	89.93	0.662
Yes	8.51	10.87	10.07	-
Iron-rich food[c] intake per week (n=146), %				
0-3 days	63.83	53.54	56.85	0.241
>=4 days	36.17	46.46	43.15	-
Vitamin A food[d] intake per week (n=146), %				
0-3 days	93.62	90.91	91.78	0.578
>=4 days	6.38	9.09	8.22	-
Breastfeeding				
Length (n=147), %				
0-5 months	8.33	14.14	12.24	0.314
>=6 months	91.67	85.86	87.76	-
Road to Health Card[e] (n=148), %				
No	10.20	2.02	4.73	0.027
Yes	89.80	97.98	95.27	-
Maternal				
Age (n=148), %				
18-24 years	6.12	9.09	8.11	0.936
25-34 years	48.98	48.48	48.65	-
35-44 years	34.69	33.33	33.78	-
>=45 years	10.20	9.09	9.46	-
Education (n=146), %				
None	2.08	9.18	6.85	0.378
Primary	35.42	35.71	35.62	-
Secondary	56.25	46.94	50.00	-
Higher	6.25	8.16	7.53	-
Number of birth (n=148), mean	2.94	2.94	2.94	0.355
Anemia when pregnant with this child (n=136), %				
No	43.18	41.30	41.91	0.836
Yes	56.82	58.70	58.09	-
Household & Environment				
Number of bednets (n=146), mean	1.41	0.93	1.09	0.004
Primary drinking water source, %				
Water well, river, public pump	2.04	6.00	4.70	0.498
Tab or faucet inside home	14.29	11.00	12.08	-
Bottled or potable water	83.67	83.00	83.22	-
Primary toilet type, %				
Open defecation	8.16	12.00	10.74	0.763
Latrine, share toilet with other households	63.27	62.00	62.42	-
Automatic flush	28.57	26.00	26.85	-

[a]Due to missing values, the number of observations used for an individual variable differ from the number of total observations (n=149).
[b]Weight-for-age <-2 Standard Deviation from the international reference median value
[c]Meats, chicken, fish, or eggs.
[d]Carrots, green leafy vegetables, pumpkins, squash, yams, or red sweet potatoes.
[e]Per Haiti national protocols, all children aged 0 to 59 months who access the healthcare system in Haiti receive a Road to Health Card (a.k.a. Vaccination Card). Therefore access to healthcare at least once during infancy or early childhood can be assessed by whether a parent reports currently having a Road to Health Card.

Table 2: Risk Factors Associated With Childhood Anemia (n=119)[a].

	OR	95% CI	p-value
Demographic			
Age			
6-59 months (ref)	-	-	-
5-11 years	1.36	(0.52-3.57)	0.531
12-14 years	0.95	(0.14-6.55)	0.959
Sex			
Female	1.13	(0.45-2.85)	0.801
Male (ref)	-	-	-
Nutrition			
Underweight[b]			
No (ref)	-	-	-
Yes	2.39	(0.54-10.52)	0.249
Iron-rich food[c] intake per week			
0-3 days (ref)	-	-	-
>=4 days	2.52	(0.95-6.69)	0.063
Vitamin A food[d] intake per week			
0-3 days (ref)	-	-	-
>=4 days	1.21	(0.14-10.51)	0.863
Breastfeeding			
Length			
0-5 months (ref)	-	-	-
>=6 months	0.60	(0.13-2.80)	0.514
Road to Health Card[e]			
No (ref)	-	-	-
Yes	2.19	(0.18-26.42)	0.537
Maternal			
Age			
18-24 years (ref)	-	-	-
25-34 years	0.32	(0.04-2.81)	0.305
35-44 years	0.28	(0.03-2.68)	0.268
>=45 years	0.20	(0.01-3.36)	0.264
Education			
None (ref)	-	-	-
Primary	0.22	(0.02-2.70)	0.235
Secondary	0.12	(0.01-2.02)	0.141
Higher	0.47	(0.02-14.20)	0.661
Number of birth	0.95	(0.71-1.27)	0.738
Anemia when pregnant with this child			
No (ref)	-	-	-
Yes	1.01	(0.38-2.65)	0.987
Household & Environment			
Number of bednets	0.60	(0.37-0.97)	0.038
Primary drinking water source			
Water well, river, public pump	2.76	(0.25-30.04)	0.404
Tab or faucet inside home	0.39	(0.06-2.37)	0.304
Bottled or potable water (ref)	-	-	-
Primary toilet type			
Open defecation	0.41	(0.06-2.92)	0.372
Latrine, share toilet with other households	0.85	(0.28-2.59)	0.770
Automatic flush (ref)	-	-	-

[a]Due to missing values, the number of observations used for this table differ from the number of total observations (n=149).
[b]Weight-for-age <-2 Standard Deviation from the international reference median value
[c]Meats, chicken, fish, or eggs
[d]Carrots, green leafy vegetables, pumpkins, squash, yams, or red sweet potatoes
[e]Per Haiti national protocols, all children aged 0 to 59 months who access the healthcare system in Haiti receive a Road to Health Card (a.k.a. Vaccination Card). Therefore access to healthcare at least once during infancy or early childhood can be assessed by whether a parent reports currently having a Road to Health Card.
OR: Odds ratio; CI: Confidence interval.

(eggs are a source of iron). However, it was clear that the participants were mostly clear that good nutrition was important. One recognized that babies born of mothers who are anemic could be anemic too. In the seeming paradox of what was known or not known-was the general lack of recognition that other causes of anemia exist in children such as diarrhea and illness. This lack of knowledge can limit the ability to see that strategies like clean water sources to prevent parasites, wearing shoes to prevent hookworm, and handwashing could help prevent anemia.

Lack of support and resources: Participants described lacking a broad range of resources and support. This included lack of money, work, training, and the means to feed the children. One participant said, "We need work. We aren't doing any commerce. We're just sitting around and we don't have anything in our hands to give the children". While another said, "We don't have support and we don't have training". Participants recognized a chain of effects that explained the lack of resources. For instance: "In order to buy the medication, you have to not eat because then it is impossible to get the money necessary to buy food…". Many comments concerned the lack of work or means to work and earn money and the inability to provide for the children. This was summed up in the comment, "Health is money if you don't have money….".

No possibility: from depression to oppression*:* Emotions ranging from anger to despair came through the words of the people in the focus groups. Several spoke of a lack of or no possibility. "I don't have the possibility to help the children. I don't have the means to give them proper food. That possibility doesn't exist." Another said, "It's not that we don't know what to do. It's that we don't have the possibility to do it that makes the children anemic". One father answered the question "What is needed to reduce the number of children with anemia" by saying, "I should have worked harder". He seemed sad and ashamed. Other expressions involved a sense of inequity. "Those who have status don't help the country. They don't support the country to fight anemia." More dramatically one participant said, "They are killing little small poor women. The poverty is killing us."

We have the will: Despite describing the lack of resources and possibility and despite the inequities, there was a strong sense of the participants' ability to help solve the issue. "We need to form groups and help others. If you know, you can educate others to help". Another said, "It's training to teach people what anemia is. Sit them down and say here is what can cause a kid to be anemic. Here is what you can give the kid. Many had strong feelings that they could do more but within the context of limitations. "We have the will at home to fight this thing, but we don't have the capacity or resources." In reflections by the researchers, multiple opportunities were seen. A group of community leaders got together and spoke with one of the researchers after the focus groups, saying that they were ready to help. That they could facilitate trainings in the community about childhood anemia – or whatever else we thought would be useful. This natural emergence of leadership is ideal for community based participatory research and provides essential community involvement for the next phase of this research project.

Discussion

In this study, we worked in partnership with families and community stakeholders to expand understanding of factors associated with childhood anemia in the area around Caracol, Haiti.

Need for a multi-sectoral approach

First and foremost, this study identified the high prevalence of childhood anemia (67%) and the overall low level of understanding and awareness of multiple causes of anemia. The rate has been so for many years and it is even similar to what it was 20 years ago [14]. More importantly, this study reaffirmed that a multi-sectoral approach would be needed to treat and prevent childhood anemia in Haiti.

From a medical point of view, iron deficiency anemia is caused by not only a shortage of iron due to the lack of iron ingested as food, but it also occurs when the amount of red blood cells cannot keep up with production due to loss of iron. Inability to make enough red blood cells may be due to a lack of iron intake in the first place, but loss of red blood cells as a result of parasitic infections including malaria can be assumed to have a large impact. Although the participants were mostly clear that good nutrition was important, the general recognition of other causes of anemia was lacking. The result of our quantitative analyses showed that the number of bednets in the home was statistically significantly associated with childhood anemia. An important interpretation of this finding would be that the distribution of mosquito nets or insecticide-treated bednets can be an extremely effective and easily preventable method in low resource settings such as Haiti, which has not been emphasized in childhood anemia intervention.

Based on prior studies, there is strong evidence that dietary intakes and nutritional status are key contributors to childhood anemia [8,20]. Our analysis, however, did not support this possibly because child dietary intakes of iron or Vitamin A rich foods were solely assessed based on a parent recall. Misreporting cannot be ruled out. We also measured the underweight as a WAZ z-score of the WHO criteria [19]. The frequency of underweight children measured by WAZ was 10% and the frequency of anemia in underweight children was slightly higher but not statistically significant. One possibility is that the actual nutrient intake is not insufficient, or iron or some other micronutrients may be lacking due to poor dietary habits. Indeed, in Haitian children and adults, the intake of sugar-sweetened beverages was known to be higher than expected due to difficulties accessing safe drinking water, and this poor dietary choice can cause anemia even without the child being physically underweight.

Several prior studies also identified maternal health literacy as the most salient predictor of child health [15,21,22]. Water, sanitation and hygiene have been a known contributor to childhood anemia [5,17]. However, in our study region, we were not able to show any statistically significant associations between childhood anemia and any maternal or environmental factors. It is possible that the small sample size may have limited this study's power to detect significant associations in the logistic regression models.

Notwithstanding the evidence, the consensus is that those factors all together could be playing a role in childhood anemia. This study also identified a lack of accurate understanding in the population served of the multiple factors contributing to childhood anemia. That said, approaches to identify and solve the full spectrum of causes of anemia such as diet, hygiene, infection control, and disease management are needed. Important actions to prevent anemia is the promotion of exclusive breastfeeding during the first 6 months of life (even though breastmilk does not contain iron) and a healthy and timely introduction of complementary feeding. Education is extremely important to help people to first understand the multiple causes of anemia and possible solutions to decreasing the prevalence of anemia in their communities.

High potential for a sustainable community-based action plan

The finding of the most interest included a strong basis of support from the community members in terms of commitment and willingness to make changes. Community members felt helpless and

unable to solve basic problems such as anemia. They are willing to work and make these changes with assistance. The people did want to be part of the solution and did want education to improve this problem. Leaders from the communities asked the researchers to come to their communities to teach about the problem. The will and interest of the participants provide high potential for a follow-up study using a community-based action plan.

Research has proven that CHW-delivered health care programs are more cost effective to promote population health particularly in low resource settings with critical shortage of skilled health professionals [15,23,24]. Haiti has used CHWs since the early 1980s for the promotion of vaccination, maternal and child health, nutrition and weight monitoring and later HIV and tuberculosis treatment support and supervision [23]. CHW interventions can be easily adopted to the local context while directly working with families and community stakeholders. Haiti should focus on community-based primary health care programs by expanding CHWs as an integral part of their community outreach activities with regard to anemia prevention.

Critical role of governmental intervention

Although Haiti's poverty and political instability leave it especially vulnerable, policy implications also include the need for governmental intervention into the systemic causes of anemia including the provision of clean water and adequate food sources, which would provide more iron. Also needed are training and education of the population and increasing levels of employment so that people can afford appropriate food and water and sanitation.

Limitations

This study has several limitations. First, hemoglobin levels of children were measured via finger-stick using the HemoCue System. These rates are likely to be even higher than actual venous levels. Second, the study was unable to determine the causes of anemia. Many causes are possible, including Hemoglobinopathies such as sickle cell anemia and thalassemia trait and disease, malaria, soil transmitted helminthes and parasites in water, and nutritional deficiencies. To minimize these risk factors, however, we excluded children having sickle cell disease, fever, diarrhea, bleeding disorder, and/or other chronic disease. Third, this study was conducted in a small region of the country and thus findings may not be generalized to the whole of Haiti. Lastly, our estimates could suffer from self-reported bias.

Conclusion

This study provides a small view of the dire situation that people in Haiti endure. The population needs sources of clean water and food sources rich in nutrients. In addition, education of the population is sorely needed in health literacy and in order that meaningful work can be engaged in. A multi-sectoral and community-based approach is critical to solve this intractable problem in low resource settings such as Haiti. Continued engagement in the community is also greatly needed in order to make lasting changes. While we did visit the community once a year since 2014, we were not able to return due to political instability in the country and the COVID 19 pandemic. We did develop an animated video on causes and prevention of childhood anemia in Haiti which we hope to return to distribute in the country. We also hope to continue our work in partnership with families and community stakeholders to develop community-based strategic recommendations that in the future would help reduce anemia in children in these communities.

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