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Iron Deficiency Anemia in Haitian Immigrants Related to Inadequate Nutrition and Parasites

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Iron Deficiency Anemia in Haitian Immigrants Related to Inadequate Nutrition and Parasites

A Thesis Submitted to
the Faculty of the University of North Georgia
in Partial Fulfillment
of the Requirements for the Degree
Bachelor of Science in Nursing
with Honors

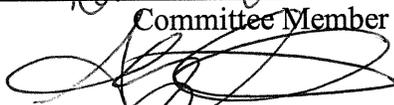
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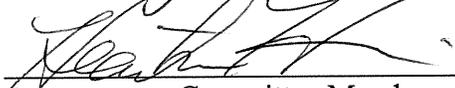
Accepted by the Honors Faculty
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Iron Deficiency Anemia in Haitian Immigrants Related to Inadequate Nutrition and Parasites

The nursing department at the University of North Georgia (UNG) has participated in a study abroad medical mission trip to La Romana, a large city in the Dominican Republic (DR), for the past six years. The nursing volunteer team partners with the Good Samaritan Hospital (Hospital el Buen Samaritano) in order to provide philanthropic healthcare to the local sugar cane plantation population. While the program since its inception has provided much-needed service to Haitian immigrants in the DR, this study seeks to improve the program's service through research illuminating the problem of anemia in the area and identification of ways to improve adequate nutrition, parasite removal, and education. A study by Ferrara, Townsley, MacKay, Lin, and Loh (2014) found the following:

This population, predominantly made up of Haitian migrant workers [and their families], lives in communities called bateyes. These communities often vary on key community health measures, such as population, proximity to an urban center, access to healthcare services, and availability of potable water and food. (p. 871)

The DR and Haiti are neighboring countries that reside on the same Caribbean island of Hispaniola. The estimated 500,000 to 1 million undocumented immigrants from Haiti, 20,000 of which are in La Romana, often cannot receive healthcare in the DR since they are not citizens (Ferrara et al., 2014, p. 871). Adding to inaccessibility to healthcare, the marginalization of rural batey towns leads to endemic poverty and subsequent poor community health conditions – not to mention disease burdens such as malnutrition, parasitic infections, and anemia (Miller, Lin, Kang, & Loh, 2016). Miller et al. (2016) explain that:

Dominican Republic has specific legislation that contains publically supported provisions for various allowances, such as old age, disability, survivor coverage, sickness and maternity, and family. However, Haitian migrants in the Dominican Republic are not given access to these provisions under Dominican law, which is exacerbated for Haitians who lack legal documentation of status. (p. 5)

La Romana, the third largest city in the DR and home to a major sugar cane industry, is the perfect area to investigate poverty's effect on health (Miller et al., 2016). In the summer of 2016, the UNG nursing team went to La Romana once more to provide care, health education, and disease prevention education to this population and the neighboring Dominicans.

Anemia in the Dominican Republic and Haiti

“Anemia is a global health problem characterized by a reduction in the number of red blood cells and the oxygen-carrying capacity of hemoglobin. The World Health Organization (WHO) estimates that half of all anemia cases are caused by iron deficiency” (Mujica-Coopman et al., 2015, p. S120). Anemia is defined as hemoglobin (Hb) below 11.0 g/dL for children ages 6-59 months, below 12.0 g/dL for women, and below 13.0 g/dL for men (Shak et al., 2011, p. 914).

“In Latin America and the Caribbean [LAC], anemia has been a public health problem that affects mainly women of childbearing age and children under 6 years of age” (Mujica-Coopman et al., 2015, p. S120). For the general population, anemia in Haiti has been shown to be a severe public health problem and has also been a moderate problem in the DR. Specific data was produced for children under age six as well as childbearing women (Mujica-Coopman et al., 2015, p. S122). A 2015 study by Mujica-Coopman et al. revealed that in Haiti, 60.6% of children below 6 years of age were stricken with anemia. In childbearing women, 45.5% were anemic; the

latter statistic is the highest prevalence of all LAC countries, and the former is second only to Bolivia by 0.7%. In the DR, 28.0% of children under the age of six were stricken with anemia, and 34% of childbearing women were as well (p. S122).

Research shows that limited meat intake and undernutrition were two main correlates of anemia in the DR (Bryce et al., 2013, p. 393). Based on the research of this student, it was noted that many parasites, such as *Cyclospora*, *Cryptosporidium*, *Schistosoma*, *Ancylostoma duodenale* (hookworm), *Trichuris trichiura* (whipworm), *Plasmodium* (malaria), and *Ascaris lumbricoides*, are an issue in the Dominican and Haitian populations. Parasites can contribute to undernutrition.

Obtaining a Research Topic and Research Articles

It was determined that we would be providing healthcare to Haitian immigrants in the DR during the 2016 trip. To look for recurrent themes of health problems in the DR, 'Dominican Republic' AND 'health' from 2011 - 2017 in Medline with Full Text (at EBSCOhost) as a Boolean/Phrase was initially searched. The search yielded 408 articles. Many irrelevant abstracts about other Latin or South American countries were showing up in these articles, so it was determined the search would have to be narrowed. 408 articles later, this student decided to focus on either anemia (also spelled anaemia) or HIV, as these were the two most prevalent health themes in the DR. After consulting with the study abroad program director, Dr. E. Taylor, the decision was made to choose iron deficiency anemia (unrelated to a genetic issue such as sickle cell anemia or a g6pd deficiency) because this topic is relevant to the care we would provide during the trip (personal communication, November 4, 2016). The search terms were narrowed to: (Dominican Republic) OR (Haiti or Haitian Immigrants) AND (anemia or iron deficiency or anaemia) NOT (sickle cell) NOT (g6pd deficiency) as Boolean/Phrase from 2011-2017 in

MEDLINE with Full Text. This search produced 295 articles, which were reviewed. Seventeen articles were selected that were relevant to iron deficiency anemia in Haiti or the DR. Five of the 17 articles weren't relevant enough and remained unused in the end of the research phase, thus leaving 12 final research articles to use for this project.

Review of Literature

Health Problems and Consequences of Iron Deficiency Anemia

Millions of people are affected by iron deficiency anemia, a major public health concern all over the world; it can occur in any age or gender, but is more prevalent among women and children of all ages. The two groups that are most affected are infants and women of childbearing age (Mujica-Coopman et al., 2015). This type of anemia is a deficient synthesis of hemoglobin resulting from a diet lacking in bioavailable iron for an extended period of time (Mujica-Coopman et al., 2015, p. S124).

The hemoglobin (Hb) protein is the human body's primary transporter of oxygen, a vital component of life. When there is not enough of this 'transporter' in the body, anemia results and cellular respiration and other fundamental body functions are impaired (Iannotti, Delnatus et al., 2015, p. 1092). "[Anemia] diminishes oxygen transport in the body and to the brain where metabolic needs are high. In the school-aged child, anemia might interact with other environmental challenges to damage vital socio-emotional and cognitive-language development" (Iannotti et al., 2016, p. 10). Diminished oxygen, especially in children, can result in permanent growth and development stunting (Iannotti, Delnatus et al., 2015, p. 1097).

During childhood development, the brain's prefrontal cortex and hippocampus are growing at an exponential rate. 'Nutrition insults' during these years can be detrimental to a child's overall and future health (Iannotti et al., 2016, p. 1). Anemia can result in severe

consequences, such as irreparable damage to brain development and reproductive development (Iannotti, Delnatus et al., 2015, p. 1097). According to Ayota et al. (2013), anemia not only has severe consequences on growth and development, but also survival rates in children as well (p. 1). “Anemia among infants, young children, and women of reproductive age is a widespread public health problem in low- and middle-income countries that has serious consequences for child development, maternal survival, and adult economic productivity” (Heidkamp et al., 2013, p. 462). Damage to the body that results from iron deficiency anemia includes compromised neurological development of children, increased maternal and infant mortality, a reduction in physical work capacity [and productivity] in adulthood, impaired psychomotor development, physiological and immune system disorders, increased incidence of preterm births, and low birth weight (Mujica-Coopman et al., 2015, p. S120). With anemia also comes an increased incidence and susceptibility of infection (Shak et al., 2011, p. 913).

Anemia alone has consistently contributed to disabilities in this population for a long time (Bryce et al., 2013). “The recently released findings for global burden of disease among children and adolescents found iron deficiency anemia to be the leading cause of years lived with disability among both children and adolescents” (Iannotti et al., 2016, p. 10).

Prevalence of Iron Deficiency Anemia in Haiti & Dominican Republic

Every study specified anemia severity via hemoglobin levels in the same way; mild anemia was reported as 11.0-11.9 Hb g/dL, moderate anemia as 8.0-10.9 g/dL, and severe anemia as below 8.0 g/dL. According to data procured in Haiti, mild anemia was roughly 20%, moderate was 22%, and severe was 5% for women 15-49 years old (Heidkamp et al., 2013). In 6-59 month old children, mild anemia was roughly 23%, moderate was 34%, and severe was 2%. Anemia was more prevalent in urban areas than rural areas by about 10% (Heidkamp et al.,

2013). A study performed on 336 children and 132 adults in Haiti revealed that anemia was present in four of every five children, as well as two of every three adults, that participated. This number supersedes any current anemia prevalence statistic in other third world countries as well as any studies performed in Haiti in the past (Shak et al., 2011).

In a study of older adults (65+ years) in LAC countries, standardized morbidity ratios proved a prevalence of anemia that was three times higher [37.3%] in the DR compared with the United States (Bryce et al., 2013). DR had an alarmingly high prevalence of anemia, and “in terms of hypoalbuminaemia, undernutrition was the most marked in Dominican Republic” (Bryce et al., 2013). In the DR population ages 70 and older, women had hemoglobin levels that were roughly 10 g/L lower than men even though older men had a higher prevalence of anemia than older women (Bryce et al., 2013).

In a study performed with Haitians of all ages, preschool aged children actually showed the lowest average hemoglobin concentrations. At the baseline examination, 70.6% of Haitian children were anemic (Iannotti, Delnatus et al., 2015). To contrast this, childhood anemia rates were found in another study to be the highest from one year old to 17 months (75%) and the lowest from three years old to 59 months (49%); severe anemia was the highest from 6-11 month old children (Heidkamp et al., 2013). Regardless of the contrasting data that is likely different due to different subject areas of examination, the rates of anemia in Haitian women and children are substantially above the WHO “severe” threshold, and action must be taken (Heidkamp et al., 2013).

Risk Factors for Iron-Deficiency Anemia

“Anemia is a significant health concern worldwide and can be the result of nutritional, environmental, social, and infectious etiologies” (Shak et al., 2011, p. 913). Children are at risk

of iron deficiency because their iron requirements are increased during periods of physical growth; women of childbearing age are at risk of iron deficiency because of actual blood loss associated with menses, pregnancy, and childbirth (Mujica-Coopman et al., 2015). Children ranging from 6-23 months are the most vulnerable to reduced iron - and subsequent reduced hemoglobin and oxygen – because their bodies metabolize it so much faster and they require more as they shift from breast milk to solid food (Shak et al., 2011). According to a study by Iannotti, Delnatus et al. (2015):

Girls were at significantly greater risk for severe anemia compared with boys. In our subgroup analyses examining anemia in girls and boys, we found a trend for increased anemia among older girls, 12-13 years of age... Thus, it is plausible that some older girls were at greater risk for anemia because of the blood loss associated with menses. (p. 1096)

“In the developing world, the most common causes of anemia are micronutrient deficiencies [and] parasitic diseases” (Shak et al., 2011, p. 913). Risk factors for anemia noted in the DR were: diet (frequency of meat consumption), under nutrition and low albumin, small arm circumference, and “self-reported ‘stomach or intestine problems’” (Bryce et al., 2013, p. 388). “Highly prevalent anemia in the [Haitian] school children (70.6%) was associated with stunting, fever, poultry ownership, and absence of deworming and vitamin A supplementation” (Iannotti et al., 2016, p. 2). Having less than two childbirths within the last five years, living in a rural setting, and being overweight lowered the risk for anemia, whereas pregnancy significantly increased the risk (Heidkamp et al., 2013).

Cause of Iron Deficiency Anemia: Inadequate Nutrition

A study by Mujica-Coopman et al. (2015) noted the following:

The diet in most of these [Caribbean] countries has a low amount of bioavailable iron (heme), which increases the difficulty of meeting the requirements. In some countries, this situation coexists with high rates of gastrointestinal infections and parasitic diseases, which impair the absorption of iron. (p. S124)

Another nutritional factor in iron deficiency other than lack of iron itself is a vitamin A deficiency. This is the second most common cause of iron deficiency anemia because a lack of Vitamin A results in iron isolation and decreased production of Hb carrying red blood cells (Mujica-Coopman et al., 2015).

Cause of Iron Deficiency Anemia: Parasites

Most infections associated with travel originate from ingestion of contaminated food or water from Caribbean countries, such as the DR and Haiti. Two parasitic pathogens that are commonly transmitted through food include *Cryptosporidium* and *Cyclospora*. The majority (79.4%) of *Cyclospora* infections were reported after a patient returned from a LAC (Kendall et al., 2012).

There is a documented positive relationship between deworming and hemoglobin concentration, whereas fever [suggesting infection] and hemoglobin concentration have a negative relationship. Parasites and parasitic infections cause low Hb concentrations and subsequent anemia via blood loss and inflammation mechanisms (Iannotti, Delnatus et al., 2015). Malaria, caused by the protozoan *Plasmodium falciparum*, was found to be a very common cause of severe anemia in vulnerable populations (Iannotti, Delnatus et al., 2015). A study in 2015 on Haitian children identified ages 6-15 to be the most at risk for helminth infections. “*Trichuris trichiura* (whipworm) was prevalent in 9.0% and *Ascaris lumbricoides* in 9.2% of Haitian children, nationally” (Iannotti, Delnatus et al., 2015, p. 1096). However, in certain parts of Haiti,

the prevalence of *Ascaris lumbricoides* in the population is as high as 37%, whipworm as high as 62%, and *Ancylostoma duodenale* (hookworm) as high as 21% (Iannotti, Delnatus et al., 2015).

Schistosomiasis is an infection present in Caribbean countries, including DR and Haiti, which is caused by “intestinal and urinary blood fluke parasites”, called *Schistosoma mansoni* (Zoni, Catalá, & Ault, 2016, p. 2). These parasitic worms make human blood vessels their home for years while they reproduce daily (Zoni et al., 2016). “The chronic infection can cause anemia, stunted growth, impaired cognition, decreased physical fitness, intestinal fibrosis veins, hepatosplenomegaly, neurological complications and death. Subsequently, this disease has a socioeconomic impact on the populations affected” (Zoni et al., 2016, p. 2). More than 200 million people are already suffering from schistosomiasis, and another 700 million are at risk (Zoni et al., 2016).

Interventions

Clearly there is an urgent need to implement interventions among the populations at risk for anemia, most specifically for children and women of childbearing age. A study by Heidkamp et al. (2013) found the following:

These should include delayed umbilical cord clamping at the time of delivery, which can improve infant iron endowment and iron stores later in life; exclusive breastfeeding, which helps maintain gut integrity and in turn prevents blood losses; and large-scale prevention and treatment of intestinal parasites and helminths, which also prevents blood loss-induced iron deficiency and anemia. (p. 477)

Nutrition

Some say that the first 1000 days of the life of a child is the most crucial time frame to promote excellent nutrition, as this window shapes the future and development of the individual;

the money spent on sufficient nutrition for the first three years of life is well worth the outcome (Ayota et al., 2013). It is essential that mothers receive education on proper nutrition for their children, because they are usually the ones providing it (Shak et al., 2011). Mothers must be urged to breastfeed, and everyone must be taught the importance of washing their hands with soap. Micronutrient powders should be mass distributed for children, water sanitation must be implemented, and lavatories must be available and promoted (Ayota et al., 2013). Improving nutrition to reduce anemia also entails understanding Dominican and Haitian cultures and food practices in order to appropriately address sanitation, diet, eating habits, parasitic control, and culinary diversity (Mujica-Coopman et al., 2015).

“Several strategies have been implemented to prevent and control anemia in Latin America and the Caribbean, most notably mass fortification of flour (wheat, rice, maize, or cassava) and milk [liquid or powdered whole cow’s milk] with iron” (Mujica-Coopman et al., 2015, p. S120). LAC countries that utilize these methods have the lowest prevalence of iron deficiency anemia (Mujica-Coopman et al., 2015). A study in Haiti using vitamin and mineral sprinkles on infant and toddler food reduced childhood anemia by more than half after only two months (Mujica-Coopman et al., 2015). Vitamin A supplementation for children over a half-year span resulted in a positive relationship with Hb concentrations, so vitamin A should be especially considered as a part of proper nutrition in the prevention of anemia. This is likely due to vitamin A’s role in erythropoiesis, iron storage, and iron release (Iannotti, Delnatus et al., 2015).

“Urban populations have more access to purchased energy-dense staples such as rice or cornmeal; rural populations are more likely to seasonally access micronutrient-dense fruits and vegetables such as mangoes or leafy green vegetables at low or no cost” (Heidkamp et al., 2013, p. 477). The wealthier population looks down upon these poor, rural foods that they ironically

require for their diet; thus, the poorer you are, the less your risk of anemia due to adequate hemoglobin and vitamin A levels from an enriched diet (Heidkamp et al., 2013).

One longitudinal study in Haiti utilized a fortified peanut butter snack called Vita Mamba in attempt to lower anemia rates in school children. In the first study of Vita Mamba, the public school feeding programs were spoken about before the supplement was introduced. The reason they came up with Vita Mamba was because the beans, rice, oil, or cereal bar the children were eating in the morning or at noon weren't really increasing their nutrition. However, the first implementation of Vita Mamba showed little effect to increasing hemoglobin concentration (Iannotti, Henretty et al., 2015).

The first study utilizing Vita Mamba proved it to not be beneficial, and they realized later that it was significantly impactful in reducing childhood anemia when used in combination with [parasitic] control (Iannotti et al., 2016). Systematic deworming was implemented alongside the distribution of Vita Mamba. Vita Mamba snack was given once at school for 26 weeks in combination with albendazole to treat parasites (Iannotti et al., 2016). They followed the general g/dL anemia parameters previously listed above for children over 12 years old, as well as childhood specific ones. Anything below 11.0 g/dL in 0-4.9 year olds as well as below 11.5 g/dL in 5-11.9 year olds is classified as anemia (Iannotti et al., 2016). Vita Mamba's 260 kilocalories supply a child with more than three-quarters of their necessary micronutrients for the day. This supplement consistently showed a positive increase in Hb concentration and effectively reduced iron deficiency anemia in Haitian children (Iannotti et al., 2016). In conclusion, Vita Mamba or other effective fortified food programs can decrease the burden of anemia when used in combination with parasite control (Iannotti et al., 2016).

Parasite Control

In the DR, residents can obtain drinking water through pipes, wells, or bottled water. Every single person that was surveyed as a part of this study stated that they preferred drinking bottled water even though it's the most expensive option (Miller et al., 2016). Themes around access to water, an essential necessity, highlight several areas of concern. Many parasitic infections are acquired through non-potable water; limited access to safe and drinkable water increases the public's vulnerability to infectious diseases (Miller et al., 2016). Many residents in La Romana bateyes were concerned about the potability of community pipe water even though it is free. The perception that bottled water is healthier presents a notable burden and additional financial strain on the limited finances of this population (Miller et al., 2016).

“A successful water filtration project, the inception of which was identified in certain responses, would thus both meet an essential need and mitigate the financial burden associated with bottled water purchase” (Miller et al., 2016, p. 4). Residents of La Romana specifically stated their city's need for filtered water through sanitation systems and requested that Hospital el Buen Samaritano and its volunteers assist them in bringing safe water from the city to all bateyes (Miller et al., 2016).

Five years ago, the World Health Assembly resolved to eliminate schistosomiasis and developed initiative and investment programs to do so worldwide (Zoni et al., 2016). Zoni et al. noted that it was possible to interrupt the transmission of schistosomiasis to humans in the Dominican Republic (2016). “Currently, the control of Schistosomiasis relies principally on mass drug administration of praziquantel” (Zoni et al., 2016, p. 2). Interventions to further reduce the prevalence and risk of *S. mansoni* should include “snail host control, health education, hygiene promotion, access to safe water, and sanitation improvement” (Zoni et al., 2016).

Methods/Project Plan

Observation during UNG's study abroad mission trip, along with a review of the literature on iron-deficiency anemia, revealed that children, women of all ages, and men above 65 years old are at risk for iron deficiency anemia in the DR and Haiti. The migrant Haitian population that is residing in the DR is especially at risk because they cannot receive consistent healthcare, are burdened with parasitic diseases, and have little access to proper nutrition and water. It is crucial to reduce anemia in children, as the first few years of life have the ability to make or break their futures. In order to effectively reduce iron deficiency in the DR and Haiti, the UNG nursing team and its partners need to be implementing a combination of adequate nutrition, parasite removal, and education.

Based on findings from the literature review, an educational tool about anemia was developed in English. It was then proofread and translated by two Spanish educators in Dawson County, GA. 100 of the educational flyers were printed in Spanish to be distributed. Two flyers were laminated – one in English, one in Spanish – to use for patient education. The tool explained the etiology of anemia, its signs and symptoms, those at risk, its association with iron and vitamin C, ways to obtain iron and vitamin C from their diet, consequences of being anemic during pregnancy, etc. I was told months before we left for the DR that the majority of the patients we would see are illiterate, so I knew I would require help with providing education. UNG ensured that the Hospital el Buen Samaritano provided our team with professional interpreters – proficient in both Spanish and Creole. I requested their assistance to help teach my patients about anemia. While in the DR, I signed up to work the anemia and deworming stations, as those pertained the most to my research.

Deworming Station

As stated in my literature review, worms and parasites can result in anemia; treating vulnerable populations, such as this one, has been shown to reduce the prevalence of anemia. At the deworming station, we had twenty reusable 25 mL medicine cups, five 5mL syringes, three jugs of anti-worming piperazine solution, a bucket of bleach, and a bucket of rinsing water. The villagers lined up at our station outside, and we asked how old they were in Spanish, "Cuántos años tienes?" Depending on their age, we gave them the proper dosage of deworming solution. Children under a year old received 5 mL in a syringe, children 1-3 years received 10 mL in a cup, children 4-7 years received 15 mL, children 8-12 years received 25 mL, and those 13 years and older received 35 mL. Every time a 25 mL cup was used, it was cleaned in the bleach solution for at least 10 seconds and then rinsed in the clean water to then be reused. A smiley face was drawn with a black sharpie marker on the left hand of every villager to keep track of who received deworming solution. At the deworming station, I educated three groups: one group of five various aged women, one whom was visibly pregnant; one group of three adolescent females (ages 13, 14, and 17); and one group of five middle aged women and one adolescent male. The other participants denied disclosing their ages as a group.

Anemia Station

The anemia station was located inside the church where the clinic was set up. A study on anemia had been conducted on certain women and children in these bateyes for the past three years, so these participants were called upon to receive their check-up. When the select patients arrived to be seen, they would be directed to sit down on a bench where we obtained their blood pressure, pulse, blood hemoglobin levels (g/dL), height (feet and inches), weight (lbs), and arm circumference in (cm). We verified their name and age, if known. At the anemia station, I

educated ten women on anemia individually while they were waiting to be seen. Their ages in order were 16 (visibly pregnant), 17, 18, 18, 22 (visibly pregnant), 24, 25, 31, and 42.

Multivitamins with Iron

Multivitamins containing iron as well as other essential nutrients were distributed to every patient seen at the clinic. Nursing students were responsible for counting 30 multivitamins (one month supply) or 60 multivitamins (two month supply) into plastic bags; the expiration dates were marked onto each bag. Youth and adult multivitamins were differentiated and distributed appropriately. “Major” brand children’s chewable vitamins with iron contained 15 mg of iron (ferrous fumarate) per tablet. “Rugby” brand Daily-Vite adult vitamins with iron contained 18 mg of iron (ferrous fumarate). Both adults and children were directed to take one tablet per day.

Patient Education

The laminated English flyer was used to educate the patients on anemia while the translator translated its meaning in Spanish. When patients arrived to be seen in the anemia station, they would sit down on a bench across from me. I had the translator sit beside the patient, and would begin patient education while they were waiting to be seen. At the deworming station, I taught teenagers and adult women when there was not a line of patients waiting to receive treatment. There, the patient/s and I were standing while the translator was sitting at the station.

I began each session with a smile and a greeting. My translator assisted me in handing the patient a Spanish flyer on anemia and explaining that I was going to teach them about health if they consented. Then, I would ask the patient if they knew what iron deficiency anemia was. This question, depending on the answer, would lead into teaching about what iron is, where it

comes from, what it does, how it can be gained or lost, etc. I provided information on ways to prevent anemia, what anemia does to the body, and the populations at risk. I looked directly at the patient while talking and answering questions, and I paused after every two sentences so that the translator received adequate time to translate the material correctly. At the end of the education session, I thanked the participant for their time, gave them a Spanish educational flyer, and encouraged them to teach their families and friends about what they had learned. I also left 10 unused flyers behind at each of the five churches since the pastors showed literacy skills.

Evaluation

The following observational data was gathered from those I interacted with in the DR and their reactions to the care and patient education we provided.

Effectiveness of Deworming

This population seemed very comfortable and familiar with being dewormed. Nearly every villager lined up at the station to receive anti-worming treatment and knew that they were to swallow however much we gave them. Their expressions changed from indifference to acceptance as we used our limited Spanish language abilities. The children aged two and under posed the most aversion to the medicine as evidenced by wide eyes, screaming, crying, clenching their family member, and spitting out the solution. Pinching the cheeks of infants the second time around facilitated better administration of the solution as they all spit it out the first time. The elderly male population also seemed wary of either the deworming solution or us, the volunteers. This was evidenced by facial expressions showing furrowed brows, firm pressed lips, and glaring eyes in our direction. Unless they were leading their children or grandchildren to our station, they did not come near us and refused deworming solution with the wave of a hand when it was offered.

Depending on the type of intestinal worms the patients carry, our deworming solution may or may not have been effective; we did not possess the tools to know for certain what biological genera of worm they suffered from. Piperazine is most effective if it is consistently given once every month or two months since they are likely obtaining them from drinking the contaminated water. Ergo, if the hospital does not visit a certain bately consistently, they will remain in a cycle of contracting and eliminating worms. This is why teaching on hand washing with soap and purifying water by boiling, if resources are available to do so, are pertinent educational topics. Due to the limited size of the 25 mL cup, we have to give the last 10 mL of the 13 years and older 35 mL dose in a second cup. Many patients refused this second cup with a smile and wave of the hand while walking off, thus not receiving the proper dose. The system of drawing a smiley face on their left hands was very effective, because many patients tried to come back for another dose. The system in which we dewormed the population was effective because they were used to it, but it was very messy, unclean, and time consuming.

Effectiveness of Anemia Station

I never understood what my role was in this station, and the station area itself was very cluttered and disorganized until the last two hours of the clinic. The entrance to this station was located in a doorway, and we had our height and weight equipment set up there. The rest of our equipment – blood pressure cuffs, measuring tapes, stacks of blank forms, gloves, gauze, band aids, alcohol wipes, and hemoglobin meters - were scattered around us on the two benches. There were seven clinic volunteers and roughly two to three patients in the station at one time, and there was only enough room for four people to sit on the benches. The benches were so close together that your knees almost touched the person's across from you.

The patients did not seem to mind the chaos as much as the volunteers. Though, they got frustrated with the amount of noise in the clinic. It was very difficult for the patients, volunteers, and translators to hear in such a loud environment. I believe I educated some women who were not part of the study, but I gave education to anyone who listened. I stopped asking for the patient's date of birth, as it seemed to incite embarrassment and shyness. After realizing that they did not know their birthdays, I instead asked for their age. Due to the noise level, the patients who consented to my education session had to lean very close to the translator to hear what he was saying, but I interpreted this as a good sign because it meant they wanted to understand the material. The participants in the study primarily focused their attention to the translator after our initial greeting, but occasionally would answer a question directly to me.

Effectiveness of Multivitamins

For the most part, patients were very grateful to receive a supply of vitamins. This was evidenced by the patients smiling, thanking us, and swallowing their first tablet before leaving the clinic. Since the care provided by clinics like ours is the only healthcare they receive, it may be anywhere from two to six months before a particular patient's population is seen again. Thus, they might not be receiving an adequate supply of iron-fortified vitamins year round, which would not sufficiently increase hemoglobin levels. The hospital staff also reported that some patients and participants turn around and sell the multivitamins or give them to family members they deem more in need. Thus, each patient may not be utilizing the multivitamins as anticipated. The administration of iron is essential, as the villagers consume rice as the majority of their diet. Their sources of protein were chicken and oxen, which from mere observation seemed very scarce.

Effectiveness of Patient Education

Using the flyer as a template for the conversation about anemia, I was able to hit all of the main educational points related to anemia: etiology, diet, pregnancy, worms, washing hands, signs and symptoms, people at risk, etc. I received short responses and head nods to my teaching at the anemia station, likely due to the language barrier and the intense volume of the room. I was only able to provide education on anemia to 24 patients total due to time constraints since both stations were very rushed. The groups at the deworming station seemed to have more confidence in talking and asking questions than the individuals in the anemia station. I had anticipated being able to educate more patients as well, so it might be more beneficial to provide teaching in groups.

The Dominican translator that assisted me at the deworming station was very fluent in English, whereas the translator at this station was still learning English and struggled with some scientific terms. Only one patient denied consent to an educational session on anemia; many participants seemed very eager to hear what I had to say. While teaching, most women nodded or said, “Sí”, as if understanding the content. One of the pregnant women asked me to clarify postpartum depression, which I explained as a loss of energy, crying often, difficulty sleeping, a lack of interest in your baby, and sometimes even thoughts of hurting yourself or your baby weeks after birth. I emphasized how important it is to tell someone if she feels this way after her baby is born. Some of the patients tried to give the flyer back, but I smiled and said, “Para tú.” Another woman asked why washing her hands before and after eating would help; I explained that this would decrease the likelihood of her getting worms. She nodded in agreement. I believe the teaching went well, but it didn't go as well as I had anticipated due to constraints, such as:

inadequate translating and language barriers, patients' levels of education and illiteracy, rushing for time, and loudness.

Discussion

During consultation with Dr. E. Taylor and Professor H. Harris about their experiences during past study abroad trips to the DR, I chose to focus this study on iron deficiency anemia in Haitian immigrants living outside of La Romana (personal communication, November 4, 2016). Dr. E. Taylor noted that the reason anemia is so prevalent in this sugar cane village population of La Romana is because these people do not have access to red meat or dark leafy greens and are often hosts to parasitic worms. She explained that UNICEF has been trying to supply these Haitian communities with high protein rice products, vitamins, and other protein and iron supplements. UNICEF, as well as study abroad groups such as ours, is trying to educate this population about anemia and ensure that they are equipped with the resources to prevent it (E. Taylor, personal communication, January 18, 2018). A barrier to the nutrition-enhanced rice is reported to be its undesirable taste.

It was recently noted that the anti-parasitic piperazine will be changed to anthelmintic albendazole for the next trip. Piperazine is the drug of choice and was supplied by the Good Samaritan Hospital, but it is only used on livestock in the United States. After being asked to supply the piperazine, UNG consulted with the Centers for Disease Control and Prevention (CDC) and decided to switch to albendazole, a chewable 400 mg tablet for future trips. The albendazole dose is the same for all age groups. This tablet will relieve many of the problems we encountered with liquid deworming and may possibly be the solution for treatment over a long period of time when healthcare accessibility is absent. The tablets will save time and resources that were associated with the medicine cups, bowls, bleach, and water used to clean each cup

after every use. Albendazole tablets are a much cleaner option and will also ensure that every patient receives the proper dose if the volunteer groups can manage to reach each batey twice a year. Albendazole also contains a supplement of vitamin A as was suggested in the literature review to increase hemoglobin levels. Future groups need to make sure they educate the population on how the worms can be expelled through the nose, mouth, and stool. The patients were very grateful to receive deworming treatments, so it will be interesting to see how well they transition from the familiarity of liquid treatment to the new tablet treatment (Schiffer, 2015).

While increasing healthcare availability and accessibility to Haitian immigrants in the DR would be an ideal goal, the realistic goal for the UNG team was to treat the patients and identify ways to improve the treatment and education; this included identifying ways to help the patients sufficiently increase their iron and hemoglobin levels on their own through education and anthelmintic drugs that work for longer periods of time.

Patient education must address the importance of taking the multivitamins with iron instead of selling them, though this is ultimately the decision of the individual. The Haitian immigrants clearly did not consume enough iron as their diet mainly consists of rice; a possibility for future groups could be to purchase vegetable seeds that are high in iron in the DR that grow well in their climate and bring them to the bateyes. From personal observation, it is crucial for students and providers to at least try to use their Spanish or Creole language abilities no matter how limited; it was clear that this attempt increased cross-cultural trust and respect between patient and provider. It is through trust and mutual respect that a strong foundation for education is built.

Expounding upon the analysis, a suggestion for future groups is the need to move the anemia station outside of the main clinic area to reduce noise levels. Each person needs to be

assigned a specific job, and the assembly line needs to flow in a logical order. Based on the responses I received between individual patient education and group teaching, it was evident that the patients learn much better in a group setting. The patients displayed increased confidence, understanding, and willingness to ask questions. Group teaching also allows a wider expanse of education amongst the population.

It should be noted that the educator and the translator should privately go over the material together in a quiet area to increase the translator's understanding of the content and expectations. This was an important step that was overlooked during this trip and may have resulted in poorer education. The importance of hand hygiene and boiled water to prevent parasites should be also covered at each batey. This could be done at the deworming and/or tooth-brushing stations to reach the most patients. For future teaching materials, the use of three or less syllable words, within a pictorial book should be considered instead of the flyer. This will ensure that the literacy level of the content is as basic as possible and subsequently easier to understand. The material must also be translated into not only Spanish, but also Creole as this population speaks a mixture of the two languages.

In conclusion, the following should be considered by future UNG study abroad participants in the care of Haitian immigrants in the DR suffering from iron-deficiency anemia. To improve the treatment and education of this population: patients should be taught in groups instead of individually, piperazine should be changed to albendazole, patients need to be educated on the importance of hand hygiene with soap and boiled water, the educator should consult with the translator before they co-teach to improve understanding, education should be held in quieter areas away from the main clinic, volunteers should attempt conversation in Spanish/Creole to enhance trust, volunteers should continue to distribute vitamins and encourage

each individual to consume them personally, and the study abroad team should consult with Hospital el Buen Samaritano about purchasing leafy green vegetable seeds to distribute to the batey populations to increase iron levels.

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