

## ISP Proposal

**Title:** Prevention of Neural Tube Birth Defects: A Folic Acid Education Program to Improve Folate Status

### **Abstract:**

The role of periconception folate in preventing neural tube defects in infants is well documented, and it is predicted that 50-75% of the 2,500 annual cases of spina bifida and anencephaly in the United States could be prevented if all pregnant women had sufficient folate levels at the time of conception.<sup>1,2</sup> The U.S. Public Health Service recommends that all women of reproductive age consume 0.4 mg of folate daily to prevent NTDs,<sup>3</sup> and a national health objective for 2010 is to increase the proportion of pregnancies begun with a sufficient folate level by increasing the median RBC folate level to 220 ng/mL among non-pregnant women aged 15-44 years.<sup>4</sup> In continuing the Folic Acid Education Campaign begun at the Baker Elementary School site of the UCSD Student-Run Free Clinic Project, we would like to assess the increase in folate status (serum and RBC folate levels) of the women in the project. Group education sessions are held month during which folate, its sources and its actions are discussed, and high folate foods and multivitamins are distributed. Participants can get vitamin refills at the Tuesday afternoon clinic or at subsequent educational sessions. The serum and RBC folate levels of new participants will be taken before their first educational session, and five months later.

### **Background:**

Neural tube defects, a class of birth defects caused by incomplete closure of the spine, affect more than 2,500 infants annually in the United States.<sup>2</sup> In California, the rate of NTDs is 1 in 1750 live births.<sup>5</sup> There are also an unknown number of fetuses lost to miscarriage, stillbirth, and abortion when detected early because of conditions of NTDs. The two most common NTDs are anencephaly and spina bifida. Anencephaly occurs when the top of the neural tube does not close and the brain does not develop, and these infants die within moments of birth. Spina bifida, occurs when the lower end of the neural tube does not close properly. Infants with spina bifida usually survive, but suffer from disabilities such as paralysis, incontinence, and learning disabilities.

Folate provides significant benefit by reduction of risk of coronary artery disease, intestinal cancers, and stroke, but the predicted potential reduction of 50-75% of incidence of NTD by adequate folate intake has been the focus of major community education efforts.<sup>1,2</sup> Folate is water soluble vitamin involved in DNA synthesis, and while its precise role in the development of neural tube defects is not clear, it is evident that NTDs occur in the first four weeks following conception, before a woman is aware that she is pregnant. In 1992, the US Public Health Service recommended that all women who are capable of getting pregnant consume 0.4 mg of folate daily, to reduce the risk of NTDs.<sup>3</sup> There have been large efforts to educate women about folate, and the March of Dimes reports an increase in awareness of folic acid from 52% in 1995 to 75% in 2000. Still, only 10% of women know that folic acid must be consumed before pregnancy, and only 15% of women know that folic acid prevents birth defects. The March of Dimes

also reports that only 32% of these women are taking a daily multivitamin containing folic acid, up slightly from 28% in 1995. In the same study, it was noted that women from racial or ethnic minorities, who had attained a high school education or less, who received later or no prenatal care, and whose pregnancies were unintended were less likely to be aware of the benefits of folic acid.<sup>6</sup> It is necessary to close the gap between knowledge and consumption if these educational campaigns are to be deemed effective in preventing neural tube defects. High folate intake is also correlated with reduced risks of specific cancer and heart problems.

Folate is found in a variety of foods including leafy vegetables, fortified grains, and some meat, as well as in multivitamins containing folic acid. Folate is absorbed as folic acid and is reduced to form tetrahydrofolate (THF), which is transported to the liver where it is stored and methylated to be released into the blood. It is then transported to the tissues where it serves as a cofactor in the carboxylation reactions of purine synthesis, methionine synthesis, and dTMP synthesis. The total body of content of folate is 5-10mg, and about half of this is stored in the liver.<sup>7</sup> The most effective interventions to increase folate status are vitamin supplementation and ingestion of fortified foods.<sup>8</sup> Folate status is most commonly measured by serum and RBC folate levels. Serum folate levels reflect the previous three weeks of folate intake, while RBC folate levels reflect the previous seventeen weeks of folate intake.<sup>9</sup> Folate status can also be decreased by the alcohol consumption, smoking, and the some pharmaceuticals, including anticonvulsants such as dilantin, antifolates such as methotrexate, anti-inflammatory medications, some diuretics, and sulfa antibiotics.<sup>10,11,12</sup>

Because it is difficult for many women to consume adequate folate from natural food sources, the FDA mandated folate fortification of all grain products in 1996 to increase folate intake in women. It has been shown that this fortification is associated with a significant increase in folate status, decreasing the prevalence of low folate concentrations (less than 3 ng/mL) and increasing mean serum folate concentrations from 4.6 to 10.0 ng/mL.<sup>13</sup>

*Healthy People 2010* objectives of the US Department of Health and Human Services include increasing the proportions of pregnancies begun with an optimum folate level. This would be done by increasing consumption of a minimum of 0.4 mg of folate by non-pregnant women ages 15 to 44 years from 21% to 80% by 2010 and increasing the median RBC folate level among this group from 160ng/mL to 220ng/mL. This is part of a greater goal to reduce the incidence of neural tube defects by 50% in the same time period.<sup>4</sup> The CDC compared serum folate and RBC folate in 1988-1994 to those levels in 1999, after the fortification of food products by the FDA, and found an increase in both. Mean RBC folate increased from 181ng/mL to 315 ng/mL and mean serum folate increased from 6.3 to 16.2 ng/mL.<sup>14</sup> It is predicted that there is a 60% decrease in the risk for NTD when RBC folate levels are raised from 150 ng/mL to 400 ng/mL.<sup>15</sup> Most of this change is attributed to increases in folate intake due to food fortification.

While this data indicates that the stated objective has been met by food fortification, preliminary data indicates that women of the underserved San Diego community are not

consuming adequate amounts of folate daily.<sup>16</sup> It was also noted by Health and Human Services that Mexican American and African American women have folate intake and RBC folate level below the median for all women.<sup>4</sup> Because folate status is a reflection of dietary intake, the population of women surrounding Baker Elementary School may initially have a lower folate status than USDHHS study averages.

The folic acid education project designed for a previous project in this community, reported 63 women attending at least one session in the first four months, with a significant increase in knowledge about folic acid immediately following and one month after the session. There was also a very significant increase from 9% to 89% in the number of women reporting to take multivitamins with folic acid. There was a small, but not statistically significant increase in the reported consumption of foods with folate.<sup>17</sup>

**Definition:**

What are the goals of this project?

1. Increase the RBC folate and serum folate levels of non-pregnant women in the Baker Elementary School community.
2. Increase the number of women consuming the recommended minimal amount of folate daily.
3. Increase awareness of the role of folic acid in the prevention of NTDs
4. Assess knowledge, compliance, and folate status over a period of five months.

What is innovative about the project?

This educational campaign attempts to not only increase folic acid awareness in the community served by the Baker Elementary School site of the UCSD Student Run Free Clinic, but also to increase the folate levels of the women who attend the sessions. This is an underserved community, where access to multivitamins and various foods are limited by the low-income level of the women. While data from the 2000 census has not yet been analyzed for this community, data from the 1990 census in this neighborhood shows the median household income is \$16,212, with 28% of households receiving public assistance. The education level is also low; only 43% of the population over age 25 has a high school diploma, and 34% have less than a ninth grade education. In addition, 63% of persons over age 5 speak a language other than English at home.<sup>18</sup>

How is the project relevant to a career in medicine?

One of the most essential roles of the physician is to educate patients on topics that are relevant to their health and the health of their families. It is also important to ensure that the patient not only understands the information, but also that the patient will be able to use it in a way that will in fact impact their health. This project gives the medical student the opportunity to practice educating patients and answering their questions, and to evaluate the methods that are most effective.

What is the student's role and time commitment to the project?

The student will be responsible for organizing the educational sessions, including providing groceries, multivitamins, and educational materials, leading the sessions, and answering questions during the session. Under the supervision of an attending physician she will also be responsible for drawing blood for analysis and recruiting other trained medical students to assist, if necessary. Finally, she will collect data to track patient

knowledge, self-reported compliance, and serum and RBC folate levels before the session, and five months after the session.

### **Methods:**

Monthly folic acid education sessions will be held on Tuesday mornings before the Baker Elementary School clinic for women of the surrounding community. A medical student will conduct the session with the help of a community health promoter. During these sessions the benefits of folic acid in the prevention of neural tube defects will be discussed, as well as supplemental and dietary means to consuming the recommended 0.4 mg/day of folate. Women will be taught how to read food labels for folate, and how to figure out how many servings of each fortified food they would need to eat to get the recommended amount. The materials for these sessions were provided by the March of Dimes and developed as part of a previous project, and are available in both Spanish and English, at a fifth grade reading level. Women who are unable to read are assisted by the medical student or another member of the community. The sessions are mostly interactive, and the medical student answers questions about folic acid, as well as other nutritional concerns. Women will be provided with multivitamins containing 400 mg of folate, foods that are high in folate, including orange juice, pasta, beans and legumes, cereals and other grain products, and a fifty dollar gift certificate to Albertson's grocery store will be raffled at the end of each session.

All women in the community are invited to attend, but the program will be targeted to women of childbearing age. We have found that the most effective invitations are by word of mouth, and women will be contacted through the school newsletter, and over the phone. Participants will be asked to fill out a short survey assessing their knowledge of folic acid prior to the session. Those patients who are over 18 years old, not pregnant, and are willing will have their blood drawn by venipuncture by medical students trained at the Student Run Free Clinic under the supervision of an attending physician. First the student will go over a questionnaire regarding behaviors and medications that may affect folate status. Two tubes of 3 mL each will be drawn (one EDTA, one without anticoagulant) and UCSD Clinical Laboratories will analyze them for RBC and serum folate levels. Because this is a community education project, women who do not wish to participate in this portion of the project will still be encouraged to attend the session and will also receive groceries and multivitamin supplements with folate. Immediately following the session, women will fill out a survey to assess their understanding of the sources and benefits of folate.

One month later, follow up phone calls will be made by the community health promoter to assess compliance of all women with the program and the amount of knowledge that they have retained, by a survey. At this time women will be invited to return to the session that month, or to refill their vitamins at the Tuesday afternoon clinic. Five months after the initial session, blood will be drawn, again by venipuncture by medical students under the supervision of an attending physician. RBC and serum folate will again be measured by UCSD Clinical Laboratories. Before this blood draw, the same questionnaire to assess factors that may decrease folate status will be completed by the participant with assistance from the medical student.

Data will be evaluated to assess the number of participants, baseline knowledge of folic acid and folate status, and knowledge and folate status after five months.

### **Evaluation:**

Each step of the project, as well as all materials for the project, will be discussed with and monitored by members of the ISP committee. The success of the project will be assessed by analysis of data, mainly the number of participants and their changes in folate status. The patients knowledge and compliance will also be analyzed. Findings will be summarized in a written report, which will be evaluated by each member of the ISP committee.

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