

# PROTECT OUR CHILDREN NOW!

***Moving Proven Research Into Practice—NOW!***  
***A Public Health Action Project***

***Improve Prenatal and Newborn Health Outcomes***  
**Education - Measurement - Tracking - Public Health Action**



## Project Manual





This manual is prepared for the Protect Our Children NOW! Project.

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## 1.0 Project description

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### 1.1 Purpose of Protect Our Children NOW! (POC)

Protect Our Children *NOW!* is a public health project whose purpose is to provide education and vitamin D testing to pregnant mothers (and subsequently, their infants) to help individuals manage their pregnancy health outcomes with regard to vitamin D status. The project will acquire health information with respect to the outcomes of the pregnancies of the individuals enrolled, i.e., such variables as preterm births, Caesarean sections, preeclampsia, low weight for gestational age, and similar outcomes, and analyze the outcomes in relation to achieved 25(OH)D status. The project is a public health intervention based on the Hollis, Wagner randomized trial (see reference) which showed that a serum level of at least 40 ng/ml was a preventive factor that predisposed the mother and fetus to decreased prenatal and postnatal diseases. This report (Am J Obstet Gynecol. 2012 Nov 3), showed a 50% reduction in preterm births with the mother's vitamin D level at approximately 40 ng/ml, among other substantial health benefits. Results will be taken to public health officials and translated to a larger population to both substantiate the results as well as to help all pregnant women have safer pregnancies, translating research into practice.

### 1.2 Overview of the GrassrootsHealth D\*action Project

Protect Our Children *NOW!* (POC) is a project of the GrassrootsHealth D\*action effort. GrassrootsHealth (GRH), as a non-profit public health organization, is committed to improving vitamin D status worldwide.

D\*action is an international public health project started by GRH to help solve the vitamin D deficiency epidemic. It currently involves over 10,000 individuals world-wide. Its principal method consists of two efforts: 1) providing educational material concerning the benefits of adequate vitamin D status, and 2) providing information about the participants' own vitamin D status, thereby allowing participants to adjust their vitamin D intake to achieve desired levels. The database which GRH has created contains anonymized health status information provided by the enrollees. This database is available to competent scientists for the testing of various hypotheses.

As a community-based subset of this larger D\*action project, POC is focused on pregnant women and their infants. The intervention, as with the larger project, consists of the provision of educational materials and information about the participants' own vitamin D status, together with gathering anonymized health status information from the participants.

## **2.0 Overview of the Protect Our Children *NOW!* Project Design**

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### **2.1 Participants**

The project will involve 500 women per sponsored community who are enrolled between the 12<sup>th</sup> and 16<sup>th</sup> week of pregnancy.

### **2.2 Procedure**

Enrollment consists of the completion of a health questionnaire (including the consent to participate and to use the de-identified data for research purposes) and a serum 25(OH)D blood spot test kit. Follow-up questionnaires and serum 25(OH)D blood spot test kits will then be provided to be completed each 10 weeks of pregnancy (for a total of 3 tests) and once for the newborn at birth. The infant test is expected to be obtained from the cord blood at birth. Health outcomes will be tracked and measured throughout pregnancy and in the newborns. Educational tools and material will be provided to all participants on vitamin D and health.

### **2.3 Communications**

Reminders (both phone and email) to complete correlating online health questionnaires will be provided in conjunction with each test. An on-site Program Facilitator will be available to participants in person should additional assistance be needed.

### **2.4 Outcomes Measured**

Hard pregnancy outcomes such as pre-term birth, low birth weight, C-section, preeclampsia, infection and other pregnancy complications will be acquired. There is an extensive online questionnaire for data gathering that will be used with the pregnant women. It includes all the conditions that the Hollis, Wagner study used including many comorbidities of pregnancy as well as other health outcomes. We will be tracking intake of vitamin D and 25(OH)D serum levels and looking for any association between achieved 25(OH)D level and pregnancy outcomes. Additionally, outcomes in project participants will be contrasted with historical data from the same community.

A summary of what will be measured is shown in the table in Section 6.0 (*What we will be Tracking*).

### **2.5 Inclusion Criteria**

This project will enroll:

1. Any woman who is 12-16 weeks pregnant is able to enroll in the study for vitamin D testing and education. Their newborns will also be included.
2. Offspring of the enrolled women.
3. An option of adding women to the project at a preconception stage is available.

## 2.6 Enrollment

Individuals will be recruited through referrals made by service providers and clinics involved in the POC program in the sponsored community.

Participants will be enrolled after they logon to the website, verify that they qualify and give consent, create their enrollment and enter data on a health questionnaire. They will then receive a 25(OH) D test, generally in the mail or at their service provider's location.

Informed consent is obtained through an IRB (Institutional Review Board) approved process utilizing online forms at enrollment, and a consent form for the newborn participants' birth location medical records, to be completed at birth.

## 2.7 Dismissal Process

Individuals who have enrolled in the POC program may be dismissed from further participation in the program under the following circumstances:

1. If the first prenatal 25 (OH)D blood spot test and/or health questionnaire are not completed and received by 20 weeks gestation.
2. If the second prenatal 25(OH)D blood spot test and/or the second health questionnaire are not completed and received by 30 weeks gestation.
3. If the third prenatal 25(OH)D blood spot test and/or the third health questionnaire are not completed and received by four weeks postpartum.
4. If the newborn 25(OH)D blood spot test and/or the newborn health questionnaire are not completed and received by two weeks of age.
5. If pregnancy is terminated, or if the participant suffers from miscarriage, stillbirth, or other loss of pregnancy.
6. If calcium levels too high? If other signs? Conditions? By order of the doctor?? (need feedback from Wagner/Heaney)

In the case of any of the above, the participant will be notified of their dismissal from the program, will be deactivated from the system, and will not receive additional 25(OH)D blood spot tests or communications regarding the program.

## 2.8 Projected Intervention Dates

This is a population study (a concurrent cohort study, not a clinical trial) which is aimed at providing continuous education about vitamin D and serum 25(OH) D testing to individuals so that they can decide for themselves what actions to take. The intervention is an intensive education program stressing the importance of vitamin D during pregnancy, along with other proven health factors such as proper exercise, diet and supplementation, as well as feedback in the form of actual vitamin D status (from the blood spot analysis).

Testing of serum 25(OH) D concentrations will be done at 12-14 weeks, 22-26 weeks and 32-36 weeks of the pregnant mother as well as of the infant at delivery. Both the pregnant women and their healthcare practitioners will be provided educational materials, videos and tracking tools, and will have access to a support service person via phone.

## 2.9 Duration of the Project – Phase 1

The approximate time from start to finish is about 24 months. The pregnant women are expected to all be enrolled within the first 10-12 months of the project and the last 9+ months will be data analysis, creation of a publication and submission to a journal. There will be the option for the women to continue their participation as well as having the child participate.

## 2.10 Sample/Data Identification & Handling

All test samples are provided from the participants with their unique participant ID on the blood spot sample card. The participant ID is assigned by the system at initial sign-up. This coding system allows for anonymous processing at the contracted laboratory.

*Back of Blood Spot Specimen Card*

The diagram shows the back of a Blood Spot Specimen Card with the following fields and labels:

- Registration Code / Clinic ID (if applicable):** 12345678. A green arrow points from the label "Unique & Ambiguous Participant Identification Number" to this field.
- Participant ID:** 12345678. A green arrow points from the label "Special code for clinics or other group participation" to this field.
- Date of Birth:** 01/01/81. A green arrow points from the label "Participant Date of Birth" to this field.
- Collection Date:** 02/02/13. A green arrow points from the label "Date of Blood Spot Collection" to this field.

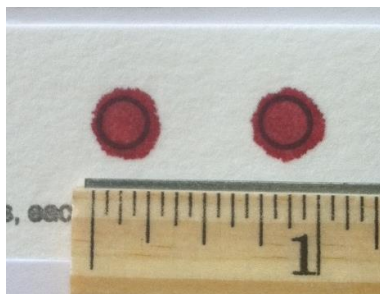
The participants must provide blood spots that are at least ¼ inch or 6 mm in size each, and which penetrate the blotter paper, in order to be adequately processed and analyzed.

*Interior of Blood Spot Specimen Card*

The diagram shows the interior of a Blood Spot Specimen Card with the following sections:

- ACCEPTABLE:** Fill in BOTH spots per the sample below. 1 large drop per circle. (Illustrated with a single large red drop in a circle).
- UNACCEPTABLE:**
  - Overlapping of multiple applications (Illustrated with two overlapping red drops in a circle).
  - Multiple insufficient applications (Illustrated with several small red drops in a circle).
- PerkinElmer 226** (Lot 102277/313131)
- Fill in BOTH spots, each at least 1/4 inch wide.** (Illustrated with two red spots).
- Blood Spots:** A green arrow points from this label to the two red spots.
- Please allow blood to dry 30 minutes before closing flap.**

*Blood Spots must be at least ¼ inch or 6mm Wide*



Completed serum 25(OH) D blood spot test cards are sent directly from the participant to GrassrootsHealth and then processed at a contracted laboratory that adheres to the testing criteria established by the NIST (National Institute of Standards Technology).

The data from questionnaires are recorded each time a blood spot test is completed via the online entry system, MyOWNHealth (see Section 5.1), which could be at a clinic or used by a participant at home. The specifics of where the data are gathered are to be worked out with different community areas. Online and smart-device tools will also be available to individual participants and clinics to assist in and promote accurate tracking.

Other items clinics and/or participants will have the option to track include nutrient intake, exercise, lifestyle habits and other regular daily activities.



### 3.0 Project Kit Contents

The contents of each serum 25(OH)D blood spot test kit will provide all the necessary materials needed to complete the test safely at home. The vitamin D test requires that the participant use a self-loaded lancet to prick a fingertip to get blood to drop on a card. Enclosed in the kit are an alcohol swab, gauze, band aid, the bloodspot card, a return envelope and instructions.

The initial 25(OH) D blood spot test kit will be sent upon completion of registration, the online questionnaire and the consent forms. Follow-up test kits will be sent automatically with prompts for the participant to complete the corresponding online health questionnaire.

#### Serum 25(OH) D Test Kit Contents:

- 1 Instruction sheet
- 1 FAQ
- 1 POC tri-fold card
- 1 business card
- 1 addressed return envelope
- 1 blood spot card
- 1 gauze pad
- 1 alcohol prep pad
- 1 Band-Aid
- 2 lancets



Each test kit is associated with an online health questionnaire, to be completed within the same time frame. The Test Kit contents for the pregnant participants are the same as those for the newborns. The pregnancy health questionnaires and newborn health questionnaire, to be completed online at the time of testing, are provided as a separate reference document.

## 4.0 Summary of Enrollment & Participation



### 4.1 Summary - Project Components

#### Online Registration Consent to Participate

##### **For the participant to complete**

Online Health Questionnaire via MyOWNHealth

Medical Records Release Form

Consent to Notify Health Care Provider of Results (optional)



##### **Once the above is completed**

Shipment of Serum 25(OH)D Test Kit to Participant

Full access to MyOWNHealth Educational Tool and other Support Materials (see Section 5.1)

##### *Responsibilities of the **project coordinators**:*

- 1) Ongoing prompts and communications regarding completion of questionnaires, tests, and consent items
- 2) Ensuring eligibility of participants
- 3) Shipment of test kits to participants
- 4) Verbal and online assistance to participants if needed
- 5) Assisting with additional educational opportunities and materials

## 4.2 Summary – Timeline & Steps



### **Participant Enrollment Initiation & Completion**

#### **12-16 weeks gestation**

Registration  
Consent  
Online Pregnancy Health Questionnaire 1  
Serum 25(OH) D Test 1

#### **22-26 weeks gestation**

Online Pregnancy Health Questionnaire 2  
Serum 25(OH) D Test 2

#### **32-36 weeks gestation (or at birth if birth occurs first)**

Online Pregnancy Health Questionnaire 3  
Serum 25(OH) D Test 3

#### **At Birth**

Hospital Records Release Form  
Online Newborn Health Questionnaire  
Newborn Serum 25(OH) D Test

#### **Data analysis**

**Creation of publications and journal submissions**

**Public action**

## 5.0 Participant Engagement

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### 5.1 The MyOWNHealth™ Application

The MyOWNHealth™ Education System is a suite of applications for self-health management for individuals enabling personalized information, analysis and tracking of targeted health outcomes and changes by the end-user. Medical Practices can use the educational system modules for its clients to help the clients understand/learn about what health choices are recommended and to enable them to choose and track results, and learn how certain practices influence the outcomes. The end results are better informed and consequently healthier patients and, a more detailed compilation of health factors and outcomes.

This system is free to any participant of the Protect Our Children NOW project.

All questionnaire and health data is collected from the participants through the MOH application.



## MyOWNHealth™ Action

- 1




National Institute of  
Child Health and  
Human Development

Checklist for Pregnancy

Choose items I want to track.

Learn More
- 2




Vitamin

Vitamin D Targets

Choose target vitamin D serum level.


Learn More
- 3



Track Health & Test

Answer health questions to track & do specific blood & urine tests.


Learn More
- 4



Customize

Pick key items to track, including unique, custom items. Set up custom reminders and alerts.

Learn More
- 5



Analyze & Share

Create charts to see my progress. Create reports, lists & questions to share.

Learn More

## MyOWNHealth Features

### Track and Chart YOUR Health Stats

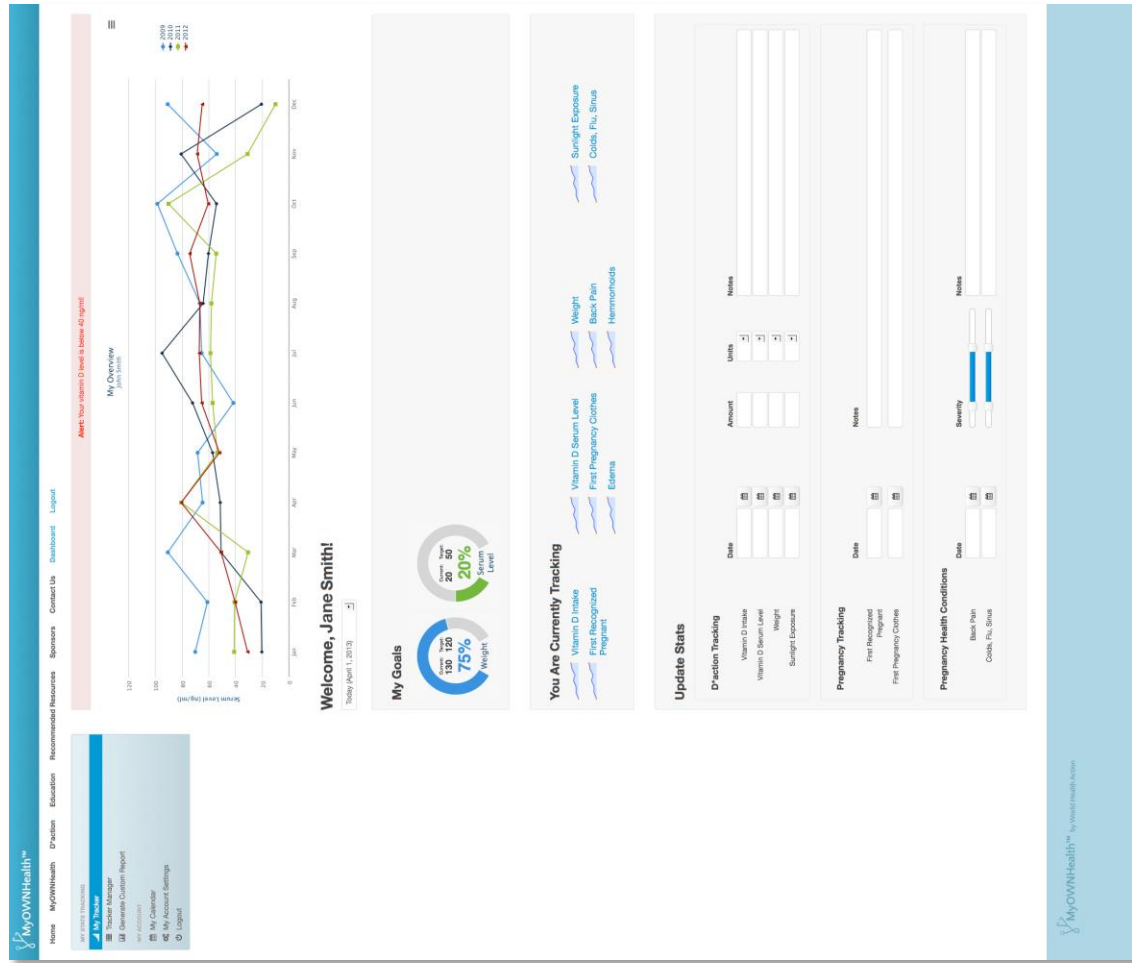
- Choose from the NICHD provided checklist of health factors to track
- Add additional custom health factors to track
- Generate and view charts of your health stats
- Set goals for any health factors you are tracking

### A Personal Health System

- Set up custom reminders and alerts
- Add personalized notes when updating health stats
- Calendar for viewing & managing upcoming appointments and reminders
- Choose only items YOU want to track

### Learn, Analyze & Share

- Compare multiple health factors with graphs to look for relationships
- Print customized reports with graphs of your health factors to provide to your physicians
- Browse our library of additional resources for information regarding health items you are currently tracking



## 6.0 Questionnaires

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A copy of each online health questionnaire is provided as a separate reference document.

### **Instructions: how to correctly complete the forms**

The health questionnaires and consent forms have been developed to be entered directly into a computer-based electronic database through the MyOWNHealth application system, with exception of the Medical Records Release Form.

#### ***Forms that will be completed directly onto the computer are listed below:***

Online Participant Registration  
Research Consent Form  
Pregnancy Health Questionnaire 1, 2 and 3  
Newborn Health Questionnaire

#### ***Forms that will be paper-based are listed below:***

Medical Records Release Form

#### ***Information for the project coordinator:***

Each questionnaire will have the name of the questionnaire, date of each entry, and the participant identification number.

*Identification Number:* The participant ID is assigned to each participant automatically by the electronic database at initial sign-up and enrollment. Each participant ID consists of a set of 8 numbers and is included on each specimen sent to the lab for processing.

## 7.0 What we will Track

	PREGNANCY	NEWBORN
Gender	X	X
Ethnicity	X	X
Weight	X	X
Height	X	X
BP	X	X
Pregnancy Status	X	X
Expected date of delivery	X	
<b>Pregnancy History: # Pregnancies, # Live Offspring, complications, abortions, miscarriages</b>	X	
<b>Conditions of Pregnancy:</b> Date of Dx, Hospitalization, Medication	X	
Gestational diabetes	X	
Pregnancy-induced hypertension	X	
Pre-eclampsia	X	
Eclampsia	X	
HELLP Syndrome	X	
Pre-term labor	X	
Infection: UTI, BV, GBS, Other	X	
<b>Delivery Method</b>	X	
Spontaneous vs/ Induced	X	
Induction Method	X	
<b>Complications during Labor</b>	X	
Failure to Progress	X	
Cephalopelvic Disproportion	X	
Fetal Decelerations / Fetal Distress	X	
Infection	X	
Placental abruption	X	
Other	X	

	PREGNANCY	NEWBORN
Gestation Time	X	X
Number of Offspring	X	
<b>Health Status of Newborn at Birth</b>		X
Living vs/ Stillborn		X
Complications		X
NICU Admission, Level, Reason		X
Preterm Birth		X
Respiratory Distress Syndrome		X
Newborn Septicemia		X
Transitory Tachypnea		X
Suspected Infection		X
Other		X
APGAR Score		X
Gestational Age: EDC, Exam		X
<b>Breastfeeding Status</b>		X
Formula Intake		X
<b>Personal Health History</b>	X	
Cancers: Breast, Colon, Prostate, Ovarian, Melanoma, Other	X	
Diabetes: Type 1, Type 2	X	
Multiple Sclerosis	X	
Hypertention	X	
Pneumonia	X	
Heart Attack	X	
Stroke	X	
Alzheimers	X	
Angina Pectoris	X	
Celiac Disease	X	
Chronic Fatigue	X	
Eczema or serious rash	X	
Preeclampsia	X	
Fibromyalgia	X	
Gluten Intolerance	X	
Kidney Failure	X	
Kidney Stones	X	



	PREGNANCY	NEWBORN
Lactose Intolerance	X	
Myasthenia Gravis	X	
Parkinsons	X	
Other	X	
<b>STDs:</b> Chlamydia, Gonorrhea, Herpes, HIV, Syphilis, Warts	X	
Drug Allergies	X	
Recent OTC Medication Use	X	
Surgical History	X	
Falls	X	
Broken Bones	X	
Colds	X	
<b>Flu with symptoms</b>	X	
fever	X	
muscle pains	X	
headaches	X	
weakness	X	
upper respiratory	X	
gastrointestinal	X	
<b>Pain:</b> location, rating, reason	X	
Milk Intake	X	
<b>Vitamin D Intake:</b> Amount, Brand, Type	X	X
Vitamin A Intake	X	
Calcium Intake	X	
Additional Supplement Use	X	
<b>Sun Exposure:</b> clothing, sunscreen, time of day	X	
Indoor Tanning	X	
Vacations: location, time of year	X	
<b>Physical Activity:</b> amount, indoor vs/ outdoor, mild vs/ moderate vs/ strenuous	X	
<b>Smoking:</b> current, history, second hand	X	
Alcohol Intake	X	
Diet	X	

	PREGNANCY	NEWBORN
<b>Family Health History</b>	X	X
Anemia	X	X
Cancer	X	X
Breast Cancer	X	X
Colon Cancer	X	X
Ovarian Cancer	X	X
Other Cancer	X	X
Diabetes	X	X
Heart Disease	X	X
Hypertension	X	X
Lung Disease	X	X
Kidney Disease	X	X
Parathyroid Disease	X	X

## 8.0 Summary of Implementation Options – Other Items to Track



### 8.1 Nutrient Intake Guidelines

#### Daily Required Nutrients (from all sources)



Vitamin A	2500 IU
Vitamin B1 (Thiamin)	1.4 mg
Vitamin B12	2.6 mcg
Vitamin C	85 mg
Calcium	1000 mg
Vitamin D	***
Vitamin E	22 IU
Folate	600 mcg
Iodine	220 mcg
Iron	27 mg
Liquid	64 oz
Omega 3 (DHA)	300 mg
Probiotics	40 billion CFU multi-strain
Protein	71 g
Zinc	11 mg

\*\*\* Take daily amount necessary to achieve 25(OH)D level of 40-60 ng/ml

This checklist is a combination of requirements from institutions including: the U.S. Preventive Services Task Force; the Centers for Disease Control and Prevention; the American College of Obstetricians and Gynecologists; the Institute of Medicine; the National Institute of Child Health and Human Development; and GrassrootsHealth Scientists.

## 8.2 Lifestyle Guidelines



### Lifestyle Recommendations

Alcohol Intake	0/day
Caffeine Intake	200 mg/day max
Fish with high mercury levels	0/day
Fruit / Vegetable pesticides	100% washed
Lead / Radiation exposure	0/day
Physical Exercise (Moderate)	30 min/day
Raw or undercooked meats & seafood	0/day
Smoking	0/day
Toxoplasmosis exposures	0/day
Unpasteurized milk or soft cheeses	0/day

This checklist is a combination of requirements from institutions including: the U.S. Preventive Services Task Force; the Centers for Disease Control and Prevention; the American College of Obstetricians and Gynecologists; the Institute of Medicine; the National Institute of Child Health and Human Development; and GrassrootsHealth Scientists.

## 9.0 Educational Tools

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### 9.1 CMEs for Medical Personnel

There will be online continuing education courses on Vitamin D, Vitamin D & Pregnancy provided by the vitamin D researchers. They are free to the physicians.

### 9.2 Scientists Answer Your Questions Webinars

Additional education is offered through scheduled webinars with top vitamin D researchers. Registrants are offered the opportunity to ask their questions of each presenting expert for reliable, evidence-based answers. While no medical advice is offered during these webinars, they do provide an opportunity for participants to obtain a greater understanding of vitamin D and various health concerns for both pregnant and non-pregnant individuals.

The webinars are free for any who wish to participate. Additional information can be found at [grassrootshealth.net/webinars](http://grassrootshealth.net/webinars).

### 9.3 Educational Documents & Charts

The following documents and charts can be found at [grassrootshealth.net/documentation](http://grassrootshealth.net/documentation), downloaded and printed to share:

- Disease Incidence Prevention Chart in ng/ml
- Disease Incidence Prevention Chart in nmol/L
- Scientist's Call to D\*action
- Vitamin D FAQs
- Vitamin D FAQs for Pregnancy, Breastfeeding & Babies
- Serum Level vs Intake Charts

Additional educational handouts on various pregnancy health topics will be accessible to each participant through the MOH system.

### 9.4 Ongoing Electronic Videos

Videos of interviews with researchers, clinicians will be made available to the project participants throughout the project.

## 10.0 Cost and Schedule Overview

### Protect Our Children NOW! Project      500 Participants

Initial Definition Consult	\$10,000
Tests, kitting, materials (3)	\$52,500
Tests, infants (1)	\$17,500
Project Management	\$60,000
Education (Online CME)	\$35,000
Programming/technical	\$35,000
Onsite Support	\$90,000
IRB Updates	\$10,000
Publication	\$50,000
Supplements	\$50,000
Travel, Misc.	\$50,000
<b>Total</b>	<b>\$450,000</b>

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
1																												
2	<b>ID</b>	<b>TASK</b>	<b>Duration</b>	<b>Pre</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>
3	1	Funding	1 day																									
4	2	Meet with Local Groups	5 days	1																								
5	3	Assign Local Leaders																										
6	4	Hire local project manager																										
7	5	Define enrollment group																										
8	6	Detail enrollment methodology																										
9	7	Schedule/prepare on-site course by scientist(s) for	36 days	2																								
10	8	Do on-site course	1 day	7																								
11	9	Initial education, practitioners	1 day	8																								
12	10	Enrollment of 500 + 100 (infants)	270 days	9																								
13	11	Ongoing education, practitioners, enrollees	660 days	9																								
14	12	Generate publication	180 days	10																								
15	13	Initiate Public Health Action Campaign	2 days+	12																								
16		MONTHS	24 mo		J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
17																												

## Appendix 1 – Contact Information

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### Protect Our Children *NOW!* Contact Information

Principal Investigator:	Dr. Carol L. Wagner, M.D. Professor of Pediatrics and Neonatology Medical University of South Carolina 315 S. Coast Hwy. 101 Suite U-87 Encinitas, CA 92024 Phone: FAX: Email:
Project Coordinator:	Jen Aliano, M.S. GrassrootsHealth Project Manager 315 S. Coast Hwy. 101 Suite U-87 Encinitas, CA 92024 Phone: 760-710-9305 FAX: Email: <a href="mailto:jen@grassrootshealth.org">jen@grassrootshealth.org</a>
Project Manager:	Carole Baggerly GrassrootsHealth Director 315 S. Coast Hwy. 101 Suite U-87 Encinitas, CA 92024 Phone: 619-823-7062 FAX: Email: <a href="mailto:carole@grassrootshealth.org">carole@grassrootshealth.org</a>

## Appendix 2 – Background Material & References

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Studies indicate that serum levels of 25(OH)D in the range of 40-60 ng/ml may (based on the specific disease) reduce or prevent serious health conditions during pregnancy and in the infant.

The National Health and Nutrition Examination Survey (NHANES)<sup>1</sup> reported that 90% of Mexican-American adolescent females had serum 25(OH)D values below 30 ng/mL (the lower end of the normal range proposed by the Endocrine Society); 20% were below 15 ng/mL. For African-American adolescents, the corresponding figures were 99% below 30 ng/mL and 58% below 15 ng/mL. Values for women in their 20s were not appreciably different.

Almost all individuals are unaware of their vitamin D status and many may be deficient. Offering testing will allow individuals to become informed of their vitamin D status. Currently, there is no way to tell a person's serum level without administering a blood test. Even if a person is taking vitamin D supplements, there is a 3 fold variation in the 25(OH)D concentration.

### Pregnancy-Related Consequences of Inadequate Vitamin D Status

- Low maternal vitamin D status is associated with increased risk of C-section<sup>2</sup>
- Low vitamin D status in infants at birth is associated with increased risk of RSV infection during the first year of life<sup>3</sup>
- Low maternal vitamin D status is associated with learning impairment in offspring five and 10 years after birth<sup>4</sup>
- Low maternal vitamin D status is associated with increased prematurity, preeclampsia, gestational diabetes, periodontal disease, and TORCH<sup>5-8</sup>
- Low infant vitamin D status in the first year of life is associated with strikingly increased risk of type 1 diabetes prior to age 30<sup>9</sup>
- Low vitamin D status in the first year of life is associated with increased risk of preeclampsia in a female child's own pregnancy when she becomes an adult<sup>10</sup>
- Low maternal vitamin D status is associated with lower birth weight and smaller head circumference<sup>11</sup>

## References

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