

What's Next...

We have already started planning for the next round of in-person visits, tentatively called the "Late Teen Visit"! Thanks to all of your contributions to Project Viva, we have been very successful in receiving funding from the National Institutes of Health (NIH) to continue our research efforts, which provide many insights into how to promote the health of mothers and children. We recently submitted a large grant proposal to continue our work with you—for the next 5 years!

Established in 1998, Project Viva—"A Study of Health for the Next Generation"—is a groundbreaking longitudinal research study of women and children based in eastern Massachusetts. The aims of our research are to examine how factors during pregnancy and after birth may affect the long-term health of a mother and her child. Project Viva enrolled over 2,600 mothers during pregnancy and has continued to follow them and their children for more than a decade. Matthew W. Gillman, MD, SM, is Project Viva's Principal Investigator. He and his colleagues conduct the study

out of the Department of Population Medicine, jointly sponsored by Harvard Medical School and Harvard Pilgrim Health Care Institute. Project Viva is funded primarily by the National Institutes of Health (NIH), with additional funding from the March of Dimes Foundation, the U.S. Centers for Disease Control and Prevention (CDC), and other agencies. The ultimate goal of Project Viva is to improve the long-term health of children by ensuring the well-being of their mothers.

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We've moved!

We've officially moved the Project Viva offices out of the Harvard Vanguard building and into the Landmark Center (next door). Please come visit us in our new space.

**Landmark Center
401 Park Drive
Suite 401
Boston, MA 02215**



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Viva Views Winter 2016

Project Viva



A Note from the Investigators

In 1994, I became aware of a new idea... that what happens during human development—even before birth—could hold clues to promoting health and preventing disease across a lifetime. Sorely needed at that time was a study that enrolled women in early pregnancy and collected detailed information from them and their children for a long time. Thus was born the idea for Project Viva.

In 1998, we received our first 5-year grant from the NIH to establish Project Viva. Flash forward 17 years and now the NIH considers Viva so valuable that we won a highly selective MERIT award. Not only that, but the idea of early life prevention—which seemed kind of wild two decades ago—is now well established, and Project Viva has played a major role.

In this edition of Viva Views, we take a look back as a reminder of how much you have contributed over the years. We pair what you did at Viva visits with selected findings that sprang from those visits. Many of them have influenced national policies on maternal and child health.

Thank you so much for being a part of making history—not just Project Viva's history but indeed the history of a new field of medicine and health.



Your Involvement Throughout the years!

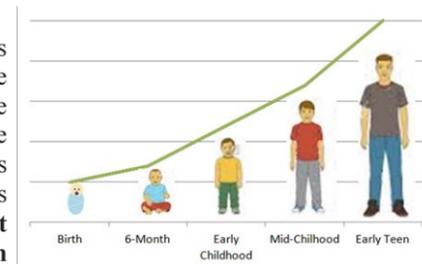
We are so grateful to all of you for your continued involvement in Project Viva over the last 16 years. Your participation has allowed us to continue our ground-breaking research on maternal and child health. You have helped inform national guidelines for prenatal care and have contributed to the publication of nearly 200 scholarly articles!

As we near the end of the Early Teen in-person visit, we'd like to take a moment to thank the over 1,000 families that have contributed to this visit's success. We hope to see you all at our next in-person visit, when the Viva "kids" will be 16 to 18 years old! We plan to begin this Mid/Late Teen visit in about 1 year.

Many of you told us that you'd like to see how much you've contributed over the years. Therefore, this edition of Viva Views outlines select participation with the project—from the beginning until now—with highlights from the visits along the way. While some of you have vivid memories of your contribution to the study, others, especially our Viva teens, may have vague recollections of the rich information we've collected.

For this edition, we highlight a few of Project Viva's nearly 200 scientific articles that are a direct result of your long-term participation, even if you haven't participated in every single step along the way. These pages give an example of research results at each stage of your participation—during pregnancy, just after birth, infancy, early childhood, and mid-childhood. These results give you an idea of how broad and important our findings are.

We can't squeeze everything into one newsletter; take a look at Viva's renewed website (see below) for more history and details about our work. We hope this edition of Viva Views leaves you with warm memories of your time with Project Viva. We look forward to your continued participation!



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Pregnancy



Your participation

- * We enrolled moms during prenatal visits at Harvard Vanguard offices
- * We collected blood samples
- * Moms reported
 - * Diet
 - * Food cravings
 - * Lifestyle

Our finding

Pregnant women often crave foods that are different from what they ate before becoming pregnant. Project Viva investigators hypothesized that cravings that start during pregnancy might be related to a biological need for those foods, or may predict health outcomes. During interviews conducted during pregnancy visits, Viva mothers

reported their food cravings. Perhaps it's not surprising that cravings for sugary, starchy, savory, and salty food were indeed related to intake of those foods during pregnancy. For example, moms who reported craving sugary food ate more sugar and fat than moms who craved other types of foods. Moms who craved more savory foods ate more omega-3 fatty acids, the type of fats found in fish and nuts.



Those who craved starchy foods ate more carbohydrates and less fat than did moms who craved other types of food. More interesting, though, is that women who had new cravings for salty foods during pregnancy were at a lower risk for gestational diabetes compared with those who did not crave salty foods.

Farland LV, Rifas-Shiman SL, Gillman MW. Early Pregnancy Cravings, Dietary Intake, and Development of Abnormal Glucose Tolerance. *Journal of the Academy of Nutrition and Dietetics*. 2015; in press.



6 Months

Your participation

- * Moms reported information about
 - * Breastfeeding
 - * Developmental milestones
- * We measured infants'
 - * Vision
 - * Height
 - * Weight

Our finding

We all know that physical activity is important for keeping off excess weight, but could that be true even for infants? Viva investigators looked at whether the age at which infants met their mobility milestones—rolling over, sitting up, crawling, and walking—was related to the amount of body fat they had in early childhood. Using mailed questionnaires completed at 6 months, 1 year, and 2 years, Viva moms reported the age at which their children achieved these milestones. At the Early Childhood Visit, we measured your child's weight, height, and skinfolds (a measure of body fat). Viva infants who began rolling over, sitting up, and walking at younger ages tended to have slightly less body fat in early childhood. Babies who rolled over or sat up after 6 months of age had slightly more central body fat in early childhood. Viva kids who started walking after 15 months of age had slightly more overall body fat in early childhood. Age of crawling didn't seem to make a difference. These results are interesting, but we wouldn't say you have to get your child to walk at an earlier age to prevent obesity!

Benjamin Neelon SE, Oken E, Taveras EM, Rifas-Shiman SL, Gillman MW. Age of Achievement of Gross Motor Milestones in Infancy and Adiposity at Age 3 Years. *Matern Child Health J*. 2012 Jul;16(5):1015-20. Pub-Med PMID: 21643834. PMCID:PMC3321389.



Birth

Your participation

- * We measured infants' blood pressure
- * Moms reported delivery information

Our finding

In the United States as a whole, about 1 of every 8 babies is born preterm, that is, before 37 weeks gestation, a rate that hasn't budged much in recent decades. New findings from Viva suggest that preterm birth not only holds health risks for the baby, but also predicts a mom's health after pregnancy. In this study, we measured lipids (types of cholesterol) in maternal blood samples and used moms' blood pressure and body measurements from the Early Childhood and Mid-Childhood visits. Viva mothers who delivered a preterm baby had higher blood pressure and lower levels of HDL cholesterol (the "good" cholesterol) at 3 years postpartum. It's not yet clear whether results like this reflect something that happened during pregnancy causing both preterm birth and higher blood pressure later; or whether moms who experience preterm delivery already had higher blood pressure before pregnancy. In either case, Project Viva's findings suggest that early detection and prevention of cardiovascular disease may be worth trying in women who have had a preterm delivery.

Peng W, Stuart J, Rifas-Shiman SL, Rich-Edwards JW, Stuebe A, Oken E. Preterm birth and long-term maternal cardiovascular health. *Ann Epidemiol*. 2015 Jan;25(1):40-5. Epub 2014 Oct 18.

Early childhood



Our finding

Some studies have shown that infants who take ibuprofen (Motrin, Advil) or acetaminophen (Tylenol) during infancy have a higher risk of asthma later in childhood. The studies, however, did not take into account the reasons people might be taking those medications. For example, respiratory infections during infancy may lead to later asthma, and they are also common reasons why people take ibuprofen or acetaminophen. This creates a "chicken or egg problem": Do the medicines actually cause asthma or does it just appear that way because parents give their children these medicines when they are ill—and it is the illness causing the asthma?

Sordillo JE, Scirica CV, Rifas-Shiman SL, Gillman MW, Bunyavanich S, Camargo CA, Weiss ST, Gold DR, Litonjua AA. Prenatal and infant exposure to acetaminophen and ibuprofen and the risk for wheeze and asthma in children. *J Allergy Clin Immunol*. 2015 Feb;135(2):441-8. Epub 2014 Oct 28.

Your participation

- * Moms reported
 - * Kids' health histories
 - * Medication intake
- * Moms and kids completed cognitive testing

Using questionnaires completed during pregnancy and infancy, Viva investigators looked at how much ibuprofen and acetaminophen infants took in the first year of life, and related that to development of asthma by early and mid-childhood. On first glance, kids who took more of these medicines during infancy were indeed more likely to develop asthma. But using modern statistics to account for respiratory infections during gave a different story—no relationship between the medicines and asthma. We were able to say that respiratory infections are more likely the root cause of later life asthma than ibuprofen or acetaminophen. That message can be reassuring for parents who want to make their kids feel more comfortable while they are sick.



Early Teen Visit

Your participation

- * We collected samples from teens, including
 - * Blood
 - * Nasal swabs
- * Teens completed activity monitoring portion



We will wait to analyze data from the Early Teen Visit until after the last visit is complete, later in 2016. For the time being, we are continuing to analyze the rich

information that Viva moms and kids provided from Pregnancy up through the Mid-Childhood Visit, as shown in the examples on these pages. Please let us know if you have any questions about these findings or any others!

One more example...

New technologies now allow scientists to look at lots of data in ways they never could before. At Project Viva, we are interested in how kids differ not only in body measurements but also in underlying biology. Using one of these new technologies, called metabolomics, we looked at measurements of 1000s of "metabolites" in the blood plasma that the body uses every day to regulate its many systems, in 262 Viva kids in Mid-Childhood. We then used statistical methods to see which patterns of metabolites were related to higher amounts of body fatness, and to risk factors like higher blood pressure and higher blood insulin and cholesterol. For this analysis, we also used information from surveys that Viva moms have filled out since pregnancy, along with children's height, weight, and fat mass from DXA scans. We found two patterns of metabolites that differed between children with and without these risk factors in mid-childhood. One is related to certain types of amino acids—building blocks of proteins. The other pattern is related to steroid hormones that drive when kids enter puberty. This was the first analysis EVER to relate metabolomics to childhood body fat and risk factors. We believe this new field of study will turn out to be important in figuring out why children are different in how they handle food, exercise, the environment, etc.

Peng W, Gillman MW, Fleisch AF, Michalek RD, Watkins SM, Isganaitis E, Patti ME, Oken E. Metabolomic profiles and childhood obesity. *Obesity (Silver Spring)*. 2014 Dec;22(12):2570-8. Epub 2014 Sep 24.

Mid-Childhood

Your participation

- * Kids completed
 - * A breathing test (spirometry)
 - * A body scan (DXA)

Our finding

We've known for some time that high levels of air pollution can affect breathing, but what about lower levels of pollution, as we have in Boston? Project Viva investigators were interested in understanding how exposure to air pollution since birth could affect lung functioning. For this analysis, we used breathing tests (spirometry) from the Mid-Childhood Visit, along with very detailed daily information on air pollution from Boston-area monitors and even satellite images.

We found that children who were living less than 100 meters (about 100 yards) from a major roadway during mid-childhood had approximately 5% lower overall breathing capacity than did children who lived 400+ meters (about 1/4 mile) from a major roadway. We also found that lifetime pollution exposure since birth was related to lower lung functioning in mid-childhood. The findings suggest that higher air pollution exposure, even in a relatively clean environment such as Massachusetts, might affect kids' lung growth.

Rice M, Rifas-Shiman SL, Litonjua AA, Oken E, Gillman MW, Kloog I, Luttmann-Gibson H, Zanobetti A, Coull BA, Schwartz J, Koutrakis P, Mittleman MA, Gold DR. Lifetime Exposure to Ambient Pollution and Lung Function in Children. *AJRCCM*. 2015; in press.

